Reconceptualising Eco-tourism: Aligning Tourism and Conservation Goals using Biodiversity Perception, Governance, and Management

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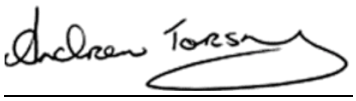
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SUMMARY

This thesis represents an in-depth exploration of the intricate relationship between tourism and conservation, delving into the critical need for robust governance to ensure effective environmental management within the tourism sector. At its core, this research redefines eco-tourism by integrating perspectives from both tourism and environmental management, distinctively differentiating it from nature-based tourism. Through a series of interconnected experiments, qualitative and quantitative assessments, the study elucidates key insights, revealing the potential synergies between tourism and conservation. Also showcasing the tangible ecological benefits that tourism can provide when managed appropriately.

The foundation of this thesis lies in recognising the fundamental role of biodiversity in supporting tourism in terms of economic viability, competitiveness and provision of ecosystem services. By employing a rigorous methodology combining qualitative techniques and psychometric measures, the research offers a nuanced understanding of stakeholder and visitor perspectives and/or interactions at tourist destinations. This approach enriches our comprehension of perception dynamics and highlights the complexity of the interplay between tourism and environmental conservation. Moreover, by utilising existing data from public sector bodies, the study not only identifies drivers of environmental impacts but also emphasises the importance of moving beyond simplistic measures such as visitor numbers to gauge environmental damage.

One of the primary contributions of this research is its focus on revealing novel insights into biodiversity dynamics in tourism and conservation management. By investigating existing conflicts and synergies, the study underscores the ecological enhancement measures implemented by tourism operators and showcases exemplary contexts where tourism and conservation goals already align. Moreover, this thesis underscores the critical role of sustainable tourism in achieving ecological victories and driving transformative change, challenging conventional wisdom regarding the inherent adverse impacts of tourism and advocating for nuanced management approaches.

This thesis also addresses the need for a clear definition of eco-tourism to prevent 'greenwashing' and align tourism practices with environmental conservation goals. Through a detailed examination of habitat management practices and conservation classifications, the study emphasises the importance of structured governance and communication processes in facilitating sustainable tourism management. Additionally, the research offers insights into

the influence of visitor demographics and psychometric measures on environmental impacts and behaviours. Advocating for integrated approaches that combine environmental conservation, community engagement, and psychometric analysis to inform sustainable tourism management effectively.

In conclusion, this thesis represents a significant contribution to the discourse on sustainable tourism, tourism governance, conservation habitat management, and policy development. By navigating the complexities of the intersection between tourism and conservation, whilst utilising robust analysis methods, this research offers valuable insights that have implications for policy, practice, and future research. Ultimately, the study advocates for informed policies, targeted education, and collaborative efforts to achieve a sustainable future where biodiversity thrives alongside tourism, fostering a harmonious relationship between nature and tourism for generations to come.

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Chapter 1 General introduction

1.1 Tourism, Biodiversity, and Conservation Dynamics

Biodiversity decline and the need for nature to thrive alongside human activities pose significant challenges in the modern world (Prakash and Verma, 2022, Díaz and Malhi, 2022). Biodiversity is important for humans (Díaz and Malhi, 2022, Romanelli et al., 2015) with respect to aspects such as overall ecosystem functionality (Hong et al., 2022) and contributions to food production viability (Kremen, 2020). Biodiversity and engagement with nature has also been identified to contribute to positive mental health outcomes (Bratman et al., 2019, Herchet et al., 2022, Lackey et al., 2021). Tourism is an important component of human activity as it has a large share of GDP (Gross Domestic Product) globally, with a notable post covid recovery demonstrating its importance for economies (WEO, 2023). When planning and managing tourism there are often overlaps or trade-offs to be considered with regard to conservation or biodiversity (Font and McCabe, 2017, Wolf et al., 2019). These challenges offer both the opportunity for co-benefits from enhanced biodiversity and human experiences – a virtuous circle – as well as the risk of further degrading biodiversity through unsustainable human use, described as being "loved to death".

This thesis delves into the trade-offs between tourism and conservation, examines nuances in tourism governance, and identifies barriers to conservation. It also explores evidence for effective management strategies and the co-benefits of tourism and conservation. By investigating assumed relationships between tourism and ecological impacts through qualitative and quantitative social science combined with quantitative and experimental ecology approaches, the research offers insights into sustainable tourism management. I draw on practical experience and academic inquiry to provide perspectives on conservation and tourism governance, exploring visitor impact drivers, eco-tourism definitions, ecological benefits, and visitor preferences.

1.2 Tourism and Conservation Interactions: Towards Responsible Slow Tourism

There is evidence for both positive and negative links between tourism and biodiversity. Nature-Based Tourism (nature-based tourism) is increasing in popularity, particularly with respect to protected sites (Winter et al., 2020, Jiang, 2020, Leung et al., 2008). The main driver of tourism is economics with environmental considerations often limited to legal compliance measures (León-Gómez et al., 2021, Buckley, 2012, McKercher, 1993). There is an emerging theme of ‘slow adventures’, which is outdoor recreation with engaging

natural connection (Varley et al., 2020). Engagement with biodiversity has been shown to reduce materialism (Joye et al., 2020) and lead to positive environmental behaviours (Shea, 2020). However, tourism impacts contribute to the loss of biodiversity and ecosystem services (Wong et al., 2021, Chen, 2010, Huybers and Bennett, 2003). An evolving framework for addressing these issues is the concept of the nature-based economy. This approach recognizes the economic value of ecosystems and biodiversity and promotes the integration of nature-based solutions into economic activities. Nature-Based Enterprises—businesses that leverage natural resources sustainably and contribute to conservation efforts—are pivotal in this context. By aligning economic incentives with environmental stewardship, these enterprises can drive more responsible tourism practices.

Research is still developing in understanding the mechanisms behind tourism-conservation relationships. Much of this research has a bias towards low-moderate income countries, and income availability influences environmental impacts (Thapa et al., 2022). There is a need to prioritise responsible 'slow' tourism in protected areas for aligning tourism and conservation goals (Jurkus et al., 2022). Slow tourism generally relates to immersive engagement aimed at maximising tourism experiences related to place and people (Oh et al., 2016). This concept has gained momentum since it was first introduced or popularised around 2004 (Mavric et al., 2021). Deploying responsible slow tourism requires understanding of existing pressures or interactions from tourists at nature-based destinations along with comprehension of tourism planning and environmental management processes. Integrating the principles of the nature-based economy and supporting nature-based enterprises can enhance these efforts by ensuring that economic activities contribute to, rather than detract from, conservation goals.

1.3 Challenges in Tourism and Recreation Ecology

Recreation ecology studies the impacts of recreation activities or tourism on the environment (Sumanapala and Wolf, 2019). Understanding these impacts is crucial for effective management of protected sites (KC, 2021, Jones et al., 2021, Spenceley et al., 2021, European Environmental Agency, 2018, Eagles et al., 2002, Torsney and Buckley, 2023). There are challenges related to implementing effective control measures to mitigate environmental impacts due to the complexity of tourism. The chaos theory of tourism identifies the sector as a complex non-linear system; the industry has a range of key factors such as seasonality, transport infrastructure, local economic fluctuations etc. Moreover, tourism can also be self-directed and somewhat transient (Altinay and Kozak, 2021). Green

marketing strategies are used to capitalise on natural assets which the tourism operator may have no functional control over (Elbe et al., 2009, Allied-Market-Research, 2021) which make it challenging to implement effective control measures, even when environmental impacts are well understood (McKercher, 1993, McKercher, 1999). A study by Ehigiamusoe (2020) identifies that early intervention tourism often has beneficial effects on the local environment; however, the scalability of this can be problematic when reaching mass tourism levels and associated impacts. To address the challenges in conservation, it's crucial to have effective landscape-scale governance because of the intricate interactions among ecological factors and the diverse interventions needed (Pătru-Stupariu and Nita, 2022). Tourism is transitioning towards ecologically sustainable practices, requiring research for effective implementation (Jones, 2023b). Many studies focus on using visitor numbers as a proxy for environmental impact (Monz et al., 2013), which has contributed to a war-on-tourism narrative within the literature (Higgins-Desbiolles, 2020b). However, addressing the environmental impacts of tourism requires a shift in focus towards identifying the drivers of these impacts as well as identifying effective management practices to avoid or minimise such impacts. Notably, much research in this area is conducted by government agencies or private enterprises for legal compliance (Buckley, 2012). It has been suggested by McLoughlin et al. (2023) that statutory adoption of evidence based approaches to environmental monitoring and understanding is needed in. As well as ensuring there is an evidence base from which to make decisions regarding the challenges faced, it is also important to identify best practice measures and existing synergies.

1.4 Synergies for tourism and conservation: Identifying ecological benefits and addressing conflicts

Understanding the baseline condition of a tourism destination is crucial, as the protection status or conservation significance of an area can directly affect the viability of tourism offerings through imposed restrictions. For example, grasslands are globally under threat and face conflicts between tourism and conservation goals; especially in vulnerable beach sites (Bardgett et al., 2021). Tourism pressures present at roughly half of Europe's Special Areas of Conservation (SACs) and Special Protected Areas (SPAs) (Torsney and Buckley, 2023). Habitat identity directly relates to conservation status and goals, impacting interactions between tourism and environmental management. Inconsistent habitat assessments across Europe highlight the need for clear criteria and classifications (Delbosc et al., 2021). More research is needed with respect to understanding the metrics which are used for habitat classifications particularly with regard to habitat management practices – as

these can have unintended consequences for other land uses such as tourism. Collaborative synergistic approaches to the management of tourism and environmental goals are needed to avoid potential conflicts and provide effective habitat management outcomes.

To identify synergies for tourism and conservation it is important to understand the benefits derived from ecology by tourism. Environmental image has been shown to be a key driver of tourism destination competitiveness (Cronjé and du Plessis, 2020). Buckley (2008) states that tourism should be used as a funding stream for conservation if managed appropriately. I believe identifying ecological benefits of tourism is a key component of this. Nature-based tourism encompasses a range of diverse tourism interactions with natural features but lacks inherent environmental benefits (Arif et al., 2022). Sub-sectors within tourism such as adventure-based tourism regularly overlap with nature-based tourism (e.g., mountain biking, hiking, surfing etc.). Although these tourism offerings are economically driven, they have potential to provide negative or positive effects on the natural assets which they capitalise on. However, these interactions are often dependent on the tourism management practices. Demonstratable synergies between tourism and biodiversity can provide invaluable conservation tools (Buckley, 2008). There is a need to identify the ecological benefits of tourism to incentivise beneficial management actions which provide win-win scenarios. Much of the existing research focuses on tropical systems with co-benefits such as safari tourism (Adhikari et al., 2021, Parker et al., 2022). As ecosystem response to tourism can be context dependant, i.e. vegetation characteristics and site types influence resistance and resilience to tourism pressures (Jahani et al., 2020), more research is needed to inform implementation of potential win-wins. To achieve this a multi-disciplinary approach is needed to facilitate tourism while also protecting and enhancing the natural assets at the nature-based tourism destinations (Mandić and McCool, 2022); particularly with regard to protected sites (Spenceley et al., 2021).

1.5 Understanding diversity perception and preference

Recognising the economic significance of biodiversity in attracting tourists can strengthen the case for conservation funding and sustainable management practices. Therefore, the interplay between visitor perception, preference, and biodiversity has practical implications for both conservation and the tourism industry. Tourism management capitalises on the perceived experience of visitors which influences their dwell time (time spent at site) and return rate (likelihood to returen). Environmental image is a leading factor in destination competitiveness (Cronjé and du Plessis (2020); therefore, research is needed to understand

what the driving force behind environmental image, and perception of it, to identify if this can be used as a conservation tool. Environmental value is extremely subjective (Austen et al., 2023, Pett et al., 2016, Hoyle et al., 2019). It has been shown that not everyone can perceive biodiversity depending on what aspect of biodiversity is being assessed (Breitschopf and Bråthen, 2023). Engaging experiences are suggested to mitigate conflict between tourism and the environment by promoting environmental stewardship, but diverse visitor behaviours and motivations complicate the creation of such experiences (Mandić and McCool, 2022, Clayton, 2020, Mandić and Vuković, 2022). In light of the practical implications of visitor perception and preference for biodiversity conservation and sustainable tourism management, it is important to note that the public has enthusiasm for engagement with conservation and biodiversity (De Oliveira Caetano et al., 2023) which presents an opportunity to address the global biodiversity crisis. Further investigation is required to identify if environmental knowledge or attitude are distinguishing factors in the ability of people to perceive diversity.

1.6 An integrated definition of eco-tourism to support tourism governance

Biodiversity and natural assets are crucial for destination tourism competitiveness (Chin et al., 2018, Wong et al., 2021, Huybers and Bennett, 2003, Mihalič, 2000, Dwyer and Kim, 2003). Environmental image ranks among the top ten factors for destination competitiveness (Cronjé and du Plessis, 2020). Mass tourists seek nature experiences, especially in or near protected areas with high biodiversity levels (Chung et al., 2018). However, there are several challenges associated with tourism and its management stem from the intricate cross sectoral and multifaceted approach used by the industry, characterised by a reliance on collaborative efforts among multiple agencies and interconnections across different sectors. The chaos theory of tourism, as outlined by Seeger (2002), underscores the intricacies and complexities inherent in the field, emphasising the need for a nuanced and interconnected approach to address these challenges. Altinay and Kozak (2021) conducted a study that highlighted the importance of government coordination at the local level. They found that with the rise in self-directed tourism, there's a need for governments to organise local offerings in a more coherent way. This coordination is crucial for enhancing the competitiveness of destinations on a larger scale. Visitor motives and attitudes drive both ecotourists and eco-tourism entrepreneurs (Thompson et al., 2018). Conflicts exist around the scalability of eco-tourism between environmental and capitalist perspectives (Isaacs, 2000). However, this could be due to a narrow definition of eco-tourism. However, synthesising findings for broader application within the tourism industry faces challenges due to diverse terminology and

methodologies (Leung et al., 2008). Without clear definition and understanding of eco-tourism and nature-based tourism there is a risk of greenwashing (Wondirad, 2019, Walsh and George, 2019). This is particularly relevant in the context of the forthcoming Green Claims Directive which is set to ensure that environmental labels and claims are credible and trustworthy, thereby enabling consumers to make more informed purchasing decisions. This initiative is expected to enhance the competitiveness of businesses committed to improving the environmental sustainability of their products and activities through certification and licencing processes. Examples of these types of systems are widespread with regard to sustainable tourism such as Earth Check, but ecotourism certifications are less established. Conflicts faced in sustainable tourism require a deeper understanding, and perspectives from stakeholder engagement are variable which will inhibit the implementation of the Green Claims Directive if these are not understood. Regenerative tourism is an emerging concept which focuses on 'leaving a place better than it was found' however, this is extremely poorly defined (Bellato and Pollock, 2023) and in my view is far too loose and open to greenwashing to be useful while also not meaningfully providing any new perspectives that cannot be brought into a reconceptualised definition of ecotourism; for this reason this thesis avoids the use or interrogation of this term.

1.7 Inter/multi/trans-disciplinary approach

The challenges facing sustainable tourism outlined above provide a clear scope for the need for interdisciplinary research due to the overlapping resources being utilised by tourism and conservation, the inconsistencies in terminology, and unstructured governance of tourism. Achieving effective governance in this context necessitates an embrace of interdisciplinary and transdisciplinary approaches. Additionally, there is a need to publish existing datasets from environmental impact assessments and park management programs can enhance understanding and inform more sustainable practices within the industry (Leung et al., 2008). By making such information publicly available, we can enhance our understanding of the environmental impacts associated with recreation and tourism, facilitating more informed decision-making and sustainable practices within the industry. Additionally, research has shown that transdisciplinary collaborations at various scales are needed for sustainable tourism (Winter et al., 2020). The Anthropocene underscores the significant and lasting impact of human activities on Earth's geology and ecosystems (Prakash and Verma, 2022). In light of high human impact on ecological systems, it can be useful to employ social science techniques and practices within ecological research to fully understand the dynamics. According to Stock and Burton (2011) multidisciplinary work involves various

academic disciplines investigating aligned goals, while interdisciplinary work takes a step further by seeking to understand and integrate perspectives to address common problems or provide resolutions. Transdisciplinary work, on the other hand, extends its focus to local and regional issues, often involving collaboration between academics from different disciplines and non-academic practitioners (Stock and Burton, 2011). Dube (2021) suggests that sticking solely to disciplines might lead to fragmented reductionist approaches in addressing shared challenges. Conversely, interdisciplinary work can result in overly cautious approaches or an inability to fully understand or implement interdisciplinary practices to their full potential (MacLeod and Nagatsu, 2018).

My interest in studying the relationship between tourism and conservation is informed by my unique position as both a researcher and an industry specialist. My journey in the field has been shaped by diverse roles, from working as a professional consultant in the tourism sector, focusing on ecological and environmental services, to conducting research aimed at bridging theory with practical applications. As Technical Director of Ecological Services at a multinational environmental consultancy, I have concentrated on understanding the delicate balance between human activities and ecological functioning, especially with regard to rare and protected species or habitats. Managing environmental frameworks, such as the environmental monitoring of the Wild Atlantic Way for Fáilte Ireland, has provided valuable insights into the complexities of balancing tourism promotion with environmental conservation and impact avoidance or minimisation. Collaborating with stakeholders from various backgrounds, including environmental agencies and interest groups, has enriched my understanding of these challenges.

1.8 Overall Aims and Methods

This research explores the intersection of tourism and environmental conservation, emphasising the role of biodiversity in supporting sustainable tourism practices. By redefining eco-tourism through the integration of tourism and environmental management perspectives, I aim to distinguish it clearly from nature-based tourism. The study is practice-driven recognising tourism as an opportunity for conservation rather than adhering to the 'war-on-tourism' approach, which often focuses on damaged sites and uses visitor numbers as a proxy for environmental damage.

My research aims to highlight ecological benefits provided by tourism operators, identifying key drivers of environmental impact and moving beyond simplistic metrics like visitor

numbers. Using qualitative techniques and psychometric measures, this study seeks to understand stakeholder and visitor perspectives, producing multi-disciplinary insights. By examining preferences for floral diversity and the influence of environmental attitudes, I aim to reveal nuanced dynamics in biodiversity perception.

The study is an exploration of the importance of robust tourism governance and effective management practices to enhance conservation outcomes. By identifying exemplary cases where tourism and conservation synergise, such as at Derrynane House, the study aims to provide evidence against the prevalent 'war-on-tourism' narrative. Ultimately, this research seeks to contribute to informed decision-making in tourism management and policy, advocating for clear governance, precise conservation classifications, and the recognition of the diverse impacts of tourism activities. The core approach focuses on exploring the opportunities of tourism for conservation.

1.9 Thesis outline

Throughout this research, three overarching themes emerged, each shedding light on different facets of the intricate relationship between tourism, ecology, and human perceptions:

1. **Visitor Experience and Biodiversity Conservation:** Chapters 2, 4, and 5 collectively explore the relationship between tourism management practices, visitor experience, and biodiversity conservation. Chapter 2 investigates factors influencing impact occurrence and severity, Chapter 4 examines the ecological benefits of tourism management in enhancing biodiversity, and Chapter 5 assesses individuals' perception of biodiversity. Together, these chapters highlight the importance of managing tourism activities to promote biodiversity conservation while enhancing visitor experiences.
2. **Terminology, Governance, and Informed Management:** Chapters 3, 4, and 6 delve into the multifaceted realm of eco-tourism terminology, governance, and informed management. Chapter 3 provides a nuanced exploration of diverse perspectives on eco-tourism among environmental and tourism professionals, setting the stage for understanding the complexities of governing sustainable tourism practices. The insights gleaned from Chapter 4's investigation into the ecological benefits of tourism management practices contribute to informed governance and planning processes. Moreover, Chapter 4 identifies the interconnections between conservation classification systems and their implications for tourism management

at the local level, thereby enriching the discourse on eco-tourism governance in Chapter 6. Collectively, these chapters offer invaluable insights into the challenges and opportunities inherent in eco-tourism governance, emphasising the importance of informed management practices for sustainable outcomes.

3. **Environmental Awareness, Perception, and Sustainable Practices:** Chapters 5 and 6 examine in detail the pivotal role of environmental attitudes and awareness in shaping perceptions of biodiversity and nature-based tourism experiences, while also informing sustainable practices. Chapter 5's investigation into individuals' ability to perceive biodiversity sheds light on the influence of environmental attitudes on this perception. This understanding is further contextualized in Chapter 6, where the broader implications of environmental awareness for sustainable tourism practices and conservation efforts are explored. Moreover, the insights from Chapter 4 into the ecological benefits of tourism management practices serve as a critical foundation for developing and implementing sustainable tourism initiatives informed by environmental awareness. Together, these chapters underscore the imperative of fostering positive environmental attitudes to enhance biodiversity appreciation, stewardship, and ultimately, sustainable tourism practices.

Each chapter of the thesis delves into distinct concepts, each offering a unique perspective on the overarching themes.

1.9.1 Identifying factors influencing visitor impact:

Chapter 2 determines the factors influencing impact occurrence and severity, moving away from visitor numbers as a proxy for damage.

In Chapter 2, the aim was to identify the prevalence and drivers of tourism-related threats/pressures in protected areas across Europe, with a focus on Ireland and sites near the Wild Atlantic Way (WAW) tourism route. The chapter utilised a multi-scale approach, combining data from Europe's Natura 2000 network and Fáilte Ireland's visitor monitoring program. The unique dataset from Fáilte Ireland comprises information from over 26,000 visitors, including demographic details, movement patterns, activities, and impacts. Generalized Mixed Effects Models were employed to analyse these data, aiming to identify the predictors of impact occurrence and severity.

1.9.2 Defining eco-tourism and examining governance:

Chapter 3 qualitatively explores the complexities of defining eco-tourism and examining governance structures related to terminology used within tourism from the perspectives of environmental and tourism professionals.

In Chapter 3, our aim was to identify commonalities and divergences in definitions and concepts of eco-tourism among cohorts of environmental and tourism professionals. By conducting semi-structured interviews and applying thematic analysis, we sought to gain novel insights into diverse perspectives, achieving data saturation independently for both cohorts. Notably, this chapter contributes a consolidated definition of eco-tourism informed by stakeholder input. This approach fills a gap in the literature by capturing in-depth insights from diverse stakeholders, complementing previous research primarily based on visitor surveys.

1.9.3 Investigating ecological benefits of tourism management:

Chapter 4 explores the potential ecological benefits of tourism management by testing the efficacy of practices aimed at increasing biodiversity and enhancing visitor experience.

In this experiment I investigate the effects of tourism management within protected habitats, focusing on the impact of grazing management practices on plant diversity and conservation goals. Over a 4-year period, a management exclosure experiment was conducted at Derrynane House, a heritage tourism site, to test the effectiveness of grazing exclusion on plant diversity. The study also investigates how habitat identity influences conservation outcomes, particularly in classifying the site as either "Fixed Dune" or the more sensitive "Machair" habitat types. By assessing changes in vegetation composition and conservation targets, this research sheds light on the nuanced relationship between tourism management and ecological preservation, challenging the prevailing narrative of conflict between tourism and conservation.

1.9.4 Assessing perception of biodiversity:

Chapter 5 investigates individuals' ability to perceive biodiversity and identifies factors influencing biodiversity perceptions and preferences.

Here I delve into the intricate relationship between visitor’s perception, preference for floral diversity in grassland ecosystems, and their underlying environmental attitudes and

ecological worldviews. The study aimed to determine whether individuals could perceive and prefer diversity in grasslands, and if their environmental attitudes influenced these perceptions and preferences. Using an adapted Ecological Concern scale and the New Ecological Paradigm scale, participants' environmental attitudes were quantified. Image-based rankings of grassland plots were used to assess preference and perception, which were compared with measured diversity indices. The findings revealed a strong correlation between participants' perceptions and calculated diversity, with environmental attitudes significantly shaping this ability. Moreover, participants exhibited a moderate preference for diversity, driven by factors such as species richness and floral abundance. These results underscore the importance of fostering positive environmental attitudes to enhance biodiversity appreciation and stewardship, thereby enriching visitor experiences and contributing to effective conservation efforts.

1.9.5 Synthesis and implications:

Chapter 6 serves as a comprehensive discussion, weaving together the insights gleaned from the preceding chapters.

Here I explore the implications and synergies arising from the diverse methodologies employed in Chapters 2 through 5. The discussion critically examines the predictors of impact occurrence and severity identified in Chapter 2, drawing connections to the consolidated definition of eco-tourism from Chapter 3. Furthermore, the discussion identifies the effectiveness of tourism management practices in enhancing biodiversity, as explored in the management exclosure experiment detailed in Chapter 4. Building upon the findings from Chapters 4 and 5, the discussion explores how individual perceptions and preferences may be influenced by environmental awareness. Additionally, it integrates visual elements from Chapter 4, providing a visual dimension to the discussion and offering a holistic perspective on the interconnectedness of ecological metrics and participant perceptions. Through this comprehensive synthesis, Chapter 6 aims to provide a nuanced understanding of the complex relationship between tourism, ecology, and human perceptions. It underscores the importance of fostering positive environmental attitudes to enhance biodiversity appreciation and stewardship, thereby enriching visitor experiences and contributing to effective conservation efforts. The chapter concludes by outlining potential avenues for future research and practical applications within the context of eco-tourism and environmental conservation derived from the overall thesis research presented.

Table 1.1. Multi-disciplinary, interdisciplinary and transdisciplinary approaches taken.

Chapter	Disciplinary Approach	Explanation
2	Multi-disciplinary	Chapter 2 involves integrating data and insights from multiple fields, such as ecology, tourism planning and management, to understand factors influencing impact occurrence and severity in protected areas.
3	Interdisciplinary	Chapter 3 integrates insights from two distinct disciplines, environmental management/research and tourism planning and management, to explore the concept of eco-tourism and examine governance structures related to terminology used within tourism.
4	Transdisciplinary	Chapter 4 goes beyond integrating insights from multiple disciplines to actively engage with stakeholders (e.g., ecologists, conservationists, tourism managers) to address complex problems related to tourism management and biodiversity conservation within protected habitats. This research harnesses social science qualitative analysis techniques to achieve an interdisciplinary synthesis of knowledge and understanding.
5	Interdisciplinary	Chapter 5 integrates insights from environmental management, psychology/social sciences to understand how individuals perceive biodiversity in grassland ecosystems and how their environmental attitudes influence these perceptions. The results are contextualised in a tourism context, focusing on tourism planning and management implication. This research provides a synthesis of viewpoints to provide collaborative insights to inform future decisions in both tourism and ecology with a clear endorsement of the use of social science methods.
6	Transdisciplinary	Chapter 6 synthesises insights from multiple disciplines (ecology, environmental management, tourism management & social sciences) to provide a holistic understanding of the complex relationship between tourism, ecology, and human perceptions, and to propose practical applications for eco-tourism

Chapter	Disciplinary Approach	Explanation
		and environmental conservation. It engages with diverse stakeholders and integrates visual elements to enrich the discussion and offer comprehensive insights.

Chapter 2 Visitor demographics, site-type and activities determine the occurrence and severity of environmental impacts at nature-based tourist destinations.

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Data availability: The data and code that support the findings of this study are openly available at Release Predictors of impact occurrence and severity of impacts · TorsneyStat/Predictors-of-impact-occurrence-and-severity-of-impacts (github.com) DOI: 10.5281/zenodo.7457424

Abstract:

1. Increasing demand for access to nature has the potential to increase environmental impacts. Identifying links between increased visitor intensity and habitat damage in context-specific studies is an oversimplification which does not account for visitor demographics or activity characteristics.
2. It was compared the prevalence of tourism related threats/pressures across protected areas in Europe, Ireland, and in sites close to the Wild Atlantic Way (WAW) tourism route along the west coast of Ireland. To better understand the drivers of tourism

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related impacts, the study analysed impact occurrence and severity at 43 sites along the WAW using a database of over 6000 visitor movement, demographic, and behaviour records gathered by a national tourism agency (Fáilte Ireland).

3. Threats/pressures related to tourism and recreation are prevalent and widespread across protected sites in Europe (49% of sites) with significantly higher ($P < 0.001$) prevalence of these threats in protected sites in Ireland (58% of sites). Over 33% of protected sites in Ireland are located within 2km of a WAW Discovery Point and 64% of these WAW adjacent sites have known threats/pressures related to recreation and/or tourism, which is significantly higher than Irish and European averages ($P < 0.001$).
4. Visitors to WAW sites ranged mostly within 1km of tourist destinations (99%) and over 75% of all visitors had no observable impact on the receiving environment. Site-type, tourist demographics and tourist activities were informative predictors of impact occurrence. Impact severity was influenced by total number of impacts, activity intensity and site-type. Site-type together with visitor activity occurrence and activity intensity were significant for impact occurrence and severity, highlighting the importance of understanding local conditions as well as visitor characteristics for impact avoidance/mitigation.
5. Tourism related pressures and threats are widespread amongst protected sites in Europe and Ireland. The results demonstrate the need to shift the focus from analysing discrete ecological responses in response to generalised tourism pressure to understanding the causes of impacts to mitigate them at source. This will help align tourism and conservation goals.

Keywords: Eco-tourism, Sustainable tourism, Nature-based Tourism, Tourism Impacts, Tourism Management, Visitor Interactions, Conservation, Natura 2000

2.1 Introduction

Nature-based tourism is increasing in popularity as public perception shifts towards valuing the ancillary benefits of nature, such as wellness (Winter et al., 2020, Jiang, 2020, Leung et al., 2008). As the popularity of nature-based tourism increases "green" branding and credentials influence the competitiveness of a tourism destination (Chin et al., 2018, Wong et al., 2021, Huybers and Bennett, 2003) which influences tourism performance (Bazargani and Kiliç, 2021). However, the fundamental drivers of tourism are primarily economic and social factors with environmental attention only being considered through legal compliance

measures (León-Gómez et al., 2021, Buckley, 2012, McKercher, 1993). This is problematic as tourism developments and related services often have negative environmental impacts (León-Gómez et al., 2021, Ren et al., 2019, Liu et al., 2018, Monz et al., 2013, Zhong et al., 2011). Moreover, with increasing prosperity and global transport, access to nature-based destinations is increasing, but awareness of impacts is weak (Davenport and Davenport, 2006). Tourism can therefore have negative impacts on the resources that support the tourism industry, threatening the sustainability of nature-based tourism (Font and McCabe, 2017), and with a clear need for investment into the natural assets which underpin the tourism industry (Sørensen and Bærenholdt, 2020, Rodríguez et al., 2020).

Sites protected for conservation are popular and nature is a key motivation for tourism; which often conflicts with conservation status (KC, 2021, Spenceley et al., 2021, Jones et al., 2021, King et al., 2012, Reinius and Fredman, 2007, Eagles et al., 2002). Participation in outdoor activities and nature-based tourism has long been increasing in countries such as the USA (Outdoor-Foundation, 2022) and Australia (Tourism & Transport Forum, 2017) and has been particularly evident since the COVID-19 pandemic (Beery et al., 2021, Askew and Bowker, 2018). The eco-tourism market was estimated at $181.1 billion in 2019 with a compound annual growth rate of 14.3% from 2021-2027 (Allied-Market-Research, 2021); showing a clear trend for increased demand globally. Within Europe a substantial volume of tourists identify nature as a primary motivation for their holiday (Table 2.1).

Table 2.1. Six European countries with the highest tourism numbers which are primarily motivated by nature (CBI, 2020).

	Outbound overnight trips 2018, in millions	Percentage of holidaymakers who see nature as a primary motive for choosing a holiday destination	Indication of number of outbound overnight trips with nature as a primary motive, in millions
Germany	109.0	15%	16.35
France	53.3	14%	7.46
Netherlands	20.8	25%	5.20
Belgium	13.1	19%	2.49
Poland	12.0	19%	2.28
Czech Republic	7.4	26%	1.92

Tourism impacts contribute to loss of biodiversity and ecosystem services; potentially undermining the attractiveness of tourism destinations (Wong et al., 2021, Chen, 2010, Huybers and Bennett, 2003). Recreation and tourism related activities are commonly cited

as issues for protected sites (KC, 2021, Jones et al., 2021, Spenceley et al., 2021, European Environmental Agency, 2018, Eagles et al., 2002). The environmental effects of tourism can be evident at a local-scale but broader/landscape scale interactions are more difficult to identify (Macdonald and Wester, 2021). Local-scale impacts are often considered to be context-specific and enterprises that operate on larger scales often fail to recognise their role in the protection/maintenance of the locations which they operate from (Weaver, 2001). Arif et al. (2022) showed that recreational pressures in the drawdown areas of freshwater systems can have both negative and positive effects on ecosystem functioning depending on the context and/or scale. This disparity of scale limits the application or influence of identified local impacts on forward planning or policy in a more general context (Ruban, 2021, Dertien et al., 2021).

The primary benefits of nature-based tourism are employment, business opportunities and income (Thapa et al., 2022) and a study by Ozcan et al. (2022) showed tourism and globalisation decreased environmental damage in countries such as the UK and France. Despite known impacts, time spent in nature positively influences environmental behaviours and decision making (DeVille et al., 2021, Pasek and Ratkowski, 2021, Fenitra et al., 2021); which is beneficial for broader conservation goals. Currently the literature expresses the need for multidisciplinary approaches and a clear lack of consideration for the experiences, management, design and planning of nature-based tourism (Mandić and McCool, 2022) which could be used as conservation resources if framed correctly.

The COVID-19 pandemic caused the closure of many sites and trails resulting in natural recovery of these sites which could lead to a global rethinking from mass tourism towards a more sustainable-tourism model (Jones et al., 2021, Spenceley et al., 2021). Eagles (2003) suggests that the negative impacts of tourism on park resources are less influenced by absolute numbers of visitors, and more influenced by weak tourism policy, management, and staffing, often caused by very low levels of finance. Furthermore, Chen et al. (2022) demonstrated that strong tourism policies can result in unintended environmental effects due to the complexities involved. This is particularly relevant where nature is used as a branding recourse or attraction; specifically, in and around national parks or nature reserves (Rhama et al., 2020, Vecco and Caust, 2019, King et al., 2012, Weaver, 2001). This can be positive for biodiversity, if the footfall presents an opportunity to educate and facilitate engagement with nature and influence environmental decision making (Massingham et al., 2019). A soft approach, using education and guidance of both the tourist and the tourism operator, can be

taken to foster environmental stewardship as a means to minimise potential impacts (Della Lucia et al., 2021, Zhang et al., 2020, King et al., 2012); however, this approach requires understanding of visitor impacts at a macro level and requires a national policy and implementation structure.

Increasing visitor intensity has been used generally as a proxy for environmental impacts (Monz et al., 2013); considering visitor behaviours as a single factor and assuming all visitors have consistent levels of impacts. Moreover, if increasing visitor numbers as a proxy for environmental damage is constantly being reaffirmed it can create misalignments between tourism and conservation goals.

Winter et al. (2020) and Gundersen et al. (2022) identified; the need for transdisciplinary collaboration at a variety of scales to achieve sustainable tourism. Political, social, cultural, and economic factors are important to consider with respect to nature-based tourism in protected areas (Rhama et al., 2020). Trends in nature-based tourism research show a high demand for increased access to nature reserves; however, the research has a bias towards low-moderate income counties (Thapa et al., 2022) and income availability is known to influence environmental impacts (Ozcan et al., 2022). There is a need to prioritise responsible low-key tourism – particularly in protected areas – to align tourism and conservation goals; this is reliant on increased understanding of visitor interactions (Jurkus et al., 2022). Recent research has shown a conflict of interest between tourism and nature protection which varies between different demographics (Tolvanen et al., 2020). Arif et al. (2022) identified links between recreational activities and ecosystem functionality which varies in different contexts; these results indicate a clear conflict between conservation goals for increased ecosystem functionality and tourism goals for increased access/engagement.

In Europe there are a network of protected sites known as Natura 2000 sites (Natura sites) designated under the European Habitats Directive (1992) [Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora] and Birds Directive (2009) [Council Directive 2009/147/EC on the conservation of wild birds] which provide a legal framework for Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). Within the legal framework in Europe there is a list of 413 threats/pressures for protected sites upon designation; 53 (12%) of these threats/pressures have attributes that relate to recreation and/or tourism (European Environmental Agency, 2018). Here, we harness monitoring data from the Natura 2000 sites across Europe and the Wild Atlantic

Way Visitor monitoring programme in the Republic of Ireland. Ireland was selected as a study country as it is a high-income country in Europe which specifically brands its natural assets with campaigns such as “Green Ireland” and the “Wild Atlantic Way”. The nature-based tourism literature shows a deficiency of research across North America, Europe and high-income countries (Thapa et al., 2022). Additionally, Ireland has high volumes of self-directed tourism.

We use a multi-scale study of tourism threats/pressures to the Natura 2000 network across Europe, the spatial co-incidence of tourist branded and Natura sites at the national-scale in Ireland as well as visitor demographic and activity drivers of environmental impact richness and severity at a regional-scale across 43 tourist destinations in Ireland. The regional-scale analysis used a multi-site, multi-year visitor monitoring data set from a regional tourism initiative in Ireland, the Wild Atlantic Way (WAW

To identify the prevalence of tourism threats/pressures across Europe, we assessed recreation and tourism associated threats/pressures recorded as part of the monitoring programmes for Europe’s Natura 2000 network of protected areas. At a regional scale in Ireland, we identified the proximity of sites promoted for tourism with Natura sites and the prevalence of recreation and/or tourism threats/pressures across all protected sites within 2km of promoted tourism sites. Finally, visitor demographics and activity engagement were investigated as factors hypothesised to drive impact richness and intensity at a regional scale across 43 sites in Ireland. By including site type, we evaluated whether the impacts observed are independent of local-scale or context-specific factors.

2.2 Materials and Methods

Data were gathered from the European Environmental Agency (2018) for known threats/pressures recorded for Natura sites and prevalence of the 53 threats/pressures that are related to recreation and/or tourism activities (Chapter 2 Appendix I) was determined.

The prevalence of tourism threats/pressures was assessed at a national-scale, for the Republic of Ireland (Ireland), to determine consistency between the European and national-scales. Within Ireland, a further targeted approach was taken focusing on the areas surrounding the Wild Atlantic Way, which has 191 ‘discovery point’ destinations across the west coast (Figure 2.1).

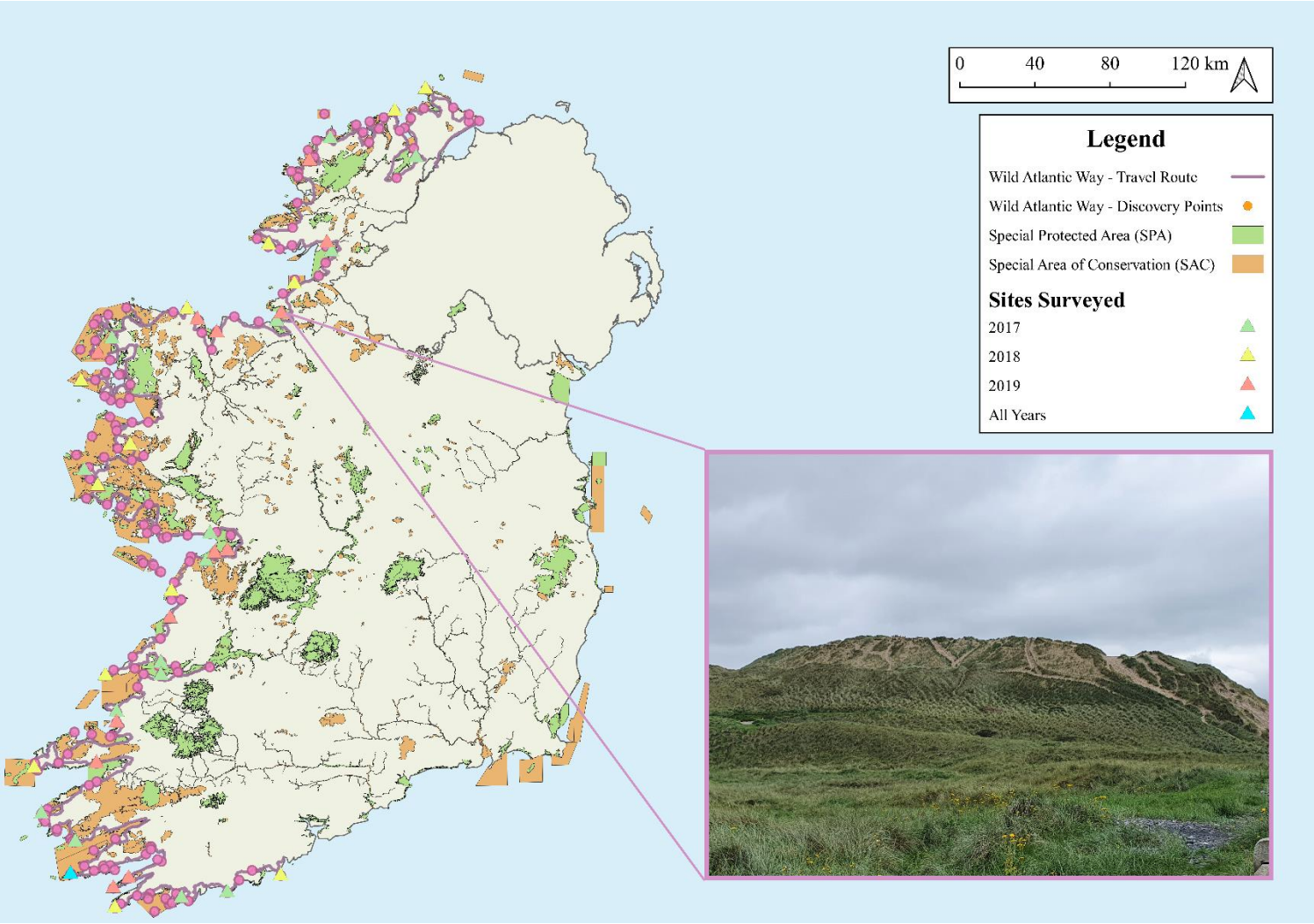


Figure 2.1. Distribution of 604 Natura 2000 sites, (SACs and SPAs), in Ireland relative to the 191 Wild Atlantic Way discovery points, sites surveyed and the WAW travel route: image demonstrating erosion caused by tourists at Strand hill.

R-Studio (4.0.3) was used throughout the analysis (R Development Core Team, 2020). The gDistance function in the package gdistance (Van Etten, 2017) was used to identify the nearest SAC and SPA to each of the discovery points; those within 2km were selected. The number of SACs and SPAs with known threats/pressures related to tourism or recreation were counted as well as the number of sites for each threat/pressure, at both scales. These data were recorded as presence absence data only which limits their interpretability**.** A chi-squared test of association was used to determine if the prevalence of tourism pressures was consistent across Europe, Ireland and the WAW associated sites.

We used visitor observation data collected as part of the environmental monitoring of the WAW over 43 sites for 3 years (Failte Ireland, 2019, Failte Ireland, 2018, Failte Ireland, 2017). Direct observation has been identified as the optimal process for collecting human distribution data (Marion et al., 2020). Analysis was constrained by this pre-existing data; for example, the activities and impacts data had no connecting metadata and therefore could only be considered independently. Monitoring sites were chosen to represent a variety of tourist destinations, management structures and site-types, spread throughout the WAW (Figure 2.1); the monitoring process was undertaken for compliance with national and international legislation.

Data were collected between 2017 and 2019; each year 14 new sites were selected and one site, Dursey Sound, was surveyed in all years. An environmental steering committee guided the site selection process annually ensuring geographic spread and variety of site-types were selected; the approaches for each year were:

- 2017 Estuaries and areas with high suitability for wading birds;
- 2018 Signature Discovery Points; and
- 2019 Sites within both SACs and SPAs.

At least two surveyors surveyed each site, three for large sites where the full extent of the site cannot be observed from 2 vantage points. Visitors on site were monitored using ArcPro (2.7.1) (ERSI, 2020) along with ESRI ArcGIS enabled apps Survey123 (ERSI, 2020b) and Collector (ERSI, 2020c). All surveys were conducted during the peak tourism season in Ireland (June-August) and surveys were conducted twice at each site for eight hours. Efforts were made to record every visitor on site, but where visitor numbers were high, recording yields were not 100%. Each group arriving to site was recorded as a single observation, visitor demographic data were collected through direct observation and included perceived

age category (child, teenager, adult, or elderly). The time of arrival, mode of transport and time of departure were also recorded (where possible); it is important to note that not all records represent the entire activity profile for the group due to view obstruction or non-returning groups etc. Visitor movement patterns were recorded using the Collector app, producing a polyline map of the group's movements. All activities undertaken were recorded using a coding system which ranked activities by the intensity of the activity (low, moderate, and high). For example, walking, jogging, or sprinting would be three equivalent activities in each of the AII categories (Chapter 2 Appendix II). Similarly, all impacts observed were recorded using a coded referencing system with low, medium, and severe impact classes (Chapter 2 Appendix II).

Data from Fáilte Irelands WAW visitor monitoring programme were used to evaluate the drivers of impact occurrence (IO) and impact severity (IS) using a set of explanatory variables (Table 2.2).

Table 2.2. Definitions of response and explanatory variables.

Response variables	**Definition**
Impact occurrence (binary)	Any impacts observed yes/no
Impact severity	Proportion of the total impacts that were high or moderate level impacts. Impact severity was a binomial proportion variable where successes were high and moderate impacts (combined), and failures were the number of low impacts.
Explanatory variables	**Definition**
Distance travelled*	Length of the polyline used to track and map visitor movements
Group-size**	Total number of people
Group-type	Category of group composition resulting in fourteen group-types; further defined in Table 2.3
Site-type	Category of site general features - built infrastructure, beach, Clifftop and highly managed.
Site	Site identity (random effect)
Number of activities undertaken**	Total number of activities which the group participated in
Activity Intensity Index**	The exertion level of the activity: e.g., Walking–Low; Jogging–Moderate, Running–High This variable was calculated as a proportion using the total number of moderate and high-level activities (combined) as a proportion of the total number of activities
Total Impacts*	Total number of impacts observed
Year	Year of observation

* Not used in IO or IS models; therefore, it was not standardised

** Numeric or count data with were standardised

The distances of all visitor movements were used to determine the distribution of visitor distances travelled upon arrival at the site. The demographic information was used to create a 'group identity' resulting in 14 different group-types (Table 2.3).

Table 2.3. Group-type category definitions.

Group-type	Definition	Count
Couple	Two adults only	2215
Individual	One adult only	742
Family	One or two adults and under 18s>0	957
Family with elderly	One or two elderly individuals with one or two adults and under 18s>0	44
Individual elderly	One elderly individual	161
Elderly Couple	Two elderly individuals	389
Elderly Group	Elderly individuals>2 and no others	101
Large Adult Group	Adults only>5 individuals	133
Small Adult Group	Adults only >2 but<5 individuals	592
Large Mixed Group	Adults, children, and elderly (inclusively)>5 individuals	155
Large Mixed Adult Group	Adults and elderly only>5 individuals	48
Small Mixed Adult Group	Adults and elderly only<5 individuals	196
Mixed Small Group	Adults, children, and elderly (inclusively)<5 individuals	104
Under 18s	No adults or elderly (0) and number of under 18s is>0	73

The total number of activities (activity richness) and total number of impacts (impact richness) for each group observation were calculated. IS was modelled as a binomial proportion of the number of medium and high-level impacts relative to the number of low-level impacts. Higher values for IS indicate a high proportion of high/medium-level impacts and lower values of IS are dominated by low level impacts. The Activity Intensity index (AII) was calculated as the proportion of all activities that were moderate or high-level. A 'site-type' factor categorised the site according to dominant features: beach, clifftop, hard infrastructure and heavily managed.

Five of the variables (indicated in Table 2.2 by a *) were standardised using the scale function. A two-step modelling approach was undertaken which focused on specific hypotheses: 1) What variables explain the occurrence of impacts (binary response, binomial

errors); 2) if impacts occurred what factors explained the IS (proportion of impacts which were moderate or high, binomial errors). For all models site was used as a random effect.

Models were fit using Generalized Linear Mixed Effects Regression model with Binomial error distribution (GLMER) (Bates et al., 2014). The maximal model was constructed for both response variables (IO and IS). The reference level group selected for the model was a couple at a built infrastructure site, as a couple is viewed to be a standard tourism unit and built infrastructure sites were anticipated to have the lowest potential for impacts. For the IO model, only second order interactions could be fit. For the IS model third order interactions were fit. The MuMin Package (Barton and Barton, 2015) was used to run all possible nested models and rank them according to their AICc values. The AICc values were used as a model selection criterion, models with the lowest AICc value were the models of best fit (Akaike, 1974). Equivalent models were any models with AICc values within 2 units of the best model; where this occurred the simpler model (lowest number of explanatory variables) was selected. Models were assessed to ensure the assumptions were met. The variables were assessed for collinearity using a correlation matrix and the models were inspected for overdispersion. Further post hoc tests were undertaken using the *emmeans* package in R (Lenth et al., 2018) to compare the estimated marginal means – using the 'Tukey' method to adjust for multiple comparison – for effects of each level of the categorical variable (full details are provided in Chapter 2 Appendix III).

The data was observational, therefore there was no meaningful way to discern between tourism and local recreation – therefore all observations are labelled as 'visitor'. Direct engagement studies would be needed to discern any potential difference. The activity and impact data were recorded with no connecting reference metadata. Future studies should connect these data to identify which activities have the highest rates of impacts associated with them. The data were non-exhaustive, meaning that data capture was not 100% at any of the sites; at high volume sites not all visitors' behaviours were recorded. Moreover, not all information could be gathered for all observations due to operational logistics during the survey. The study was limited in its scope in that it did not cover the full litany of possible nature-based tourism site-types. We interpret the results with these limitations in mind.

2.3 Results

The data show that 49% of all Natura sites have recreation and/or tourism related activities among the known threats/pressures for the site (Table 2.4). 58% of the 604 Natura sites in

Ireland have known threats related to tourism or recreation (Table 2.4), which is significantly higher than the European average (χ^2 = 16.08, df = 1, P < 0.001). Over a third of all of Ireland's Natura sites are located within 2km of a WAW discovery point (Table 2.4). Furthermore, there are discovery points within or directly adjacent (within 100m) to 23% of Natura sites along the WAW (Chapter 2 Appendix IV). Of the Natura sites within 2km of discovery points 64% of them have known threats/pressures related to recreation and/or tourism which is significantly higher than the averages for Ireland and Europe (χ^2 = 31.93, df = 2, P < 0.001).

The prevalence (number of sites) where the 53 activities from the known threats/pressures associated with recreation, tourism or both were identified within the Natura 2000 network across Europe, Ireland and the WAW can be found in Table 2.4. The prevalence of the top five threats/pressures at each scale are shown in Figure 2.2 and further detail is provided in Chapter 2 Appendix V.

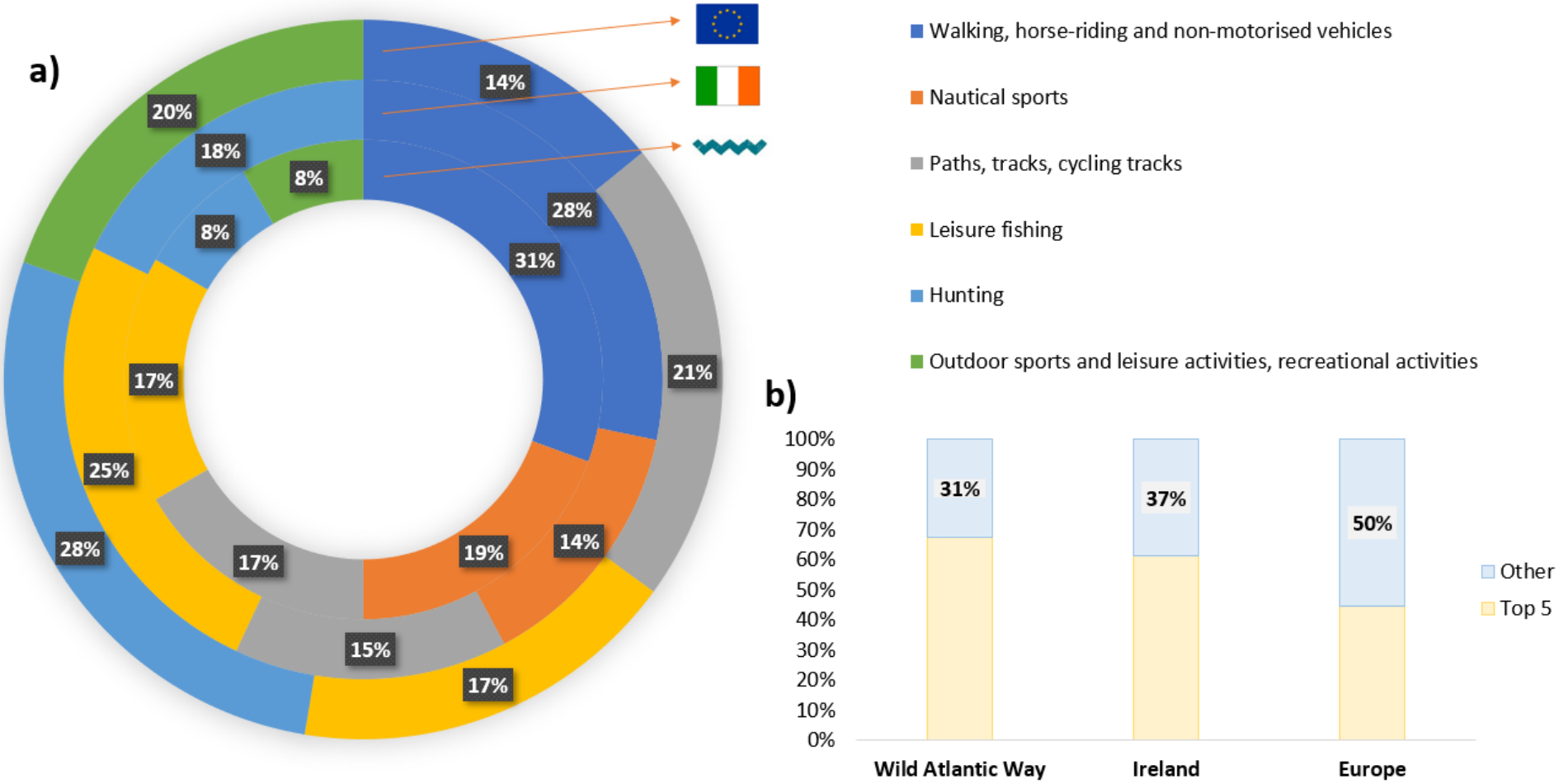


Figure 2.2. A: Top five threats/pressures at Natura sites in Europe (outermost circle), Ireland (middle) and along the Wild Atlantic Way (central donut) * Hunting and outdoor sports and leisure activities, recreational activities were joint 5th for the WAW. B: The proportions of other pressures were also graphed for comparison; Chapter 2 Appendix V gives the full breakdown of all pressures.

Table 2.4. Counts of sites within the Natura 2000 Network with known threats/pressures related to tourism or recreational pressures at various scales.

Scale/Region	Sites	SACs	SPAs	Total*
Across Europe	Number of Sites	3328	789	3444(338)
	Sites with known tourism pressures	1498 45%	471 60%	1682(144) 49%
Ireland	Number of Sites	439	165	604
	Sites with known tourism pressures	239 54%	110 67%	349 58%
Within 2km of WAW Discovery Points	Number of Sites	129	73	202
	Sites with known tourism pressures	75 58%	55 75%	130 64%

*() number of sites that are designated as both an SAC and SPA

The most common threat/pressure for European Natura sites is hunting (14% of sites), whereas in Ireland it is Walking, horse-riding and non-motorised, occurring at 37% of sites nationally and 23% of sites along the WAW (Figure 2.2).

The median distance travelled by groups was from the discovery point was 202m; the furthest distance observed was 5.66km. 94% of all observations were less than 1km and 99% of all observations were less than 2km from the discovery point. Less than 1% (0.88%) of observed visitors travelled beyond 2km from the discovery points.

Two equivalent models were found to best explain IO ($\Delta AIC_c = 0.5$). The model with the lower AICc contained an interaction between Group-size and AII, which did not significantly contribute to model performance ($\beta = -0.08$, SE = 0.050, z = -01.64, p = 0.1012; full Model in Chapter 2 Appendix VI). Therefore, the simpler model was selected as the model of best fit. This model contained the following six fixed effects: Site-type, Group-type, Activity Richness; AII; Group-size; and the interaction between Activity Richness and AII. The model explained almost 70% of the variance in IO (Marginal R^2 0.6, Conditional R^2 0.698).

Activity richness and AII had positive effects on IO (β (richness) = 1.8, SE = 0.13, z = 10.93, $P < 0.001$; β (intensity) = 0.43, SE = 0.45, z = 23.89, $P < 0.001$). Similarly, the interaction between AII and activity richness had a positive effect ($\beta = 0.04$, SE = 0.11, z = -5.79, $P < 0.001$). The number of individuals in a group positively affected observable impact of the group ($\beta = 0.12$, SE = 1.13, z = 1.25, $P < 0.05$).

Most group-types were not significantly different from the IO of a couple at a built

infrastructure site with the following exceptions: Families and Large Mixed Adult Groups were significantly less likely to have impacts than the reference level group-type (β (families) = -0.33, SE = 0.12, z = -2.06, P < 0.04; β (large mixed adults) = -1.86, SE = 0.16, z = -1.37, P < 0.03). 33 of the 48 records for Large Mixed Adult Groups were recorded as large coach tours and a further 5 were minibus tours.

Under 18s groups and individual adults were significantly more likely to have impacts than the reference group (β (under 18s) = 0.54, SE = 0.07, z = 2.02, P < 0.002, β (individual adults) = 0.49, SE = 0.33, z = -0.65, P < 0.03; respectively).

Clifftop sites were the only site-type that had a significant effect on IO compared to the reference site-type (β = 0.87, SE = 0.99, z = 2.28, P < 0.008).

The graph below (Figure 2.3) shows the strength of association of each of the fixed effects detailed in Table 2.5 for the IO model. All variables above one has a positive effect and all those below one has a negative effect.

Table 2.5. Impact occurrence model outputs (GLMER, Family = Binomial).

Predictors	***Estimates*** (β)	***Standard Errors***	***z-value (n = 5910)***	***p***
(Intercept) [Couple, Built Infrastructure]	-2.55	0.03	-5.788	**<0.001**
Group-type [Family]	-0.33	0.12	-2.062	**0.039**
Group-type [Mixed Over 18 Large Group]	-1.86	0.16	-1.373	**0.022**
Group-type [Individual Adult]	0.54	0.07	2.018	**0.001**
Group-type [Under 18]	0.48	0.33	-0.650	**0.022**
Group-type [Small Adult Group]	0.91	0.58	-0.087	0.086
Group-type [Elderly Couple]	-0.30	0.27	3.421	0.170
Group-type [Elderly Group]	-0.28	0.36	0.238	0.516
Group-type [Large Adult Group]	-0.11	0.32	-0.314	0.754
Group-type [Individual Elderly]	0.07	0.31	-0.132	0.812
Group-type [Mixed Over 18 Small Group]	0.04	0.13	-2.289	0.816
Group-type [Mixed Large Group]	-0.04	0.29	0.233	0.895

Group-type [Mixed Small Group]	0.28	0.38	0.115	0.908
Group-type [Family with Elderly]	-0.05	0.22	1.716	0.931
Site-type [Cliff Site]	0.86	0.99	2.283	**0.007**
Site-type [Highly Managed]	0.70	0.85	0.933	0.212
Site-type [Beach Site]	1.41	2.15	2.721	0.351
Group-size	0.12	1.66	1.247	**0.044**
Activity Richness	1.79	0.13	10.929	**<0.001**
Activity Intensity Index	0.43	0.45	23.885	**<0.001**
Activity Richness*Activity Intensity Index	0.04	0.11	-5.788	**<0.001**
Random Effects				
σ^2	3.29			
$\tau_{00\ Site}$	1.06			
Intraclass Correlation Coefficient	0.24			
$N_{\ Site}$	42			
Observations	5910			
Marginal R^2/Conditional R^2	0.600/0.698			

For IO, the interaction between AII and total number of activities shows that the positive relationship between the number of activities is strengthened if a higher proportion of the activities being undertaken are at a high or moderate intensity level (Figure 2.3).

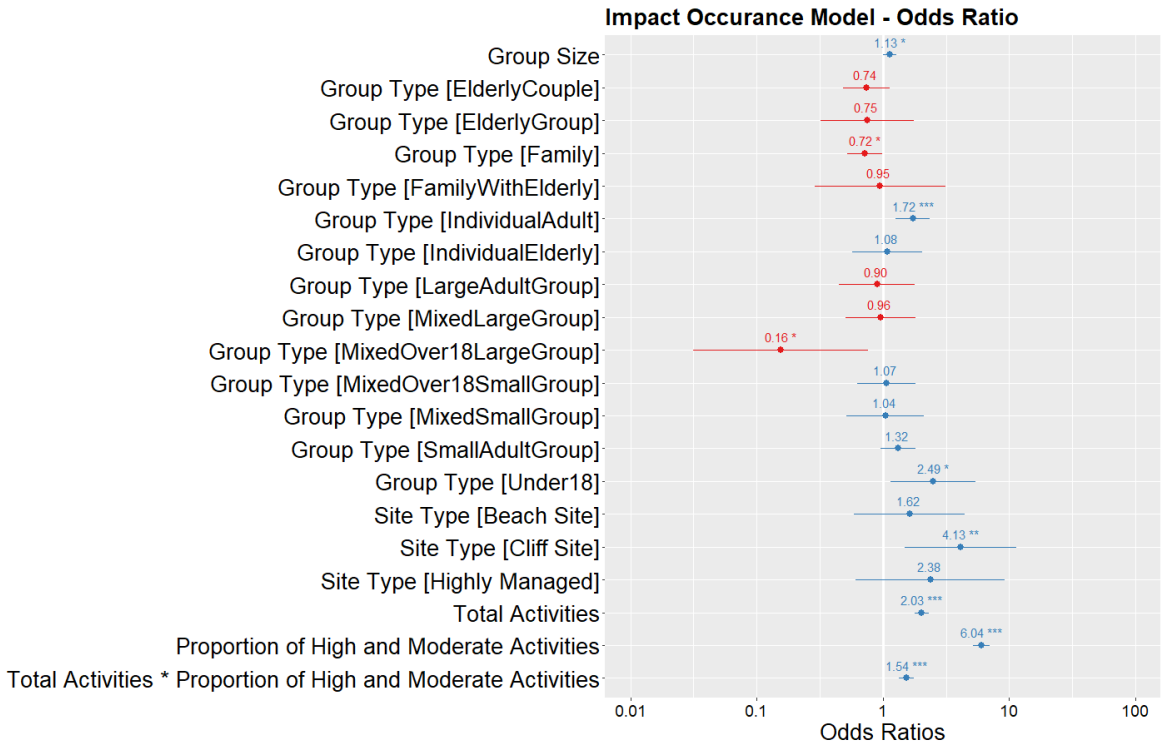


Figure 2.3. Odds ratios for each of the fixed effects in the final observable impact model; showing the 95% confidence intervals (* indicates significant terms in the model; red indicates a negative effect and blue indicates a positive effect compared to the reference value).

The model of best fit for IS contained the following fixed effects: total impacts, total activities, proportion of activities high or moderate, site-type, year and the interaction terms total activities*proportion of activities high or moderate, total impacts*proportion of activities high or moderate, total impacts*total activities and total impacts*total activities*proportion of activities high or moderate (Table 2.6). Total number of impacts, total number of activities and proportion of activities high or moderate all had significant positive effects on IS (β (number impacts) = 0.54, SE = 0.17, z = 5.47, P < 0.001, β (number activities) = 0.54, SE = 0.28, z = 3.38, P < 0.001, and β (AII) = 0.37, SE = 0.13, z = 4.22, p = 0.001; respectively).

Table 2.6. Impact severity model outputs (GLMER, family = Binomial).

Predictors	***Estimates*** (β)	***Standard Error***	***z-value (n = 1354)***	***p***
(Intercept) [Built Infrastructure, 2017]	-0.79	0.23	-1.57	0.116
Total Impacts	0.54	0.17	5.47	**<0.001**
Total Activities	0.54	0.28	3.38	**0.001**

Proportion of Activities High or Moderate	0.37	0.13	4.22	**<0.001**
Site-type [Beach Site]	-0.38	0.33	-0.78	0.431
Site-type [Cliff Site]	-1.96	0.08	-3.67	**<0.001**
Site-type [Highly Managed]	-1.69	0.12	-2.70	**0.007**
Year [2018]	1.42	1.76	3.36	**0.001**
Year [2019]	0.48	0.58	1.36	0.173
Total Activities* Proportion of Activities High or Moderate	-0.19	0.06	-2.84	**0.004**
Total Impacts* Proportion of Activities High or Moderate	-0.09	0.04	-2.55	**0.011**
Total Impacts* Total Activities	-0.19	0.06	-2.58	**0.009**
Total Impacts* Total Activities* Proportion of Activities High or Moderate	0.06	0.03	2.35	**0.019**

Random Effects	
σ^2	3.29
$\tau_{00\ Site}$	0.59
ICC	0.10
$N_{\ Site}$	40
Observations	2167
Marginal R^2/Conditional R^2	0.17/0.26

Figure 2.4 (below) shows the strength of association of each of the fixed effects in the final impact severity model graphically.

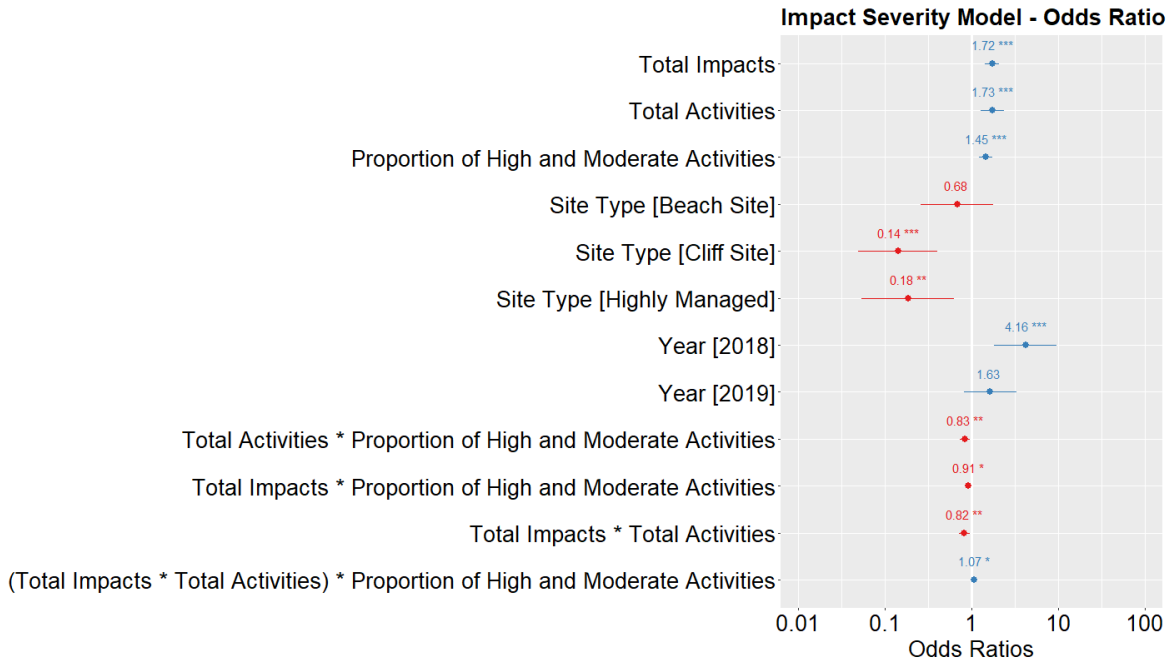


Figure 2.4. Odds ratios for each of the fixed effects in the final impact severity model; showing the confidence intervals (* indicates significant terms in the model; red indicates a negative effect and blue indicates a positive effect compared to the reference value).

There were a number of second and third order interactions which significantly contributed to model performance. The interaction between total number of impacts and AII shows that AII strengthens the positive effect of impact richness when numbers are low; however, as number of impacts increase the negative interaction weakens the effect (Chapter 2 Appendix VI Figure 1). AII strengthened the effect of activity richness when numbers are low; however, at high number of activities activity richness has the stronger influence (Chapter 2 Appendix VI Figure 2). For IS the total number of impacts strengthens the effects of the total number of activities at low levels, however as activity numbers increase this relationship weakened (Chapter 2 Appendix VI Figure 3).

The number of observations at each of the different site-types varied across each of the years (Table 2.7). IS also varied with respect to year with 2018 having lower IS identified than other years (Figure 2.5).

Table 2.7. Breakdown of observations at each site-type for each of the years.

Site-type	2017	2018	2019
Beach Site	250	239	1208
Built Infrastructure	139	106	320
Cliff Site	65	2368	446
Highly Managed	130	247	402

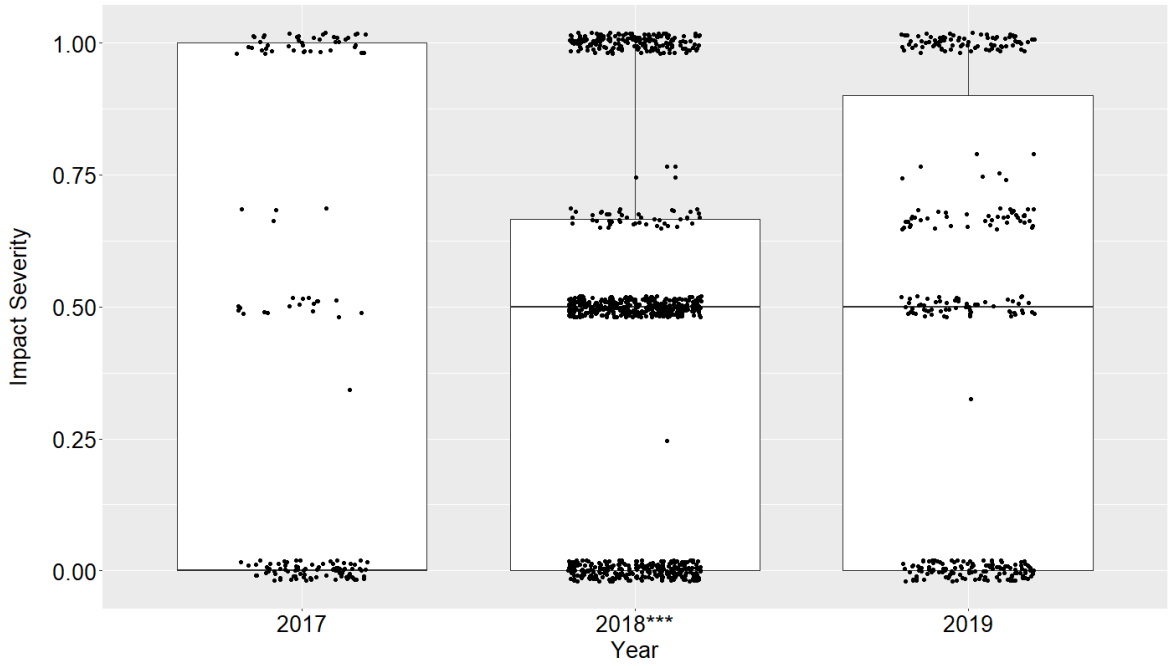


Figure 2.5. Box plot of impact severity levels within each year of the study. The median and interquartile range are shown within the box (* indicate significant difference).

Site-types had varying levels of moderate/high IS. Beach sites and built infrastructure were identified to be statistically similar, whereas cliff sites and highly managed sites had lower levels of impacts when compared to the others (Figure 2.6). All data and code for the work presented above is available online (Torsney and Buckley, 2022).

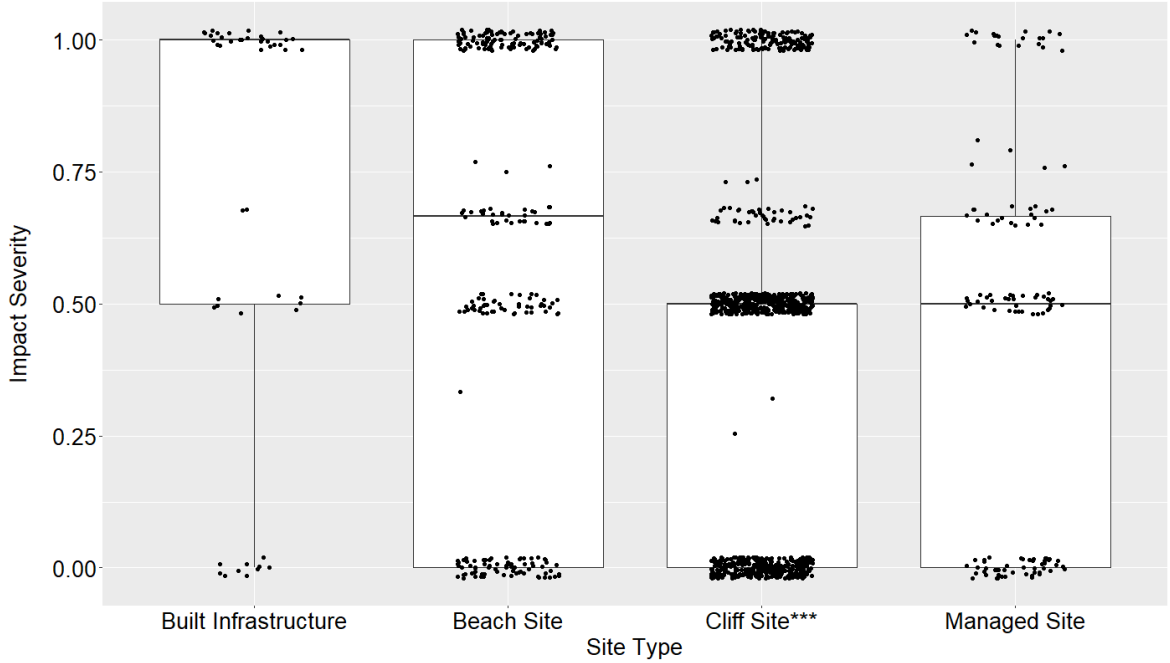


Figure 2.6. Box plot showing impact severity levels at each of the site-types observed with median and interquartile range shown within the box (* indicate significant difference).

2.4 Discussion

The results show that visitor pressures are widespread throughout the protected sites across Europe (49%). This presents potential conflicts in tourism goals and conservation goals and impedes sustainability (Buckley, 2012, McKercher, 1993, Thapa et al., 2022, Tolvanen et al., 2020). They also show that activity dynamics are key drivers of both impact occurrence and impact severity; which supports the concept that visitor behaviours are complex (Tolvanen et al., 2020) and using general visitor numbers is an over simplification of impact (Monz et al., 2013). Therefore, management practices should identify and appropriately manage the activities available at nature-based destinations to reduce overall impacts. Additionally, the study showed 75% of all visitor observations resulted in no identifiable effects on the environment. While not all impacts can be directly observed and ascribed to individuals or groups this result highlights the feasibility of 'no impact tourism' being an achievable target and that the prevalence of impacts are not attributable to all tourism.

The results show that threats/pressures related to tourism occur at nearly half of all protected sites across Europe, with higher proportions in Ireland and at almost two thirds of protected sites close to a major tourism discovery route. We highlight key damaging activities that have high occurrence rates at protected sites, which vary across the continental and regional scales shown. The complexities of tourism activities, behaviours and attitudes are known to influence environmental action (Tolvanen et al., 2020). The threats/pressures data are recorded in the EEA Natura 2000 database in a form that gives little understanding with regard to the intricacies of the threats; for example, "Outdoor sports and leisure activities, recreational activities" was recorded at 10% of sites across Europe with no further detail provided. The study therefore used a detailed study of tourism movements and behaviours to identify the key drivers of impacts. Impact occurrences were low – less than 25% of visitor observations had impact records. These results help to dispel the myth that increasing visitor numbers alone is inherently damaging to a nature-based destination. To achieve no impact from nature-based tourism, policy measures are needed to incorporate environmental considerations into the consent and decision-making frameworks for tourism at national and regional levels; specifically with regard to protected sites to incentivise the alleviation of threats and pressures related to tourism. Given the widespread nature of the problem identified in protected sites in Europe action is needed; policy measures could include the need for nature-based tourism developments which facilitate access or activities within protected areas to be required to submit environmental visitor management plans or introduce licencing processes for activities at or adjacent to protected areas to provide

regulated and controlled access in a systematic and structured manner. Existing protocols which explore these concepts include:

- Limits of Acceptable Change (LAC) (McArthur, 2000, Jurkus et al., 2022);
- Visitor Impact Management Model (VIMM) (McArthur, 2000, Jurkus et al., 2022);
- Visitor Activity Management Programme (VAMP) (McArthur, 2000, Jurkus et al., 2022);
- Visitor Experience and Resource Protection Model (VERP) (McArthur, 2000, Jurkus et al., 2022);
- Tourism Optimization Management Model (TOMM) (McArthur, 2000, Jurkus et al., 2022); and
- Integrated Monitoring and Adaptive Management System (IMAMS) (McArthur, 2000, Jurkus et al., 2022).

The number of visitors per group was not a strong predictor of impact occurrence in isolation and does not contribute to the impact severity for the group. This is an important finding as the literature focuses on identifying links between visitor numbers and impacts more broadly (Monz et al., 2013) or oversimplifying visitor behaviours/interactions . Transdisciplinary approaches to understanding the complexities of visitor behaviours and complex planning/management dynamics are well supported in the literature (Thapa et al., 2022, Winter et al., 2020, Gundersen et al., 2022, Jurkus et al., 2022). This research shows a need to focus on site-type, tourist demographics and activity interactions when trying to understand impact occurrence. Increased education, awareness and guidance material is needed to support the tourism industry in understanding site-type from an ecological perspective to understand the known sensitivities threats or pressures associated with broadscale classes of nature-based tourism destinations (beach sites, cliff top sites etc.). The impact severity model was more complex with second and third order interactions moderating the main effects. However, site-type, activity richness and intensity and number of impacts were all significant as main effects. Therefore, site management should focus on understanding their site and the availability of activities with a view to ensuring the activities can be facilitated in a manner aligned with the sensitivities of the site to ensure impacts are mitigated. The advancement of this understanding may be reliant on ‘citizen science’ or increased remote sensing technologies (Jurkus et al., 2022) asstudies of this scale (5910 groups observed) are rare.. Resources and training are needed at a national level to provide a platform to facilitate standardised replicate datasets which can be analysed effectively. This approach could facilitate on the ground understanding and learnings being harnessed

by national decision makers.

There is a need to complement the focus on discrete ecological responses to tourism – such as vegetation cover with respect to trampling and subsequent erosion (Bateman and Fleming, 2017, Monz et al., 2013) – to understanding the sources of effects. Looking at visitor behaviours, attitudes and activities in a broader context is where nature-based tourism research needs to focus in a transdisciplinary approach (Tolvanen et al., 2020, Arif et al., 2022, Gundersen et al., 2022, Jurkus et al., 2022, Winter et al., 2020). This shift could facilitate the alignment of conservation and tourism goals and enable informed conversations/knowledge exchanges at planning level where interventions are needed (Mandić and McCool, 2022). Tourism-typologies are widely recognised in the tourism literature with many studies showing the variant behaviours or motives of different types of tourists (Mehmetoglu and Normann, 2013) from various demographics (Ozcan et al., 2022, Thapa et al., 2022, Tolvanen et al., 2020). This research shows that group-types also have different environmental behaviours and therefore can connect to discussions of Tourism-typology, although further research is needed to interrogate this concept further with direct engagement surveys. Integrating these concepts into tourism management practices can help to reduce overall impacts which degrade a site, thus promoting a more sustainable model for tourism. It is important to build demographic understanding into the policy and decision-making framework; particularly with respect to promotional material to target low impact demographics and build targeted impact alleviation campaigns.

Site-type was a significant contributor of both impact occurrence and severity. Therefore, tourism planning/management processes need to understand the type of site being promoted to ensure it can sustainably host the activities being offered/marketed (Bazargani and Kiliç, 2021, Zhang et al., 2020, Chin et al., 2018, Font and McCabe, 2017, Liburd and Becken, 2017). Clifftop sites had higher rates of observed impacts which is probably due to the topography and gradient of the sites; steep embankments and irregular ground at these sites leave them susceptible to soil slippage when walkers use trails at these sites. Conversely, clifftop sites were seen to have lower impact severity than built infrastructure sites, which may be due to the limited range of activities which are typically supported at these sites. Site managers can use these findings to promote path fidelity on site, particularly at steep areas. The impacts at managed sites were highly variable which is expected as management practices are site specific with minimal continuity between sites. There is a need to have overall management practices and guidelines set out at a high level to ensure nature-based

tourism destinations are managed in a way that is cognisant of the reliance of tourism on nature (Vecco and Caust, 2019, Zaremba et al., 2018, Elbe et al., 2009, Huybers and Bennett, 2003, Steele, 1995).

The results show that visitor demographics influence impact occurrence; therefore, marketing specifically towards demographics with lower impact could lead to better outcomes. Marketing campaigns are known to be successful in eliciting sustainable visitor behaviours if implemented correctly (Zhang et al., 2020, Font and McCabe, 2017, Liburd and Becken, 2017). Most group-types behaved consistently with the reference group (adult couple); however, families and mixed large over 18s groups had significantly lower rates of observed impacts. This is likely to be due to the managed/controlled nature of such groups. Families are usually constrained in their ranging behaviours and activity patterns. Mixed large over 18s groups are mostly large coach tours which are often guided with potential for context-specific issues to be communicated to the visitor at arrival to a site. Individual adults are more free roaming and likely to engage in activities which are off the beaten track, or at more sensitive/vulnerable locations. Similarly, groups of unsupervised under 18-year-olds had significantly higher impact rates, which may be due to antisocial behaviours associated with teenagers (Dishion and Patterson, 2006). Marketing campaigns and on-site management measures should be targeted towards specific demographics to avoid impacts; both approaches have been shown to have positive effects (Zhang et al., 2020, Font and McCabe, 2017, Elbe et al., 2009). Direct engagement surveys are needed to further investigate the motives and demographics of visitors; this can help disentangle local recreational pressures and tourism pressures.

In general, visitor intensity has been used as a proxy for environmental impacts (Monz et al., 2013). Interestingly, although group-size significantly contributed to the overall model performance the effect size was relatively low ($\beta = 0.12$). The number of activities and intensity of activities undertaken had greater influence on observable impact. It is important to note that increasing visitor numbers is often a fundamental target embedded in tourism strategies and although group-size is a factor, it needs to be considered together with site dynamics, tourism demographics and activity interactions. Understanding environmental attitudes and behaviours are important considerations so as not to oversimplify interactions (Fenitra et al., 2021). There needs to be a shift away from focusing on visitor numbers for performance and/or environmental damage. Moreover, tourism targets should be expanded to focus on increasing engagement, awareness and interaction to activate the learning

opportunities presented by tourism; this could increase environmental stewardship and responsible behaviours (Fenitra et al., 2021, Tolvanen et al., 2020, Jurkus et al., 2022) to alleviate existing conflicts.

Activity intensity (the proportion of moderate or high-level activities) had significant contributions to both the observable impact and impact severity models. For impact occurrence the positive interaction between activity intensity and total number of activities shows that the relationship with number of activities is strengthened if the activities being undertaken are at a high or moderate intensity level. Positive main effects, negative two-way interactions and a positive three-way interaction between total impacts, total activities and activity intensity in the impact severity model however show that there is a threshold value for the combination of these factors in determining impact severity which needs to be understood from a management perspective (Steele, 1995). The Integrated Monitoring and Adaptive Management System (IMAMS) could be used with direct community involvement focused on activity types, intensities, and frequencies; this approach could provide valuable learnings to assess the relative merits or successes of various management interventions.

Understanding the predictors of impact occurrence and severity is particularly relevant when the site managers are somewhat removed from the tourism hierarchy such as council owned beaches or clifftop walks or when the tourism destination is within 1km of a protected site as the 99% of visitor observations were recorded within 1km of sites. Distance based impact density issues needs to be extended into the tourism hierarchy of planning to ensure adequate resources and communication chains are in place to facilitate sustainable management (Liburd and Becken, 2017). Understanding the activities that have the highest impact occurrence rates across protected sites could help to focus management action to control these impacts and possibly reduce their effects. This is particularly important in an Irish context where there are widely recognised threats to protected areas from walking, horse-riding, and non-motorised vehicles. Guidelines should be produced for regulating activities which have a known environmental impact and funds made available for conflict resolution in this regard.

The study was limited in its scope in that it did not cover all possible nature-based tourism site-types. Similarly, the study had a short time period; year was not significant with respect to impact occurrence however, it was significant for impact severity. 2018 had lower rates of moderate/high impacts, this is thought to be due to the 2018 sites being the ‘signature

discovery points'; the 15 sites along the WAW which are key mass tourism destinations in Ireland. At mass tourism destinations movement patterns and activities may be constrained by high volumes of tourists doing coordinated activities and therefore there are fewer free roaming incidences for impacts to occur. Further studies focusing on direct engagement studies at a wider variety of sites could help to further understand the role of demography and site type in impact occurrence and severity and disaggregate tourism effects from local amenity use. However, there are no significant limitations identified with regard to the reported findings of the study.

Further research is needed to identify the distribution of impacts around tourism destinations. It is expected that impacts are concentrated around the receiving locations (such as carparks) and that there is a distance threshold where impacts are negligible. Understanding the spatial distribution of impact would help to focus interventions. A clearer understanding is needed with respect to the relationships between activities and impacts, i.e., do specific activities cause specific impacts or impact types. This could be achieved through a more refined data collection system which links impacts to activities where they are apparent. To further expand the scope of our understanding, applying these methods to a wider array of site-types would help to understand broader site interactions. Additional nature-based site-types which were not included in this research would be riparian destinations, woodland parks and/or mountain trails. Using average daily visitor numbers could provide insight into capacity thresholds within site-type. Further research to garner a deeper understanding into tourism-typologies are needed with respect to environmental impacts. This could be achieved by intercepting visitors upon departure, having captured their movement and behaviours on site and collecting information relating to environmental literacy, cultural background, motive for attending the site etc. This could deepen our understanding of the intricacies within group-type which are currently not known with respect to environmental impacts.

Chapter 3 Defining eco-tourism for mainstream application and to support sustainable tourism governance.

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Author contributions: Andrew Torsney, Patrick O'Driscoll and Yvonne M. Buckley had substantial contributions to conception, design, analysis, and interpretation of data to support the paper. Andrew Torsney oversaw the data collection, performed the data analysis, and wrote the first draft.

Data availability: The full set of coded thematic data that support the findings of this study are openly available at DOI: 10.5281/zenodo.8328947: https://github.com/TorsneyStat/An_integrated_definition_of_eco-tourism

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Abstract:

- There is increasing demand for nature-based tourism, and tourism destination competitiveness is increasingly reliant on a positive environmental image. However, long term viability of the nature-based tourism experience relies on sustainability of the underlying natural assets.
- Eco-tourism has highly variable definitions with important differences, in terms of sustainability, between eco-tourism and nature-based tourism. Policy formation around eco-tourism and the sustainability of nature-based tourism requires clear communication and shared understanding of these concepts.
- The study explored a wide range of perspectives on the concepts of eco-tourism, tourism management and visitor interactions with nature-based tourism destinations, to inform an integrated and effective definition of eco-tourism. The study used thematic analysis of 31 semi-structured interviews from cohorts of tourism (n=15) and environmental (n=16) professionals in Ireland. Data saturation was achieved for both cohorts.
- Participants identified that nature is often viewed as a tourism product and, without sustainable management practices, the long-term economic viability of nature-based tourism is questionable. Environmental engagement of visitors was linked to tourism-experience and overall destination competitiveness and was considered an important facilitator of sustainable practices.
- Participants showed concern for a shift in the perceived biodiversity of the environment, with the richness and quality of biodiversity degrading over time. Collaborative action and engagement with local communities with a focus on long term environmental action was seen as essential for sustainable nature-based tourism.
- The study synthesised existing definitions from the literature and the perspectives gained from the thematic analysis to provide an integrated definition of eco-tourism: *Any tourism activity or product which interacts with, or capitalises on, natural assets (nature-based tourism) that has integral long-term benefits to the environment such as: positive conservation outcomes, engaging environmental experiences (including education) and/or raised environmental awareness that facilitates positive environmental stewardship, while also ensuring tourism is sustainably managed for the environment, communities and the economy.*
- Meaningful definitions of eco-tourism and/or nature-based tourism are required within national tourism policy frameworks; with metrics associated with the definitions to avoid misuse. Collaborative management practices are needed to

integrate nature engagement into the tourism experience to enrich the visitor experience while facilitating positive environmental attitudes and behaviours.

Keywords: Eco-tourism, Sustainable Tourism, Nature-based Tourism, Tourism Management, Thematic Analysis, Tourism Policy, Tourism

3.1 Introduction

Biodiversity and other natural assets are important for destination (macro-level) tourism competitiveness (Chin et al., 2018, Wong et al., 2021, Huybers and Bennett, 2003, Mihalič, 2000, Dwyer and Kim, 2003), with environmental image in the top ten factors identified for destination competitiveness (Cronjé and du Plessis, 2020). With increasing environmental awareness among the general public, there is an increased demand for environmental engagement at tourist destinations (Lee and Jan, 2018). Mass tourists seek to experience nature and to engage with natural assets directly, particularly in or near protected areas with high levels of biodiversity (Chung et al., 2018). While eco-tourism is often considered a niche offering, the broad appeal of nature-based tourism points to an opportunity to mainstream the concept of eco-tourism Weaver (2001).

Recreation and tourism related impacts are prevalent and widespread in protected areas across multiple scales (KC, 2021, Jones et al., 2021, Spenceley et al., 2021, European Environmental Agency, 2018, Eagles et al., 2002, Torsney and Buckley, 2023). This has the potential to generate conflict between tourism and environmental management and it has been suggested that the framing of sustainable tourism research has presented a 'war on tourism' narrative (Higgins-Desbiolles, 2020b). and further research is needed to understand the interface between tourists and the environment (Wolf et al., 2019). There is a need to focus not only on understanding the environmental perspective but also the tourism stakeholders' perspectives to ensure the understanding of this interface is holistic.

Visitor motives or attitudes are a key driving force for both ecotourists and eco-tourism entrepreneurs (Thompson et al., 2018). Conflicts exist between the scalability of eco-tourism from both environmental and capitalist perspectives (Isaacs, 2000). Picard (2015) explores the pitfalls and successes of including eco-tourism in a national planning framework and identifies that eco-tourism '*needs to be economically viable at a micro-economic scale, and it needs to be integrated within a pertinent macro-economic and political scheme of tourism development and planning*' [page 15]. This is particularly important for modern tourism as

macro-tourism is the key driver of tourism competitiveness (Altinay and Kozak, 2021), which may be connected to natural assets. There are concerns that without a clear definition of eco-tourism it is being used as to greenwash positive marketing of nature-based tourism which has no inherent environmental protection measures (Wondirad, 2019, Walsh and George, 2019, Abeyratne and Arachchi, 2021, Smith and Font, 2014).

Mainstream tourism policy needs to recognise the environment as a core asset/product for the sector (McLoughlin and Hanrahan, 2016). Roe et al. (2014) found that in the absence of a prescribed framework for sustainable tourism, the measure of environmental effects or use of existing management models – such as limits of acceptable change (LAC) and visitor impact management (VIM) – poses a challenge. Tourism is a known threat/pressure in over half of all protected sites in Europe (Torsney and Buckley, 2023) and with the increase in demand for outdoor recreation and nature-based tourism (Winter et al., 2020) there is potential for conflicts with conservation goals particularly at protected sites (Jones et al., 2021, Spenceley et al., 2021). There is therefore a need to structure environmental tourism policies to better manage potential conflicts. This is particularly difficult within tourism as a sector due to the complex nature of the tourism hierarchy (Altinay and Kozak, 2021). The chaos theory of tourism identifies that the tourism hierarchy is often difficult to define due to the diverse nature of hotels, restaurants etc. catering to business and residential clients as well as providing tourism services (Altinay and Kozak, 2021). Stanković et al. (2022) identified a clear need to provide a legal framework around eco-tourism at an international level. However, without clear definitions of the terms within the environmental tourism space, creating a policy framework would be unbounded.

Eco-tourism and nature-based tourism are two of the most prominent concepts related to the interactions between tourism and the environment. Weaver (2001) identifies that eco-tourism is distinct from nature-based tourism due to the inherently consumptive components of nature-based tourism and identifies sustainability to be a major distinguishing factor between the two. Many definitions of eco-tourism refer to sustainability; however, the definition varies depending on the qualifying interests/relative values of those providing the definition (Pascual et al., 2017) such as cultural values, governance structures and societal norms (Walsh and George, 2019). Sustainable tourism has experienced rapid policy uptake in the last decade; however, it is often used as a self-explanatory term and therefore is underdeveloped as a concept and difficult to apply in practice (Guo et al., 2019). Buckley (1994) found that a strict definition of eco-tourism was only relevant for planning and

development purposes and suggested that a universal definition of eco-tourism was unlikely due to cultural differences and context specific influences. However, it is recognised that concrete principles are needed to ensure eco-legitimacy and avoid greenwashing (Walsh and George, 2019). Without clearly defined terms of reference for eco-tourism there can be issues related to legal provisions or protections required for avoidance of conflicts from eco-tourism (Stanković et al., 2022). While providing a clear universal definition has been shown to be problematic (Buckley, 1994, Donohoe and Needham, 2006, Fennell, 2001, Fennell, 2014, Honey, 2008, Ivanov and Ivanova, 2013, Ross and Wall, 1999, Spenceley and Rylance, 2021, Stronza et al., 2019, Weaver, 2001), a number of studies have provided key principles or factors when defining eco-tourism (Table 3.1 – further insights into definitions of eco-tourism are provided in Chapter 3 Appendix IV).

Table 3.1. Examples of papers with key principals or factors for defining eco-tourism.

Reference	Key principals or factors for defining eco-tourism
Buckley (1994)	Nature-based tourism; Conservation supporting tourism; Environmentally educated tourism; and Sustainably managed tourism.
Fennell (2001)	Where eco-tourism occurs, e.g. natural areas; Conservation; Culture; Benefits to locals; and Education.
Donohoe and Needham (2006)	Nature-based; Preservation/conservation; Education; Sustainability; Distribution of benefits; and Ethics/responsibility/awareness.
Honey (2008)	Involves travel to natural destinations; Minimizes impact; Builds environmental awareness; Provides direct financial benefit for conservation; Provides financial benefits and empowerment for local people Respects local culture; Supports human rights and democratic movements.
Buckley (2009)	Nature-based product Minimal-impact management Environmental education

	Contribution to conservation
Walsh and George (2019)	Reiterates the principles from Honey (2008) when bespoke principles are not developed.

These studies identify conservation or sustainability within the guiding principles; however, one of the earliest definitions of eco-tourism was by Ceballos-Lascurain (1987) [page 14] which states:

> *"Travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas."*

The initial definition from 1987 has no inherent sustainability or conservation elements and therefore aligns more readily with the current nature-based tourism definition. Fennell (2001) identified that the definition of eco-tourism has evolved over time with concepts such as conservation, education, ethics, sustainability, impacts, and local benefits being better represented in the more recent definitions. Fennell (2014) [page 15] then provided a more complete definition of eco-tourism:

> *"An intrinsic, participatory and learning-based experience which is focused principally on the natural history of a region, along with other associated features of the man–land nexus. Its aim is to develop sustainably (conservation and human well-being) through ethically based behaviour, programmes and models of tourism development which do not intentionally stress living and non-living elements of the environments in which it occurs."*

This definition requires education as a fundamental tenet and would preclude activities such as self-directed immersive experiences which are motivated by nature, connected to nature and have no impact on the local environment. Furthermore, a study by Conway and Cawley (2016), identified that the criteria from Fennell (2001) are poorly understood within the industry; stating that personal interest in ecological issues have implications for understanding eco-tourism. In 2011 the Mohonk Agreement set out criteria for establishing sustainable tourism or ecotourism certification programs (Alliance, 2011). However, this agreement sets 'minimal environmental impacts as an ecological criterion and not 'no environmental impact'. Forje and Tchamba (2022) suggest that there is a clear need for ecotourism policies to accelerate sustainable management at protected sites. This subjectivity further supports the need for a clear definition in a policy context to regulate the industry and avoid greenwashing.

There are three widely recognised pillars of sustainability; economic, social and environmental (Hansmann et al., 2012, Purvis et al., 2019). Tourism is an economically driven sector (León-Gómez et al., 2021) which has clear links to social and environmental domains (Streimikiene et al., 2021). Stakeholder engagement is important with regard to tourism professionals to understand the economic elements of sustainability in order to identify holistic solutions. Sustainable tourism is widely recognised to be independent of sustainable development because tourism is fundamentally reliant on capital and consumption; with less scope for exploring meaningful alternatives (Guo et al., 2019). A systematic review of sustainable tourism by Streimikiene et al. (2021) identified that tourism governance/structures or responsibilities influence conflict alleviation with regard to potential social and environmental issues; however, a deeper understanding of the conflicts faced is required. Sustainable tourism policy formation often recognises the importance of stakeholder engagement without specifying the processes involved or specifically who this refers to; this is important as perspectives are highly variable (Guo et al., 2019).

While the concept of sustainable tourism addresses the economic, social, and environmental dimensions (Hansmann, Mieg, & Frischknecht, 2012) it is important to note that sustainability is not the fundamental driver of tourism. It is imperative to have informed planning procedures for the success of sustainable tourism which may require legislative enforcement (McLoughlin et al., 2023). It is essential to consider how the dimensions of sustainability intersect with tourism competitiveness, a vital factor in the overall performance of the industry (Bazargani & Kiliç, 2021). The shift from business-oriented to destination-oriented competitiveness has introduced new complexities in understanding the success of a destination (Altinay and Kozak, 2021), and it is crucial to explore how sustainability practices impact this changing landscape

3.2 Research Aims

Here the study aimed to identify commonalities and divergences in definitions and concepts of eco-tourism elicited from cohorts of environmental and tourism professionals, informing the development of an integrated and effective definition of eco-tourism. This study is novel in its approach, as it delves into the nuanced understandings of eco-tourism among different professional cohorts, filling a gap in the literature that has primarily relied on visitor surveys. Our objectives were to:

- Explore diverse perspectives on eco-tourism, tourism management, and visitor interactions with the environment, particularly in the context of nature-based tourism destinations.
- Identify commonalities and divergences in definitions and concepts of eco-tourism that were elicited from cohorts of environmental and tourism professionals and identify key aspects that may be uniquely understood within specific professional cohorts.
- Inform the development of an integrated and effective definition of eco-tourism.

The study provide an updated, stakeholder-informed, definition of eco-tourism. There is limited research that captures the in-depth insights from diverse tourism and environmental stakeholders, particularly around eco-tourism concepts using qualitative interviews; with most previous work tending to rely on visitor surveys (from a Republic of Ireland perspective).

3.3 Methods

3.3.1 Research Approach

The nature-based tourism literature shows a deficiency (only 5% of studies) of research across North America, Europe and high-income countries (Thapa et al., 2022). The Republic of Ireland was selected as a study country as it is a high-income country in Europe which specifically brands its natural assets with tourism campaigns such as “Green Ireland” and the “Wild Atlantic Way”. Data was gathered using a semi structured interview approach with two cohorts of respondents, environmental managers and tourism professionals, which were analysed to identify emerging themes using the qualitative method of thematic analysis, as per Braun and Clarke (2006). This method uses units of meaning gleaned from words, phrases, expressions of thought, ideas, experiences and emotions etc. which were extracted from interviews. These units of meaning are then interpreted in the context of the research topic in a systematic manner; as per Clarke and Braun (2013). The approach for forming themes was guided by Braun et al. (2022). Throughout the data collection period (September 2020 to June 2023) and analysis process a reflexivity journal was kept to guide and inform the research.

3.3.2 Participants

The strategy for recruitment of participants involved identification of a gender-balanced group of stakeholders from diverse tourism-related sectors. The study sought tourism and

environmental professionals in both private and public sectors in Ireland, based in 11 counties, from national governmental organisations to local operators and site managers. Individual (one-to-one) interviews were conducted following a semi-structured approach. Ethical approval was granted by the Research Ethics Board in the School of Natural Sciences, Trinity College Dublin. Saturation was achieved for both cohorts individually, with a total of 31 interviews completed. The sectoral and gender profile of the participants is shown in Table 3.2.

Table 3.2 Gender and cohort profile of interviewees (participants). All participants identified as either male or female.

	Tourism	Environmental	Total
Male	8	7	15
Female	7	9	16
Total	**15**	**16**	**31**

3.3.3 Procedure

The researcher contacted potential participants for engagement via email, targeting environmental and tourism management professionals throughout the management hierarchy. This included government officials, semi state agencies, private sector interest groups, individuals from large scale enterprises within the sector etc. Efforts were made to target high ranking individuals in each organisation. The resultant participants represented a range of individuals who worked from local to national levels within both cohorts. All participants were given a research information sheet (Chapter 3 Appendix I) and signed a consent form in advance of completing the interview. The interviews were conducted in person for the first 15 interviews – however, due to the COVID 19 pandemic, the remaining 16 interviews were conducted online over Teams video conference calls. Both cohorts were represented by both in person and online interview techniques with no differences observed between the themes extracted from responses using the different interview methods. All interviewees were asked the same 11 overarching questions (Table 3.3), with follow up questions prompted by the discussions where relevant to ensure all emerging topics pertaining to the research area were explored. The rationale for each question selected can be found in Chapter 3 Appendix II. An important element of the question development process was to ensure we understood the variability in understanding and perceptions around a topic using a theoretically informed and constrained methodology (Braun and Clarke, 2019). Each interview lasted between 25 and 80 minutes and all were recorded to facilitate

the preparation of the transcript. Transcripts were manually prepared from the audio recordings by the researcher and cross checked by the co-researcher.

Table 3.3. Set questions which all participants were asked within the semi-structured interviews including the question rationale.

Interview Question
Can you explain the tourism hierarchy, highlighting roles and responsibilities from local to national level?
What do you think is meant by the term 'eco-tourism'?
How does your definition of eco-tourism fit into the tourism management structure that you described previously?
Describe what you understand biodiversity to be and how do you think it might be important from a tourism perspective, if at all?
In your opinion, who is responsible for the protection and enhancement of biodiversity at tourist destinations?
How do tourists interact with a given site?
How should tourism interaction be planned and/or managed beyond site level?
Are there any circumstances where biodiversity is, or should be, prioritised above tourism/economic gain?
What is more valuable to Ireland and why; tourism or biodiversity?
Have you heard of natural capital? If so, can you explain what it is?
Do you think people have an inherent right to freely access nature, explain why?

3.3.4 Analysis

The data transcripts were systematically coded by the researcher and co-researcher using an inductive method – following the step-by-step process outlined in Braun and Clarke (2006) & Clarke and Braun (2013). The codes were individual concepts of meaning within the transcript and a theme was a repeated pattern of meaning identified by combined codes that are perceived to have similar or shared interpretation. These codes and themes were cross-examined and compared amongst the participant transcripts to identify any continuity or repetition throughout transcripts and to see if it captured meaning as a theme. To ensure a data focused approach was achieved, a triangulation process was undertaken with two independent researchers (Table 3.4). Following the detailed analysis process the final main themes and sub themes were identified and cross examined against the research aims.

Table 3.4. Description of analysis steps.

Analytic steps suggested by Braun and Clarke (2006) and Clarke and Braun (2013)	Analytic steps of the current study
Familiarizing yourself with your data	Verbatim transcription with a focus on the systematic and equal transcription of all the interviews. The researcher and co-researcher read all the interviews several times and separately recorded their initial pre-codes and thoughts. A critical review of the interview guide ensured that the questions were as clear as possible between every interview.
Generating initial codes	The researcher and co-researcher discussed the different pre-codes after participants transcript. Initial thoughts and reflections were formalised into emerging patterns. The data-driven focus was on the actual verbal statements and not the studies' goals.
Searching for themes	Codes grouped into emerging level 1 themes and the differences between the interviews were critically reviewed. Level 1 themes were then grouped into Level 2 themes within each transcript – and again discussed between the researcher and co-researcher to ensure agreement.
Reviewing themes	The themes were critically reviewed once more to determine the core meaning of the themes, and initial themes that had a certain pattern of similarities were joined together as one theme. These were then grouped into Level 3 – main - themes across all participant transcripts. This approach ensured the individual nuances and participants opinions are still captured within the data. The main themes and sub themes (Levels 3 and 2) were discussed regarding their relevance for the studies' goals. The recordings were listened to once more to ensure that all relevant themes had been captured during the analytic process.
Not suggested	An additional step was employed by the researcher and co-researcher – when all codes had been grouped into level 3 – main – themes; a subset (2 environmental and 2 tourism) of transcripts were sent to two independent qualitative specialists for triangulation purposes. This was to ensure the analysis approach was truly data led to remove unconscious bias towards the research goals. These four transcripts were coded (as above) and organised into themes by the two independent researchers and a discussion was had with respect to the emerging findings.
Defining and naming themes	Discussion between the researcher and co-researcher about the definition and precision of the relevant themes to the research questions. Applying and revising labels/ titles of themes to ensure meaning is extracted from lower levels codes and themes.
Producing the report	Mutual discussion between the researchers and authors about the themes and how to describe them in an article. In this case this involved the researcher and co-researcher, two independent qualitative specialists for triangulation and the senior author.

3.4 Results

The interview respondents from the two cohort groups (environmental and tourism) were coded and anonymised using the cohort group and a letter as unique identifier together referred to as the respondent ID (for example Environmental_A and Tourism_A). These IDs are referenced throughout the results where a direct quote was used. The analysis resulted in 3006 initial codes which were aggregated into five main themes partitioned into 21 sub themes (Chapter 3 Appendix III). Each of the definitions of eco-tourism were extracted individually and can be seen in Chapter 3 Appendix IV.

3.4.1 Theme 1: Importance of policy structure and communication in tourism

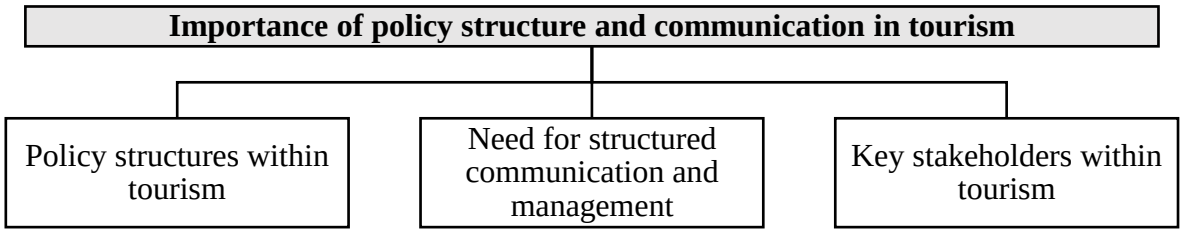


Figure 3.1. Identified sub-themes (white boxes) within the main Theme 1: Importance of policy structure and communication in tourism (grey box).

There was broadscale agreement between the two cohorts with regard to the main theme: 'Importance of policy structure and communication in tourism' (Figure 3.1). There was a general understanding of the tourism hierarchy, although the identification of the key stakeholders involved in tourism varied; particularly within the environmental cohort. Policy measures were recognised consistently in playing a key role in conservation action and it is known that *"national biodiversity policy minimises or avoids impact on nature"* [Environmental_G]. A key focus of the main theme was the need for communicating policy and the apparent disconnect of "*perspectives between policy makers and locals*" [Environmental_S]. There is a strong sense that "*collaboration between organisations to identify opportunities*" [Environmental_M] needs to be embedded not only within the management of a tourism destination – but also within the tourism policy structures at all levels; this is because "*destination managers look at all the strategic plans*" [Tourism_A] from higher levels. There is a sense that the '*government disregard community and the social capital in communities'* [Environmental_D] within the tourism policy structures.

3.4.2 Theme 2: Significance of economics, business development, management and communication structures within tourism

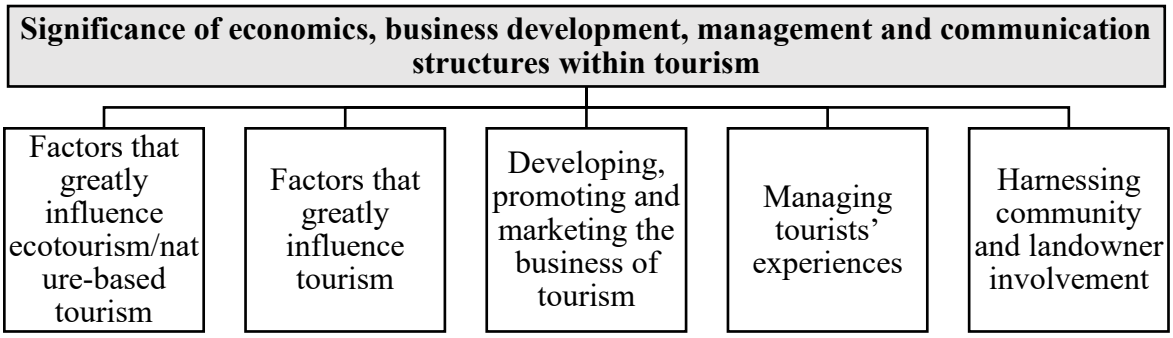


Figure 3.2. Identified sub-themes (white boxes) within the main Theme 2: Significance of economics, business development, management and communication structures within tourism (grey box).

Within the second main theme 'Significance of economics, business development, management and communication structures within tourism' five sub themes were identified (Figure 3.2). These sub-themes identified eco-tourism or nature-based tourism as distinct from tourism – recognising the key economic components behind the business of tourism. Management and community engagement practices were strong factors.

In general, the concept of communication was prevalent throughout the data, particularly with the need for bottom-up communication. The sub theme – 'Harnessing community and landowner involvement' – highlights the need to prioritise communication within localities. "*If the community are not engaged with - you could be creating problems*" [Environmental_L]. It is clear that *"tourism is an economic, for profit, business driven sector"* [Tourism_C] and that *"nature is a lower priority regarding decisions"* [Tourism_H]. However, there was an apparent disconnect between the prioritisation of nature and the integral reliance of tourism on nature as a product. Moreover, *"biodiversity underpins much more than just economic gain or tourism value"* [Environmental_L] and the *"mistreatment (of biodiversity) diminishes (the tourism) product"* [Environmental_M]. Although these concepts were well understood and nature being recognised as a tourism product was repeated throughout the data – eco-tourism was still viewed as a subsector or niche tourism offering. "*Eco-Tourism_historically niche/hipster/hippy*" [Tourism_N] and is "*a specific type of tourism*" [Tourism_N]. It was recognised that eco-tourism is a term that can have *"variable definition*" [Environmental_I] and there is disparity behind the intentions around the use of the term:

"*I know what it's meant to mean and I know what people generally take it to mean*"

[Environmental_A];

"*It's kind of a phrase almost like sustainability …everyone would have a different opinion or interpretation of a definition for eco-tourism"* [Tourism_N]; and

"I think the term means two things simultaneously, possibly at the same time for some people" [Environmental_C].

The idea that eco-tourism has a highly variable meaning was expressed throughout the data. For all aspects of tourism discussed - eco-tourism, nature-based tourism or mainstream tourism – the sub theme 'managing visitor experiences' was prevalent within the tourism hierarchy. This was because *"management shapes visitor experience"* [Tourism_J] and there is a need to focus processes on *"maximising visitor experience"* [Tourism_N]. The management of visitors and the subsequent environmental impacts are considerations within tourism; "*understanding the issue plus a willingness to take measures*" [Environmental_G] is a core concept within this. It was expressed that tourism focuses on *"enabling access over tourism impact"* [Environmental_G] and environmental interventions are only engaged with when *"complying with law"* [Environmental_K]. When trying to understand the business of tourism it was presented that biodiversity could conflict with tourism, in that *"biodiversity sectors' aims/goals impact tourism product(s)"* [Tourism_M]. Therefore, it became evident that tourism business development focuses on economic success "*budgets for marketing compared to budgets for community groups"* [Environmental_I]; there was a large "*focus on increasing numbers*" even though the *"mistreatment (of biodiversity) diminishes (the tourism) product"* [Environmental_M]. Again, the connection between tourism and local communities was recognised as central to developing the business of tourism, *"tourist sites contribute to the local economy"* [Tourism_B]. However, the importance of biodiversity continues to be undervalued at nature-based tourism destinations and seen as secondary to tourism itself. The economics in developing nature-based tourism can also be underestimated and therefore not allocated the required time or capital for its development.

3.4.3 Theme 3: Importance of understanding and engaging with nature

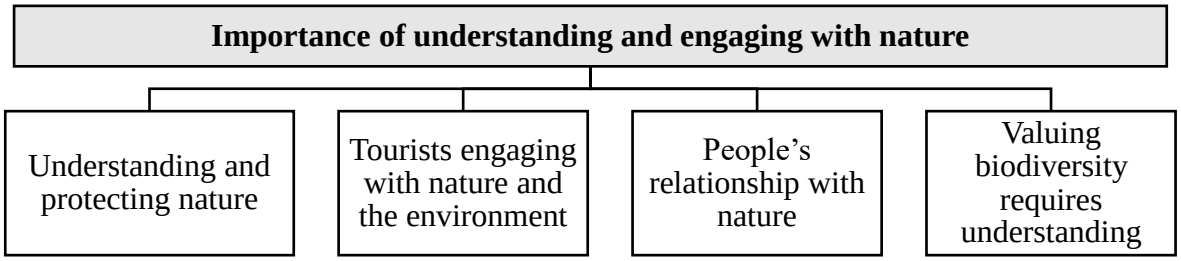


Figure 3.3. Identified sub-themes (white boxes) within the main Theme 3: Importance of understanding and engaging with nature (grey box).

The 'importance of understanding and engaging with nature' theme was supported by four sub themes which identified the importance of understanding, and valuing nature in the context of people's relationships with nature and how those relationships are developed and maintained Figure 3.3).

It is evident to both tourism and environmental cohorts that engaging with nature and having environmentally informed policy is central to maintaining tourism and protecting biodiversity. Engaging with nature was recognised as an essential need with "a*ccess to nature similar to need of access to water or fresh air*" [Tourism_G]. It was understood that *"people don't want to go about and destroy nature or biodiversity"* [Environmental_I] however, *"people have limited understanding of biodiversity"* [Tourism_I]; it is clear that *"more education and awareness (is) needed in tourism"* [Tourism_J]. This need for increased awareness and education was reflected in both the tourism and environmental cohorts. The environmental cohort identified the sub theme 'Valuing biodiversity requires understanding' – this subtheme was absent from the tourism cohort. This is a key difference as it demonstrates the need for better informed tourism management in relation to environmental perspectives.

It was expressed that *"supporting biodiversity requires reflection"* [Environmental_K] and there is a need to *"avoid tipping point (to facilitate) protecting biodiversity (and) preventing environmental degradation"* [Environmental_N]. Understanding the tipping points or critical thresholds for visitor numbers is complex and the themes show there is a need for a greater level of understanding of environmental problems to foster environmental stewardship; there is a *"shift in ecology towards including people"* [Environmental_I] because it is recognised if there is "*no connection with nature how ~~are you~~ (is one) going to really care"* [Environmental_I]. It was equally recognised in the tourism cohort that

engaging with nature contributed towards their goal of "*maximising visitor experience*" [Tourism_N]. The themes demonstrate that *"a lot of our management and structures are geared towards product development"* [Tourism_A] which can result in the *"exploitation of nature"* [Environmental_K]; while demonstrating the *"human dependency on nature"* [Environmental_K]. It was expressed that the "*baseline of memories are shifting*" [Environmental_I] and "*people don't even notice that stuff is gone now*" [Environmental_I]. There is a sense that *"health and safety (is prioritised) above natural environment"* because "*health and safety resonate with people*" [Environmental_N]. This is similar to the sub theme managing tourists' experiences under Theme 2 which identified that tourism fixates on *"enabling access over tourism impact (on nature)"* [Environmental_G]. If health and safety and access are prioritised over nature over a long time this could result in potential issues/conflicts – such as the introduction of light fixtures which introduces barrier effects through illumination to nocturnal species such as bats [Tourism_B].

3.4.4 Theme 4: Safeguarding and prioritising biodiversity

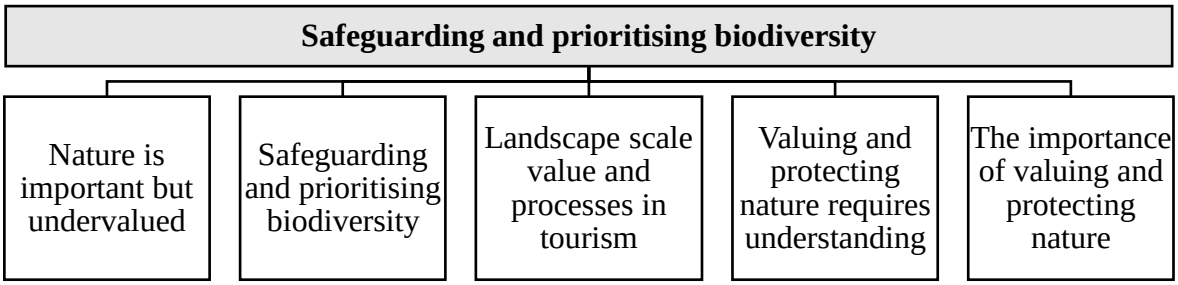


Figure 3.4. Identified sub-themes (white boxes) within the main Theme 4: Safeguarding and prioritising biodiversity (grey box).

'Safeguarding and prioritising biodiversity' was the fourth main theme. There were five sub-themes which focused on the importance of nature with respect to understanding, protection, prioritisation, scaling and valuation processes within tourism (Figure 3.4).

There is a strong sense that 'Nature is important but undervalued' which appeared as a sub theme under the fourth main theme 'Safeguarding and prioritising biodiversity'. It is evident that "*ignoring biodiversity causes issues*" [Tourism_D] and that *"eco-tourism is not recognised as a major driver of tourism"* [Environmental_A]. Although, conversely *"biodiversity obviously contributes to (tourism) experiences"* [Environmental_A] and that there is inherent link that *"valuing tourism equates to valuing biodiversity"* [Environmental_B]. Despite the sense that there is a lack of prioritisation of nature within this sub theme, under 'Safeguarding and prioritising biodiversity', the sub theme asserts that

"by prioritising biodiversity, you are prioritising what people want to come and see" [Tourism_B]. It identifies the clear links that *"tourism products have their origin in nature*" [Environmental_D]. This sub-theme provides clarity that both the tourism and environmental cohorts agree that "t*ourism development shouldn't impact biodiversity*" [Environmental_H] as "t*ourism needs to be sustainable in terms of environmental protection*" [Tourism_G]. Importantly, it was expressed that "*access (should be) denied due to damage and exploitation*" [Environmental_O]. It was important to note that – when discussing the theme 'Safeguarding and prioritising biodiversity' – the tourism cohort asserted that *"tourism is important to rural economies"* [Tourism_F] and that *"without biodiversity we will have barren landscapes"* [Tourism_P].

The final two sub themes under Main Theme 4 were closely related:

- Valuing and protecting nature requires understanding; and
- The importance of valuing and protecting nature.

Although these themes overlapped in their general construct, the sub-theme "Valuing and protecting nature requires understanding" identified the fundamental importance of data/understanding to inform protection protocols. This nuance was only expressed by the environmental cohort who – understandably – had a deeper knowledge base of the potential interactions between tourism and the environment. The environmental cohort recognised that *"certain locations are sensitive to numbers"* [Environmental_G]. It is also understood that there is a *"lack of education or understanding of natural environment"* [Tourism_C]. There was a need to raise "*awareness of sensitivity and significance of environment*" [Environmental_E]. It is recognised that "*biodiversity and scenery are interlinked*" [Environmental_H] and features such as a "*meadow provides unique experience for guests*" [Tourism_H] as "*the traveller wants an experience*" [Tourism_H]. With the obvious links between nature and tourism *"conserving for purely economic gain is obtuse and short sighted"* [Environmental_L]. To this end it is important that tourism managers, promotors and operators recognise and understand potential impacts biodiversity as well as being willing to implement measures to avoid this; for the sustainability of their tourism product and industry by extension.

3.4.5 Theme 5: The need for meaningful long-term sustainability and environmental management structures

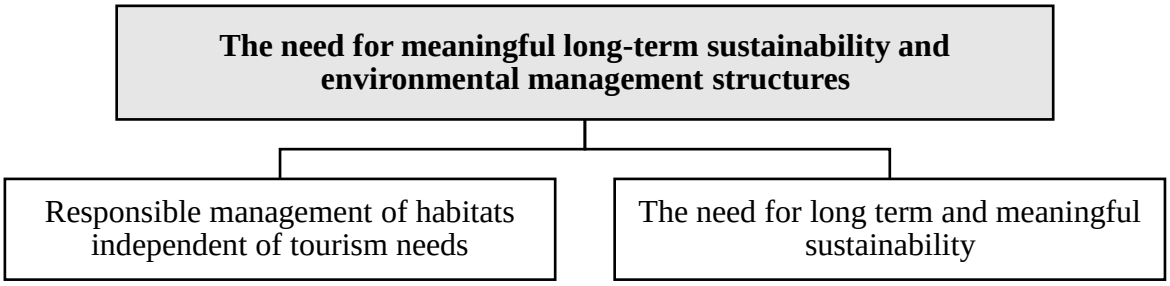


Figure 3.5. Identified sub-themes (white boxes) within the main Theme 5: The need for meaningful long-term sustainability and environmental management structures (grey box).

There were two sub themes within main theme 5 (Figure 3.5), 'the need for meaningful long-term sustainability and environmental management structures':

- Responsible management of habitats independent of tourism needs;
- The need for long term and meaningful sustainability.

Both cohorts recognised the importance of habitat and tourism management for sustainability. This concept of management practices being linked to sustainability was also contained within theme 2 with statements like *"destination management organisation could lead to the sustainable management of tourism"* [Tourism_A] and *"visitor management equals sustainability"* [Tourism_J]. There is a sense that tourism management needs to be cognisant of environmental sensitivities and managed accordingly – such as prioritising *"developments away from forests and wetlands"* [Environmental_H]. There was a keen sense that *"awareness brings passion and understanding"* [Tourism_K] and a recognition of the ancillary benefits of nature particularly related to *"our own mental health and well-being"* [Environmental_D]. It is evident however, within main theme 5, that the environmental sector is concerned about the short-sighted nature of the current considerations for sustainability. "*Sustainability is managing resources for future generations*" [Environmental_G] which is problematic as there are various meanings of sustainability with *"weak and strong sustainability"* [Environmental_I]; resulting in cynicism in relation to the term sustainability being viewed as an "*empty phrase*" [Environmental_E]. Within ecology *"resilience has begun to replace sustainability"* [Environmental_I] but despite the terminology used there was a need to prioritise the *"coexistence of human activity with nature"* [Environmental_E] to ensure that nature-based tourism is *"not impinging on the rights of future generations"* [Environmental_I].

3.5 Discussion

Five main themes emerged from interviews with both sets of participants from the perspectives of environmental stakeholders and tourism stakeholders. These themes connect to critical concepts in the definition of eco-tourism highlighting the importance of governance, prioritisation of nature, long term sustainability and the need for an informed approach. There is a need for a clear definition of eco-tourism to ensure policy and legal processes can be put in place to ensure the protection of sensitive environments (Stanković et al., 2022). The following stakeholder informed definition of eco-tourism was derived from the themes extracted from the participants – along with a review of existing definition (see Chapter 3 Appendix IV for a full list of definitions):

> *Any tourism activity or product which interacts with or capitalises on natural assets (nature-based tourism) that has integral long-term benefits to the environment such as: positive conservation outcomes, engaging environmental experiences (including education) and/or raised environmental awareness that facilitates positive environmental stewardship, while also ensuring tourism is sustainably managed for the environment, communities and the economy.*

This definition builds on the existing definitions, but leaves it open enough to include self-directed tourism which does not require educational benefits from experiences – as would be seen in the Fennell (2014) definition. The definition provided is essentially the sustainable practice of nature-based tourism – which has been shown to have global appeal to mass tourism with potential conflicts (Higgins-Desbiolles, 2020b, Mandić, 2019, Mandić and Marković Vukadin, 2021); although these conflicts are not necessarily an inherent problem if managed correctly (Torsney and Buckley, 2023). The inclusion of nature-based tourism in the definition is a novel contribution and ensures the two cannot be conflated. The structures of tourism governance are fundamental for ensuring that appropriate levels of environmental and social sustainability are integrated into the planning and management of tourism products/destinations. Despite the clear cohesion and shared understanding of this concept – it is evident that such structures are clearly misunderstood or perhaps absent entirely. Within tourism and governmental bodies there is an obvious disparity between the economic focus of tourism and a "willingness to take measures" to resolve environmental issues. It was identified that environmental action is only applied in practice when there is legal incentive or requirements. Therefore, without legislation or robust policy measures in place conflicts can arise. The focus of tourism development is often fixated on increasing visitor numbers with reference to health and safety protocols but little heed to anything else despite the recognition of the value of natural assets as tourism products. Intervention is

required in this regard to ensure high value tourism products – such as nature – are considered meaningfully when planning tourism at all levels. Despite the clear perception that tourism is reliant on natural assets such as landscape features, biodiversity, habitats and species, 'eco-tourism' was still viewed as niche tourism for both cohorts within the study. The concept of eco-tourism had highly variable definitions with a distinct sense that there was a difference between its intended meaning and its operational use. The themes extracted demonstrate that it is perceived that engaging and interacting with nature is fundamental for both tourism and environmental management. Moreover, there is a worrying shift in baseline memories with respect to biodiversity richness and quality.

The DPSIR model serves as a comprehensive framework for understanding the complex interactions between human activities and the environment. The themes extracted connect to the facets of the DPSIR model (Table 3.5); thus, validating its technical merit. However, a critical element which was not present within the themes was the 'environmental governance and subsidies element'.

Table 3.5. DPSIR model details connected to the research themes extracted.

Model Element		**Identified Themes**
D	Tourism industry and economic development	Significance of economics, business development, management and communication structures within tourism
P	Ecological pressure	Importance of understanding and engaging with nature
		Safeguarding and prioritising biodiversity
S	Environmental governance and subsidies	
I	Ecological quality and tourism attractiveness	Importance of understanding and engaging with nature
R	Ecological security and economic structure	The need for meaningful long-term sustainability and environmental management structures
		Safeguarding and prioritising biodiversity

Despite the critical role of environmental governance in sustainable tourism, it did not emerge as a central theme. This observation hints at a potential barrier within the tourism

industry, where professionals may perceive environmental governance as inherently restrictive. This perception could hinder active engagement with environmental governance practices. In light of these findings, it becomes evident that there is a need for targeted efforts to bridge the gap between environmental governance and tourism practices. This might involve addressing the perceived restriction and fostering a collaborative approach. For instance, the development of tailored environmental communication processes within the tourism sector could play a pivotal role in ensuring that environmental governance is viewed not as a constraint but as a facilitator of collaboration. Such initiatives can pave the way for a more comprehensive and sustainable approach to tourism, aligning with the broader goals of the DPSIR model.

Eco-tourism presents a challenge due to its varying definition, as seen in the results, leaving the term open to greenwashing (Smith and Font, 2014, Ivanov and Ivanova, 2013, Wondirad, 2019, Buckley, 1994). A common thread in these definitions is the connection to natural assets and the goal of neutral or positive interactions, i.e., maintaining ecological condition. Clear measurements of eco-tourism are crucial (Stronza et al., 2019), as is recognising the need for investment and impact avoidance (Winter et al., 2020). Highlighting the importance of eco-tourism governance and prioritising biodiversity as recognised by the themes extracted. However, the themes also highlight the variability in eco-tourism definitions and the risks of greenwashing without clear policy measures. From a tourism perspective any tourism product which relies on natural assets should manage its interaction to ensure the long-term viability of their tourism business. The themes identify strongly that nature is a tourism asset, which is reflected in the literature with environmental image being a key driver of destination competitiveness (Cronjé and du Plessis, 2020). Therefore, the sustainable management of such nature-based tourism destinations should include actions to protect the natural asset being utilised, which therefore aligns with the proposed definition of eco-tourism. Within the literature the key differentiating characteristic of nature-based tourism is that it is utilitarian – focusing on reductive extractive use of natural assets with no inherent or long-term suitability measures (León-Gómez et al., 2021, Ren et al., 2019, Monz et al., 2013). In order for long term sustainability to be achievable there is a need to invest in and protect the assets for which a tourism business is reliant. The themes extracted show a strong sense of tourism governance and the need to prioritise and protect biodiversity – however, the results also highlight the variability in the definitions around eco-tourism, the lack of understanding of ecological interacts/damage and the risk associated with greenwashing without clear policy measures being put in place manage eco-tourism principals.

The study highlights the high value of nature as a tourism product and the tourism industry's reliance on nature – with the need to prioritise and safeguard nature. A study by Bielański et al. (2022) identified that there is limited overlap between environmental and tourism research, primarily focusing on context-specific impact studies; this was identified following a comprehensive bibliometric analysis of over 66,000 documents. There is a need for a holistic approach to understanding visitor impacts to avoid conflicts between tourism and conservation (Torsney and Buckley, 2023, Higgins-Desbiolles, 2020b, Mandić, 2019, Mandić and Marković Vukadin, 2021).

The themes extracted from the data show the differences between nature-based tourism and eco-tourism are poorly understood or recognised – which is echoed in the systematic review by Mandić and McCool (2022). Despite the acknowledged importance of nature, there is a perception of undervaluation from both the tourism and environmental perspectives. Surprisingly, this contradicts existing literature, which demonstrates that tourism competitiveness is directly linked to the natural or environmental image (Streimikiene et al., 2021, Cronjé and du Plessis, 2020). Moreover, engagement with nature is crucial for tourism, enhancing visitor experiences and destination competitiveness (Chin et al., 2018, Huybers and Bennett, 2003, Wong et al., 2021). Even nature soundscapes, as demonstrated by Jiang (2022), have been shown to have tourism benefits. Engagement with nature, such as whale watching, has been shown to increase positive environmental behaviours (Clark et al., 2019, Clayton, 2020, Mandić and McCool, 2022, Mandić and Vuković, 2022). While both the tourism and environmental cohorts recognise the need for safeguarding and prioritising nature within tourism, there is a shared recognition that a science-based approach is required to understand the complex interactions between tourism and the environment. Despite this common understanding, the tools or mechanisms for this were not well described by the participants.

The study underscores the crucial role of chaos engagement in the sustainable development of nature-based tourism. Which aligns with the current trend around stakeholder engagement for nature-based tourism (Ferreira et al., 2020). Both environmental and tourism cohorts recognise the significance of community involvement, emphasising the need for effective communication structures, collaborative efforts, and bottom-up approaches within localities. There are practical barriers to engagement with the ‘host community’ in a planning context due to complexities involved with engagement processes (Hanrahan, 2010). A study by Han

et al. (2023) suggests a synthesis of a bottom-up spillover theory and social exchange theory could be used in nature-based tourism. This is that the benefits of tourism spill over to the community but the exchange of feedback from the community could foster mutualistic benefits. Overtourism at nature-based destinations is of increasing concern and the use of local communities within the planning process is through to be a key avenue for alleviating conflicts (Wearing and Schweinsberg, 2018). This could be useful as long term monitoring of nature-based tourism is often overlooked (Mandić and McCool, 2022) and the theoretical frameworks presented by Han et al. (2023) could provide these long term supports. The themes in this study reveal that successful tourism management necessitates fostering positive relationships with communities, acknowledging their integral role in tourism, and prioritising their well-being. Despite the acknowledged importance of biodiversity and nature, there is a notable disconnection between the prioritisation of nature and the economic success of tourism, highlighting the need for a balanced approach that values both community livelihoods and environmental conservation. The study emphasises the intricate interplay between tourism, nature, and local communities, suggesting that meaningful and sustainable tourism management must consider the perspectives and needs of the communities involved.

Furthermore, the themes show (as can be seen in Chapter 3 Appendix III) that habitat management practices were viewed as being important from a tourism perspective with an awareness of the ancillary benefits of nature such as mental health benefits. The mental health benefits of nature are well documented in the literature (Barnes et al., 2019, Bratman et al., 2019, Jackson et al., 2021, Herchet et al., 2022). It was shown by Cooper and Buckley (2022) that destination choice was linked to positive mental health marketing; therefore, nature-based tourism destinations can harness the mental health benefits of nature as a marketing tool. However, these practices need to be long term to protect the rights of, and opportunities for, future generations.

3.6 Conclusion

Comprehensive definitions of eco-tourism and/or nature-based tourism are required within national tourism policy frameworks to facilitate the necessary legal frameworks. Full definitions will facilitate the development of carefully considered metrics associated with the definitions to avoid misuse and enable enforcement. Collaborative management practices are needed to integrate nature engagement into the tourism experience which will enrich the overall experience of visitors – while facilitating positive environmental attitudes and

subsequent behaviours. These actions require detailed understanding of the environmental assets being promoted by tourism – which requires financial investment to facilitate the learnings required. Prioritising nature while facilitating tourism access is fundamental for sustainability, but long-term plans are needed to ensure the equity for future generations is not lost through short sighted planning structures. Community engagement is a key factor in the success of environmental and tourism projects which needs to be recognised by policy makers and fund management. Further research is required to understand the shift in baseline awareness of environmental character and condition; this is important to ensure the goals for nature-based tourism are not tarnished by recent stark losses in biodiversity.

3.7 Limitations

This study was undertaken in Ireland, with the majority of the participants being Irish (93.5%). It is recognised that cultural identity and spiritual beliefs influence definitions of eco-tourism (Walsh and George, 2019, Buckley, 1994) which could influence the findings. However, given the broad nature of the resultant definitions for eco-tourism this is not identified to be a significant limitation.

Chapter 4 Grazing management of tourism site aligns ecological and visitor experience goals and habitat identity determines conservation outcomes.

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Biographical note: Lead author Andrew Torsney is a part-time PhD candidate in Trinity College Dublin looking at the interactions between tourism and the environment. Andrew is a full time Principal Ecological consultant who has worked on a range of local and national scale projects – including the management of the National Tourism Monitoring Programme on behalf of Fáilte Ireland (Ireland Tourism Development Agency). Prof. Yvonne Buckley, senior author, is a professor of Zoology at Trinity College Dublin. She is the co-Director of Nature+: Trinity Centre for Biodiversity and Nature-based Solutions and has research interests in determining the future of how we live well on the planet, environmental decision making, plant ecology and quantitative ecology.

Author contributions: Andrew Torsney, and Yvonne M. Buckley had substantial contributions to conception, design, analysis, and interpretation of data to support the paper. Andrew Torsney oversaw the data collection, performed the data analysis, and wrote the first draft.

Data availability: The data and code that support the findings of this study are openly available at https://github.com/TorsneyStat/Ecological-Benefits-of-Tourism-Management/releases/tag/EcologicalBenefits DOI: 10.5281/zenodo.10055215

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Abstract:

1. Nature-based tourism is increasing in popularity and destination competitiveness is increasingly linked to natural assets or protection status. However, many protected areas have tourism-related threats and pressures presenting conservation challenges. While negative environmental impacts of tourism are often identified, there is limited literature exploring potential ecological benefits of tourism through management aligned for both ecological and visitor experience goals.
2. Here the study test the effects of management practices, which are intended to develop the tourism offering of a site, on plant diversity within a Natura 2000 (EU) Special Area of Conservation. The study also test how habitat identity of the protected site determines conservation outcomes for either the more sensitive Machair Grassland or the less sensitive Fixed Dunes habitat type. The criteria applied to the classification could result in variable outcomes for biodiversity, the protection status of a site and assessment of its vulnerability to effects of tourism.
3. The study used a grazing exclosure experiment to analyse how plant diversity (Simpson's index) is influenced by grazing management. The study investigates the classification metrics for the defined habitat type on site (Fixed Dune) and an alternative categorisation as the more sensitive habitat type (Machair) by quantifying and comparing the effect of grazing management on criteria for each habitat type.
4. The study finds that appropriate grazing management significantly increases and sustains plant diversity, underscoring the ecological benefits of managing for visitor experience goals. Furthermore, the study demonstrates that habitat classification criteria can directly affect the assessment of conservation management outcomes for protected habitats.
5. This study underscores a positive role for tourism in conservation when ecological and visitor goals are jointly managed, challenging the prevailing 'war-on-tourism' narrative. The study advocates for a win-win management approach as nature-based tourism grows, emphasising the imperative understanding of ecological benefits for effective alignment of tourism and conservation goals.

Keywords: Ecological Benefits of Tourism, Nature-Based Tourism, Eco-tourism, Tourism Management, Floral Diversity, Machair, Annex I Habitat, Grassland.

4.1 Introduction

Tourism is currently transitioning towards ecologically sustainable practises (Jones, 2023a),

while still sustaining and promoting an economically viable industry. Nature-based tourism encompasses all tourism that interacts with natural features with no reference to inherent environmental benefits (Winter et al., 2020). Eco-tourism has a variety of definitions which are typically united by principles of environmental enhancement and engagement with nature (Honey, 2008). Despite the global demand for nature-based tourism particularly at protected sites (Chung et al., 2018), it is often viewed as niche tourism which lacks scalability due to the potential for negative environmental impacts from tourism (Stronza et al., 2019). Many of the studies looking at tourism impacts focus on using visitor numbers as a proxy for damage (Monz et al., 2013). The perceived conflicts between tourism and conservation goals have therefore resulted in a war on tourism narrative (Higgins-Desbiolles, 2020b).

While the adverse effects of tourism are regularly studied and cited within the literature (Wolf et al., 2019), there is a need to shift away from using visitor numbers as a proxy for environmental damage. The effects of tourism are likely to be complex and may vary depending on visitor demographics, activity types or group size and/or composition (Torsney and Buckley, 2023). It is important to not only understand the impacts from tourism but also to identify management practices which have co-benefits for tourism and the environment. Understanding effective management strategies that balance tourism with conservation goals is imperative (Mandić and McCool, 2022) especially in protected areas vulnerable to overtourism (Spenceley et al., 2021). In this study management strategies for visitor experiences were evaluated to identify their influence on grassland plant diversity and conservation outcomes within protected areas.

Globally, grasslands are under severe threat due to inappropriate management practices such as farming and land use change (Bardgett et al., 2021). Studies looking at the impacts of tourism on grassland communities often focus recommendations on restrictions to visitor numbers (Feng et al., 2019), which presents a conflict between tourism and conservation goals. Similarly, a study by Kerbiriou et al. (2008) identified impacts from human visitation affecting coastal systems with low organic matter with suggested management options to steer visitors towards less sensitive habitats. Vegetation characteristics influence resistance and resilience to tourism pressures (Jahani et al., 2020) as well as site type, with beach sites being particularly vulnerable to visitor impacts (Torsney and Buckley, 2023). Torsney and Buckley (2023) identified that tourism and recreational pressures are present at roughly half of all Special Areas of Conservation (SACs) and Special Protected Areas (SPAs) in Europe.

These protected sites are collectively known as the Natura 2000 network, designated under the European Habitats Directive (1992) and Birds Directive (2009) . The European Habitats Directive (1992) has 230 characteristic habitat types (known as Annex I habitats) for which it provides legal protection including low organic matter grassland types: Machair Grassland [21A0] and Fixed Dunes [2130]. Associated with this designation are site specific conservation objectives with defined targets and attributes for the maintenance and enhancement of the protected features of the sites. Moreover, the protection status of a site has been shown to influence its desirability from a tourism perspective (KC, 2021, Spenceley et al., 2021, Jones et al., 2021, King et al., 2012, Reinius and Fredman, 2007, Eagles et al., 2002). Collaborative synergistic approaches to the management of tourism and environmental goals are needed to avoid potential conflicts and provide effective habitat management outcomes.

Fixed dune and machair habitats are closely related coastal habitats with similar physical characteristics; however, the community compositions are very different, with machair having a more diverse range of species and structural components. Machair habitats are often influenced by shifting sands, storm events, and seasonal variations. A defining feature of machair is its lush and diverse vegetation with vibrant wildflowers, grasses, and herbs (Angus, 2006, Bassett and Curtis, 1985, European Environmental Agency, 2019b, Gaynor, 2006, Kent et al., 2003, Love, 2009, Ritchie, 1976, Delaney et al., 2013). Fixed dunes are often stabilised by vegetation and are not as dynamic as machair. Vegetation on fixed dunes may include hardy grasses and specialized dune plants (Andersson, 1950, Robinson and Anderson, 1997, Doody, 1991, Tzonev et al., 2005, Quigley, 1991, Delaney et al., 2013). For further details related to the defining characteristics of Machair and Fixed Dunes see Chapter 4 Appendix I. Moreover, the management practices required for each habitat type are different. There are no climatic variables within the habitat classification system for fixed dune, in contrast to machair where climate variables are used to screen locations. Therefore, there is potential for ‘machair-like’ habitats (habitats which have the community composition and functional structure of a machair but the site does not conform to all of the climatic variables required) to be classified as fixed dunes, if factors such as prevailing wind direction are used as classification criteria as per Gaynor (2006). The criteria applied to the classification therefore could result in variable outcomes for biodiversity, the protection status of a site and assessment of its vulnerability to effects of tourism.

The protection status of a site directly depends on the habitat classification system used in

its designation, which aligns with the management issues related to habitat identity mentioned earlier. Having clear habitat identity with associated goals and targets is an important starting point for understanding the potential interactions between tourism and environmental management. Sullivan et al. (2010) identified that habitat classification criteria impacted the conservation status of high nature value grasslands in the west of Ireland. Moreover, habitat classification and conservation status – specifically with respect to protected coastal habitats – are inconsistently assessed across Europe, with nationally specific expert opinion being the key criteria used in most cases (Delbosc et al., 2021). This means that conservation outcomes could also be inconsistent as a result. However, it is yet to be understood if the approaches used for habitat classifications with respect to Annex I habitats have any implications for their conservation status. This uncertainty therefore has implications for management action, which is problematic from an environmental stand point, but also has implications for tourism operators and their management plan.

4.1.1 Research Aim and Approach

The aim of this study is to test whether grazing management focused on enhancing visitor experience yields positive impacts on plant diversity and conservation objectives. The study expected that exclusion of large grazing herbivores (domestic cattle) will decrease plant diversity (McKeon et al., 2022, Borer et al., 2014), and therefore the use of low frequency grazing as a management tool for improving visitor experience also increases plant diversity. The study test the effects of changes in vegetation composition on conservation outcomes for two habitat classifications in this location. The “fixed dune” habitat is the current classification used; however, the vegetation composition is also compatible with a “machair” habitat which is more sensitive to compositional changes. Habitat identity influences the protection status and conservation goals of a site and our study assesses the implications of habitat identity, together with the effects of grazing enclosure’s, on conservation targets for the site.

4.2 Methods

4.2.1 Research Approach

A grazing exclusion experiment was conducted over 4 years (2019-2022) within 20 blocks of paired plots in a grassland habitat. The effect of grazing exclusion on plant diversity was analysed and the consequences of grazing removal on the conservation status of both fixed dune and machair habitat classifications was assessed.

Derrynane house was selected as a study site as it has a high volume of tourist/visitors with reportedly low rates of observable impacts from tourism – despite being a sensitive beach/dune site (Torsney and Buckley, 2023). The dune habitats were surveyed and the area of fixed dune/machair-like habitat was mapped first using the Best Practice guide to habitat ID (Smith et al., 2011) which uses the Fossit Level 3 classification system (Fossit, 2000). This system focuses on broadscale species composition for classification and defines machair as being dominated by fescue grasses (*Festuca spp.*), ribwort plantain (*Plantago lanceolata*), daisy (*Bellis perennis*), common bird's-foot trefoil (*Lotus corniculatus*), Lady's bedstraw (*Galium verum*) and white clover (*Trifolium repens*). The full extent of the habitat was mapped using the ERSI enabled Collector App (ERSI, 2020c) (Figure 4.1).

At Derrynane House there is 14,500 m^2 (3.58 acres) of fixed dune/machair-like habitat that is currently managed for plant diversity using a controlled grazing approach; specifically using cattle to strip graze the site fully for one/two weeks in late autumn after seed set every year. To assess the efficacy of the management practice the study excluded grazing from one of each plot from each block. Blocks were established using a setback of 5m from the habitat boundary to eliminate edge effects and avoiding paths through the habitat. 20 random points were generated in ArcPro (2.7.1) (ERSI, 2020) distributed throughout the setback habitat area with a minimum of 10 m between each point. These points formed the southern point of each block, which were divided into plots – a control and a treatment - demarcated with poles with two paired 5x5m plots as per Figure 4.1. The management practice – one/two weeks of complete strip grazing by cattle in late autumn – was removed using electrified wire to implement ungrazed treatment plots for one of each plot pair each year for the duration of the experiment (4 years).

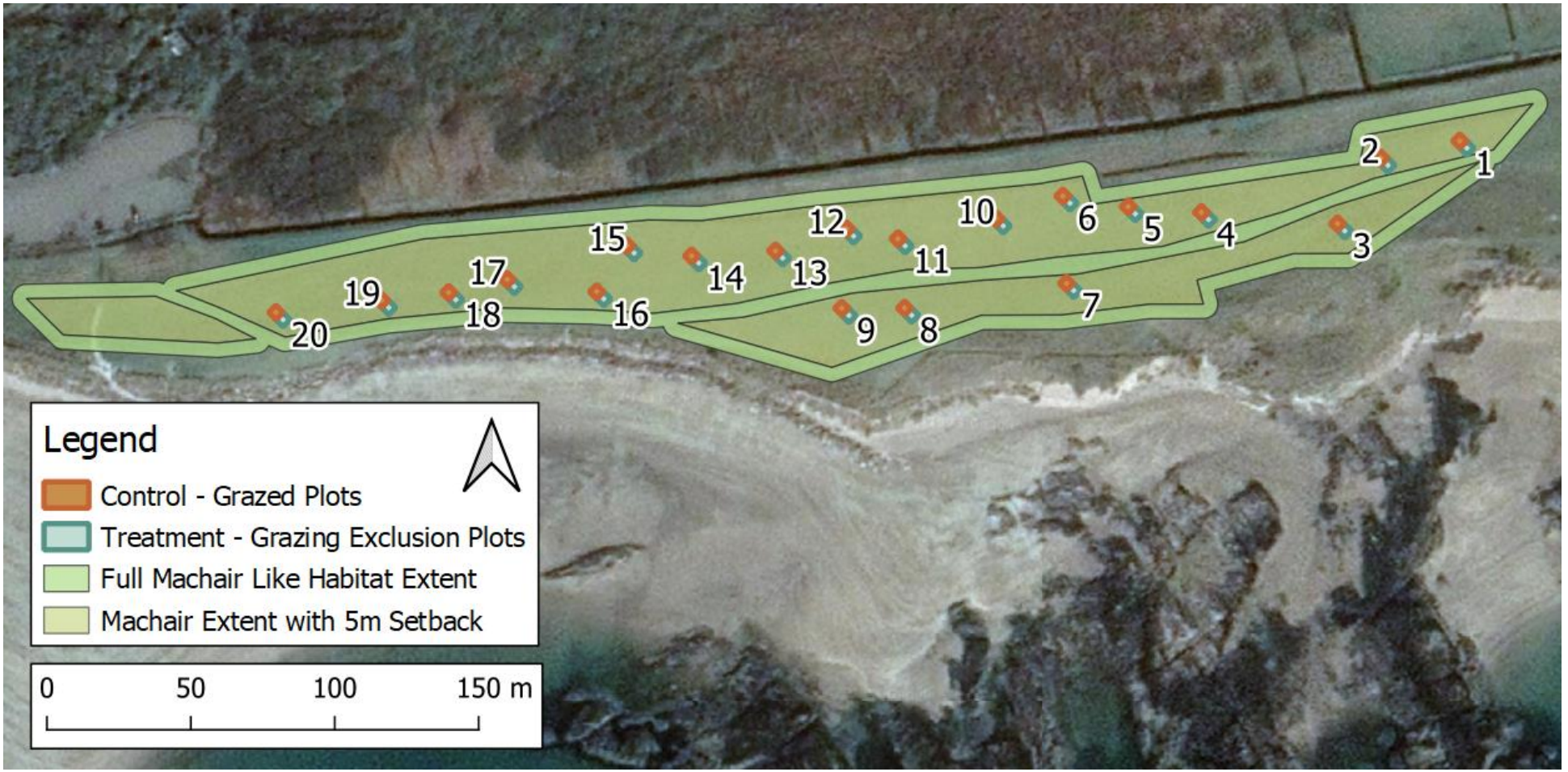


Figure 4.1. Layout of the block and plot matrix across the site to demonstrate the full extent of the survey work – 20 blocks which are subdivided into plots for treatment (grazed = green) and control (ungrazed = coral) – including the area of Machair-like habitat identified on site using the Fossit coding system (outer polygon) along with the 5m setback distance to remove edge effects (inner polygon).

In year one (2018), before intervention, the site was surveyed every 2 weeks from early June to late August to assess species composition and to identify any obvious seasonal variability or short bloom species and confirming consistent community composition across the summer. There were no seasonally cryptic species and vegetative characteristics could be used for species identity. Each year (from 2019-2022) the site was visited on the third week of June and each plot was sampled using four 1 x 1 m sub-plots within a plot with an edge setback distance of 1 m (Figure 4.2). This within plot edge setback was to avoid any edge grazing of the exclusion plots. All species within the sub-plots were identified and the percentage cover was recorded for each. Due to the complexity of the grassland sward and overlapping vegetation, the total percentage cover was often greater than 100%. Measurements of above and below sward light penetrance and sward height were also recorded for each sub-plot using a 1-m light ceptometer (Apogee MQ-300) which measures photosynthetically active radiation (PAR, µmol photons per m^2/s). Each year a 1 m x 0.15 cm strip was cut from one of the quadrats – as indicated by the orange crosshairs in Figure 4.2. The cut strips were rotated annually so that the same area was not cut twice and care was taken to ensure these cuts did not overlap with the sub-plot locations. The samples were used to sort the alive and dead matter from the plots; once sorted these samples were dried at 80 degrees Celsius for 48 hours (Perez-Harguindeguy et al., 2016) and then weighed to find the dry matter yield for alive and dead biomass for each plot. All data in the field was collected using ESRI ArcGIS enabled app Survey123 (ERSI, 2020b).

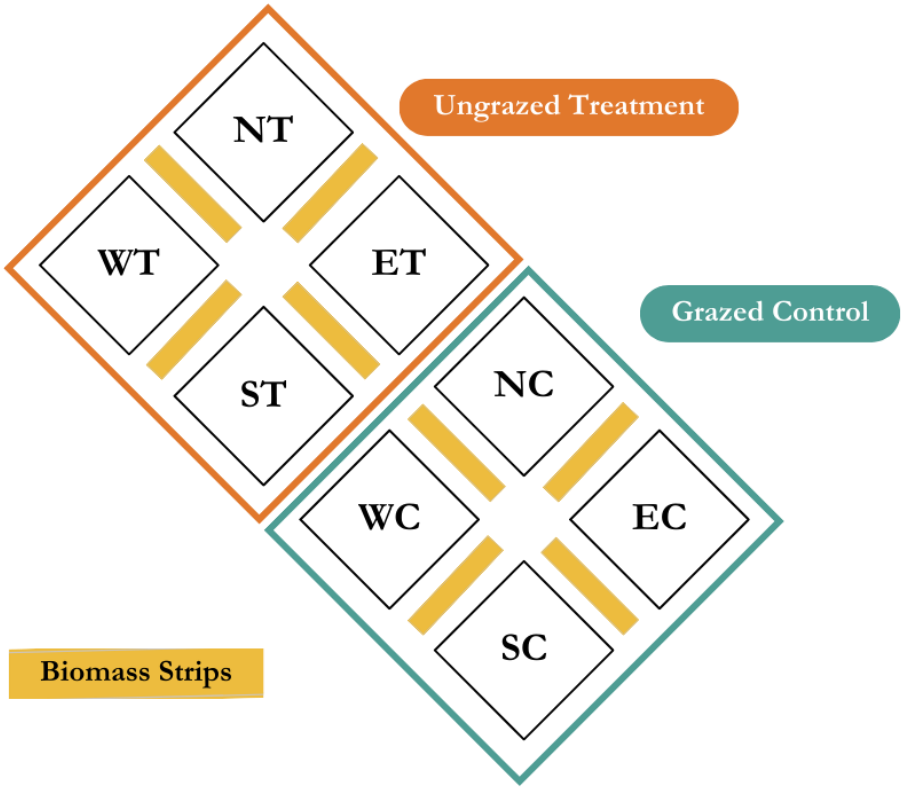




Figure 4.2. Grid layout within each block (overall shape) with the plots (cyan and coral squares) showing the sub-plot locations (white squares) and biomass cut areas which were cut once each in a clockwise manner year on year from 2019-2022 (orange strips); the codes represent the North (N), South (S), East (E) and West (W) quadrats in the Control (C) and Treatment (T) i.e., North control is NC.

4.2.2 Analysis

Data analysis was conducted in R-Studio (version 4.0.3) (R Development Core Team, 2020). The experimental data used was for 2019-2022 for years 1-4 post treatment. The species richness of each sub-plot was calculated and species identity and cover were used to calculate the Simpson's index for each of the sub-plots in treated (grazing excluded) and control plots with the Diverse Package (Keenan et al., 2013). Given the variability of the habitat, each sub-plot was used to calculate an average diversity score for the plots. A Linear Mixed Effects Model (LMEM) was run to investigate the relationship between Simpson's Index with respect to treatment (grazed or ungrazed) over time (year as a categorical variable) accounting for the interaction between treatment and year. This model was run with block set as a random effect as well as plot nested within block, to account for spatial autocorrelation of the paired observations through time plots were nested within block. The model assumptions were tested to ensure the validity of our analysis. The same LMEMs were run to investigate the relationships between the explanatory variables – treatment (categorical: grazed and ungrazed), year (categorical) - and their interaction on live biomass, dead biomass and light absorption. Live and dead biomass data were log transformed. To address non-normality and heteroscedasticity observed in the original light absorption data, a square root transformation was applied for all models, year data were standardised to ensure the coefficients represent the change in the response variable associated with a one-standard-deviation change in the predictor.

The effects of grazing exclusion on the conservation status of machair habitat and fixed dune habitat identities were determined using characteristics of treatment and control plots. There are several criteria used to define these habitats, the Irish Wildlife Manual No. 75 was used to determine the specific criteria used for Annex I habitat quality (Delaney et al., 2013); (Table 4.1). Each of these criteria were investigated by calculating the corresponding metrics from the data and compiled into a reference table.

Table 4.1. Annex I compositional habitat quality criteria for Machair [21A0] and Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] as per the Irish Wildlife Manual No. 75 (Delaney et al., 2013).

Machair Criteria
At least six positive indicator species present in more than 20% of sub-plots
At least three positive indicator species present in every sub-plot
Bryophyte cover over 1% at all sub-plots
No negative indicator species present in more than 40% of sub-plots

Lolium perenne and Phleum pratense not present in more than 20% of sub-plots
Combined cover of negative indicators 5% or less
No non-native species present in more than 20% of sub-plots
Flowering and fruiting of positive indicators at 40% of sub-plots
Up to 5% bare ground across the whole site but must be present
Mean sward height between 2 and 10 cm and >8 in July
Fixed Dune Criteria
At least eight positive indicator species present in more than 20% of sub-plots
At least four positive indicator species present in every sub-plot
No negative indicator species present in more than 60% of sub-plots
Combined cover of negative indicators 5% or less
Negative indicators highest Domin Scale Score of 5 or less (i.e. a % coverage of <25%)
Trees and scrub not present in more than 60% of stops of sub-plots
Combined cover of trees and scrub 5% or less
Trees/saplings within 20m at not more than 20% of sub-plots
At least 30-70% of sub-plots at appropriate vegetation 2-10 cm
Flowering and fruiting of positive indicators at 40% of sub-plots
Bare sand present but total not more than 10%
Disturbance at no more than 20% of habitat

4.3 Results

The mean diversity in the grazed and ungrazed plots in 2019 (after treatment grazing management had been removed in November 2018) was 0.808 and 0.799 respectively; in 2022 (year 4 of treatment) the grazed plots were consistent at 0.827 whereas the ungrazed plots had a substantial reduction in diversity to 0.595. This represents > 25% loss in diversity after 4 years due to the removal of grazing (Figure 4.3). In 2019 the diversity of grazed and ungrazed plots were consistent; however, in ungrazed plots diversity declined over time from 2020-2022. Grazed plots (control) had a positive effect from year in 2020 and 2021 showing increased diversity, but in 2022 year had no effect on the overall diversity of the grazed plots when compared to 2019 (Table 4.2). This shows there is variability is annual variability with respect to the increase in diversity with respect to grazing. Grazed and ungrazed plots had similar alive biomass in 2019; however, the alive biomass significantly increased in all other years (2020 to 2022) when compared with grazed 2019. It is important to note that the effect size of the decrease due to the removal of the management (grazing) is an order of magnitude different from the effect size of year. The largest change observed was in 2020. Year was observed to have a significant reduction in alive biomass for all three years (2020 to 2022)

for grazed plots (Figure 4.4). There was no difference in dead biomass between grazed and ungrazed plots in 2019. However, dead biomass in grazed plots had a significant decrease for each year (2020-2022) when compared with grazed plots from 2019. Moreover, in ungrazed plots the dead biomass significantly increased over time (Figure 4.5 & Table 4.2). The grazing exclusion treatment resulted in consistent overall light absorption by the sward in all years except 2022 where there was a significant difference in treated (ungrazed) versus grazed plots from 2019 (Figure 4.6). It is important to note that 2019 observations had bimodality in the observed data – this is identified to be due to a data collection error related to cloud cover – a further model was run without 2019 to observe this influenced the trend observed (Chapter 4 Appendix IV). In this, grazed and ungrazed plots were identified to be significantly different in 2020. However, ungrazed plots were not significantly different in 2021 and 2022 when compared to 2020.

The pass-fail vegetative composition criteria for Machair [21A0] as per the Irish Wildlife Manual 75 (Delaney et al., 2012) results show that the grazed plots align with all criteria for Machair for the duration of the study; however, in the ungrazed plots the Machair habitat assessment fails some criteria in each year (Table 4.3). Failure is due to a loss of bryophyte cover, changes to overall sward height and loss of indicator species within the plots as well as an overall reduction in flowering indicator species. The grazed plots were in favourable condition for all years, the ungrazed plots were in unfavourable status (1-2 fails) for the first 3 years and in year 4 there were four fails resulting in the composition no longer being consistent with machair habitat according to the compositional criteria.

The pass-fail criteria for fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] as per the Irish Wildlife Manual 75 (citation) results show that the managed plots (grazed) align with all criteria for the duration of the study; however, in the unmanaged plots (ungrazed) the habitat fails for some criteria in each year (Table 4.5). The metrics for each failing criterion are reported in Table 4.6 which show that there is a reduction in flowering and fruiting positive indicators in year 3 and 4 as well as less than four positive indicator species present in every sub-plot from 2019-2021. The grazed plots were in favourable condition for all years, the ungrazed plots were in unfavourable status (1-2 fails) in all years, with the classification as fixed dunes consistent in all years.

Table 4.2. Linear Mixed-Effects Model results for effects on Diversity (Simpsons index), Live Biomass, Dead Biomass and Light Absorption due to management practices (grazed and ungrazed) over time (2019 to 2022).

Model Type	Fixed effects	Estimate	Std. Error	t Value	P Value
Diversity Model Simpsons Index	**(intercept)**	**0.808**	**0.01**	**54.399**	**<0.001***
	Treatment Ungrazed	-0.009	0.02	-0.475	0.636
	Year 2020	**0.033**	**0.02**	**2.024**	**0.045***
	Year 2021	**0.047**	**0.02**	**2.867**	**0.005***
	Year 2022	0.018	0.02	1.138	0.257
	Treatment: Year 2020	**-0.050**	**0.02**	**-2.174**	**0.031***
	Treatment: Year 2021	**-0.175**	**0.02**	**-7.553**	**<0.001***
	Treatment: Year 2022	**-0.222**	**0.02**	**-9.586**	**<0.001***
Live Biomass Model ln (grams)	**(intercept)**	**3.112**	**0.12**	**25.45**	**<0.001***
	Treatment Ungrazed	-0.028	0.16	-0.18	0.856
	Year 2020	**-0.321**	**0.15**	**-2.13**	**0.035***
	Year 2021	**-0.448**	**0.15**	**-2.89**	**0.005***
	Year 2022	**-0.345**	**0.15**	**-2.29**	**0.023***
	Treatment: Year 2020	**0.625**	**0.21**	**2.93**	**0.004***
	Treatment: Year 2021	**0.469**	**0.21**	**2.15**	**0.033***
	Treatment: Year 2022	**0.533**	**0.21**	**2.50**	**0.013***
Dead Biomass Model ln (grams)	**(intercept)**	**1.123**	**0.28**	**4.06**	**<0.001***
	Treatment Ungrazed	0.273	0.34	0.81	0.422
	Year 2020	**-0.857**	**0.33**	**-2.61**	**0.010***
	Year 2021	**-1.933**	**0.33**	**-5.90**	**<0.001***
	Year 2022	**-1.593**	**0.33**	**-4.86**	**<0.001***
	Treatment: Year 2020	**1.160**	**0.46**	**2.50**	**0.014***
	Treatment: Year 2021	**2.353**	**0.46**	**5.05**	**<0.001***
	Treatment: Year 2022	**2.627**	**0.46**	**5.67**	**<0.001***
Light Absorption Model sqrt (PAR, µmol photons per m^2/s)	**(intercept)**	**12.747**	**1.50**	**8.47**	**<0.001***
	Treatment Ungrazed	1.165	1.69	0.68	0.492
	Year 2020	**10.222**	**1.69**	**6.03**	**<0.001***
	Year 2021	**8.497**	**1.69**	**5.02**	**<0.001***
	Year 2022	**6.485**	**1.69**	**3.83**	**<0.001***
	Treatment: Year 2020	4.061	2.40	1.70	0.092
	Treatment: Year 2021	4.475	2.40	1.87	0.064
	Treatment: Year 2022	**6.383**	**2.40**	**2.66**	**0.008***

* Significant.

** The random effects used in all cases were block and plot nested within block. The intercept is the reference estimate for the control (grazed) plot in 2019.

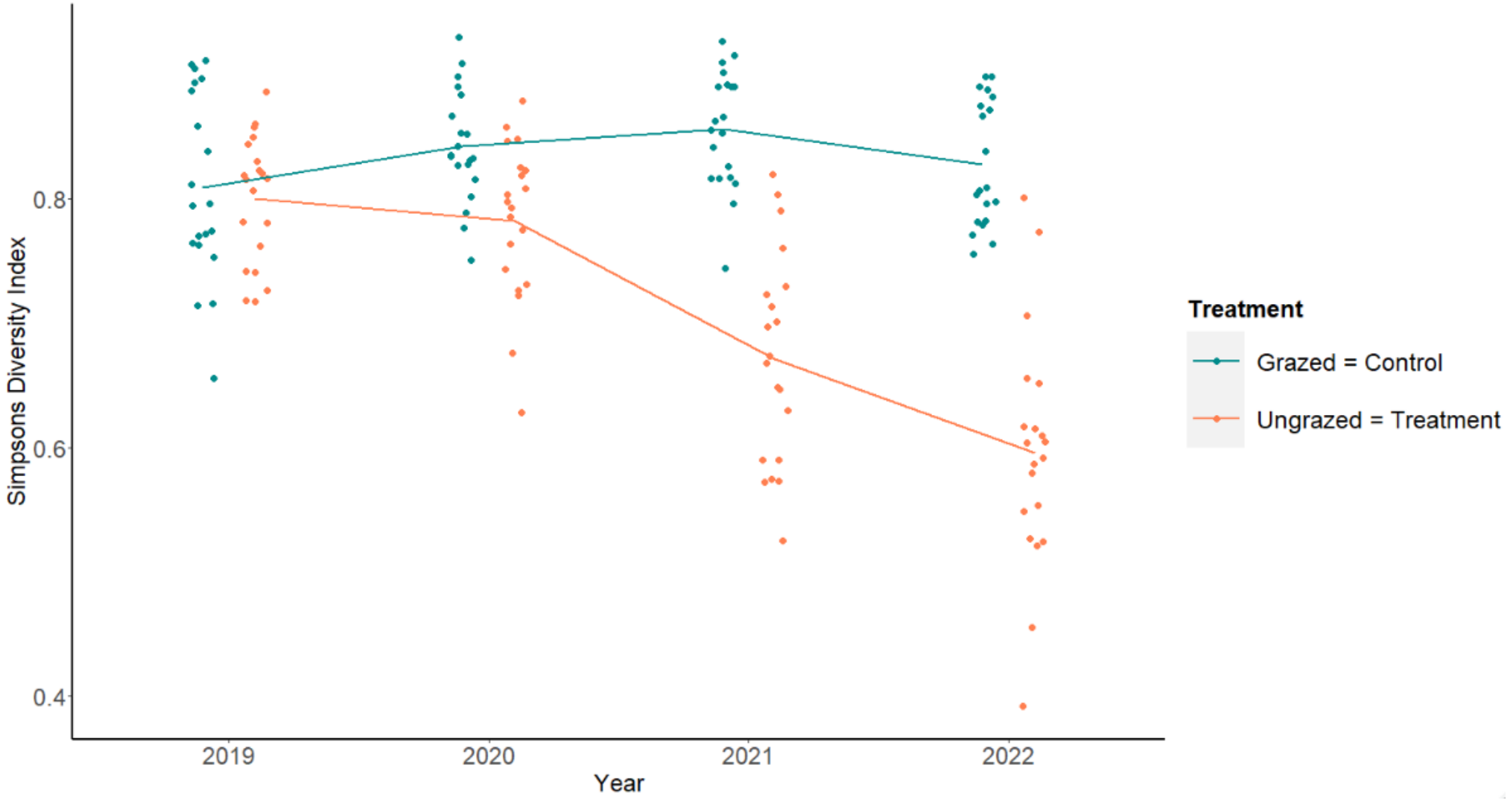


Figure 4.3. Change in plant diversity (Simpson's index) over time due to grazing management: ungrazed plots (coral) have a significantly lower diversity than grazed plots (cyan). The effect of year on diversity was consistent across grazed plots and had a compounding effect reducing diversity for ungrazed. Lines are the predicted values from the model using the Stat Package (Lüdecke et al., 2021) and the dots represent the raw datapoints.



Figure 4.4. Shift in alive biomass yield (grams) due to grazing management over time: data was log transformed. The alive biomass yield was significantly higher in ungrazed plots (coral) which was consistent over time. Alive biomass decreased over time in grazed plots (cyan). Lines are the predicted values from the model using the Stat Package (Lüdecke et al., 2021) and the dots represent the raw datapoints.

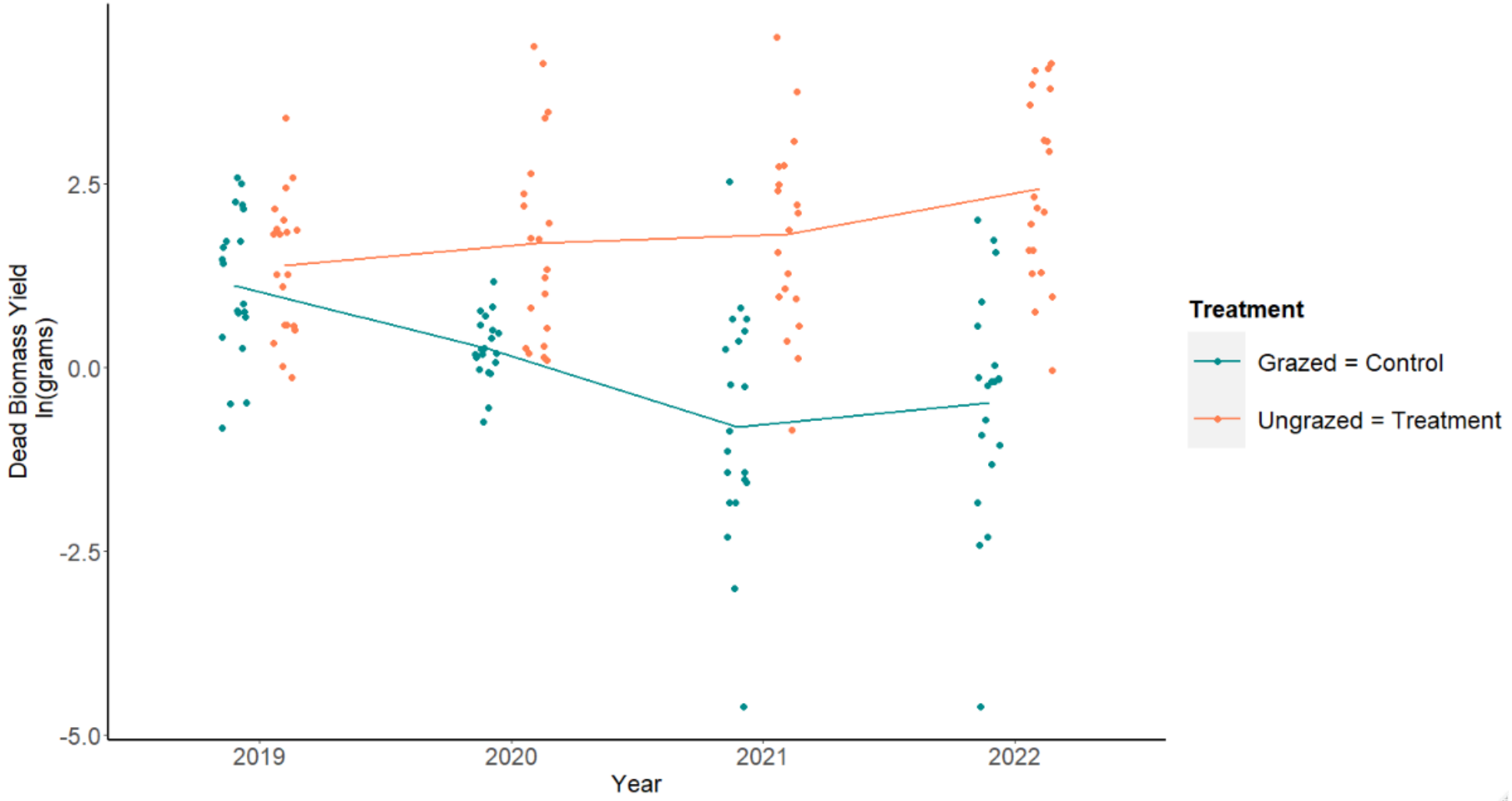


Figure 4.5. Shift in dead biomass yield (grams) due to grazing management over time: data was log transformed. Ungrazed plots (coral) had a higher dead matter yield which increased over time while dead matter yield in grazed plots (cyan) decreased over time. Lines are the predicted values from the model using the Stat Package (Lüdecke et al., 2021) and the dots represent the raw datapoints.

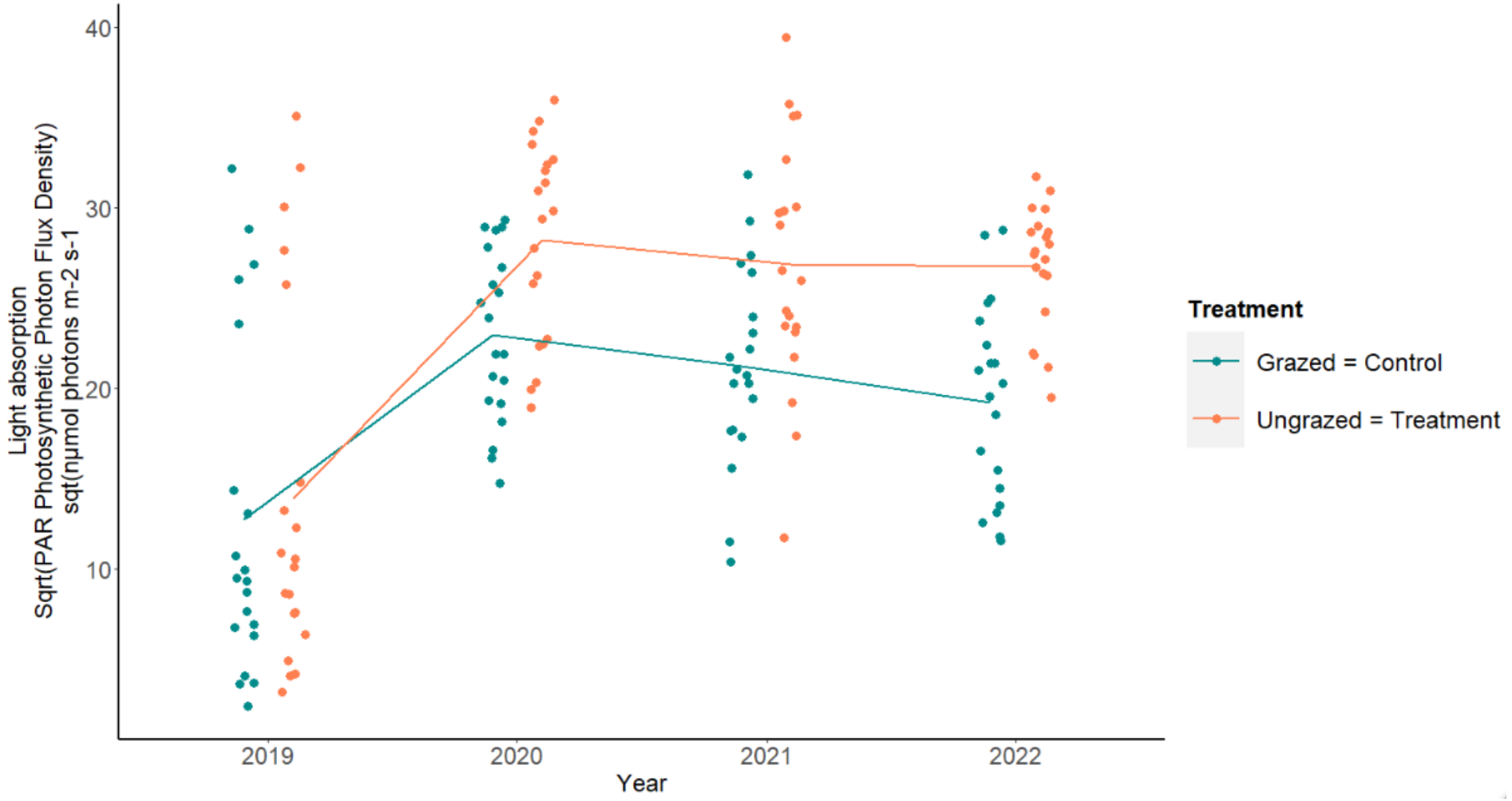


Figure 4.6. Change in light absorption [PAR Photosynthetic Photon Flux Density (PPFD) µmol photons m^{-2} s^{-1}] over time due to grazing treatment: data was square root transformed (sqrt). Light absorption was significantly higher in ungrazed (coral) versus grazed plots (cyan) with increased compounding effect of time. Lines are the predicted values from the model using the Stat Package (Lüdecke et al., 2021) and the dots represent the raw datapoints.

Table 4.3. Pass/Fail Criteria record for Machair [21A0] – following the Irish Wildlife Manual 75 specifications (Pass = Green; Fail = Red).

Pass Fail Criteria	Grazed – Control				Ungrazed – Treatment			
	2019	2020	2021	2022	2019	2020	2021	2022
At least six positive indicator species present in more than 20% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
At least three positive indicator species present in every sub-plot;	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail
Bryophyte cover over 1% at all sub-plots;	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail
No negative indicator species present in more than 40% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Lolium perenne and Phleum pratense not present in more than 20% of stops;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Combined cover of negative indicators 5% or less;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
No non-native species present in more than 20% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Flowering and fruiting of positive indicators at 40% of sub-plots;	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail
Up to 5% bare ground across the whole site but must be present;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Mean sward height between 2 and 10 cm and >8 in July.	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail

Pass		Fail	

Table 4.4. Pass/Fail Criteria metrics for Machair [21A0] – following the Irish Wildlife Manual 75 condition specifications – 0 failures = favourable (green), 1-2 failures = unfavourable/inadequate (yellow), 3+ failures = Unfavourable/Bad (amber) beyond 4 is not qualified as Annex I habitat (red).

Year	Treatment	Number of sub-plots with ≥ 6 indicator species	% of sub-plots with ≥ 6 indicator species	Number of sub-plots with > 40% forbs (flowering plants)	% of sub-plots with > 40% forbs (flowering plants)	Mean sward height (cm)	Number of sub-plots with ≤ 3 indicator species	% of sub-plots with ≤ 3 indicator species	Number of sub-plots with bryophytes < 1%	% of sub-plots with bryophytes < 1%	Number of Criteria Failures
2019	Grazed	60	75.00	44	55.00	4.77	0	100	0	0	0
2020	Grazed	69	86.25	34	42.50	5.45	0	100	0	0	0
2021	Grazed	74	92.50	45	56.25	6.09	0	100	0	0	0
2022	Grazed	75	93.75	43	53.75	4.80	0	100	0	0	0
2019	Ungrazed	43	53.75	30	37.50	5.23	0	100	12	15.00	2
2020	Ungrazed	54	67.50	20	25.00	8.05	3	3.75	8	10.00	3
2021	Ungrazed	28	35.00	3	3.75	9.86	6	7.50	14	17.5	3
2022	Ungrazed	20	25.00	4	5.00	18.74	8	10	10	12.5	4

Favourable		Unfavourable/inadequate condition		Unfavourable/Bad		Not qualified as Annex I habitat	

Table 4.5. Pass/Fail Criteria for fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] – following the Irish Wildlife Manual 75 specifications (Pass = Green; Fail = Red).

	Grazed – Control				Ungrazed – Treatment			
Pass Fail Criteria	**2019**	**2020**	**2021**	**2022**	**2019**	**2020**	**2021**	**2022**
At least eight positive indicator species present in more than 20% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
At least four positive indicator species present in every sub-plot;	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Pass
No negative indicator species present in more than 60% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Combined cover of negative indicators 5% or less;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Negative indicators highest Domin Score 5 or less	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Combined cover of negative indicators 5% or less;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Trees and scrub not present in more than 60% of stops of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Combined cover of trees and scrub 5% or less;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Trees/saplings within 20m at not more than 20% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
At least 30-70% of sub-plots at appropriate vegetation 2-10 cm;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Flowering and fruiting of positive indicators at 40% of sub-plots;	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
Bare sand present but total not more than 10%;	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Disturbance at no more than 20% of habitat.	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Pass		Fail	

Table 4.6. Pass/Fail Criteria metrics for fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] – following the Irish Wildlife Manual 75 condition specifications – 0 failures = favourable (green), 1-2 failures = unfavourable/inadequate (yellow), 3+ failures = Unfavourable/Bad (amber) beyond 4 is not qualified as Annex I habitat (red).

Year	Treatment	Number of sub-plots with ≥ 8 indicator species	% of sub-plots with ≥ 8 indicator species	Number of sub-plots with > 40% forbs (flowering plants)	% of sub-plots with > 40% forbs (flowering plants)	Number of sub-plots height of vegetation 2-10 cm	% of sub-plots height of vegetation 2-10 cm	Number of sub-plots with ≤ 4 indicator species	% of sub-plots with ≤ 4 indicator species	Number of Criteria Failures
2019	Grazed	79	98.75	74	92.50	70	87.50	80	100.00	0
2020	Grazed	80	100.00	63	78.75	73	91.25	80	100.00	0
2021	Grazed	65	81.25	58	72.50	72	90.00	80	100.00	0
2022	Grazed	62	75.00	64	80.00	63	78.75	80	100.00	0
2019	Ungrazed	80	100.00	53	66.25	66	82.50	79	98.75	1
2020	Ungrazed	80	100.00	44	55.00	62	77.50	78	97.50	1
2021	Ungrazed	75	93.75	18	22.50	46	55.75	79	98.75	2
2022	Ungrazed	56	70.00	8	10.00	57	71.25	80	100.00	1

Favourable		Unfavourable/inadequate condition		Unfavourable/Bad		Not qualified as Annex I habitat	

Table 4.7. Mean floral diversity (Simpson's Index) for grazed and ungrazed plots each year.

Year	Treatment	Mean Simpson's Index
2019	Grazed	0.808
2020	Grazed	0.842
2021	Grazed	0.855
2022	Grazed	0.827
2019	Ungrazed	0.799
2020	Ungrazed	0.782
2021	Ungrazed	0.671
2022	Ungrazed	0.595

4.4 Discussion

The results show that management practices carried out for their perceived benefit to human visitors at the site significantly increase and maintain plant diversity, demonstrating an ecological benefit of management for tourism in this location that could be applied elsewhere. Moreover, the results show the criteria for habitat identification can directly influence conservation outcomes for protected habitats. Focusing on climatic variables for habitat identification over community composition can result in machair-like habitats being regarded as fixed dunes; the conservation condition of which the study demonstrates is less sensitive to compositional change due to grazing removal. The results show that when applying the criteria for Annex I habitat quality for fixed dune, the site was maintained as a designated fixed dune, despite the loss of diversity of over 20% and the shift to "unfavourable/inadequate" condition. However, if the criteria for Machair was applied, the habitat degrades to the extent that it fails to meet the requirements for the habitat by year 4. Therefore, applying the more sensitive machair criteria could have better conservation outcomes in terms of diversity due to the higher sensitivity of machair compositional criteria to grazing removal. Careful consideration is required with respect to the current approaches to habitat classification and conservation goals.

For both fixed dune and machair habitats the Article 17 reporting identifies Sports, tourism and leisure activities [F07] and extensive grazing or undergrazing by livestock [A10] as known threats or pressures for the habitats (NPWS, 2019). Therefore, there is a clear need to understand effective management strategies for alignment of tourism, diversity and agricultural goals. The grazing regime used on site is 1-2 weeks of cattle strip grazing after

seed set in late autumn, this is demonstrated to maintain high diversity (>0.8 Simpsons index) across the site; without grazing diversity drops significantly. Kenmare River SAC [IE 002158] is the protected site which the study site sits within and the habitat is a qualifying interest, identified as fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]. The standard data form for the SAC identifies walking, horse riding and non-motorised vehicles as a known threat or pressure for the SAC overall. However, the study site at Derrynane has low levels of recorded impacts to the environment despite having a high volume of tourism present (Torsney and Buckley, 2023, Torsney and Buckley, 2022). The site has dedicated mown strips throughout the site, to encourage visitors to keep out of sensitive areas as a protection measure. Given the high quality of habitat and plant diversity identified it is likely this management practice is effective. However, further studies are required to investigate path fidelity and the effects of visitor management on habitat quality.

A study by Ford et al. (2021) identifies the importance of steering clear of polarizing conservation narratives and selectively interpreting evidence. Their findings emphasise the risk of perpetuating divisive viewpoints and highlight the need for nuanced approaches to address complex conservation challenges. Although this research identifies the benefits of tourism for biodiversity at a local level it is not to say that tourism in dune systems should be freely promoted. The focus is placed on ensuring that active management is engaged to maintain or increase biodiversity at tourism destinations so that tourism management can be harnessed as a conservation tool by focusing on understanding the win-win scenarios. There is a need to deepen our understanding surrounding the ecological benefits of tourism and the effective management strategies which currently exist – so as to apply them to other areas to reduce existing threats and pressures.

When looking at the ecological benefits of tourism the literature typically focuses on tropical ecosystems specifically in regard to conservation tourism where the overall motivation for travel is for conservation engagement with charismatic megafauna such as sea turtles, coral reefs, Komodo dragons etc. (Stronza et al., 2019). However, the use of flagship species may be more of a socioeconomic benefit than a true conservation or ecological benefit (Walpole and Leader-Williams, 2002, Walpole and Goodwin, 2000). This study demonstrates the ecological benefit of tourism management on floral diversity at a heritage destination particularly related to a less charismatic ecological receptor, in this case a grassland system. This is an important concept as eco-tourism is often viewed as niche tourism (Stronza et al., 2019) despite the clear dependence of tourism on natural assets. Biodiversity and other

natural assets are attributable to destination competitiveness (Chin et al., 2018, Wong et al., 2021, Huybers and Bennett, 2003, Mihalič, 2000, Dwyer and Kim, 2003); for example environmental image is in the top 10 factors identified for destination competitiveness (Cronjé and du Plessis (2020). Trends in nature-based tourism research show a high demand for increased access to nature reserves; however, the research has a bias towards low-moderate income counties (Thapa et al., 2022). Our research supports the concepts within Higgins-Desbiolles (2020b) to provide evidence that a war-on-tourism is not necessarily in the best interest of conservation goals. This study shows tourism can be harnessed for ecological benefit even outside of conservation-based tourism or eco-tourism settings. Further research is needed to identify other ecological benefits from tourism and tourism management practices with positive outcomes for biodiversity to further understand how tourism goals can be aligned with conservation goals.

The management practices over time were shown to have a significant effect on diversity, alive and dead biomass (Table 4.2) to various degrees. Diversity levels increased in 2020 and 2021 while 2022 were observed to be consistent in the grazed plots – whereas there was a significant decrease in diversity in the ungrazed plots which was compounded over time. It is important to note that the effects sized observed in the variation within the grazed plots were extremely small while the effects from the ungrazed plots were an order of magnitude higher. This demonstrates the stark effect of the grazing management on diversity. Overall, it was identified that treatment (the removal of graze) did not have a clear effect on light absorption; however, this may be down to user error in the 2019 data collection due to cloud cover. Competitive exclusion has been shown to mediate above-ground productivity in species rich plant assemblages (Feßel et al., 2016). This could have functional benefits to the ecosystem beyond diversity effects. The management practices increase the level of competition by removing the alive and dead biomass build up and therefore, facilitating competition within the grassland system. Higher rates of above ground functional diversity in semi natural grasslands have been shown to influence soil functioning (Gould et al., 2016, Legay et al., 2014, Boeddinghaus et al., 2019); thus, the ecological benefits could be more extensive. Further, investigation is required to identify the effects of the management practices on soil and invertebrate diversity to support this.

The conservation status of the habitats on site has a high reliance on the ecological metrics being applied, which are directly linked to habitat identity. There is a clear need to unify the habitat classification systems for Annex I grasslands and coastal systems in general, to

ensure the approach taken is consistent across Europe. This research calls for a closer look at the climatic variables being used which classifying machair habitats, as these factors may be limiting the conservation potential at sites such as Derrynane house and causing machair-like habitats (those with a species composition and the functional traits of machair) to be identified as fixed dunes. This concept could apply to other habitat types particularly in coastal systems as indicated by Delbosc et al. (2021).

4.5 Conclusion

Understanding the natural assets which tourism capitalises on is complex and requires careful consideration of habitat identity. Habitat identity requires complex considerations and it is important at a local level to recognise community composition structure and function when defining a habitat. Consideration should be given to what the best conservation outcomes for the site might be when identifying a habitat type and challenge any static metrics or classification criteria which could adversely impact the conservation outcomes for a site. A deeper understanding of habitat identity is needed – particularly with respect to semi-natural grassland habitats to provide clear processes and repeatable criteria. Regardless of conservation outcome, this study has shown that tourism management practices can have significant ecological benefits when applied appropriately. This study highlights that, when applied appropriately, tourism management practices can yield significant ecological benefits. Effective governance and management of tourism destinations depend on having clear and implementable standards from a conservation management perspective. There is a need to showcase best practice examples like this to dispel the war-on-tourism narrative and focus conservation efforts on understanding the win-win scenarios in order to incentivise and replicate these actions.

Chapter 5 Environmental attitudes shape student's ability to perceive biodiversity, but not their preferences, in a manipulated grassland experiment

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Author contributions: Andrew Torsney, and Yvonne M. Buckley had substantial contributions to conception, design and analysis. Andrew Torsney oversaw the data collection, performed analysis, and wrote the first draft. YMB made contributions drafts.

Data availability: The data and code that support the findings of this study are openly available at https://github.com/TorsneyStat/Environmental-attitudes-shape-people-s-ability-to-perceive-biodiversity DOI:10.5281/zenodo.11073085

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Abstract:

- Nature-based tourism in protected areas necessitates a delicate balance between visitor experience and conservation priorities, posing challenges due to diverse visitor motivations and behaviours.
- This study investigates individuals' perception and preference for floral diversity in grassland ecosystems, aiming to elucidate the influence of environmental attitudes and ecological worldviews on diversity preferences and perceptions.
- Participants' image-based rankings of grassland plots varying in diversity were used to assess preference and perception for different plots, these rankings were compared with measured Simpson's Diversity Index for the same plots. The study tested how participants' environmental attitudes affected their ability to perceive and prefer diversity. Environmental attitudes were quantified using the Ecological Concern and New Ecological Paradigm scales.
- The study found a strong correlation between participants' perceptions and calculated diversity, with environmental attitude (as per the ecological concern scale) significantly influencing this ability. Biocentric individuals had the strongest ability to perceive diversity, followed by altruistic individuals, and then egocentric individuals – these differences highlight the significant role of environmental attitudes in shaping perceptions of biodiversity.
- Participants exhibited a moderate preference for diversity, driven by factors such as species richness, colour variety, and floral abundance, while landscapes dominated by grass species and lacking diversity ranked lower in preference.
- These findings underscore the value of biodiversity as a tourism asset and stress the importance of fostering positive environmental attitudes for effective conservation. By promoting a deeper appreciation for biodiversity, conservation efforts can better leverage diverse natural landscapes, enhancing visitor experiences and fostering environmental stewardship.

Keywords: Environmental Attitude, Diversity Perception, Tourism, Ecological Concern, New Ecological Paradigm, Preference, Floral Diversity.

5.1 Introduction

Nature-based tourism (nature-based tourism) is in high demand, particularly in protected sites (Winter et al., 2020, Jiang, 2020, Leung et al., 2008). This presents a potential conflict between tourism and conservation goals (KC, 2021, Spenceley et al., 2021, Jones et al., 2021, King et al., 2012, Reinius and Fredman, 2007, Eagles et al., 2002) as tourisms generally aims to increase visitor numbers and conservation goals may have impacts from such increases through increased trampling or noise impacts if unmanaged (Torsney and Buckley, 2023). Engaging experiences are suggested as a means to mitigate these conflicts and promote environmental awareness and positive behaviours (Mandić and McCool, 2022, Clayton, 2020, Mandić and Vuković, 2022). However, it is broadly understood that visitor behaviours, motivations and expectations are highly diverse, and the creation of such experiences are complex (Mandić and McCool, 2022). In this context, identifying the factors that influence the preferences and perceptions of visitors towards biodiversity becomes paramount. By elucidating how visitors perceive and value biodiversity in natural landscapes, we can better tailor nature-based tourism experiences to align with both visitor preferences and conservation objectives.

There is a growing societal interest in conservation and biodiversity, (De Oliveira Caetano et al., 2023), presenting an opportunity to harness public enthusiasm in addressing the global biodiversity crisis. Navarro-Perez and Tidball (2012) identified four key challenges for nature education emphasising the importance of understanding the audience and constructing effective messaging strategies. Here the study investigated individuals' perception and preference for floral diversity in an experimentally manipulated grassland ecosystem. The study also tested the effects of environmental attitudes and ecological worldviews on diversity preferences and perceptions. The experimental manipulation, based on a common diversity management technique - conservation grazing - created a gradient of diversity among plots. It provided an ideal situation in which to test whether management for conservation produced diversity effects that were both discernible and preferred by non-expert potential visitors to this popular tourism site and whether perceptions and preferences were shaped by environmental attitudes.

At nature destinations it is often assumed that greater biodiversity results in a greater perceived experience. However, this assumes that all visitors have a similar preference for biodiversity and similar ability to perceive diversity. However, it has been shown that there is a significant gap between biodiversity professionals and laypeople with regard to species

literacy (Hooykaas et al., 2019). Species literacy includes the ability to identify species and understand their different roles in an ecosystem (Hooykaas et al., 2019). Biodiversity perception varies significantly depending on the specific biodiversity metric being assessed, such as species richness, evenness, or turnover (Breitschopf and Bråthen, 2023). Dallimer et al. (2012) observed that participants struggled to perceive species richness in the case of birds, butterflies, and plants. Hoyle et al. (2019) highlighted the influence of people's subjective connection to nature on their ability to perceive diversity or the naturalness of a site. Moreover, perceived biodiversity has been linked to restoring one's cognitive, emotional, and physical resources to influence positive mental well-being specifically when looking at woodlands (Nghiem et al., 2021) and urban species (Fisher et al., 2021). Aspects of nature such as vegetation cover and bird abundances have been linked with positive mental health (Cox et al., 2017).

As well as variable perception levels with regard to biodiversity, people have diverse connections to different aspects of nature, a factor that can significantly shape their perceptions and values (Austen et al., 2023, Pett et al., 2016). Like animals, humans have habitat preferences – it has been shown that habitats associated with water have greater aesthetic appeal while sand dune habitats have the least appeal (Eroğlu et al., 2018). Emphasising forest biodiversity has been shown to contribute to greater engagement with/or use of forest systems (Austen et al., 2023). Perceptions of forest diversity have been linked to smells, colours, shapes etc. which may not align with traditional ecological terminology or targets (Austen et al., 2021). Additionally, aesthetic considerations play a role in individual preferences for biodiversity (Curtin and Papworth, 2020). Maund *et al.* (2020) identified substantial variability in public values related to ecosystem services, further indicating that differences in values could impact perceptions and preferences related to biodiversity. Notably, there is a growing focus in the literature on the value of biodiversity in urban greenspaces and their connections to human wellbeing (Fisher et al., 2021). Nowak-Olejnik et al. (2020) demonstrated that the community composition of grasslands impacts the perceived cultural ecosystem services, such as spiritual enrichment and amenity value, when looking at different grassland types.

Attitudes, in essence, are a composite of cognitive (beliefs and thoughts), affective (emotional), and behavioural aspects (intentions and actions) (Rosenberg, 1956). These components collectively shape how an individual perceives and engages with the world, influenced by a myriad of factors like personal experiences, cultural values, and social

influences (Eagly and Chaiken, 2007, Gawronski, 2007, Fabrigar and Wegener, 2010). Psychometric scales are used to systematically measure the predispositions in an individual's attitude to predict their behaviour (Thurstone, 1928, Gawronski, 2007, Cruz and Manata, 2020). Environmental attitudes specifically pertain to an individual's stance or disposition concerning environmental matters such as policy initiatives and conservation; it reflects the level of concern or commitment a person has toward environmental protection and sustainability (Cruz and Manata, 2020). The Ecological Concern (EC) scale is a commonly used item which assesses a person's environmental attitude (Cruz and Manata, 2020); categorising an individual as biocentric, altruistic or egocentric (Figure 5.1).

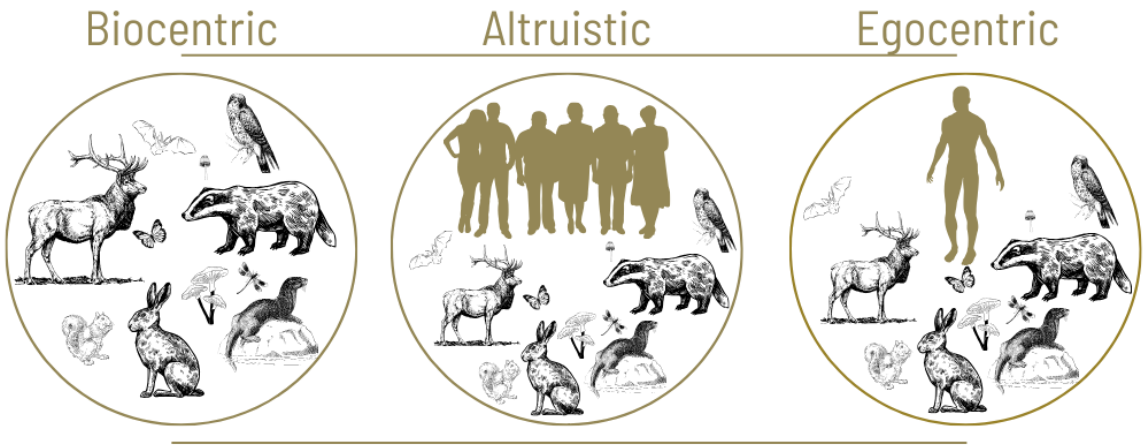


Figure 5.1. Illustration of biocentric (left), altruistic (middle) and egocentric (right) social constructs.

The New Ecological Paradigm scale (Catton Jr and Dunlap (1978) represents an eco-centric worldview, where nature is seen as interconnected and valuable in its own right, beyond its instrumental value for human use. It identifies perspective regarding the relationship between humans and the natural environment; the scale includes items that reflect beliefs about the interconnectedness of nature, the importance of preserving natural ecosystems, and the recognition of limits to human exploitation of the environment. It measures attitudes such as concern for environmental degradation, support for conservation efforts, and acknowledgment of the need for sustainable practices. It measures underlying environmental values and beliefs on a scale from anti-ecological values to pro-ecological values. This contrasts with the "Dominant Social Paradigm" (DSP), which traditionally emphasised human dominance over nature and viewed nature as a resource to be exploited for human needs, which is prevalent in western society (Dunlap and Liere, 1984). The Ecological Concern scale and New Ecological Paradigm have been shown to influence intentions

towards positive environmental behaviours in accordance with the theory of planned behaviour (Gansser and Reich, 2023). Given that attitudes are shaped by personal experiences, cultural values, and social influences it is proposed that these attitudes are likely to impact an individual's preferences for biodiversity. If so, the framing of environmental messages for protection or enhancement may need to vary according to environmental attitudes.

Here the study focused on perceived diversity in a grassland ecosystem at a popular cultural heritage tourism destination. The site is managed using conservation grazing for higher diversity under the assumption that higher diversity has a higher perceived experience for visitors. The general literature on biodiversity perception has a focus on landscape features, urban green areas and forest habitats with regard to assessing preferences and mental health benefits. Here the study selected a grassland habitat which requires closer focus on fine scale detail, in order to interrogate introspective views of something that may otherwise be walked past or ignored. The site is within a protected area – a Special Area of Conservation – which has a coastal grassland system as the qualifying interest for the designation. The results of the Chapter 4 demonstrate that the conservation grazing management practice carried out for their perceived benefit to human visitors at the site significantly increases and maintains plant diversity – demonstrating an ecological benefit of management for tourism in this location.

The study aimed to determine whether individuals could perceive floral diversity in grasslands and if they had a preference for diversity. Additionally, the study aimed to determine if environmental attitude and ecological world view of participants influenced preferences for grassland plot images, as well as participants' ability to perceive diversity. To achieve this, the study used an adapted Ecological Concern scale (see methods for details) and New Ecological Paradigm scale to quantify the participants' environmental attitudes and used image-based rankings of grassland plots to determine preference and perception, relative to a known set of diversity measures (Simpson's Diversity Index). The study used participants' narrative responses to explore drivers of their perspectives and extracted key themes related to their rankings of images for preference and diversity.

Hypothesis 1: Students can perceive plant diversity in a grassland.

Hypothesis 2: Students have a preference for higher diversity grasslands.

Hypothesis 3: Environmental attitude (as measured by adapted ecological concern scale) and/or ecological world view (New Ecological Paradigm score) influences

ability to perceive diversity.

Hypothesis 4: Environmental attitude (as measured by the adapted ecological concern scale) and/or Ecological world view (New Ecological Paradigm score) influences preference for diversity.

5.2 Methods

5.2.1 Photo Selection Process

The photos and associated diversity data were collected as part of a grassland diversity experiment from Chapter 4, and comprehensive details of the methods used can be found therein. In general, Chapter 4 used 1 x 1m plots to quantify the percentage cover of all species in plots across the site. Diversity was manipulated using a randomly applied grazing exclosure experiment at the plot scale which resulted in a gradient of diversity across the site from 2018 to 2022; overall diversity declined in ungrazed plots by over 20%. Vegetative field identification techniques were used to record plant species identity and abundance which were used to calculate Simpson's Diversity Index for each plot. Simpson's Diversity Index is a measure of diversity which considers species richness (number of species) as well as their relative abundance and evenness within the sample. Diversity is presented on a scale of 0-1 where values closer to 1 indicate higher diversity and values closer to 0 indicate lower diversity. Each plot had a photo taken from the southern corner facing north at a height of 1m for consistency. The use of the photos decoupled diversity scores of the plots from any other local context which might influence perceptions and preferences for particular plots (e.g. coastal context, broader landscape features, noise etc.).

16 photos were randomly selected from the photo library to form the rank order (Figure 5.2), with each rank possessing a unique index value higher than the one below and lower than the one above (these are available through the GitHub and Zenodo links). The diamond order is an approach in the Q-method (see below) designed to encourage participants to make discriminations between items more effectively; particularly which items are most representative of their viewpoint and which are least representative (Zabala et al., 2018). The Q-method is a research technique to systematically study subjective viewpoints or perspectives on a particular topic (Corr, 2001). Positive and negative representation avoids skewness and allows for a nuanced representation; this also reduces the likelihood of participants choosing a neutral or middle-ground response for all items (Stenner et al., 2008, Watts and Stenner, 2012a, Zabala, 2014, Zabala et al., 2018). All the selected photos were taken in 2021.



Figure 5.2. Ranking matrix used for the photo selection to inform preference and diversity perception.

The photos were printed using a high-quality inkjet printer (Epson P800 series) at a resolution of 300 dots per inch (dpi) on Permajet Oyster paper, measuring 20.32 x 15.24 cm. Each image was assigned an identifying number on the back which did not correspond to its calculated diversity relative rank position. Photo order was randomised within the photo bundles.

5.2.2 Participants

A "purposeful snowballing recruitment" or "chain referral sampling" approach was used. Student groups were targeted to engage and then asked for referrals to other individuals who fit the research criteria. For this study a focus was placed on third level students to control the research population; for a breakdown of participant demographics see Chapter 5 Appendix V. All participants had the details of the study explained to them and signed consent forms for the research. Research was carried out under ethical approval from Trinity College Dublin.

5.2.3 Perception and preference survey

Each participant received an identical survey questionnaire accompanied by an associated photo bundle, along with detailed instructions provided in Chapter 5 Appendix I. The surveys consisted of some basic demographic questions, the adapted Ecological Concern scale, the New Ecological Paradigm scale, participants' preference ranking of the photos together with a series of qualitative questions about the preference ranking and then finally the participants' diversity ranking of the photos with the same qualitative questions. The surveys were administered in the presence of the lead researcher to address any follow-up questions regarding the survey process. Emphasis was placed on providing clarifications, avoiding the introduction of examples, and maintaining participant autonomy in determining preferences, allowing them to justify their choices in the qualitative response sections. After the initial set of data was collected, a series of workshops were set up to recruit further participants to assess if the order of the ranking questions (preference and then diversity) had an anchoring effect. The anchoring effect refers to the cognitive bias where individuals rely on initial information encountered (the "anchor") as a reference point which can impact decision-making and perceptions (Bahník et al., 2016). Thus, within each of the follow-up groups half of the participants were given the instructions as provided in Chapter 5 Appendix II, ranking diversity first and then preference (group A), while the other half received the questions as per Chapter 5 Appendix I from the first cohort, ranking preference first and then diversity (group B).

5.2.4 Analysis

The analysis was conducted in R-Studio (version 4.0.3) (R Development Core Team, 2020). The position of each of the photos within the ranking matrix was used to assign the rank level 1-7. These preference rankings and diversity perception rankings were then compared to the calculated diversity ranking; as per the field collected diversity values of each photographed plot ordered from highest to lowest Simpson's Diversity Index. A Spearman's rank correlation test was undertaken to achieve this. This was undertaken assuming each participant was independent. A Wilcoxon rank sum test (also known as the Mann-Whitney U test) was undertaken to verify the independence assumption, and showed that the mean correlation scores were no different in those who conducted the survey on their own versus in a group. Each participant therefore had a rank correlation score describing the correlation between their ranked preference and diversity and the calculated diversity (Hypothesis 1 and 2). The resulting correlation scores were compared to the interpretation guidance outlined in Salkind and Frey (2021) (Table 5.1).

Table 5.1. Interpretation guide to correlation as per Salkind and Frey (2021).

Absolute Value of Correlation Coefficient	General Coefficient Interpretation
0.8 - 1	Very Strong Relationship
0.6 - 0.8	Strong Relationship
0.4 - 0.6	Moderate Relationship
0.2 - 0.4	Weak Relationship
0 - 0.2	Weak to no correlation

To test the effect of anchoring (the order of the perception and preference rankings), a Wilcoxon rank sum test was undertaken to see if the diversity correlation scores and preferences correlation scores differed significantly between groups A and B (direction of the question i.e. elicitation order) in the sub-population of student participants engaged with through the workshops. The explanatory variable used was the elicitation order and the response variable was the correlation score for diversity perception order and for the preference order. If elicitation order is important then the study would expect the correlation of participants' perceived diversity ranks with calculated diversity ranks to change depending on whether their diversity ranks are given before elicitation of preference (Group A) or after elicitation of preference (Group B).

The adapted Ecological Concern scale scores were determined by summing relevant survey responses and categorising participants into Biocentric, Altruistic or Egocentric categories; in terms of environmental attitude. The traditional method for scoring the Ecological Concern Scale is to collect the data using a Likert Scale for all items and averaging the results of each category – as described by Schultz (2001). By limiting the rank prioritisation between 1 and 7 – 7 being the highest priority – it forces prioritisation and encourages deliberation which aligns with Elimination by Aspects Theory. Elimination by Aspects Theory was presented by Tversky (1972) and asserts that when presented with multiple options, individuals often eliminate alternatives that fail to meet specific criteria until they arrive at a preferred choice. This theoretical framework sheds light on how people prioritise items or options when making decisions within limitations. This scoring limitation was imposed to improve conceptual coherence with the three categories through prioritisation and to reduce dimensionality to increase statistical power (see Chapter 4 Appendix III for further details on adaptation testing). The responses for the New Ecological Paradigm scale were summed to produce a total score ensuring the negatively phrased questions were reverse scored (Dunlap et al., 2000). The resulting scores were used to categorise

participants' ecological world view as Pro-Ecology (greater than 75), Mid-Ecology (between 45-75) or Anti-Ecology (less than 45).

To assess if the adapted Ecological Concern (environmental attitude) or New Ecological Paradigm (ecological world view) were influenced by the diversity-preference correlation scores (Spearman's rank correlation scores) a mixed effects general linear model was used. The Preference Correlations and Diversity Perception Correlations were transformed to a positive 0-1 scale by adding 1 and dividing by 2. Models were fit using Linear Mixed Effects Regression (LMER) (Bates, 2010). The maximal model was constructed for both response variables (Preference Correlation and Diversity Perception Correlation). The explanatory variables used were eco-concern categories and New Ecological Paradigm categories. The reference level for the adapted Ecological Concern was set as egocentric, as egocentric individuals are anticipated to have the lowest correlation scores. The reference level for the New Ecological Paradigm was set to the mid-ecology view; as mid-ecology was the lowest category within the dataset (no anti-ecology participants) and was anticipated to have the lowest correlation scores. Group was introduced as a random effect to remove any influence of the workshop setting on the predictions. Models were assessed to ensure the assumptions were met by examining residual plots, assessing normality and homoscedasticity of residuals, evaluating the linearity of the model, and inspecting influential observations. Additionally, diagnostic tests such as Shapiro-Wilk tests for normality and plots of residuals versus fitted values were used. It was necessary to square transform the preference correlation data and logit transform the diversity perception correlation scores to meet assumptions. Further *post hoc* tests were undertaken using the *emmeans* package in R (Lenth et al., 2018) to compare the estimated marginal means – using the 'Tukey' method to adjust for multiple comparison – for the effects of each level of the categorical variables. This model was used to test hypotheses 3 and 4.

To explore potential drivers of aligned perspectives among the participants the study used the Q-method for grouping participants based on their image preferences and qualitative analysis of their narrative responses for the Q-method groupings. The ranking results were prepared in accordance with the Q-method, where each participant's photo preferences were quantified by assigning values based on their rank position (Table 5.2).

Table 5.2. Scoring metrics used for the Q-method according to each of the ranks.

Rank Number	Assigned Value
Rank 1	+3
Rank 2	+2
Rank 3	+1
Rank 4	0
Rank 5	-1
Rank 6	-2
Rank 7	-3

Factor analysis was conducted to explore the underlying structure of the Q-sort data. (Zabala, 2014). Factors are understood by analysing quantitative factor arrays, which are hypothetical Q-sorts for each factor, calculated by assigning scores to each image within the factor, equating to shared perspectives among individuals grouped into the identified factor. Principal Component Analysis (PCA) was used to identify the latent factors that best accounted for the variance in participants' sorting patterns and varimax r rotation methods were applied to enhance the interpretability of the factor loadings (Ramlo, 2016). The scree plot and eigenvalue criterion were used to determine the number of factors to retain. Factors with eigenvalues greater than 1 or those that were identified as significant contributors to the variance in the scree plot were selected (Sandbrook et al., 2013). Participants' Q-sort data were then subjected to factor loading analysis. Each participant's Q-sort configuration was correlated with the factor loadings obtained from the factor analysis to determine the degree to which they aligned with each identified factor (Watts and Stenner, 2012b). Participants were considered to load successfully onto a factor if their correlation coefficient with that factor exceeded a threshold of 0.5. The Q-method– as outlined above – was also applied to the preference order ranking and the resulting factors were explored qualitatively to extract themes within these shared perspective factors. A frequency table of word/phrase occurrence and word cloud images were generated for the data – this was also undertaken for each of the factors identified by the Q-sort.

5.3 Results

A total of 81 participants were included in the study which represented a range of university course disciplines, qualification levels (undergraduate, masters and PhD) and demographics. There was a good representation of male (n = 37) and female (n = 44) participants. Most of the participants were Irish (n = 61), with a total of 14 nationalities represented.

Undergraduates were the dominant course level (n = 62) with only 3 masters students taking part and 16 PhD level students. Students who took part were from seven universities in Ireland with the majority being from University College Cork (n = 26) or Trinity College Dublin (n = 46). There were 17 groups undertaken along with 8 solo participants. The group sizes ranged from 2 individuals to 8. A total of 60 individuals were given Order A while 21 completed the survey following Order B (see Chapter 4 Appendix V for further breakdown).

The median correlation score of 0.64 (SE = 0.02, SD = 0.19) indicates a positive ability among participants to perceive diversity in the presented images (Figure 5.3). This means that, on average, participants were skilled at assessing the diversity levels within the images (hypothesis 1 supported). The lower median correlation score of 0.39 (SE = 0.02, SD = 0.25) for preference against calculated diversity suggests that while a positive correlation was found, participants had a somewhat weaker correlation between their preferences and the calculated diversity of the images (Figure 5.3) as compared to the correlation between perceived and calculated diversity. When comparing participants' ability to perceive diversity with their preferences, the median correlation score was 0.69 (SE = 0.03, SD = 0.27), a strong positive correlation, suggesting that participants tended to prefer images that they ranked higher in terms of perceived diversity (Figure 5.3). This means that participants tended to prefer images that they perceived as more diverse (hypothesis 2 supported). In simpler terms, there was a consistent alignment between participants' perceptions of diversity and their preferences. There was no difference observed in the correlation scores for perceived diversity between those who undertook the assessment alone as compared to those who did it as part of a group (W = 348, P = 0.3796).

Overall, the ecological world view scores observed were high, with no participant having an ‘anti’ ecological world view in terms of the New Ecological Paradigm scores; Pro-Ecology (19.75%), Mid-Ecology (80.25%) or Anti-Ecology (0%); see Figure 5.4. There was good representation of the three ecological attitudes from the adapted Ecological Concern scale; biocentric (43.2%), egocentric (13.6%) and altruistic (43.2%). The anchoring tests (Mann-Whitney U test) to check if the photo rankings order influenced the results showed no difference between correlations when diversity or preference were presented to participants first (W =878, P = 0.577; W = 892.5, P = 0.490; respectively). Therefore, all data, regardless of elicitation order, was used together for the analysis.

The mixed effects model for preference showed that participants’ preference for biodiversity

was significantly different to 0 (β = 0.452, df = 69.5, P < 0.001); showing a strongly supported correlation between calculated diversity scores and preference ranking (further supporting hypothesis 2). The preference correlation was not significantly different for the adapted Ecological Concern categories or the New Ecological Paradigm categories (Table 5.3); demonstrating that participants' knowledge and/or environmental attitude did not influence their preference for diversity - hypothesis 4 rejected (Figure 5.5).

Table 5.3. Linear Mixed-Effects Model Results for participants' preference against calculated diversity. Impact of adapted Ecological Concern and New Ecological Paradigm on preference correlation (square transformed), with group as random effect. Degrees of freedom calculated using Satterthwaite approximation method. * Indicates significance.

Predictors	***Estimates*** (β)	***Standard Errors***	***Degrees Freedom***	***t-value***	***P***
(Intercept)	0.452	0.047	69.54	9.615	**<0.001***
Ecological Concern - Altruistic	-0.006	0.049	66.22	-0.123	0.903
Ecological Concern - Biocentric	0.057	0.050	69.91	1.156	0.251
New Ecological Paradigm – Pro-Ecology	0.012	0.043	76.14	0.297	0.767
Random Effects					
Sigma squared (σ^2)	0.020				
Group-level variance ($\tau_{00\ Group}$)	0.005				
Intra-Class Correlation (ICC)	0.206				
Number of Groups (N_{groups})	18				
Observations	81				
Marginal R^2/Conditional R^2	0.038/ 0.24				

The results of the diversity perception model showed a significant ability to perceive diversity (β = 1.038, df = 71.8, *P* < 0.001); which further supports hypothesis 1. The results of the model also show that altruistic individuals have a significantly greater ability to perceive diversity than egocentric individuals and biocentric individuals have a significantly higher ability than altruistic individuals (Figure 5.5); this partially supports hypothesis 3 that environmental attitude (as measured by your adapted ecological concern scale) influences

your ability to perceive diversity (Figure 5.6). There was no significant difference between Pro-Ecological world view according to the New Ecological Paradigm than those with a Mid-Ecological world view (β = 0.191, df = 76.8, *P* = 0.23); thus hypothesis 3 is only partially supported (Figure 5.6).

Table 5.4. Linear Mixed-Effects Model Results: Impact of Adapted Ecological Concern and New Ecological Paradigm on Diversity Correlation Score (logit transformed), with Group as Random Effect. Degrees of freedom calculated using Satterthwaite approximation method. * Indicates significance.

Predictors	***Estimates*** (β)	***Standard Errors***	***Degrees Freedom***	***t-value***	***P***
(Intercept)	1.038	0.17	71.79	6.11	**<0.001***
Ecological Concern - Altruistic	0.424	0.18	68.98	2.287	**0.025***
Ecological Concern - Biocentric	0.494	0.19	73.72	2.614	**0.011***
New Ecological Paradigm – Pro-Ecology	0.191	0.16	76.87	1.209	0.230
Random Effects					
Sigma squared (σ^2)	0.298				
Group-level variance ($\tau_{00\ Group}$)	0.030				
Intra-Class Correlation (ICC)	0.092				
Number of Groups (N_{groups})	18				
Observations	81				
Marginal R^2/Conditional R^2	0.096/ 0.179				

The Q-sort analysis grouped 70 of the participants into three factors. The remaining 11 participants failed to load onto these factors. Overall, the key themes which emerged from the qualitative data gathered related to the highest and lowest-ranking preference images (Figure 5.8 and Figure 5.9) are identified in 6 below.

It was noted that the key themes identified above were consistent between the three factors as can be seen in Figure 5.7. There were no discernible differences between the preference data within the factors identified.

Table 5.5. Qualitative themes for the highest and lowest-ranking preference images.

Highest-Ranking Preference Themes	Lowest-Ranking Preference Themes
Species	Grass
Variety of colour	Dead patches
Floral diversity	Dry flowers
Most plants	Less diversity
Healthy	Sparse
Green	Less species
Long	Brown
Lush/rich	Short

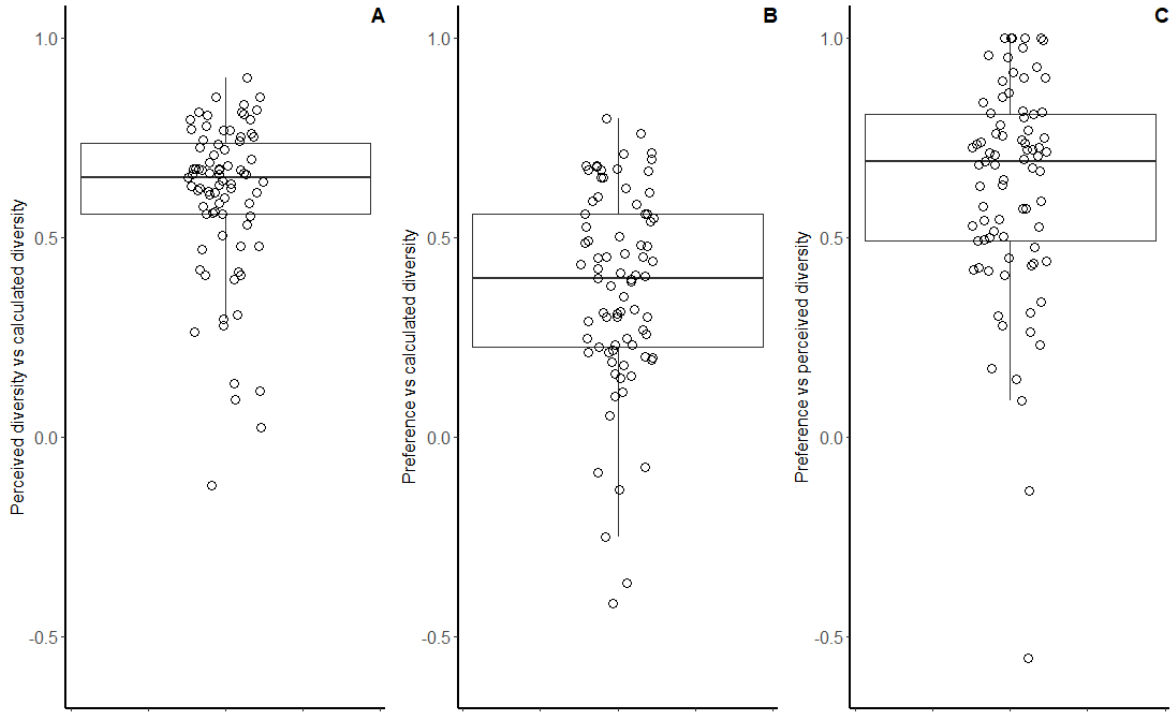


Figure 5.3. Correlation scores between: A) perceived vs calculated diversity; B) preference vs calculated diversity; and C) preference vs perceived diversity. The boxes are the interquartile ranges with the black whiskers representing the upper and lower extremes of the data range (1.5 times the interquartile range). The dots represent individual datapoints.

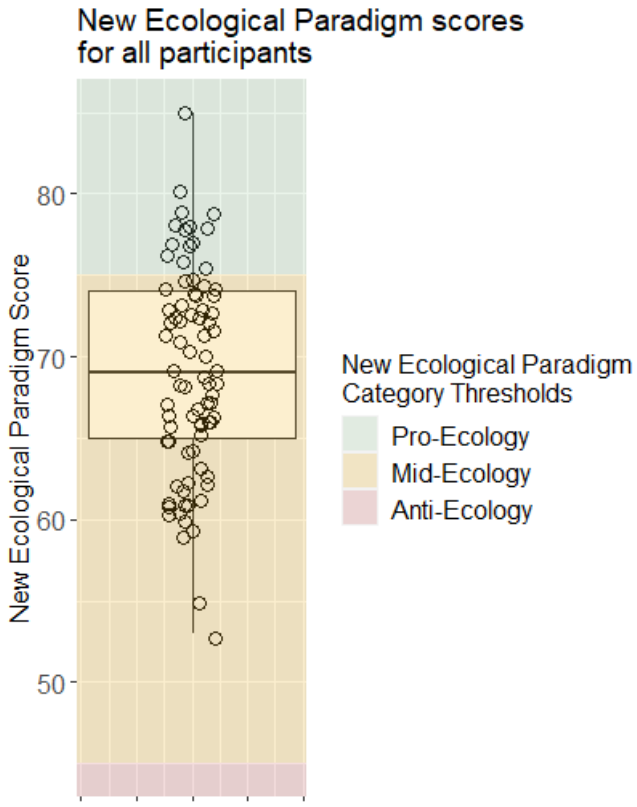


Figure 5.4. New Ecological Paradigm scores from all participants: pale pink = anti-ecology; amber = mid-ecology; green = pro-ecology. The boxes are the interquartile ranges with the black whiskers representing the upper and lower extremes of the data range (1.5 times the interquartile range). The dots represent individual datapoints.

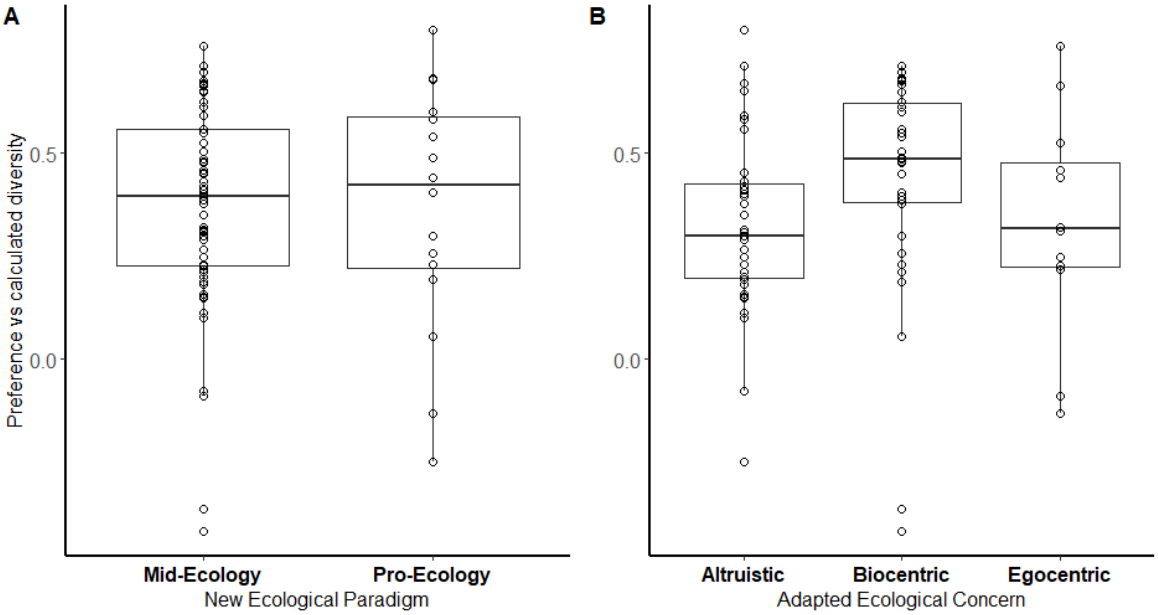


Figure 5.5. Correlation scores between preference and calculated diversity ranking (Simpson's Diversity index) compared with A) the adapted ecological concern scale; and B) the New Ecological Paradigm scale. Central box represents the interquartile range (IQR) and the black whiskers show the overall data spread (1.5 times the IQR) and the dots represent individual datapoints.

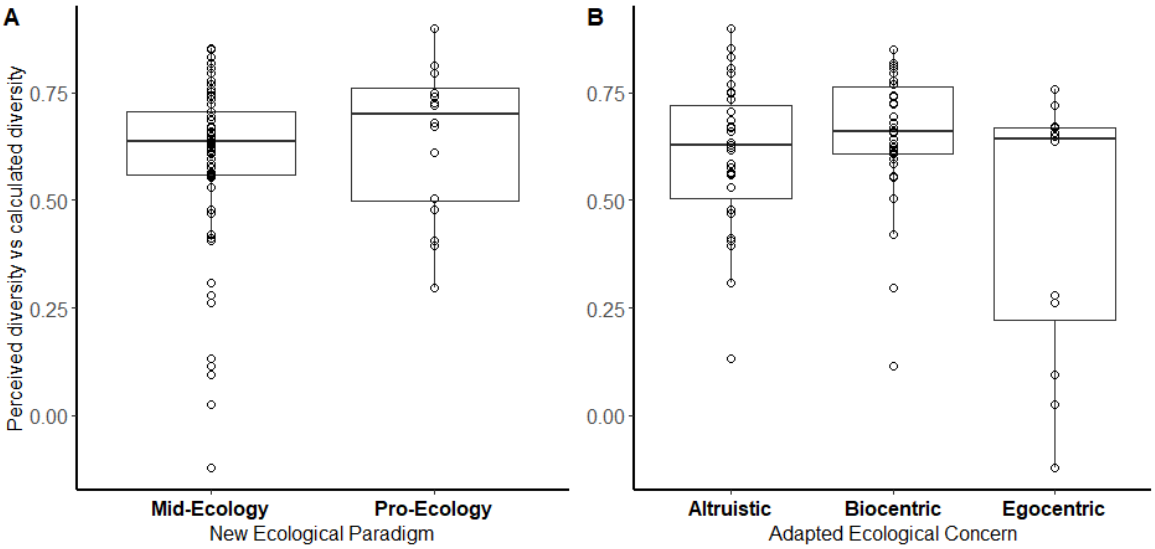


Figure 5.6. Correlation scores between participants diversity ranking order and the calculated diversity ranking (Simpson's Diversity index) compared with A) the adapted ecological concern scale; and B) the New Ecological Paradigm scale. Central box represents the interquartile range (IQR) and the black whiskers show the overall data spread (1.5 times the IQR) and the dots represent individual datapoints.

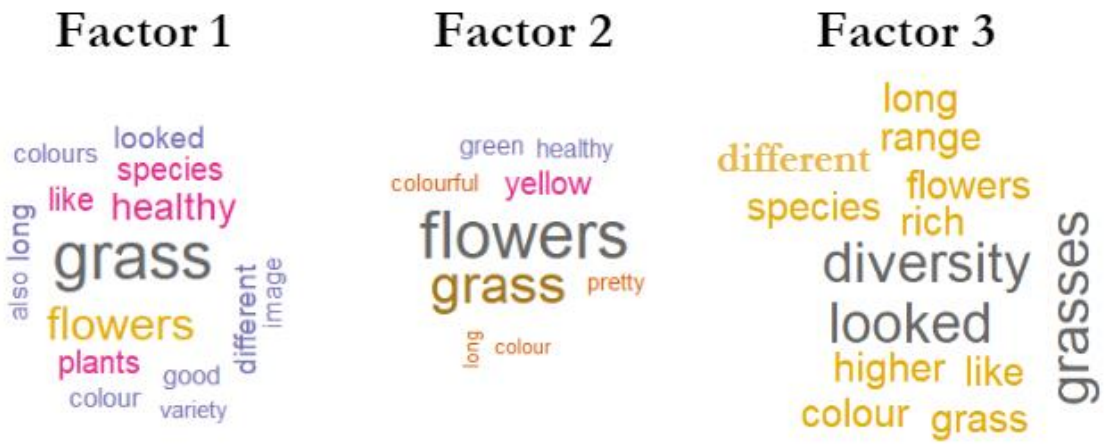


Figure 5.7. Word cloud illustrating key themes and preferences with regard to each q-sort factor expressed by participants regarding the highest-ranked image. Font size represents word frequency.

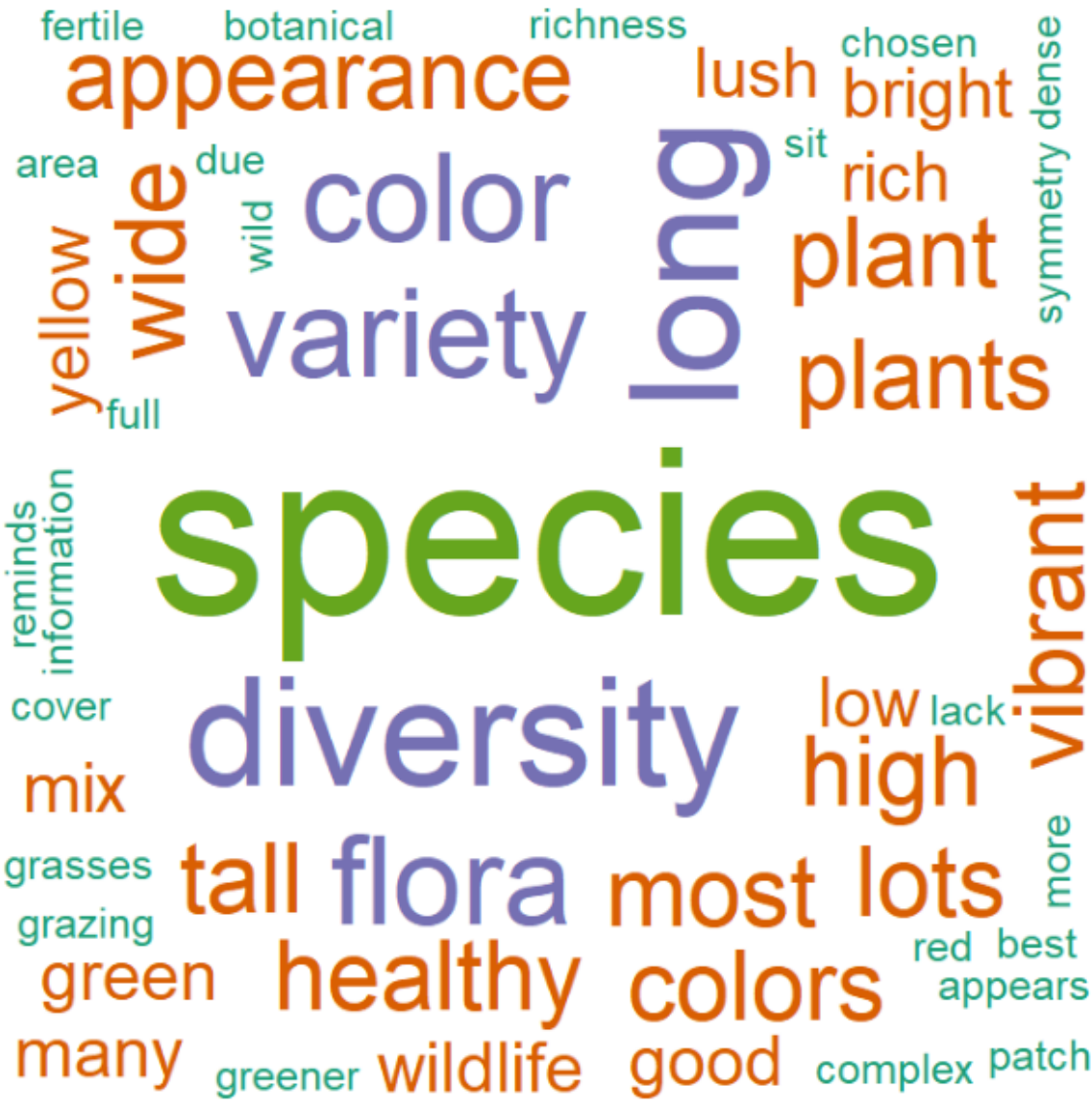


Figure 5.8. Word cloud illustrating key themes and preferences expressed by participants regarding the highest-ranked image. Font size represents word frequency.



Figure 5.9. Word cloud illustrating key themes and preferences expressed by participants regarding the lowest-ranked image. Font size represents word frequency.

5.4 Discussion

The investigation of plant diversity perception and preference within an experimentally manipulated grassland ecosystem showed participants have a strong ability to discern diversity within the presented images, as evident by the median diversity correlation score of 0.64. Participants showed a strong preference for their perceiving diversity (0.68) i.e. what they perceive as diverse and what they prefer are similar. However, their preferences aren't strongly correlated with actual diversity as preference for diversity was observed to have a weak correlation with calculated diversity (0.39) but overall, this was identified to be significantly greater than 0 ($\beta = 0.047$, $df = 69.54$, $P < 0.001$). The study found that environmental attitude (as measured by the adapted ecological concern scale) influenced perception of diversity with altruistic individuals demonstrating a significantly higher ability to perceive diversity compared to egocentric individuals. Biocentric individuals, in turn, surpassed altruistic individuals in their ability to perceive calculated diversity. Notably, there were no significant differences in perception or preference correlations with calculated diversity observed among the groups represented by the New Ecological Paradigm (mid and pro), indicating that these ecological worldviews do not influence individuals' perceptions or preferences related to biodiversity. These findings underscore the influence of individual environmental attitudes on perception of biodiversity. The key drivers of preference were identified as number of species, variety of colour, floral diversity, and overall plant abundance, while images with features such as grass dominance, dead patches, and dry flowers ranked lower in the preference ranking.

Hypothesis 1: Students can perceive plant diversity in a grassland.	**Supported**
Hypothesis 2: Students have a preference for higher diversity grasslands.	**Supported**
Hypothesis 3: Environmental attitude (as measured by adapted ecological concern scale) and/or ecological world view (New Ecological Paradigm score) influences ability to perceive diversity.	**Partially Supported**
Hypothesis 4: Environmental attitude (as measured by the adapted ecological concern scale) and/or Ecological world view (New Ecological Paradigm score) influences preference for diversity.	**Rejected**

In Chapter 4, the conservation grazing management practices at Derrynane House significantly increased and maintained plant diversity driven by the assumption that greater biodiversity would benefit tourism, particularly by aligning with visitor preferences. The study has shown that potential visitors can perceive diversity differences relevant to the management regime, and that some visitors (biocentric and altruistic) are better able to perceive these differences. The study also demonstrated a positive preference for more biodiverse plots, but with no difference between students with different ecological world views/attitudes. These findings highlight a direct link between tourism objectives (greater perceived experience) and conservation efforts (increasing diversity) in grassland ecosystems—an important concept often overlooked in conservation discourse, which tends to focus heavily on the negative impacts of tourism (León-Gómez et al., 2021, Ren et al., 2019, Liu et al., 2018, Monz et al., 2013, Zhong et al., 2011, Higgins-Desbiolles, 2020b). Derrynane House is a prime example of where strategic management of grassland diversity for greater perceived visitor experience has bolstered natural capital assets, showcasing the potential for mutual benefits of carefully managed nature-based tourism.

Despite being a cultural heritage destination without explicit economic incentives for biodiversity management, the success at this site underscores the potential for smart tourism practices to enhance plant diversity. While scalability issues of eco-tourism have been raised from environmental and capitalist perspectives (Isaacs, 2000), our research demonstrates tangible tourism/visitor benefits that can be achieved. A persons experience at a destination is often determined by their attitude – which is shaped by cultural values and social influences (family, peers, community and media etc.) which, in turn, shape a person's experience (Eagly and Chaiken, 2007, Gawronski, 2007, Fabrigar and Wegener, 2010). This study reveals that there is a general preference for biodiversity independent of one's environmental attitude and/or ecological world view. Further studies are required to identify if these preferences for biodiversity influence the visitor experiences at destinations.

Understanding the drivers of preference is a key insight from this research, which identified variety of colour, floral diversity and health of the sward as key themes. Colour has been shown to be a preference factor for destinations at a landscape scale in a study by Huang and Lin (2020), as well as being a key factor in preferences for birds (Santangeli et al., 2023). Interestingly, the least preferred images had themes related to dead patches, dull condition and bare soil etc. The build-up of dead matter was significantly associated with exclusion of grazing as seen in Chapter 4. The conservation grazing management practices employed not

only increased the floral diversity – which had associated perception benefits – but also removed the build-up of dead matter, suggesting the importance of active management in maintaining landscape attractiveness. Therefore, management practices should aim to create florally diverse grassland systems which have high diversity, a variety of colours and an absence of dead matter build up or bare patches.

Torsney and Buckley (2023) showed that managed sites have lower rates of environmental impacts occurring from visitors than unmanaged sites. Therefore, in the absence of management practices impacts occur freely and therefor are driven by individual behaviours. The theory of planned behaviour states that behaviours are influenced by our attitudes, perceived behavioural controls and subjective norms which all interact with our intention and ultimately influences our behaviour (Ajzen, 1991). All participants were shown to have a high environmental knowledge base with none having an anti-ecology world view; though this may represent a bias in our sample, see the limitations section below. Ecological world view (as measured by the New Ecological Paradigm) was shown to have no influence on preference or ability to perceive diversity. Raising ecological education levels and/or awareness is important but it may not be sufficient for effective conservation management. This is because knowledge does not necessarily challenge one's attitude – which has been shown in this study to play a key role in influencing individuals' perception and preference of biodiversity. There is a critical need to focus on shifting environmental behaviours to promote environmental stewardship (Nilsson et al., 2020, Arundati et al., 2020). Fenitra et al. (2021) demonstrated that emotionally engaging experiences positively influence environmental behaviours; this research supports the call for further study in this area. With the increase in environmental knowledge globally and the rising trend in demand for nature (Balmford et al., 2009) – and nature-based experiences – this represents a great opportunity to harness engagement opportunities through tourism to foster positive environmental action. Building engaging experiences which focus on a shift in environmental attitude and understanding of individuals self-directed behaviour control is an important aspect of future education processes and research direction. This is particularly relevant for sites where the primary motive for visitors might not be nature such as at cultural heritage destinations which also have natural landscapes present.

When developing meaningful engagement processes with regard to nature-based tourism it is important to note there are a range of existing management models. For example, the Visitor Experience and Resource Protection Model (VERP) is an existing management tool

for engaging experience development (McArthur, 2000, Jurkus et al., 2022). VERP integrates visitor experience goals with resource protection objectives; it aims to enhance visitor satisfaction while ensuring the long-term conservation of natural and cultural resources. VERP involves stakeholder engagement, visitor use planning, and ongoing evaluation and adaptation of management strategies. Similarly, the Tourism Optimization Management Model (TOMM) focuses on optimising tourism development and management to maximize economic benefits while minimising negative environmental and social impacts. It involves strategic planning, market analysis, product development, and destination marketing, with an emphasis on sustainability and community involvement (McArthur, 2000, Jurkus et al., 2022). The Integrated Monitoring and Adaptive Management System (IMAMS) is a comprehensive approach to monitoring and managing visitor activities and environmental conditions in protected areas. It involves collecting data on visitor use patterns, resource conditions, and socio-economic factors, and using this information to adaptively manage tourism operations for sustainability and resilience (McArthur, 2000, Jurkus et al., 2022). The IMAMS is particularly relevant in the context of protected sites as the data driven approach ensures alignment with conservation goals can be more easily achieved as ecosystem protection is often a complex task. This research identified the importance of collecting visitor activity, movement and demographic data to inform adaptive management strategies for sustainable and resilient operations. Moreover, the influence of environmental attitudes on biodiversity perception and preference, can enhance the effectiveness of IMAMS in aligning tourism activities with conservation goals. By highlighting the need for active management practices and stakeholder engagement, our findings support the data-driven approach advocated by IMAMS for sustainable ecosystem protection.

5.5 Conclusion

In conclusion, the study found that individuals prefer more diverse grassland plots irrespective of their environmental attitude or ecological world view. Environmental attitude, however, influence's ability to perceive biodiversity, with biocentric individuals having the strongest ability to perceive diversity followed by altruistic individuals and then egocentric individuals. Grassland biodiversity should therefore be considered a valuable (preferred) tourism asset, and effective management strategies should be implemented to increase plant diversity. Prioritising diverse, colourful, lush, and healthy systems is important for maximising the appeal of nature-based tourism destinations which have grassland systems on site.

5.6 Limitations

This study employed a diverse sample of third-level students to gauge perceptions of biodiversity, yet the results may not fully represent other demographic groups. The sample consisted exclusively of third-level students; a demographic characterized by higher educational attainment. While third-level education in Ireland is widely accessible—with over 50% of 25-64-year-olds holding such qualifications (Central Statistics Office, 2023). —this demographic may still differ significantly from the general population. Individuals with varying educational backgrounds, ages, socio-economic statuses, or cultural contexts might exhibit different perceptions and attitudes towards biodiversity. Consequently, future studies should include a broader range of demographic groups to ascertain whether these findings are unique to students or can be generalized more widely.

Higher education can profoundly influence individuals' environmental awareness and values. Third-level students are often more informed about environmental issues, which could result in a heightened awareness and appreciation of biodiversity compared to the general public. This educational bias means the findings might reflect the perspectives of an educated subset of the population rather than a cross-section of society. While students are seen as representatives of the modernising generation and might provide insights into future trends, the study’s results cannot be generalised beyond this group. The views of students today may not perfectly mirror those of older or younger generations. Nevertheless, understanding the perspectives of this demographic is valuable, as they will play crucial roles in shaping future societal norms and policies.

The population of students in Ireland includes a mix of nationalities, which may offer a global perspective to some extent. However, cultural differences can significantly impact perceptions of biodiversity. The diversity within the student sample could mask variations in attitudes that would be more apparent in a study designed to compare different cultural backgrounds directly. Furthermore, the nature of voluntary participation in research may introduce a self-selection bias. Individuals who choose to participate in studies about biodiversity might already have an interest in the topic, leading to over-representation of pro-environmental attitudes. Ego-centric individuals or those less concerned with environmental issues might be underrepresented. Implementing an incentivized participation process in future studies could help mitigate this bias and attract a more representative sample of the general population.

The study's design and methods also impose certain limitations. For instance, the use of surveys or interviews might not fully capture the complexity of students' perceptions or the depth of their understanding. Additionally, the specific phrasing of questions and the context in which they are asked can influence responses. Employing a mixed-methods approach, combining quantitative and qualitative data, could provide a more comprehensive understanding of the topic. By addressing these limitations in future research, we can gain a more nuanced understanding of public perceptions of biodiversity and develop more targeted strategies for environmental education and conservation efforts.

Chapter 6 Overall Discussion

6.1 Foundations and Key Insights

This research underscores the critical need for robust tourism governance to ensure effective environmental management practices by tourism operators. Biodiversity plays a fundamental role in supporting tourism, as the industry heavily relies on nature for its appeal. I redefine eco-tourism by integrating perspectives from both tourism and environmental management, clearly distinguishing it from nature-based tourism based on previous definitions and stakeholder engagement.

My study highlights the ecological enhancement measures implemented by tourism operators, showcasing the tangible ecological benefits that tourism can provide. These findings illustrate the potential synergies between tourism and conservation. Additionally, I identify the drivers of environmental impact occurrence and severity, moving beyond the simplistic use of visitor numbers as a proxy for environmental damage.

By employing qualitative techniques and psychometric measures to understand stakeholder and visitor perspectives, this research produces multi-disciplinary and trans-disciplinary outputs. This comprehensive approach enhances our understanding of the complex interplay between tourism and environmental conservation, offering insights that are crucial for informed decision-making in tourism management and policy.

6.2 Revealing Novel Insights: Biodiversity Dynamics in Tourism and Conservation Management

The overarching aim of the thesis was to investigate the intersection of tourism and conservation from a pragmatic stance to understand existing conflicts and synergies. Recognising the role of nature in tourism was a fundamental tenet of my research while seeking to understand drivers of positive and negative impacts of tourism management on biodiversity and the environment. I found a preference among students for floral diversity of grasslands – this preference was not influenced by an individual's environmental attitude. This approach should be extended to a broader population study. Key features of this preference were floral diversity, species richness and colour variety. Notably, one's environmental attitude (or how 'biocentric' an individual is; as measured by the adapted Ecological Concern Scale) significantly influenced diversity perception. Biocentric individuals believe that all living things are equally important and demonstrated a significantly greater ability to discern diversity accurately (Chapter 5). This is an important

finding as preference and/or perception studies often treat participants (tourists) as a homogenous group. Employing psychometric measures enriches our comprehension of perception dynamics as demonstrated in Chapter 5. Psychometric measures or scales are tools for quantifying or identifying specified behaviours, intention, knowledge, abilities, attitudes, personality traits, values or attributes to describe participants (Raykov and Marcoulides, 2011). While not all tourists accurately discern biodiversity in nature-based destinations a preference for it remains fundamental, offering clear benefits from biodiversity to tourism.

My results reveal that the management practices employed by the tourism operator at Derrynane House are not only increasing overall floral diversity by over 20% but are also maintaining the conservation status of the protected habitat (Chapter 4). This signifies the pivotal role that tourism operators have in habitat preservation in some contexts, countering the prevalent 'war-on-tourism' narrative. The term 'war-on-tourism' refers to the perceived conflict between tourism and conservation objectives, wherein both compete for planning and management resources. Conservationists often view the presence of tourists as harmful or damaging to the environment (Higgins-Desbiolles, 2020b). Identifying exemplary cases like this, where tourism and conservation synergise, constitutes a significant finding. These results underscore the ecological benefits of tourism if managed appropriately.

Further inquiry is needed to quantify biodiversity benefits in terms of perceived experiences of visitors to ensure that this preference is understood from a tourism value perspective. From a conservation standpoint, my findings highlight that habitat identity and the metrics used to classify it have demonstratable impacts on the conservation outcomes (Chapter 4). Conservation classifications need to be robust and well-designed so that tourism operators, who are not conservation experts, can easily implement effective management practices. Therefore, clear governance and communication processes are required which is echoed in results from the thematic analysis in chapter 3. The results of the thematic analysis (Chapter 3) show concern related to shifting environmental baselines and the need for precise definitions in nature-based tourism and eco-tourism. This distinction is crucial, given the emergent nature-based tourism market with its mass tourism appeal and its consequential environmental effects. Moreover, my research sheds light on the tourism-related threats faced by over half of conservation areas (SACs and SPAs) in Europe, offering insights into impact drivers and severity. Over 75% of visitors have no impact on the receiving environment but factors such as demographics and site type significantly influence impact

occurrence, with activity dynamics (such as number and intensity) significantly contributing to impact severity (Chapter 2). Clifftop sites had higher rates of observed impacts which is probably due to the topography and gradient of the sites; steep embankments and irregular ground at these sites leave them susceptible to soil slippage when walkers use trails at these sites. Conversely, clifftop sites were seen to have lower impact severity than built infrastructure sites, which may be due to the limited range of activities which are typically supported at these sites. Families and large mixed adult groups had significantly lower rates of observed impacts than adult couple groups. This is thought to be due to the controlled nature and short ranging patterns of large escorted groups; however, further study is needed in this regard. This nuanced understanding facilitates informed decision-making in tourism planning, dispelling assumptions of inherent adverse tourism impacts.

6.3 Advancing Sustainable Tourism: Spotlighting Ecological Victories for Transformative Change

My research has underscored the critical role of sustainable tourism in achieving ecological victories and driving transformative change. While traditional conservation approaches often view visitor numbers as a proxy for environmental impact (Monz et al., 2013), my research provides a more nuanced understanding. 75% of visitors had no identifiable negative effects on the environment (Chapter 2). I also discovered ecological benefits from tourism, particularly in contexts where management practices preserve habitat diversity and conservation status (Chapter 4). While research has more often focused on tropical systems to date (Adhikari et al., 2021, Parker et al., 2022), my findings highlight benefits in less charismatic ecosystems. Despite these positive findings, 49% of protected sites in Europe (SACs and SPAs) have threats and pressures related to tourism (Torsney and Buckley, 2023). Managed sites, however, tend to have lower impact rates (Chapter 2). Nevertheless, conflicts between tourism and conservation goals persist (Buckley, 2012, Thapa et al., 2022, Tolvanen et al., 2020). Addressing these conflicts requires understanding impact drivers and promoting best practices for win-win scenarios.

I found that not all tourists have equal environmental impacts. Visitor demographics have a significant influence on environmental impacts (Chapter 2). Biocentric individuals were better able to recognise grassland diversity (Chapter 5), aligning with Tolvanen et al. (2020). Therefore, nuanced approaches to management of eco-tourism sites; considering demographics, tourism typologies, and ideological factors are essential.

Variability in visitor interactions due to demographics or environmental attitude could also be important from a marketing perspective. Marketing campaigns can promote positive environmental behaviours (Zhang et al., 2020, Font and McCabe, 2017, Liburd and Becken, 2017). Further research should explore strategies for targeting specific demographic groups and understand how environmental attitudes shape visitor typologies and or motives – the learnings from such research could be used to enhance conservation outcomes. Additionally, investing in the natural assets that underpin tourism is crucial (Chapter 3). Biodiversity preferences significantly enhance visitor experiences, suggesting that biodiversity conservation can bolster tourism sustainability (Sørensen and Bærenholdt, 2020, Rodríguez et al., 2020). By highlighting ecological victories and advocating transformative change in sustainable tourism, my research aims to foster a harmonious relationship between tourism and conservation, promoting long-term sustainability. Strategic focus should be placed on cultural identity and values also play a significant role in shaping perceptions of biodiversity and eco-tourism. Although the student sample includes a mix of nationalities, the predominance of Irish participants and cultural context might influence the findings. Cultural and spiritual beliefs can affect definitions and perceptions of eco-tourism, which could be a limitation despite the broad definitions used in this study. Additionally, the social science aspect of the research is subject to limitations inherent in survey and interview methodologies. The complexity of individuals' perceptions and the potential influence of question phrasing and context can impact the results. Mixed-methods approaches, integrating both quantitative and qualitative data, could offer a more nuanced understanding of biodiversity perceptions and the role of cultural and social values.

6.4 Defining Eco-Tourism: Balancing Nature Conservation and Tourism Governance

It is evident that much tourism relies heavily on natural assets, with biodiversity often serving as a key selling point (Chapter 4). The demand for engagement with nature is increasing (Thapa et al., 2022), and the COVID-19 pandemic has heightened recognition of the value of nature recreation, prompting a shift towards sustainable tourism (Jones et al., 2021, Spenceley et al., 2021). Defining eco-tourism is crucial to avoid ‘greenwashing’ and for aligning tourism practices with environmental conservation goals (Wondirad, 2019, Walsh and George, 2019, Abeyratne and Arachchi, 2021, Smith and Font, 2014). Without a robust definition, a clear policy structure for management or enforcement of eco-tourism cannot be designed or implemented; moreover, without a clear policy definition it is difficult to align resources for adequate resourcing and funding mechanisms (Wondirad, 2019, Walsh and George, 2019, Abeyratne and Arachchi, 2021, Smith and Font, 2014). My analysis

underscores the significance of this definition in preventing the 'greenwashing' of nature-based tourism lacking environmental protection measures. Environmental image and the use of European Tourism Indicator System (ETIS) are key for destination competitiveness (Cronjé and du Plessis, 2020, Font et al., 2023). Without structured governance, nature-based tourism can have detrimental impacts on the environment and the long-term sustainability of the industry.

Eco-tourism is often recognised as niche tourism, which lacks scalability (Picard, 2015). However, the Wild Atlantic Way is a successful nature-based tourism campaign in Ireland that has scale but lacks sustainable management practices (Fáilte Ireland, 2015). I propose that if managed sustainably- with appropriate and extensive control measures and licencing systems put in place - the Wild Atlantic Way could become a large-scale eco-tourism brand. Careful consideration is needed to identify the appropriate management practices needed to facilitate regional scale sustainable management – which can be informed by the factors identified by Chapter 2, as discussed above. Mismanaged tourism can have detrimental impacts, particularly on protected sites (León-Gómez et al., 2021, Ren et al., 2019, Liu et al., 2018, Monz et al., 2013, Zhong et al., 2011). Therefore, prioritising nature in tourism is essential not only for economic gain but also for environmental sustainability.

Barriers like insufficient funding, awareness, and governance hinder the implementation of environmental management processes such as habitat management (McLoughlin et al., 2023, Dodds and Butler, 2009). Gasparini and Mariotti (2023) note that environmental indicators (ETIS) are often too narrow for practical use. The themes identified emphasised a tension between the recognition of biodiversity value and fear of the unknown with regard to controlling or managing nature-based tourism (Chapter 3). Font et al. (2023) suggest tourism lacks 'absorptive capacity' for environmental understanding; the ability of a sector to identify, assimilate, transform, and use external knowledge, research and practice. This is underscored by my subthemes: the 'need for structured communication and management' and the 'need for understanding and prioritising nature'. my research (Chapters 2 & 4) identified drivers of impacts which can be used to inform planning and decision-making.

My consolidated definition of eco-tourism offers a cohesive overview of tourism and environmental perspectives, informed by preceding definitions. Its key benefit is including nature-based tourism in the definition of eco-tourism prevents conflation between the two. My definition can support policy frameworks for sustainable tourism:

Any tourism activity or product which interacts with or capitalises on natural assets (nature-based tourism) that has integral long-term benefits to the environment such as: positive conservation outcomes, engaging environmental experiences (including education) and/or raised environmental awareness that facilitates positive environmental stewardship, while also ensuring tourism is sustainably managed for the environment, communities and the economy.

The study demonstrated the need for structured communication to facilitate governance and support environmental indicators for clear governance (Chapter 3). A cohesive policy framework with stringent guidelines is necessary to prioritise nature in tourism. Particularly because without legal incentive, environmental measures may not be readily implemented (León-Gómez et al., 2021, Buckley, 2012, McKercher, 1993).

6.5 Future Research Directions in Sustainable Tourism: Integrating Environmental Conservation, Community Engagement, and Psychometric Analysis

Integrated approaches for sustainable tourism management, which combine environmental conservation goals with tourism practices, represent a critical area for future research. Evaluating collaborative governance frameworks involving government agencies, local communities, and tourism operators can help scholars assess the effectiveness of these models in promoting sustainable tourism development and conservation initiatives. Chapter 3 demonstrated that '*government disregard community and the social capital in communities'* [Environmental_D]. The results of this study indicated that community engagement is essential for successful tourism; as without community buy-in there is potential for social conflicts to challenge long term sustainability while also missing the opportunity to garner local knowledge to incorporate into an engaged/integrated tourism product (Chapter 3). This highlights the need for meaningful policy structures to include communities in tourism planning (Han et al., 2023, Higgins-Desbiolles, 2020a, Wight, 1995). However, my research (Chapter 2) and Hanrahan (2010) have shown that communities lack homogeneity with respect to their interactions with the environment and behaviours, presenting a need for nuanced thinking in relation to tourism planning. There are also issues related to the definitions of "community" (Hanrahan, 2010). Furthermore, communities often benefit from tourism indirectly, as suggested by the bottom-up spillover theory (Han et al., 2023). Leveraging community participation in line with social exchange theory can create a framework that ensures mutual benefits for both the community and the tourism sector (Han et al., 2023). Hanrahan et al. (2017) found that despite community support for the Wild Atlantic Way, there was a sense of disconnection from the initiative.

This disconnect represents a missed opportunity to harness the known benefits of community engagement, such as environmental stewardship (Shea, 2020). Transdisciplinary research is needed to define "community" in sustainable tourism contexts and to identify successful community-based tourism feedback mechanisms that foster environmental stewardship. Previous research shows that engagement with nature promotes environmental stewardship (Darcy et al., 2022, Ferreira et al., 2020, Massingham et al., 2019, Shea, 2020), suggesting this should be incorporated into sustainable tourism and community engagement research.

Exploring the influence of psychometric measures, such as the adapted Ecological Concern Scale, on individuals' perceptions of biodiversity and environmental behaviours within tourism contexts presents a promising avenue for future inquiry. I proposed that the adapted Ecological Concern Scale be used in research which is primarily focused on the differentiation of biocentric, altruistic and egocentric individuals; the adapted method was demonstrated to have a higher level of discernment between the categories due to forced prioritisation. When using the traditional method, participants have freedom to rate each item independently from 7 to 1 meaning answers can be conflated in terms of their importance. However, the study required participants to rank all items from 7 to 1 forcing introspection with regard to value and placing a priority order on the items. Miah et al. (2019) asserts that the use of multidimensional psychological research should be used to inform conservation management research. Understanding how psychometric measures shape tourists' perceptions and behaviours can inform more effective tourism management strategies aimed at promoting sustainability. Studies by Breitschopf and Bråthen (2023) and Hooykaas et al. (2019) have shown differences in perception abilities between environmental professionals and laypeople. I propose that these differences may be broader and represented by psychometric measures such as environmental attitudes; it is hypothesised that environmental professionals are more likely to be biocentric individuals. Accounting for psychometric measures in future studies could provide a more nuanced understanding of observed variabilities. Additionally, exploring the role of visitor demographics in shaping environmental impacts and behaviours is crucial. Conservation research needs to move beyond using visitor numbers as a proxy for damage and understand the diversity of interactions (Jurkus et al., 2022), which is particularly important due to the increasing demand for engagement with nature (Thapa et al., 2022). This could be achieved through mixed-method studies combining visitor observations (as in Chapter 2) and on-site surveys to gather data on cultural background, income bracket, travel motivations, etc. Identifying which activities cause specific impacts would also be beneficial for managing those

activities. This approach is being implemented by Fáilte Ireland in their National Tourism Monitoring Programme (2021-2025). The information gained from such studies could inform marketing strategies designed to promote sustainable behaviours among specific demographic groups, offering valuable insights for conservation-oriented tourism initiatives (Della Lucia et al., 2021, Zhang et al., 2020, King et al., 2012).

Examining the implications of habitat identity and classification metrics on conservation effectiveness is essential for enhancing biodiversity preservation. This is important for tourism destinations as habitat classification influences appropriate management practices. Research has shown that tourism often lacks a strong environmental knowledge base (Font et al., 2023). My research further exemplifies this need to deepen understanding of environmental tourism interactions (Chapter 3). Discrepancies in understanding or communication breakdowns within a sector make cross-sectoral collaboration more complex. Research could assess the compatibility between existing habitat classification frameworks and tourism management practices, identifying areas where alignment is needed to optimise conservation outcomes. I advocate for research that consolidates knowledge from existing tourism operations with progressive environmental management strategies to create a knowledge base for win-win scenarios, informing guidelines and policy frameworks at regional or national levels.

6.6 Policy Implications and Broader Industry Insights

With regard to the forthcoming Green Claims Directive, it is essential to establish clear definitions and understand existing governance structures within sustainable tourism, eco-tourism, and nature-based tourism. This thesis provides a clear roadmap for initiating this journey. The themes and sub-themes outlined in Chapter 3 offer robust scaffolding for policy formation, garnering invaluable insights from both tourism and environmental perspectives.

An important aspect of tourism policy in Ireland is that all strategic plans and programmes from the Department of Tourism and Fáilte Ireland are legally distinct from the National Planning Framework. Consequently, these policies are not legally required for future development consent processes. This separation results in a lack of regulation and enforcement of nature-positive policies by the Department and Fáilte Ireland. The results from chapter 2 identify the drivers of impact occurrence independent of site-specific factors. Site type is present in both the impact occurrence and impact severity models; therefore, it is imperative for tourism operators to understand the sensitivity of their site type and how to

manage appropriately for the constraints therein. A national guidance document on site type and known sensitivities is needed – however, to achieve this further research is needed on a broader range of site types. Moreover, it is recognised the Fáilte Ireland is a marketing agency that drives visitor numbers to specific sites – however, the Fáilte Ireland (2015) and Failte Ireland (2018) reports identified Malin Head to have significant impacts from tourism on the qualifying interests of the Special Area of Conservation – yet in 2021 Fáilte Ireland also ran an online marketing campaign to attract visitors to this site with no additional management action or control measures put in place. There needs to be enforceable consequences aligned with action-based monitoring programmes to ensure such obvious and recorded/reported impacts are not ignored.

Currently there is no enforcement outside of protected sites and national parks. Most of our protected sites are privately owned lands with imposed management requirements with limited if no funding or support. The responsibility of any such enforcement lies with the National Parks and Wildlife Service (NPWS) which faces extensive governance issues, as detailed in the 'Review of the NPWS – 2021'. The broadening of the NPWS's remit to include nature protection, education and awareness would be beneficial however, given the issues with the organisation as it stands, I am not convinced they would have the capabilities even if adequate funding was provided due to the existing and blatant governance issues. Similarly, although the Environmental Protection Agency (EPA) has a strong track record in scientific monitoring and licence enforcement, it lacks the ecological credentials and in-house tourism knowledge needed for effective governance in this sector. The definition provided in chapter 3 serves as a starting point for creating a national policy on eco-tourism, facilitating the development of appropriate licensing and enforcement processes. This definition is fundamental to achieving the targets of the Green Claims Directive concerning tourism. Any such policies for positive or sustainable tourism practices require legislative enforcement – as it was demonstrated in chapter 3 that environmental action is regularly only implemented with legal incentive.

As demonstrated in chapter 4, understanding habitat identity requires complex considerations, particularly at the local level. Recognising community composition, structure, and function is crucial when defining habitats. Identifying the best conservation outcomes for a site should challenge static metrics or classification criteria that might adversely impact these outcomes. There is a need to audit and scrutinise the existing habitat identification criteria used by the NPWS. Furthermore, the resulting criteria should be made

readily available in a clear and concise manner. Currently, the criteria are contained within the Appendices to the Irish Wildlife Manuals and each grouping of habitats has a variable reporting style and accessibility of information. For example the IWM 128 has a very poorly defined set of criteria (Smith and Crowley, 2020). The NPWS should create a set of publicly available tools setting out the criteria for each Annex I habitat – along with a species identification guide which provides the tools for identifying all of the indicator species for each. This approach is especially relevant for semi-natural grassland habitats, where clear processes and repeatable criteria are needed. Creating these tools could provide a higher degree of data available to the NPWS as consultant ecologists would have access to the key body of knowledge. Furthermore, changes in governance from an ecological perspective, such as designating new protected sites or altering existing habitat identities, must consider the implications for existing land uses, including tourism, agriculture, and fisheries. Win-win scenarios should be prioritized to avoid unnecessary conflicts. A data-driven approach, focusing on best-in-class examples, should be championed. These concepts must be integrated fully into the policy context of tourism and be legally transferrable/connected to future tourism funding along with the national planning framework.

To achieve these goals within a tourism context, it is important to establish dedicated collaborative research centres. Currently, there is no Science Foundation of Ireland Centre for Sustainable and Eco-tourism, which could provide the necessary knowledge pipeline to address challenges associated with the Green Claims Directive. The details in this thesis outline key areas of focus that could be vital for such a centre. Such a centre could be tasked with developing and maintaining sustainable tourism and eco-tourism certification programs, requiring clear engagement with key stakeholders like the NPWS, EPA, and Fáilte Ireland. This collaborative approach would ensure the use of transdisciplinary methods to address forthcoming challenges in sustainable tourism governance.

6.7 Achievements and Contributions of Research

This research has significant ancillary applications, influencing various policy guidelines and industry practices. The insights gathered from this research, combined with my experience in Strategic Environmental Assessment (SEA), directly informed the EPA's "Good Practice Guidance on Strategic Environmental Assessment for the Tourism Sector". I co-authored this guidance document with David L'Estrange on behalf of the EPA (Supplemental Appendix II). This document integrates key findings from my study to enhance environmental assessment practices within the tourism sector. The document

provides a framework for assessing and mitigating the environmental impacts of tourism, emphasising the need for robust governance and stakeholder engagement.

As a member of the Chartered Institute of Ecology and Environmental Management (CIEEM) policy committee, I contributed to the development of the "Biodiversity Enhancement for New Developments in Ireland" briefing paper (Supplemental Appendix III). Concepts from my research, such as the importance of long-term monitoring and understanding of management efficacy, were integrated into this document. This policy paper aims to guide developers and policymakers in implementing biodiversity enhancement measures, ensuring that new developments contribute positively to ecological conservation.

Furthermore, the work undertaken with regard to the Wild Atlantic Way monitoring was developed and expanded to create a National Tourism Monitoring Programme, which is currently being undertaken by Fáilte Ireland. This dataset aims to provide long term data (5 years) at 19 nature-based tourism destinations. The aims of this are to confirm the results of the findings seen in Chapter 2 while garnering a deeper understanding of the interactions between specific activities and impacts. Additionally, the NTMP aims to look at impact dynamics as a feature of distance, as it is hypothesised that the majority of impacts are concentrated within the immediate vicinity of destination receiving points such as carparks.

I aim to strive for continued communication and collaboration with key stakeholders such as the Department of Tourism, Fáilte Ireland and the EPA, to ensure the research is incorporated into future decision-making processes. Focus will be placed on ensuring each chapter is published in journals with a high impact factor. A core concept within my work within this thesis, and in general beyond the scope of this work is continued collaboration and communications with interdisciplinarity. This is exemplified in the publication “Reconciling climate action with the need for biodiversity protection, restoration and rehabilitation”; which can be found in supplemental Appendix IV.

6.8 Conclusion

In conclusion, this PhD thesis significantly advances our understanding of the complex interplay between tourism management and environmental conservation. By moving beyond visitor numbers as a simplistic proxy for environmental impact, this research provides nuanced insights into the drivers of impact occurrence and severity. Key findings highlight the potential for tourism to contribute positively to biodiversity conservation when managed

effectively. The interdisciplinary approach adopted in this research integrates qualitative and quantitative methods, offering a comprehensive perspective on stakeholder and visitor perceptions. This work redefines eco-tourism by integrating tourism and environmental management perspectives, setting a clear distinction from nature-based tourism. Policy implications are substantial. The research directly informed the EPA's "Good Practice Guidance on Strategic Environmental Assessment for the Tourism Sector" and contributed to the CIEEM's "Biodiversity Enhancement for New Developments in Ireland" briefing paper. These contributions underscore the importance of robust governance and stakeholder engagement in achieving sustainable tourism outcomes. Future research should build on these findings by exploring collaborative governance frameworks, incorporating psychometric measures to better understand tourist behaviours, and evaluating the long-term impacts of biodiversity enhancement measures. By fostering interdisciplinary and trans-disciplinary research, we can better navigate the complexities of tourism and conservation, promoting sustainable practices that benefit both the environment and local communities. This thesis highlights the necessity for informed policies and targeted education to achieve a sustainable future where biodiversity and tourism can coexist and thrive harmoniously.

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Technical Appendices to Thesis
Reconceptualising Eco-tourism: Aligning Tourism and Conservation Goals using Biodiversity Perception, Governance, and Management

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Visitor demographics, site-type and activities determine the occurrence and severity of environmental impacts at nature-based tourist destinations.

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Data availability: The data and code that support the findings of this study are openly available at Release Predictors of impact occurrence and severity of impacts · TorsneyStat/Predictors-of-impact-occurrence-and-severity-of-impacts (github.com)

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Chapter 2 Appendix I Pressure codes and descriptions related to tourism and recreation taken from the EEC Natura 2000 network database

Pressure Code	Pressure
G	Human intrusions and disturbances
G01	Outdoor sports and leisure activities, recreational activities
G01.01	Nautical sports
G01.01.01	Motorized nautical sports
G01.01.02	Non-motorized nautical sports
G01.02	Walking, horseriding and non-motorised vehicles
G01.03	Motorised vehicles
G01.03.01	Regular motorized driving
G01.03.02	Off-road motorized driving
G01.04	Mountaineering, rock climbing, speleology
G01.04.01	Mountaineering & rock climbing
G01.04.02	Speleology
G01.04.03	Recreational cave visits
G01.05	Gliding, delta plane, paragliding, ballooning
G01.06	Skiing, off-piste
G01.07	Scuba diving, snorkelling
G01.08	Other outdoor sports and leisure activities
G02	Sport and leisure structures
G02.01	Golf course
G02.02	Skiing complex
G02.03	Stadium
G02.04	Circuit, track
G02.05	Hippodrome
G02.06	Attraction park
G02.07	Sports pitch
G02.08	Camping and caravans
G02.09	Wildlife watching
G02.10	Other sport / leisure complexes
G03	Interpretative centres
G05	Other human intrusions and disturbances
G05.01	Trampling, overuse,

G05.02	Shallow surface abrasion/ mechanical damage to seabed surface
G05.03	Penetration/ disturbance below surface of the seabed
G05.04	Vandalism
G05.05	Intensive maintenance of public parcs /cleaning of beaches
G05.06	Tree surgery, felling for public safety, removal of roadside trees
G05.07	Missing or wrongly directed conservation measures
G05.08	Closures of caves or galleries
G05.09	Fences, fencing
G05.10	Overflying with aircrafts (agricultural)
G05.11	Death or injury by collision
D01.01	Paths, tracks, cycling tracks
D03.01.02	Piers / tourist harbours or recreational piers
D04	Airports, flightpaths
D04.01	Airport
D04.02	Aerodrome, heliport
D04.03	Flight paths
D05	Improved access to site
F02.03	Leisure fishing
F02.03.01	Bait digging / collection
F02.03.02	Pole fishing
F02.03.03	Spear-fishing
F03.01	Hunting
F03.01.01	Damage caused by game (excess population density)

Chapter 2 Appendix II Activity and impact code index used for recording visitor behaviours on site

Activities		
Category 1 Low Level		
Walking, running or cycling on paths, marked trails or hard surfaces		LA 1
Walking, running, cycling or playing in mown grass, managed grassland or level sand		LA 2
Sitting on benches, walls, mown grass, sand		LA 3
Swimming, sailing, surfing, kayaking in water		LA 4
Resting, reading, looking, picnicking, sightseeing, painting, photographing		LA 5
Vehicular movement on roads and parking areas		LA 6
Watching nature in hedges, woods, streams, pools and intertidal areas		LA 7
Category 2 Medium Level		
Powered movement through water		MA 1
Any movement leaving an existing trail or marked path		MA 2
Any movement leaving a trail through leafy vegetation		MA 3
Any movement leaving a trail through woody vegetation		MA 4
Climbing on walls, loose stones, sand, soil etc.		MA 5
Fishing		MA 6
Category 3 High Level		
Walking through wet/muddy soil		HA 1
Scrambling on steep or loose slopes		HA 2
Off road vehicular movement		HA 3
Disturbance of wildlife		HA 4
Deliberate building or moving or knocking site materials - parts of monuments, walls, stones, sand etc.		HA 5
Picking herbaceous vegetation		HA 6

Category 1 Low Impact		
No identifiable effect		LIE 1
Desire lines or trails visible on grass and leafy vegetation		LIE 2
Temporary disturbance (including chasing and feeding) of insects, fish, amphibian, reptiles, insects, birds and mammals		LIE 3
Temporary change of character - due to the appearance or nature of activities (noise, crowds, etc.)		LIE 4
General/light littering		LIE 5
Category 2 Medium Impact		
Desire lines or tracks visible outside of existing trail or marked path		MIE 1
Trampling of herbaceous vegetation		MIE 2
Damage to woody vegetation		MIE 3
Incidentally moving or knocking site materials - parts of monuments, walls, stones, sand, rooted vegetation, flora, fauna etc.		MIE 4
Addition/alteration of site features, transient emissions, noise		MIE 5
Transient disturbance, emissions, noise		MIE 6
Disturbance of wildlife		MIE 7
Category 3 Severe Impact		
Direct interference with site material - parts of monuments, walls, stones, sand, rooted vegetation, flora, fauna etc.		SIE 1
Removal of material - parts of monuments, walls, stones, sand, rooted vegetation, flora, fauna etc.		SIE 2
Vandalism or graffiti		SIE 3
Destruction of structures, vegetation or fauna		SIE 4
Heavy littering or dumping quantities of waste		SIE 5
Burning materials or lighting a fire		SIE 6
Injuring, killing or taking wildlife		SIE 7

Chapter 2 Appendix III - Post hoc testing

In R using the "*emmean*" package, we estimated the marginal means of each site type in the impact occurrence model in a pairwise fashion; taking account of multiple comparisons using the Tukey method. Estimated marginal means (EMMs) are defined as equally weighted means of these predictions at specified margins.

Impact Occurrence Model – Pairwise level testing

Chapter 2 Appendix III Table 1 Results of the estimation of means post hoc analysis looking at the pairwise comparisons of site types within the Impact Occurrence model (* indicates significant differences).

Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Built Infrastructure - Beach Site	-0.487	0.517	-0.941	0.7826	-1.81	0.8413
Built Infrastructure - Cliff Site*	**-1.417**	**0.518**	**-2.736**	**0.0316**	**-2.75**	**-1.0856**
Built Infrastructure - Highly Managed	-0.854	0.692	-1.234	0.6051	-2.63	0.9240
Beach Site - Cliff Site	-0.930	0.409	-2.274	0.1040	-1.98	0.1205
Beach Site - Highly Managed	-0.368	0.615	-0.598	0.9327	-1.95	1.2125
Cliff Site - Highly Managed	0.563	0.615	0.916	0.7965	-1.02	2.1414

The only site types which was significantly different in terms of their effects within the Impact Occurrence model were Built Infrastructure and cliff sites (built infrastructure was the reference value); see Chapter 2 Appendix III Table 1 and Chapter 2 Appendix III Figure 1. This is anticipated to be largely due to the absence of activities at cliff sites given the topography – most visitor interactions at these sites are primarily walking and other passive activities such as photography or bird watching.

The interrelationships between each of the groups within the Impact Occurrence model showed a number of significant differences (Chapter 2 Appendix III Table 2); individual adults were seen to have higher impact occurrence rates than couples, elderly couples and families. Indicating lone travellers should be a focal group in terms of impact occurrence.

The interaction between group type and site type was not present within the final model; so, it was not necessary to perform a post hoc test on this interaction.

Chapter 2 Appendix III Table 2 Results of the estimation of means post hoc analysis looking at the pairwise comparisons of group types within the Impact Occurrence model (* indicates significant differences).

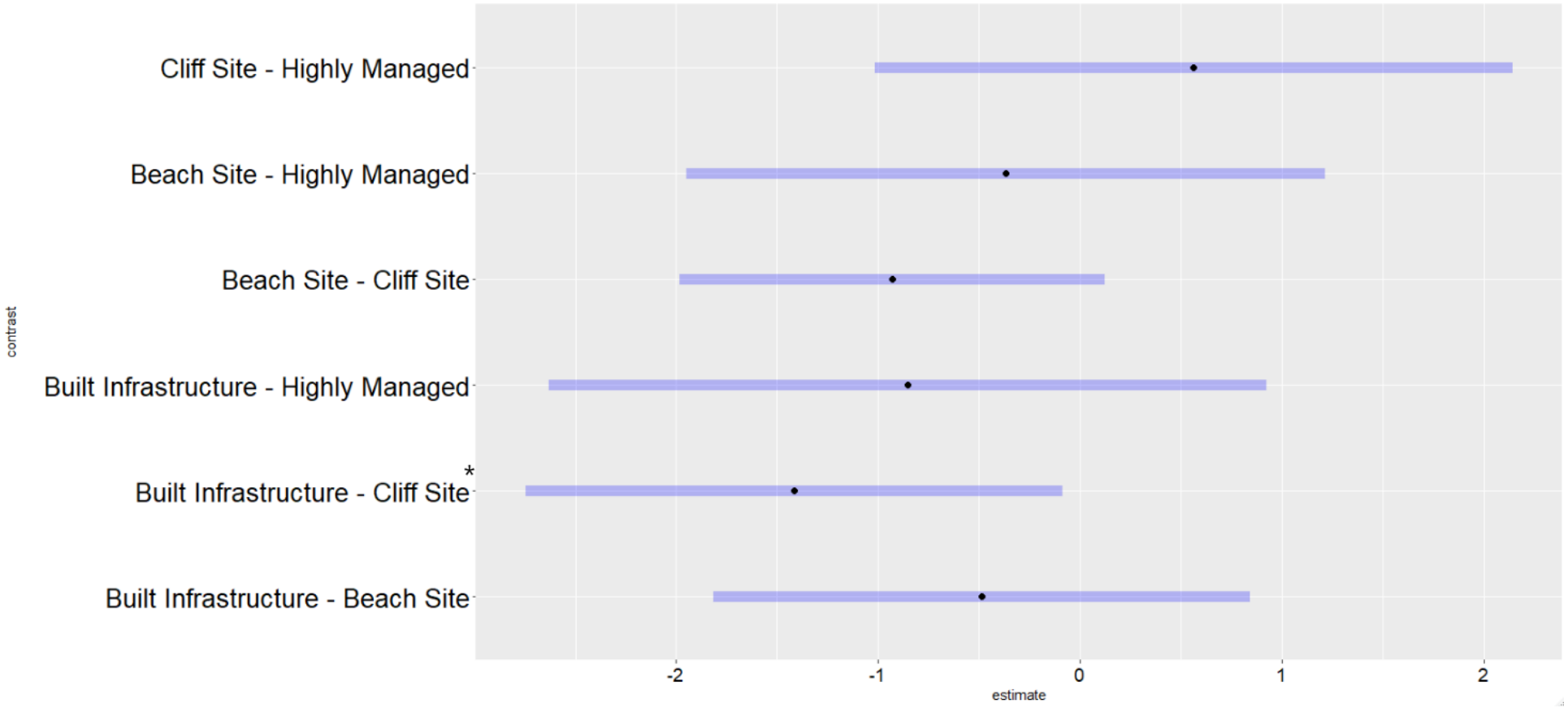
Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Couple – Elderly Couple	0.300488	0.217839	1.379405	0.984328	-0.43006	1.031037
Couple – Elderly Group	0.284323	0.434429	0.654474	0.999995	-1.17259	1.741232
Couple - Family	0.332802	0.160597	2.072281	0.720685	-0.20578	0.871384
Couple – Family with Elderly	0.052729	0.606308	0.086968	1	-1.98059	2.086054
Couple – Individual Adult*	**-0.54373**	**0.158008**	**-3.44118**	**0.037778**	**-1.07363**	**-0.01384**
Couple – Individual Elderly	-0.07919	0.329135	-0.2406	1	-1.18298	1.024604
Couple – Large Adult Group	0.110556	0.352183	0.313915	1	-1.07053	1.291644
Couple – Mixed Large Group	0.042286	0.322042	0.131307	1	-1.03772	1.122291
Couple – Mixed Over 18 Large Group	1.863083	0.810579	2.29846	0.556049	-0.85529	4.581456
Couple – Mixed Over 18 Small Group	-0.06322	0.271527	-0.23284	1	-0.97382	0.847376
Couple – Mixed Small Group	-0.04178	0.359584	-0.11619	1	-1.24769	1.164127
Couple – Small Adult Group	-0.28045	0.162677	-1.72395	0.907873	-0.826	0.26511
Couple - Under18	-0.91152	0.396313	-2.29999	0.554896	-2.2406	0.417565
Elderly Couple – Elderly Group	-0.01617	0.471886	-0.03426	1	-1.59869	1.566359
Elderly Couple - Family	0.032314	0.247688	0.130464	1	-0.79833	0.862964
Elderly Couple – Family with Elderly	-0.24776	0.634443	-0.39051	1	-2.37544	1.879921
Elderly Couple – Individual Adult*	**-0.84422**	**0.245147**	**-3.44374**	**0.037463**	**-1.66635**	**-0.02209**
Elderly Couple – Individual Elderly	-0.37968	0.377735	-1.00514	0.999301	-1.64646	0.887101

Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Elderly Couple – Large Adult Group	-0.18993	0.39928	-0.47569	1	-1.52896	1.1491
Elderly Couple – Mixed Large Group	-0.2582	0.37312	-0.69201	0.99999	-1.5095	0.993101
Elderly Couple – Mixed Over 18 Large Group	1.562595	0.831358	1.87957	0.837954	-1.22546	4.350652
Elderly Couple – Mixed Over 18 Small Group	-0.36371	0.328493	-1.10721	0.998082	-1.46535	0.73793
Elderly Couple – Mixed Small Group	-0.34227	0.406558	-0.84187	0.999901	-1.70571	1.021171
Elderly Couple – Small Adult Group	-0.58094	0.248288	-2.33976	0.525009	-1.4136	0.251729
Elderly Couple – Under 18	-1.212	0.438299	-2.76525	0.242256	-2.68189	0.257882
Elderly Group – Family	0.04848	0.44819	0.108168	1	-1.45458	1.551539
Elderly Group – Family With Elderly	-0.23159	0.736969	-0.31425	1	-2.70311	2.239919
Elderly Group – Individual Adult	-0.82806	0.450614	-1.83762	0.859157	-2.33924	0.68313
Elderly Group – Individual Elderly	-0.36351	0.534421	-0.6802	0.999992	-2.15576	1.428731
Elderly Group – Large Adult Group	-0.17377	0.531749	-0.32678	1	-1.95705	1.609515
Elderly Group – Mixed Large Group	-0.24204	0.517336	-0.46785	1	-1.97698	1.492911
Elderly Group – Mixed Over 18 Large Group	1.578761	0.897199	1.759655	0.893959	-1.4301	4.587623
Elderly Group – Mixed Over 18 Small Group	-0.34754	0.498925	-0.69659	0.999989	-2.02075	1.325658
Elderly Group – Mixed Small Group	-0.3261	0.550386	-0.5925	0.999998	-2.17189	1.519682
Elderly Group – Small Adult Group	-0.56477	0.447701	-1.26149	0.993082	-2.06619	0.936647
Elderly Group – Under 18	-1.19584	0.574684	-2.08087	0.71482	-3.12311	0.731429
Family – Family with Elderly	-0.28007	0.613972	-0.45617	1	-2.3391	1.778956
Family – Individual Adult* **	**-0.87654**	**0.192964**	**-4.54249**	**0.000473**	**-1.52366**	**-0.22941**

Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Family – Individual Elderly	-0.41199	0.346507	-1.18899	0.996088	-1.57405	0.750061
Family – Large Adult Group	-0.22225	0.359814	-0.61767	0.999997	-1.42893	0.984433
Family – Mixed Large Group	-0.29052	0.327936	-0.88589	0.999824	-1.39029	0.809255
Family – Mixed Over18 Large Group	1.530281	0.810583	1.887878	0.833555	-1.1881	4.248665
Family – Mixed Over 18 Small Group	-0.39602	0.294176	-1.34622	0.987391	-1.38258	0.590529
Family – Mixed Small Group	-0.37458	0.373819	-1.00204	0.999323	-1.62823	0.879064
Family – Small Adult Group	-0.61325	0.196677	-3.11806	0.100455	-1.27283	0.046329
Family – Under 18	-1.24432	0.404868	-3.07339	0.113567	-2.60209	0.113454
Family With Elderly – Individual Adult	-0.59646	0.614327	-0.97092	0.999518	-2.65668	1.463753
Family With Elderly – Individual Elderly	-0.13192	0.676471	-0.19501	1	-2.40054	2.136704
Family With Elderly – Large Adult Group	0.057826	0.688244	0.08402	1	-2.25028	2.365933
Family With Elderly – Mixed Large Group	-0.01044	0.671835	-0.01554	1	-2.26352	2.242635
Family With Elderly – Mixed Over 18 Large Group	1.810354	0.999489	1.81128	0.871591	-1.54155	5.162257
Family With Elderly – Mixed Over 18 Small Group	-0.11595	0.654011	-0.17729	1	-2.30925	2.077353
Family With Elderly – Mixed Small Group	-0.09451	0.694045	-0.13617	1	-2.42207	2.233051
Family With Elderly – Small Adult Group	-0.33318	0.617229	-0.53979	0.999999	-2.40313	1.736774
Family With Elderly – Under 18	-0.96425	0.712354	-1.35361	0.986754	-3.35321	1.424717
Individual Adult – Individual Elderly	0.464545	0.341641	1.359745	0.986206	-0.68119	1.610278
Individual Adult – Large Adult Group	0.654291	0.376743	1.736702	0.90305	-0.60916	1.917743
Individual Adult – Mixed Large Group	0.586021	0.344705	1.700067	0.916476	-0.56999	1.742029

Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Individual Adult – Mixed Over 18 Large Group	2.406818	0.822643	2.925713	0.166531	-0.35201	5.165649
Individual Adult – Mixed Over 18 Small Group	0.480513	0.294087	1.633915	0.937431	-0.50574	1.466768
Individual Adult – Mixed Small Group	0.501954	0.377267	1.330499	0.988663	-0.76326	1.767163
Individual Adult – Small Adult Group	0.263287	0.199567	1.319293	0.989505	-0.40598	0.932558
Individual Adult - Under18	-0.36778	0.406589	-0.90455	0.999778	-1.73133	0.995762
Individual Elderly – Large Adult Group	0.189746	0.474368	0.399997	1	-1.4011	1.780595
Individual Elderly – Mixed Large Group	0.121476	0.448813	0.270661	1	-1.38367	1.626622
Individual Elderly – Mixed Over 18 Large Group	1.942273	0.870395	2.231486	0.606269	-0.9767	4.861245
Individual Elderly – Mixed Over 18 Small Group	0.015968	0.41185	0.038772	1	-1.36522	1.397156
Individual Elderly – Mixed Small Group	0.037409	0.475432	0.078684	1	-1.55701	1.631824
Individual Elderly – Small Adult Group	-0.20126	0.351105	-0.57321	0.999999	-1.37873	0.976214
Individual Elderly - Under18	-0.83233	0.498076	-1.67108	0.92617	-2.50268	0.838031
Large Adult Group – Mixed Large Group	-0.06827	0.413135	-0.16525	1	-1.45377	1.317229
Large Adult Group - MixedOver18LargeGroup	1.752528	0.824096	2.126605	0.682873	-1.01118	4.516232
Large Adult Group - MixedOver18SmallGroup	-0.17378	0.426029	-0.4079	1	-1.60252	1.254962
Large Adult Group – Mixed Small Group	-0.15234	0.47868	-0.31824	1	-1.75765	1.452973
Large Adult Group – Small Adult Group	-0.391	0.361402	-1.08191	0.998487	-1.60301	0.821002
Large Adult Group - Under18	-1.02207	0.506344	-2.01853	0.756318	-2.72016	0.676011
Mixed Large Group - MixedOver18LargeGroup	1.820797	0.824964	2.207122	0.624369	-0.94582	4.587412
Mixed Large Group - MixedOver18SmallGroup	-0.10551	0.402212	-0.26232	1	-1.45437	1.243358

Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Mixed Large Group – Mixed Small Group	-0.08407	0.45842	-0.18339	1	-1.62143	1.453297
Mixed Large Group – Small Adult Group	-0.32273	0.333891	-0.96659	0.999541	-1.44248	0.797007
Mixed Large Group - Under18	-0.9538	0.484467	-1.96877	0.787435	-2.57852	0.670916
Mixed Over 18 Large Group – Mixed Over 18 Small Group	-1.92631	0.84443	-2.28119	0.569035	-4.7582	0.905591
Mixed Over 18 Large Group – Mixed Small Group	-1.90486	0.870358	-2.1886	0.638029	-4.82371	1.013983
Mixed Over 18 Large Group – Small Adult Group	-2.14353	0.812771	-2.63731	0.316363	-4.86925	0.582191
Mixed Over 18 Large Group – Under 18	-2.7746	0.886531	-3.12973	0.097237	-5.74769	0.198486
Mixed Over 18 Small Group – Mixed Small Group	0.021441	0.436467	0.049123	1	-1.4423	1.485185
Mixed Over 18 Small Group – Small Adult Group	-0.21723	0.295893	-0.73414	0.999979	-1.20954	0.775087
Mixed Over 18 Small Group – Under 18	-0.84829	0.465665	-1.82168	0.866762	-2.40996	0.713368
Mixed Small Group – Small Adult Group	-0.23867	0.376445	-0.634	0.999996	-1.50112	1.023787
Mixed Small Group – Under 18	-0.86974	0.51843	-1.67763	0.92405	-2.60835	0.86888
Small Adult Group – Under 18	-0.63107	0.411299	-1.53433	0.961538	-2.01041	0.748269



Chapter 2 Appendix III Figure 1 Estimated marginal means (indicated by dots) and confidence intervals (blue bars) for the pairwise comparisons of the Site Type level within the Impact Occurrence model; negative interactions indicate that the 1st site type of the pair has less potential to result in impact occurrence than the other; whereas positive interactions demonstrate that the 2nd site type within the pair has higher impact occurrence potential.

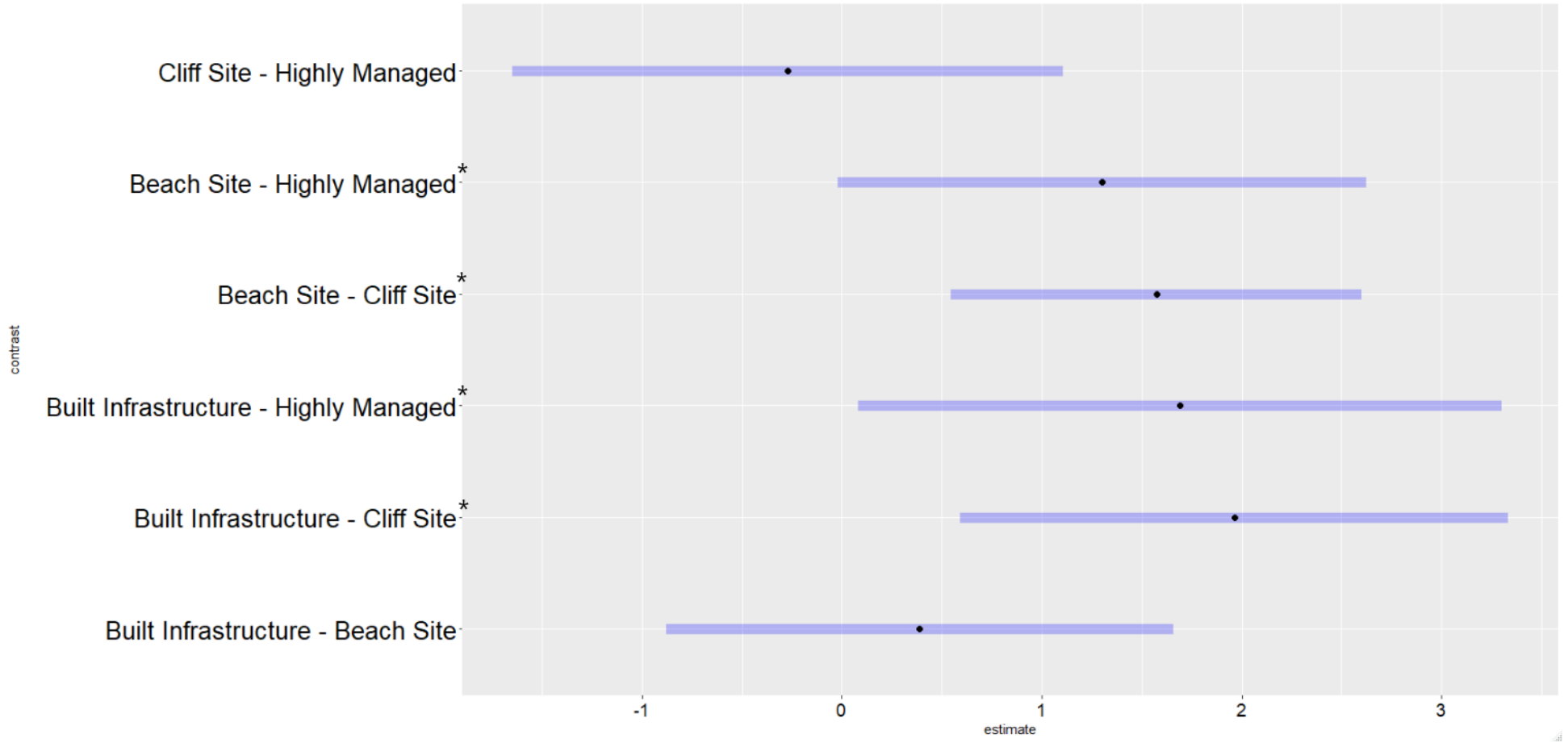
Impact Severity Model – Pairwise level testing

Impact severity varied with site type – there are significant differences between several of the contrasts (Chapter 2 Appendix III Table 3).

Cliff sites have higher impact severity rates than beach sites and built infrastructure sites. Although cliff sites have a lower impact occurrence rate – when impacts occur, they are more severe. This could be due to the exposed harsh conditions with variable topography causing damage due to trampling. Highly managed sites have a higher impact severity than built infrastructure sites and beach sites.

Chapter 2 Appendix III Table 3 Results of the estimation of means post hoc analysis looking at the pairwise comparisons of site types within the Impact Severity model (* indicates significant differences).

Contrast	Estimate	SE	z ratio	p value	Lower CI	Upper CI
Built Infrastructure - Beach Site	0.389	0.494	0.787	0.8603	-0.8803	1.66
Built Infrastructure - Cliff Site**	**1.963**	**0.534**	**3.675**	**0.0014**	**0.5905**	**3.33**
Built Infrastructure - Highly Managed*	**1.691**	**0.626**	**2.703**	**0.0346**	**0.0840**	**3.30**
Beach Site - Cliff Site***	**1.574**	**0.400**	**3.931**	**0.0005**	**0.553**	**2.60**
Beach Site - Highly Managed *	**1.302**	**0.514**	**2.534**	**0.0549**	**-0.0182**	**2.62**
Cliff Site - Highly Managed	-0.271	0.536	-0.506	0.9576	-1.6479	1.11



Chapter 2 Appendix III Figure 2 Estimated marginal means (indicated by dots) and confidence intervals (blue bars) for the pairwise comparisons of the Site Type level within the Impact Severity model; negative interactions indicate that the 1st site type of the pair has less potential to result in impact occurrence than the other; whereas positive interactions demonstrate that the 2nd site type within the pair has higher impact occurrence potential.

Chapter 2 Appendix IV Distance matrix and associated European sites for each of the discovery points along the Wild Atlantic Way

Chapter 2 Appendix IV Table 1 Distances between discovery points and the nearest European site; broken down according to SACs and SPAs

Discovery Point	SAC Distance	SPA Distance	Closest Site
Easky Pier	10.22	11.36	10.22
Bantry Harbour (Embarkation Point for 144)	7.36	21.23	7.36
Downpatrick Head	5.8	7.17	5.8
Whiddy Island	5.31	20.17	5.31
Bái Fhionn Trá	5.68	5.19	5.19
Doranás Point (Embarkation Point for 58)	3.1	3.1	3.1
Cuan na hAisláime	3.08	7.45	3.08
Inis Bigil	4.19	3.01	3.01
Pontoon Pier (Embarkation Point for 141)	4.37	2.84	2.84
Clahane	3.51	2.7	2.7
Inishbeg	2.63	4.69	2.63
Castletownbere Harbour (Embarkation Point for 141)	5.72	1.99	1.99
Seancheaibh an Spideal	1.94	3.6	1.94
Bere Island (west end pier)	7.17	1.93	1.93
Whiddy Island View	1.89	18.04	1.89
Magilligan Point View	1.88	11.98	1.88
An Cháibh Bheag (Embarkation Point for 69)	1.63	5.82	1.63
Calafort Ros an Mhál (Embarkation Point for 98,99,100)	1.63	5.46	1.63
Cáibh Bhaile na hAbhann	1.36	5.68	1.36
Altar	1.32	4.09	1.32
Aerfort Rácigiánach Chonamara (Embarkation Point for 98,99,100)	1.27	4.31	1.27
Aughris Head	6.12	1.13	1.13
Gour	4.44	1.08	1.08
Sky Road	0.74	2.59	0.74
Malaidh Ghleann Gheis	0.72	5.3	0.72
Ballyheigue Beach	0.7	0.71	0.7
Bere Island (east end pier)	6.49	0.68	0.68

Cuan an Daingin (Embarkation Point for 125)	0.67	2.16	0.67
Claggan	0.64	0.64	0.64
Coomanaspic	3.07	0.64	0.64
Kilrush Marina (Embarkation Point for 111)	0.57	0.57	0.57
An Fáil Máir	0.96	0.5	0.5
Cáide	0.42	11.52	0.42
Dunree Head	0.4	2.15	0.4
Inishowen Head	0.38	16.53	0.38
Island Roy View	0.35	2.89	0.35
Manorcunningham View	0.41	0.35	0.35
Geokaun Mountain	1.63	0.34	0.34
Cnoc Fola	0.33	2.75	0.33
Strandhill Beach	0.31	0.31	0.31
Glinsce	0.27	4.4	0.27
Inis Oárr (seaport)	0.27	7.53	0.27
Old Head	0.24	11.33	0.24
Croagh Patrick View	0.23	15.38	0.23
Bridges of Ross	0.22	2.11	0.22
Teach an Phiarsaigh	0.21	0.75	0.21
Lehinch Beach	0.19	6.32	0.19
Islands View	0.16	5.27	0.16
Derrigimlagh	0.15	0.59	0.15
Doolin Pier (Embarkation Point for 98,99,100)	0.15	1.33	0.15
Old Head of Kinsale	9.2	0.13	0.13
Doughmore Bay	0.12	0.13	0.12
Inis Oárr (airport)	0.12	8.35	0.12
CáAilt an Chorráiin (Embarkation Point for 25,26)	0.1	3.91	0.1
Cá an Bhuna Bhig (Embarkation Point for 21,23)	0.08	0.08	0.08
An Ceann Ramhar	0.07	3.34	0.07
Killary Harbour	0.07	14.43	0.07
Ceann an Eanaigh	0.06	1.32	0.06
Kilkee Cliffs	0.06	0.5	0.06
Kilmakilloge	0.05	12.1	0.05
Cleggan Harbour (Embarkation Point for 77)	0.03	3.8	0.03

Fenit Harbour (Embarkation Point for 119)	0.03	0.6	0.03
Roonagh Pier (Embarkation Point for 69,70)	0.03	5.53	0.03
Tullan Strand	2.79	0.03	0.03
Foynes Island Viewpoint	0.02	0.02	0.02
Killimer Port (Killimer to Tarbert Ferry)	0.02	0.02	0.02
Rossnowlagh Beach	0.88	0.02	0.02
Carrigaholt Bay	0.01	3.71	0.01
Inchydoney Beach	0.01	0.02	0.01
Inis Má³r (seaport)	0.01	1.84	0.01
árainn Mháir	0	2.69	0
Aasleagh Falls	0	12.46	0
An Bhinn Bhuá	0	2.47	0
An Chonair	0	1	0
An Fád Dubh	0	0	0
Bái Bhaile Uá Thiarnáiin	0	1.62	0
Bái na Scealg	0	1.14	0
Ballina Quay	0	0.22	0
Ballybunion Beach	0	4.92	0
Ballymastocker Strand	2.81	0	0
Ballyvaughan Pier	0	0	0
Baltimore Harbour (Embarkation Point for 150,151)	0	0.54	0
Banna Strand	0	0	0
Barley Cove	0	0	0
Beale Strand	0	0	0
Blue Pool (Embarkation Point for 143)	0	21.18	0
Bray Head	0.03	0	0
Bunowen Bay	0	0.52	0
Cá Bhaile an Sceilg (Embarkation Point for 131)	0	0.06	0
Cá Bhun an Bhaile (Embarkation Point for 131)	0	0.38	0
Cá Dháon Chaoin (Embarkation Point for 125)	0.01	0	0
Cá Mhachaire Uá Rabhartaigh (Embarkation Point for 20,21)	0	0	0
Cappagh Pier	0	0	0
Carrigafoyle Castle	0	0	0

Carrownisky Strand	0	2.83	0
Castlegregory Beach	0.01	0	0
Ceann Iorrais	0	4.11	0
Ceann Sláibhe	1.17	0	0
Cionn Fháinada	0	0	0
Cionn Mhucrois	2.33	0	0
Cláire	0	8.92	0
Clare Island	0	0.83	0
Cliffs of Moher	4.77	0	0
Colla Pier (Embarkation Point for 150a)	0	9.81	0
Com an Chiste	0	0.55	0
Culdaff Beach	0	6.56	0
Cunnamore Pier (Embarkation Point for 152)	0	4.06	0
Dáºn na mBá³	0	1.02	0
Derrynane House	0	0.16	0
Doe Castle View	0	1.77	0
Doolough Valley	0	9.24	0
Dooneen	0.01	0	0
Droichead Charraig an Logáiin	0	8.28	0
Dumhach Bheag	0	2.14	0
Dursey Island	0.06	0	0
Dursey Sound (Embarkation Point for 139)	0.01	0	0
Fanore Beach	0	5.61	0
Flaggy Shore	0	0	0
Gabhla	0	0	0
Galley Head	1.89	0	0
Gap of Mamore	0	6.6	0
Garinish Island	0	21.69	0
Glengarriff Harbour (Embarkation Point for 143)	0	21.12	0
Heir Island	0	3.69	0
Horn Head	0	0.06	0
Inch Island	0	0	0
Inch Strand	0	0	0
Inis Bá³ Finne	0.94	0	0

Inis Fraoigh	0	2.78	0
Inis Má³r (airport)	0	0.78	0
Inis Meáiin (airport)	0	3.44	0
Inis Meáiin (seaport)	0	2.91	0
Inishbofin	0	0.28	0
Inishcrone Pier	0.34	0	0
Inishkea South	0	0	0
Inishturk	0	8.57	0
Ionad an Bhlascaoid Mhá³ir	0.28	0	0
Keel Strand	0	7.18	0
Keem Bay	0	9.84	0
Kenmare River View	0	7.71	0
Kerry Cliffs	1.45	0	0
Killala Quay	0	0	0
Kinnagoe Bay	0	14.9	0
Lackan Strand	0	0	0
Lisfannon Beach	0	0	0
Long Island	0	10.33	0
Loop Head	0	0.1	0
Lough Hyne	0	1.09	0
Máilainn Bhig	0	0	0
Malin Head	0	1.96	0
Marblehill	0	0.51	0
Mizen Head	0	0	0
Mountain Stage	0.02	0	0
Mountcharles Pier	0	0	0
Mullaghmore Head	0	8.59	0
Murrooghtoohy	0	4.3	0
Murvagh Beach	0	0.1	0
Narin-Portnoo Strand	0	0.47	0
Oileáin Chloigeann	0	0	0
Omey Island	0	0.85	0
Pollan Bay	0	2.23	0
Port na Feadáige	0	1.31	0

Portmagee Harbour (Embarkation Point for 131)	0	0.99	0
Radharc na mBlascaodaá	0.06	0	0
Rinville Park	0	0	0
Ros Goill	0	0	0
Rossbeigh Strand	0	0	0
Rosses Point Beach	0	0.38	0
Salthill Promenade	0	0	0
Samphire Island	0	0.97	0
Scattery Island	0	0	0
Schull Harbour (Embarkation Point for 150)	0	10.65	0
Seefin Viewpoint	0	2.61	0
Sheep's Head	0	0	0
Sherkin Island	0	0.71	0
Silver Strand	0	6.43	0
Sliabh Liag	0	0	0
Spanish Armada Viewpoint	0	7.55	0
Spanish Point	0	0	0
Trá Bhroin	0	0	0
Streedagh Beach	0	6.02	0
Tarbert Port (Killimer to Tarbert Ferry)	0	0	0
Timoleague Abbey	0	0	0
Toe Head Bay	1.03	0	0
Toraigh	0	0	0
Trá an Dáilán	0	9.91	0
Trá Dhumha Goirt	0	0.4	0
Trá na Carraige Finne	0	0.03	0
Trá na gCeann	0	0	0
Trá Oilá	0	0	0
Traught Beach	0	0	0

Chapter 2 Appendix IV Table 2 List of discovery points closest to each of the European sites identified in the nearest neighbour matrix above

Site Code	EU Site Name	Discovery Points
IE0004003	Puffin Island SPA	Garinish Island, Kilmakilloge, Lisfannon Beach
IE0004004	Inishkea Islands SPA	Bantry Harbour (Embarkation Point for 144), Inch Island, Kenmare River View
IE0004005	Cliffs of Moher SPA	Dooneen, Manorcunningham View, Mountain Stage, Whiddy Island
IE0004006	North Bull Island SPA	Bray Head, Dursey Sound (Embarkation Point for 139), Seefin Viewpoint
IE0004007	Skelligs SPA	Dursey Island, Geokaun Mountain, Sheep's Head
IE0004008	Blasket Islands SPA	Altar, Gour, Portmagee Harbour (Embarkation Point for 131)
IE0004009	Lady's Island Lake SPA	Barley Cove, Castletownbere Harbour (Embarkation Point for 141), Kerry Cliffs, Srá³n Bhroin
IE0004013	Drumcliff Bay SPA	An Chonair, Coomanaspic, Mizen Head, Pontoon Pier (Embarkation Point for 141)
IE0004014	Rockabill SPA	Bere Island (west end pier), Cá Bhaile an Sceilg (Embarkation Point for 131), Ceann Sláibhe, Schull Harbour (Embarkation Point for 150)
IE0004015	Rogerstown Estuary SPA	Bá¡ na Scealg, Bere Island (east end pier), Colla Pier (Embarkation Point for 150a), Radharc na mBlascaodaá
IE0004016	Baldoyle Bay SPA	Cá Dháºn Chaoin (Embarkation Point for 125), Cláire, Com an Chiste
IE0004017	Mongan Bog SPA	Cá Bhun an Bhaile (Embarkation Point for 131), Ionad an Bhlascaoid Mhá³ir, Long Island
IE0004019	The Raven SPA	Cuan an Daingin (Embarkation Point for 125), Derrynane House, Sherkin Island
IE0004020	Ballyteigue Burrow SPA	Heir Island
IE0004021	Old Head of Kinsale SPA	Cunnamore Pier (Embarkation Point for 152), Gabhla
IE0004022	Ballycotton Bay SPA	Baltimore Harbour (Embarkation Point for 150,151)

Site Code	EU Site Name	Discovery Points
IE0004023	Ballymacoda Bay SPA	Ceann an Eanaigh, Inishbeg
IE0004024	South Dublin Bay and River Tolka Estuary SPA	Lough Hyne
IE0004025	Malahide Estuary SPA	Toe Head Bay
IE0004030	Cork Harbour SPA	Inishturk
IE0004033	Bannow Bay SPA	Inishowen Head
IE0004034	Trawbreaga Bay SPA	Magilligan Point View
IE0004035	Cummeen Strand SPA	An Bhinn Bhuá, Kinnagoe Bay
IE0004036	Killala Bay/Moy Estuary SPA	Ceann Iorrais
IE0004037	Blacksod Bay/Broadhaven SPA	Inch Strand
IE0004038	Killarney National Park SPA	Culdaff Beach, Rossbeigh Strand, Trá¡ Oilá
IE0004040	Wicklow Mountains SPA	An Fád Dubh, Inishcrone Pier, Oileá¡n Chloigeann, Pollan Bay
IE0004041	Ballyallia Lough SPA	An Ceann Ramhar
IE0004042	Lough Corrib SPA	Doranâ€™s Point (Embarkation Point for 58), Inis Bigil, Timoleague Abbey, Toraigh
IE0004049	Lough Oughter SPA	Narin-Portnoo Strand
IE0004050	Lough Arrow SPA	Ballina Quay
IE0004051	Lough Carra SPA	Killala Quay
IE0004052	Carrowmore Lake SPA	Lackan Strand
IE0004056	Lough Cutra SPA	Downpatrick Head
IE0004058	Lough Derg (Shannon) SPA	Cáide
IE0004060	Lough Fern SPA	Rosses Point Beach
IE0004064	Lough Ree SPA	Bá¡ Fhionntrá¡
IE0004065	Lough Sheelin SPA	Ballybunion Beach, Cliffs of Moher, Dáºn na mBá³, Doolin Pier (Embarkation Point for 98,99,100)
IE0004066	The Bull and The Cow Rocks SPA	An Fá¡l Má³r, Clahane

Site Code	EU Site Name	Discovery Points
IE0004068	Inishmurray SPA	Lehinch Beach
IE0004069	Lambay Island SPA	Aasleagh Falls
IE0004075	Lough Swilly SPA	Tarbert Port (Killimer to Tarbert Ferry)
IE0004076	Wexford Harbour and Slobs SPA	Carrigafoyle Castle
IE0004077	River Shannon and River Fergus Estuaries SPA	Beale Strand, Old Head of Kinsale
IE0004080	Boyne Estuary SPA	Cá Mhachaire Uá Rabhartaigh (Embarkation Point for 20,21)
IE0004081	Clonakilty Bay SPA	Carrigaholt Bay, Claggan
IE0004082	Greers Isle SPA	Dumhach Bheag, Kilrush Marina (Embarkation Point for 111)
IE0004083	Inishbofin, Inishdooey and Inishbeg SPA	Cappagh Pier, Gap of Mamore, Spanish Armada Viewpoint
IE0004084	Inishglora and Inishkeeragh SPA	Dunree Head, Inchydoney Beach, Scattery Island
IE0004086	River Little Brosna Callows SPA	Keem Bay, Killimer Port (Killimer to Tarbert Ferry)
IE0004089	Rahasane Turlough SPA	Ballymastocker Strand, Derrigimlagh, Trá¡ Dhumha Goirt
IE0004090	Sheskinmore Lough SPA	An Cháibh Bheag (Embarkation Point for 69), Cionn Fhá¡nada, Croagh Patrick View, Keel Strand
IE0004091	Stabannan-Braganstown SPA	Bá¡ Bhaile Uá Thiarná¡in, Cuan na hAisláime
IE0004092	Tacumshin Lake SPA	Island Roy View
IE0004093	Termoncarragh Lake and Annagh Machair SPA	Ros Goill, Teach an Phiarsaigh
IE0004094	Blackwater Callows SPA	Bridges of Ross, Bunowen Bay, Loop Head, Marblehill, Port na Feadá³ige, Trá¡ an Dá³ilán
IE0004095	Kilcolman Bog SPA	Calafort Ros an Mhál (Embarkation Point for 98,99,100), Glinsce, Horn Head, Inis Bá³ Finne
IE0004096	Middle Shannon Callows	Clare Island, Droichead Charraig an Logá¡in,

Site Code	EU Site Name	Discovery Points
	SPA	Roonagh Pier (Embarkation Point for 69,70)
IE0004097	River Suck Callows SPA	Cá Ailt an Chorrá¡in (Embarkation Point for 25,26), Cáibh Bhaile na hAbhann
IE0004098	Owenduff/Nephin Complex SPA	Aerfort Ráigiánach Chonamara (Embarkation Point for 98,99,100), Inis Fraoigh
IE0004099	Pettigo Plateau Nature Reserve SPA	á• rainn Mhá³r, Killary Harbour, Seancháibh an Spidáil, Spanish Point
IE0004100	Inishtrahull SPA	Doughmore Bay, Islands View
IE0004101	Ballykenny-Fisherstown Bog SPA	Aughris Head, Easky Pier
IE0004107	Coole-Garryland SPA	Galley Head
IE0004111	Duvillaun Islands SPA	Cleggan Harbour (Embarkation Point for 77)
IE0004113	Howth Head Coast SPA	Inishbofin
IE0004114	Illaunonearaun SPA	Omey Island
IE0004115	Inishduff SPA	Sky Road
IE0004117	Ireland's Eye SPA	Cnoc Fola, Mountcharles Pier
IE0004118	Keeragh Islands SPA	Cá an Bhuna Bhig (Embarkation Point for 21,23), Murvagh Beach
IE0004119	Loop Head SPA	Rossnowlagh Beach
IE0004120	Rathlin O'Birne Island SPA	Trá¡ na Carraige Finne, Tullan Strand
IE0004121	Roaninish SPA	Mullaghmore Head
IE0004124	Sovereign Islands SPA	Glengarriff Harbour (Embarkation Point for 143)
IE0004125	Magharee Islands SPA	Blue Pool (Embarkation Point for 143)
IE0004127	Wicklow Head SPA	Malaidh Ghleann Gheis, Malin Head
IE0004129	Ballysadare Bay SPA	Má¡lainn Bhig
IE0004132	Illancrone and Inishkeeragh SPA	Sliabh Liag
IE0004133	Aughris Head SPA	Cionn Mhucrois, Strandhill Beach
IE0004137	Dovegrove Callows SPA	Old Head
IE0004140	Four Roads Turlough SPA	Ballyheigue Beach
IE0004142	Cregganna Marsh SPA	Banna Strand
IE0004143	Cahore Marshes SPA	Carrownisky Strand, Fenit Harbour (Embarkation Point for 119)

Site Code	EU Site Name	Discovery Points
IE0004144	High Island, Inishshark and Davillaun SPA	Inis Oárr (seaport), Samphire Island, Silver Strand
IE0004145	Durnesh Lough SPA	Castlegregory Beach, Doolough Valley, Inis Oá-rr (airport)
IE0004146	Malin Head SPA	Inis Meá¡in (seaport)
IE0004148	Fanad Head SPA	Inis Meá¡in (airport)
IE0004150	West Donegal Coast SPA	Inis Má³r (seaport)
IE0004151	Donegal Bay SPA	Inis Má³r (airport)
IE0004152	Inishmore SPA	Streedagh Beach
IE0004161	Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA	Rinville Park, Salthill Promenade, Trá¡ na gCeann
IE0004162	Mullaghanish to Musheramore Mountains SPA	Kilkee Cliffs, Traught Beach
IE0004165	Slievefelim to Silvermines Mountains SPA	Inishkea South
IE0004182	Mid-Clare Coast SPA	Doe Castle View
IE0004187	Sligo/Leitrim Uplands SPA	Flaggy Shore
IE0004189	Kerry Head SPA	Ballyvaughan Pier
IE0004190	Galley Head to Duneen Point SPA	Murrooghtoohy
IE0004191	Seven Heads SPA	Fanore Beach
IE0004235	Doogort Machair SPA	Foynes Island Viewpoint, Whiddy Island View
IE0000006	Killyconny Bog (Cloghbally) SAC	Toe Head Bay
IE0000007	Lough Oughter And Associated Loughs SAC	Killala Quay
IE0000019	Ballyogan Lough SAC	Pontoon Pier (Embarkation Point for 141)
IE0000020	Black Head-Poulsallagh Complex SAC	Inch Strand
IE0000032	Dromore Woods And Loughs SAC	Rossbeigh Strand

Site Code	EU Site Name	Discovery Points
IE0000036	Inagh River Estuary SAC	Flaggy Shore
IE0000037	Pouladatig Cave SAC	Ceann Sláibhe
IE0000064	Poulnagordon Cave (Quin) SAC	Radharc na mBlascaodaá
IE0000101	Roaringwater Bay And Islands SAC	Mizen Head
IE0000106	St. Gobnet's Wood SAC	Carrigaholt Bay, Inis Fraoigh, Killary Harbour, Má¡lainn Bhig
IE0000115	Ballintra SAC	á• rainn Mhá³r, Kilrush Marina (Embarkation Point for 111), Sliabh Liag
IE0000116	Ballyarr Wood SAC	Cappagh Pier, Cionn Mhucrois
IE0000129	Croaghonagh Bog SAC	Droichead Charraig an Logá¡in
IE0000133	Donegal Bay (Murvagh) SAC	Ballina Quay
IE0000140	Fawnboy Bog/Lough Nacung SAC	Trá¡ an Dá³ilán
IE0000163	Lough Eske and Ardnamona Wood SAC	Kilkee Cliffs, Mullaghmore Head
IE0000168	Magheradrumman Bog SAC	Whiddy Island View
IE0000185	Sessiagh Lough SAC	Carrownisky Strand, Scattery Island
IE0000191	St. John's Point SAC	An Fá³d Dubh
IE0000218	Coolcam Turlough SAC	Inishowen Head, Oileá¡n Chloigeann
IE0000255	Croaghill Turlough SAC	Killimer Port (Killimer to Tarbert Ferry)
IE0000285	Kilsallagh Bog SAC	Silver Strand
IE0000295	Levally Lough SAC	Bere Island (east end pier)
IE0000297	Lough Corrib SAC	Aasleagh Falls, Doolough Valley
IE0000304	Lough Rea SAC	Mountain Stage
IE0000322	Rahasane Turlough SAC	An Ceann Ramhar, Com an Chiste, Magilligan Point View
IE0000364	Kilgarvan Ice House SAC	Cá an Bhuna Bhig (Embarkation Point for 21,23), Claggan
IE0000375	Mount Brandon SAC	Easky Pier, Omey Island

Site Code	EU Site Name	Discovery Points
IE0000404	Hugginstown Fen SAC	Cuan an Daingin (Embarkation Point for 125)
IE0000407	The Loughans SAC	Timoleague Abbey
IE0000412	Slieve Bloom Mountains SAC	Dumhach Bheag
IE0000428	Lough Melvin SAC	An Cháibh Bheag (Embarkation Point for 69), Spanish Armada Viewpoint
IE0000448	Fortwilliam Turlough SAC	Kinnagoe Bay
IE0000458	Killala Bay/Moy Estuary SAC	Cá Bhun an Bhaile (Embarkation Point for 131)
IE0000461	Ardkill Turlough SAC	Sky Road
IE0000470	Mullet/Blacksod Bay Complex SAC	Derrynane House
IE0000472	Broadhaven Bay SAC	Kilmakilloge
IE0000474	Ballymaglancy Cave, Cong SAC	Ballyheigue Beach
IE0000475	Carrowkeel Turlough SAC	Culdaff Beach
IE0000480	Clyard Kettle-Holes SAC	Ceann Iorrais
IE0000484	Cross Lough (Killadoon) SAC	Dáºn na mBá³, Spanish Point
IE0000507	Inishkea Islands SAC	Fanore Beach, Inis Meá¡in (seaport)
IE0000527	Moore Hall (Lough Carra) SAC	Banna Strand
IE0000532	Oldhead Wood SAC	Seefin Viewpoint
IE0000534	Owenduff/Nephin Complex SAC	Fenit Harbour (Embarkation Point for 119)
IE0000542	Slieve Fyagh Bog SAC	Samphire Island
IE0000571	Charleville Wood SAC	Castlegregory Beach
IE0000576	Fin Lough (Offaly) SAC	Roonagh Pier (Embarkation Point for 69,70)
IE0000581	Moyclare Bog SAC	Clare Island
IE0000588	Ballinturly Turlough SAC	Glengarriff Harbour (Embarkation Point for 143)
IE0000607	Errit Lough SAC	Sheep's Head
IE0000614	Cloonshanville Bog SAC	Inishturk
IE0000623	Ben Bulben, Gleniff And	Croagh Patrick View, Toraigh

Site Code	EU Site Name	Discovery Points
	Glenade Complex SAC	
IE0000638	Union Wood SAC	Foynes Island Viewpoint
IE0000647	Kilcarren-Firville Bog SAC	Old Head
IE0000665	Helvick Head SAC	Malin Head
IE0000668	Nier Valley Woodlands SAC	Pollan Bay
IE0000679	Garriskil Bog SAC	Ceann an Eanaigh, Streedagh Beach
IE0000688	Lough Owel SAC	Inis Oárr (seaport), Keem Bay
IE0000717	Deputy's Pass Nature Reserve SAC	Old Head of Kinsale
IE0000729	Buckroney-Brittas Dunes And Fen SAC	Inis Má³r (seaport)
IE0000733	Vale of Clara (Rathdrum Wood) SAC	Malaidh Ghleann Gheis
IE0000764	Hook Head SAC	Gap of Mamore
IE0000781	Slaney River Valley SAC	Inis Má³r (airport)
IE0000859	Clonaslee Eskers And Derry Bog SAC	Port na Feadá³ige, Schull Harbour (Embarkation Point for 150)
IE0000869	Lisbigney Bog SAC	Calafort Ros an Mhál (Embarkation Point for 98,99,100)
IE0000925	The Long Derries, Edenderry SAC	Blue Pool (Embarkation Point for 143), Doe Castle View
IE0000979	Corratirrim SAC	Colla Pier (Embarkation Point for 150a), Horn Head
IE0001013	Glenomra Wood SAC	Garinish Island, Marblehill
IE0001021	Carrowmore Point To Spanish Point And Islands SAC	Cláire, Inishkea South
IE0001043	Cleanderry Wood SAC	Long Island
IE0001061	Kilkeran Lake and Castlefreke Dunes SAC	Ballymastocker Strand
IE0001107	Coolvoy Bog SAC	Sherkin Island
IE0001125	Dunragh Loughs/Pettigo	Heir Island

Site Code	EU Site Name	Discovery Points
	Plateau SAC	
IE0001141	Gweedore Bay And Islands SAC	Cunnamore Pier (Embarkation Point for 152)
IE0001151	Kindrum Lough SAC	Baltimore Harbour (Embarkation Point for 150,151)
IE0001179	Muckish Mountain SAC	Cá Bhaile an Sceilg (Embarkation Point for 131)
IE0001190	Sheephaven SAC	Bá¡ na Scealg
IE0001257	Dog's Bay SAC	Bantry Harbour (Embarkation Point for 144)
IE0001271	Gortnandarragh Limestone Pavement SAC	Cionn Fhá¡nada
IE0001398	Rye Water Valley/Carton SAC	Bá¡ Bhaile Uá Thiarná¡in, Tullan Strand
IE0001482	Clew Bay Complex SAC	Rosses Point Beach
IE0001497	Doogort Machair/Lough Doo SAC	Whiddy Island
IE0001529	Lough Cahasy, Lough Baun And Roonah Lough SAC	Strandhill Beach
IE0001656	Bricklieve Mountains and Keishcorran SAC	Inis Oárr (airport)
IE0001673	Lough Arrow SAC	Ballyvaughan Pier
IE0001774	Lough Carra/Mask Complex SAC	Cá Mhachaire Uá Rabhartaigh (Embarkation Point for 20,21)
IE0001776	Pilgrim's Road Esker SAC	Inis Bá³ Finne
IE0001810	White Lough, Ben Loughs And Lough Doo SAC	Trá¡ na gCeann
IE0001818	Lough Forbes Complex SAC	Trá¡ Oilá
IE0001831	Split Hills And Long Hill Esker SAC	Salthill Promenade
IE0001873	Derryclogher (Knockboy) Bog SAC	Rinville Park
IE0001879	Glanmore Bog SAC	Traught Beach
IE0001926	East Burren Complex SAC	Ros Goill

Site Code	EU Site Name	Discovery Points
IE0002010	Old Domestic Building (Keevagh) SAC	Cá Dháºn Chaoin (Embarkation Point for 125), Doranâ€™s Point (Embarkation Point for 58)
IE0002032	Boleybrack Mountain SAC	Galley Head
IE0002041	Old Domestic Building, Curraglass Wood SAC	Gabhla
IE0002098	Old Domestic Building, Askive Wood SAC	Derrigimlagh, Trá¡ na Carraige Finne
IE0002110	Corliskea/Trien/Cloonfelliv Bog SAC	Carrigafoyle Castle, Tarbert Port (Killimer to Tarbert Ferry)
IE0002112	Ballyseedy Wood SAC	Cuan na hAisláime
IE0002117	Lough Coy SAC	Beale Strand
IE0002118	Barnahallia Lough SAC	Aughris Head
IE0002120	Lough Bane And Lough Glass SAC	Ballybunion Beach
IE0002123	Ardmore Head SAC	Islands View
IE0002125	Anglesey Road SAC	Srá³n Bhroin
IE0002130	Tully Lough SAC	Bá¡ Fhionntrá¡, Inishbofin
IE0002141	Mountmellick SAC	An Chonair
IE0002158	Kenmare River SAC	Inishcrone Pier, Rossnowlagh Beach
IE0002162	NA, River Barrow and Nore SAC	Castletownbere Harbour (Embarkation Point for 141), Dooneen, Dursey Island, Dursey Sound (Embarkation Point for 139), Gour, Kenmare River View
IE0002164	Lough Golagh And Breesy Hill SAC	Altar, Bere Island (west end pier)
IE0002165	Lower River Shannon SAC	Barley Cove, Inchydoney Beach
IE0002170	Blackwater River (Cork/Waterford) SAC	Bray Head, Geokaun Mountain, Lackan Strand, Narin-Portnoo Strand, Portmagee Harbour (Embarkation Point for 131)
IE0002171	Bandon River SAC	Kerry Cliffs
IE0002172	Blasket Islands SAC	Doolin Pier (Embarkation Point for 98,99,100), Inis Meá¡in (airport)
IE0002173	Blackwater River (Kerry)	Coomanaspic

Site Code	EU Site Name	Discovery Points
	SAC	
IE0002193	Ireland's Eye SAC	Dunree Head
IE0002199	Ballygar (Aghrane) Bog SAC	An Fá¡l Má³r
IE0002205	Wooddown Bog SAC	Downpatrick Head
IE0002206	Scohaboy (Sopwell) Bog SAC	Cáide
IE0002207	Arragh More (Derrybreen) Bog SAC	An Bhinn Bhuá
IE0002236	Island Fen SAC	Cáibh Bhaile na hAbhann
IE0002241	Lough Derg, North-east Shore SAC	Inishbeg
IE0002245	Old Farm Buildings, Ballymacrogan SAC	Cnoc Fola, Inis Bigil, Ionad an Bhlascaoid Mhá³ir
IE0002246	Ballycullinan, Old Domestic Building SAC	Island Roy View
IE0002250	Carrowmore Dunes SAC	Murrooghtoohy
IE0002252	Thomastown Quarry SAC	Bridges of Ross, Keel Strand
IE0002256	Ballyprior Grassland SAC	Aerfort Ráigiáºnach Chonamara (Embarkation Point for 98,99,100)
IE0002257	Moanour Mountain SAC	Seancháibh an Spidáil
IE0002263	Kerry Head Shoal SAC	Teach an Phiarsaigh
IE0002268	Achill Head SAC	Lough Hyne
IE0002293	Carrowbaun, Newhall and Ballylee Turloughs SAC	Lisfannon Beach
IE0002294	Cahermore Turlough SAC	Inch Island
IE0002298	River Moy SAC	Clahane, Cliffs of Moher, Lehinch Beach
IE0002299	River Boyne And River Blackwater SAC	Bunowen Bay
IE0002313	Ballymore Fen SAC	Manorcunningham View
IE0002324	Glendine Wood SAC	Cá Ailt an Chorrá¡in (Embarkation Point for 25,26), Loop Head, Trá¡ Dhumha Goirt
IE0002350	Curraghlehanagh Bog SAC	Mountcharles Pier

Site Code	EU Site Name	Discovery Points
IE0002354	Tullaghanrock Bog SAC	Doughmore Bay, Murvagh Beach
IE0002953	Blackwater Bank SAC	Cleggan Harbour (Embarkation Point for 77)
IE0002999	Hempton's Turbot Bank SAC	Glinsce

Chapter 2 Appendix V Known threats and pressures related to tourism across all sites protected under the Habitats and Birds Directives in Europe, Ireland and along the Wild Atlantic Way; accompanied by the occurrence rates at the relevant scale.

Chapter 2 Appendix V Table 1 Prevalence of known threats and pressures related to recreation and/or tourism across all sites protected under the Habitats and Birds Directives in Europe

Pressure	Impact Code	# of SACs	# of SPAs	Total
Hunting	F03.01	341	152	493
Paths, tracks, cycling tracks	D01.01	318	54	372
Outdoor sports and leisure activities, recreational activities	G01	230	121	351
Leisure fishing	F02.03	233	80	313
Walking, horse-riding and non-motorised vehicles	G01.02	203	49	252
Other human intrusions and disturbances	G05	152	45	197
Trampling, overuse,	G05.01	170	13	183
Motorised vehicles	G01.03	137	24	161
Off-road motorized driving	G01.03.02	117	0	117
Nautical sports	G01.01	75	39	114
Sport and leisure structures	G02	76	34	110
Missing or wrongly directed conservation measures	G05.07	101	3	104
Improved access to site	D05	68	36	104
Vandalism	G05.04	78	16	94
Mountaineering, rock climbing, speleology	G01.04	74	20	94
Other outdoor sports and leisure activities	G01.08	54	19	73
Damage caused by game (excess population density)	F03.01.01	60	5	65
Camping and caravans	G02.08	45	12	57
Other sport / leisure complexes	G02.10	35	9	44
Motorized nautical sports	G01.01.01	37	4	41
Death or injury by collision	G05.11	36	3	39
Gliding, delta plane, paragliding, ballooning	G01.05	23	16	39
Skiing complex	G02.02	26	6	32

Pressure	Impact Code	# of SACs	# of SPAs	Total
Recreational cave visits	G01.04.03	30	0	30
Skiing, off-piste	G01.06	18	11	29
Human intrusions and disturbances	G	25	3	28
Interpretative centres	G03	10	16	26
Wildlife watching	G02.09	17	8	25
Golf course	G02.01	19	4	23
Scuba diving, snorkelling	G01.07	21	0	21
Fences, fencing	G05.09	20	0	20
Speleology	G01.04.02	19	0	19
Piers / tourist harbours or recreational piers	D03.01.02	18	1	19
Intensive maintenance of public parcs /cleaning of beaches	G05.05	17	1	18
Spear-fishing	F02.03.03	16	0	16
Shallow surface abrasion/ mechanical damage to seabed surface	G05.02	16	0	16
Circuit, track	G02.04	10	6	16
Tree surgery, felling for public safety, removal of roadside trees	G05.06	14	1	15
Mountaineering & rock climbing	G01.04.01	12	3	15
Airport	D04.01	8	7	15
Aerodrome, heliport	D04.02	10	4	14
Bait digging / collection	F02.03.01	9	4	13
Non-motorized nautical sports	G01.01.02	9	4	13
Penetration/ disturbance below surface of the seabed	G05.03	12	0	12
Pole fishing	F02.03.02	4	4	8
Closures of caves or galleries	G05.08	7	0	7
Airports, flightpaths	D04	2	5	7
Attraction Park	G02.06	5	1	6
Sports pitch	G02.07	2	4	6
Regular motorized driving	G01.03.01	4	0	4
Hippodrome	G02.05	3	1	4

Pressure	Impact Code	# of SACs	# of SPAs	Total
Stadium	G02.03	2	2	4
Flight paths	D04.03	1	2	3

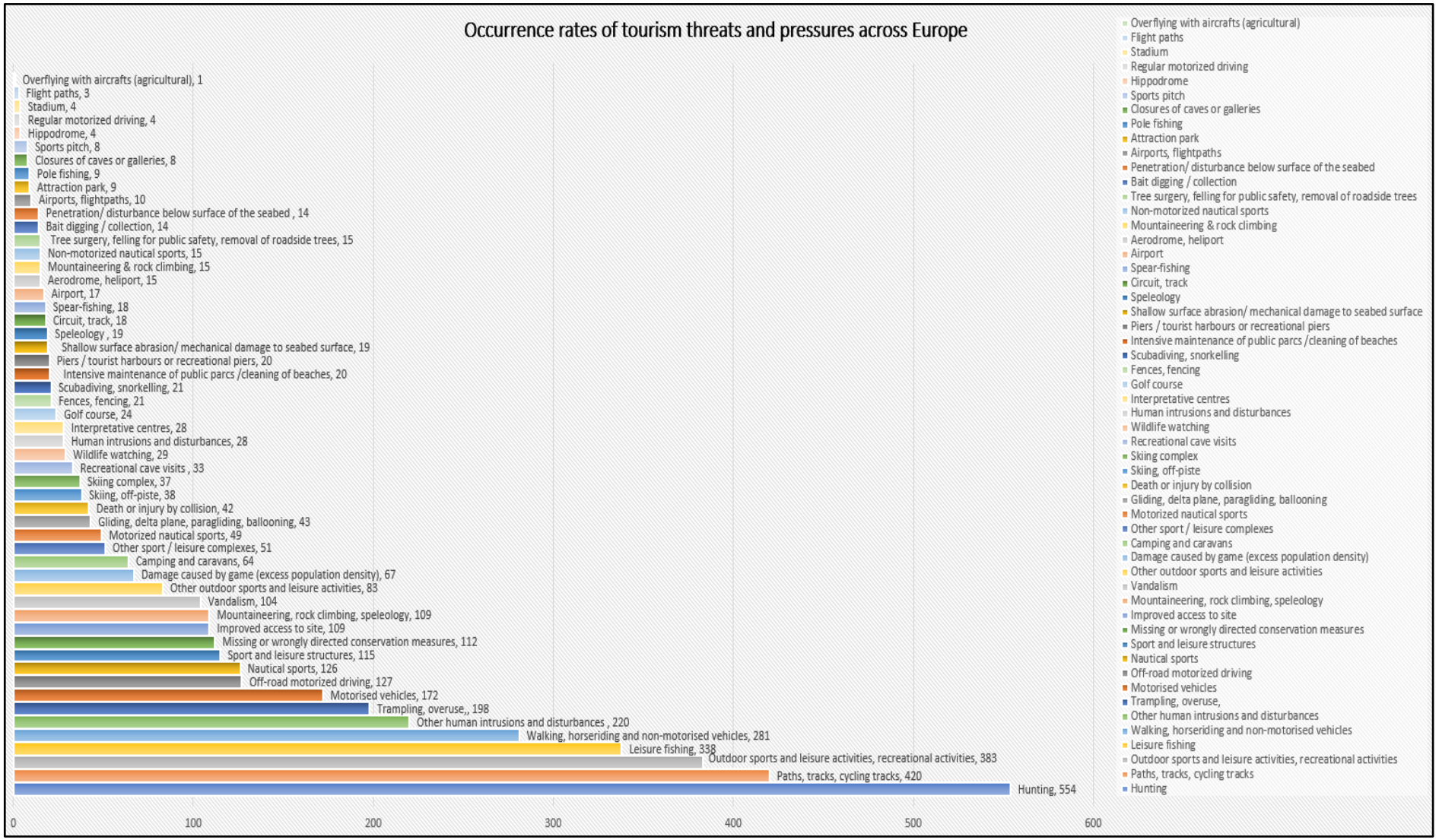
Chapter 2 Appendix V Table 2 Prevalence of known threats and pressures related to recreation and/or tourism across sites protected under the Habitats and Birds Directives in Ireland

Pressure	Impact Code	# of SACs	# of SPAs	Total
Walking, horse-riding and non-motorised vehicles	G01.02	73	57	130
Leisure fishing	F02.03	47	41	88
Paths, tracks, cycling tracks	D01.01	72	14	86
Hunting	F03.01	42	33	75
Nautical sports	G01.01	22	33	55
Outdoor sports and leisure activities, recreational activities	G01	35	5	40
Off-road motorized driving	G01.03.02	35	0	35
Trampling, overuse,	G05.01	26	1	27
Golf course	G02.01	19	5	24
Camping and caravans	G02.08	18	3	21
Bait digging / collection	F02.03.01	15	6	21
Other human intrusions and disturbances	G05	19	1	20
Fences, fencing	G05.09	17	0	17
Piers / tourist harbours or recreational piers	D03.01.02	15	0	15
Improved access to site	D05	14	1	15
Vandalism	G05.04	14	0	14
Wildlife watching	G02.09	13	0	13
Interpretative centres	G03	5	8	13
Motorised vehicles	G01.03	8	1	9
Tree surgery, felling for public safety, removal of roadside trees	G05.06	8	0	8
Sport and leisure structures	G02	7	0	7
Non-motorized nautical sports	G01.01.02	7	0	7

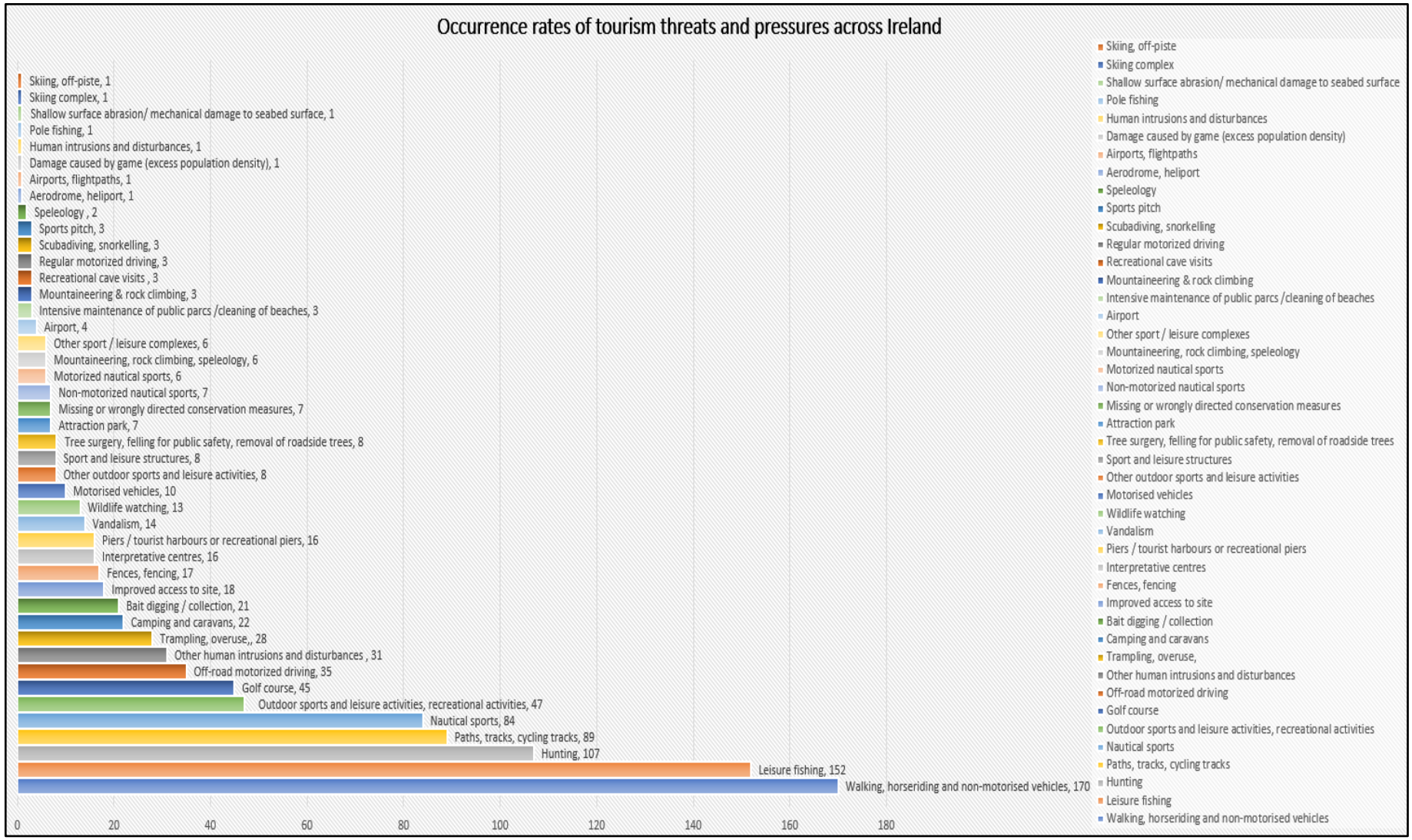
Pressure	Impact Code	# of SACs	# of SPAs	Total
Missing or wrongly directed conservation measures	G05.07	7	0	7
Other sport / leisure complexes	G02.10	6	0	6
Motorized nautical sports	G01.01.01	6	0	6
Other outdoor sports and leisure activities	G01.08	4	1	5
Mountaineering, rock climbing, speleology	G01.04	3	2	5
Attraction Park	G02.06	4	0	4
Airport	D04.01	3	1	4
Sports pitch	G02.07	3	0	3
Scuba diving, snorkelling	G01.07	3	0	3
Regular motorized driving	G01.03.01	3	0	3
Recreational cave visits	G01.04.03	3	0	3
Mountaineering & rock climbing	G01.04.01	3	0	3
Intensive maintenance of public parcs /cleaning of beaches	G05.05	3	0	3
Speleology	G01.04.02	1	0	1
Skiing, off-piste	G01.06	0	1	1
Skiing complex	G02.02	1	0	1
Shallow surface abrasion/ mechanical damage to seabed surface	G05.02	1	0	1
Pole fishing	F02.03.02	1	0	1
Human intrusions and disturbances	G	1	0	1
Damage caused by game (excess population density)	F03.01.01	1	0	1
Airports, flightpaths	D04	1	0	1
Aerodrome, heliport	D04.02	1	0	1

Chapter 2 Appendix V Table 3 Prevalence of known threats and pressures related to recreation and/or tourism across sites protected under the Habitats and Birds Directives within 2 km of discovery points along the Wild Atlantic Way

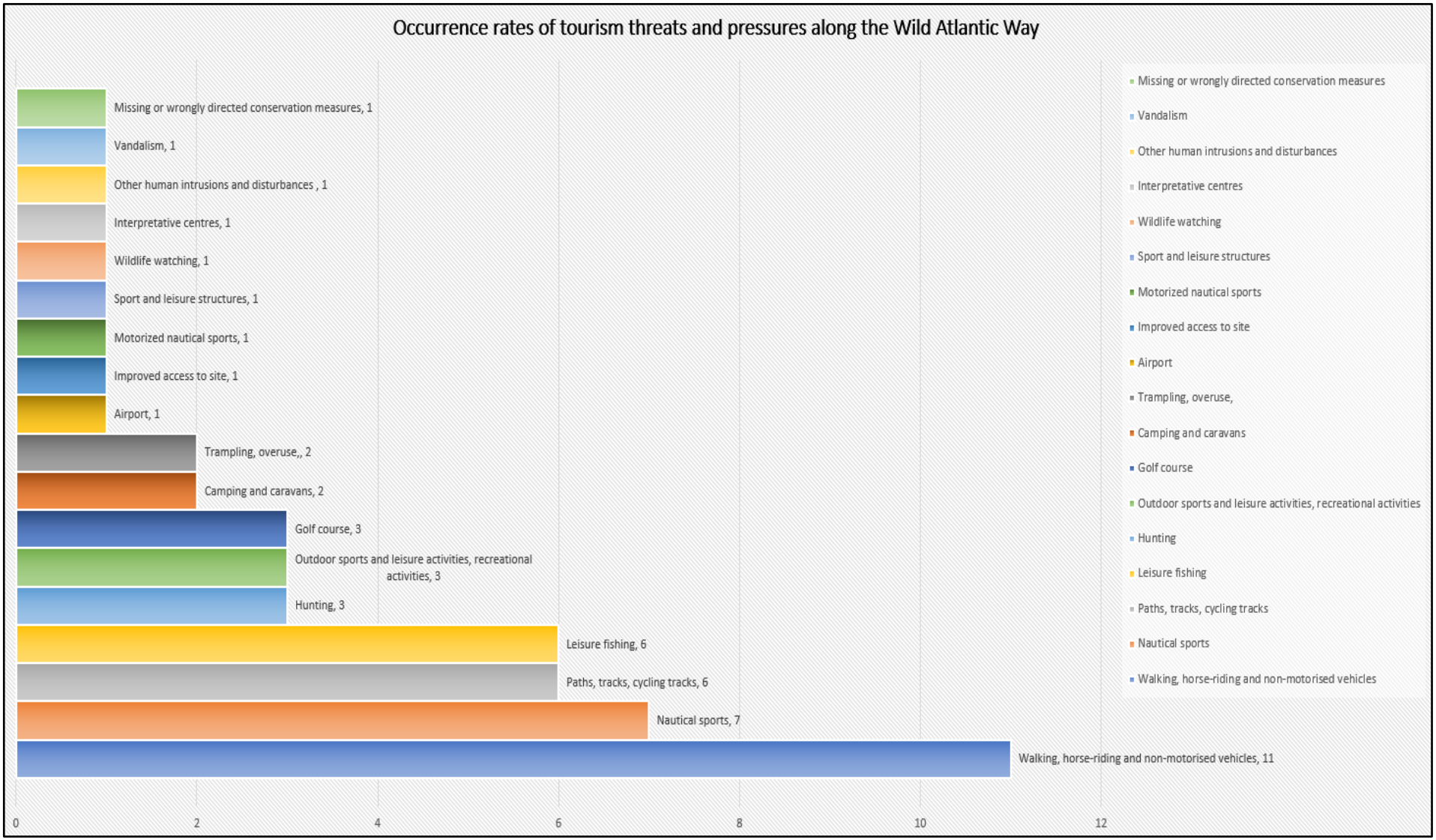
Pressure	EU Impact Code	SAC within 2 km	SPA within 2 km	Total
Walking, horse-riding and non-motorised vehicles	G01.02	5	6	11
Nautical sports	G01.01	4	3	7
Paths, tracks, cycling tracks	D01.01	4	2	6
Leisure fishing	F02.03	3	3	6
Hunting	F03.01	1	2	3
Outdoor sports and leisure activities, recreational activities	G01	3	0	3
Golf course	G02.01	2	1	3
Camping and caravans	G02.08	2	0	2
Trampling, overuse,	G05.01	2	0	2
Airport	D04.01	1	0	1
Improved access to site	D05	0	1	1
Motorized nautical sports	G01.01.01	1	0	1
Sport and leisure structures	G02	1	0	1
Wildlife watching	G02.09	1	0	1
Interpretative centres	G03	1	0	1
Other human intrusions and disturbances	G05	1	0	1
Vandalism	G05.04	1	0	1
Missing or wrongly directed conservation measures	G05.07	1	0	1



Chapter 2 Appendix V Figure 1 Site counts of tourism threats and pressures occurrences across Europe

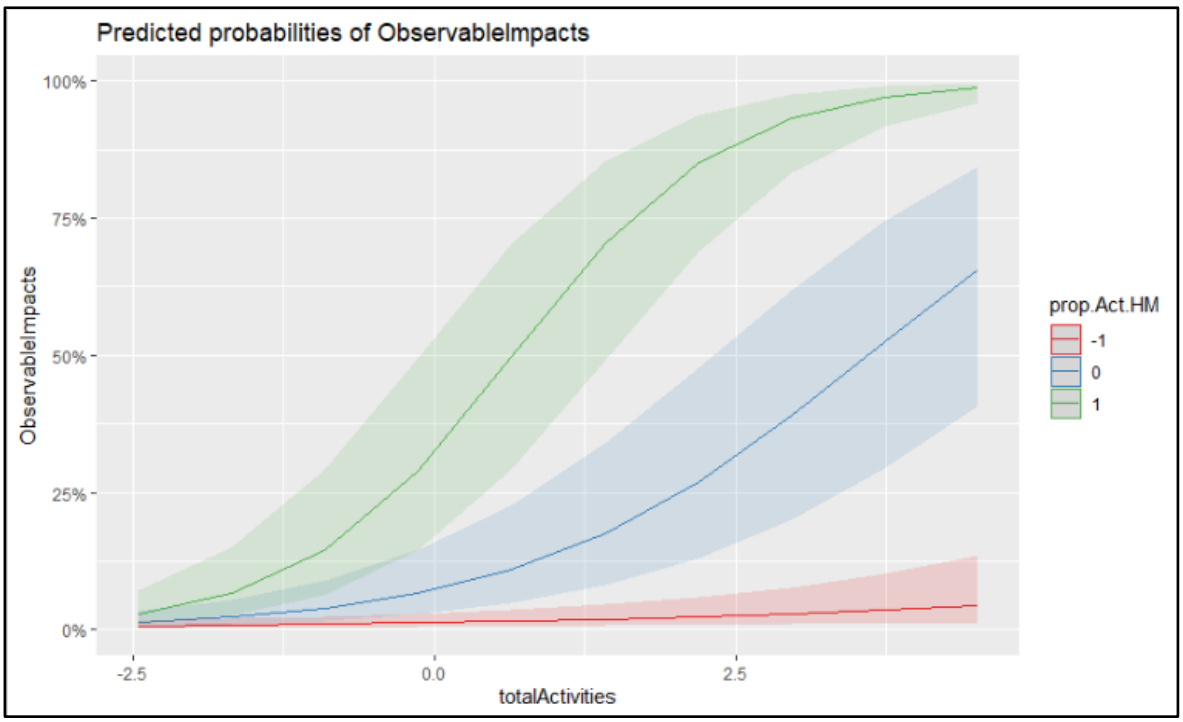


Chapter 2 Appendix V Figure 2 Site counts of tourism threats and pressures occurrences across Ireland

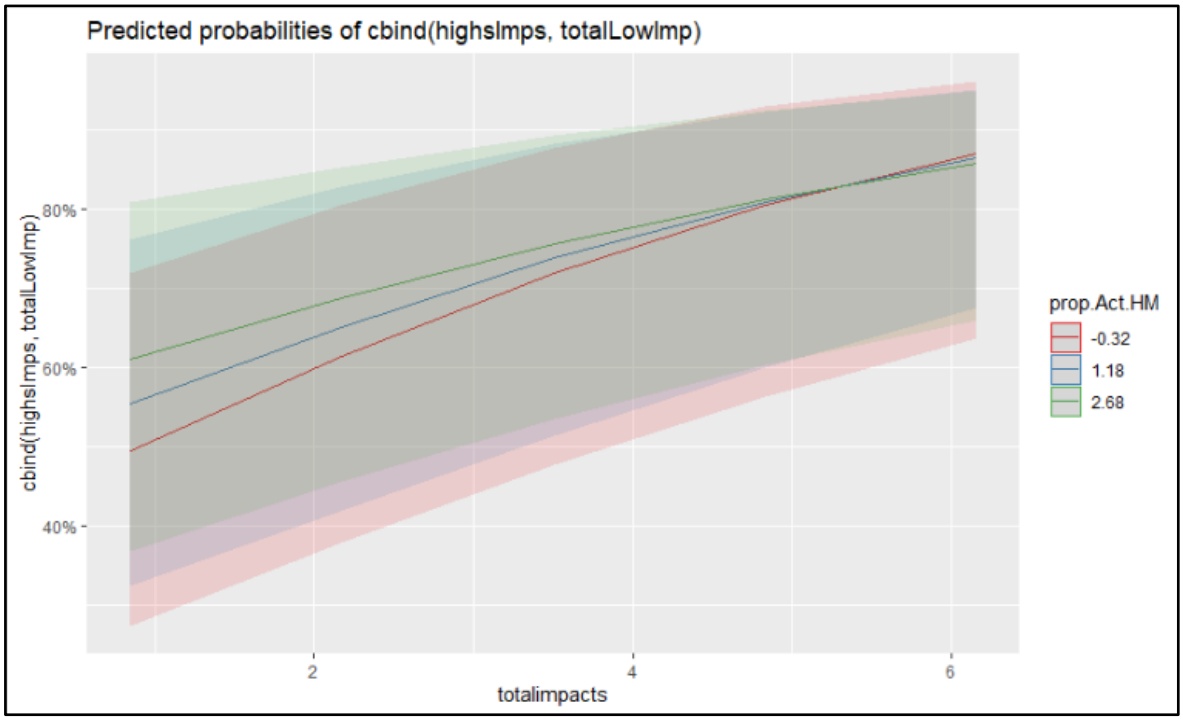


Chapter 2 Appendix V Figure 3 Site counts of tourism threats and pressures occurrences across the Wild Atlantic Way

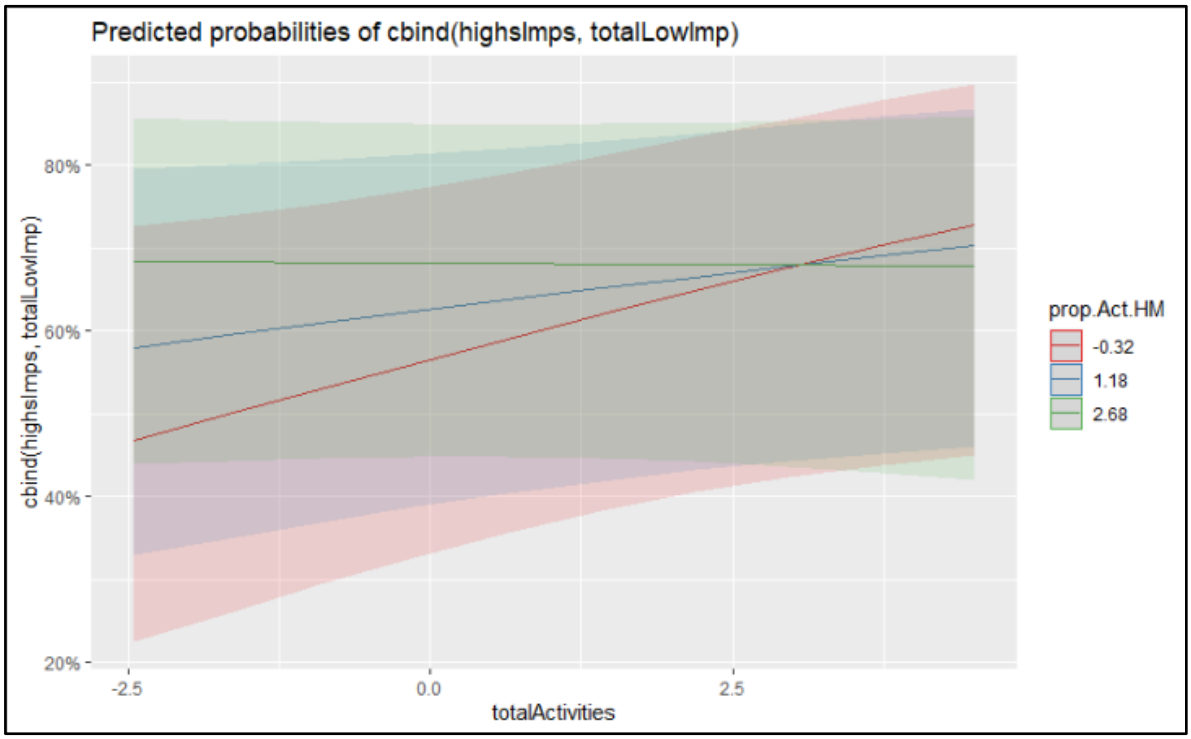
Chapter 2 Appendix VI Figures showing the interaction terms from the best performing models, which illustrate the relationship among the variable



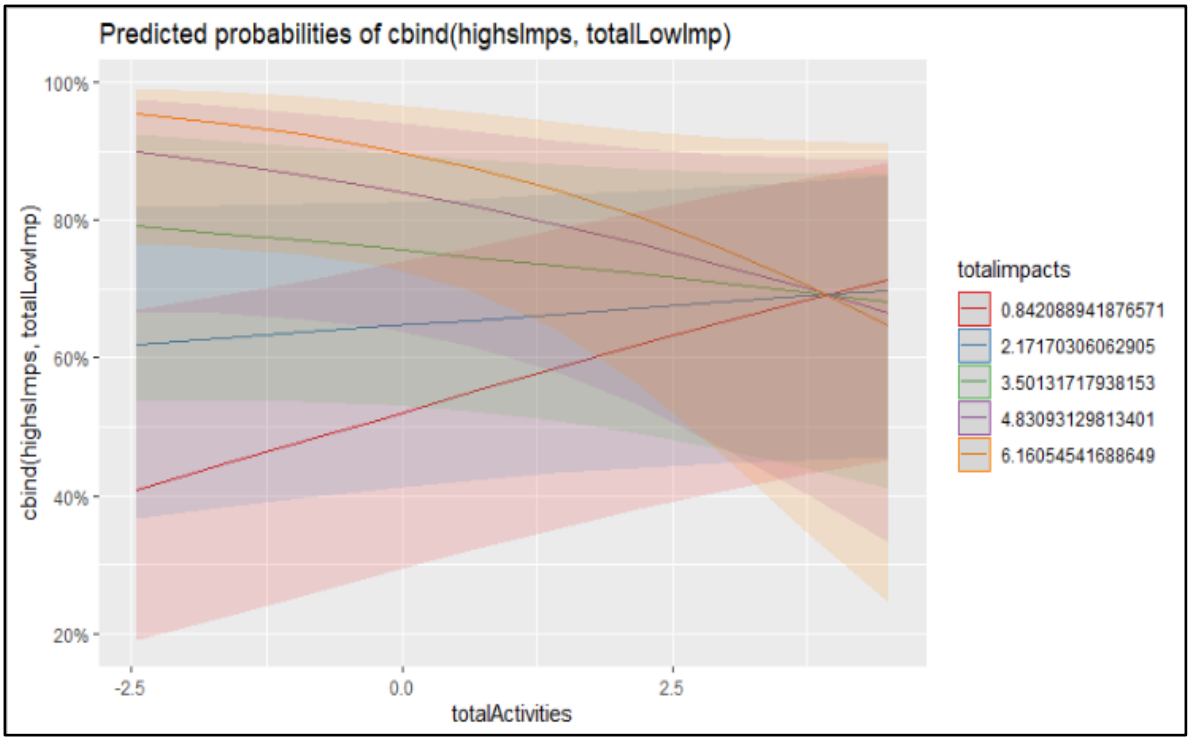
Chapter 2 Appendix VI Figure 1 Interaction between the total number of impacts and total number of activities as a function of Impact occurrence



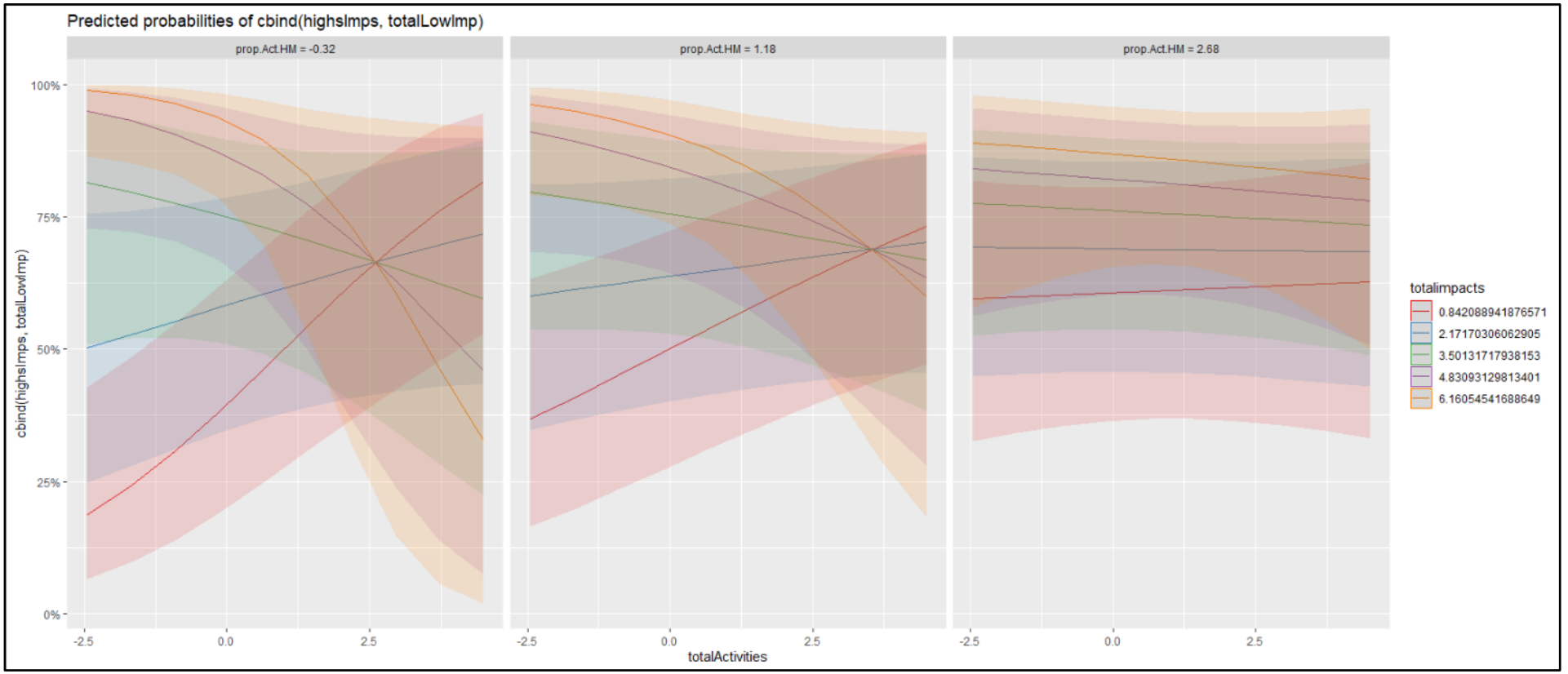
Chapter 2 Appendix VI Figure 2 Interaction between the proportion of moderate/high level activities and total number of impacts as a function of impact severity



Chapter 2 Appendix VI Figure 3 Interaction between the proportion of moderate/high level activities and total number of activities as a function of impact severity



Chapter 2 Appendix VI Figure 4 Interaction between the total number of impacts and total number of activities as a function of impact severity



Chapter 2 Appendix VI Figure 5 Interactions amongst the total number of impacts, total number of activities and the proportion of moderate/high level activities as a function of impact severity

Chapter 2 Appendix VI Model outputs from the equivalent model identified through the model selection process; as determined by the AICc values being within 2 units

Equivalent impact occurrence model with an AICc within 2 units of the final model. This model contained interaction between Group-Size and Total Activities which was seen to have a small effect size. Therefore, the simpler model was selected.

Predictors	***Estimates*** (β)	***Standard Errors***	***z-value (n=5910)***	***p***
(Intercept)	-2.526944	0.03	-5.781	**<0.001**
Group-Size	0.206085	0.09	2.942	**0.003**
Group-Type [Elderly Couple]	-0.2999591	0.16	-1.373	0.170
Group-Type [Elderly Group]	-0.374736	0.30	-0.859	0.390
Group-Type [Family]	-0.359074	0.11	-2.233	**0.026**
Group-Type [Family with Elderly]	-0.074658	0.56	-0.123	0.902
Group-Type [Individual Adult]	0.567860	0.28	3.572	**<0.001**
Group-Type [Individual Elderly]	0.104803	0.37	0.317	0.751
Group-Type [Large Adult Group]	-0.256915	0.27	-0.733	0.463
Group-Type [Mixed Large Group]	-0.091062	0.29	-0.289	0.772
Group-Type [Mixed Over 18 Large Group]	-2.179265	0.09	-2.769	**0.006**
Group-Type [Mixed Over 18 Small Group]	0.044216	0.28	0.162	0.871
Group-Type [Mixed Small Group]	0.001883	0.36	0.005	0.996
Group-Type [Small Adult Group]	0.254105	0.21	1.559	0.119
Group-Type [Under18]	0.859946	0.94	2.161	**0.031**
Site-type [Beach Site]	0.486529	0.84	0.941	0.347

Predictors	***Estimates*** (β)	***Standard Errors***	***z-value (n=5910)***	***p***
Site-type [Cliff Site]	1.416931	2.14	2.736	**0.006**
Site-type [Highly Managed]	0.854264	1.63	1.234	0.217
Total Activities	0.712764	0.13	10.997	**<0.001**
Activity Intensity	1.799401	0.45	23.923	**<0.001**
Total Activities * Activity Intensity	0.439517	0.11	6.428	**<0.001**
Group-Size * Total Activities	-0.081996	0.05	-1.643	0.100

Random Effects	
σ^2	3.29
$\tau_{00\ Site}$	1.05
ICC	0.24
$N_{\ Site}$	42
Observations	5910
Marginal R^2/Conditional R^2	0.602/0.699

Appendices for Chapter 3

Defining eco-tourism for mainstream application and to support sustainable tourism governance.

Authors:

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Author contributions:

Andrew Torsney, Patrick O'Driscoll and Yvonne M. Buckley had substantial contributions to conception, design, analysis, and interpretation of data to support the paper. Andrew Torsney oversaw the data collection, performed the data analysis, and wrote the first draft.

Data availability: The full set of coded thematic data that support the findings of this study are openly available at:

https://github.com/TorsneyStat/An_integrated_definition_of_ecotourism

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Chapter 3 Appendix I Participant Information Form

Participant Information Form

School of Natural Sciences, Trinity College Dublin

Where applicable, a Participant Information Leaflet and Consent Form must be submitted to the committee. The leaflet should be written in clear non-technical English and aimed at the potential subjects in the project, not at the REC. All the headings should be included. For several of the headings, recommended wording is provided in *italics* and should be used if appropriate for the particular study.

1. Title of study: Reconciling the understanding of ecotourism and nature-based tourisms between environmental and tourism management perspectives.

2. Details: Name of principal investigator and research assistants; name of organisation; name of sponsor; name of project

3. Introduction: The aim of this research is to identify the variability in use of the term eco-tourism across the tourism and environmental management hierarchies in Ireland. When interrogating the definitions presented it is important to assess if they align more consistently with nature-based tourism or eco-tourism; this is important from a sustainability perspective.

4. Procedures: Participants will be members of the tourism and environmental management hierarchy. The methods to be undertaken will be semi structured interviews that will be recorded for transcribing and using in thematic analysis. Sample size is set to be at least 30 individuals. These individuals will be recruited through direct engagement processes and an informed consent form will be completed by all participants.

5. Benefits: There are no direct benefits from engagement in the research.

6. Risks: There are no risks to participation in the study as the study aims to gather qualitative data surrounding the topic of ecotourism amongst professionals in the environmental management and tourism industries.

7. Exclusion from participation: Anyone who does not work in environmental management or the tourism industry. All at risk individuals or individuals below 18.

8. Confidentiality: Your identity will remain confidential. Your name will not be published and will not be disclosed to anyone outside the study.

9. Voluntary Participation: *You have volunteered to participate in this study. You may quit at any time. If you decide not to participate, or if you quit, you will not be penalised and will not give up any benefits*

which you had before entering the study.

10. Reimbursements*:* N/A

11. Stopping the study: *You understand that the researcher may stop your participation in the study at any time without your consent.*

12. Permission: State that the study has School of Natural Sciences Research Ethics Committee approval. Also include any additional organisational or national research ethics committee approvals.

13. Access to data: Tell the participant that they can access their own data at any time under the Freedom of Information Act 2014.

14. Sharing the results: Confirm that the research results will be shared with the participants and community before publication (this is now common practice for participatory research projects).

15. Further information: *You can get more information or answers to your questions about the study, your participation in the study, and your rights, from Andrew Torsney who can be telephoned at 0851550240.*

Chapter 3 Appendix II Questionnaire Rational

Chapter 3 Appendix II Table 1 Set questions which all participants were asked within the semi-structured interviews including the question rationale

Interview Question	Rationale for Question
(1) Can you explain the tourism hierarchy, highlighting roles and responsibilities from local to national level?	This question is to identify the participants understanding of the overall tourism governance to set the context of their understanding.
(2) What do you think is meant by the term 'eco-tourism'?	Definitions of eco-tourism are extremely variable within the literature and this question investigates the principals which fit within an individual's definition.
(3) How does your definition of eco-tourism fit into the tourism management structure that you described previously?	This question sets the intended definition in a real-world context and therefore introduces potential flexibility in the definition previously described.
(4) Describe what you understand Biodiversity to be and how do you think it might be important from a tourism perspective, if at all?	Garner understanding of the participants understanding of biodiversity and assess their value system in the context of tourism.
(5) In your opinion, who is responsible for the protection and enhancement of biodiversity at tourist destinations?	This question aims to identify where in the hierarchy of tourism (or outside of tourism) the responsibility should lie.
(6) How do tourists interact with given site?	Aims to identify if the participant views tourism as inherently damaging to natural features or has a strong sense of impact related to tourism.
(7) How should tourism interaction be planned and/or managed beyond site level?	To identify pragmatic solution focused means of facilitating tourism at natural sites.
(8) Are there any circumstances where biodiversity is, or should be, prioritised above tourism/economic gain?	Understand the value system and prioritisation of the participant or if tourism is viewed to be of higher standing.
(9) What is more valuable to Ireland and why; tourism or biodiversity?	This question is aimed to identify a bias, or to justify why a bias or dichotomy is not favoured.

(10) Have you heard of Natural Capital? If so, can you explain what it is?	Natural capital is an academic concept which is mainly a communication tool between environmental managers and relevant sectors – this question was introduced to identify if there is a difference of knowledge between the two cohorts.
(11) Do you think people have an inherent right to freely access nature, explain why?	This question was aimed at identifying the role of nature in peoples well-being or connection to nature outside of tourism to see if there are views of higher need with regard to access.

Chapter 3 Appendix III Thematic framework of main and sub-themes

Chapter 3 Appendix III Table 1 Thematic framework of main and sub-themes from environmental (n=16) and tourism (n=15) cohorts

Main Theme	Sub-Theme	Sample Quotes	Respondent ID
Importance of policy structure and communication in tourism	Policy structures within tourism	*"Destination managers look at all the strategic plans"*	Tourism_A
		"Formulate policies to align with departments higher order policies"	Tourism_F
		"Perspectives between policy makers and locals"	Environmental_M
		"National biodiversity policy minimises or avoids impact on nature"	Environmental_G
	Need for structured communication and management	*"Information enables tourist to interact with the cultural heritage or wildlife"*	Environmental_A
		"People should have access once it does not cause harm"	Environmental_A
		"Disconnect between local management plans to growth of Wild Atlantic Way"	Environmental_A
		"Engage with stakeholders to make visitor management/conservation plan work"	Tourism_C
		"Collaboration between organisations to identify opportunities"	Tourism_C
	Key stakeholders within tourism	*"Hierarchies - local authorities to national parks and wildlife, Fáilte Ireland, tourism Ireland"*	Tourism_J
		Local authorities consenting/permitting development	Environmental_M
Significance of economics, business development, management and communication structures within tourism	Factors that greatly influence eco-tourism/nature-based tourism	*"Destination management organisation could lead the sustainable management of tourism"*	Tourism_A
		"Eco-tourism historically niche/hipster/hippy"	Tourism_N
		"Ecotourism as sociable, manageable, environmentally responsible"	Environmental_L
		"Biodiversity underpins much more than just economic gain or tourism value"	Environmental_L
		"Ecotourism is slow tourism - gives people time"	Tourism_O
	Factors that greatly influence tourism	*"tourism is an economic for profit, business driven sector"*	Tourism_C
		"Nature is a lower priority regarding decisions"	Tourism_H
		"tourism is about what you have and what you want to sell"	Tourism_O
		"Tourists with particular interests - birdwatching, best 10 places to go, want to see a particular bird"	Tourism_O
		"All tourism products have their origin in nature"	Environmental_D
		"Beneficiaries of tourism but not embedded completely with it"	Environmental_Z

Main Theme	Sub-Theme	Sample Quotes	Respondent ID
		"Tourists might not understand biodiversity"	Environmental_B
	Developing, promoting and marketing the business of tourism	*"Tourist sites contribute to the local economy"*	Tourism_B
		"Encourage tourists to slow down and experience an area"	Tourism_B
		"Biodiversity sectors' aims/goals impact tourism product"	Tourism_M
		"Use of marketing/branding/media campaigns"	Tourism_N
		"Mistreatment diminishes product"	Environmental_M
		"Focus on increasing numbers"	Environmental_G
		"Different groups working on the ground"	Environmental_I
		"Budgets for marketing compared to budgets for community groups"	Environmental_I
	Managing tourists' experiences	*"Management shapes visitor experience"*	Tourism_J
		"Visitor management equals sustainability"	Tourism_J
		"More education and awareness needed in tourism"	Tourism_J
		"Complying with law"	Environmental_K
		"Maximising visitor experience"	Tourism_N
		"Understanding the issue plus a willingness to take measures"	Environmental_G
		"Enabling access over tourism impact"	Environmental_G
	Harnessing community and landowner involvement	*"Good community is involved in the development of sites"*	Tourism_E
		"Plan or aim to get community engaged first"	Tourism K
		"If the community are not engaged with you could be creating problems"	Environmental_L
		"Community based natural resource management model (CBMRM)"	Environmental_L
Importance of understanding and engaging with nature	Understanding and protecting nature	*"Maximising visitor experience"*	Tourism_N
		"Understanding the issue plus a willingness to take measures"	Environmental_G
		"Enabling access over tourism impact"	Environmental_G
		"Good community is involved in the development of sites"	Tourism_E
	Tourists engaging with nature and the environment	*"Plan or aim to get community engaged first"*	Tourism_K
		"If the community are not engaged with you could be creating problems"	Environmental_L
		"Community based natural resource management model (CBMRM)"	Environmental_L
		"Access to nature similar to need of access to water or fresh air"	Tourism_G
	People's	*"Embracing natural aspects of nature"*	Tourism P

Main Theme	Sub-Theme	Sample Quotes	Respondent ID
	relationship with nature	*"Shift in ecology towards including people… No connection with nature how are you going to really care"*	Environmental_I
		"People have limited understanding of biodiversity"	Tourism_I
		"People don't want to go about and destroy nature or biodiversity"	Environmental_I
		"A lot of our management and structures are geared towards product development"	Tourism_A
		"Health and safety above natural environment"	Environmental_N
		"Health and safety resonate with people"	Environmental_N
		"Exploitation of nature"	Environmental_K
		"Human dependency on nature"	Environmental_K
	Valuing biodiversity requires understanding	*"Supporting biodiversity requires reflection"*	Environmental_K
		"Tipping point – tourism numbers"	Environmental_N
		"Avoid tipping point…. Protecting biodiversity preventing environmental degradation"	Environmental_N
		"Biodiversity officers that promote education, awareness, understanding"	Environmental_N
Safeguarding and prioritising biodiversity	Nature is important but undervalued	*"Valuing tourism equates to valuing biodiversity"*	Environmental_B
		"Ignoring biodiversity causes issues"	Tourism_D
		"Biodiversity obviously contributes to experiences"	Environmental_A
		"Eco-tourism not recognised as a major driver of tourism"	Environmental_A
	Safeguarding and prioritising biodiversity	*"Biodiversity is being prioritized for tourism and planning"*	Tourism_B
		"By prioritising biodiversity, you are prioritising what people want to come and see"	Tourism_B
		"Awareness of tourism in biodiversity and the environment"	Tourism_N
		"Tourism development shouldn't impact biodiversity"	Environmental_H
		"Tourism needs to be sustainable in terms of environmental protection"	Tourism_G
		"Access denied due to damage and exploitation"	Environmental_O
		"Uninfluenced habitats are more valuable"	Tourism_G
	Valuing and protecting nature	*"Tipping point – tourism numbers… Closure of sites for days/weeks"*	Environmental_N
		"Not entitled to degrade nature"	Environmental_N

Main Theme	Sub-Theme	Sample Quotes	Respondent ID
	requires understanding	*"Value implies protection"*	Environmental_B
		"Lack of education or understanding of natural environment"	Tourism_C
		"Understanding the issue plus a willingness to take measures"	Environmental_G
		"Certain locations are sensitive to numbers"	Environmental_G
		"Awareness of sensitivity and significance of environment"	Environmental_E
		"Interpretation and guides influence behaviour"	Environmental_I
	Landscape scale value and processes in tourism	*"Tourism important to rural economies"*	Tourism_F
		"Landscape is important for tourism"	Environmental_C
		"Damage to landscape is acceptable once it doesn't deter tourism"	Environmental_C
		"Without biodiversity we will have barren landscapes and people"	Tourism_O
		"How should we protect biodiverse environments"	Tourism_O
	The importance of valuing and protecting nature	*"Biodiversity and scenery are interlinked"*	Environmental_H
		"Meadow provides unique experience for guests"	Tourism_H
		"The traveller wants an experience"	Tourism_H
		"Conscious of nature protected area od designation"	Tourism_J
		"Also want to protect the environment or point of attraction"	Tourism_M
		"Significant number of sites are natural environment"	Environmental_N
		"Conserving for purely economic gain is obtuse and short sighted"	Environmental_L
The need for meaningful long-term sustainability and environmental management structures	Responsible management of habitats independent of tourism needs	*"Developments away from forests and wetlands"*	Environmental_H
		"Biodiversity action plan for vulnerable species: bats, freshwater pearl mussel, hen harrier"	Tourism_K
		"Increasing people's awareness about species or habitats"	Tourism_K
		"Awareness brings passion and understanding"	Tourism_K
		"Woodlands for health - mental health scheme"	Tourism_K
		"Regulation linked to potential for damage"	Environmental_K
	The need for long term and meaningful sustainability	*"Sustainability is managing resources for future generations"*	Environmental_G
		"Environment doesn't work society and economy don't work"	Environmental_G
		"Degraded habitats become places where nobody wants to be (e.g., blanket bog)"	Environmental_G
		"Coexistence of human activity with nature"	Environmental_E

Main Theme	Sub-Theme	Sample Quotes	Respondent ID
		"Resilience has begun to replace sustainability"	Environmental_I
		"Not impinging on the rights of future generations"	Environmental_I
		"Weak and strong sustainability"	Environmental_I
		"Operationalising of sustainability"	Environmental_E
		"Various meaning of sustainability… Empty phrase"	Environmental_E
		"Sustainable as a catch phrase"	Environmental_E

Chapter 3 Appendix IV Definitions of Eco-tourism

Chapter 3 Appendix IV Table 1 Definitions of eco-tourism from each of the participants (n=31)

Participant	Eco-tourism Definition
Environmental A	So, for me, eco-tourism. I would find that's quite outdated, to just focus on eco-tourism. If you think of wild, the Wild Atlantic Way is equally made up of the wild people along the Atlantic Way. So, for me, you're bringing in, you need to think of the people, whereas I would probably define eco-tourism as, you know, it's more the environmental, the bio-diversity, all that, whereas where I would be coming from and feel that it should be driven from as the sustainable management of tourism, and that would be the development of tourism in a sustainable manner. And that is totally not attainable unless you've got all the stakeholders brought in. And that's the communities along the Wild Atlantic Way, for example. So, sustainable eco-tourism for me is just more the environmental aspect, whereas sustainable tourism is where I feel it should be going. And that's bringing in your environmental and your social, cultural heritage, the economic aspect and destination management. So, personally, if you were going to be developing your research like when I started, I like you, I was doing all the literary reviews and desktop research and I was coming at it from the Eco at beginning. And to be honest, I just realized very quickly that's out of date we've progressed from that a long time ago. We need to be looking at the sustainable management of a tourism destination.
Environmental B	I know what it's meant to mean and I know what people generally take it to mean, what I understand it to mean is tourism which has sound sustainability practices built into it. That's not what I believe most people think of it as. Most people think of it as something that involves the outdoors or wildlife.
Environmental C	In my mind eco-tourism would revolve around wildlife watching and sustainability in tourism. My first thoughts about eco-tourism would be things like whale watching, that sort of thing; but then I also would look (this is just for my own experience) at the operator who is organising those tours and I would see if the organiser is managing their business in an environmentally responsible way and in an ecologically sensitive way.
Environmental D	Ultimately low impact tourism and something that might even educate people on the environment or that would have negligible or no impact on the environment or possibly a positive impact on the environment.
Environmental E	Eco-tourism, possibly tourism that has very little or no impact on the environment, wherever tourist enters an area of tourism. That is my understanding, and I'm not even going to try to explain more. That is as simple as that.
Environmental F	So, eco-tourism to me, I suppose, is tourism where you're both being sensitive to the environment but you're also, experiencing an alternative experience really in, I suppose straightaway, something like glamping comes to mind or an eco-tourism in terms of here in West Cork we work closely with the IDENTIFIABLE BRAND (Redacted). And I'm not sure if

Participant	Eco-tourism Definition
	they have themselves classified as eco-tourism but at the end of the day, basically, it's a group of dairy farmers who have got together and are organising tours on their farm where people get to experience the life and the working day of a of a dairy farmer to the point of learning how the milk is produced, where it is going to, what's the source of the radius of the creamery that it's going to what's the ranges of by products like cheeses are coming out of that. So, that's been massively of interest. Both for us, for people attending conferences who want to do add on programmes, we're promoting it. And also, then for general leisure tourism, for tour operators and that they've been selling it as part of a program for international people
Environmental G	I suppose like anything environmental, there's a habit for in terms of use very broadly, sometimes that can be misused. And in the process, we sometimes describe in the environmental NGO sector as greenwashing. Eco tourism, you could also put a frame it within that perspective whereby it's used to reflect really anything that could incorporate and tourism a tourist desire, I suppose, to benefit or engage in the environment in some way. And so there's an environment product, there are an environment framework. I suppose when you're looking at a broader environment where tourists might come, for example, to Ireland for them, I generally say I come for the environment. I describe our landscape and our built to natural heritage without specifically defining and things in particular. So, I'd say it's a broad term that we cover and the tourism sector's interaction with the environment, then maybe specific and environment driven deliverables, whether that's you could be birdwatching or it could be and something as broad as people come because they want to experience the West Coast of Ireland, something very high level and broad.
Environmental H	Eco-tourism, I suppose, like I would understand it, twofold is one thing is the tourists and maybe visitors that are coming, let's say, to Ireland or to visit places because of the ecological value, you know, biodiversity value or, you know, some kind of designations that are on it that make them ecologically important. And I suppose the other meaning how I would understand is that the tourism now cannot really strive or develop without kind of appreciation of that and without being sustainable in terms of environment and environmental protection. It's really a big it has probably gone even beyond just being a selling point for the tourists. It is now more of a requirement to actually survive in this industry.
Environmental I	In practice or in theory, I think they may be two different elements. In practice its often sort of an add on or suggestion that things are 'green', 'sustainable, undamaging and even down to carbon and biodiversity neutral in terms of effects. There is no real indication that that would be the case in practice. The theory is that it would be those things. The theory should be undamaging, neutral etc. And positive for ecology, no additional disturbances and no additional impacts.
Environmental J	Eco tourism is. Aligning tourism and the environment in terms doing things that are out in the environment and enjoying the lovely things that Ireland has to offer. But having you know a minimal effect on an environment that you step into would be my understanding.
Environmental K	I wouldn't have sufficient knowledge to know the difference in eco-tourism and wildlife tourism but it would be tourism that

Participant	Eco-tourism Definition
	would be I suppose sustainable in the context of impacts. For example, you might have a tourism business which is based on people is going to Man United to watch matches. There is probably no eco-tourism dimension but if you are people coming to Kerry to look at the tourism product here which is landscape it is potentially. It's not it's a natural. It's a it's a product that is based on a naturally occurring as opposed to an artificial thing. Tourism in Manchester United is an artificial manmade construct. Tourism in this region in the in the landscape area is a natural product. The thing is. Then there's the distinction between that and suppose tourism which is based on interpretation of the environment which would be the kind of the eco tour type things and people that actually bring people on tours of the landscape specifically for interpretation of the landscape. Hill walkers and the like. I know there is a certain distinction between what would be called eco-tourism and other wildlife tourism type environmental tourism product.
Environmental L	I have issues with the word eco-tourism myself, because I believe eco-tourism is I've done research on this as well. It's what's termed a terminal green in that it very clearly presumes that whatever activity it is, it is positive for the environment. It certainly gives that impression. So eco-tourism implies, it's good for the environment as opposed to nature-based tourism, which is tourism based around nature, but that doesn't necessarily have a positive or negative impact. So you might see in Africa, for example, nature-based tourism would be going to see the elephants, whereas eco-tourism would be something like working in an elephant sanctuary or helping to build a fence around the reserve or something that is positive for the environment, for the ecology of the region. And I do think eco-tourism itself is a term can mislead and can often you brain wash something that isn't necessarily good for the environment.
Environmental M	I presume what people understand it to be is tourism that targets people who are interested in being outdoors, enjoying nature and enjoying natural environment. I don't know whether it focuses on sustainability in terms of how people travel and where people stay. I think probably it's more about the experience. But maybe there's an element of sustainability in terms of the travel as well.
Environmental N	I suppose it means something different to everyone. I suppose it could be that you're going to a destination or a product or you are viewing something that is in some way green, involves nature involves the outdoors, being out in nature and something that's developed in a sustainable manner. Something that's developed in a sustainable manner. I think if whether that be something like loop Head Lighthouse in Clare or the Cliffs or Mohair that you're striving to provide a product or service that takes the environment into account and I suppose provide some form of protection in some ways as well.
Environmental O	Um, I, I haven't actually mulled it over or given it thought. but if I just speaking off the top of my head, ecotourism, I would see it as, um, tourism initiatives that have, uh, an environmental focus that the focus is on making the environment at key attraction as part of the initiative. Um, so promoting, um, it might be, for example, a particular wildlife project by diversity, aspects, within, tourism development, ecotourism. suppose it's, it's the two, it's protecting, it's ensuring that the tourism

Participant	Eco-tourism Definition
	activity, um, is carried out in a way that protects the environment, but also making the environment a core part of the appeal is the, the attraction. So, making is central to the, um, to the whatever's being sold as the, to the, um, unique selling point, testicles of a particular initiative or a particular development. Um, I suppose rather than that, that's an in a general sense rather than getting down into specific examples.
Tourism A	Eco Tourism is bringing nature lovers, people who like ecology like landscape, they like habitats biodiversity and bringing people into an area and maybe showcasing what is within an area that will give that experience of going around and being able to experience it.
Tourism B	So, I think the term means two things simultaneously, possibly at the same time for some people and possibly there are some people who just take it as being one of those meanings. So, for me, it simultaneously means earning a living from tourism in a way that is sustainable and doesn't have a negative impact and may enhance the environment. But it also means using the environment, using something in the environment, some kind of a service or a set of conditions like a landscape using that as a basis of your business or in some way, intrinsically in your business, so to me, it means both of those things together. So, for example, horse-riding stables close to a sand dune, where you can go for a gallop on the beach, but where they're not littering or something where they're managing it in some way so that they think they enhance landscape rather than degrade it.
Tourism C	Ecotourism is a term that can have two meanings: There is a meaning that is applied in the marketing sense of providing guilt free tourism which allows people to enjoy tourism convinced of the fact that people will leave a lighter footprint after themselves by embarking on certain types of travel, certain types of accommodation, the use of certain types of facilities. So, in that sense it's a marketing tool. There is a deeper meaning to ecotourism, where the balance between inputs and outputs is measured and management by owners and operators and that can be for instance, an accommodation place that looks after its water supply and waste water treatment and its waste delivery and its food sourcing and supply and things like that. So, there are 2 definitions of it.
Tourism D	Eco-tourism is as interested in the development and protection of the natural world around as much as it is in terms of developing a business model that can provide employment, growth and profit. But I'm under no illusion that unless there's a financial model behind a product and an experience, it's not sustainable in the long run. What I mean by that is that often there are some great experiences to be had, but there is just not a financial model behind them that makes them viable and need to be kind of conscious of that. My opinion on eco-tourism is about experiencing the natural world, natural environment and it's structured in such a way that it is about a business that's trying to bring visitors and let them have an experience and that there needs to be a financial model behind that.
Tourism E	To my mind, it's environmentally sustainable tourism. And so, it's something which is it still the business of tourism, it's still the activity of tourism but in a way that is mindful of the environment and the environmental impact. So, whether that's

Participant	Eco-tourism Definition
	reducing the carbon footprint of that particular tourism activity or single use plastics and all that sort of stuff it's got that in mind. I think Ireland is well geared towards eco-tourism and I think the industry is very open to embracing as much eco-tourism as possible. If you look at the Wild Atlantic Way or even Ireland's hidden heartlands in the Midlands you know there are lots, you know there are swathes of Ireland which are green and beautiful and lend themselves very favourably to eco-tourism. And the last thing we want to do is to embrace mass tourism or over tourism and damage Ireland or the Irish tourism product by treating tourism as a pure commodity.
Tourism F	You know, it's a bit like lots of these words like sustainability, and I think it means that I think some of it is in the eye of the beholder. It can mean what people wanted to meet, but I presume the idea might be something along the lines of that it's tourism with a lighter touch in terms of the environment. Or perhaps its tourism focused for individuals who want some kind of experience to do with the environment. But I think underlying whatever definitions you might have, there is some kind of idea that it's in sync with the local environment somehow and shouldn't be, you know, having impacts that, for instance, mass tourism might have. Which can be quite damaging in terms of the environment, both locally and at an international scale.
Tourism G	Eco Tourism is tourism that uses, in a sustainable way, and enhances the landscape that's around it and product that surround it. It very sensitive and respectful to it and tries to help others understand this as well. This is two-fold that visitors who are coming in want to and are more environmentally aware and therefore want to try and reduce their carbon footprint or be more sensitive to the environment in which they're in. So, we'd like to have experiences that are also conscious of that and there is the educational bit as well. I think eco-tourism is concerned with their environment in a sustainable way and I think it should be profitable as well. But predominately it's all about sustainability of the assets that we have.
Tourism H	So, it's tourism that is sustainable, local, place based. I was part of the eco-tourism network, so I should be able to say a little bit more. But yeah, it's a lot of the time it would be local guides, maybe a little bit off the beaten track. So the sustainability element, I suppose, runs through everything from the accommodation to the eating local food, so it's again, it's just a whole experience. Staying in one place as well rather than going from Kerry to Donegal in a day or something. So, getting to know a place really well and the people, so it is that people and place as well incorporated into it.
Tourism I	The terms are often interchanged between sustainable and eco. And but there is a difference. And then there is rural tourism as well. So, I suppose the eco-tourism, my understanding would be it focus on protecting the environment would be their main focus and ensuring… all. You know that the tourism i… the service they are delivering is… Protective of the environment, I'm trying not to use the word sustainable so that carry over a lot of… you know, to make sure everything is recyclable, try to be as much involved in the circular economy as much as possible, reuse and reduce, even their water systems, if they were ecohotel their water systems, more recycle. And the waste water and that. You have fresh, fresh produce and make sure it's organic and as much as possible by as locally as possible.

Participant	Eco-tourism Definition
Tourism J	Ecotourism is about visitors who want to come to have an experience that is ecologically friendly. It is environmentally, environmental sustainability is to the core of the experience and less so for example, perhaps about economic sustainability or you know, it is Eco tourism so its ecologically centred. So, it's a narrow definition of sustainable tourism. If you like. It's a subset of a broader sustainable tourism umbrella and it is for those as I say who prize environmental sustainability as an integral part of experience nearly evolved beyond anything else. That's a very small sector in Ireland. Very small sector that I would finds ecotourism as opposed to sustainable tourism should be broader
Tourism K	Ecotourism, the technical term is responsible travel to natural areas that benefits communities, tourists and the visitor. And my understanding of it is tourism is much, much more enriching and the contribution to conservation is what matters, that the visitor actually learned something; goes home with something different that adds a little bit more to that holiday. And they take a lot more care in where they choose. They usually travel smaller, in smaller groups and maybe don't do this seven-day bus tour of Ireland. So it's holistic but it's probably the most misunderstood word. When I do slide shows training and I'm that kind of stuff, I have a lovely exotic Caribbean shot that I say that's what everyone thinks ecotourism is.
Tourism L	I think it was something to do with sustainability so you know we talk about sustainability to businesses in certain ways so in one way there's financial sustainability so say the other businesses I would have talked about who are running on a shoe string so how are those businesses going to survive, but then in relation to the environment this would be; are people doing things in a responsible way, are they protecting their local environment, and the town and are they being responsible in say they are building something at the back of their heritage centre are they making sure that they've done all the checks for the environment and there's no bird habitat or anything that would be kind of on their land.
Tourism M	we have difficulty ourselves in coming up with a definition of different types of tourism, because, for instance, we would also have what we call business tourism and several other niche areas of tourism. I think what a lot of people's definition would be is of a tourism product that attracts overseas visitors because of the fact that we are seen as being a green or eco-friendly country and that some of the tourism products that we have, for instance, green ways etc. would fit into that environmentally friendly category and thus attracting certain types of individuals who would gravitate towards such an attraction for tourism product.
Tourism N	It's kind of a phrase almost like sustainability that it almost has like, everyone would have a different opinion or interpretation of a definition for ecotourism. From my own opinion it historically, previous decades or years, ecotourism would have been almost a very niche area of tourism for a specific type of traveller who wants to get away from it all and is very green environmentally focused, their main aim is to have eco-friendly type of experience when they are on a vacation or holiday and it informs their choice of a destination. Having the least impact on the environment. In recent years there is a trend in my opinion that even mainstream tourism is actually becoming more eco in the way its planning for the future. There

Participant	Eco-tourism Definition
	is a lot more awareness around the impact of tourism on climate change, our travel habits and things like that. So, going forward I can see ecotourism being more of a mainstream type of tourism. It would be that providers and different people would be aiming to have an eco-friendly or ecotourism business as a mainstream element of their product or destination or whatever sector it is. So historically it would have been very niche, environmentally sustainable hipster hippy people, whereas now a lot more people would like to see themselves as an eco-friendly traveller as best they can in relation to their awareness of global climate change issues and sustainability.
Tourism O	Eco tourism is low-impact tourism. Tourism that doesn't have a huge impact on the environment. And that's not just talking about rural areas, but also talking about city areas. You may have seen recently there have been large protests in cities like Barcelona, Venice who are major urban areas about the huge impact tourism is having on their cities, both from a social point of view, but also from an environmental point of view as well. You can see the effects on the ground in Venice. You can see the effects on the infrastructure that's required to have such numbers of tourists within the city and the problems that are or the environmental impact that has within the city as well, everything from waste to extra demand and on the infrastructure of the city too. And then you can see the impact of that to a very small tourism attraction that just has a few thousand as well. That's the Skellig's, which has been in the news quite a bit, but with even a small amount of tourists, that has an environmental impact there as well. So the capacity of a tourism attraction really depends on the tourism attraction you're talking about, you know, they will differ greatly. Like the capacity to say in Newgrange is very small and even though they have a greater capacity to take there'd be more numbers than they're actually reducing the numbers in these years because even with the numbers they're taking and they can manage. The volume of people, the oxygen in the chamber, that all has an effect on the environment inside and the archaeology inside as well. In the same way there are only small numbers going to the Skellig's that has an impact on that environment there as well. The ability of each environment is different to what the numbers they can take and really you need to do an assessment on each attraction to see what is the ability of that environment to take tourists. I think that's what I would understand as far as eco-tourism is concerned. On the other side into services that would be provided that they are done in an ecological way. That say like hotels their procurement of products that they would utilize in providing the services they would look at the impact of all of those products as well on the environment. And there are a number of eco labels around Europe that Hotels are assessed for which they can apply for different standards as well. I think it's important that they are conscious in their mind of the product they're using, how far the products are travelling to get to their hotels, whether the food is local, what food miles are being used in it, and there are hotels who provide huge amounts of their own food within five, 10 miles of where they're living. That's important for local economies, as well that most of the stuff that they're providing for tourists gives them a flavour of what the locals but also helps them develop the local economy as well. And I think that's really important, too. So for me, the understanding of it is

Participant	Eco-tourism Definition
	this low impact on the environment that there is a consideration in all areas of our products that are being used as well of what the impact would be on the environment as well. And if they can use products that have a lower, lower impact, too. And I would also say the way people get there as well and the way they travel between different destinations and so on, that should also be considered because anything that increases carbon emissions, the carbon footprint is very important and I think also can be measured by each establishment in what they're providing as well to inform tourists of the impact they're having in the area in what they do. I'd be in favour of something like within hire-cars that at the end of a tour, they know the mileage first and then they can calculate the carbon footprint of what they've done within a tour of Ireland within their hire-car. We can calculate that for flights now. So there's no reason why we can't be saying to the same tourist, well, your impact on your travel within your car was so and so many tons of carbon emissions, you know. So that can inform them as well. There is a market out there for people who want low impact and the eco tour, the eco-tourism product, and they try to do it in the best way possible. I think there's a hierarchy as well. I think bus tourism is one of the lowest impacts as far as carbon emissions are concerned, say, compared to people hiring their own car. And then rail tours, of course, as well would be very low impact too. So if people travelling in groups also tend to have a lower impact, if they're using vehicles that would be burning carbon put it that way. So the higher numbers that travel together it's just like anything, whether you're looking at a car, what people are driving to work in, car sharing, you know, when we go on holidays as well, a group touring tends to be lower carbon impact on the global scale. And then if we all hire a car and go and see that hiring a car. If every tourist drove a hired car then the roads to the west coast of Ireland would be all clamed up. So that would have an impact as well. So getting people to come to Ireland, we're not a big country. Weather wise, there are issues along the West Coast, particularly say if you're a cycling and there are days where wind and rain does make it very amenable to cycling. But, you know, you say if you're travelling in Germany or Holland or somewhere like that, it would be easier to do or the Mediterranean areas it would be easier to do. In Ireland, we get wind and rain on the on the West Coast, and if you have ever cycled out that area on a not so good today. You see the consequences for your progress. Sometimes you just have to put the bike underneath the coach and take your coach to the next destination. But I think all of those things must be made available to people if you want to have a lower impact on the way they travel and the way they see the city. Also, where they stay and the restaurants they are, it's important that they develop labels for themselves to show well if people want to go to a restaurant where it's produce is all from the local area. They show what percentage of products they use from the local area and how to develop that. The same with hotels, the standards that they have, and the labels that they abide by. So that's how I would see the eco-tourism. The other important point is entry into Ireland. We've got a lot of people coming into Dublin their flying in for two or three days or four days, and there's lots of flights to as well. To get people to stay here longer because the big impact on carbon emissions is flights. Then if they have a slower holiday, like the slow food movement, we need to slow

Participant	Eco-tourism Definition
	holiday movements, then they can do things that they can do in a way that is more carbon intensive, that need quicker travel around as well. Also, may benefit if they came to Ireland for two weeks rather than four days, they wouldn't just go to Dublin. There would be a greater spread of tourism around the country as well.
Tourism P	Eco-tourism to me is a destination that you can go on holiday to and it has a particular leaning towards ecology the ecology of the place, nature and experience wild life. So, it could in this context here it could be walks through the national park to look at the trees, look at the flowers, the sand dunes to go around and discover it or it could be the beaches in terms of the Blue Flag initiative. It could be going out whale watching. So, it's a destination really that has a leaning towards one of its key assets which in this case is the ecology of the area.

Chapter 3 Appendix IV Table 1 Existing definitions of eco-tourism - table adapted from Sirakaya et al. (1999) and updated.

Research Article	Page number(s)	Eco-tourism Definition	Critical review
Ceballos-Lascurain (1987)	[page 14]	*Traveling to relatively undisturbed areas or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas*	This relies on undisturbed/ natural conditions. It does not provide for restorative eco-tourism.
Butler (1989)	[page 9-17]	*Ecotourism can be described as the type of tourism that is inherently sensitive to communication, awareness and environmental enhancement. These characteristics of ecotourism make it less likely to create social and environmental problems commonly associated with conventional tourism. Ecotourism attempts to give travellers a greater awareness of environmental systems and contribute positively to the destination's economic social and ecological conditions*	This relies on motives which are intrinsic to knowledge and does not clearly define the scope of what the parameters are.
Fennell and Eagles (1990)	[page 23 & 24]	*Ecotourism or nature-oriented travel...[is] a viable means to stimulate economy and at the same time to establish and maintain a system of protected areas...characterized by a primary desire to study specific elements of nature in sensitive environments...fulfilled by activities such as bird watching, whale viewing and wild-flower photography. The ecotourism industry involves the systematic development and marketing of nature-oriented travel packages.... Eco-tourism thrives on three main com-ponents: the attraction of tourists to unique, accessible natural areas; the use of tourism as a tool in nature conservation through the generation of education, profits, changing attitudes, community development, and political priorities; the provision of employment and entrepreneurial opportunities for local people.*	This definition required the receiving natural asset to be sensitive which is not always the case.
Kutay (1989)	[page 30]	*Ecotourism is a model of development in which natural areas are planned as part of the tourism base and biological resources are clearly linked to social economic sectors.*	This is infrastructure focused.
Ziffer (1989)	[page 6]	*A form of tourism inspired primarily by the natural history of an area, including its indigenous cultures. The ecotourist visits relatively undeveloped areas in the spirit of appreciation, participation, and sensitivity. The*	This excludes urban ecotourism experiences.

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		ecotourist practices a non-consumptive use of wildlife and natural resources and contributes to the visited area through labour or financial means aimed at directly benefiting the conservation of the site and the economic well-being of the local residents. Ecotourism also implies a managed approach by the host country or region which commits itself to establishing and maintaining the sites with the participation of local residents, marketing them appropriately, enforcing regulations, and using the proceeds of the enterprise to fund the area's land management as well as community development.	
Boo (1993)	[page 4-8]	*Ecotourism / nature-oriented tourism refers to tourism to relatively undisturbed natural areas with the specific objective of admiring, studying and enjoying the scenery and its flora and fauna.*	This relies on undisturbed/ natural conditions. It does not provide for restorative eco-tourism.
Farrell and Runyan (1991)	[page 34]	*Focus on the environment in a special manner in which conservationists and tourist interests see the mutual advantages of working together to preserve environmental quality while mutually protecting tourism... nature conservation aided by cooperative strategies... a subset of nature tourism taken a step farther, with nature and tourism considered equal partners... exclusively purposeful and focused on the enhancement or maintenance of natural systems through tourism.*	This relies on the need for conservation management to be part of the experience; which is often not the case in practice.
Place (1991)	[page 189]	*Gradual small-scale approach, based on local savings and investment...local participation may provide the opportunity to integrate conservation and economic development for park-based tourism development.*	Narrow scope that does not provide for the suite of large-scale ecotourism available.
Hunt (1992)	[page 2-3]	*Among the list of "neo-tourism" (new tourism initiatives, new players, new concerns, new approaches, new ideas and new terminology) activities is ecotourism. Eco/nature tourism is the result of a long overdue recognition that tourism, if properly developed and managed, can contribute to the protection and preservation of unique natural and cultural environments, rather than exploit them. Ecotourism advocates believe that there is a "kinder and gentler" tourism that does not necessarily require extensive and intensive development or environmentally or socially degrading activities.*	This is an oversimplified introduction to the concept.

Research Article	Page number(s)	Eco-tourism Definition	Critical review
Williams (1992)	[page 15]	*Ecotourism entails "travel with substance" [and involves] traveling in relatively primitive and rural circumstances, rustic accommodations, muddy trails, basic amenities, the pay-off being a stronger appreciation and closer contact with wildlife, local culture and resource conservation issues.*	Narrow scope that does not provide for the suite of large-scale ecotourism available.
Brause (1992)	[page 29]	*Ecotourism suggests travel opportunities designed to help people get more in touch with the beauty, wonder, and value of the environment and then to do something to preserve, protect, or restore what has been destroyed or nearly destroyed by our recent (and, in some cases, distant) ancestors.*	Narrow scope that does not provide for the suite of large-scale ecotourism available.
Western (1993)	[page 7-8]	*Ecotourism is really an amalgam of interests arising out of environmental, economic and social concerns...incorporates both a strong commitment to nature and a sense of social responsibility...extends to the sensitivity of the travellers. The term "responsible travel," another aphorism for ecotourism, encapsulates its aims.*	This is an oversimplified introduction to the concept.
Agardy (1993)	[page 224-225]	*Viewing wildlife (such as birds, sea turtles, and marine mammals), learning about coastal ecology (especially wetlands ecology), SCUBA diving or snorkelling in undisturbed areas, or to experience nature in its broadest sense.*	Narrow scope that does not provide for the suite of large-scale ecotourism available.
Miller (1993)	[page 187-88]	*Ecotourism has international currency as a concept grounded in preservation-conservation and sustainable development ideals. As the term has come to be employed, it evokes a host of near-synonyms... "equality tourism," "ethnic tourism," "cultural tourism," "socio-ecological tourism," "photo-safari tourism," "drive tourism," and "surfing tourism.*	Narrow scope that does not provide for the suite of large-scale ecotourism available.
	[page 108-109]	*New form of tourism...especially concerned with the appreciation of nature as the primary motive to participate, but with an essential element of zero negative impacts...based on relatively undisturbed natural areas, non-damaging, non-degrading, ecologically sustainable, a direct contributor to the continued protection and management of the natural areas used, subject to an adequate and appropriate management regime.*	Narrow scope that does not provide for the suite of large-scale ecotourism available. Does not provide adequate structures for policy makers.
Wallace (1993)	[page 40]	*Providing assistance such as interpretation, resource inventory and monitoring, and visitor concession management—working effectively with*	This is an oversimplified introduction to the concept. Does

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		local people who live in or near wildlands and cooperating with non-profits—everyone will benefit from viewing wilderness in the global context.	not provide adequate structures for policy makers.
Wight (1995)	[page 5]	*An enlightening nature travel experience that contributes to conservation of the ecosystem, while respecting the integrity of host communities.*	This is an oversimplified introduction to the concept. Does not provide adequate structures for policy makers.
Andersen (1994)	[page 32]	*Ecotourism is a tourism experience infused with the spirit of conservation and cultural change that results in a net positive effect for the environment and local economy...may be part of an overall economic and environmental plan that includes sustainable agriculture, micro-industries and other activities...minimize the human intrusion on the ecosystem, to educate travellers and to enhance the spiritual experience in nature that fosters respect and stewardship.*	This definition assumes the need for conservation measures, when the tourism activity may have no adverse impacts and therefore, can be observation based with no positive action – i.e. neutral outcomes for conservation.
Buckley (1994)	[page 664]	*Integration of nature-based products and markets, sustainable management to minimize impacts, financial support for conservation, and environmental attitudes and education of individual people.*	Minimising impacts does not avoid impacts and thus can facilitate a gradual decline in the ecological integrity of an area.
Wall (1996)	[page 7]	*Ecotourism is usually used to refer to tourism which takes place in relatively natural settings or is directed at specific components of such settings including rare or endangered species of plants or animals. These locations are often at considerable distance from the areas of demand, the former often being in countries of the South whereas the ecotourists usually originate in the North... "eco-nomically viable tourism."*	Narrow scope that does not provide for the suite of large-scale ecotourism available.
Place (1995)	[page 161-162]	*Ecotourism represents a response to phenomena occurring in both center and periphery, deriving from the dominant global economic paradigm based on continuous growth... in the center, industrial and urban development caused destruction of natural ecosystems and degradation of the environment in general...in the periphery, stagnant or declining commodity prices and growing foreign debts forced governments to seek economic alternatives.*	This definition is more descriptive of the emergence of the concept than a clear definition.

Research Article	Page number(s)	Eco-tourism Definition	Critical review
Kinnaird and O'Brien (1996)	[page 72]	*Ecotourism or nature tourism is implicitly assumed to have little or no impact on the environment...appears to be an ideal solution for combining goals of development and conservation.*	This is a broad definition which is inclusive – however, cultural connection has been shown to be a key element or tenet of ecotourism in recent literature.
Weaver (2001)	[page 105]	*Ecotourism is a form of tourism that fosters learning experiences and appreciation of the natural Environment and enhances the cultural resource base of the destination and promotes the viability of the operation.*	This definition provides for learning experiences in a non-prescriptive way but fails to address the issue of sustainability.
Fennell (2001)	[page 416]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states: *The five variables most frequently cited, of the 17 dependent variables, include the following: (1) reference to 'where ecotourism occurs', e.g. natural areas; (2) 'conservation'; (3) 'culture'; (4) 'benefits to locals'; and (5) 'education'*	It is not clear if these principals would be a fundamental requirement for a definition or steering guidelines. There vague elements in this would present as complex to implement from a policy perspective.
Fennell and Dowling (2003)		*Ecotourism is a sustainable form of natural resource-based tourism that focuses primarily on experiencing and learning about nature, and which is ethically managed to be low-impact, non-consumptive and locally oriented (control, benefits and scale). It typically occurs in natural areas and should contribute to the preservation of such areas.*	Minimising impacts does not avoid impacts and thus can facilitate a gradual decline in the ecological integrity of an area.
Donohoe and Needham (2006)	[page 2006 – 207]	Does not provide a formal definition but identifies tenets of ecotourism. *Ecotourism includes community participation and benefits, environmental conservation, sustainable development, awareness/education, cultural sensitivity towards locals, ethics/responsibility and cultural conservation."*	No formal definition from which to assess.
Honey (2008)		*Ecotourism is travel to fragile, pristine and usually protected areas that strives to be low impact and (usually) small scale. It helps educate the*	This relies on fragile and pristine natural conditions. Therefore, the

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		traveller; provides funds for conservation; directly benefits the economic development and political empowerment of local communities; and fosters respect for different cultures and for human rights.	definition is too narrow for the modern application.
Nistoreanu et al. (2011)	[page 35]	*Ecotourism is a form of tourism where main motivation for tourists is the observation and appreciation of nature and local traditions related to nature and it must meet the following conditions: to contribute to preserving and protecting nature, to use local human resources, to have an educational experience, to cultivate respect for nature - awareness of tourists and local communities, to have minimum negative impact on the natural environment and socio-cultural upliftment.*	This definition assumes the need for conservation measures, when the tourism activity may have no adverse impacts and therefore, can be observation based with no positive action – i.e. neutral outcomes for conservation.
Sambotin et al. (2011)	[page 266]	*Ecotourism is a form of tourism developed in natural areas, whose goal is to acknowledge and to appreciate nature and local culture, which includes conservation measures and ensure an active involvement, generating benefits for the local population.*	This definition assumes the need for conservation measures, when the tourism activity may have no adverse impacts and therefore, can be observation based with no positive action – i.e. neutral outcomes for conservation.
Fennell (2014)	[page 15]	*An intrinsic, participatory and learning-based experience which is focused principally on the natural history of a region, along with other associated features of the man–land nexus. Its aim is to develop sustainably (conservation and human well-being) through ethically based behaviour, programmes and models of tourism development which do not intentionally stress living and non-living elements of the environments in which it occurs*	This required an educational experience and precludes self-directed tourism with ecological motives and neutral or positive engagement with nature.
Hunt et al. (2015)	N/A	No formal definition provided by the study. The introduction uses the International Eco-tourism Societies definition (see below).	N/A
The International Eco-tourism	[page 1]	Responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education.	This required an educational experience and precludes self-directed tourism with ecological

Research Article	Page number(s)	Eco-tourism Definition	Critical review
Society (2015)			motives and neutral or positive engagement with nature. While the definition includes "responsible travel," it could be more explicit about the specific responsible travel practices.
Das and Chatterjee (2015)	[page 8]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states: *All these cases reflect the failure of ecotourism to espouse the underlying principles of biodiversity conservation. The reasons behind the problems associated with ecotourism are numerous like (1) revenue leakages, as labor is drawn from urban sector instead of focusing on training of unskilled or less-skilled locals, (2) inequitable distribution of income among the locals, (3) compulsory displacement for the creation of national parks leading to large scale loss of land, homelessness, food insecurity, loss of lives and increase in morbidity, (4) restrictions in accessing sanctuary resulting in joblessness and (5) damage to crop and livestock by wildlife, (6) sticking only to gun and guard approach for preservation, (7) crowding, crime, begging, prostitution etc. associated with the increase in the number of tourists in ecotourism spots, (8) insensitive attitude of the tourist, (9) lack of education for visitors as well as locals and* ***(10) policy gap in terms of poor planning and improper and unethical management of ecotourism.***	N/A
Cobbinah (2015)	[page 185]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states:	It is not clear if these principals would be a fundamental requirement for a definition or

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		The prevailing ecotourism mantra, espousing sustainable development over the traditional concentration on revenue generation in tourism activities, has resulted in the recognition of ecotourism as a 'change driver', due to its foundational principles. This characteristic of ecotourism is based on five principles; its potential to: stimulate environmental conservation, encourage community participation (working in cooperation with local people), empower vulnerable groups (e.g., women), deliver economic benefits (e.g., jobs), and preserve local culture.	steering guidelines. There vague elements in this would present as complex to implement from a policy perspective.
Conway and Cawley (2016)	[page 4-5]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states: *More emphasis was placed on maximising the economic benefits to be gained from ecotourism and protecting the quality of the environment than on defining ecotourism strictly or developing particular activities, an approach confirmed during interviews with the organisational representatives.*	N/A
Chandel and Mishra (2016)	[page 150]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states: *The present paper concludes that the ecotourism product must focus on the following salient features:* • Tourists appreciate it more when they are given the opportunity to directly and personally experience nature (focus on natural area); • Assistance must be provided only when needed to enhance the experience (interpretation and education); • Tourism should be in line with the best practices of environmental sustainability (environmentally sustainable practices);	The principals require contribution from **all** stakeholders which is overly proscriptive and would result in a very narrow application in practice. However, these principals are generally well considered.

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		• Generous contributions from different stakeholders towards the environmental conservation of the local area (contribution towards conservation); • Local communities must benefit economically from independent activities of all stakeholders (benefit to local communities); • Local cultural interpretation and upliftment are important. The local culture must be inclusive in the ecotourism philosophy (respect towards indigenous culture); • From the business and profit-making perspective, consumers' expectations must be consistently met (customer satisfaction); • Tourism must be promoted in such a way that it does not lead to unrealistic expectations (responsible marketing). [page]	
Boley and Green (2016)	[page 7]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. This paper presents a conceptual framework of the "*Symbiotic relationship between natural resource conservation and ecotourism… where quality natural resources increase an ecotourism destination's competitiveness while tourism embedded in natural areas increases the economic incentives to protect the remaining natural land since the natural resources are the foundation of ecotourism demand.*"	N/A
Stronza et al. (2019)	[page 244]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states: *Defining and measuring ecotourism carefully and writing about its impacts—both positive and negative, social, and ecological—are critical also for subjecting all forms of tourism operations to scrutiny. Added rigor in evaluation can help distinguish greenwashing from legitimate and effective*	N/A

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		forms of ecotourism.	
Hussain (2022)	[page 124]	No formal definition provided. This paper discusses ecotourism concepts without providing a definition. The paper states: *Since no global initiative exists at present for gathering ecotourism data, ecotourism is considered a specialty segment of the larger nature tourism market. Ecotourism, however, should be viewed as a distinct from of nature tourism, as nature tourism is not defined by its benefits to both conservation and people in the host country*	N/A
The International Ecotourism Society [2024 derived from a 2015 definition]	[page 1]	Ecotourism is now defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (TIES, 2015). Education is meant to be inclusive of both staff and guests. Ecotourism is about uniting conservation, communities, and sustainable travel. This means that those who implement, participate in and market ecotourism activities should adopt the following ecotourism principles: • Minimize physical, social, behavioral, and psychological impacts. • Build environmental and cultural awareness and respect. • Provide positive experiences for both visitors and hosts. • Provide direct financial benefits for conservation. • Generate financial benefits for both local people and private industry. • Deliver memorable interpretative experiences to visitors that help raise sensitivity to host countries' political, environmental, and social climates. • Design, construct and operate low-impact facilities.	This required an educational experience and precludes self-directed tourism with ecological motives and neutral or positive engagement with nature. While the definition includes "responsible travel," it could be more explicit about the specific responsible travel practices.

Research Article	Page number(s)	Eco-tourism Definition	Critical review
		• Recognize the rights and spiritual beliefs of the Indigenous People in your community and work in partnership with them to create empowerment.	
World Tourism Organization (UN Tourism) [2024 derived from a 2002 definition]	[page 1]	According to the UN Tourism's definition, ecotourism refers to forms of tourism which have the following characteristics: • All nature-based forms of tourism in which the main motivation of the tourists is the observation and appreciation of nature as well as the traditional cultures prevailing in natural areas. • It contains educational and interpretation features. • It is generally, but not exclusively organised by specialised tour operators for small groups. Service provider partners at the destinations tend to be small, locally owned businesses. • It minimises negative impacts upon the natural and socio-cultural environment. • It supports the maintenance of natural areas which are used as ecotourism attractions by: • Generating economic benefits for host communities, organisations and authorities managing natural areas with conservation purposes; • Providing alternative employment and income opportunities for local communities; • Increasing awareness towards the conservation of natural and cultural assets, both among locals and tourists. Source: The British Ecotourism Market, UNWTO 2002	This required an educational experience and precludes self-directed tourism with ecological motives and neutral or positive engagement with nature.

Appendices for Chapter 4

Ecological Benefits of Tourism Management: Enhancing floral diversity and the implication of habitat identity on conservation goals.

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Author contributions: Andrew Torsney, and Yvonne M. Buckley had substantial contributions to conception, design, analysis, and interpretation of data to support the paper. Andrew Torsney oversaw the data collection, performed the data analysis, and wrote the first draft.

Data availability: The data and code that support the findings of this study are openly available at https://github.com/TorsneyStat/Ecological-Benefits-of-Tourism-Management/releases/tag/EcologicalBenefits DOI: 10.5281/zenodo.10055215

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Chapter 4 Appendix I Technical definitions for Machair and Fixed Dune Habitats.

The habitat classification of fixed dunes is highly variable; however, this variability is due to the broad nature of the classification and there are many sub-class habitats within the Fixed Dune habitat type (Andersson, 1950, Robinson and Anderson, 1997, Doody, 1991, Tzonev et al., 2005, Quigley, 1991, Delaney et al., 2013); generally this habitat is less floristically diverse than machair with a much less complex community composition – often dominated more strongly by graminoid species. The European Environmental Agency (2019a) describes fixed dunes as a habitat stabilised and colonised by more or less closed perennial grasslands and abundant carpets of lichens and mosses. The vegetation may be a closed cover of grassland, sparse annual grassland on sand or dominated by mosses and lichen; the content of limestone (Ca2+) may vary greatly and is generally diminishing with age and succession towards brown dune systems (dune heathland).

The defining characteristics of machair are relatively consistent within the literature; focusing on a species rich diverse community composition with soil/sand substrate with high mineral content that is lime rich and a pH usually greater that 7.0 (Angus, 2006, Bassett and Curtis, 1985, European Environmental Agency, 2019b, Gaynor, 2006, Kent et al., 2003, Love, 2009, Ritchie, 1976, Delaney et al., 2013). Within the machair classification there are also sub classes of dry and wet machair as described in (Gaynor, 2006) which are distinguishable by the community composition. The initial scientific classification of the habitat was presented by Ritchie (1976) with following criteria:

- A base of blown sand which has a significant percentage of shell-derived materials;
- Lime-rich soils with pH values normally greater than 7.0;
- A level or low-angle smooth surface at a mature stage of geomorphological evolution
- A sandy grassland type vegetation with long dune grasses and other key dune species having been eliminated. Core plants are red fescue (*Festuca rubra*), common bird's-foot-trefoil (*Lotus corniculatus*), white clover (*Trifolium repens*), yarrow (*Achillea millefolium*), lady's bedstraw (*Galium verum*), ribwort plantain (*Plantago lanceolata*), eyebright (*Euphrasia officinalis*), daisy (*Bellis perennis*) and the moss (*Rhytidiadelphus squarrosus*);
- Biotic interference such as is caused by heavy grazing, sporadic cultivation, trampling and sometimes artificial drainage should be a detectable influence within the recent historical period;
- An oceanic location with a moist, cool climatic regime; and
- Machair plains flood or are at least marshy in winter

The European Environmental Agency (2019b) describes machair (*in Ireland) as a complex habitat comprised of a sandy coastal plain resulting partially from grazing and/or rotational cultivation, in an oceanic location with a cool, moist climate. The windblown sand has a significant percentage of shell derived material, forming a lime rich soil with pH values normally greater than 7. Vegetation is herbaceous, with a low frequency of sand binding species. This habitat type is known to be particularly vulnerable to effects from tourism and trampling. The identification of machair is now recognised to be exceptionally complex and challenging (Angus, 2006); with climate variables playing a vital part of the habitat classification used by Gaynor (2006). This approach relies on wind directionality and other static geomorphological features to first screen for location eligibility before the species composition criteria are applied. Thus, this approach does not account for the occurrence of machair outside of these climatic factors even if the topography, physical structure, substrate characteristics and community composition are consistent with the habitat identity.

Appendices for Chapter 5

Environmental attitudes shape people's ability to perceive biodiversity, but not their preferences, in a manipulated grassland experiment

Authors: Andrew Torsney[32,33] & Yvonne M. Buckley[34,35]

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Author contributions: Andrew Torsney, and Yvonne M. Buckley had substantial contributions to conception, design, analysis, and interpretation of data to support the paper. Andrew Torsney oversaw the data collection, performed the data analysis, and wrote the first draft. YMB made contributions to subsequent drafts.

Data availability: The data and code that support the findings of this study are openly available at https://github.com/TorsneyStat/Environmental-attitudes-shape-people-s-ability-to-perceive-biodiversity DOI:10.5281/zenodo.11073085

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Chapter 5 Appendix I Questionnaire used for the study group A – including the participant consent form

Informed Consent Form

School of Natural Sciences, Trinity College Dublin

Title of research study: Preference testing of grasslands

This study and this consent form have been explained to me. I believe I understand what will happen if I agree to be part of this study.

I have read, or had read to me, this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.

Participant Name (Block Caps): _____.

Participant Signature: _____.

Date: _____.

Researchers Signature:_____**Date:**_____

Participant Details	
Name	
Preferred Gender ID	
Age	
Nationality	
College Course	
Year of Course	
University	
Phone Number	

Ecological Concern Parameters

People around the world are generally concerned about environmental problems because of the consequences that result from harming nature. However, people differ in the consequences that concern them most. Please rate each of the following items from 1 (not important) to 7 (supreme importance) in response to the question:

Only use each number once

Leave 5 options blank

I am concerned about environmental problems because of the consequences for ____.					
Plants		Me		People In My County	
Marine Life		My Lifestyle		All People	
Birds		My Health		Children	
Animals		My Future		Future Generations	

SAMPLE ANSWER

I am concerned about XXXXX ____.					
Example A		Example E	**5**	Example I	
Example B	**7**	Example F	**3**	Example J	**4**
Example C	**1**	Example G		Example K	
Example D		Example H	**2**	Example L	**6**

Ecological World View - Tick the Appropriate Box from Very Strongly Agree (Left) to Very Strongly Disagree (Right)

	New Ecological Paradigm (NEP) Scale	Very Strongly Agree	Strongly Agree	Mildly Agree	Mildly Disagree	Strongly Disagree	Very Strongly Disagree
1	We are approaching the limit of the number of people the Earth can support.						
2	Humans have the right to modify the natural environment to suit their needs.						
3	When humans interfere with nature it often produces disastrous consequences.						
4	Human ingenuity will ensure that we do not make the Earth un-liveable.						
5	Humans are seriously abusing the environment.						
6	The Earth has plenty of natural resources if we just learn how to develop them.						
7	Plants and animals have as much right as humans to exist.						
8	The balance of nature is strong enough to cope with the impacts of modern industrial nations.						
9	Despite our special abilities, humans are still subject to the laws of nature.						
10	The so-called "ecological crisis" facing humankind has been greatly exaggerated.						
11	The Earth is like a spaceship with very limited room and resources.						
12	Humans were meant to rule over the rest of nature.						
13	The balance of nature is very delicate and easily upset.						
14	Humans will eventually learn enough about how nature works to be able to control it.						
15	If things continue on their present course, we will soon experience a major ecological catastrophe.						

TOP RANK

Rank 1

Preference

Rank 2 | Rank 2

Rank 3 | Rank 3 | Rank 3

Rank 4 | Rank 4 | Rank 4 | Rank 4

Rank 5 | Rank 5 | Rank 5

Rank 6 | Rank 6

BOTTOM RANK

Rank 7

INSTRUCTIONS

Rank photos according to **your preference** in the layout shown – then flip the photos and put the *corresponding number in*

Questions related to <u>your preference</u> ranking	
Reasons for rankings	**Answers**
Why did you choose your top-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
Why did you choose your bottom-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
How similar or dissimilar do you think the photos are?	
Do you think you were able to observe enough of a difference between the photos to make an informed decision? Please provide details explaining why.	
Which ranking categories were the hardest to order and why?	
Do you have any other comments related to the images?	

TOP RANK

Diversity

Rank 1

Rank 2 | Rank 2

Rank 3 | Rank 3 | Rank 3

Rank 4 | Rank 4 | Rank 4 | Rank 4

Rank 5 | Rank 5 | Rank 5

Rank 6 | Rank 6

Rank 7

BOTTOM RANK

INSTRUCTIONS

Rank photos according to **diversity** in the layout shown – then flip the photos and put the *corresponding number in the box*

Questions related to <u>your perceived diversity</u> ranking	
Reasons for rankings	**Answers**
Why did you choose your top-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
Why did you choose your bottom-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
How similar or dissimilar do you think the photos are?	
Do you think you were able to observe enough of a difference between the photos to make an informed decision? Please provide details explaining why.	
Which ranking categories were the hardest to order and why?	
Do you have any other comments related to the images?	

Chapter 5 Appendix II Questionnaire used for anchoring test group B

Participant Details	
Name	
Preferred Gender ID	
Age	
Nationality	
College Course	
Year of Course	
University	
Phone Number	

Ecological Concern Parameters

People around the world are generally concerned about environmental problems because of the consequences that result from harming nature. However, people differ in the consequences that concern them most. Please rate each of the following items from 1 (not important) to 7 (supreme importance) in response to the question:

Only use each number once

Leave 5 options blank

I am concerned about environmental problems because of the consequences for ____.					
Plants		Me		People In My County	
Marine Life		My Lifestyle		All People	
Birds		My Health		Children	
Animals		My Future		Future Generations	

SAMPLE ANSWER

I am concerned about XXXXX ____.					
Example A		Example E	**5**	Example I	
Example B	**7**	Example F	**3**	Example J	**4**
Example C	**1**	Example G		Example K	
Example D		Example H	**2**	Example L	**6**

Ecological World View - Tick the Appropriate Box from Very Strongly Agree (Left) to Very Strongly Disagree (Right)

	New Ecological Paradigm (NEP) Scale	Very Strongly Agree	Strongly Agree	Mildly Agree	Mildly Disagree	Strongly Disagree	Very Strongly Disagree
1	We are approaching the limit of the number of people the Earth can support.						
2	Humans have the right to modify the natural environment to suit their needs.						
3	When humans interfere with nature it often produces disastrous consequences.						
4	Human ingenuity will ensure that we do not make the Earth un-liveable.						
5	Humans are seriously abusing the environment.						
6	The Earth has plenty of natural resources if we just learn how to develop them.						
7	Plants and animals have as much right as humans to exist.						
8	The balance of nature is strong enough to cope with the impacts of modern industrial nations.						
9	Despite our special abilities, humans are still subject to the laws of nature.						
10	The so-called "ecological crisis" facing humankind has been greatly exaggerated.						
11	The Earth is like a spaceship with very limited room and resources.						
12	Humans were meant to rule over the rest of nature.						
13	The balance of nature is very delicate and easily upset.						
14	Humans will eventually learn enough about how nature works to be able to control it.						
15	If things continue on their present course, we will soon experience a major ecological catastrophe.						

TOP RANK

Rank 1

Diversity

Rank 2 | Rank 2

Rank 3 | Rank 3 | Rank 3

Rank 4 | Rank 4 | Rank 4 | Rank 4

Rank 5 | Rank 5 | Rank 5

Rank 6 | Rank 6

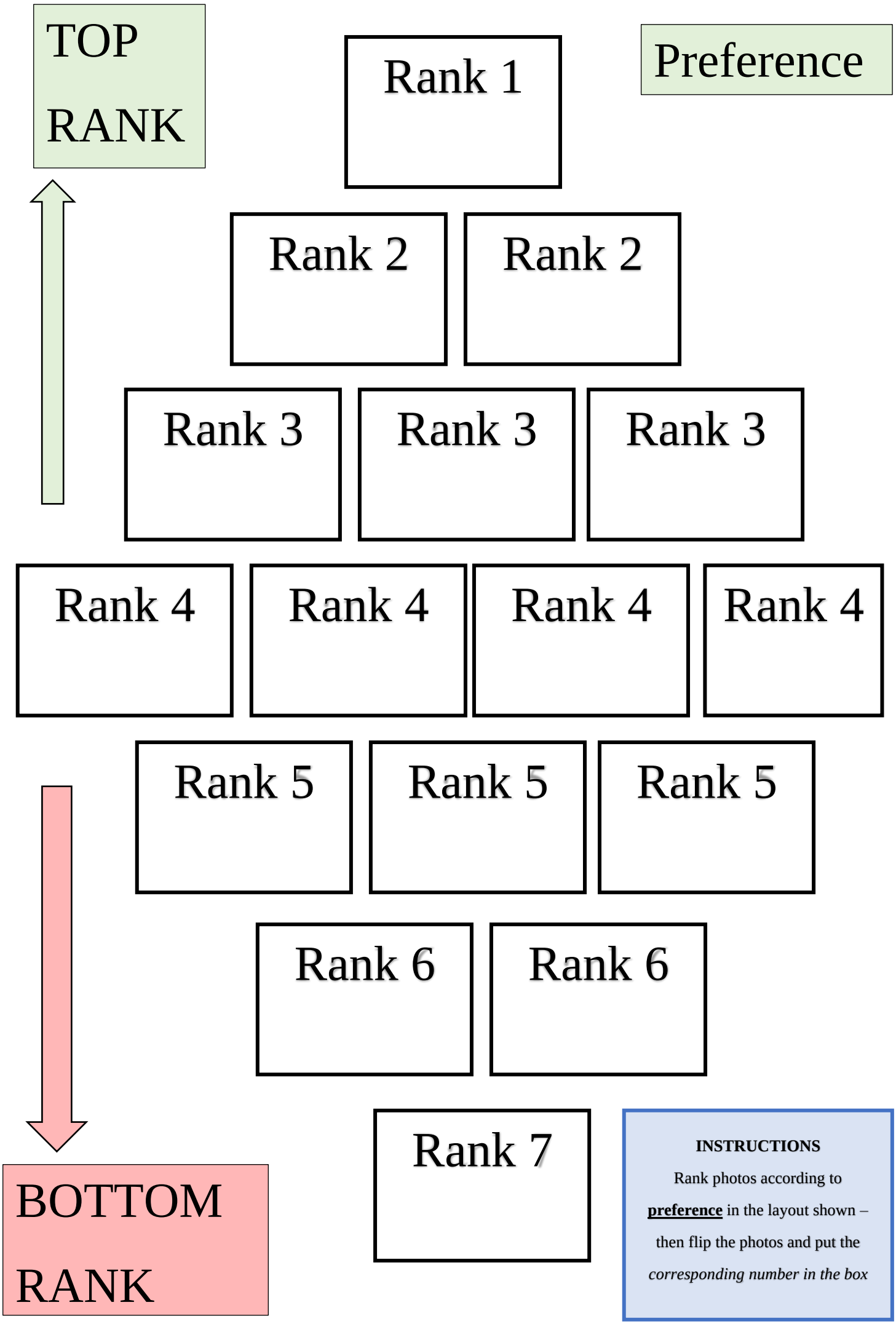
Rank 7

BOTTOM RANK

INSTRUCTIONS

Rank photos according to **your diversity** in the layout shown – then flip the photos and put the *corresponding number in the box*

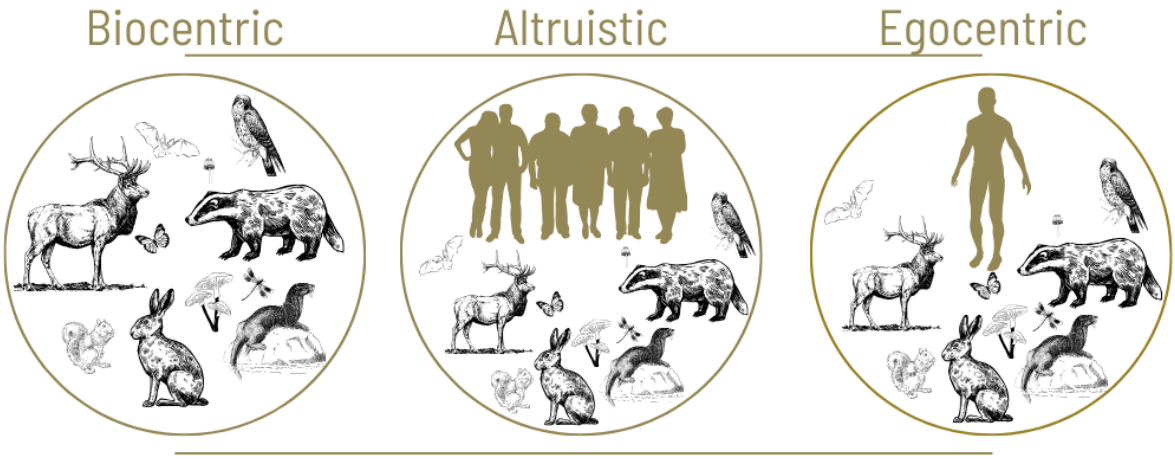
Questions related to <u>your perceived diversity</u> ranking	
Reasons for rankings	**Answers**
Why did you choose your top-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
Why did you choose your bottom-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
How similar or dissimilar do you think the photos are?	
Do you think you were able to observe enough of a difference between the photos to make an informed decision? Please provide details explaining why.	
Which ranking categories were the hardest to order and why?	
Do you have any other comments related to the images?	


TOP RANK
Rank 1
Preference
Rank 2
Rank 2
Rank 3
Rank 3
Rank 3
Rank 4
Rank 4
Rank 4
Rank 4
Rank 5
Rank 5
Rank 5
Rank 6
Rank 6
Rank 7
BOTTOM RANK
INSTRUCTIONS
Rank photos according to preference in the layout shown – then flip the photos and put the corresponding number in the box

Questions related to <u>your preference</u> ranking	
Reasons for rankings	**Answers**
Why did you choose your top-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
Why did you choose your bottom-ranking image? Please provide descriptive features of any features you prefer or contextual reasons for your choice.	
How similar or dissimilar do you think the photos are?	
Do you think you were able to observe enough of a difference between the photos to make an informed decision? Please provide details explaining why.	
Which ranking categories were the hardest to order and why?	
Do you have any other comments related to the images?	

Chapter 5 Appendix III Adapted Method for Ecological Concern

The Ecological Concern (EC) scale is a commonly used psychometric measure which assesses a person's environmental attitude (Cruz and Manata, 2020); categorising an individual as biocentric, altruistic or egocentric (Chapter 5 Appendix III Figure 1).



Chapter 5 Appendix III Figure 1 Illustration of biocentric (left), altruistic (middle) and egocentric (right) social constructs

The EC scale is collected using the Likert scale (1-7) with 7 being 'supreme importance' and 1 being 'not important'. We wanted to test alternative methods of scoring the surveys to assist with category discernment. To achieve this, we asked 30 students to answer the EC scale in three ways:

- Using the Likert Scale – Traditional Method – 7 Supreme Importance and 1 Not Important;
- Ranking from 12 to 1 – 12 Supreme Importance and 1 Not Important; and
- Ranking from 7 to 1 – 7 Supreme Importance and 1 Not Important.

Our rationale is that by limiting the number of choices participants can make, it forces them to prioritise their selections based on what they perceive as most important. This prioritisation process can provide insights into the relative importance of different aspects of ecological concern for each participant. Limiting choices means participants may need to engage in deeper thought and consideration when deciding which items to assign values to and which ones to leave unvalued (Tversky, 1972).. This process of deliberation can lead to more thoughtful responses and may encourage participants to reflect on their own beliefs and attitudes towards environmental issues; which is supported by the Elimination by Aspects Theory within the study of choice theory (Tversky, 1972).

Moreover, in real-life situations individuals often face constraints on the number of choices they can make or the amount of attention they can allocate to different issues. By requiring participants to make decisions about which items to value, the assessment mirrors this aspect of real-world decision-making processes. The decision to leave certain items unvalued may indicate areas of uncertainty or ambivalence for the participant. These areas of uncertainty can be just as informative as the items that are valued, as they highlight aspects of ecological concern that may be more complex or contentious.

As the research questions of this thesis are focused on the use of the EC categories, it is important to understand the underlying priorities of each participant and to try to avoid data conflation. The reduction in the level of choices creates a scalable comparison between participants, and is thought to reduce the incidents of co-occurring category assignments due to conflation of results and an absence of introspection or prioritisation (Tversky, 1972). Aggregating the scores into distinct groups has been shown here to facilitate hypothesis testing regarding differences in environmental attitudes between groups (e.g., comparing biocentric versus egocentric considerations). It allows for more focused and hypothesis-driven analyses. Additionally, participants might find it easier and less burdensome to provide scores for aggregated groups rather than individual items. Items are the specific questions used within the psychometric measure, in this case the EC scale. This can potentially improve response rates and data quality. However, aggregating scores may obscure variability within each group and overlook nuances in participants' attitudes towards specific items.

Results

Of the 29 participants 24.14% of them have equivalent or co-occurring categories following the traditional Likert scoring mechanism. Whereas for the 12-order ranking there were no equivalent or co-occurring categories and only 3.44% (1 co-occurrence) for the 7-order ranking.

With regard to the agreement between the three methods in terms of categorisation of participants it was seen that the 12-order ranking was 86% aligned, and the 7-order ranking was 83% aligned (Chapter 5 Appendix III Table 2) with the original scoring method. A chi-squared test of association for both rank orders showed that they are both statistically similar to the original Likert method (12-Order Rank Chi-Squared = 37.678, df = 4, $P < 0.001$; 7-

Order Rank Chi-Squared = 33.811, df = 6 P < 0.001). This test compared the categorisations between the scoring types under the assumption that if there was more than one equivalent category which overlapped, then it was viewed to be accurate. Additionally, we created a matrix of binary variables to analyse the detection of each category (biocentric, altruistic and egocentric) between the original method and the 7-order ranking method. We then performed a chi-squared test of association on each of these groups to see if the methods are equivalent in their detection. When comparing the biocentric categories and the altruistic categories they were equivalent (Chi-Squared = 12.05, df = 1, P < 0.001; Chi-Squared = 5.49, df = 1, P = 0.019; respectively). For egocentric the 7-rank order was significantly different to the detection rate for the original method (Chi-Squared = 3.28, df = 1, P = 0.070); however, upon further investigation it was identified that this may be due to the higher accuracy in detection due to the prioritisation. For example, in one of the misaligned results the participants scored all four altruistic items as 7 – supreme importance – and only one egocentric item had a score of 7. However, when faced with a need to prioritise the same individual scored the top 3 in the egocentric category (Chapter 5 Appendix III Table 1).

Chapter 5 Appendix III Table 1 Example scores from one individual with the misaligned Ecological Concern Scale categories following the Likert (Original) and the 7-Rank order methods.

I am concerned about environmental problems because of the consequences for ____.										
Likert (Original)						**7-Rank Order**				
Plants	6	Me	6	People In My County	7	Plants	0	Me	6	People In My County	0
Marine Life	6	My Lifestyle	6	All People	7	Marine Life	0	My Lifestyle	7	All People	2
Birds	6	My Health	6	Children	7	Birds	0	My Health	5	Children	3
Animals	6	My Future	7	Future Generations	7	Animals	1	My Future	0	Future Generations	4

The misaligned categories appeared to be conflated by the Egocentric category in particular (Chapter 5 Appendix III Table 3). Where other categories rank highly when using the Likert scale, when forced to prioritise there is a higher occurrence rate of Egocentric viewpoints. Therefore, it is identified that the 7-rank order forces prioritisation which promotes the identification of egocentric viewpoints which may be subdued which choices are left open ended.

Conclusion

Based on the above, the adapted method is viewed to be appropriate for the methods within this study due to the reduction in co-occurrence rate, the consistency/agreement with the Likert method and the higher levels of discernment/identification of egocentric viewpoints. As both the 12-Rank Order and 7-Rank Order were viewed to be consistent and there is less dimensionality in the 7-Rank order, which reduces the burden on participants, the 7-Rank Order was selected.

Chapter 5 Appendix III Table 2 Ecological Concern Scale categorisation using three alternate scoring methods. Likert Mean Score (original), 12-Order Ranking Sum and 7-Order Randing Sum. Green indicates alignment with the Likert scale and red indicates divergence from that scale.

Likert (Original)	12-Order Ranking	7-Order Ranking
Altruistic	Altruistic	Altruistic
Altruistic	Altruistic	Altruistic
Altruistic	Biocentric	Altruistic
Altruistic	Altruistic	Altruistic
Altruistic	Altruistic	Altruistic
Altruistic	Altruistic	Biocentric
Altruistic	Altruistic	Egocentric
Altruistic	Egocentric	Egocentric
Altruistic	Egocentric	Egocentric
Altruistic	Altruistic	Equivalent: Biocentric, Altruistic
Biocentric	Biocentric	Biocentric
Biocentric	Biocentric	Biocentric
Biocentric	Biocentric	Biocentric
Biocentric	Altruistic	Biocentric
Biocentric	Biocentric	Biocentric
Biocentric	Biocentric	Biocentric
Biocentric	Biocentric	Biocentric
Egocentric	Egocentric	Altruistic
Egocentric	Egocentric	Egocentric
Egocentric	Egocentric	Egocentric
Egocentric	Egocentric	Egocentric
Egocentric	Egocentric	Egocentric
Equivalent: Biocentric, Altruistic	Altruistic	Altruistic
Equivalent: Biocentric, Altruistic	Biocentric	Biocentric
Equivalent: Biocentric, Altruistic	Biocentric	Biocentric
Equivalent: Biocentric, Egocentric	Biocentric	Egocentric
Equivalent: Biocentric, Egocentric, Altruistic	Biocentric	Biocentric
Equivalent: Egocentric, Altruistic	Altruistic	Altruistic
Equivalent: Egocentric, Altruistic	Altruistic	Altruistic

Chapter 5 Appendix III Table 3 Scores from the misaligned Ecological Concern Scale categorisation using three alternate scoring methods. Likert Mean Score (original), 12-Order Ranking Sum and 7-Order Randing Sum. Green indicates alignment with the Likert scale and red indicates divergence from that scale.

Likert (Original)				12-Order Ranking Scores				7-Order Ranking Scores			
Category	**Biocentric**	**Egocentric**	**Altruistic**	**Category**	**Biocentric**	**Egocentric**	**Altruistic**	**Category**	**Biocentric**	**Egocentric**	**Altruistic**
Altruistic	6	5.5	6.75	Biocentric	34	18	26	Altruistic	11	4	13
Altruistic	5.5	6.75	7	Altruistic	26	10	42	Biocentric	14	1	13
Altruistic	6	6.25	7	Altruistic	10	26	42	Egocentric	1	18	9
Altruistic	6.25	6.75	7	Egocentric	10	39	29	Egocentric	3	13	12
Altruistic	6	5.75	7	Egocentric	30	10	38	Egocentric	1	18	9
Biocentric	6	5.5	6.75	Altruistic	30	10	38	Biocentric	14	1	13
Egocentric	5.75	6.75	5.75	Egocentric	20	31	27	Altruistic	7	8	13

Participant survey form:

Participant Details	
Preferred Gender ID	
Age	
Nationality	
College Course	
Year of Course	
University	

Ecological Concern Parameters

People around the world are generally concerned about environmental problems because of the consequences that result from harming nature. However, people differ in the consequences that concern them most.

Rank the following from **1 (not important) to 7 (supreme importance)** according to the above statement and the topic in each question.

Each one is to be ranked on a scale of 1-7 in its own right.

I am concerned about environmental problems because of the consequences for ____.					
Plants		Me		People In My County	
Marine Life		My Lifestyle		All People	
Birds		My Health		Children	
Animals		My Future		Future Generations	

SAME QUESTION NEW RANKING

Rank the following from **1 (not important) to 12 (supreme importance)** according to the above statement and the topic in each question.

Each category gets 1 rank - you should end up with one 12, one 11, one 10 etc.

I am concerned about environmental problems because of the consequences for ____.

Plants		Me		People In My County	
Marine Life		My Lifestyle		All People	
Birds		My Health		Children	
Animals		My Future		Future Generations	

SAME QUESTION NEW RANKING

Rank from Supreme Importance (7) to Not Important (1)

Leave 5 options blank

Only use each number once

There are 12 items but you only have 7 numbers to rank

I am concerned about environmental problems because of the consequences for ____.					
Plants		Me		People In My County	
Marine Life		My Lifestyle		All People	
Birds		My Health		Children	
Animals		My Future		Future Generations	

Chapter 5 Appendix IV Other correlation score coefficient thresholds

Chapter 5 Appendix IV Table 1 Interpretation of the Pearson's and Spearman's correlation coefficients.

Absolute Value of Correlation Coefficient	Salkind and Frey (2021) [Psychology]	Dancey and Reidy (2007) [Psychology]	Chan (2003) [Medicine]
1	Perfect	Perfect	Perfect
0.9	Very Strong	Strong	Very Strong
0.8	Very Strong	Strong	Very Strong
0.7	Strong	Strong	Moderate
0.6	Strong	Moderate	Moderate
0.5	Moderate	Moderate	Fair
0.4	Moderate	Moderate	Fair
0.3	Weak	Weak	Fair
0.2	Weak	Weak	Poor
0.1	Weak to None	Weak	Poor
0	None	Zero	None

Chapter 5 Appendix V Demographic Information

Chapter 5 Appendix V Table 1 Demographic information of participants including university, course type, workshop group and questionnaire order.

Preferred Gender ID	Age	Nationality	College Course	Year	University	Group	Order
Male	30	Irish	Zoology PhD	4	UCC	G1	A
Female	26	French	Zoology PhD	2	UCC	G1	A
Male	27	UK/Irish	Zoology PhD	4	UCC	G1	A
Male	26	Irish	Zoology PhD	2	UCC	G1	A
Male	40	Spain	Zoology PhD	4	UCC	G1	A
Male	33	Irish	Zoology PhD	4	UCC	G1	A
Male	29	Irish	Zoology PhD	4	UCC	G1	A
Female	26	Irish	Zoology PhD	1	UCC	G1	A
Female	22	Irish	Civil, structural and environmental Engineering	4	UCC	G2	A
Female	23	Irish	Planning, Regeneration and Development	4	University of Ulster	G2	A
Male	23	Irish	Pharmacy	5	UCC	G2	A
Female	23	Irish	General Nursing	4	UCC	G3	A
Female	23	Irish	Civil, structural and environmental Engineering	4	UCC	G3	A
Male	22	Irish	Applied Psychology	2	UCC	G4	A
Male	22	Irish	Bachelor of Business in Information Systems	3	MTU	G2	A
Male	24	Irish	Masters in Planning and Sustainability	5	UCC	G2	A
Female	27	Irish	Masters in HR and Management	1	UCC	Solo1	A
Male	21	Irish	General Nursing	4	UCC	Solo2	A
Female	22	Irish	General Nursing	4	UCC	Solo3	A
Female	33	Irish	Environmental Health	3	TUD	Solo4	A
Female	20	Irish	Physical Sciences	2	Trinity	G6	A
Female	19	Irish	Philosophy & Social Justice	2	UCD	G6	A
Male	24	Irish	Strength and Conditioning	1	Setanta	G7	A

					College		
					Setanta		
Male	37	Brazilian	Strength and Conditioning	2	College	G7	A
					Setanta		
Male	25	Irish	Strength and Conditioning	1	College	G7	A
			PhD Environmental				
Female	25	Irish	Engineering	4	UCC	G5	A
Male	27	Colombian	MSc Sustainable Energy	1	UCC	G5	A
			PhD Environmental				
Female	28	Brazilian	Engineering	1	UCC	G5	A
			PhD Environmental				
Female	23	Irish	Engineering	2	UCC	G5	A
Male	35	Mexican	PhD Civil Engineering	3	UCC	G5	A
Female	19	Irish	Biology	2	UCD	Solo5	A
Male	19	Irish	Chemistry	2	UCD	Solo6	A
Male	21	Irish	Applied Psychology	2	UCC	Solo7	A
Female	35	Irish	Applied Psychology	2	UCC	G4	A
Female	46	Irish	Applied Psychology	2	UCC	G4	A
Female	34	Irish	Applied Psychology	2	UCC	G4	A
		South					
Female	35	African	PhD Engineering	2	Trinity	G8	A
Female	26	Irish	PhD Anthropology	2	Trinity	G8	A
Male	28	Italian	PhD Botany	3	Trinity	Solo9	A
			Biological and Biomedical				
Female	21	Irish	Sciences	2	Trinity	17G5	A
Male	21	Irish	BESS	3	Trinity	17G4	A
Female	20	Irish	Geoscience	2	Trinity	17G1	A
Male	18	Irish	Economics and History	1	Trinity	17G2	A
			Biological and Biomedical				
Female	19	Irish	Sciences	2	Trinity	17G2	A
			Biological and Biomedical				
Female	20	Irish	Sciences	3	Trinity	17G3	A
Female	18	Irish	Biomedical Sciences	2	Trinity	17G3	A
Female	34	Unknown	Botany	4	Trinity	17G3	A
Male	19	Jordanian	Biomedical Sciences	2	Trinity	17G3	A
Male	21	Irish	BESS	2	Trinity	17G4	A

Female	19	Irish	Geoscience	2	Trinity	17G1	A
Female	48	Irish	Psychology	3	Trinity	17G5	B
Female	19	Canadian	Biomedical Sciences	2	Trinity	17G5	B
Male	19	Irish	Science	2	Trinity	17G5	B
Male	20	Irish	Biological and Biomedical Sciences	3	Trinity	17G5	B
Male	19	Irish	Biomedical Sciences	2	Trinity	17G5	B
Female	24	USA	PhD Environmental Engineering	2	Trinity	17G5	B
Female	20	Irish	Biological and Biomedical Sciences	2	Trinity	17G1	B
Female	20	Irish	Geography and Geosciences	2	Trinity	17G1	B
Female	20	Irish	Geography and Geosciences	2	Trinity	17G1	B
Male	25	Irish	Science	2	Trinity	17G2	B
Male	22	Irish	Botany	2	Trinity	17G2	B
Female	20	Irish	Biological and Biomedical Sciences	2	Trinity	17G3	B
Female	20	Irish	Biological and Biomedical Sciences	2	Trinity	17G3	B
Male	19	French	Biomedical Sciences	2	Trinity	17G3	B
Female	20	Irish	Biological and Biomedical Sciences	4	Trinity	17G3	B
Female	20	Romanian	Biological and Biomedical Sciences	2	Trinity	24G1	A
Female	21	Irish	Psychology	4	Trinity	24G1	A
Female	19	Irish	Biological and Biomedical Sciences	2	Trinity	24G2	A
Female	19	Irish	Biological and Biomedical Sciences	2	Trinity	24G3	A
Male	18	Irish	Chemical Sciences	1	Trinity	24G3	A
Male	20	Spanish	Chemical Sciences	1	Trinity	24G4	A
Male	18	Irish	Physical Sciences	1	Trinity	24G4	A
Female	19	American	Geography and Geosciences	2	Trinity	24G4	A

Male	21	Irish	Biological and Biomedical Sciences	2	Trinity	24G4	A
Male	19	Romanian	Biological and Biomedical Sciences	2	Trinity	24G1	A
Female	20	Italian	Biological and Biomedical Sciences	2	Trinity	24G2	B
Female	21	Dutch	Psychology	3	Trinity	24G2	B
Female	18	Irish	Biological and Biomedical Sciences	1	Trinity	24G3	B
Male	29	Irish	Physical Sciences	1	Trinity	24G4	B
Male	19	Irish	Chemical Sciences	1	Trinity	24G4	B
Male	20	Irish	Music	2	Trinity	24G4	B

Chapter 5 Appendix VI Light Absorption Model 2019 investigation

Chapter 5 Appendix VI Table 1 Linear Mixed-Effects Model results for effects on Light Absorption due to management practices (grazed and ungrazed) over time (3 years). The random effects used in all cases were block and plot nested within block. The intercept is the reference estimate for the control (grazed) plot in 2020. * Significant.

Model Type	Fixed effects	Estimate	Std. Error	t Value	P Value
Light Absorption Model sqrt (PAR, µmol photons per m^2/s)	**(intercept)**	**22.969**	**1.19**	**19.30**	**<0.001***
	Treatment Ungrazed	**5.225**	**1.36**	**3.84**	**<0.001***
	Year 2021	-1.724	1.28	-1.34	0.184
	Year 2022	**-3.736**	**1.28**	**-2.89**	**0.004***
	Treatment: Year 2021	0.414	1.82	0.22	0.820
	Treatment: Year 2022	2.322	1.82	1.27	0.206

Supplemental Appendices to Thesis Reconceptualising Eco-tourism: Aligning Tourism and Conservation Goals using Biodiversity Perception, Governance, and Management

Supplemental Appendix I: Buckley, Y.M. and Torsney, A., 2024. When function, not origin, matters. Science, 383(6682), pp.478-479. DOI: 10.1126/science.adn4126

Supplemental Appendix II: Good practice guidance on Strategic Environmental Assessment (SEA) for the Tourism Sector; This guidance note has been prepared by CAAS Consultants on behalf of the EPA. David L'Estrange and Andrew Torsney (2023). ISBN 978-1-80009-097-2

Supplemental Appendix III: CIEEM (2023) Briefing Paper: Biodiversity Enhancement for New Developments in Ireland. Chartered Institute of Ecology and Environmental Management.

Supplemental Appendix IV: Gorman, C.E., Torsney, A., Gaughran, A., McKeon, C.M., Farrell, C.A., White, C., Donohue, I., Stout, J.C. and Buckley, Y.M., 2023. Reconciling climate action with the need for biodiversity protection, restoration and rehabilitation. Science of The Total Environment, 857, p.159316. https://doi.org/10.1016/j.scitotenv.2022.159316

INSIGHTS



PERSPECTIVES

ECOLOGY

When function, not origin, matters

Native and introduced megaherbivores similarly affect plant diversity and abundance

By **Yvonne M. Buckley**[1] *and* **Andrew Torsney**[2]

Both extinctions and introductions of large mammalian herbivores (>45 kg) affect biodiversity and ecosystem function. An important question is whether the origin of herbivorous megafauna predicts impacts on an ecosystem that are specific to introduced species in general, more severe than those of native species, or both. On page 531 of this issue, Lundgren *et al.* (*1*) report that functional traits, rather than the origin (introduced or native), of large herbivores are correlated with native plant diversity. Together with previous contradictory findings on the ecological effects of introduced and native herbivores (*2*), the study raises the question of whether herbivore size and dietary specialism are general determinants of invasion impact, origin effects, or both.

Large mammalian herbivores that range in size from red kangaroos (*Osphranter rufus*) and goats (*Capra hircus*) to African bush elephants (*Loxodonta africana*) have profound effects on ecosystems through their functions as consumers and modifiers of plant biomass (*3*), dispersers of seeds (*4*), and, when dead, concentrated resources for scavengers and decomposers (*5*). The largest adult megaherbivores (>1000 kg; e.g., *Rhinoceros* spp., *Hippopotamus amphibius*, and elephants) are relatively resistant to predation pressure, which has important consequences for the flow of energy through ecosystems and landscape heterogeneity (*6*). However, large animals are also vulnerable to local and global extinctions (*7*). This is attributed to a mixture of intrinsic traits, such as low reproductive output, and extrinsic exposure to human impacts. Although large mammalian herbivores have been lost in many habitats, some ecosystems have gained them through human-mediated introductions to areas where they did not previously occur.

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Plant biodiversity is related to the abundance of large herbivores, such as the white rhinoceros, whose muzzle width allows for a less selective diet.

Feral goats, buffalo, and horses (wild populations of formerly domesticated species) are high-impact invasive species, particularly in regions where humans have caused the decline and extinction of other large herbivores or where large herbivores with traits similar to the introduced species never occurred. Indeed, goat (*C. hircus*), fallow deer (*Dama dama*), and wild boar (*Sus scrofa*) are included in the list of 100 of the world's worst invasive species (*8*). Goats that were introduced to islands have proven to be particularly problematic as a driver of local species extinctions (*9*), and their eradication from islands is a conservation success story (*10*).

Lundgren *et al*. examined the datasets of 221 studies (spanning six continents, although biased to Europe, North America, and Australia) to determine whether herbivore nativeness or other factors accounted for the effect of large herbivores on plant abundance and diversity. The authors found no evidence that herbivore origin correlates with effects. This was true irrespective of several conditions. Coevolutionary history, such as an herbivore sharing a native range with plant species, was not a factor. Neither was remote island status, where plants may not have coevolved with large herbivores. Phylogenetic or functional novelty of large herbivores relative to closely related or functionally similar prehistoric native megafauna with which the plants had coevolved also had no effect. The finding of Lundgren *et al*. is surprising given that it is in contrast with a previous meta-analysis of vertebrate herbivores of all sizes, which found opposing effects of native and introduced herbivores on plant diversity and abundance, albeit from a narrower range of species and regions (mostly from North America) (*2*). Lundgren *et al*. did, however, find a relationship between the diversity of plant species and both body size and muzzle width of large mammalian herbivores. Muzzle width is an indicator of dietary selectivity. Larger muzzled species (such as rhinoceros) are less selective of what they eat. This agrees with the general finding that body size of herbivores is a critical determinant of their relationship with other species in the ecosystem, including plants (*11*).

In addition, Lundgren *et al*. found similar effects on the diversity or abundance of native plants by invasive and feral herbivores compared with native herbivores. This is unexpected because invasive species, by definition, are expected to have bigger impacts than noninvasive introduced species. However, very few invasive species were assessed (invasives, $n = 3$; feral, $n = 6$).

The native or non-native origin of a species can be a proxy for one or more of four underlying processes. These include the strength of a species' association with humans, disjunct evolutionary history (when native and introduced species do not share an evolutionary association), an expanded species pool that increases the probability of encountering those with high performance, and superior adaptation to, or tolerance of, environmental conditions encountered in the habitat to which the species is introduced (*12*). Therefore, origin effects, if they occur, may manifest in different ways, depending on the underlying process they are a proxy for, the functional ecology of the introduced species, and the condition of the recipient ecosystem.

A better understanding of how traits influence the likelihood of species being introduced through different pathways, and the effects of those traits on different recipient ecosystems, is likely to lead to more powerful insights on the ecology of introduced species compared with a focus on species origin alone. For example, the spatially extensive (and replicated) herbivore exclusion experiment in the Nutrient Network (NutNet) project has shown that the environment mediates the effects of herbivory on grassland communities through the effect of herbivores on ground-level light conditions (*13*). Where light is limiting, such as in productive grasslands, herbivores increase opportunities for the coexistence of plant species by removing biomass and disturbance, thus reducing competition for light. The use of functional traits, such as body size or muzzle width, together with the recipient environmental context, would enable more specificity in explaining and ultimately predicting the effects of large herbivores in different ecosystems. This has considerable value for land management, conservation, and restoration.

There is a wide range of introduced species within many ecosystem contexts, and only some of these combinations are harmful. There is a separate question about the desired versus unwanted effects of native and introduced herbivores. For example, removal of biomass or litter through herbivory may suppress fire risk, but whether this is good or bad depends on the current and desired state of the ecosystem that is affected. Although Pleistocene communities (2.6 million to 11,700 years ago) contained many more large-bodied herbivores than contemporary ecosystems, particularly in the Americas and Europe, profound changes in ecosystems throughout the Anthropocene mean that there are no well-understood, well-defined, or even achievable "natural" reference conditions for many ecosystems.

The desired state of a contemporary ecosystem can take many forms, including being closer to a historical reference state, being more diverse in terms of a particular group of species, or exhibiting desired ecosystem functions, composition of species, or ecosystem services. If the desired state is a historical reference state, in which only native species are present (a "wild" or prehuman ecosystem), then the presence of any introduced species moves the community away from that desired state. However, if the desired state is one in which the ecosystem function of large mammalian herbivores is restored or maintained, then introduced species could provide that function.

A functional traits approach could be useful in reconciling Lundgren *et al*.'s findings with previous meta-analyses and known effects of problematic invasive herbivores. The search for predictive traits of problematic invaders is urgent because resources for ecosystem management are scarce. It is promising that some of the variance in the effects of native and introduced herbivores on plants can be resolved through functional traits of the herbivores. However, more evidence is needed on the broader role of herbivore body size, dietary selectivity, and other functional traits in combination with, not instead of, origin. ■

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Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil



Good practice guidance on Strategic Environmental Assessment (SEA)

for the Tourism Sector

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Good practice guidance on Strategic Environmental Assessment (SEA)

for the Tourism Sector

This guidance note has been prepared by CAAS Consultants on behalf of the EPA.

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Abbreviations

AA	Appropriate Assessment
DECC	Department of the Environment, Climate and Communications
DHLGH	Department of Housing, Local Government and Heritage
EC	European Commission
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EU	European Union
GIS	Geographical Information Systems
IAIA	International Association for Impact Assessment
LAP	Local Area Plan
NPF	National Planning Framework
NPWS	National Parks and Wildlife Service
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SEO	Strategic Environmental Objective
SEPA	Scottish Environment Protection Agency
SI No.	Statutory Instrument Number
SPA	Special Protection Area
UK	United Kingdom

1. Introduction

1.1 Purpose of this document

This note aims to provide good practice guidance and suggestions on how to carry out Strategic Environmental Assessments (SEAs) of tourism plans in Ireland. It responds to a recommendation by the Second Review of the Effectiveness of SEA in Ireland (EPA, 2020a). The focus of the guidance is SEA and tourism, rather than trying to simplify the entire tourism planning process.

This note is not stand-alone guidance: rather it supplements other EPA guidance on SEA, including guidance on SEA screening, SEA and alternatives, SEA and climate, SEA statements and monitoring and SEA and cumulative effects. Other resources include the SEA pack and SEA process checklist.

Permission for the use of all case study material in this document has been provided by each relevant competent authority.

1.2 History of tourism and its promotion in Ireland

'Tourism' is loosely used to describe a spectrum of activities ranging from the use of local amenities and recreational facilities through to places and experiences that are enjoyed by the whole population, local and national as well as international. Amenities such as beaches and coastal walks are just as likely to be used by year-round local residents as by international tourists. Similarly, recreational facilities, such as golf courses or facilities for water sports, adventure, equestrian activities or yachting, are equally likely to be used by locals and Irish weekenders as by international visitors. A very small number of very specific locations and projects are used exclusively, or almost exclusively, by international visitors.

Tourism and its promotion are long-established activities in Ireland. Many existing tourism destinations, attractions, routes, etc. are subject to both recent and long-established promotion activities. Thus the destinations, attractions and routes, their promotion and the intensity of their use are not new.

There is a long-established pattern of tourism promotion in Ireland. The first promotion of Irish tourism is generally credited to Thomas Browne, 4th Viscount Kenmare, who began to promote Killarney and its environs in the 1750s. Touring guides to Ireland date from the late 18th century (Young, 1897) and large-scale touring in Ireland dates back to the latter part of the 19th century. At that time railways and associated large hotels offered access to areas that had hitherto been remote and inaccessible. The 1914 edition of the *Michelin Guide to the British Isles* identified routes and viewing points across Ireland, which have featured in various travel guides since then.

By the beginning of the 20th century, tourism was being actively branded and promoted on a national scale, initially by the Irish Tourism Association and since 1955 by Bord Fáilte,[1] which has continually and consistently promoted Ireland as a tourist destination – both as a country and as specific local/iconic destinations.

1.3 Tourism management and planning in Ireland

By international standards, Ireland has a high level of tourism management, planning and research. There is overwhelming evidence from Fáilte Ireland's environmental surveying and monitoring of the Wild Atlantic Way Operational Programme that international tourists in rural locations give rise to very low levels of environmental impacts. Most Irish tourism is now urban and structured. Fáilte Ireland's Wild Atlantic Way Monitoring Programme has confirmed that the majority of high-visibility/high-impact visitor effects arise from local recreational use, as levels of visitor impacts have shown no evidence of reduction throughout the Covid period. Most of the impacts from tourism are indistinguishable from the recreational, occupational and betterment effects[2] generated by local and national populations.

Stand-alone, tourism-specific plans (or policies, programmes, strategies, etc.) are not required to be prepared by legislation. Tourism is, however, already provided for by various statutory documents setting out public policy for, among other things, land use development and activities, infrastructure, sustainable development, environmental protection and environmental management. These plans provide the accommodation, movement and hospitality facilities that are the fundamentals on which the tourism sector is based. All of these documents will have been subject to their own environmental assessment processes, as relevant, and form part of the decision-making and consent-granting framework.

To date, tourism plans in Ireland have generally elaborated on what is already provided for by the existing decision-making and consent-granting framework. They facilitate, promote, support and coordinate stakeholders (including local authorities, other government agencies, tourism operators, communities and visitors) in their activities in a way that is consistent with plans that have been subject to SEA and other assessments. They do not provide consent, establish a framework for granting consent or tend to contribute towards a framework for granting consent. They often provide mechanisms under which funding can be provided for projects (developments or activities), which must comply, as relevant, with various legislation, policies, plans and programmes (including requirements for lower-tier Appropriate Assessment, Environmental Impact Assessment and other licensing requirements as appropriate) that form the statutory decision-making and consent-granting framework.

1 Replaced by Fáilte Ireland in 2003.

2 'Occupational and betterment effects' refers to:

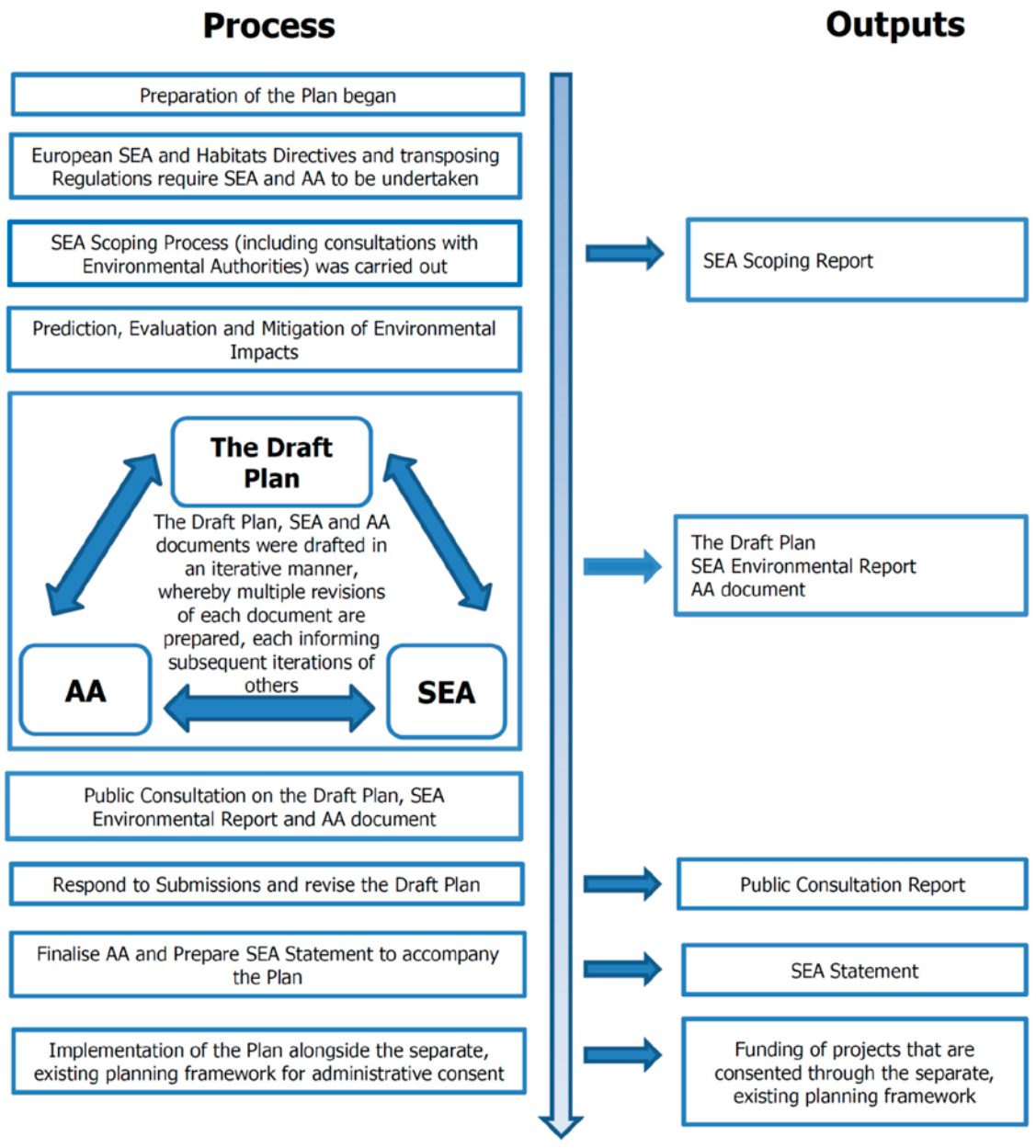
- ongoing improvements in terms of a lack of exploitative behaviours as well as improvements in standards of employment and pay as a result of national wage agreements, employee rights, and health and safety at work;
- ongoing public and private investment to improve ('better') infrastructure (transport, energy, water, sanitation and amenities).

The competent authority for a tourism plan (the body preparing and implementing the plan) may be, for example, a government department, Fáilte Ireland (the National Tourism Development Authority, whose role is to support long-term sustainable growth in the economic, social, cultural and environmental contribution of tourism to Ireland), Tourism Ireland (responsible for marketing the island of Ireland overseas as a leading holiday destination) or planning authorities.

1.4 Strategic environmental assessment (SEA)

SEA aims to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development: as such, this report focuses on ensuring that SEA is a proactive tool for improving a plan, rather than providing a passive 'snapshot' of a plan's impacts.

Figure 1.1 *Example:* SEA process and outputs flowchart (Fáilte Ireland, 2020b)



Annex I (h) of the SEA Directive requires the environmental report to describe 'how the assessment was undertaken'. Figure 1.1 shows how the SEA process and its outputs can be described.

This chapter of the SEA report can also document the links between the SEA process and the appropriate assessment/Habitats Directive Assessment process, as is also shown on Figure 1.1. Other assessments that may be required for certain plans and programmes include Strategic Flood Risk Assessment and Water Framework Directive related assessment.

The SEA is procedural in nature. Figure 1.2 sets out the overall stages involved in the process, while Figure 1.3 provides a flowchart of the SEA process.

Tourism is one of the specified sectors falling under the remit of the SEA Directive. The national SEA regulations applicable to tourism-related plans are provided by European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (SI No. 435 of 2004), amended by the European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011 (SI No. 200 of 2011). Screening for SEA may be required in certain instances in order to determine whether SEA is required. The EPA's (2021a) 'Good Practice Guidance on SEA Screening' and the Department of Housing, Local Government and Heritage's (2022) 'Strategic Environmental Assessment: Guidelines for Regional Assemblies and Planning Authorities' may be useful for those undertaking screening for SEA.

The EPA's SEA screening guidance states that 'SEA is directly linked to Appropriate Assessment under the EU Habitats Directive through Article 3.2b. In circumstances where screening for SEA is pointing toward screening out (i.e. SEA is determined not to be required), this determination cannot be concluded until such time as screening for Appropriate Assessment (AA) has been concluded.' Furthermore, certain plans and programmes that require Stage 2 Appropriate Assessment under the Habitats Directive automatically require SEA under the SEA Directive (SEA Directive article 3.2b).

When modifications to plans and programmes involve the use of small areas at local level or are considered to be minor modifications to the plan or programme, they shall require an environmental assessment only where it is determined that they are likely to have significant effects on the environment (SEA Directive article 3.3).

For plans and programmes that require SEA, Table 1.1 presents the requirements of the SEA Directive and shows where they are discussed in this guidance.

Table 1.1 SEA Directive requirements and where they are discussed in this guidance note

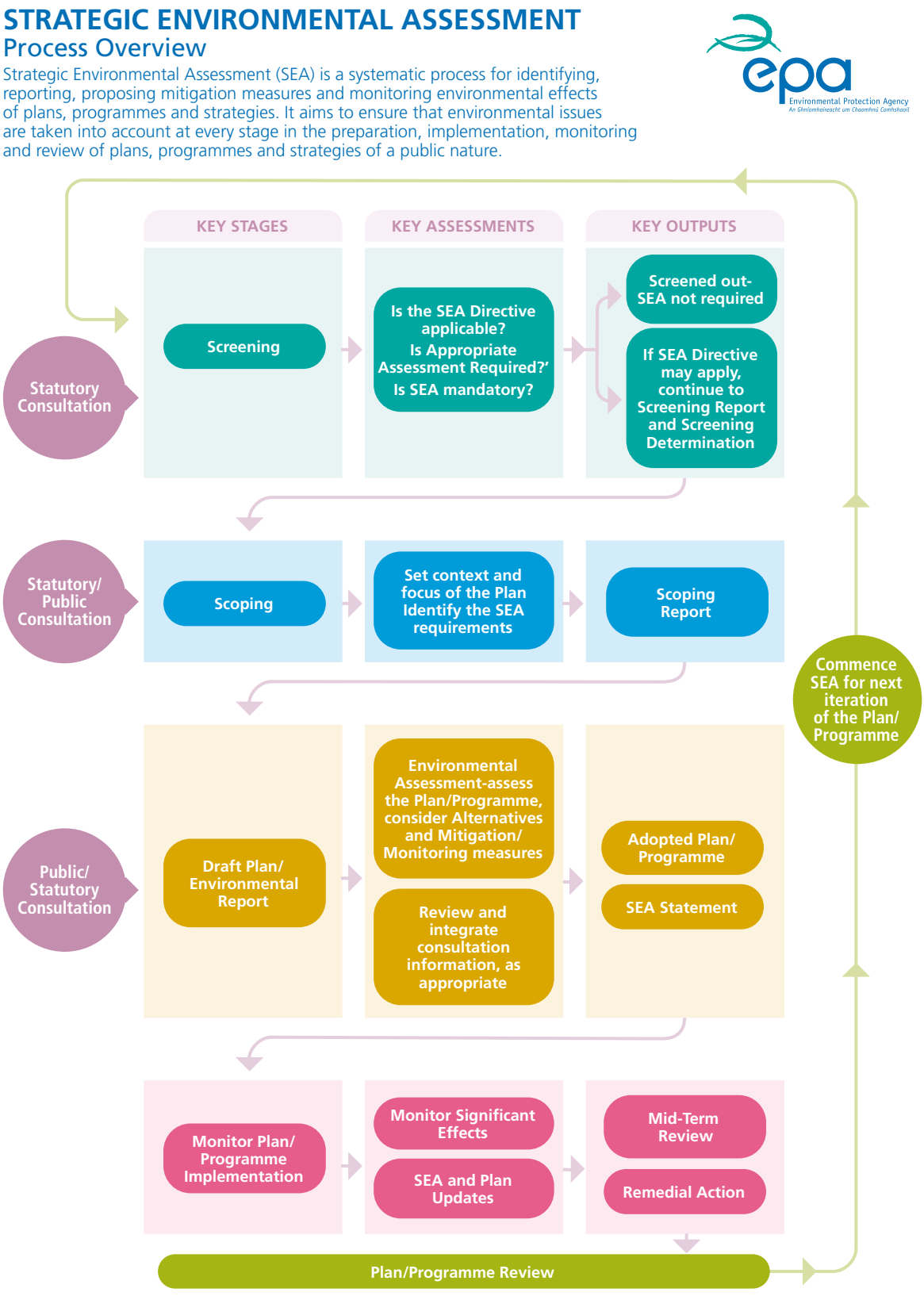
SEA Directive requirement	Section(s) of this guidance note
Preparing an environmental report in which the likely significant effects on the environment of implementing the plan, and reasonable alternatives taking into account the objectives and geographical scope of the plan, are identified, described and evaluated. The following information needs to be provided (as set out in Article 5 and Annex I):	
a) An outline of the contents, main objectives of the plan, and relationship with other relevant plans and programmes;	4 and 6
b) The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan;	7
c) The environmental characteristics of areas likely to be significantly affected;	8
d) Any existing environmental problems that are relevant to the plan including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;	9
e) The environmental protection objectives, established at international, community or national level, that are relevant to the plan and the way those objectives and any environmental considerations have been taken into account during its preparation;	10
f) The likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors. (These effects should include secondary, cumulative, synergistic, short-, medium- and long-term permanent and temporary, positive and negative effects);	12
g) The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan;	13
h) An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;	11
i) a description of measures envisaged concerning monitoring in accordance with Article 10;	14 and 16
j) a non-technical summary of the information provided under the above headings.	15
The report must include the information that may reasonably be required taking into account current knowledge and methods of assessment, the contents and level of detail in the plan, its stage in the decision-making process and the extent to which certain matters are more appropriately assessed at different levels in that process to avoid duplication of the assessment (Article 5.2).	

SEA Directive requirement	Section(s) of this guidance note
Consulting: ■ authorities with environmental responsibilities, when deciding on the scope and level of detail of the information that must be included in the environmental report (Article 5.4); ■ authorities with environmental responsibilities and the public, to give them an early and effective opportunity within appropriate time frames to express their opinion on the draft plan and the accompanying environmental report before the adoption of the plan (Article 6.1, 6.2); ■ other EU Member States, where the implementation of the plan is likely to have significant effects on the environment in these countries (Article 7).	5 and 16
Taking the environmental report and the results of the consultations into account in decision-making (Article 8).	
Providing information on the decision (often referred to as the 'SEA Statement'). Article 9 (Information on the decision) requires that: ■ When the plan is adopted, the public and any countries consulted under Article 7 must be informed and the following made available to those so informed: • the plan as adopted; • a statement summarising how environmental considerations have been integrated into the plan and how the environmental report of Article 5, the opinions expressed pursuant to Article 6 and the results of consultations entered into pursuant to Article 7 have been taken into account in accordance with Article 8, and the reasons for choosing the plan as adopted, in the light of the other reasonable alternatives dealt with; and • the measures decided concerning monitoring (in accordance with Article 10).	16
Monitoring the significant environmental effects of the plan's implementation (Article 10)	14 and 16

Figure 1.2 Overall SEA process stages



Figure 1.3 Flowchart of the SEA process



2. General Principles

Key points:

- SEA is a proactive problem-solving process. It provides for structured review of the plan with the aim of making it more environmentally sustainable.
- SEA should foster the participation of statutory environmental authorities and the public in the plan-making process.
- The SEA process should start early in plan-making and be integrated throughout the plan-making process.

The overall aim set out in Article 1 of the SEA Directive (2001/42/EC) is to provide for a high level of environmental protection and to contribute to the integration of environmental considerations into the preparation of plans and programmes, with a view to promoting sustainable development. In short, the SEA should seek to minimise a plan or programme's potential environmental impacts.

Reviews of SEA effectiveness in Ireland (EPA, 2012, 2020a) have recommended that the SEA process commence early in the plan-making process and be integrated throughout the plan-making process.

The International Association for Impact Assessment (IAIA) has established a set of SEA performance criteria, and several studies on SEA effectiveness and efficiency recommend ways in which these criteria can be achieved: see Table 2.1.

Table 2.1 Does your SEA fulfil these criteria?

IAIA SEA performance criteria (based on IAIA, 2002)	**Practical tips for achieving the criteria** (developed from EC, 2009; SEPA, 2011)
SEA is integrated	
■ Ensures assessment of all strategic decisions relevant to the achievement of sustainable development ■ Addresses the interrelationships of biophysical, social and economic aspects ■ Is tiered to policies in relevant sectors and (transboundary) regions and, where appropriate, to project EIA and decision-making	■ Start the SEA early in the plan-making process ■ Integrate the SEA process with the plan-making process ■ Integrate the early, evidence-gathering stages of the plan-making and SEA processes
SEA is sustainability-led	
■ Facilitates identification of development options and alternative proposals that are more sustainable	■ Focus on improving the plan, rather than providing a 'snapshot' of the plan's impacts

IAIA SEA performance criteria (based on IAIA, 2002)	**Practical tips for achieving the criteria** (developed from EC, 2009; SEPA, 2011)
SEA is focused ■ Provides sufficient, reliable and usable information for development planning and decision-making ■ Concentrates on key issues of sustainable development ■ Is customised to the characteristics of the decision-making process ■ Is cost- and time-effective	Be spatially specific where possible: ■ The level of detail of the SEA should reflect the level of detail of the plan. Where the plan is spatially specific, the SEA should be too ■ Map key constraints such as designations and areas prone to flooding to help inform the plan, e.g. using GIS ■ The scope of the SEA should reflect the alternatives being considered ■ 'Scope out' impacts that are not likely to be significant, as long as good reasons are provided for this
SEA is accountable ■ Is the responsibility of the leading agencies for the strategic decision to be taken ■ Is carried out with professionalism, rigour, fairness, impartiality and balance ■ Is subject to independent checks and verifications ■ Documents and justifies how sustainability issues were taken into account in decision-making	■ The SEA should provide plan-makers with explicit recommendations to which they can respond ■ If the SEA is carried out in-house, it can be useful for a colleague to critically review the environmental report and/or the overall SEA process ■ Document changes made to the plan as a result of the SEA process ■ Document how consultation comments on the SEA and the plan were taken into account in plan-making
SEA is participative ■ Informs and involves interested and affected public and government bodies throughout the decision-making process ■ Explicitly addresses their inputs and concerns in documentation and decision-making ■ Has clear, easily understood information requirements and ensures sufficient access to all relevant information	■ Actively engage the public on the plan and SEA, e.g. through the use of stakeholder events/workshops focused on options
SEA is iterative ■ Ensures availability of the assessment results early enough to influence the decision-making process and inspire future planning ■ Provides sufficient information on the actual impacts of implementing a strategic decision to judge whether this decision should be amended and to provide a basis for future decisions	■ Focus on improving the plan, rather than providing a 'snapshot' of the plan's impacts ■ Identify and evaluate impacts with reference to the baseline situation ('how will things be different without the plan?') rather than with reference to SEA objectives ('does the plan help to achieve environmental objectives?') ■ Consider the extent to which environmental provisions will be effectively delivered on the ground

3. Scoping

Key points:

- Scoping aims to get agreement on the scope and level of detail of the Environmental Report.
- Scoping aims to focus the SEA on key significant issues relevant to the plan. This makes the SEA process more efficient and the Environmental Report more readable

3.1 What is scoping?

Once it has been established that SEA is required, scoping should take place. The purpose of scoping is to ensure that the key environmental issues are identified, and the level of detail to which they should be assessed is agreed by the plan-making team, so that they can be given the necessary emphasis in the environmental assessment.

Scoping is a mandatory requirement and requires consultation with the relevant statutory environmental authorities.

Scoping focuses the SEA on key significant issues relevant to the plan, making the SEA process more efficient and communication more effective.

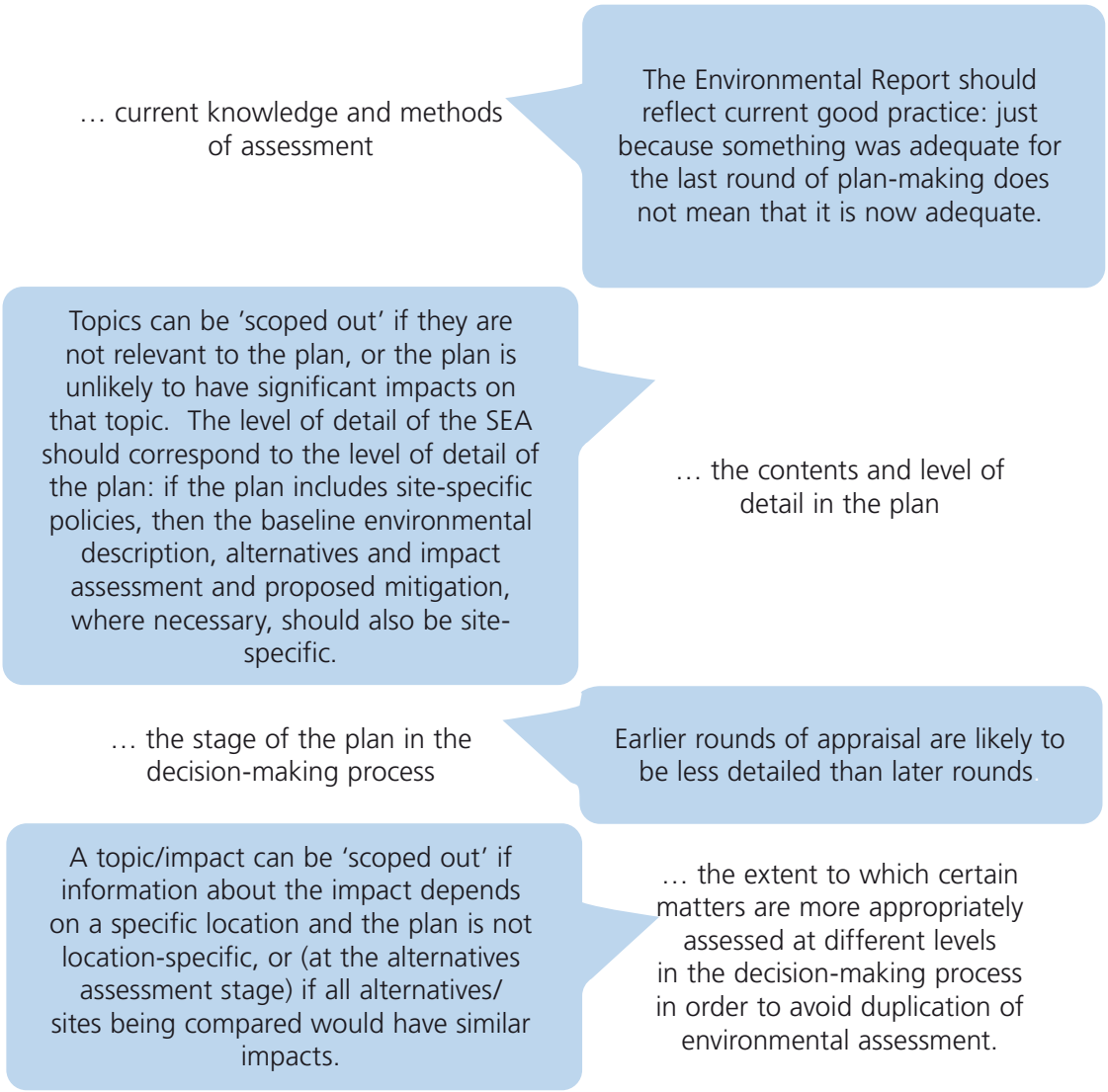
The scope of the environmental report refers to:

- Its geographical scope: the area over which the plan is likely to have significant environmental effects, i.e. the zone of influence of the plan. This may well go beyond the administrative boundaries of the competent authority, and indeed for some plans may go beyond the border of Ireland and lead to transboundary impacts.
- The temporal scope: the time period that the SEA covers. This is typically the time period of the plan.
- The level of detail of the assessment. This will be influenced by the level of detail of the plan: the more detailed the plan, the more detailed the assessment can be.
- The environmental topics to be covered by the SEA (see Section 3.3 below).

The SEA Directive requires that the level of detail of the SEA should take into account the considerations outlined on Figure 3.1.

Figure 3.1 SEA Directive considerations relating to the level of detail of the SEA (EPA, 2019b)

SEA guidance on blue background. SEA Directive text on white background



More general scoping guidance can be found in the 'Strategic Environmental Assessment Guidelines for Regional Assemblies and Planning Authorities' (Department of Housing, Local Government and Heritage, 2022), which have informed this section of the guidance document.

3.2 Scoping process and report

The usual approach to SEA scoping is for the plan-making authority to: carry out preliminary environmental baseline data collection and interpretation; prepare an 'SEA Scoping Report'; and send this to the relevant environmental authorities for consultation.

Scoping can begin the process of collating currently available, relevant environmental data that will ultimately inform the environmental report. It generally does not require major new research (refer also to Section 7.2 below, 'Identifying and presenting the data'). The plan preparation and SEA scoping process may be informed by sources of both tourism, such as spatially specific visitor data from Fáilte Ireland, and environmental information, such as that on water services demand and capacity from Irish Water or the EPA's Environmental Sensitivity Mapping (ESM) Webtool[3] that allows users to create area-specific environmental sensitivity maps. The identification of relevant environmental and development issues should also be informed by the results of monitoring the significant environmental effects of previous plans (refer also to Section 14 below, 'Monitoring Measures').

The Department of Housing, Local Government and Heritage's website[4] provides the most up-to-date contact details for the environmental authorities that must be consulted during various stages of the SEA (including scoping), taking account of transfers of functions between Ministers since the SEA Regulations first identified the environmental authorities. The statutory environmental authorities for the purposes of plans falling under SI 435 of 2004 as amended currently are:

- Environmental Protection Agency;
- Department of Environment, Climate and Communications;
- Department of Housing, Local Government and Heritage;
- Department of Agriculture, Food and the Marine.

The public, adjacent authorities and other countries ('transboundary consultation'; see also Section 5.2 below, 'Consultation') can also be consulted at this stage if the plan could significantly affect them.

Table 3.1 shows how consultation responses, in this instance submissions on the scope of an SEA, and actions taken in response to the consultation can be documented.

The content and nature of the SEA Scoping Report is not prescribed in legislation. However, in order to facilitate consultation with the relevant environmental and planning authorities, it is recommended that such a report should give an outline of:

- the geographic area involved (a map can be included);
- the nature of the plan, and its intended lifespan;
- the likely scale, nature and location of development within the area during the life of the plan (in broad terms);
- the methodology to be applied in the assessment, including draft Environmental Objectives;

3 Available at https://enviromap.ie/

4 https://www.gov.ie/en/publication/3539d-strategic-environmental-assessment-sea/

- in broad terms and where possible, the plan's predicted significant environmental impacts;
- the scope and level of detail expected of the environmental report;
- including focused questions in the scoping report will help inform feedback from the SEA statutory authorities.

Table 3.1 *Example:* **Documenting SEA scoping consultation responses** (Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017a)

Consultee	Key Issue Raised	SEA Response
Environmental Protection Agency		
	The SEA ER should consider assessing the potential additional pressures, including seasonal pressures, on existing critical service infrastructure (drinking water/ wastewater/waste) and transport related infrastructure. The Plan should include commitments for relevant infrastructure and any necessary associated upgrades/maintenance of existing infrastructure. Any priority commitments should where necessary be reflected in at LAP/Development Plan Level also.	Noted, pressures and capacity of existing critical services are described and assessed in this SEA ER. Please see Chapter Four, Environmental Baseline. Recommendations in relation to same are also included in this SEA ER. Please see Chapter Eight, Mitigation Measures.
	The SEA ER should ensure that the potential environmental effects of a likely increase in traffic volumes in the wider Mountshannon area resulting from implementation of the plan, is assessed and mitigated for where appropriate. The needs for additional parking during peak season should also be considered and assessed.	Noted, detailed traffic and transport studies were not undertaken as part of the plan preparation; however, existing transport provision and potential environmental effects are discussed in Chapter Four and Seven respectively in this SEA ER.
	Key additional plans/programmes are provided and attached in the submission; these include: • National Landscape Strategy • National Biodiversity Plan • National Planning Framework (under preparation) • Regional Spatial and Economic Strategies (to commence) • Water Framework Directive River Basin Management Plans (2nd cycle in preparation) • Shannon Catchment and Flood Risk Assessment and Management Study • National Mitigation Plan (in preparation)	Noted and are included in Chapter Three of this SEA ER.

3.3 Tourism attribution and scoping in and out

The SEA should consider each of the environmental components listed in the SEA Directive: biodiversity; population; human health; fauna; flora; soil; water; air; climatic factors; material assets; cultural heritage, including architectural and archaeological heritage; landscape; and the interrelationships between these factors.

If the plan is likely to have minimal or no impact on any environmental topic, then this component can be 'scoped out', with an explanation given for why it is being scoped out. Otherwise, the assumption is that the SEA will cover all the environmental components.

Where a plan is very unlikely to have significant impacts on a certain environmental component, where information about the impact depends on a specific location and the plan is not location-specific, or where all alternatives being compared would have similar impacts, it may make sense to 'scope out' impacts from analysis, with an explanation of why. Any scoping out of impacts should be documented, e.g. 'the environmental component of landscape is being screened out as the tourism plan is not providing for any new built development, only activities, and relates to an urban destination that has no landscape designations'.

Table 3.2 provides guidance as to how SEA exclusions – issues that are scoped out of the SEA – can be documented.

Tourism plans in Ireland, to date, tend to facilitate and coordinate stakeholders (including local authorities, other government agencies, tourism operators, communities and visitors) in their activities in a way that is consistent with plans that have been subject to SEA and other assessments.

Understanding the hierarchy of statutory documents within which a tourism plan is positioned will be essential in identifying which developments and activities can reasonably be assigned to the plan being considered and which are already provided for and assessed by the existing planning framework, including provision of infrastructure and amenities for the general population.

Table 3.2 Documenting SEA scoping in and out of issues

Inside the scope of the SEA	Outside the scope of the SEA
Potential environmental effects will be identified and assessed at a strategic level.	Effects will not be assessed at a project-specific level. The SEA does not replace the need for project EIAs to be carried out where relevant.
The SEA will provide baseline information pertinent to the strategic issues associated with the potential development of tourism.	The SEA will not replace the need for developers to collect detailed project specific baseline data.
The SEA will inform the development and implementation of the tourism plan.	The SEA will not specifically address issues of land use or infrastructure planning policy, including that relating to consent procedures, but will cross-refer to other policies, plans and programmes where relevant.
The SEA will help identify areas where there may be opportunities for, or environmental constraints against, development.	The SEA will not demarcate specific sites or areas for development or avoidance but will identify the technical issues leading to constraints or opportunities.

Although the SEA Directive seeks to avoid duplication of assessment (it mentions this a number of times), it does require that cumulative effects (when the effects of the implementation of a plan occur in combination with those of other plans, programmes, etc.) are taken into account (see also Section 12.5 below, 'Cumulative effects'). Certain strategic planning issues may already have been determined – and their impacts assessed – at a national, regional or county level, whereas other more detailed issues will more appropriately be left for consideration at a local area plan level or even at the detailed project EIA level. The scoping process should seek to identify what supporting infrastructure and services (e.g. waste water, drinking water, transport, waste management, amenities) and other specific projects (such as signage programmes, visitor centres or car parks) are already provided for by the existing and previously assessed hierarchy of plans. These projects should be taken into account by the SEA in the consideration of cumulative in-combination effects. Additional advice on how best to ensure that tiering takes place effectively can be found in the EPA's Guidance on Strategic Environmental Assessment–Environmental Impact Assessment Tiering (EPA, 2021b).

Where the tourism plan introduces a new development or activity that has not been provided for or assessed elsewhere, or where the tourism plan introduces new detail, including that which may diverge from what is provided and assessed elsewhere, such initiatives should provide a focus for the assessment of direct effects attributable to the plan. Where these are proposed after a tourism plan is adopted, they should be subject to SEA screening and a determination made with respect to the potential for likely significant effects, where appropriate and relevant.

In scoping the environmental assessment for plans, therefore, it is important at the outset to identify the issues that are best dealt with at the scale and level of that plan, and the issues that are better dealt with at the level of other plans and projects elsewhere in the hierarchy. It is important to try to eliminate the potential for consideration of certain issues to be passed down to lower levels, unless necessary, as many important choices (for example, development standards) may have implications for the environment and may be better considered at higher, more strategic levels.

Table 3.3 provides guidance on how to consider tourism attribution in the context of an SEA for a tourism plan.

Table 3.3 Considering tourism attribution in the context of SEA scoping for a tourism plan

Issue being considered by SEA scoping	Should provide a focus in the SEA for direct effects attributable to the plan	Should provide a focus in the SEA for cumulative effects, in combination with the wider planning framework
Supporting infrastructure and services (e.g. waste water, drinking water, transport, waste management, amenities) and other specific projects (such as signage programmes, visitor centres or car parks) that are already provided for by the existing planning framework and that have already been subject to environmental assessment		✓
New supporting infrastructure and services or new other specific projects (such as signage programmes, visitor centres or car parks) that are being introduced by the tourism plan and have not been provided for and assessed elsewhere	✓	
New detail, including that which may diverge, around developments or activities that are already provided for and assessed elsewhere, that is being introduced by the tourism plan	✓	

4. Outline of the Contents and Main Objectives of the Plan

Key points:

- The environmental report needs to describe the contents and main objectives of the plan.
- It can also give information on the more technical aspects of the plan.

Annex I (a) of the SEA Directive requires the environmental report to include 'an outline of the contents and main objectives of the plan'. As such, one of the first chapters of the environmental report should briefly describe the plan and its context in the planning process.

This should include a description of:

- who is preparing the plan and why;
- the plan area;
- the area over which the plan could have impacts (often referred to as 'the zone of influence of the plan', which may be wider than the plan area);
- the time period over which the plan will apply;
- the plan objectives.

It can also include a description of the process used to develop the plan, and a summary of the tourism-related uses and activities covered by the plan.

4.1 Plan contents

Box 4.1 provides an example of how plan provisions could be summarised in a focused way. Table 4.1 shows how a plan's objectives could be presented. Not all of this information will be available early in the SEA process, but it should be included in the environmental report.

Box 4.1 *Example:* Summary of plan content (Tourism Masterplan for the Shannon Region, Waterways Ireland, 2020a)

2.2.1 Key elements of the masterplan

Waterways Ireland is the Competent Authority for the management of the navigable waterways on the island of Ireland, as outlined in Section 1.0, and is responsible for carrying out the Tourism Masterplan for the Shannon Region. The key aims of this masterplan are to:

1. Identify **Products and Themes** with the most potential and offering a unique differentiator
2. **Destination Vision** – establish a shared view of the destination's desired qualities (and profile) in the long-term, including land-based activities and attractions that will complement the water-based activities, and suggest best options to deliver on this.
3. Make **recommendations on other influencing factors** that will stimulate a varied product offering and quality experience e.g. Policy changes (Bye laws), innovative programmes to support private sector (tax incentives) or investment in infrastructure.

In implementing the Masterplan for the Shannon navigation, the objectives are to:

- Increase the distinctiveness and visitor appeal of the area and diversify the offer;
- Attract new visitors;
- Encourage repeat visits
- Increase dwell time
- Drive economic and social benefit;
- Deliver authentic experiences;
- Be of scale;
- Protect environmental sensitivities; and
- Provide for sustainable development.

Table 4.1 *Example:* Identification of plan objectives (Sceilg Mhichil World Heritage Property Management Plan, National Monuments Service, 2021a)

2.2 Objectives of the Plan

The outline Management Objectives of the Plan are presented in Table 2-1 below.

Table 2-1 Plan Objectives

Objectives	
1	To have in place an effective management framework to protect the Outstanding Universal Value of Sceilg Mhichíl.
2	To improve liaison with local interest groups and other relevant parties.
3	To preserve the cultural heritage of the island and sustain its' Outstanding Universal Value.
4	To identify and conserve the natural heritage of the island.
5	To further promote the importance of the WHS to ensure continued coordination by government departments, agencies and other statutory bodies with responsibilities for making and implementing national policies and undertaking activities that may impact on Sceilg Mhichíl and its environs.
6	To manage visitors to Sceilg Mhichíl effectively.
7	To maintain an appropriate standard of safe, regulated visitor access system that supports conservation aims.
8	To increase understanding of and appreciation for Sceilg Mhichíl and its environs.
9	To maintain and enhance the landscape setting of Sceilg Mhichíl.
10	To monitor those factors with the potential to impact on the built and natural environment of Sceilg Mhichíl.
11	To establish a research framework for Sceilg Mhichíl.

4.2 Scope of application and implementation

Stand-alone tourism-specific plans (or policies, programmes, strategies, etc.) are not required to be prepared by legislation. Tourism is, however, already provided for by various statutory documents setting out public policy for, among other things, land use development and activities, infrastructure, sustainable development, environmental protection and environmental management. These plans provide the accommodation, movement and hospitality facilities that are the fundamentals on which the tourism sector is based. All these documents will have been subject to their own environmental assessment processes, as relevant, and form part of the decision-making and consent-granting framework. It is therefore important for tourism plans, and associated SEAs, to explain their scope of application and how they will be implemented – including identifying collaborators, funding mechanisms and whether the plan is part of the framework for granting consent. Box 4.2 provides an example of how this has been done. Section 6, 'Relationship with Other Relevant Plans and Programmes', and Section 3.3, 'Tourism attribution and scoping in and out', should also be referred to.

Box 4.2 *Example:* **Scope of application and implementation** (Clew Bay Destination Experience Development Plan, Fáilte Ireland, 2021a)

Implementing the Plan will involve Fáilte Ireland helping to facilitate, promote, support and coordinate stakeholders (including local authorities, other government agencies, tourism operators, communities and visitors) in their activities in a way that is consistent with existing and emerging plans that have been subject to environmental assessment. The Plan does not provide consent, establish a framework for granting consent or contribute towards a framework for granting consent.

Fáilte Ireland provides funding for sustainable tourism projects that emerge as part of specific, competitive, themed and time-bound grant schemes or as part of wider strategic partnerships. These include projects relating to land use, infrastructural development and land use activities and attractions. Reference made to such projects included in the Plan does not guarantee funding. While funding is provided to certain projects, Fáilte Ireland is not the developer.

In order to achieve funding (including promotion) for land use or infrastructural development or land use activities from Fáilte Ireland, Fáilte Ireland's stakeholders shall be required to demonstrate compliance with measures relating to sustainable development, environmental protection and environmental management contained within the following Fáilte Ireland published documents:

- Wild Atlantic Way Operational Programme Appendix 5 'Site Maintenance Guidelines' and other relevant measures from the Fáilte Ireland visitor and habitat management guidelines series (and any subsequent replacements); and
- Wild Atlantic Way Operational Programme Appendix 6 'Environmental Management for Local Authorities and Others' (and any subsequent replacements).

In order to be realised, projects included in the Plan (in a similar way to other projects from any other sector) will have to comply, as relevant, with various legislation, policies, plans and programmes (including requirements for lower-tier Appropriate Assessment, Environmental Impact Assessment and other licencing requirements as appropriate) that form the statutory decision-making and consent-granting framework, of which the Plan is not part and does not contribute towards.

4.3 Plan development process

This early chapter in the environmental report can also explain the process by which the plan is being developed. Questions relating to this process of 'who', 'why', 'what', 'where' and 'how' are likely to be of interest. Tourism plans are prepared and implemented by a wide range of bodies and organisations. Those involved can include Government Departments, Fáilte Ireland (the National Tourism Development Authority, whose role is to support long-term sustainable growth in the economic, social, cultural and environmental contribution of tourism to Ireland), Tourism Ireland (responsible for marketing the island of Ireland overseas as a leading holiday destination), planning authorities, communities, representative groups and industry.

Figure 4.2 provides an example of the type of background information that might be included in the development of a plan.

Figure 4.2 *Example:* **Plan development process** (Lough Derg Destination Development Plan, Tipperary County Council, 2020a)

How we developed the plan

This plan was developed collaboratively by the members of the Lough Derg Marketing Group and region-wide stakeholders who participated in two workshops in November 2018 in Portumna and Killaloe/Ballina and in follow up meetings and conversations. The output of these workshops was collated into Workshop Outcomes Reports which were issued to all participants and form the basis of strategy development.

The Plan is rooted in the expertise and experience of people already working in the visitor economy in the Lough Derg region, and the strategic priorities of the agencies tasked with looking after the place and planning its future.



5. Public Consultation/Stakeholder Participation

Key points:

- Consultation with, and participation of, the public, environmental authorities and key stakeholders is a core element of good plan-making.
- It is a requirement of the SEA process under the SEA Regulations.

5.1 Consultation

Consultation with, and participation of, the public, statutory environmental authorities and key stakeholders is a core element of good plan-making and a requirement of the SEA process.

The statutory environmental authorities must be consulted when screening[5] for the need to undertake SEA and, when undertaking SEA, early in the SEA process on the scope and level of detail of the information that must be included in the environmental report.

The Department of Housing, Local Government and Heritage's website[6] provides the most up-to-date contact details for the statutory environmental authorities that must be consulted as part of SEA screening, taking account of transfers of functions between Ministers since the SEA Regulations first identified the statutory environmental authorities. The statutory environmental authorities for the purposes of plans falling under SI 435 of 2004, as amended, currently are:

- Environmental Protection Agency;
- Department of Environment, Climate and Communications;
- Department of Housing, Local Government and Heritage;
- Department of Agriculture, Food and the Marine.

5 There is separate EPA Good Practice Guidance on SEA Screening (2021a) that should be consulted when screening for the need to undertake SEA is being undertaken.

6 https://www.gov.ie/en/publication/3539d-strategic-environmental-assessment-sea/

Scoping consultations can be done very early in the SEA process (see also Section 3, 'Scoping').

- It is good practice to consult more widely at this stage and throughout the plan-making/SEA process, for instance on the identification of issues and alternatives, and on an early version of the plan.
- The public, statutory environmental authorities and relevant other Member States[7] must be consulted on the draft plan and environmental report.
- A copy of the adopted plan and the 'SEA statement' (see Section 16), including environmental monitoring arrangements that will be carried out during plan implementation, should be sent to the statutory environmental authorities. The competent authority should also publish notice of the preparation of the draft plan and for adoption of the plan and make the plan and associated SEA documents publicly available, on the competent authority's website and in its offices.

It is useful to explain what consultation has been carried out so far, and how the consultation comments have been taken into account. It can also be useful to include questions in the scoping report to prompt feedback on specific areas of interest.

Table 3.1 in Section 3, 'Scoping', shows how consultation responses, in this instance submissions on the scope of an SEA, and actions taken in response to the consultation can be documented. Figure 5.1 shows how public consultation responses, including those in relation to environmental protection and sustainable development, have been documented, setting a direction for the plan in question.

The information on how comments have been taken into account by the planning team not only shows that the planning team is responsive to comments but will also be helpful when preparing the 'SEA statement' discussed at Section 16 of this guidance note (which provides further details regarding how submissions from the public and stakeholders should be taken into account by the process).

7 Article 7 of the SEA Directive requires transboundary consultation where transboundary impacts are likely. As identified in the Department of Housing, Local Government and Heritage's 2022 'Strategic Environmental Assessment – Guidelines for Regional Assemblies and Planning Authorities', prior to the departure of the UK from the European Union in 2020, the most likely occurrence of transboundary consultations by Ireland pursuant to the SEA Directive was with authorities in Northern Ireland in the context of the preparation of plans that were considered likely to have significant cross-border environmental effects. However, since the UK has left the European Union, any transboundary consultations can no longer be formally undertaken with Northern Ireland under the auspices of the EU SEA Directive but may, in the future, be subject to specific UK and/or Irish legislation, for example, legislation implementing the SEA (Kiev) Protocol to the UNECE's Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention). In the interim, it is noted that Article 393 of the UK/EU's Trade and Cooperation Agreement, agreed on Christmas Eve 2020, reaffirms the UK and EU's commitments to procedures for evaluating the likely impact of a proposed activity on the environment and, where specified projects, plans and programmes are likely to have significant environmental, including health, effects, this includes an environmental impact assessment or a strategic environmental assessment, as appropriate. It is therefore recommended that the competent authority for the relevant tourism plan continue to engage as normal with Northern Ireland's authorities. Competent authorities should offer the opportunity for Northern Ireland authorities to hold transboundary consultations on relevant plans of Irish authorities, in compliance with general principles of transboundary consultation in the SEA Directive and in the context of consultation, cooperation and action within the island of Ireland on matters of mutual interest, North and South, through the North–South Ministerial Council. Technical guidance on arrangements for transboundary consultations with Northern Ireland concerning SEA of plans and programmes will be updated in due course.

Figure 5.1 *Example:* Documenting public consultation responses (Lough Derg Destination Development Plan, Tipperary County Council, 2020b)



Key local insights

Ideas for developing the destination were discussed at the workshops and in follow on conversations with stakeholders, these are summarised below:

- Take a **hub and spoke** approach – offer visitors a great place to stay with plenty to do nearby - creative curation of clusters of existing experiences can bring quick results
- We need to make the experiences **easy to consume**
- The southern half of the lake is already well on the way to positioning itself as a key regional hub within Ireland's Hidden Heartlands for **high adrenaline activities on and off the water**
- Developing **Portumna as a destination town** would be a game changer – its geography positions it at the junction of the **two strategic spines of the Ireland's Hidden Heartlands** brand experience
- The ongoing work to present **Holy Island** in new ways to visitors can have knock on benefits for the **whole central region of the lake** on both the Clare and Tipperary sides if easy ways for visitors to cross the lake are progressed
- **The environment is the asset**
- **Off-road connections beyond the immediate lake context** are important – south to Limerick and north to Meelick and Clonmacnoise – with potential for developing experiences along the way which reveal the interaction of people and water through history such as the Pilgrimage journey and the harnessing of the river's power at Ardnacrusha
- The comprehensive existing audits of heritage and natural assets provide a **strong basis for curating experiences** for visitors, along trails, and within easily understood geographies
- **Lakeshore forests** in state ownership have a key role to play in deepening visitor experiences in key locations around the lake
- **Digital is everything** and business websites are the shop window for the destination
- **Blueway enterprise activation and support** is crucial
- Pick a few things and **do them well**
- We need to ensure visitors **understand distances** within the destination and the **options for moving around** the intricate land and water geography
- The current use of existing visitor infrastructure is **unbalanced**
- **Rural depopulation** is happening – particularly in the northern and north western areas
- Different parts of the lake are at **varying stages of destination development**
- There is still much **scope for new businesses** to take advantage of the opportunities provided by new infrastructure development

6. Relationship with Other Relevant Plans and Programmes

Key points:

- The aim of this section, and that on environmental protection objectives, is to put the plan into context: what other plans, programmes and objectives affect the plan, and how are other plans etc. affected by the plan?
- Focus on *key relevant* other plans, programmes and environmental objectives, rather than trying to be comprehensive.

The relationship with other relevant plans and programmes, as well as the identification of relevant environmental protection objectives, helps to put the tourism plan into context: what other plans, programmes and objectives affect the plan, and how other plans, programmes and projects are affected by the plan. These effects may occur over a range of environmental criteria, such as land use planning, biodiversity, water services, transport, air quality, water quality and climate action.

Identifying key plans, programmes and environmental objectives relevant to the plan and at the appropriate level in the hierarchy (a county plan may be more relevant than a national plan to a local plan, for example) being assessed in the main body of the environmental report, rather than trying to be comprehensive, can help focus attention on the most important relationships. Other, less important plans, programmes and environmental objectives can be identified in appendices for completeness.

6.1 Hierarchy of plans, programmes projects and environmental assessment

Tourism plans will sit alongside or within a hierarchy of statutory documents setting out public policy for, among other things, tourism, land use development and activities, infrastructure, sustainable development, environmental protection and environmental management. These plans provide the accommodation, movement and hospitality facilities that are the fundamentals on which the tourism sector is based. All these documents will have been subject to their own environmental assessment processes, as relevant, and form the decision-making and consent-granting framework. The particular hierarchy may change depending on the characteristics of the relevant tourism plan.

The National Planning Framework (NPF) sets out Ireland's planning policy direction up to 2040. The NPF is implemented through Regional Spatial and Economic Strategies (RSESs) and through lower tier Development Plans and Local Area Plans. The RSESs set out objectives relating to tourism development that have been subject to environmental assessment, including those relating to, for example: enhancing provision of tourism and leisure amenity; promoting tourism activity; developing a road network and public transport services, facilitating improved visitor access and longer dwell times; developing walking and cycling trails, opening greater accessibility to the marine and countryside environment by sustainable modes; and facilitating appropriate tourism development, including that relating to greenways, blueways and peatlands. The RSESs have provided a framework for the assessment and review of existing local

authority development plans and local area plans, which already include various provisions relating to land use, tourism and infrastructure. These Development Plans and Local Area Plans have been, are being or will be reviewed and prepared to be consistent with the RSESs and they are likely to elaborate on the framework for tourism development provided for by the RSESs. Such reviews are also subject to environmental assessments.

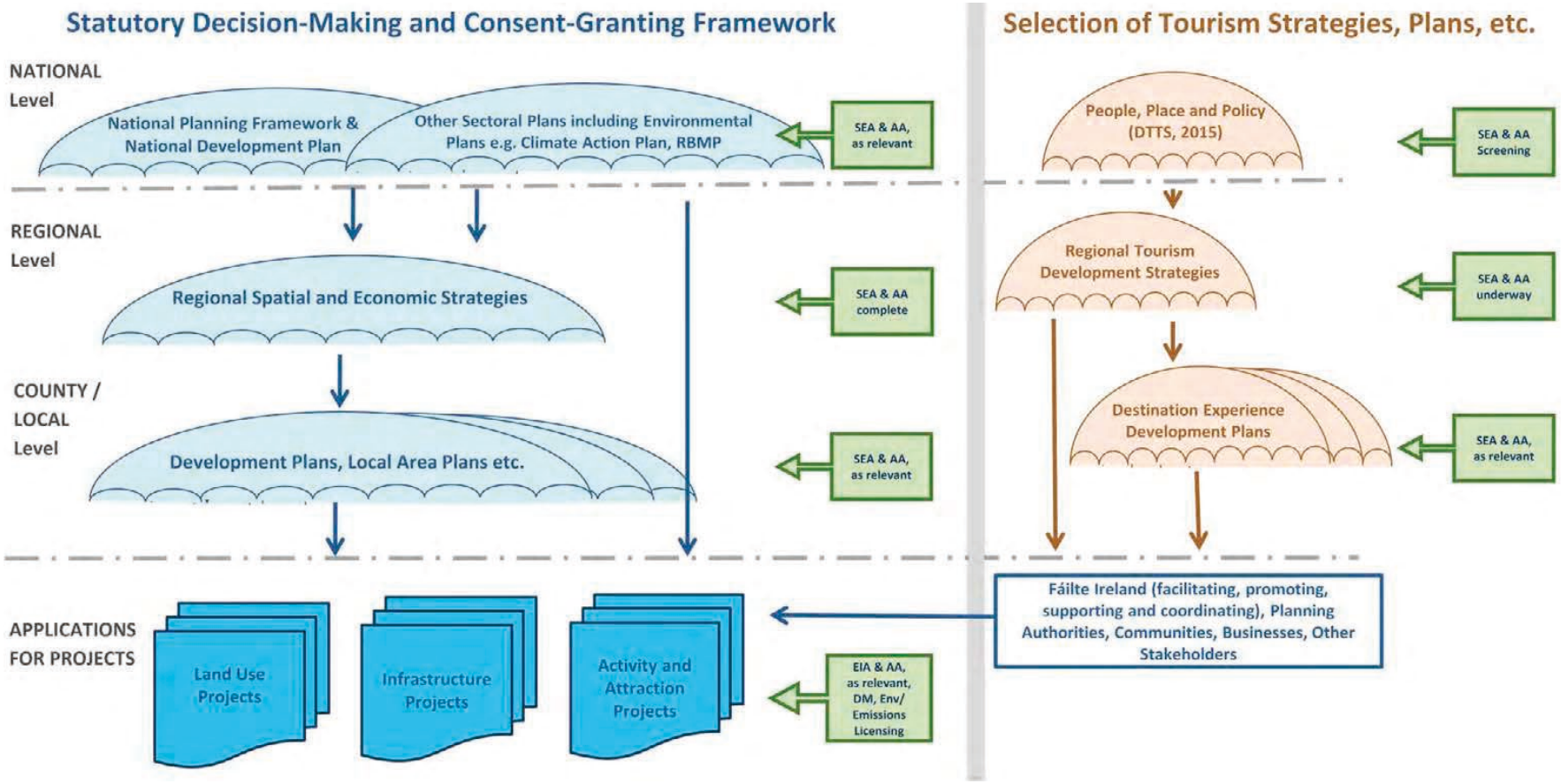
'People, Place and Policy – Growing Tourism to 2025' is a Department of Tourism policy statement that aims to ensure that the tourism sector continues to grow in a sustainable manner. It represents a key national policy document for the tourism sector. Although the policy is centred on Ireland achieving its full potential as a destination for overseas tourism, it acknowledges that the domestic tourism market underpins the range of visitor accommodation and services that provide competitive advantage to Ireland in the international market; therefore, many of the policy statement's measures will also benefit the domestic tourism sector. Tourism plans should consider and align with, as relevant and appropriate, the policy statement.

Implementation of tourism plans needs to be consistent with and conform with the NPF, the RSESs and lower-tier land use plans, including provisions relating to sustainable development, environmental protection and environmental management that have been integrated into these documents including through SEA and AA processes. In order to be realised, projects included in tourism plans (in a similar way to projects from any other sector) will have to comply, as relevant, with various legislation, policies, plans and programmes (including requirements for lower-tier Appropriate Assessments and Environmental Impact Assessment, as appropriate) that form the statutory decision-making and consent-granting framework.

Figure 6.1 provides an example that shows how a selection of tourism plans relate to other plans and programmes that form part of a statutory decision-making and consent-granting framework. This example also identifies requirements relating to environmental assessment and where applications at project level fit. The figure identifies, in **grey** colour, different spatial decision-making levels (national, regional county/local and applications for projects). To these levels, the figure aligns both examples of associated plans, programmes, strategies and projects from the statutory decision-making and consent-granting framework in **blue**, and examples of a selection of tourism policy, plans and strategies in **brown**. The **green** boxes indicate a selection of applicable environmental assessment requirements. With dividing lines between the different levels and arrows connecting the examples, the figure indicates linkages between the levels and examples. The text in the bottom right-hand corner of the figure – 'Fáilte Ireland (facilitating, promoting, supporting and coordinating), Planning Authorities, Communities, Businesses, Other Stakeholders' – indicates the role of the competent authority (Fáilte Ireland) and other stakeholders in implementing the Tourism Plans through progressing applications for development under the statutory decision-making and consent-granting framework.

Understanding this hierarchy, including the relationships between the different policies, plans, strategies, etc., the scope of application of the tourism plan in question and how it will be implemented, is essential in identifying: which developments and activities can reasonably be assigned to the plan being considered; and which are already provided for and assessed by the existing planning framework, including as infrastructure and amenities for the general population (refer also to Section 3.3, 'Tourism attribution and scoping in and out').

Figure 6.1 *Example:* How selected tourism plans relate to other plans, programmes and projects (includes Environmental Assessment requirements) (Fáilte Ireland, 2022c)



7. Relevant Aspects of the Current State of the Environment and the Likely Evolution Thereof, Without Implementation of the Plan

Key points:

- The baseline description should discuss the likely future without the plan as well as current conditions.
- Environmental issues can be 'scoped out' if they are not relevant to the plan, provided that an explanation is given of why they are scoped out.
- Full use should be made of information that would anyway be gathered as part of the plan-making process.

The description of the current state of the environment is a key part of SEA, as it sets a baseline against which the plan's impacts can be assessed and monitored, helps to identify existing environmental problems, and allows data gaps to be identified and, if necessary and where possible, filled. Annex I (b) of the SEA Directive requires the environmental report to include a description of:

- 'relevant aspects' of the current state of the environment – this implies that some aspects may not be relevant and can be 'scoped out';
- likely evolution of the environment without implementation of the plan;
- any existing environmental problems relevant to the plan.

The 'relevant aspects' of the current state of the environment will be informed by the SEA Scoping process described under Section 3, 'Scoping'.

Only 'relevant aspects' of the current state of the environment need to be included in the environmental report, and more generally the environmental report only needs to include 'information that may reasonably be required taking into account':

- current knowledge and methods of assessment;
- the contents and level of detail in the plan or programme;
- the stage of the plan or programme in the decision-making process;
- the extent to which certain matters are more appropriately assessed at different levels in the decision-making process to avoid duplication of assessment. (Article 5.2 of the SEA Directive and transposing Regulations, as amended, including Article 11(2) of SI 435 of 2004, as amended)

7.1 Current state of the environment

The description of the current state of the environment should cover the components listed in the SEA Directive – biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and

the interrelationship between the above factors – unless a good reason is given for why certain issues should be 'scoped out'. It is worth noting that the wording in the Directive (Annex I(f) related to this is *'including on issues **such as** biodiversity, population'* (emphasis added). This can be interpreted as suggesting that there may be other topics also.

Tourism plans are prepared for a variety of areas (national, regional and destination, for example).

The current state of the environment should describe, for example:

- the spatial and seasonal spread of existing levels of tourism across the relevant region/area/destination, including visitor levels, trends, relevant activities and developments;
- how the following existing infrastructure within the area to which the plan relates, and beyond where relevant, currently services tourism, including details on capacities and trends:
  - transport (to and within the region/area/destination);
  - water services – waste water and drinking water;
  - waste management;
  - telecommunications;
  - energy transmission.
- how use of this infrastructure currently interacts with the environment, for example:
  - generation or minimisation of transport emissions to air;
  - conveyance of visitors to/through ecologically sensitive areas;
  - generation or minimisation of waste water emissions to water;
  - interaction between drinking water usage and source water bodies/wider environment and population;
  - generation or minimisation of litter in sensitive areas;
  - minimisation of carbon footprint.
- the environmental components that may be affected by the plan/programme, which are prepared for areas that are environmentally sensitive (such sensitivities are often sustaining resources for tourism, for example, natural/semi-natural habitats, valued landscapes and cultural heritage). Other environmental issues, such as those relating to infrastructural capacity, may not be the primary attractors of visitors, but may be adversely affected by increases in tourism – potentially impacting on future tourism potential of areas.

Where possible, when describing the current state of the environment, consider utilising the available data for the scale at which the plan is being prepared. In other words, a national level tourism plan would be informed by national level environmental baseline information. Lower down the hierarchy, more regionally and locally specific information should, where available, be taken into account.

7.2 Identifying and presenting the data

The EPA's State of the Environment report series *Ireland's Environment – An Integrated Assessment* can be a good starting point for baseline data collection and for recognising the overall environmental challenges facing Ireland. Plans at all levels in the planning hierarchy (tourism in this case) should consider how these challenges can be addressed.

During engagement with various bodies including the statutory environmental authorities, asking questions regarding additional data sources can help further refine the scope of the assessment.

For cyclical plans, the monitoring data from the previous plan and SEA will, where available, also be useful. The EPA has published 'Good Practice Guidance on SEA Statements and Monitoring' (EPA, 2020b), which can be a useful reference document when preparing monitoring measures and SEA Statements.

Existing project-level EIAs may also provide useful site-level data where the plan is spatially specific. EPA Guidance on Strategic Environmental Assessment–Environmental Impact Assessment Tiering (EPA, 2021b) might also be useful to consider.

This chapter of the environmental report can also document the location of any Special Protection Areas and Special Areas of Conservation, for example, that might be affected by the plan, why they have been designated, and the kinds of impacts that they are vulnerable to, as a link to the appropriate assessment/Habitats Directive Assessment process.

The description of baseline can be in the form of text, mapping, tables and graphs or a combination (see example at Figure 7.1).

Mapped data can be helpful in facilitating the direction of development towards robust, well-serviced and well-connected areas – thereby facilitating the general avoidance of incompatible areas in the most sensitive, least well-serviced and least well-connected areas. Where environmental sensitivities occur, there is an increased likelihood that development will conflict with these sensitivities and cause environmental deterioration. The EPA–OSI funded Environmental Sensitivity Mapping Webtool[8] can help identify what environmental sensitivities are within the study area, to inform the SEA and the plan/programme/strategy being prepared. However, the occurrence of environmental sensitivities does not preclude development; rather it flags at a strategic level that, if tourism-related development or activities are to be provided for, mitigation measures will need to be integrated into the relevant plan in order to ensure that implementation of the plan contributes to the protection of the environmental sensitivities in question.

8 https://enviromap.ie/

The EPA's Geoportal site (http://gis.epa.ie/) provides spatial environmental data, and www.enviromap.ie is a web-tool focused specifically on environmental sensitivity mapping for SEA. The EPA's manuals on GIS for SEA and Environmental Sensitivity Mapping provide further guidance on GIS and mapping techniques. Weighting can also be applied in a GIS system, such as the ESM Webtool, to illustrate the relative importance and significance of relevant datasets: different datasets can be assigned different weights (e.g. more weight for internationally important than locally important biodiversity sites) and overlaid. This allows for the generation of map(s) illustrating cumulative vulnerability/constraints, such as that shown by the environmental sensitivity mapping at Figure 7.2. This also can help to identify sensitive areas where development should be avoided or mitigated.

7.3 Likely evolution without the plan

Annex I (b) of the SEA Directive specifies that the baseline description should also include a description of 'the likely evolution [of the current state of the environment] without implementation of the plan'. The plan or programme's impacts can then be determined as the difference in environmental conditions with and without the plan. Generally, this means a 'business as usual' scenario where the current plan continues into the future, rather than a 'no plan at all' scenario; and typically, it means looking forward for the length of time of the new plan (say 20 years).

Under a 'business as usual' scenario, the situation in 20 years may be quite different than the current situation: for instance, air pollution levels may have fallen as a result of tightening European legislation, but biodiversity may have worsened. Boxes 7.1 and 7.2 provide examples of how the likely evolution of the environment without implementation of the plan has been described.

Figure 7.1 *Example:* Description of current state of cultural heritage (Sceilg Mhichil World Heritage Property Management Plan, National Monuments Service, 2021a)

Cultural Assets Overview

Sceilg Mhichíl (Great Skellig) is one of two rocky islands—the other being Little Skellig— known as the Skellig Rocks, situated in the Atlantic Ocean off the coast of the Iveragh Peninsula, Co. Kerry. Geologically, these islands are formed of Old Red Sandstone and are part of the same formations as the Macgillycuddy's Reeks and the Caha mountains. Sea level rise separated the Skelligs from the mainland making them islands, though both clearly maintain their mountainous form, projecting from the sea. Sceilg Mhichíl, the larger of the two islands is 218m above sea level and is 21.9 hectares in extent. The location and natural setting of Sceilg Mhichíl is spectacular in itself; but it is its remaining cultural heritage remains that provide it with its Outstanding Universal Value. It is arguably the most spectacularly situated early medieval island monastic site in Ireland and globally and 'It represents a unique cultural achievement, illustrating a significant period of history and civilisation that has disappeared' (NMS, 2020). Its location at the western edge of the Europe which was then thought as the edge of the known world, Sceilg Mhichíl was the chosen destination for a small group of ascetic monks who, in their pursuit of greater union with God, withdrew from civilisation on the mainland to this remote and precipitous rock. Sometime between the sixth and eight centuries, a monastery was founded there producing one of the most dramatic examples of the extremes of Christian monasticism. The religious community left for the mainland sometime in the thirteenth century but Sceilg Mhichíl continued as a place of pilgrimage. Due to its setting and cultural heritage remains and traditions there is no comparable archaeological monument to Sceilg Mhichíl currently known.

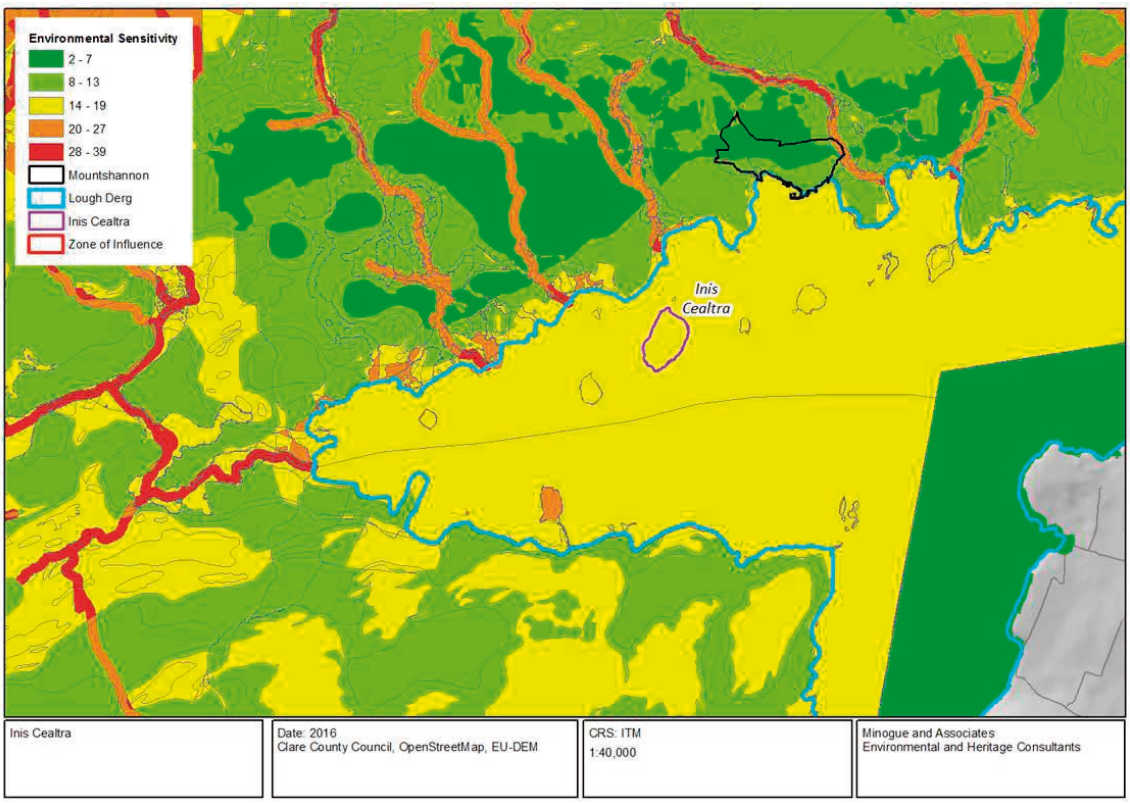
In addition, Sceilg Mhichíl has important nineteenth-century evidence for the early establishment and history of lighthouses on the Irish coast (Taylor, 2006; O'Reilly, 2018). Two separate lighthouses were constructed on the island. Both were particularly challenging building projects due to the location and remoteness of the island. A rock-cut road was also constructed to connect the two lighthouses to the pier at the eastern end of the island. This pier remains the primary landing place for island visitors today,

Sceilg Mhichíl (Great Skellig) island is a National Monument in State ownership, No. 61.[8] In 1996 UNESCO inscribed the island onto the World Heritage List in recognition of its Outstanding Universal Value.[9] The island is located in the barony of Iveragh and the civil parish of Killemlagh. It comprises a single townland of Sceilg Mhichíl or Skellig Rock Great and its name derives from the Irish translated as 'the steep rock of Michael'; Michael being the Archangel Saint Michael.[10]



Recorded archaeological monuments (indicated by red dots)

Figure 7.2 *Example:* **Environmental sensitivity mapping** (Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017b)



Box 7.1 *Example:* **Description of likely evolution of the environment without the plan** (National Monuments Service, 2021a)

The likely future changes to Sceilg Mhichíl and the surrounding area in relation to the relevant SEA topics are described below:

Biodiversity, flora and fauna

- Resident cliff nesting bird populations on the Skellig islands are likely to remain at similar levels as the present day. Burrowing bird species such as Atlantic puffin, Manx shearwater and European storm petrel may however be subject to increased disturbance through deteriorating physical conditions of the site and increased numbers of visitors.
- Disturbance of cetaceans and pinniped species in the waters surrounding Sceilg Mhichíl could potentially increase due to an increased number of vessels circulating around the island.
- Bird populations could be at severe risk from potential introduction of predatory mammalian.
- Increased disturbance to nesting bird species during the breeding season, leading to reduction in breeding success and population declines, should helicopter tours and use of drones increase.

Climatic factors

- Current and predicted changes to the local weather conditions, such as change in dominant wind direction and increased severity of winter storm events, will continue into the future.

Cultural, architectural & archaeological heritage

- Boats and visitor numbers to island and 'off island' may increase without monitoring and cause erosion to monuments and underlying deposits, effects including rockfalls, soil erosion, degradation of monuments and features such as steps, as well as negative impacts on the location's spiritual integrity.
- The lack of a future interpretative base/centre that would clearly show the international significance of the site may lead to a lack of awareness of the reasoning behind Sceilg Mhichíl's World Heritage Status inscription, its historic integrity and its spiritual significance may wane. Should this occur it may be difficult to re-establish spiritual significance and historic integrity.
- Lack of monitoring of the consolidated monuments and structures may lead to their deterioration and ultimately their destruction due to lack of mitigation in relation to, for example, climate impact.
- Ongoing research on the island's cultural heritage, both material and intangible, may be stunted.
- Loss of Word Heritage Status and loss of recognition of Sceilg Mhichíl as a place of Outstanding Universal Value.

Soil

- Due to increasing frequency and severity of extreme weather conditions in the vicinity of Sceilg Mhichíl, erosion and rockfall events are likely to occur with increasing frequency on Sceilg Mhichíl.

Landscape and visual amenity

- The present landscape and seascape, through deterioration of the site due to the effects of climate change, may be negatively impacted in the long-term.

Material assets and infrastructure

- Necessary renovations of the existing lower lighthouse complex may not proceed, leading to deterioration of the structures and inability for their use by workers and visitors to the island.

Population and human health

- No further safety structures and procedures may be implemented on the site, potentially leading to more hazardous conditions for both workers and visitors on the island.
- The current permit system for commercial boats to take visitors to Sceilg Mhichíl would likely remain in its current iteration, with 15 operators competing in a commercial tender on a 3-year basis.

Box 7.2 *Example:* Description of likely evolution of the environment without the plan
(West Cork Destination Experience Development Plan, Fáilte Ireland, 2020c)

The likely evolution of the environment in the absence of a plan would resemble the environmental effects that are described for Alternative 1 (Business as Usual):

As identified in the Plan, there are various strengths associated with the current tourism development situation include:

- Diversity of coastal landscapes and ecosystems.
- Unique and welcoming small towns in close proximity to each other.
- Array of opportunities to build 'slow' tourism.
- Sense of intimacy balanced with a 'cosmopolitan' feel.
- Energy and commitment to sustainability and maintaining local traditions and values.
- Quality of the food, diversity of local artisan food producers – highest numbers in Ireland.
- Well established recognition for local foods and food specialisms such as Clonakilty black pudding.
- Rich depth and colour in local stories – layers of history.
- Distinctive and vibrant maritime heritage.

However, there are a number of weaknesses associated with this situation, including:

- Seasonality.
- Limited public transport.
- Reduction of sea routes.
- No traffic management systems in place.
- Roads not suited to high volumes/signage to towns.
- Insufficient focus on the strengths of the area – its potential for 'slow' travel.
- Insufficient marine infrastructure for visiting boating vessels.
- Accommodation – varied needs - to include parking for camper vans near amenities.
- No significant markers for start or end of Wild Atlantic Way.
- Insufficient experiences, particularly in non-peak periods.
- Staff shortages and issues relating to affordable housing for staff.
- Marketing and positioning of West Cork experiences.

Sustainable development, environmental management and environmental protection under Alternative 1 is provided through the existing statutory planning and consent framework. These measures would contribute towards positive effects on the protection and management of all environmental components (see Table 7.3).

Tourism related development would continue to be planned for and consented through the existing statutory planning and consent framework. Potential adverse effects (see Table 7.3) would continue be mitigated through that process.

In the absence of a Plan, there would continue to be an increase in tourist numbers – consistent with the development of tourism over many decades. The most popular locations in the West Cork Coast area would see the largest increases in visitors, which would occur during the peak season. This would give rise to greater concentration of tourists during peak seasons and in the most popular locations thereby increasing potential environmental effects on all components and peak load additions on various infrastructure in particular locations/at particular times.

Contributions towards an increase in travel related greenhouse gas and other emissions to air, including from aviation, would not occur as a result of a Plan that seeks to lengthen dwell time and grow visitor numbers, however increases in tourist numbers would occur. Similarly, the positive mitigatory effects as a result of provisions of a Plan, such as those relating to sustainable mobility, traffic management and compliance with climate adaptation and management plans/strategies would not be provided for.

There would be one layer of mitigation under Alternative 1, through the existing statutory planning and consent framework.

8. Environmental Characteristics of Areas Likely to be Significantly Affected

Key points:

- The level of detail of the SEA should correspond to the level of detail of the plan.
- Overlay maps are particularly useful for site-level assessments.

Annex I (c) of the SEA Directive requires the environmental report to describe 'the environmental characteristics of areas likely to be significantly affected' by the plan. This is a 'zoom down' to areas where the plan proposes significant change. This is particularly relevant for plans that propose areas or sites for development or that are looking to expand significantly tourism-related activities over the lifetime of a particular plan. Environmental conditions in those areas might be different from the overall plan area, requiring location-specific mitigation measures.

The siting of these types of developments needs to take account of the environmental sensitivities within and adjacent to the plan area, in addition to ensuring that the environment in that area can absorb further development (tourism in this case).

Aspects such as holiday homes can add to ribbon development if not carefully planned, sited and developed, for example.

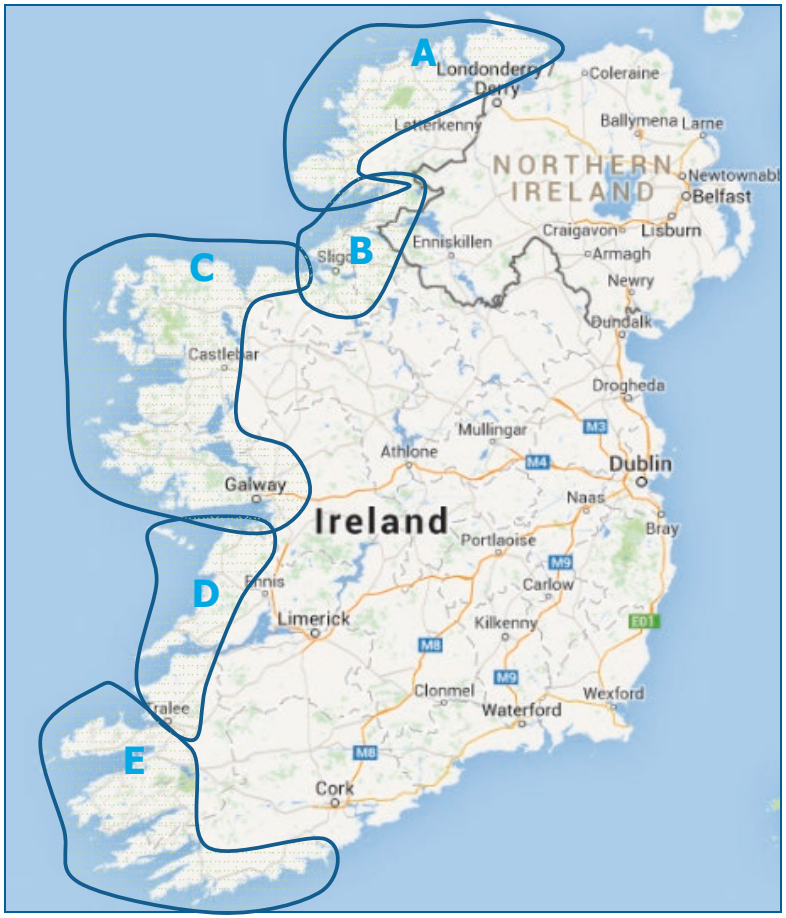
The description of these environmental characteristics will be guided by the scope of the SEA (see Section 3, including 3.3 'Tourism attribution and scoping in and out').

The level of detail (and summary of the environmental characteristics) of the SEA should correspond to the level of detail of the plan/programme.

Combining constraints on a single map, such as those used in environmental sensitivity mapping, can be useful to inform site-level assessments.

Figure 8.1 provides an example of this 'zoom down' to areas within a region, with characteristics, sensitivities, effects and mitigation all identified.

Figure 8.1 *Example:* Environmental characteristics of particular areas (Wild Atlantic Way Operational Programme, Fáilte Ireland, 2015)



Natural Heritage

Zone	Characteristic Features
A.	Mountains, bogs, rocky coasts, islands and scattered farming [Western lowland blanket bog, wet heaths, permanent lowland wet meadows, lowland grasslands and coastal communities]
B.	Coastal farming, Mixed sandy and rocky coasts, mountains, bogs [Lowland Grasslands, wet heaths, permanent lowland wet meadows and coastal communities and western lowland blanket bog]
C.	Mountains, bogs, rocky coasts, islands and scattered settlements [Western lowland blanket bog, wet heaths, permanent lowland wet meadows and coastal communities]
D.	Coastal farming Rocky Coasts, Bogs [Lowland and marginal grasslands and wetlands and wet heaths]
E.	Mountains, bogs, rocky coasts, islands and scattered farming [Western lowland blanket bog, dry heather, wet heaths and heathy grassland, lowland grasslands]

Regional Natural Heritage Assessment				
Zone	**Character**	**Sensitivity**	**WAW Effects**	**Mitigation**
A	**Donegal Peninsular** Mountains, bogs, rocky coasts and scattered farming with scattered settlements. Contains extensive areas of designated habitats, species and features.	Generally high sensitivity both to new development and activities associated with maintenance and renewal of existing developments. Sensitivity is highest outside of established settlements and existing road network.	Developments or use of an inappropriate scale or intensity – even of a small scale – can have disproportionately extensive effects.	None required if use and development conform with existing regulatory requirements and FI Guidelines
B	**Sligo Coastal Plain** Coastal farming, Mixed sandy and rocky coasts, mountains, bogs – this zone is characterised by many types of different habitats and species in very close proximity	Generally robust with locally high sensitivity – often with transitions between significantly different habitats over very short distances.	Developments within working landscapes and established settlements will have little discernible effect – care required in the vicinity of individual sites.	None required if use and development conform with existing regulatory requirements and FI Guidelines
C	**Mayo/Galway Peninsular** Mountains, bogs, rocky coasts and scattered farming with scattered settlements. Contains extensive areas of designated habitats, species and features.	Generally high sensitivity both to new development and activities associated with maintenance and renewal of existing developments. Sensitivity is highest outside of established settlements and existing road network.	Developments or use of an inappropriate scale or intensity – even of a small scale – can have disproportionately extensive effects.	None required if use and development conform with existing regulatory requirements and FI Guidelines
D	**Clare / North Kerry Coastal Plain** Coastal farming, Mixed sandy and rocky coasts, mountains, bogs – this zone contains large-scale areas of designated habitats, species and features	Generally robust with locally high sensitivity in the unique Burren landscapes and nearby large-scale coastal sea-cliff complexes.	Developments within working landscapes and established settlements will have little discernible effect – care required in the vicinity of individual sites.	None required if use and development conform with existing regulatory requirements and FI Guidelines
E	**South Kerry/ West Cork Peninsular** Mountains, bogs, rocky coasts and scattered farming with scattered settlements. Contains extensive areas of designated habitats, species and features.	Generally high sensitivity both to new development and activities associated with maintenance and renewal of existing developments. Sensitivity is highest outside of established settlements and existing road network.	Developments or use of an inappropriate scale or intensity – even of a small scale – can have disproportionately extensive effects.	None required if use and development conform with existing regulatory requirements and FI Guidelines

9. Existing Environmental Problems

Key points:

- Existing problems are helpful for identifying issues that the plan should focus on.
- They must include any problems related to the integrity of Special Protection Areas and Special Areas of Conservation.

Annex I (d) of the SEA Directive requires a description of 'existing environmental problems which are relevant to the plan including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC'. Areas designated pursuant to Directive 79/409/EEC are Special Protection Areas (SPAs) for birds. Areas designated subject to Directive 92/43/EEC are Special Areas of Conservation (SACs) for habitats and species.

Existing environmental problems can be identified from the policy analysis (Section 6) and baseline environmental description (Sections 7 and 8). Are any standards being exceeded? Are targets not being met? Are trends going in the wrong direction? Examples of potential existing environmental problems that should be taken into account include:

- European sites (SPAs and SACs) where tourism-related activities or developments are identified by the National Parks and Wildlife Service as a threat or pressure on the relevant sites;
- areas where capacities in infrastructure – transport or water services, for example – are exceeded on an ongoing basis or at particular times of the year;
- areas where water quality does not achieve European Water Framework Directive standards;
- areas where air quality does not meet European air quality standards;
- protected habitats and species whose status is inadequate or bad.

A good starting point for this section is to consider the environmental monitoring results from the previous iteration of the plan, if one exists, as recommended by the EPA (2020b) 'Guidance on SEA statements and monitoring'. That will give an indication of the effectiveness of previous mitigation measures and whether environmental problems are increasing or abating. Monitoring is dealt with at Section 14 of this guidance note.

Once the existing environmental problems are identified, it would be worth considering why they arose and what is contributing to them. This can help to inform the plan, so that it can help to reduce the causes of the problems. The SEA should seek to ensure that the tourism plan does not make any existing problem worse and it should examine whether the plan could contribute towards the improvement of any existing problem.

Where infrastructural or assimilative capacity in particular locations is being exceeded at particular times, for example, an examination of factors such as demand from local populations and normal local/regional visitors, demand from additional tourism, environmental/seasonal conditions (such as heavy rainfall, drought, low flow periods) or temporary loss of capacity due to improvement/ maintenance works could allow for an identification of how much of the pressure is due to additional tourism. Where pressures are identified on ecological resources, monitoring and surveys at particular locations could allow for an identification of which proportion of the pressure is due to normal local/ regional recreational and amenity use and which proportion is due to additional tourism.

Table 9.1 suggests how environmental problems might be documented by the SEA. Table 9.2 provides an example of how environmental problems relating to European sites have been identified, while Box 9.1 identifies how environmental problems relating to a plan area have been identified.

Table 9.1 Suggestion: How existing environmental problems might be documented

Problem	Evidence	Cause
Infrastructure project supported by the previous iteration of the tourism plan will increase the future loadings on the existing waste water treatment plant, which is over capacity.	The annual reports from the local waste water treatment plant identify that there are annual exceedances.	Annual exceedances correlate with the tourism peak season, therefore the issues associated with capacity limits are identified as likely to be directly attributable to tourism.
Trail promoted by the previous iteration of the tourism plan has resulted in damage to protected habitats.	Special Area of Conservation database, specifically the site-specific conservation objectives or standard data, identifying trampling as a known threat or pressure for the SAC.	Visitor numbers through the habitat have exceeded the natural resilience of the habitat type and no management interventions have been implemented at the site to address the issue.
Activities promoted within the previous iteration of the tourism plan, such as kayaking, increase accessibility of lake islands, resulting in a potential conflict with breeding birds and/or winter waders.	Survey X in 2021 by organisation Y.	Land-based recreational disturbances are known to cause effects to winter waders. This is particularly relevant with respect to islands, as the species that nest there are likely to be particularly sensitive to disturbance.

Table 9.2 *Example:* **Environmental problems relating to particular European sites** (Burren and Cliffs of Moher Visitor Experience Development Plan, amended from Fáilte Ireland, 2020a)

Site code	Site name	Distance (km)	Qualifying features (qualifying Interests and Special Conservation Interests)	Potential effects (refer also to Sections 3.3.2 and 3.3.3 above)	Pathway for significant effects	Potential for in-combination effects
004005	Cliffs of Moher SPA	Within (study area)	Fulmar *(Fulmarus glacialis)* Kittiwake *(Rissa tridactyla)* Guillemot *(Uria aalge)* Razorbill *(Alca torda)* Puffin *(Fratercula arctica)* Chough *(Pyrrhocorax pyrrhocorax)*	The SCIs for the SPA are sensitive to potential effects such as direct disturbance and noise pollution issues. Sources for effects that could impact upon the SCIs include: ■ Disturbance of wildlife; ■ Heavy littering or dumping quantities of waste; ■ Addition/alteration of site features, transient emissions, noise; ■ Removal and throwing of large rocks; and ■ Unrestricted dogs causing disturbances to wildlife.	Yes	Yes
004031	Inner Galway Bay SPA	Within (study area)	Great Northern Diver *(Gavia immer)* Cormorant *(Phalacrocorax carbo)* Grey Heron *(Ardea cinerea)* Light-bellied Brent Goose *(Branta bernicla hrota)* Wigeon *(Anas penelope)* Teal *(Anas crecca)* Shoveler *(Anas clypeata)* Red-breasted Merganser *(Mergus serrator)* Ringed Plover *(Charadrius hiaticula)* Golden Plover *(Pluvialis apricaria)* Lapwing *(Vanellus vanellus)* Dunlin *(Calidris alpina)* Bar-tailed Godwit *(Limosa lapponica)* Curlew *(Numenius arquata)* Redshank *(Tringa totanus)* Turnstone (Arenaria interpres) Black-headed Gull *(Chroicocephalus ridibundus)* Common Gull *(Larus canus)* Sandwich Tern *(Sterna sandvicensis)* Common Tern *(Sterna hirundo)* Wetland and Waterbirds	The SCIs for the SPA are sensitive to potential effects such as direct disturbance and noise pollution issues. Sources for effects that could impact upon the SCIs include: ■ Disturbance of wildlife; ■ Heavy littering or dumping quantities of waste; ■ Addition/alteration of site features, transient emissions, noise; ■ Removal and throwing of large rocks; and ■ Unrestricted dogs causing disturbances to wildlife.	Yes	Yes

Box 9.1 *Example:* **Environmental problems relating to a tourism plan area** (Sceilg Mhichil World Heritage Property Management Plan, National Monuments Service, 2021)

The environmental baseline identified a number of environmental problems that have been deemed relevant for Sceilg Mhichíl including:

- Potential for the introduction of invasive non-native species (INNS);
- Current conservation status of Atlantic puffin, Manx shearwater and European storm petrel on Sceilg Mhichíl is unknown;
- Pressure from increasing visitor numbers to Sceilg Mhichíl on the resident seabird population;
- Disturbance of nesting seabird species and damage to their habitat; and
- Increasing frequency and intensity of storm events in the region leading to rockfall incidents.

10. SEA Framework

Key points:

- SEA frameworks are not legally required but can help to structure the impact assessment and mitigation process.
- The framework should be linked to existing thresholds and targets (e.g. European Directives).

While there is no legal requirement for an environmental report to include a formal framework by which to assess the impacts of the plan objectives, alternatives, policies and/or sites, it makes sense to develop such an 'SEA framework', as is described below.

10.1 Strategic environmental objectives, indicators and targets

The SEA framework can comprise:

- a simple list of topics or themes that will be considered during the assessment (e.g. the status of surface waters);
- strategic environmental objectives that state the direction in which the plan should be going. These may be developed from policies that generally govern environmental protection objectives established at international, Community or Member State level (e.g. to contribute towards the maintenance and improvement, where possible, of the quality and status of surface waters);
- indicators that measure the impacts that the plan is likely to have (e.g. classification of Overall Status of Water Bodies, comprising ecological and chemical status, under the European Communities Environmental Objectives (Surface Waters) Regulations 2009);
- targets that the plan should achieve (e.g. no deterioration in the status of any surface water or adverse effect on the ability of any surface water to achieve 'good status' as a result of the plan);
- responses to any problems identified through monitoring (e.g. if the status of waters declines as a result of implementation of the tourism plan, the competent authority will seek to investigate the issue in consultation with the DHLGH Water Section, the EPA Catchment Unit, Irish Water and the relevant planning authority or authorities), as appropriate, and implement a tailored response.

Any/all of these are acceptable as long as they help to identify the plan's impacts and possible mitigation measures.

Table 10.1 shows examples of SEA objectives, targets and indicators for two environmental components. A typical SEA framework might have between eight and 15 SEA objectives, focused on the characteristics of the plan in question. When using SEA objectives as a basis, the assessor asks, for each plan provision, 'will this provision help to achieve the SEA objective?'. Where a plan is likely to have impacts on other countries, this could be added as a separate SEA criterion or information from that country's policy framework could be integrated into relevant strategic environmental objectives, indicators and targets.

Table 10.1 *Example:* Strategic environmental objectives, indicators and targets (Fáilte Ireland, 2021a)

Environmental component	Strategic environmental objectives	Indicators	Targets
Air and climatic factors	AC1: To contribute towards climate adaptation and mitigation	AC1: Demonstration of compliance with provisions relating to climate adaptation and mitigation have been integrated into the Plan	C1: To maximise the amount of measures relating to climate adaptation and mitigation being implemented
Material assets	M1: For development to be served with adequate and appropriate critical infrastructure with sufficient capacity (drinking water, wastewater, waste and transport) that does not present a danger to human health	M1: Number of instances whereby additional tourists are directed by beneficiaries of funding towards areas in the Plan area where adequate and appropriate critical infrastructure with sufficient capacity is unavailable	M1: No instances whereby additional tourists are directed by beneficiaries of funding towards areas in the Plan area where adequate and appropriate critical infrastructure with sufficient capacity that does not present a danger to human health are unavailable
	M2: To contribute towards the protection of public assets and infrastructure, including that relating to recreation and leisure, transport, utilities and marine areas and fisheries	M2: Number of significant adverse effects on the use of or access to public assets and infrastructure	M2: No significant adverse effects on the use of or access to public assets and infrastructure
	M3: To reduce waste volumes, minimise waste to landfill and increase recycling and reuse	M3: Preparation and implementation of construction and environmental management plans	M3: For construction and environmental management plans to be prepared and implemented for relevant projects

10.2 Significance criteria

The SEA frameworks should be accompanied by criteria for determining whether an impact is likely to be significant. Impact significance will depend on factors such as the type and magnitude of impact, duration, probability, sensitivity of the receiving environment, and cumulative impacts, and will ultimately be a matter for expert judgement. An example of a framework of such criteria is shown at Figure 10.1.

Figure 10.1 *Examples*: Sets of Significance Criteria

(**Green** box below: National Monuments Service, 2021a) (**Blue** box below: Fáilte Ireland, 2022d)

The assessment of significant environmental effects was undertaken using a matrix to consider the Plan Objectives and Actions against a set of defined SEA Objectives. Table C-2 – C-12 provide the detailed findings of the assessment. In addition to the text, scoring symbols have been used to denote the effect on the SEA Objectives, the key for which is found in Table C-1 below.

Table C-1 Significance criteria for assessment

Significance of effect	Description of effect significance
Substantially supports SEA objective 	Is considered significant, e.g. beneficial impacts are substantial, substantially accelerate an improving trend, substantially decelerate a declining trend, substantially support delivery of a declared objective.
Support SEA objective 	Supports SEA objective but not to a significant extent, e.g. beneficial impacts are not substantial, do not substantially accelerate an improving trend, do not substantially decelerate a declining trend, do not substantially support from delivery of a declared objective.
Neutral contribution to SEA objective 	Either no impacts or on balance (taking account of positive and negative impacts) a neutral contribution.
Detracts from SEA objective 	Detracts from SEA objective but not to a significant extent, e.g. adverse impacts are not substantial, do not substantially decelerate an improving trend, do not substantially accelerate a declining trend, do not substantially detract from delivery of a declared objective.
Substantially detracts from SEA objective 	Is considered significant, e.g. adverse impacts are substantial, substantially decelerate an improving trend, substantially accelerate a declining trend, substantially detract from delivery of a declared objective.

The relevant aspects of the current state of the environment (see Section 4) and the Strategic Environmental Objectives (SEOs, see Section 5 and Table 7.1) are used in the evaluation of Strategy provisions. This methodology is also used in the assessment of alternatives, the findings of which are provided in Section 7 of this report.

The Strategy provisions (and, in Section 7, the alternatives) are evaluated using compatibility criteria (see Table 7.2 below) in order to determine how they would be likely to affect the status of the existing environment and the SEOs. The SEOs and the Strategy provisions (and, in Section 7, the alternatives) are arrayed against each other in order to demonstrate which interactions would cause effects on specific components of the environment. Where the appraisal identifies an interaction with the status of an SEO the relevant SEO code is entered into the relevant column.

The interactions identified are reflective of likely significant environmental effects:

- Interactions that would be *likely to improve the status* of a particular SEO would be likely to contribute towards a significant positive effect on the environmental component to which the SEO relates, including in-combination with the existing statutory planning/decision-making and consent-granting framework.

- Interactions that would *potentially conflict with the status* of *an SEO and would be likely to be mitigated* would be likely to result in potential significant negative effects; however, these effects will be mitigated by measures which have been integrated into the Strategy and residual effects would not be significant (see Table 8.3 of this report).

- Interactions that would probably *conflict with the status of an SEO and would be unlikely to be mitigated* would be likely to result in a significant residual negative effect on the environmental component to which the SEO relates.

These effects include secondary, cumulative (see also Section 7.3), synergistic, short, medium and long-term permanent and temporary, positive and negative effects.

The degree to which effects can be fully determined at this level of decision-making is limited, as the Strategy will be implemented alongside planning and project development and associated environmental assessments and administrative consent of projects. More detailed environmental measures may emanate from such assessments, further facilitating the mitigation of adverse effects.

11. Alternatives

Key points:

- The consideration of alternatives is at the heart of the SEA process. Poor consideration of alternatives has led to successful legal challenges.
- The environmental report should present a clear 'storyline' of why, of all the possible ways that the final plan could look, it looks the way that it does.
- The plan-maker can choose any of the alternatives considered as the final preferred alternative(s), even if the SEA shows it to be problematic, but the environmental report must clearly explain the reasons for the choice.

Article 5 of the SEA Directive requires the environmental report to identify, describe and evaluate 'the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and geographical scope of the plan or programme'. Annex I (h) of the Directive requires the report to provide 'an outline of the reasons for selecting the alternatives dealt with'. In practice, this suggests a three-part process:

1. identifying reasonable alternatives;

2. assessing and comparing these alternatives on a consistent basis;

3. explaining the choice of preferred alternatives.

The consideration of alternatives is a key part of the SEA process, as this is where the SEA can provide the most useful information to facilitate the integration of environmental considerations into decision-making and potentially steering the plan towards a more environmentally sensitive and/or sustainable approach. The competent authority can choose any final option, even if the SEA shows it to be problematic, but it must clearly explain the reasons for its choice. It is worth noting that the least favoured option will need particular emphasis on relevant mitigation measures and still needs to comply with any relevant environmental legislation.

11.1 Identifying reasonable alternatives

The identification of 'reasonable alternatives' (also called options or scenarios) is the aspect of SEA that has been subject to the most legal challenges to date.[9] Further information on SEA-related legal challenges is discussed in the EPA's Developing and Assessing Alternatives in Strategic Environmental Assessment (EPA, 2015) guidance note.

9 For example, in Northern Ireland in 2007 in relation to the 'Northern Area Plan' and 'Magherafelt Area Plan' SEAs, and in England in 2009 in relation to the 'East of England plan – The revision to the regional spatial strategy for the East of England' SEA.

Different types of plans will have different potential alternatives. The EPA has published Developing and Assessing Alternatives in Strategic Environmental Assessment (EPA, 2015), which can be a useful reference document when considering alternatives as part of the plan preparation and SEA processes.

It may be helpful to consider a 'hierarchy of alternatives' (e.g. Table 11.1[10]), with alternatives higher up the hierarchy typically having more potential to consider more strategic alternatives, such as those relating to need or demand, than those lower down in the hierarchy.

Table 11.1 'Hierarchy of mitigation alternatives' for tourism plans

Types of alternative	Examples
Need or demand: ■ Is the plan needed? ■ Should increases/decreases in levels of tourism, tourism development and/or related tourism activities be provided for?	■ Do not prepare a plan (business as usual) or prepare a plan. ■ Alternatives that provide for different increases and reductions in levels of tourism, tourism development and/or related tourism activities.
Mode or process: ■ To what extent should a new plan manage tourism, tourism development and/or related tourism activities? ■ Alternatives around tourist spend and bed-nights. ■ Consolidation and improvement versus development of new.	■ Prepare a plan with additional requirements for environmental protection and management or prepare a plan without additional requirements for environmental protection and management. ■ Alternatives around the amount of money to be spent by tourists. In considering alternatives around spend, the plan could evolve in a way that provides for increases in income from tourists without increasing the number of tourists. ■ Alternatives around the time to be spent by tourists in a destination. In considering alternatives around bed nights per tourist, the plan could evolve in a way that provides for increases in bed nights and income from tourists without increasing the number of tourists travelling to and from a destination. ■ Consolidation and improvement to existing tourism infrastructure, visitor attractions and experiences versus development of major new visitor attractions and experiences – for example, taking account of context-specific considerations based on existing loadings and issues, alternatives might comprise: (a) concentrating loadings to one area; (b) dispersing loadings to satellite areas; (c) creating new areas to ensure existing pressures are not confounded.

10 Table 11.1 has been prepared for this guidance document taking account of the approach suggested in the EPA's Good Practice Note on SEA for the Energy Sector (2021c).

Types of alternative	Examples
Seasonality, regionality and locations: ■ When tourist activity and associated peaks occur will influence the plan's effects. ■ The regional spread of tourism development and activities will influence the plan's effects. ■ Plans can specify locations for new tourism development or new/intensified tourism activities, or provide guidance or criteria for how such locations can be chosen.	■ Alternatives around the degree to which seasonality is provided for. In considering alternatives around the spread of tourists across various seasons or the clustering of tourists within a peak period, the plan could evolve in a way that provides a greater spread of tourists throughout the year, thereby reducing peak load additions on infrastructure at particular times and other potential environmental effects. ■ Alternatives around the degree to which regionality is provided for. In considering alternatives around the spread of tourists across various locations or the clustering of tourists within particular locations, the plan could evolve in a way that provides a greater spatial spread of tourists throughout the year and/or to less sensitive locations, thereby reducing peak load additions on infrastructure at particular locations and other potential environmental effects. ■ One large or several small projects. ■ Choice of location A, B or C for a particular tourism development or activity and/or supporting infrastructure. ■ Choice of activity X, Y or Z at a particular location.
Timing and implementation: These alternatives can include different timetables (including phasing), and different requirements for implementation such as further studies or mitigation requirements	■ Different phasing. ■ Timetable for implementation of milestones. ■ Criteria for choosing future sites or required mitigation. ■ Requirements for future impact assessments etc.

Public and/or statutory consultee input, by the way of scoping/alternatives workshops, on the identification and assessment of alternatives may identify further alternatives, allow the identified alternatives to be refined, and facilitate an extensive consideration of plan alternatives. Some alternatives – for instance, those suggested by a stakeholder – may not be reasonable because they conflict with national legislation, national guidelines or national policy, are not technically feasible, are exorbitantly expensive, etc. It is good practice to include a brief statement to explain why such alternatives are not taken forward for further assessment.

Boxes 11.1, 11.2 and 11.3 provide examples of different alternatives that have been identified as part of SEA/tourism plan-preparation processes.

Box 11.1 *Example:* **Visitor number and other alternatives** (Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017a)

Low, Medium and High Visitor Number Alternatives ('Need or demand' on Table 11.1's hierarchy)

Period	Low	Medium	High
Year 1	15,000	21,000 (23,500)	33,000
Year 2-3	27,000	33,000 (35,500)	45,000
Year 4-5	39,000	45,000 (47,500	69,000

Other alternatives considered as part of this SEA included those under the headings of:

- The requirement for a visitor centre or not
- Potential locations for a visitor centre
- Content of visitor centre
- Traffic and transport
- Access to the island
- Crossing to and from the island
- Departure location
- Arrival/Landing locations
- Landing type – pier options
- Ferry operator
- Unscheduled landing
- Protection of built heritage
- Protecting ecology
- Managing meadows
- On-island facilities
- Paths and routes
- Public furniture
- Guide/Emergency room
- Toilet facilities
- Waste management
- Displaying small finds
- Electricity and phone
- Storm shelter
- Signage
- Guiding/Tours
- Community drop-in
- Camping/Picnics etc
- Funerals (historic family plots)
- Graves
- Marketing and promotion times and seasons
- Identity, branding etc.
- Illumination
- Implementation

Box 11.2 *Example:* Alternatives relating to 'need or demand' and 'mode or process'[11] for a plan
(Three Peninsulas West Cork and Kerry Visitor Experience Development Plan, Fáilte Ireland, 2021b)

Alternatives 1 and 2 relate to 'Need or demand' on Table 11.1's hierarchy

Alternative 1 (Business as Usual)

Strengths in the arts, a strong food culture and a rich cultural heritage are experienced by tourists to the Three Peninsulas. There are a number of existing challenges to the tourism product (and associated value of tourism to the local economy) in the Three Peninsulas area including:

- Increase in visitor numbers with potential to disturb or damage the natural environment;
- High level of seasonality;
- Visitors are primarily day trippers;
- Few experiences designed to promote overnight stays;
- New accommodation options required to better service the more rural areas and long-distance trails;
- Preservation of key heritage sites such as Dunboy Castle;
- Lack of cohesive approach; and
- Lack of resources to coordinate and develop experiences and events.

This current situation presents Alternative 1 (Business as Usual). Numbers of visitors (and associated day-trip journeys) would be likely to continue to increase under this scenario – consistent with the development of tourism over many decades.

Alternatives 2A and 2B: Prepare a Plan

The challenges posed by the current situation establish a potential need for a plan that seeks to strengthen the value of tourism to the local economy and better manage tourism in the area that relates to the Plan; facilitating, promoting, supporting and coordinating stakeholders (including local authorities, other government agencies, tourism operators, communities and visitors) in their activities in a way that is consistent with existing and emerging plans that have been subject to environmental assessment. Such a plan would not provide consent, establish a framework for granting consent or contribute towards a framework for granting consent (such frameworks fall under the remit of other public authorities). Any projects would continue to be required to comply, as relevant, with the various provisions of documents that form the statutory decision-making and consent-granting framework.

Features of such a Plan (in combination with the wider and extensive policy and planning framework) would include:

- Position the peninsulas as a 'must do' destination and motivate visitors to stay overnight and spend more;
- Extend the length of the season;
- Improve the overall economy of communities through strengthening individual businesses, creating new entrepreneurial opportunities sustaining and increasing job creation and increasing the attractiveness of the area for other forms of economic growth;
- Align to the Wild Atlantic Way brand and target markets;
- Support community values and aspirations, and strengthen community appreciation of local culture and intangible heritage;
- Support sense of place enhancement; and
- Promote collaboration and partnership, support engagement of businesses, and build lasting links between national and regional partners, local agencies and associations, and local tourism experiences.

11 Refer to Table 11.1.

Alternatives 2A and 2B relate to 'Mode or Process' on Table 11.1's hierarchy

Under Alternative 2, there are two separate alternatives:

Alternative 2A: A Plan with Additional Requirements for Environmental Protection and Management

Fáilte Ireland provides funding sustainable tourism projects including land use and infrastructural development and land use activities. In order to achieve funding (including promotion) for land use or infrastructural development or land use activities from Fáilte Ireland, **Alternative 2A** would require Fáilte Ireland's stakeholders to demonstrate compliance with measures relating to sustainable development, environmental protection and environmental management contained within the following Fáilte Ireland published documents:

- Wild Atlantic Way Operational Programme Appendix 5 'Site Maintenance Guidelines' and other relevant measures from the Fáilte Ireland visitor and habitat management guidelines series (and any subsequent replacements); and
- Wild Atlantic Way Operational Programme Appendix 6 'Environmental Management for Local Authorities and Others' (and any subsequent replacements).

In order to be realised, projects included in the Plan (in a similar way to other projects from any other sector) would have to demonstrate compliance, as relevant, with various provisions of legislation, policies, plans and programmes that form the statutory decision-making and consent-granting framework, of which the Plan is not part and does not contribute towards.

Further environmental requirements would be integrated into the Plan under Alternative 2A, relating to infrastructure capacity, visitor management and green infrastructure and ecosystem services.

Alternative 2B: A Plan without Additional Requirements for Environmental Protection and Management

Alternative 2B would not include the requirements for environmental protection and management described under Alternative 2A. Projects would continue to be required to comply, as relevant, with the various provisions of documents that form the statutory decision-making and consent-granting framework.

Box 11.3 *Example:* Alternatives relating to 'mode or process'[12] for a plan with spatial elements
(Lough Derg Destination Development Plan, Tipperary County Council, 2020b)

Alternative 1: Consolidation and improvement to existing tourism infrastructure, visitor attractions and experiences and to provide new attractions in existing settlements

Traditionally Lough Derg has been a popular destination for both overseas and domestic visitors and the height of its popularity coincided with popularity in angling and emergence of the all island boat hire industry which acted as the cornerstone of Ireland's tourism product in the 1990s. The area and the popularity of this product in particular has since declined, leaving behind a variety of underused hotels, jetties, harbours and boats. A key issue of the VEDP is the need to address the fall off in visitor number and regenerate the visitor infrastructure, services and towns that depend on the tourism industry as a basis for their economy.

Alternative 2: Develop major new visitor attractions on or alongside the water/river

Lough Derg is located within a predominantly rural area which means that visitor infrastructure in terms of attractions, accommodation and associated activity is also low. Generally, speaking, the study area lacks any attractions of scale. The development of new attractions of scale will be required to invigorate the visitor offer and experience. Several locations for new attractions were identified and considered during the preparation of the VEDP; however, these would require the development of green field sites.

Alternative 3: Do nothing

The do nothing scenario was considered prior to the commissioning of the VEDP. With the emergence of Ireland's Hidden Heartlands brand, a requirement for a planned and coordinated approach was established. Without a masterplan in place, a number of potential disbenefits and environmental impacts would accrue.

11.2 Assessing and comparing the alternatives

The reasonable alternatives are then assessed and compared using the SEA framework developed in Section 10. The alternatives are assessed to the same level of detail and against the same set of criteria. Where relevant, site alternatives can be mapped onto constraints or sensitivity maps. Weighted multi-criteria analysis can be utilised to help identify preferred alternatives, particularly locational options.

Tables 11.2 and 11.3 and Box 11.4 show examples of such comparisons. The assessment process is discussed further at Section 12.

12 Refer to Table 11.1.

Table 11.2 *Example:* **Part of the assessment of alternatives** (Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017a)

Note that this is only an excerpt of the assessment table from the environmental report. The Strategic Environmental Objectives (SEOs; indicated through codes, e.g. B1, B2, B3) are assessed against compatibility/significance criteria, explained below. More information on such SEOs and criteria are provided in Section 10 of this guidance note, 'SEA Framework'.

No likely interaction with/insignificant impact with SEOs **0** Potential conflict with SEOs – likely to be mitigated ⇳
Likely to improve status of SEOs ↑ Uncertain interactions with SEOs **?** Probable conflict with SEOs – unlikely to be mitigated ↓

Alternative	0	↑	↓	⇳	?	Comment
Cable Car	**CH3 S1 Ws1, WS2 WW1,**		**CH1, CH2 L1, L2 B2 P3**	**L3 B1,B3-B5,B6 S2,S3 W1-7 P1-2 T1,**	**CC1**	Depending on which crossing point was selected, this option is identified as giving rise to a number of environmental effects, whilst several could be mitigated; significant and long term negative impacts are identified for cultural heritage, landscape and population.
Causeway	**CH3 S1 Ws1, WS2 WW1,**		**L1 to L3 CH1 P3 B1 to B6 W1, W2,W6,CC1**	**All other SEOS**		This option represents a substantial physical intervention to provide access and would generate a range of short to long term impacts particularly for water, biodiversity, population, landscape and cultural heritage.
Boats	**S1,S2, S3 WA1, WS1, WS2 WW1**	**Ch1, Ch2 P3 L1, L2, L3 T1 P1, P2 CC1**		**Bio 1 to 6 S4 W1 to W7**		This option represents the continued transport means to the island and is consistent with the historical access route to this island; it requires the most minimal physical intervention of the three options.

Table 11.3 *Example:* **Part of the assessment of alternatives** (Three Peninsulas West Cork and Kerry Visitor Experience Development Plan, Fáilte Ireland, 2021b)

Note that this table is accompanied by more detailed text in the environmental report. The SEOs (indicated through codes, e.g. B1, B2, B3) are assessed against compatibility/significance criteria, explained across the first two rows in the table. More information on such SEOs and criteria are provided in Section 10 of this guidance note, 'SEA Framework'.

	Likely to **Improve** status of SEOs			**Potential Conflict** with status of SEOs - likely to be mitigated by complying with other measures included within the Plan		Probable **Conflict** with status of SEOs- unlikely to be fully mitigated
	to the **Greatest** degree	to a **Moderate** degree	to a **Lesser** degree	to a **Moderate** degree	to a **Greater** degree	
Alternative 1: Business as Usual			**B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** **Sustainable development**, **environmental management** and **environmental protection** is provided through the existing statutory planning and consent framework. These measures would contribute towards positive effects on the protection and management of all environmental components (see Table 7.3).		**B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** Tourism related development would continue to be planned for and consented through the existing statutory planning and consent framework. Potential adverse effects (see Table 7.3) would continue be mitigated through that process. **B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** In the absence of a Plan, there would likely to be a continuing increase in tourist numbers – consistent with the development of tourism over many decades. The most popular locations in the Clew Bay area would be likely to see the largest increases in visitors, which would be likely to occur during the peak season. This would be likely to give rise to greater concentration of tourists during peak seasons and in the most popular locations thereby increasing potential environmental effects on all components and peak load additions on various infrastructure in particular locations/at particular times.	
Alternative 2A: A Plan with Additional Requirements for Environmental Protection and Management	**B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** In addition to the measures relating to **sustainable development**, **environmental protection**, **environmental management** (and associated effects - see Table 7.3) and measures relating to **seasonality, regionality and visitor management strategies**, provided for by this alternative and Alternative 2B, this Alternative (2A) would provide **additional requirements for environmental protection and management**.			**B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** Tourism related development would continue to be planned for and consented through the existing statutory planning and consent framework. Potential adverse effects (see Table 7.3) would continue be mitigated through that process. **B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** Although a Plan would help to improve the seasonal and geographic spread of visitors, a Plan's objective would be to increase the number of visitors in the Clew Bay area. Although this would be likely to happen without a Plan, a Plan would have the potential to increase numbers of tourists – and associated potential adverse effects – to a greater degree. A Plan would also help to promote new experiences – including those relating to land use activities and developments. These would also have the potential to increase adverse effects. Notwithstanding these issues, there would be three layers of mitigation, through: • The existing statutory planning and consent framework; • Visitor management strategies; and • Additional environmental requirements for environmental protection and management, under this alternative.		

	Likely to **Improve** status of SEOs			**Potential Conflict** with status of SEOs - likely to be mitigated by complying with other measures included within the Plan		Probable **Conflict** with status of SEOs- unlikely to be fully mitigated
	to the **Greatest** degree	to a **Moderate** degree	to a **Lesser** degree	to a **Moderate** degree	to a **Greater** degree	
Alternative 2B: A Plan without Additional Requirements for Environmental Protection and Management		**B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** In addition to the measures relating to **sustainable development**, **environmental management** and **environmental protection** (and associated effects - see Table 7.3), this alternative would provide measures relating to **seasonality and regionality** – such measures would also be provided for by Alternative 2A.			**B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** Tourism related development would continue to be planned for and consented through the existing statutory planning and consent framework. Potential adverse effects (see Table 7.3) would continue be mitigated through that process. **B1 B2 B3 PHH1 S1 W1 W2 W3 AC1 M1 M2 M3 CH1 CH2 L1** Although a Plan would help to improve the seasonal and geographic spread of visitors, a Plan's objective would be to increase the number of visitors to the Clew Bay area. Although this would be likely to happen without a Plan, a Plan would have the potential to increase numbers of tourists – and associated potential adverse effects – to a greater degree. A Plan would also help to promote new experiences – including those relating to land use activities and developments. These would also have the potential to increase adverse effects. Notwithstanding this, there would be two layers of mitigation, through: • The existing statutory planning and consent framework; and • Visitor management strategies.	

Box 11.4 *Example:* Part of the assessment of alternatives (Lough Derg Destination Development Plan, Tipperary County Council, 2020b)

Note that this table is accompanied by more detailed consideration against Strategic Environmental Objectives in the environmental report.

Alternative 1: Consolidation and improvement to existing tourism infrastructure, visitor attractions and experiences and to provide new attractions in existing settlements

The central environmental benefit of this alternative is associated with its focus on the re-use and regeneration of existing tourism facilities and infrastructure and the regeneration of town centres. Whilst in some cases increased visitor numbers will mean that upgrades to existing infrastructure may be required it is generally considered that the environmental impacts on air, water will be captured using these specific infrastructure upgrades and therefore minimised in this scenario. Indeed, the socio-economic benefits are likely to be greatest under alternative 1 as the economic benefits will accrue in areas where the existing population is highest.

Alternative 2: Develop major new visitor attractions on or alongside the water/river

The environmental impacts associated with developing wholly new visitor attractions within the VEDP area are dependent on the nature, scale and location of the development and are potentially wide ranging.

Alternative 3: Do nothing

The do nothing and business as usual approach was not considered appropriate on the basis that it would result in poor value for money in terms of any future investment as well as a potentially greater scale of environmental impacts associated with significant levels of unplanned and uncoordinated development. Without a plan led approach, the opportunity to test and consult on the strategy in accordance with the requirements of the Strategic Environmental Assessment Directive would also be missed.

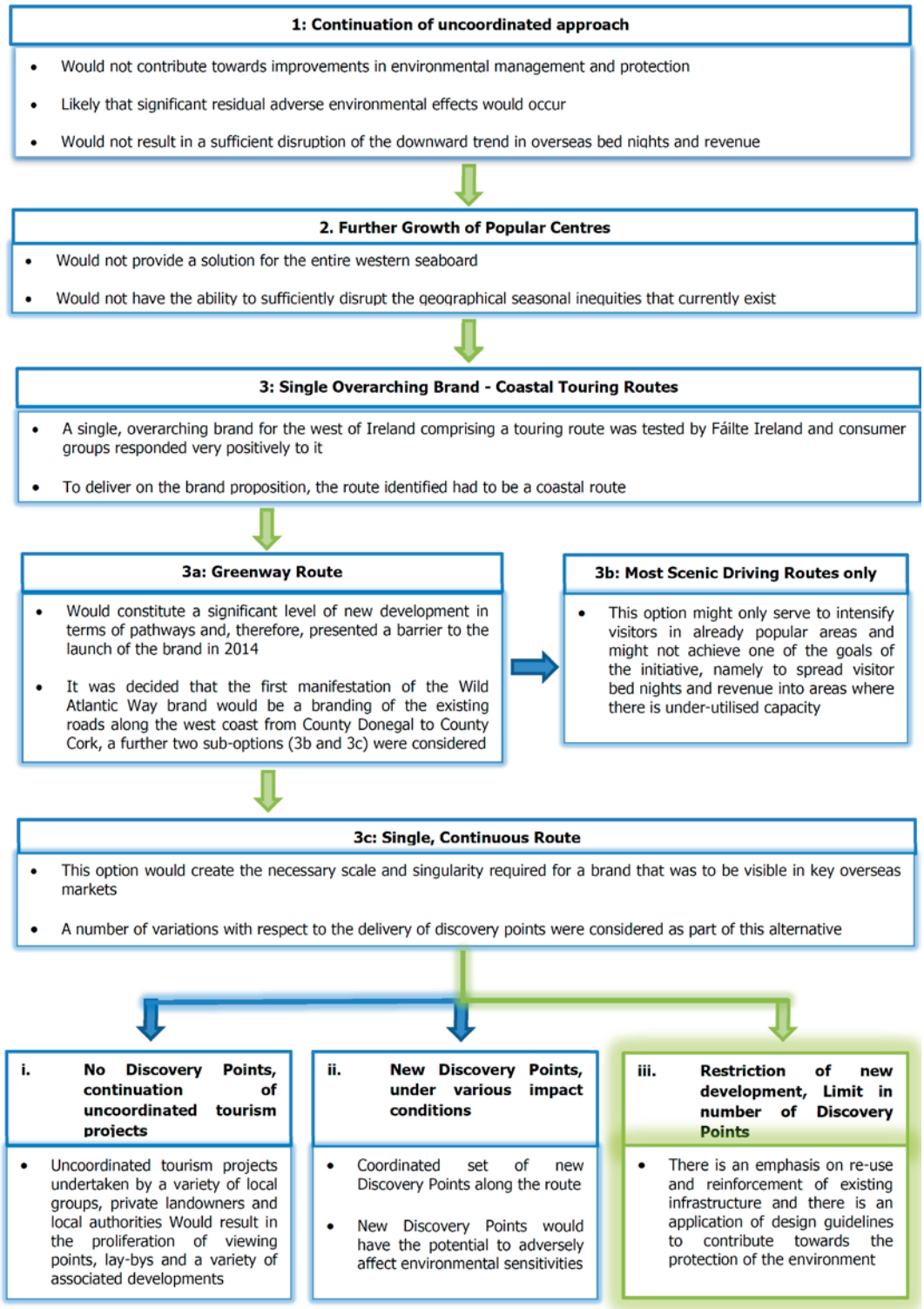
11.3 Explaining the choice of preferred alternatives

The preferred alternative(s) should be viable legally, technically, financially, environmentally and socially and should be resilient and able to cope with a range of scenarios and shocks. A key role of the SEA is to 'tell the story' of how the plan developed: to explain how environmental factors were taken into account in the decision-making process, including the selection of preferred alternatives. Reasons should be given for the rejection of alternatives that are not preferred and/or for the choice of the preferred alternative(s).

Figure 11.1 provides an example of telling the story of how a particular alternative was selected for a tourism plan.

Figure 11.1 *Example:* Decision tree showing process of choosing selected alternative
(Wild Atlantic Way Operational Programme, Fáilte Ireland, 2015)

As the National Tourism Development Authority, Fáilte Ireland needed to respond to the significant decline in international bednights and revenue in the west of Ireland that had occurred between 2007 and 2010 with a marketing initiative that would help to arrest and eventually begin to reverse this decline. A wide range of options were open to the Authority (Option 1, 2 and Option 3; Option 3a, 3b and 3c; and Option 3ci, 3cii and 3ciii) and all were considered, as indicated on the decision tree for the selected alternative below.)



12. Likely Significant Environmental Effects

Key points:

- This impact prediction stage should be inextricably linked with the next, mitigation, stage: mitigation should be considered for any significant negative impacts identified.
- The level of detail of the analysis should be proportional to the level of detail of the plan and the significance of the effects.
- The impact assessment should consider not only direct, short-term impacts but also secondary, cumulative, etc. impacts.

This is the stage where the impacts of a draft plan and its alternatives are identified.

12.1 Range and type of effects

The SEA Directive does not require any particular form of analysis, but it does require that a particular range of effects be considered. Annex I (f) of the SEA Directive requires that the environmental report should describe 'the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage, landscape and their interrelationship … These effects should include secondary, cumulative, synergistic, short, medium and long-term permanent and temporary, positive and negative effects.' In practice, assessments are normally made using the SEA framework from Section 10.

Section 3.3 of this document provides guidance on 'Tourism attribution and scoping in and out' and should be referred to when considering which effects should be considered in the SEA.

Types of tourism effects can arise from the developments and/or activities, including those relating to:

- mobility, such as effects relating to:
  - emissions – including noise and greenhouse gas emissions;
  - energy;
  - transport infrastructure/traffic management;
- accommodation and hospitality, such as effects relating to:
  - land-take;
  - water services infrastructure[13] – there is significant seasonality in capacity (assimilative and flow) and demand;

13 There is a need for close collaboration with the relevant stakeholders, such as local authorities and Irish Water, to ensure that any proposals within the tourism plan align with the capacity of the supporting critical service infrastructure.

- emissions – which may interact with the status of waters and aquatic life; also including noise and greenhouse gas emissions;
- energy;
- displacement;

- other tourism-related products (developments and activities), such as effects relating to:
  - ecology;
  - heritage;
  - water services infrastructure[14] – there is significant seasonality in capacity (assimilative and flow) and demand;
  - landscape;
  - land-take;
  - emissions – which may interact with the status of waters and aquatic life; also including noise and greenhouse gas emissions;
  - energy;
  - displacement.

More detail on frequently identified potential significant environmental effects is provided under a number of headings below.

Transportation, water services and land development

The main impacts from tourism arise from effects on transportation, water services and land development. Tourism is already provided for by various statutory documents setting out public policy for, among other things, land use development and activities, infrastructure, sustainable development, environmental protection and environmental management. These policy documents provide the accommodation, movement and hospitality facilities that are the fundamentals on which the tourism sector is based. All these documents will have been subject to their own environmental assessment processes, as relevant, and form the decision-making and consent-granting framework. Tourism plans, which are the subject of SEAs that this note provides guidance on, are likely to facilitate, promote, support and coordinate stakeholders in their activities in a way that is consistent with these documents that have been subject to SEA and other assessments. Supporting infrastructure and services and other specific projects (such as signage programmes, visitor centres or car parks) that are already provided for by the existing planning framework and that have already been subject to environmental assessment should provide a focus in the SEA for consideration of cumulative, in-combination effects.

14 There is a need for close collaboration with the relevant stakeholders, such as local authorities and Uisce Éireann, to ensure that any proposals within the tourism plan align with the capacity of the supporting critical service infrastructure.

Ecology

By international standards, Ireland has a high level of tourism management, planning and research with effects that are well understood, especially when it comes to ecology (see case study at Box 14.1 of this guidance note, for example). There is significant evidence from Fáilte Ireland's environmental surveying and monitoring of the Wild Atlantic Way Operational Programme that international tourists in rural locations give rise to very low levels of impacts. Most Irish tourism is now urban and structured. Covid evidence has confirmed that most high-visibility/high-impact visitor effects arise from local recreational use. Most of the impacts from tourism are indistinguishable from the recreational, occupational and betterment effects generated by local and national populations.

Potential effects on ecology, if these effects are not mitigated (Section 13 of this guidance note covers mitigation), are:

- destruction of structures, vegetation or fauna;
- trampling of herbaceous vegetation;
- disturbance of wildlife;
- heavy littering or dumping of quantities of waste;
- addition/alteration of site features, transient emissions, noise;
- harvesting of large quantities of shells from beach sites;
- fishing activities;
- removal of large rocks;
- unrestricted dogs causing disturbances to wildlife.

Effects arising from greenways, blueways, etc.

The development of new and existing greenways, blueways, peatways, trails and walking and cycling routes, including those within and between existing destinations, has the potential to contribute to sustainable mobility and a better management of movements in sensitive areas, thereby benefiting various environmental components including habitats at certain locations.

The development of these projects, however, presents a variety of potentially adverse environmental effects that would, if unmitigated, have the potential to arise from both the construction and operation of such developments and/or their ancillary infrastructure. These types of infrastructure are often located in ecologically and visually sensitive areas adjacent to the banks of rivers and streams or along the coast. Potential adverse effects can be mitigated using established techniques, such as minimising the crossing of water bodies and setting infrastructure a suitable distance away, e.g. a field's width from the bank of the waterbody. Such projects are likely to be subject to normal planning and environmental assessment processes.

Creating new routes can introduce invasive alien species. These routes also need to be sensitively designed and maintained to protect habitats and species along the routes (considering, for example, lighting, drainage and maintenance practices for weed control). Efforts should be made to control and monitor invasive species and provide where appropriate the relevant biosecurity-related awareness and measures as necessary.

Parking/disembarking facilities need to be sensitively designed also to cater for numbers while reducing adverse impacts such as congestion, noise and littering.

The development of green infrastructure can achieve synergies with regard to the provision of open space amenities, sustainable mobility, the sustainable management of water, the protection and management of biodiversity, the protection of cultural heritage and the protection of designated landscape sensitivities.

Visitor management

Most tourism and recreational issues arise from management, not development, and management is generally not subject to planning, permitting or licensing. Tourism plans offer an opportunity to provide for mitigation measures relating to management, and a number of examples of this are provided at Section 13, 'Mitigation Measures', of this guidance note.

Greenhouse gas emissions and the Climate Action Plan

Tourists contribute to greenhouse gas emissions across the same sources/sectors as local and national populations, e.g. transport, heating and electricity, agriculture/food production and waste generation. Measures within tourism plans that encourage low-carbon travel, such as walking and cycling, low-carbon activities and the circular economy, can help to minimise any increases in and reduce emissions.

The Government's National Climate Action Plan 2023 provides a detailed plan for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050. The Action Plan lists the actions needed to deliver on climate targets and sets indicative ranges of emissions reductions for each sector of the economy. It will be updated annually, to ensure alignment with legally binding economy-wide carbon budgets and sectoral ceilings. The Action Plan supports the further development of sustainable tourism and sustainable destination management and provides for various measures that will contribute to climate mitigation, such as those relating to sustainable mobility, carbon pricing, electricity, agriculture and the built environment.

With regard to Non-Road Transport Activities, the Action Plan recognises that action is being taken at EU and international levels to address emissions from the aviation and maritime sectors, including through market-based measures such as the Emissions Trading Scheme and sustainable fuel mandating initiatives (through ReFuel EU Aviation, Fuel EU Maritime and the Alternative Fuel Infrastructure Regulation, which will all include binding targets once adopted). The Action Plan commits to supporting such measures.

12.2 Level of detail

The level of detail and the level of analysis should be proportional to the level of detail of the plan and the environmental sensitivity within the plan area. Where the plan is site-specific, appropriate levels of site-specific assessment should be carried out.

The higher the level of the plan in the tourism hierarchy, e.g. a national or a regional plan, the more strategic and less detailed the plan provisions and the environmental assessment (including, for example, baseline description, alternatives considerations and mitigation and monitoring measures) are likely to be. The lower the level of the tourism plan, e.g. a town or a destination plan, the more detailed the plan provisions are likely to be and the environmental assessment should be.

The baseline environmental description should already include information about characteristics of area(s) that are likely to be significantly affected (see Section 8 of this guidance note). This will provide the basis for the environmental assessment. Information on the level of detail proposed (and sensitivity of the area) could also be provided at the scoping stage of the process.

Figure 12.1 summarises a regional assessment taking account of accommodation, tourism facilities and associated water and waste infrastructure, which uses the baseline information that was included earlier in the environmental report.

Figure 12.2 provides an example of a site-specific assessment.

Figure 12.1 *Example:* Regional assessment (Wild Atlantic Way Operation Programme, Fáilte Ireland, 2015)

This section attempts to provide a holistic evaluation of the overall potential for regional environmental effects.

It has been observed that the evaluation of potential effects relies on existing Strategic Environmental Assessment of Regional, City, Town and Local Area Plans and that these principally address either zoned lands or high-level developmental policy. It is also challenging to adequately assess effects from activities which are highly mobile, which straddle many administrative boundaries – such as tourism – and which take place in both urban and rural areas.

All of these factors give rise to the potential to overlook a consideration of the entire environment which accommodates other unregulated activities – such as agriculture, unstructured and passive recreation, transportation as well as tourism.

To address this issue this section attempts to provide an overview of the environments that contain the Wild Atlantic Way – and its associated effects. The purpose is to identify if there are any general environmental characteristics that are evident and can be more effectively assessed at a regional scale.

Previous sections provided mapped regional summary of the three environmental resources that are most likely to be affected by the Wild Atlantic Way – Cultural Heritage, Natural Heritage and Landscape – in order to establish whether any regional pattern of common characteristics could be determined.

These are combined – see Figure 8.1 – to identify boundaries between five areas of broadly shared characteristics. These areas are examined in turn to determine whether there is existing broad regional capacity to ensure that likely effects can be managed and absorbed.

This mapping indicates that each generalised region is served at the boundary and internally by at least one major gateway town. These all have regionally significant existing capacity in terms of accommodation, tourism facilities and associated water and waste infrastructure. All of these gateways also have transportation capacity of regional and national scaled capacity – including six airports, and 7 intercity rail terminals.

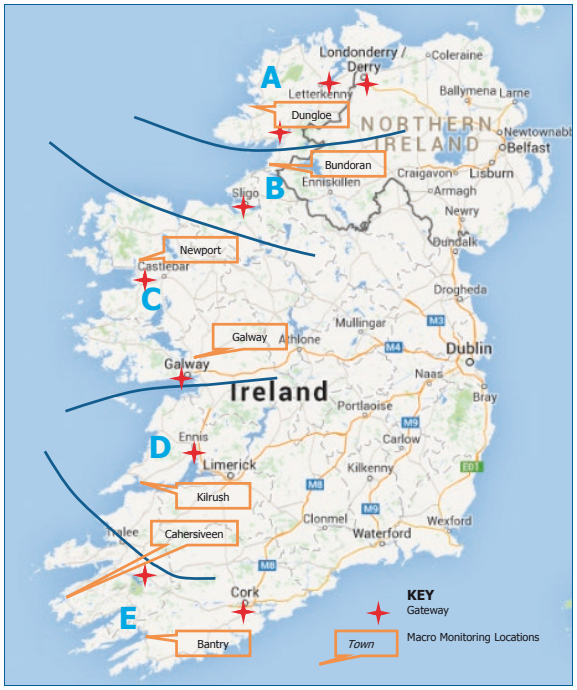


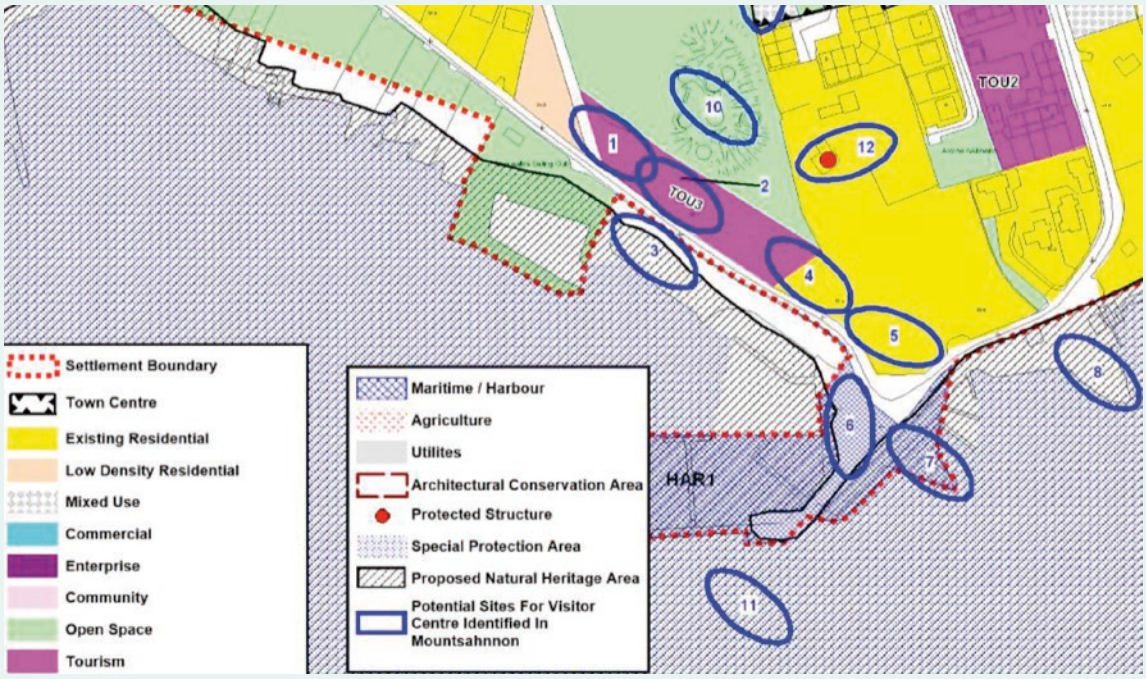
Figure 8.1 Assessment of Regional Assimilative Capacity

Figure 12.2 *Example:* **Site-specific assessment** (Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017a)

Below is part of a site-specific assessment provided for potential locations for a proposed visitor centre. Potential sites were identified, as can be seen on the map. The tabulated assessment for four of these sites is provided beneath the map – refer to the environmental report for full assessment. Strategic Environmental Objectives (SEOs) (indicated through codes, e.g. L1, P1, P3) are assessed against compatibility/significance criteria, explained below. More information on such SEOs and criteria are provided in Section 9 of this guidance note.

No likely interaction with/insignificant impact with SEOs **0**
Potential conflict with SEOs – likely to be mitigated ⇳
Likely to improve status of SEOs ↑
Uncertain interactions with SEOs **?**
Probable conflict with SEOs – unlikely to be mitigated ↓

Alternative	o	↑	↓	⇳	?	Comment

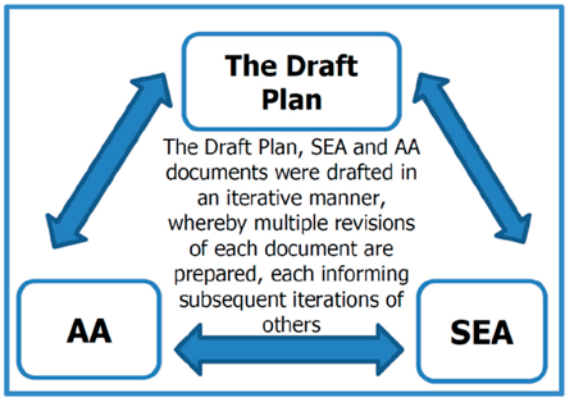


Alternative	o	↑	↓	⇳	?	Comment
1. North west stretch of southern boundary (lower road) of Aistear Park		L1 P1 P3 T1 Ch1		All other SEOs		Site 1 is located at the southern boundary of the existing Aistear Park. It can provide for a view to the island which is a key design consideration for the visitor centre; this option also allows for a direct access to embarkation to the island. This site can accommodate a visitor centre within its footprint. Positive effects on SEOs include population and human health, landscape and a number of material assets most notably transport as it can facilitate access from the main street and onto the embarkation point. This location would allow pedestrian movement from the main street through the park and onto access to this island, which also generates positive effects for population and human health. Its location allows for a circulation of pedestrians and, if necessary, coaches around the village. There is also existing footpath provision along the Aistear Park, main street and down to the harbour so would not require additional footpaths in this scenario. Some removal and/or thinning of trees may be required in this scenario although it would depend on the final detailed design and a key aim should be to minimise removal of mature trees where possible. In this instance, existing mitigation measures developed for the plan as well as objectives of the Clare CDP 2017–2023 would apply. This location is also zoned as 'TOU' – Tourism under the Clare CDP 2017–2023, and a visitor centre would be consistent with this land use zoning. This site is located within Flood Zone C and a flood risk assessment undertaken for this site has also found that it is consistent with the flood risk assessment guidelines (2009).
2. Middle of southern boundary (lower road) of Aistear Park		L1 P1 P3 T1 Ch1		All other SEOs		Site 2 is located adjacent to Site 1, slightly further to the east and closer to the harbour. Impacts are similar to those outlined for Site 1, i.e. positive effects on Population and Human Health and Transport SEOs in particular. This option also allows for pedestrian movement, utilisation of existing footpaths, access to the harbour and views to the island. This location is also zoned as 'TOU' Tourism under the Clare CDP 2017–2023, and a visitor centre would be consistent with this land use zoning. This site is located within Flood Zone C and a flood risk assessment undertaken for this site has also found that it is consistent with the flood risk assessment guidelines (2009).

Alternative	o	↑	↓	⇳	?	Comment
3. Public open space to lake side of lower road (south east of sailing club)			W6	All other SEOs		Site 3 is on the current open space southeast of the sailing club on the lake front. It has the advantage of being on the lake front but this positive is somewhat offset by any visitor centre here having a slightly inferior view to the island. This site is identified as giving rise to adverse effects on a number of SEOs namely landscape, population and human health, biodiversity, transport and flood risk. Its location reduces connectivity between the village and a visitor centre in this site, it would require more physical interventions in terms of safe pedestrian access and transport movement around the site. The key environmental constraint for this location is that the site is located in Flood Zone A as identified in the strategic flood risk assessment and developing a new building on this land is not in compliance with the sequential approach to development as detailed in the Flood Risk Assessment Guidelines (2009). Finally, Site 3 is situated within the proposed Natural Heritage Area (site code 000011) and has no land use zoning in the Clare CDP 2017–2023. For all these reasons the option gives rise to a number of potential adverse effects on SEOs and has been excluded from further consideration.
4. Boundary between Aistear Park and the Rectory (along lower road)		L1 P1 P3 Ch1		All other SEOs		Sites 4 and 5 are both similar to Sites 1 and 2 in that they are located in the same area close to the harbour and present similar positive effects for a number of SEOs, namely landscape, material assets (transport) and population and human health. Site 4 is located in both Tourism and Existing Residential land use zonings so a visitor centre would be partly compatible with this location (under the Tourism zoning). The site is also outside a flood zone A or B. The main environmental constraint associated with Site 4 relates to accessibility from the main street and there may also be constraints about accessing this location via the Aistear Park as such access may not be as easily facilitated to this location. In turn, this may result in the requirement for additional physical interventions such as additional footpaths through the Aistear or a new footpath between the Aistear and adjacent lands to the west. This could give rise to adverse effects on biodiversity, landscape, material assets and population and human health SEOs. This option was therefore excluded.

12.3 Iterative process

Figure 12.3 *Example:* The iterative process (Fáilte Ireland, 2020b)



Several rounds of impact assessment and mitigation may be needed alongside the preparation of a given tourism plan. The assessment should be communicated to the plan-preparation team on an ongoing basis from the outset in order to enable the full integration of key environmental considerations into the plan. The assessment should ideally be undertaken in an iterative manner whereby multiple revisions of SEA and corresponding emerging plan documents are prepared, each informing subsequent iterations of the other. This iterative process can help to integrate mitigation into the plan and steer the plan towards contributing to sustainable development and environmental protection and management.

The prediction of likely significant environmental effects should be linked with mitigation (see Section 13 of this guidance note); mitigation should be considered for any significant adverse effects identified.

12.4 Carrying out the impact assessment; SEA Framework and source-pathway-receptor

Impact assessments typically use the SEA framework as a structure, and are often presented in the form of tables (e.g. Table 12.1), with the plan components on one axis and the environmental components on the other axis, or maps.

The identification of potential significant environmental effects and associated environmental assessments should be conducted following a standard source-pathway-receptor[15] model, where, in order for an effect to be established all three elements of this mechanism must be in place. The absence or removal of one of the elements of the model is sufficient to conclude that the significant effect is not likely.

A source is any identifiable element of the plan provision that is known to interact with environmental components, for example increased levels of treated or untreated wastewater. Receptors are the environmental features that are sensitive to impacts, for example sensitive aquatic habitats and species. Pathways are any connections or links between the source and the receptor, for example a stream downstream of a discharge and upstream of a sensitive river system.

15 Source(s) – e.g. increased levels of waste water; Pathway(s) – e.g. stream connecting to nearby river system; and Receptor(s) – sensitive aquatic habitats and species.

There is a degree of uncertainty associated with impact prediction for tourism at this level. This relates to factors such as the strategic nature of the interventions being considered, which can be regional and county level rather than site-specific; elements of independent, self-directed tourism that is not determined by established touring groups or guides, so the specific routes and times of movement may not be readily predictable; and changes in visitor patterns that may occur due to changes in weather, seasons, products and promotion. The promotion of places, activities and products is an integral part of tourism, and tourism promotion and marketing campaigns are one of the primary drivers of tourism numbers. Environmentally responsible promotion and marketing can be used in visitor management techniques that can help to mitigate adverse effects – see Section 13, 'Mitigation Measures'. Data from surveys and monitoring (see Section 14, 'Monitoring Measures') can be used to reduce uncertainties in visitor movements and inform responses in promotion.

Table 12.1 *Example:* Plan policy assessment using SEA framework (Wild Atlantic Way Operational Programme, Fáilte Ireland, 2015)

	Likely to **Improve** status of SEOs	Probable **Conflict** with status of SEOs - unlikely to be mitigated	Potential **Conflict** with status of SEOs- likely to be mitigated	**No Likely** interaction with status of SEOs
Objective				
To use seasonal and site-specific visitor management measures to anticipate and avoid increases in environmental loadings due to changing visitor numbers. To influence Local Authorities to take steps to avoid unwanted traffic congestion in local areas.	**B1 B2 B3 PHH1 S1 W1 W2 M1 M2 CH1 CH2 L1 C1**			**M4 W3 M3**
Commentary: *Anticipation and avoidance of increases in environmental loadings would benefit the protection and management of various environmental components. The objective is consistent with the other parts of the Programme, allowing for visitor management:* • *At a macro spatial level in terms of what sections of the western seaboard can accommodate increases in visitors;* • *At a micro spatial level in terms of what areas adjacent to viewing points, lay-bys etc. should be avoided; and* • *In terms of time; growth can be sought in times outside of the summer peak.*				
Strategy				
To target areas where there is under-utilised capacity and encourage greater levels of travel during the shoulder season by using sales and marketing initiatives. To work with Local Authorities to ensure that unsustainable environmental loading (such as traffic congestion, water loading or habitat pressure) are identified in advance and action taken to avoid the issue or reduce its impact locally. To ensure that visitor activities are managed to avoid and reduce additional pressures at sensitive sites.	**M4 B1 B2 B3 PHH1 S1 W1 W2 M1 M2 CH1 CH2 L1 C1**		**B1 B2 B3 PHH1 S1 W1 W2 W3 M1 M2 M3 CH1 CH2 L1 C1**	
Commentary: *Encouraging greater levels of travel, the evaluation provided for this Strategy is generally consistent with that provided for the selected alternative under Section 7 including at Table 7.5. Avoiding or reducing traffic congestion would help to reduce travel related emissions to air. By contributing towards the spread of visitors over the season and focusing on the off-peak months this Strategy would help to minimise potential stresses and avoid increases in infrastructural demand during the summer peak season thereby improving the protection and management of environmental components. The Strategy also provides for the anticipation and avoidance of increases in environmental loadings and site specific visitor management – both of which would benefit the protection and management of environmental components.*				

12.5 Cumulative effects

Cumulative effects are the total impacts of the plan, in combination with the environmental effects of other past, current and foreseeable plans, projects and trends.

Cumulative effects can be grouped into:

- Intra-plan cumulative effects – these arise from the interactions between different types of potential environmental effects resulting from a plan, programme, etc. Where there are elevated levels of environmental sensitivities, future development could result in environmental conflicts and lead to a deterioration in environmental integrity. Interrelationships between environmental components help determine these potential effects, e.g. interrelationships between: human health and water quality; human health and air quality; human health and flood risk; and ecology and water quality.
- Inter-plan cumulative effects – these arise when the effects of the implementation of one plan occur in combination with those of other plans, programmes, developments, etc.

Climate change, habitat fragmentation, soil erosion and deterioration of water quality can all be examples of cumulative effects. Whereas the rest of the impact assessment process focuses on the impacts of the plan, cumulative effects consider the impacts on environmental receptors. Overall cumulative effects must stay within environmental limits, otherwise the plan/programme will not be sustainable in the long term.

By the time likely significant environmental effects are being assessed, the SEA scoping process will have been largely completed, although scoping continues throughout the process. This process should have identified which developments and activities can reasonably be assigned to the tourism plan being considered and which are already provided for and assessed by the existing planning hierarchy, including as infrastructure and amenities for the general population (refer also to Section 3.3, 'Tourism attribution and scoping in and out', and Section 6, 'Relationship with Other Relevant Plans and Programmes').

Although the SEA Directive seeks to avoid duplication of assessment,[16] it does require that cumulative effects (when the effects of the implementation of a plan occur in combination with those of other plans, programmes, etc.) are assessed. Supporting infrastructure and services (waste water, drinking water, transport, waste management, amenities, for example) and tourism-specific projects (such as signage programmes, visitor centres, ferry services or car parks) that are already provided for by the existing planning hierarchy and may have been subject to environmental assessment should provide a focus in the SEA for cumulative, in-combination effects.

16 Article 5 (2) The environmental report prepared pursuant to paragraph 1 shall include the information that may reasonably be required taking into account current knowledge and methods of assessment, the contents and level of detail in the plan or programme, its stage in the decision-making process and the extent to which certain matters are more appropriately assessed at different levels in that process in order to avoid duplication of the assessment.

Most of the impacts from tourism are indistinguishable from the recreational, occupational and betterment effects generated by local and national populations. Where infrastructural or assimilative capacity in particular locations is being exceeded at particular times, an examination of factors such as demand from local populations and normal local/regional visitors, demand from additional tourism, environmental/ seasonal conditions (such as heavy rainfall, drought, low flow periods) or temporary loss of capacity due to improvement/maintenance works could allow for an identification of how much of the pressure is due to additional tourism. Ideally, where environmental pressures are identified, additional targeted monitoring and surveying of these areas may identify which proportion of the pressure is due to normal local/regional recreational and amenity use and which proportion is due to additional tourism.

The EPA (2020a) Good Practice Guidance on Cumulative Effects Assessment in Strategic Environmental Assessment is a useful starting point for considering cumulative effects.

Tables 12.2 and 12.3 and Box 12.1 provide examples of how cumulative effects have been assessed.

Table 12.2 *Example:* Cumulative effects – biodiversity and flora and fauna (Tourism masterplan for the Shannon Region, Waterways Ireland, 2020a)

Biodiversity Flora and Fauna: Cumulative effects in this regard is often a gradual erosion of open and wild spaces and squeezing of buffer areas particularly along rivers and coasts and deterioration of ecological condition e.g. water or air quality. Cumulative effects will arise from increased human activity leading to increased disturbance of animal and bird species and their habitat.

Plan / Project	Summary of Relevant Policies/ Project	Potential Cumulative effect
Government of Ireland. Outdoor Recreation Plan for Public Lands and Waters in Ireland 2017-2021	Developed by five public landowning organisations as 'creating step change' in delivery of outdoor recreation opportunities on public lands and waters, comprising 15% of Ireland's land surface.	Further recreational development in natural areas
Lough Ree & Environs - UNESCO Biosphere Designation	UNESCO Biosphere Designation for Lough Ree and its environs, will enhance the environmental status and create opportunities for low impact, nature-based tourism experiences.	Enhance habitat management
Beara Briefne Way	Redevelopment of existing walking route	Further recreational development / disturbance in natural areas

Table 12.3 *Example:* Cumulative effects – water (Lough Derg Destination Development Plan, Tipperary County Council, 2020b)

Water: Due to the projected visitor numbers, there may be negative impacts due to additional demand on water supply and wastewater services which are at or are approaching capacity in some areas or have limited or no treatment. Water and wastewater services must be delivered on a phased basis to match projected demand.

The re-development of harbours and waterways could have negative cumulative impacts in terms of the resultant increase in boating, which will increase the number of sources of pollution e.g. emissions to air, wastewater and litter.

Plan / Project	Summary of Relevant Policies/ Project	Potential Cumulative effect
River Basin Management Plan for Ireland 2018-2021	The Plan sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in water bodies (rivers, lakes, estuaries and coastal waters) by 2027. An enhanced evidence base has been developed to guide national policies and the targeting of local measures. Technical assessments of 4,829 water bodies have been carried out, examining their status (quality) and whether they are 'at risk' of not meeting status objectives in the future. Using this information, the River Basin Management Plan sets out national policies and regional prioritised measures.	Improved water quality
Irish Water Capital Investment Plan 2017 to 2021	Irish Water's Investment Plan set out the capital projects and programmes that it plans to progress and deliver during the plan period. They include proposed costs and timelines and the outputs and outcomes that will be delivered for the investment. The Investment Plans allow Irish Water to maintain, upgrade and build new treatment plants, sewers, pipes and so on. This allows Irish Water to improve the quality of water and wastewater treatment, to provide better service to homes and businesses, and, to help facilitate social and economic growth. Irish Water's Investment Plans contain a mix of projects, national programmes and capital maintenance programmes including projects deliver new and upgraded assets at specific locations e.g. a new treatment plant.	Improved water quality

Box 12.1 *Example:* Cumulative effects (Three Peninsulas West Cork and Kerry Visitor Experience Development Plan, Fáilte Ireland, 2021b)

Cumulative effects that have been considered include those resulting from the Plan in-combination with the following:

- Land use policy, plans and programmes (e.g. the National Planning Framework, the Regional Spatial and Economic Strategy, Development Plans and Local Area Plans);
- Water services, waste management, transport and energy infrastructure plans (e.g. Irish Water's Water Services Strategic Plan and associated Capital Investment Plan, Regional Waste Management Plans, Transportation Policies and Strategies, Grid25 and associated Implementation Programme) and the Local Economic and Community Plans; and
- Environmental protection and management plans (e.g. River Basin Management Plans, National Climate Action Plan, National Adaptation Framework, and Flood Risk Management Plans).

Potential cumulative effects include the following arising from the alternatives in combination with the plans etc. detailed above (note that potential adverse cumulative effects will be mitigated by provisions that have been integrated into the Plan - see Section 9):

- Contribution towards sustainable development, environmental protection and environmental management – various provisions for which are provided for in the aforementioned plans (**Alternatives 1, 2A and 2B**).
- Need for and use of services, infrastructure and other development (to service development, including tourism), including those related to water services, transport, access or accommodation, that are planned for and consented through the statutory framework – and associated potential adverse environmental effects on various environmental components including biodiversity and flora and fauna, the status of waters, human health, soil, emissions, cultural heritage and landscape (**Alternatives 1, 2A and 2B**).
- Contribution towards climate adaptation and mitigation through measures such as those relating to walking and cycling, charging infrastructure, flood risk management and resilience (**Alternatives 1, 2A and 2B**).
- Contribution towards travel related greenhouse gas and other emissions to air as a result of increases in tourist numbers (**Alternatives 1, 2A and 2B**).
- Helps to minimise likelihood of exceeding capacity in material assets as a result of not directing additional tourists towards specific locations in instances where significant problems with critical infrastructure (drinking water, wastewater, waste and transport) have been identified (**Alternative 2A**). This would positively impact upon the protection and management of environmental components such as human health, water, soil, air and climatic factors.
- Contribution towards the protection and management of biodiversity and flora and fauna (in designated sites, including European Sites and Wildlife Sites, and Annexed habitats and species, listed species, ecological connectivity and non-designated habitats) through visitor management strategies, as relevant and appropriate (**Alternative 2A**).
- In combination with plans and programmes from all sectors potential adverse effects on all environmental components arising from all development in greenfield and brownfield areas (e.g. infrastructural, residential, accommodation, economic, forestry, agricultural etc.). The type of these effects are consistent with those described on Table 7.3. These plans and programmes from other sectors undergo SEA and comply with environmental legislation while projects are subject to EIA and AA, as relevant (**Alternatives 1, 2A and 2B**).

12.6 Secondary and transboundary impacts

Secondary impacts are impacts that are not a direct result of the project, often produced away from the plan area/project site or because of a complex pathway. For example, the development of a tourist experience in the west of Ireland would have the potential to contribute to potentially adverse environmental effects in cities such as Dublin. The experience could attract visitors to Ireland who consist of day-trippers from major cities. This results in the need to provide bed-nights in the cities, contributing to an increased demand for constructed accommodation and associated services – all of which present potentially adverse effects on environmental components such as water, infrastructure and cultural heritage.

Transboundary impacts are those that affect other Member States (see also Section 5.2 'Consultation'). Transboundary impacts could be systematically identified through the SEA framework (see Section 10), or they could be identified at the end of the assessment process and described in a separate section. Refer to Section 5.2 for details on the procedure associated with consultations where there are likely to be transboundary effects.

Box 12.2 provides an example of how the consideration transboundary effects might be documented in an SEA where no likely significant environmental effects are predicted.

Box 12.2 *Example:* Documenting the consideration of transboundary effects
(Ireland's Ancient East Regional Tourism Strategy, Fáilte Ireland, 2022b)

> The scope of the assessment (including description of baseline, the relationship to other plans and programmes and the evaluation of effects) has considered the environment of both Ireland and Northern Ireland. Taking into account, inter alia, the detailed mitigation which has been integrated into the Plan and the status of the Plan (the Plan does not provide consent, establish a framework for granting consent or contribute towards a framework for granting consent), it has been determined that significant residual adverse environmental effects will not occur in either Ireland or Northern Ireland.

13. Mitigation Measures

Key points:

- Where a negative impact is identified in the impact assessment stage, mitigation measures for that impact should be considered at this stage.
- Avoiding impacts is better than minimising them, which in turn is better than compensating for impacts.

Where a potentially significant adverse environmental effect likely to arise from implementation of a plan is identified during the assessment, Annex I (g) of the SEA Directive requires mitigation measures to be provided.

13.1 Hierarchy of mitigation

Measures to prevent/avoid, reduce/minimise and offset adverse impacts are called 'mitigation measures'. Within them is a hierarchy: avoidance is generally considered better than reduction, which in turn is generally considered better than offsetting/compensating:

- Prevention/avoidance (e.g. avoiding European site(s) for which tourism is identified as an existing threat or pressure) is generally considered better than
- reduction/minimisation (e.g. reducing the number of visitors in areas that are threatened by visitors), which is considered better than
- compensation/offset (e.g. provide compensatory habitat for habitat lost to a tourism development or activity).

Using this hierarchy, different types of mitigation are suggested in Figure 13.1.

Enhancement should also be considered, for instance supplementary planting or alteration to existing management practices to promote increased biodiversity at a site, which can in turn improve perceived experience of tourism. An example of altering existing management practices would be to replace mowing regimes with low-intensity cattle grazing regimes in coastal grasslands, thereby increasing floral diversity, improving both habitat value and the perceived experience of visitors.

Figure 13.1 'Hierarchy of mitigation measures' for tourism plans

	Examples
Avoidance/ Prevention: Not causing impacts in the first place.	**Awareness:** ■ Promoting responsible tourism practices. ■ Raising the education profile of the tourism operators, site managers and/tour tourist on the ground. **Density reduction:** ■ Promoting satellite site or alternate destinations within the plan area to reduce visitor numbers at heavily impacted sites. **Removal from plan:** ■ Remove elements of the plan that are foreseen to have environmental consequences which cannot be controlled by the plan itself.
Reduction/ Minimisation: Lowering impact occurrence rates and severity; causing the least negative impacts possible.	**Intensity alleviation:** ■ Ticketing or licensing site usage. ■ Closing off tracks/trails in advance of capacity issues. Providing trail options to disperse potential effects. **Activity control measures:** ■ Ensure problematic activities are constrained to a specific area – such as a controlled BBQ area to avoid impacts such as fire damage. **Improve existing resources:** ■ Ensure services – such as waste and wastewater management are adequately provided. **Visitor management plans:** ■ Provide visitor management guidelines to service providers and site managers which highlight key sensitivities in the area and provide action protocols to reduce such effects.
Offset/ Compensation: Causing an impact but providing compensatory benefit.	**Habitat loss:** ■ Loss of important habitats and resources to be supplemented by planting elsewhere on the site to cause an overall net gain. **Concentrations of effects:** ■ Concentrating effects in a less vulnerable area to alleviate pressures elsewhere to allow for recovery.

13.2 Strategic mitigation

Table 13.1 shows examples of strategic mitigation. These measures have been used effectively across various Fáilte Ireland SEAs to ensure that mitigation is achieved across the following topics:

- infrastructure capacity, including drinking water, wastewater, waste, transport, traffic volumes and the Water Framework Directive;
- visitor management;
- green infrastructure and ecosystem services;[17]
- conflict resolution;
- environmentally responsible promotion;[18]
- site management.

Table 13.1 *Example:* **Selection of strategic mitigation measures** (environmental report for Ireland's Hidden Heartlands Regional Tourism Strategy, Fáilte Ireland, 2022)

Topic	Requirement
Infrastructure capacity	■ With respect to infrastructural capacity (including drinking water, wastewater, waste and transport) the potential impact on existing infrastructure as well as the potential environmental effects of a likely increase in tourism-related traffic volumes along any routes resulting from the relevant initiative shall be considered and mitigated as appropriate, where relevant. ■ Fáilte Ireland will follow national planning framework guidelines and liaise with relevant planning authorities to ensure any proposed developments are adequately provided for in terms of critical service infrastructure. ■ The promotion of developing visitor friendly infrastructure where it is required will also be encouraged. ■ Any proposed site management and maintenance guidelines produced by Fáilte Ireland will encourage site owners and operators to consider environmentally sustainable solutions and compliance with the Water Framework Directive.

17 Includes requirement relating to 'Connecting with nature for health and wellbeing' (EPA, 2020c).

18 Environmentally responsible promotion and marketing can be used in visitor management techniques that can help to mitigate adverse effects. Data from surveys and monitoring (see Section 13, 'Monitoring Measures') can be used to reduce uncertainties in visitor movements and inform responses in promotion. Environmentally responsible promotion can involve stakeholders, including operators, communities and visitors, thereby enhancing awareness of capacities and facilitating effective interventions where necessary.

Topic	Requirement
Visitor management	■ In contributing towards outcomes under the Strategies, partners and stakeholders shall seek to manage any increase in visitor numbers and/or any change in visitor behaviour in order to avoid significant effects including loss of habitat and disturbance, including ensuring that new projects are a suitable distance from ecological sensitivities. ■ Extensive research by Fáilte Ireland has shown improved environmental outcomes (including improved attainment of conservation objectives) in areas with visitor management strategies. Visitor management strategies may be required from partners and stakeholders who are contributing towards outcomes under the Strategies, as relevant and appropriate.
Green infrastructure and ecosystem services	■ In contributing towards outcomes under the Strategies, partners and stakeholders shall contribute towards the maintenance of existing green infrastructure and its ecosystem services, taking into account the output of the Mapping and Assessment of Ecosystem Services project being undertaken by the NPWS. Proposals for the development of any green infrastructure should demonstrate the synergies that can be achieved with regard to the: provision of open space amenities; sustainable management of water; protection and management of biodiversity; protection of cultural heritage; and protection of protected landscape sensitivities. ■ Where possible, extension of existing greenways and future development of new greenways and blueways should complement and integrate rather than replace existing green infrastructure. Stakeholders considering the development of greenways and blueways should have regard to the Fáilte Ireland publication 'Greenway – Visitor Experience & Interpretation Toolkit' and 'Connecting with nature for health and wellbeing' EPA Research Report 2020.
Conflict resolution	■ Action-based responses are essential at site-specific level in response to instances of environmental perturbation. Although the Strategies are not envisaged as being likely to directly result in any such instances of environmental perturbation, they form part of a hierarchy of tourism initiatives, including lower tier DEDPs, and the wider Statutory planning framework. The process outlined in the Appendix provides for a consistent approach in responding to such issues and is available for integration at DEDP and site-specific levels.
Environmentally responsible promotion	■ Fáilte Ireland will integrate environmental considerations into promotional processes and will ensure environmentally responsible tourism campaigns. Such campaigns will garner environmental stewardship that will help to ensure environmental protection and management. Promotional processes must be informed by environmental considerations, including available capacity, at a local level.
Site management	■ Fáilte Ireland's extensive monitoring of the effects of tourism to date has shown predictors of impact occurrence to include: site type; group type; the number of activities; activity intensity; and the interaction between activity intensity and abundance. Site management must consider these factors in seeking to reduce the potential for impacts to occur and to remove impacts.

13.3 Visitor management and techniques for infrastructure

The majority of tourism and recreational issues arise from management, not development, and management is generally not subject to planning, permitting or licensing. Tourism plans offer an opportunity to provide for mitigation measures relating to management.

- Figure 13.2 details a case study as to how strategic visitor management can help to accommodate increasing numbers of visitors while reducing pressure on archaeological monuments.
- Figure 13.3 suggests how strategic visitor management could be applied in busy coastal zones in order to: minimise traffic; facilitate efficient and effective infrastructure and service provision in nearby settlements; benefit the 'wild' appearance of sensitive landscapes; protect sensitive habitats; and maintain and improve the visitor's experience.
- Figure 13.4 provides examples of appropriate and inappropriate techniques from a publication that developers are required to consult when preparing applications for funding under various tourism plans.

Figure 13.2 *Example:* Strategic visitor management: Brú na Bóinne (CAAS for Fáilte Ireland, 2020)

APPENDIX 2 – CASE STUDIES

The Brú na Bóinne Visitor Management Strategy has successfully implemented the concept of separating visitor attractions from visitor facilities at a strategic level and has now been reproduced in many international locations.

This Appendix looks at this site specifically as a practical example. It aims to illustrate how this concept could be applied to attractions in the coastal zone along the Wild Atlantic Way. It also illustrates how visitor facilities can gradually be moved away from the most sensitive and significant near coastal zones and into more robust near-by areas of managed agricultural lands.

CASE STUDY 1 – STRATEGIC VISITOR MANAGEMENT - BRU NA BOINNE

A cluster of 3 large Neolithic passage tombs – Knowth, Newgrange and Dowth, are one of Ireland's most important archaeological sites. They are protected by a Visitor Management Plan.

Located less than an hour from Dublin, the site annually attracts hundreds of thousands of visitors. These ancient sites have a limited capacity to accommodate visitors without causing wear and tear to the fabric and context of the monuments – or reducing the quality of the visitor experience.

Landowners, local and state agencies have collaborated since 1995 to devise a strategy to manage visitor numbers - with the objective of accommodating ever increasing numbers – yet reducing pressure on the monuments.

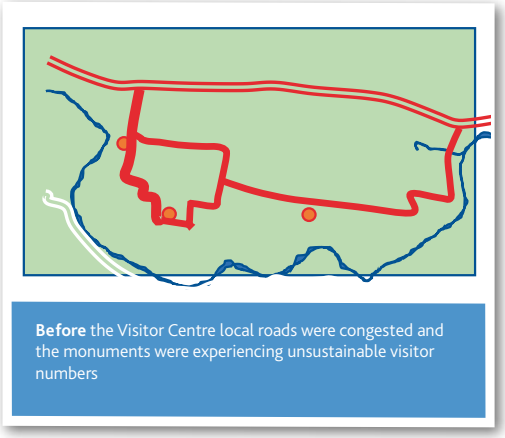
At the core of the strategy lay two simple approaches;

1. to spread the load more evenly between the three sites
2. to move parking, shops, cafes and visitor facilities away from the monuments.

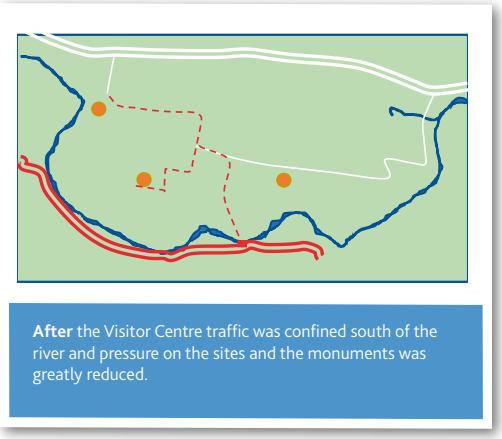
The diagrams illustrate how the original overcrowding was reduced by a combination of the removal of direct car access to the monuments and by the provision of new visitor facilities at a site south of the river.

This approach has succeeded in reducing 2017 visitor numbers to the Newgrange monument to levels last experienced in 1988.

This pioneering technique is now being widely adopted.



Before the Visitor Centre local roads were congested and the monuments were experiencing unsustainable visitor numbers



After the Visitor Centre traffic was confined south of the river and pressure on the sites and the monuments was greatly reduced.



Visitors Experience is greatly improved with better information, more comfort, no traffic congestion, less crowds and full catering and rest facilities.

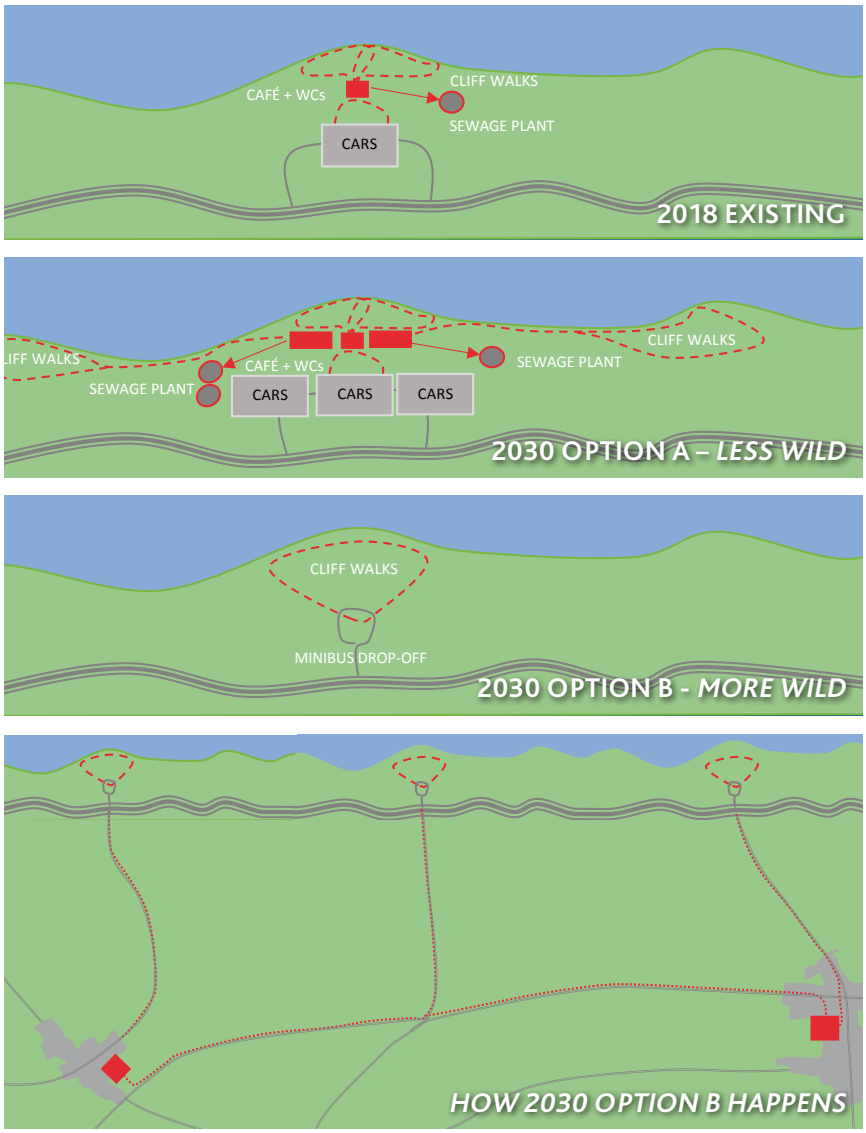
Figure 13.3 *Suggestion:* **Strategic visitor management in busy coastal zones** (Visitor Management Guidelines for the Wild Atlantic Way, CAAS for Fáilte Ireland, 2020)

CASE STUDY 2 - STRATEGIC VISITOR MANAGEMENT – POTENTIAL FUTURE APPLICATION IN BUSY COSTAL ZONE

It is possible to grow visitor numbers while also increasing the wildness of the more intensively used coastal locations by adopting a strategic approach.

The graphic below illustrates the options that might be available to site owners or operators and how considering the "more wild option" could be realised for an iconic cliff-top viewing point. This may be applicable to recommendations and actions coming from the recently completed Wild Atlantic Way Route Review.

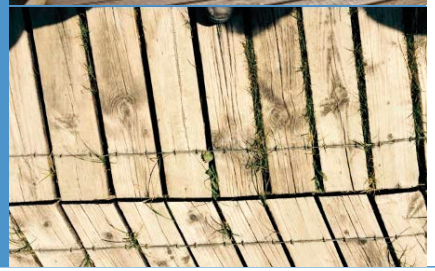
As numbers increase, on-site facilities – such as parking, toilets and shops – can be relocated away from the coast to existing nearby settlements and villages. Here, visitors pay for parking in return for a free minibus to the coastal features. Visitors may also opt to hike or cycle to the coast. The visitor facilities would augment the existing business in the settlements, as well as allowing more mixing with locals.



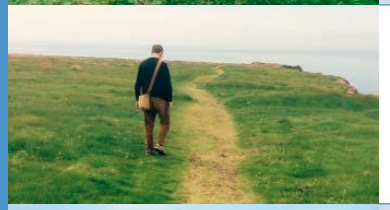
Built elements gradually re-located away from coast to nearby villages. Visitors travel to a number of smaller dispersed cliff-walks.

Figure 13.4 *Examples:* **Techniques for infrastructure** (Visitor Management Guidelines for the Wild Atlantic Way, CAAS for Fáilte Ireland, 2020)

LEARNING FROM SUCCESS

EXAMPLES	USE APPROPRIATE TECHNIQUES
	Flexible and adaptive structures, such as this partially floating walkway – allow access through sensitive tidal areas – without the requirement for intrusive permanent civil engineering projects.
	Appropriate Techniques that are most suitable for the receiving environment. This example of a boardwalk is fixed directly onto a sandy, well-drained surface – which permits these attractive flowing lines. These are suitable for areas in the vicinity of dunes.
	Appropriate Applications, such as the construction of this boardwalk involves elevation of the structure above the saturated peats in this example. The supporting timber framework results in a very difference appearance – with a defined edge composed of straight segments. These are suitable for areas commonly found near cliff edges and rock shores.
	

LEARNING FROM MISTAKES

EXAMPLES	INAPPROPRIATE TECHNIQUES
	Good Technique – Wrong Place Boardwalks can be successful in wetland or dune sites – but winter storm waves and surges on exposed beaches can quickly damage them.
	Good Materials – Wrong Place Stainless steel, insitu concrete and grass sward have very high resistance to extreme weather – but not to the actions of the sheep who roam this visitor attraction.
	Good Design – Poor Management Mown grass paths can be unobtrusive and robust. However, they need to be regularly rotated with due consideration to the resilience of the specific species of the underlying vegetation.
	Good Intention – Poor Execution Concerns about controlling erosion, traffic, safety and convenience appear to have squeezed natural features from a number of coastal locations on the coast.
	Good Intentions – Wrong Place Artificial floral displays that are appropriate in parks and urban areas are not compatible with the aim of sustaining the wilderness character of the WAW. They also require levels of care and maintenance that are often unrealistic at more remote coastal sites.

13.4 Climate action

The Government's National Climate Action Plan 2023 supports minimising negative environmental impacts of tourism. It includes actions associated with a just transition plan for the midlands region. These actions relate to supporting regeneration, repurposing and sustainable development of walking and cycling tracks and trails and waterways.

Measures within tourism plans that encourage low-carbon travel, such as walking and cycling, low-carbon activities and the circular economy, can help to minimise any increases in, and reduce, emissions. Issues that can be addressed by the wider planning framework include:

- the relevant policies and objectives of regional and local authority level land use plans;
- Integrated land use/transport planning, including taking into account existing and future demand and capacities and the need to integrate connectivity and accessibility to tourism locations;
- prioritisation of low-carbon options and improving frequency of public transport.

13.5 Documenting the integration of mitigation

The SEA Environmental Report should document what mitigation measures have been recommended, and where relevant whether they have been incorporated into the tourism plan. This chapter of the SEA Environmental Report should also identify which of the mitigation measures resulted from the Appropriate Assessment process. Many mitigation measures will already be part of the plan, or will have been added to the plan as it was developed. This information will also be useful for the post-adoption SEA statement (see Section 16). It can be useful and is recommended to link mitigation measures with likely significant effects, by way of a table. The example at Table 13.2 demonstrates how significant effects identified by the SEA can be linked to specific measures that have been integrated into the tourism plan in order to mitigate these effects.

Table 13.2 *Example:* Linking effects to mitigation (Extract from Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017a)

Strategic Environmental Objectives	Potential Significant Effects from plan implementation	Mitigation Measures developed through SEA and AA.
		Features and Objects of Archaeological Interest CDP15.10Development Plan Objective: Zones of Archaeological Protection CDP15.13 Development Plan Objective: Underwater Archaeology CDP 15.14Development Plan Objective: Cultural Development
	Biodiversity, Flora and Fauna	
B1 – Protect, conserve, enhance where possible and avoid loss of diversity and integrity of the broad range of habitats, **B2 – To achieve the conservation objectives of European Sites (SACs and SPAs) and other sites of nature conservation. species and wildlife corridors.** **B3 - Conserve and protect other sites of nature conservation including NHAs, pNHAs, National Parks, Nature Reserves, Wildfowl Sanctuaries as well as protected species outside these areas as covered by the Wildlife Act.** **B4 - Meet the requirements of the Water Framework Directive and the Shannon River Basin Management Plan/National River Basin Management Plan** **B5 – To minimise and, where possible, eliminate threats to bio-diversity including invasive species.** **B6 - Promote green infrastructure networks, including riparian zones and wildlife corridors**	The potential impacts associated with increasing visitor numbers relate to potential disturbance to species and habitats, particularly during seasons when they are more sensitive to disturbance associated with human activity Construction activities and potential pollution incidents. Accidental introduction of alien and invasive species Increased footfall could give rise to effects associated with trampling, new informal paths into more sensitive archaeological and ecological areas, subsequent erosion of soil and increase in rank grass species. Disturbance to bat species Loss of habitats or declining quality of habitats.	Visitor Management Mitigation Measures in particular MM1 Seasonality Access and Transport AT2 Physical Proposals in particular PP14 to PP18 Shoreline and Pier Proposals SP2, SP6 and SP7 Grazing and Woodland Management, in particular GW4, GW5 and GW 17 Pathways in particular P5 and P6 Toilet Facilities TF6 CDP 14.2Development Plan Objective: European Sites CDP 14.3 Development Plan Objective: Requirement for Appropriate Assessment under the Habitats Directive CDP 14.11 Development Plan Objective:

14. Monitoring Measures

Key points:

- Monitoring provides information on the actual impacts of the plan's implementation. This allows fine-tuning of the plan in response to problems. It also provides valuable information for any next round of plan-making.
- Monitoring should aim to identify not just whether problems occur but why they occur.

Annex I (i) of the SEA Directive requires the environmental report to describe 'the measures envisaged concerning monitoring in accordance with Article 10'. Article 10 of the SEA Directive requires the significant effects of plans and programmes of plans to be monitored, in part so that future rounds of impact predictions can be based on better evidence, and also so that unforeseen adverse effects impacts can be identified at an early stage, and appropriate remedial action can be undertaken.

The EPA has published good practice guidance on SEA statements and monitoring (EPA, 2020b), which can be a useful reference document when preparing monitoring measures and SEA statements. Monitoring frameworks are normally related to the SEA framework (Section 10).

Monitoring can inform future iterations of the tourism plan and/or lower tier plans and programmes, while also ensuring the efficacy of the mitigation measures within the plan. Monitoring can be accompanied by mechanisms and procedures for remedial action that facilitate responses to adverse results.

14.1 Focus of monitoring programmes

Monitoring frameworks should thus focus on:

- significant negative residual (post-mitigation) effects predicted in the SEA;
- ensuring that monitoring is undertaken, by specifying who is responsible for monitoring and how frequently it should take place;
- making the monitoring information publicly available, as a resource to support the ongoing implementation, and review where appropriate, of the plan;
- ensuring that unforeseen adverse impacts identified through monitoring are dealt with in a timely manner.

Box 14.1 details a case study of a monitoring programme that was prepared as part of the SEA of a tourism plan and implemented since adoption of the plan.

Box 14.1 *Example:* **SEA monitoring programme for Fáilte Ireland's Wild Atlantic Way operational programme 2015-2019** (environmental report for the Wild Atlantic Way Operational Programme 2015-2019, Fáilte Ireland, 2015; 2018 'Visitor Observation Study Results – Environmental Surveying and Monitoring of the Wild Atlantic Way Operational Programme', Fáilte Ireland, 2019)

The Operational Programme for the Wild Atlantic Way [WAW] sets out a strategy for the coordination and linking of a number of existing touring routes stretching approximately 2,500km along the Atlantic coast from Donegal to West Cork. This stretch of the coast is subject to various ecological designations.

Along the route, there are various Discovery Points (existing viewing points and lay-bys). Fáilte Ireland is co-ordinating and funding future WAW works relating to the Discovery Points through the Operational Programme, but not developing any of these works – they will be developed by the relevant local authorities and others. 'Site Maintenance Guidelines' have been integrated into Operational Programme providing environmental requirements in relation to parking surfaces, boundaries, signage, seating, facilities, lighting – as a condition of funding.

A comprehensive and detailed monitoring programme was set out in the SEA ER and SEA Statement for Fáilte Ireland's Wild Atlantic Way Operational Programme 2015–2019.

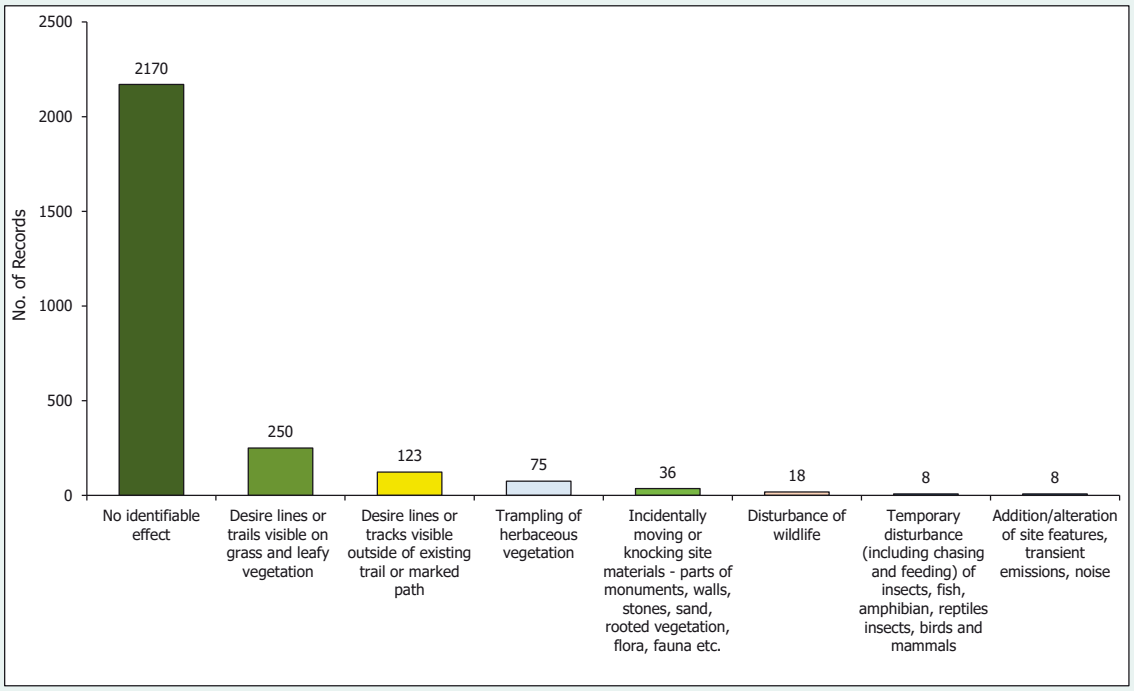
This is being implemented by Fáilte Ireland and includes:

1. Macro monitoring of Regional/County visitor numbers and associated level effects caused by the visitor contributions to loadings on transportation, waste and water infrastructure;
2. Site Surveys of visitor behaviour to describe general activities and associated environmental effects of visitors; and
3. Site Surveys to describe the specific effects on the ecology of areas that were observed to have been used/trafficked by visitors.

A Monitoring Group was established with a wide range of stakeholders that meets a number of times per year. Reporting is done annually.

Thresholds and Corrective Action were also integrated into the Monitoring Programme. The route and the Discovery Points may change if visitor activity and/or visitor intensification is predicted or observed to result in a negative impact on the environment in particular locations. Changes that could be made include the de-marketing of candidate Discovery Points, the removal of signage and the temporary or permanent removal of candidate Discovery Points from the route.

The findings of the Monitoring Programme show that, in general, visitors cause no identifiable effect on habitat or species. Where adverse effects are identified, these feed into visitor management strategies undertaken by Fáilte Ireland.



Range of impacts observed across all sites 2014–2018 (Fáilte Ireland, 2019a)

14.2 Sources of information

As demonstrated on Figure 6.1, tourism plans/programmes will be situated alongside a hierarchy of statutory documents setting out public policy for, among other things, land use development, tourism, infrastructure, sustainable development, environmental protection and environmental management. These other existing policies, plans, etc. will have been subject to their own environmental assessment processes, as relevant, and will form the decision-making and consent-granting framework. In developing monitoring programmes for tourism plans and programmes, the competent authority should take into account this hierarchy of planning and associated environmental monitoring.

Monitoring sources that may be useful include:

- information from existing and new environmental monitoring programmes for other tourism plans/programmes that the competent authority may be responsible for;
- existing sources maintained by local authorities (such as those arising from the SEA of land use plans) and the relevant authorities, e.g. the Environmental Protection Agency, the National Parks and Wildlife Service and the Central Statistics Office;
- emerging new information such as that from the Government's National Climate Action Plan 2023, which includes various measures to improve the evidence base for sustainable tourism.[19]

19 For example, utilise Destination Experience Development Plans to measure environmental impacts at key tourism destinations, commence a process to establish a benchmark CO_2 value for Irish tourism and develop a mechanism that allows industry to report on carbon reduction and offsetting measures.

14.3 Thresholds and remedial actions

Ideally, in order to ensure the effectiveness of monitoring programmes, threshold limits and remedial actions to address any exceedances recorded should be identified alongside organisational procedures for taking action. This will help to facilitate the resolution of all exceedances or issues in an efficient and controlled manner.

Remedial actions may relate to environmentally responsible promotion and marketing, which can be used in visitor management techniques. Data from surveys and monitoring can be used to reduce uncertainties in visitor movements. Environmentally responsible promotion can involve stakeholders, including operators, communities and visitors, thereby enhancing awareness of capacities and facilitating effective interventions where necessary. Other remedial actions may limit activities or change management practices to reduce impacts identified. There is a need to inform relevant stakeholders responsible for providing supporting actions or measures (such as local authorities, Irish Water and the Office of Public Works) of the findings of the monitoring programme and any remedial actions undertaken.

14.4 Integration and reporting

SEA monitoring should be aligned with the ongoing review of the implementation of the subject plan or programme. For instance, the Planning and Development Act requires development plans to be reviewed after six years, and a monitoring report on the implementation of the plan to be prepared two years after adoption: the SEA monitoring information should be included in that monitoring report. Such a procedure could be provided for within tourism plans also.

Table 14.1 shows an example of a monitoring programme, including timescale/frequency of monitoring, that integrates environmental monitoring with monitoring of tourism plan actions.

Table 14.1 *Example:* Part of SEA monitoring programme (Sceilg Mhichil World Heritage Property Management Plan, National Monuments Service, 2021a)

Management Objective	Applicable Actions	Targets/Indicators	Timescales
Objective 4: To identify and preserve the natural heritage of the island	**A4.1:** Prepare site-specific conservation objectives for the bird species for which the Skelligs SPA has been designated. Include quantitative conservation objectives attributes and targets.	1. Continue the monitoring of the SCI's of Skelligs SPA to determine species specific issues and population levels (As per Actions 4.5 and 4.6 in the management plan). 2. Available information on the ecological requirements of each of the SCIs of the Skelligs SPA used to select suitable attributes with targets for conservation objective-setting. Available monitoring data used to set targets for each attribute, which will be quantitative where possible. 3. Where necessary, refine quantitative attributes and targets as further monitoring data becomes available.	1. Ongoing. 2. Within 1 year of Plan's adoption. 3. Within 5 years of Plan's adoption.
	A4.2: Maintain close cooperation between the SMIG, the Property Management Team, the NPWS and the Guide team.	1. Schedule regular meetings between the interested parties. 2. Summary of meetings disseminated within the team and to the interested parties.	1. Ongoing, quarterly from the Plan's adoption, twice yearly in respect of Guide team. 2. 1 week after meeting is held.
	A4.4: Ensure an ecological assessment is undertaken for any project or activity which might significantly impact on the biodiversity of the island (including Screening for Appropriate Assessment and Appropriate Assessment if necessary, for any plan or project likely to have a	1. OPW to conduct initial ecological assessment and consult with NPWS/ecological experts as required.	1. Ongoing as required. 2. Ongoing as required. 3. Annually each January.
	significant effect on the species and their habitats for which the SPA has been designated) so that nature conservation issues are considered alongside built heritage.	2. Screening for AA and AA undertaken as required for any project where significant effects on the Skelligs SPA are possible. 3. Summary of assessments conducted each year released.	

15. Finishing the Environmental Report

Key points:

- When you have completed this stage, you may want to go back to Table 2.1 and carry out a self-test before making your Environmental Report public.

When the environmental report is prepared, it may be useful to assess it against the criteria detailed earlier in this guidance note at Table 2.1 in advance of public display.

The EPA's SEA Pack (EPA, 2021d) includes an SEA process checklist that can assist in ensuring the relevant information is included, as appropriate, at the various stages of preparing the SEA and plan/programme.

The environmental report can broadly be structured along the lines of Table 1.1, which is reflected in the table of contents of this note.

Four additional concluding sections need to be added:

1. Non-technical summary – which can be useful to provide at the beginning of the environmental report;
2. Difficulties encountered – which can be included in an earlier section on methodology;
3. Comments made by stakeholders (including the public, where relevant) as part of the SEA scoping process/plan scoping process, and how the SEA/planning team responded to them;
4. Next steps in the SEA process.

These are now dealt with in turn.

15.1 Non-technical summary

Annex I (j) of the SEA Directive requires the environmental report to include 'a non-technical summary of the information provided under the above headings'. In other words, the non-technical summary should summarise the information provided in the main report, and not just describe how the main report has been compiled. The non-technical summary should provide a brief discussion of the policy and environmental context, alternatives considered, main impacts of the plan and alternatives, mitigation measures, monitoring arrangements, etc.

The non-technical summary should be concise and should avoid scientific terms. The inclusion of suitable maps and tables can be particularly useful.

15.2 Difficulties encountered

Annex I (h) of the SEA Directive requires the environmental report to include a description of 'any difficulties (such as technical deficiencies or lack of know-how) encountered' in compiling the required information'.

Difficulties encountered could include:

- a plan's strategic, non-spatial and/or non-specific character, making assessment difficult;
- a plan's transboundary and multi-jurisdictional aspects;
- lack of baseline data, for instance about population and human health, the marine environment or past environmental trends;
- data that have not recently been updated;
- challenges in assessing the effects of new technologies due to a lack of data about the impacts of these technologies.

Boxes 15.1 and 15.2 show examples of how difficulties faced can be described.

Box 15.1 *Example:* **Difficulties encountered** (Tourism Masterplan for the Shannon Region, Waterways Ireland, 2020a)

Difficulties were encountered in the development of the Shannon Masterplan and in the SEA of the Shannon Masterplan due to the transboundary and the multi-jurisdictional aspects of the Masterplan as the length spans 10 administrative boundaries in Ireland, and 1 administrative boundary in Northern Ireland.

There are a number of stakeholders involved in the formation of the Masterplan with differing priorities and amounts/levels of information which must feed into the Shannon Masterplan and the corresponding SEA. Due to these variances, there are difficulties in the creation of an even assessment across the potential alternatives in the Shannon Masterplan as to focus into significant project details in one section which may have more information will not lead to a balanced assessment of alternatives.

Due to these reasons, it was important to determine a strategic level of assessment that is replicable across all alternatives.

Box 15.2 *Example:* **Difficulties encountered** (Wild Atlantic Way Operational Programme, Fáilte Ireland, 2015 – referring to a centralised database of environmental baseline data sets)

A challenge to the undertaking the SEA and a future challenge for lower tier assessments and decision-making by local authorities is the lack of a centralised database including data (for both Ireland and Northern Ireland) that could make all environmental baseline data readily available and in a consistent format. This challenge is one which is encountered for various plans, programmes and projects and is overcome by investing time resources in assimilating information from various sources. The information used by the assessment and referred to in this report is appropriate for this level of decision-making and environmental assessment.

15.3 Summary of influence of the SEA process

A summary of the influence the SEA process has had on the plan/programme can add transparency and be useful to those reading the plan or the SEA. Such a summary can also be helpful in the preparation of the post-adoption SEA statement.

15.4 Next steps

It can be useful to include a final section in the environmental report to explain what happens next. This will be consultation on the draft plan and environmental report, subsequent amendments to the draft plan and environmental report, and various steps towards plan adoption. Readers should be told when and where they can submit their opinions/observations.

This can be succinct, for instance:

- This environmental report is being published alongside the draft plan for formal consultation. A written submission or observation with respect to the draft plan and associated environmental report may be made to the competent authority within a specified period.
- Feedback received from consultees will be documented and considered in reviewing the proposals for the draft plan. A post-adoption statement (referred to as an SEA statement[20]) will summarise how the environmental report and the consultation responses have been taken into account and how environmental considerations have been integrated into the final decisions regarding the plan.
- Where the plan is materially amended in response to consultee feedback, these amendments should be screened to determine whether they are likely to have significant environmental effects, and reassessed if they are. A subsequent stage of public consultation may be required where amendments are considered significantly material and/or have been determined as being likely to have significant environmental effects.

20 The EPA has published good practice guidance on SEA Statements and Monitoring (EPA, 2020b), which can be a useful reference document when preparing monitoring measures and SEA Statements.

16. Post-Adoption SEA Statement (Information on the Decision) and Monitoring

Key points:

- After the plan has been adopted, an 'SEA statement' must be prepared that explains how environmental information was taken into account in the plan-making process and how the plan's impacts will be monitored.
- The SEA statement should focus on the changes made to the plan in response to the SEA process.
- It is important to note that *much of this should ideally also be included in the environmental report, to show that the SEA process has influenced the plan-making process*.

16.1 Information required post adoption

Once a plan is adopted, Article 9 of the SEA Directive requires the following information to be made available to the environmental authorities, the public and other Member States (if required).

Table 16.1 Information required by Article 9 of the SEA Directive

Information requirement	Covered in this guidance at:
1. The adopted plan –	–
2. An 'SEA statement' that summarises:	
■ how environmental considerations have been integrated into the plan and how the environmental report has been taken into account;	Figures 5.1 and 5.2, and the rest of this section
■ how the opinions of statutory consultees, the public and any relevant other countries have been taken into account;	Section 5.2
■ the reasons for choosing the plan as adopted, in the light of the other reasonable alternatives dealt with.	Section 11.4
3. The measures decided concerning monitoring	Section 14

16.2 SEA statement

The EPA's (2020b) guidance on SEA statements and monitoring provides useful guidance for this section. The SEA statement essentially 'tells the story' of the SEA process, and can give a good indication of whether the process was carried out in a timely and effective manner.

If a good practice SEA process has already been followed, most of the information that an SEA statement must cover will already be available, and can simply be copied from the environmental report/other SEA documents into the SEA statement. The remaining requirement – how environmental considerations have been integrated into the plan – can involve a description of how the SEA was carried out: who was involved, relevant dates, and a flowchart that shows the key links between the stages of plan-making and SEA stages. Figure 5.1 from earlier in this guidance note shows an example of this.

The main findings and recommendations of the SEA process are summarised, as well as changes made to the plan in response to the findings/recommendations.

Box 16.1 provides an example of how consultations throughout the plan-preparation/SEA process could be summarised, while Table 16.1 provides an example of documenting how the opinions provided in written submissions as part of the plan-preparation/SEA process have been taken into account.

Table 16.2 shows how environmental considerations have been integrated into a tourism plan through the plan-preparation/SEA process by showing how, in advance of public display of the draft plan, the wordings of actions were updated and how new actions were added to the plan.

Monitoring measures are also required to be included in the environmental report and these have been covered under Section 14 of this guidance note.

Box 16.1 *Example:* Summary of consultations throughout the plan preparation/SEA process
(Tourism Masterplan for the Shannon Region, Waterways Ireland, 2020b)

Working/ Steering Group

Formal meetings were held throughout the development of the Shannon Masterplan with the project Working Group, comprising representatives of Waterways Ireland and Fáilte Ireland. Additional consultations and feedback were held with the Steering Group, comprising representatives of the Working Group and representatives of the ten Local Authorities that are adjacent to the Shannon and Shannon and Shannon Erne Waterway.

Consultations

A range of key consultations were held with the executive teams (CEO, Directors of Services) of each of the ten counties adjacent to the Shannon in late 2018. Additionally, consultations were held with the various statutory bodies, responsible for aspects of the management of the Shannon and Shannon Erne Waterway, including: Waterways Ireland, Fáilte Ireland, NPWS, EPA, OPW, National Monuments Service and ESB. Electronic communications were held with the Inland Fisheries Ireland, Coillte and Bord na Mona. Additional consultations were held with Irish Boat Rental Association (IBRA), Inland Waterways Association of Ireland and a number of other NGOs.

Consultations were held with tourism and heritage officers in each local authority through workshops. Workshops commenced in November 2018 and continued with tourism trade and SMEs in a series of sub-regional workshops in late January 2019. Community representatives, tourism activity and service providers were consulted through the thematic framework workshops, with follow-on consultations with individuals and groups.

Summary of consultations

All consultations were noted in the course of the Study. These responses were analysed in further detail to provide inputs to the development of the strategic initiatives in the Masterplan (Volume 2).

Thematic Workshop

The Thematic Workshop on the 29th November 2018 attracted 29 people. They represented all parts of the Shannon and a wide range of interests, with tourism, archaeology, wildlife, folklore, history and river-based recreation being particularly well-represented (see Participant Interests document).

During the workshop the participants discussed the special and distinctive qualities of the Shannon in depth. These deliberations focused on six provisional thematic areas that had been derived from discussions with the consultant team and the client Working Group. The goal of the workshop was to test and refine these six themes and, if possible, reduce the number.

The provisional themes were:

- The Living Shannon
- Shannon routes, crossings and meetings
- The Timeless Shannon
- Wellspring of Early Christianity
- People of the River Shannon
- The Shannon, mighty river of Ireland

Review of themes: Stage 1

The workshop tested how far the provisional themes aligned with participants' sense of what was special and distinctive about the Shannon.

This raw data showed:

- an extremely good match – of 200 responses all but three fitted this provisional thematic framework
- all the provisional themes had traction – i.e. they all attracted good numbers of responses

These results were reported to the Project Steering Group on November 30 who responded warmly to the six provisional themes. They said these expressed the Shannon accurately.

Outcome

The conclusion from this stage is that the provisional themes are essentially correct and there is nothing missing. This indicates that they could be refined and streamlined but should not be profoundly altered.

Review of themes: Stage 2

The workshop outputs were scrutinised for overlap and duplication between the themes and the comparative strength of responses. Responses that suggest strong themes are specific to the Shannon, diverse, place-based and/or detailed. Responses that indicate weaker themes are fewer and more generic (e.g. 'culture', 'history', 'nature').

In a group exercise of this type the difference between strong and weak responses can indicate the topics that people are most motivated by i.e. the ones that they are most interested to talk about. This suggests a stronger basis for developing tourism products.

Our analysis of participants' interests suggested that the weaker responses in the workshop were not usually due to under-representation of knowledge areas.

This exercise showed:

Responses for The Timeless Shannon, Shannon routes, crossings and meetings, and the landscape and activity elements of The Living Shannon were particularly strong and substantial.

This suggests these are the strongest themes.

- The Wellspring of Early Christianity is strong, but more limited in scope. Many of the responses here were duplicates from elsewhere. This suggests this is a sub-theme, probably of Shannon routes, crossings and meeting).
- The responses on the nature and biodiversity aspects of The Living Shannon were non-specific. There was wildlife expertise in the room so this suggests that this may not be a strong theme. It would be helpful to talk to a specialist to explore this further.
- Similarly, the responses on People of the Shannon were few and generic e.g. 'craft', 'heritage', 'traditional culture and beliefs'. In this case it could be that people in the room did not know enough about the topic. Alternatively, it may be that this area is not particularly locally distinctive, or that local people do not recognise it or that they do not want to talk about it. A theme that relates directly to contemporary life on the Shannon is vital for the Tourism Masterplan so it will be important to explore this further at the local workshops.
- The importance of the islands and the stories came out strongly and was mentioned in several of themes. This suggests this is an under-told story that participants would like to see highlighted more. We need more information on these stories.
- The scale of the river and its status as the longest in the British Isles was emphasised in several of the themes. This has also been highlighted in many of our conversations. It seems resonant; this scale seems symbolic as well as geographic. This is a core idea around which people unite.

These considerations fed into the re-drafting of the themes.

Parting shots

The workshop concluded with a parting shots exercise. This allows the participants who have spent the previous few hours in tightly structured group conversations to make an individual comment about any aspect of the Tourism Masterplanning. It is an important technique for ascertaining concerns that people may not wish to express in the group. The results are in the Parting Shots Responses document.

The striking thing about the results of this exercise from this group, when compared with many other workshop groups in a wide range of situations, is the consistency of the responses. Over 40% (12 out of 29) of respondents choose to emphasise the importance of sustainable development and the importance of conserving the natural environment of the Shannon. This will inform many aspects of the Masterplan and suggests theming around the value of the natural environment is important.

The other responses from this exercise focused on improved access and infrastructure (8 out of 29 responses) and the need for local people to be involved in the development of tourism and to benefit from it (6 out of 29 responses).

Table 16.2 *Example:* Documenting how written submissions were taken into account (Inis Cealtra Visitor Management and Sustainable Tourism Plan, Clare County Council, 2017b)

Summary of submission	Action/amendment proposed to the Plan documents	SEA and AA Response
Location of interpretative centre-Consider using the Rectory-unoccupied, visual link to island from 1st floor, adequate land/space for parking, planning not a problem, and likely to be available at a competitive price	Add Rectory as a site no 12 (table 3-1 page 44), and reassess. Add language to Objective 5 to allow Rectory building, or south part of its site be considered (at the time of design of the VMSTDP), should the previously identified site be unfeasible.	The SEA will assess the Rectory site as part of updating the Consideration of Alternatives Section of the SEA ER. The site will be assessed in line with the SEOs prepared for the SEA ER. Objective 5 will be assessed as part of the SEA screening process also upon receipt of additional text.

Table 16.3 *Example:* Integration of environmental considerations – updated and new actions (Sceilg Mhichil World Heritage Property Management Plan, National Monuments Service, 2021b)

Original Action	Updated Action	Justification for Change
Action 4.1: Prepare site-specific conservation objectives for the bird species for which the Skelligs SPA has been designated.	**Action 4.1:** Prepare site-specific conservation objectives for the bird species for which the Skelligs SPA has been designated. Include quantitative conservation objectives attributes and targets.	The additional wording is recommended to make it clear that the conservation objectives will include attributes and targets so that the status of each species can be clearly assessed against what has been defined as a favourable conservation status. To enable a quantitative assessment, population trends, range and use of area for each species would be required. This will be an output from Action A4.5 which will continue to develop the seabird monitoring programme. Therefore, the timelines for completing this Action would need to be phased.
Action 4.10: Ensure that helicopter flights over and in the vicinity of Skelligs SPA are avoided during the birds' breeding season.	**Action 4.10:** Exclude recreational and other non-essential helicopter flights from an exclusion zone of 1km surrounding Skelligs SPA.	In the event that helicopter flights over Sceilg Mhichíl continue into the future, limitations on the distance they are permitted to fly within should be implemented. This will limit the negative effects of their presence on birds (from noise disturbance, buffeting from the rotors downdraft and bird strikes), as well as noise disturbance to visitors to the site, thus improving the visitor experience.
Action 6.1: Continue to manage the National Monument, Nature Reserve and SPA at Sceilg Mhichíl while allowing a system of managed public access	**Action 6.1:** Continue to balance the need to preserve the integrity of the National Monument, Nature Reserve and SPA at Sceilg Mhichíl while allowing a system of managed public access so as to ensure the conservation of the	Wording has been changed to clarify that the WHS taking priority does not mean that the cultural heritage features will take priority over the natural heritage features of the site.

Objective	Proposed Action	Reasoning
Objective 2: To improve liaison with local interest groups and other relevant parties	**Action 2.5:** Make publicly available existing and future reports on Sceilg Mhichíl via a dedicated website page for Sceilg Mhichíl.	This will provide greater transparency to the decision-making process on Sceilg Mhichíl and the data that underpins these decisions.
Objective 4: To identify and preserve the natural heritage of the island	**Action 4.14:** Develop guidance for boat operators to follow to reduce potential impacts on wildlife on Sceilg Mhichíl, and in the surrounding waters.	An increase in tours around Sceilg Mhichíl as an alternative to landing, will help reduce some of the pressure to the island from visitor footfall. However, increased numbers and frequencies of vessels circumnavigating the Skelligs have the potential to impact wildlife. This action could be achieved through a public awareness campaign to make the boat operators and public aware of activities which could disturb wildlife such as seals and rafting birds. This information could be displayed at the piers.

Glossary

Appropriate Assessment
The obligation to undertake Appropriate Assessment (AA) derives from Article 6(3) and 6(4) of the European Habitats Directive 92/43/EEC. AA is a focused and detailed impact assessment of the implications of a strategic action (such as a plan or programme) or project, alone and in combination with other strategic actions and projects, on the integrity of a European Site (Special Areas of Conservation or Special Protection Areas) in view of its conservation objectives.

Competent Authority
Competent Authority refers to the plan-making body undertaking the environmental assessment.

Effect
A change resulting from the implementation of a plan, programme or project.

Environmental Impact Assessment
The process of examining the anticipated environmental effects of a proposed project – from consideration of environmental aspects at design stage, through consultation and preparation of an Environmental Impact Assessment Report (EIAR), evaluation of the EIAR by a competent authority, and the subsequent decision as to whether the project should be permitted to proceed, encompassing public response to that decision.

Environmental Problems
Environmental problems arise where there is a conflict between current environmental conditions and ideal targets. If environmental problems are identified at the outset they can help focus attention on important issues and geographical areas where environmental effects of the plan or programme may be likely.

Likely Effect
The effect that is specifically predicted to take place – based on an understanding of the interaction of the proposed plan, programme or project and the receiving environment.

Mitigate
To make or become less severe or harsh.

Mitigation Measures
Measures designed to avoid, prevent or reduce effects. These measures can mitigate effects by: avoidance, when no effect is caused (often through consideration of alternatives); prevention, when a potential effect is prevented by a measure to avoid the possibility of the effect occurring; and/or reduction, when an effect is lessened.

Potential Effect
The effect that would occur without mitigation.

Pathway
The route by which an effect is conveyed between a source and a receptor.

Receptor
Any element in the environment which is subject to effects.

Residual Effect
The final predicted effect remaining after mitigation.

Scoping
The process of determining what issues are to be addressed and setting out a methodology in which to address them in a structured manner appropriate to the plan or programme. Scoping is carried out in consultation with appropriate environmental authorities.

Screening
The process of determining whether SEA is required to be undertaken for certain plans and programmes.

Strategic Environmental Assessment (SEA)
The assessment of the effects of certain plans and programmes on the environment. It presents a structured and participative process containing a set of tools to assist in the integration of environmental considerations and promote informed decision-making at plan/programme level.

Statutory environmental authority
The SEA Regulations (as amended) specify which environmental authorities need to be consulted at different stages of the SEA Process.

SEA framework
An SEA framework can comprise:

- a simple list of topics or themes that will be considered during the assessment;
- strategic environmental objectives that state the direction in which the plan should be going. These may be developed from policies that generally govern environmental protection objectives established at international, Community or Member State level;
- indicators that measure the effects that the plan is likely to have;
- targets that the plan should achieve;
- responses to any problems identified through monitoring.

Source
The activity or place from which an effect originates.

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CIEEM

Briefing Paper

Biodiversity Enhancement for New Developments in Ireland

CIEEM Ireland Policy Group

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Introduction

In simple terms, Biodiversity Enhancement (BE) is about designing developments in a manner that leaves biodiversity in a better state than before. This is achieved by avoiding impacts on ecological features of high value, minimising unavoidable impacts, enhancing the value of existing features, and providing new ecological features that were not previously present.

A number of terms and acronyms for BE have been used to describe the process. Early approaches typically focussed on No Net Loss (NNL), which requires negative impacts on biodiversity to be offset by gains elsewhere, thereby achieving a neutral effect. However, in recent years the level of ambition has increased, aiming for a positive rather than a neutral effect.

A pioneering approach was taken in England using the 'Biodiversity Net Gain' (BNG) approach, where the Environment Act 2021 introduced a legal requirement for all new developments to achieve a 10% increase in biodiversity units. This is calculated using a metric developed by the Department for Environment, Food and Rural Affairs (DEFRA) that compares habitats before and after development. Scotland and Wales are developing similar frameworks, implemented under planning policy rather than legislation.

However, there is currently no formal legislation or policy regarding BE in the Republic of Ireland or Northern Ireland. In this Briefing Paper we make recommendations on the approach to BE that we propose for use in the Republic of Ireland and Northern Ireland. We hope that it will contribute to a broader discussion about the best approach for Ireland, and will assist policy-makers in each jurisdiction when developing national guidance.

This document has been prepared by the Ireland Policy Group of the Chartered Institute of Ecology and Environmental Management (CIEEM). CIEEM is the main professional body for ecologists in Ireland, with 530 members across the island. We are a cross-border group, so this document represents our approach both for the Republic of Ireland and Northern Ireland.

This document may be of interest to the following groups:

- Public authorities responsible for guidance and policy on BE
- Ecologists designing biodiversity enhancements for new developments
- Biodiversity Officers, Planners and other specialists reviewing BE proposals
- Developers, Architects and Planning Consultants that wish to understand the process
- Members of the public who wish to review and/or critique BE proposals





Existing Policy Regarding BE in Ireland

In the absence of national guidance, a number of public, semi-state and private organisations have started to develop policy regarding Biodiversity Enhancement. Some examples are presented below:

- The Irish National Biodiversity Action Plan (BAP) 2017-2021 includes the following action: *"All Public Authorities and private sector bodies move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting, etc"*. A new BAP is currently in development, and is expected to include a similar or more ambitious requirement regarding BE.
- In Northern Ireland, the Wildlife and Natural Environment Act (Northern Ireland) 2011 states that *"it is the duty of every public body, in exercising any functions, to further the conservation of biodiversity"*.
- Many county/city/local development plans now include commitments to implementing BE for new developments. For example, Policy GI16 of the Dublin City Development Plan 2022-2028 states that "Opportunities should be taken as part of new development to provide a net gain in biodiversity" and policy GINHP14 of the Fingal Development Plan 2023-2029 says *"Promote biodiversity net gain in new developments and develop a planning guidance document on Biodiversity Net Gain"*.
- Dún Laoghaire Rathdown, Fingal and Dublin City councils have included the development of Biodiversity Net Gain guidance as an action of the biodiversity plans for each county.
- The (Draft) Derry City and Strabane Local Development Plan 2032 includes the following: *"where possible, developments will be expected to include suitable measures to contribute positively to overall biodiversity net gain in the District or to mitigate harm caused by development through measures including additional and compensatory tree planting"*.
- Action 3.9 of The Office of Public Works Biodiversity Action Plan 2022-2026 is the *"Development of a suitable approach to Biodiversity Net Gain as a policy principal within flood scheme decisions"*.
- Objective 3 of Irish Water's Biodiversity Action Plan is to *"Ensure 'no net loss' of biodiversity when carrying out activities, or delivering plans or projects" and "actively seek opportunities for biodiversity net gain by identifying opportunities for biodiversity enhancement at both existing and proposed Irish Water sites"*. To measure this quantitatively, Irish Water has developed an in-house metric based on habitat extent and quality.
- Engineers Ireland produced an issues paper in 2021 titled 'Protecting Biodiversity: The role of Engineers', which noted that: *"To halt the loss of biodiversity through development, a project should leave the environment in a better state than before. Aiming for Biodiversity Net Gain should form the basis of all engineering projects."*
- SSE Renewables "*is targeting Biodiversity No Net Loss from 2023 and Biodiversity Net Gain from 2025 on newly-consented large onshore projects"*. They have published internal guidance on Biodiversity Net Gain on new onshore wind energy projects in Ireland and Scotland, which is adapted from English guidance and the Defra metric (see below). They highlight an ambition to improve biodiversity at all new sites, despite *"an absence of a recognised framework in Scotland and Ireland"*.
- The Irish Green Building Council has developed the 'Home Performance Index', which awards certificates for the standard of a home's design, construction and environmental sustainability. Category EN5 refers to Ecology, and awards points for developments that achieve slight, moderate, or significant Biodiversity Net Gain, to be determined by an independent ecologist.

Based on the examples provided above, it is apparent that BE has already arrived in Ireland. It represents current planning policy in several local authorities, and is expected to be promoted more widely in the next iterations of development plans. Many semi-state bodies have committed to NNL or BE for all of their projects. Some private companies that engage in large projects (e.g. SSE Renewables) are voluntarily committing to BE on all new projects.

CIEEM has held recent events on Biodiversity

Enhancement in Ireland, including a webinar in January 2023 and a panel discussion at the Annual Irish Conference in April 2023. Members were asked whether they had carried out a Biodiversity Enhancement/Biodiversity Net Gain assessment, and more than half of the attendees indicated that they had. Most had used the English BNG approach and the Defra metric.

In this context, there is now a clear requirement for national guidance on BE in Ireland. In the absence of such guidance, different organisations are using different approaches, including adapting methods from England. This is far from ideal, because there is no consistency in approach, nor any agreement on what would constitute a legitimate enhancement. We strongly encourage the relevant authorities in the Republic of Ireland and Northern Ireland to develop national guidance in each jurisdiction, to ensure that all methods and outcomes are comparable.

CIEEM is the largest professional body of ecologists in Ireland and Northern Ireland. As such, we wish to provide some recommendations on the approaches to be implemented in Ireland, to assist the relevant authorities when developing national guidance. This document includes the following sections:

- A review of the approaches used in England, Scotland and Wales
- Criteria for a competent ecologist
- Whether we favour a quantitative approach (a biodiversity metric), a qualitative approach (professional judgement), or a combined approach
- How to incorporate BE into other ecological assessments
- Ecological features that may be considered 'irreplaceable'
- Categories of development for which BE should be mandatory, recommended or exempt
- Feasibility of ex-situ compensation
- Timescale for implementation, and monitoring
- Key considerations for habitat enhancement
- Some suggested biodiversity enhancements for urban and suburban projects







Approaches to Biodiversity Enhancement in Britain

CIRIA-CIEEM-IEMA Guidance

CIEEM in association with Construction Industry Research and Information Association (CIRIA) and the Institute of Environmental Management and Assessment (IEMA) published '*Biodiversity Net Gain: Good Practice Principles for Development, A Practical Guide*' in 2019. It is a very comprehensive guide, and should be the first source of guidance for BE assessments. The key considerations of the guidance are summarised as follows:

- Ecologists should be engaged at the very start of the design process. They should visit the site and identify any important ecological features, so that they can be taken into account during the preliminary design phase.
- The mitigation hierarchy should always be applied sequentially. The ecologist's first approach should always be to avoid impacts on ecological features. Where this is not possible, they should mitigate/minimise negative impacts. As a last resort, impacts can be compensated elsewhere.
- Avoid losing biodiversity that cannot be offset elsewhere, e.g. designated sites, irreplaceable habitats.
- Engage stakeholders early, and involve them in scoping and implementing BE approaches.
- Interventions must be implemented and monitored in the long-term, usually 25 - 30 years.

Varying approaches in England, Scotland and Wales

The CIEEM-CIRIA-IEMA guidance applies to all of Britain and Ireland, but slight variations in national guidance have been adopted in England, Scotland and Wales. There is currently no formal guidance in the Republic of Ireland or Northern Ireland.

The English approach: Biodiversity Net Gain

Under the Environment Act 2021, the English government introduced a mandatory legal requirement that new developments must achieve a 10% net gain. The law will come into force from January 2024.

The English approach is quantitative, using the Defra Biodiversity Metric (further details are provided below) to mathematically calculate changes in the extent, distinctiveness and condition of habitats between the pre-construction and post-construction scenarios. It should be noted that this refers only to habitats, and not to any other ecological features (designated sites, protected species, invasive species, etc).

Where the 10% biodiversity net gain cannot be met within a development site, provision is made to compensate for impacts outside the development site. The Environment Act 2021 also provides a legislative basis for a register of 'biodiversity gain sites', which are managed solely for the purpose of biodiversity enhancement. The Act also creates a system of national 'biodiversity credits', which formalises the means by which developers can make financial contributions to biodiversity gain sites. However, on-site gain will always be favoured over off-site gain.

Exemptions to the 10% net gain are provided for householder applications and other small-scale developments, as well as for sites consisting only of buildings and artificial surfaces (i.e. zero baseline ecological value). With these exceptions, the 10% net gain applies to all developments, regardless of scale.

As an aside, we do not recommend the use of the term 'Biodiversity Net Gain' for BE assessments undertaken in Ireland, because the term refers specifically to the methodology used in England. To avoid confusion, we currently recommend the use of the generic term 'Biodiversity Enhancement', or the selection of a specific term/title that refers only to the Irish methodology.

The Scottish approach: Positive Effects for Biodiversity

The Scottish Government has opted to deal with BE using policy (The Fourth National Planning Framework 'Policy 3: Nature Crisis') rather than legislation. It recommends a qualitative rather than a quantitative approach, and thus does not make reference to metrics, numerical targets or biodiversity credits. Instead, ecologists use their professional judgement to determine whether or not a development will enhance a site.

In September 2023 the Scottish Government published a document titled Measuring biodiversity: research into approaches. It concluded that *"with refinement, Natural England's Biodiversity Metric 3.1 could be adapted for planning and development use, and as part of a wider set of metrics within a biodiversity framework. These refinements include the coverage of habitats, and adjustments to condition assessment and multipliers to reflect Scottish contexts."* They also committed to the development of a biodiversity metric or measurement tool in Scotland that could unite multiple related sectors: natural capital markets, planning and development, biodiversity conservation and monitoring and agriculture. However, pending the creation of the new metric/tool, all assessments should follow a qualitative approach.

Importantly, the Scottish approach provides different expectations for BE depending on the scale of the development, rather than introducing a single rule for all developments (in contrast to the English approach). Biodiversity Enhancement is required under planning policy for all *"development proposals for national, major and of EIA development or development for which an Appropriate Assessment is required"*. These developments *"should only be supported where it can be demonstrated that the proposal will conserve and enhance biodiversity, including nature networks within and adjacent to the site, so that they are in a demonstrably better state than without intervention, including through future management."*

Developments of smaller scale (referred to as 'local developments') should only be supported if they *"include appropriate measures to enhance biodiversity, in proportion to the nature and scale of development"*, but there is not an explicit requirement to demonstrate an enhancement in all cases. Individual householder developments do not have any requirements for enhancement.

The Welsh approach: Net Benefits for Biodiversity

The Welsh government has also opted to deal with BE using policy, as outlined in Section 6.4 of Planning Policy Wales: Edition 11. It states the following: *"Planning authorities must follow a step-wise approach to maintain and enhance biodiversity and build resilient ecological networks by ensuring that any adverse environmental effects are firstly avoided, then minimised, mitigated, and as a last resort compensated for; enhancement must be secured wherever possible"*. As in Scotland, the Welsh approach requires a qualitative (professional judgement) rather than a quantitative (metric) approach.

Ecologists are therefore encouraged to take a whole system approach when conducting assessments including an understanding of:

- The biodiversity value of a site
- Its ecosystem resilience, described using the DECCA approach (Diversity, Extent, Condition, Connectivity and Aspects)
- The ecosystem services or benefits provided, and
- Its existing and potential linkages with the wider green infrastructure network – before and after as a result of the development proposal.

The Welsh approach does not distinguish between different scales of development, but the inclusion of *"whenever possible"* in the policy document may provide an exemption for certain developments.





Key considerations for BE on the Island of Ireland

In this section we provide recommendations for the implementation of BE on the Island of Ireland. In general terms, we consider the CIEEM-CIRIA-IEMA Good Practice Guidance to provide the best over-arching framework for BE, and we recommend that it should be considered as the main reference text for all BE assessments. However, within this framework there are a number of key considerations, which we outline below.

Engaging a competent ecologist

Developers should ensure that ecologists are suitably-qualified to carry out a BE assessment. We consider the following qualifications and experience to be the minimum requirements for the lead ecologist on a BE assessment:

- A Full Member of the Chartered Institute of Ecology and Environmental Management (CIEEM) or similar professional body, and subject to a published code of conduct
- A minimum of 3 years experience as an ecologist
- Demonstrable experience and training in any specialist surveys required (e.g. bats, birds, botany)
- A qualification in ecology or a related subject

Although aspects of BE can be designed and/or implemented by other environmental disciplines (e.g. a landscape architect, environmental consultant), the assessment must always be coordinated and reported by a competent ecologist.

The ecologist must be engaged at the start of the design process, and should carry out a baseline survey of the development site before any work commences. This will ensure that any important ecological features (e.g. irreplaceable habitats) can be identified at an early stage, and ideally avoided.

The ecologist will then provide iterative assessment over the course of the design process, culminating with a planning assessment. After planning is secured, the ecologist will often need to advise the developer during the construction process, and to monitor ecological features when the development is operational.

Measuring Changes in Biodiversity: Qualitative vs Quantitative Approach

When carrying out an ecological assessment for BE assessment, it is necessary to determine the 'importance' of ecological features. This valuation process can be complex, as it is influenced by a range of variables, such as the extent of a given ecological feature in the region, the condition of that feature at the time of survey (e.g. anthropogenic degradation), and the longer-term national trends in its conservation status. CIEEM guidance on Ecological Impact Assessment sets out a framework for ecologists to value and identify features of ecological importance. In Ireland, EPA Guidance for Environmental Impact Assessment Reports provides additional terminology based on context, character, significance and sensitivity. These are qualitative assessments based on an ecologist's professional opinion of the information available to them.

As an alternative to the qualitative approach, the UK Department for Environment, Food & Rural Affairs (DEFRA) developed a Biodiversity Metric for England, which is a habitat-based approach used to calculate an area's value. The metric assigns a score (referred to as 'biodiversity units') for each habitat based on its area, distinctiveness and condition. The ecologist must judge which category to select, but they are unable to vary the scores assigned by the metric. By comparing biodiversity units between the pre-development and post-development scenarios, the metric then determines the change in ecological value of a site.

By representing habitat features using numerical values, the metric allows a quantitative rather than a *qualitative* approach. This is necessary when applying numerical targets to BE: for example, the Environment Act 2021 requires a minimum 10% net gain (calculated using the biodiversity metric) for all new developments in England.

Other metrics have been developed in Ireland by certain organisations, usually by multiplying the area of the habitat by a weighting value based on its quality, or by the number of species present.

A quantitative approach may seem preferable to a qualitative approach, in order to reduce subjectivity of ecologists' conclusions. However, ecosystems are inherently complex, and any attempt to represent them numerically will involve a series of assumptions and simplifications, which are inevitably open to

critique. Different approaches are used in each of the British nations, some using a qualitative and others a quantitative approach.

Should we use a biodiversity metric and/or numerical target?

As discussed above, a key consideration in Biodiversity Enhancement is whether it should comprise a quantitative assessment (using a metric) or a qualitative assessment (based on professional judgement). Having considered both approaches, we recommend that BE in Ireland is based primarily on a qualitative assessment. This means that the ecologist should use their professional judgement to determine whether or not a development results in BE, rather than basing their decision on a metric or numerical target.

In general terms, we do not recommend the standardised use of a metric for the following reasons:

- The Defra metric is based only on habitats, and does not consider other ecological features such as protected species (e.g. bats, fish, rare flora), invasive species, ex-situ designated sites, etc. A development may have a positive effect on habitats and a negative effect on species, but only the former will be counted by the metric. Some protected species favour habitats of relatively low intrinsic value (e.g. built structures for roosting bats, or pre-thicket conifer plantations for Hen Harriers)
- The Defra metric has been developed for use in England, based on several years of consideration and consultation. It would need to be adapted for use in an Irish context, because it uses a different habitat classification system (the *UK Habitat Classification* scheme, which differs from the Fossitt (2000) classification scheme used in the Republic of Ireland), and because there are differences in the relative importance of some habitats between England and Ireland. The adaptation process would require research, consultation and trialling.

For similar reasons, we do not currently recommend the use of a numerical target for BE in Ireland (e.g. the requirement for a 10% BNG in England), because this could only be achieved using a biodiversity metric.

Although we favour a qualitative approach, the ecologist's decision should be evidence-based, including specialist or expertise input where required, and include facts and figures that justify their conclusion, e.g. 100m of existing non-native hedgerows will be removed, and 200m of new native hedgerow will be planted, resulting in a net gain in the quantity and quality of hedgerow habitat.

An ecologist may also adopt a 'hybrid approach' in which a metric is used to assess certain habitat features, e.g. to demonstrate that proposed habitat management measures would achieve net gain in comparison to habitats that will be removed. However, we recommend that any such calculations should be used in support of a broader qualitative assessment, and should not be the primary focus. The ecologist should also acknowledge the limitations of the metric and explain how they have been taken into account.

Finally, while we have some concerns about the adoption of a quantitative approach based on the Defra metric, but we would be open to the use of a metric that was developed specifically for an Irish context. The metric would need to incorporate Irish habitat classification schemes (notably the Fossitt scheme in the Republic of Ireland), and have 'distinctiveness' weightings that represent the relative importance of habitats in Ireland. This would need to be developed by statutory agencies in each jurisdiction, with reference to contemporary metrics in Britain.

How can BE be incorporated into other ecological assessments?

Most aspects of a BE assessment are covered in an Ecological Impact Assessment (EcIA) or Biodiversity Chapter of an Environmental Impact Assessment Report (EIAR), such as the description and valuation of baseline features, assessment of potential impacts, addressing impacts using the mitigation hierarchy, and consideration of residual impacts. The 'Residual Effects' section of an EcIA involves a review of the positive or negative impacts of a development after mitigation measures, and thus is effectively a judgement of whether a development results in a biodiversity gain or loss.

In this context, we recommend the following additions to an EcIA when considering BE:

- It should be declared clearly in the introduction of the EcIA that the aim is to achieve BE. Relevant national or local policies (e.g. County Development Plans) should be quoted. The ecologist should outline their approach to assessing BE.
- In the 'Mitigation' section of the EcIA, the ecologist should discuss all impacts using the mitigation hierarchy. In the first instance they should aim to avoid impacts, and then to

mitigate/minimise impacts. Where this is not possible, compensation is the last option. An evidence base for all avoidance, mitigation and compensation measures should be provided.

- Separate to the compensation process, an ecologist may propose measures whose only purpose is to enhance the ecological value of a site, e.g. providing bat or bird boxes, reducing frequency of mowing grassland habitats. This is different from mitigation, because it is not linked to any impacts - these measures should be described as 'Biodiversity Enhancements' and presented under a separate heading.
- In the residual impacts section, the ecologist should summarise the impacts on each Important Ecological Feature and conclude whether the impacts are negative, neutral or positive. This process should be honest and transparent so that third parties can understand the ecologists' rationale. At the end of the process the ecologist should provide an overall conclusion for the development as a whole, using significance terms (e.g. slight, moderate, significant) and geographic terms (e.g. Local, County) as appropriate.

In this context, we do not consider it necessary to prepare stand-alone BE assessments alongside an EcIA or EIAR Biodiversity chapter. Where possible it is best to include all relevant information in one document rather than producing multiple repetitive documents. However, the ecologist should use separate headings to distinguish between Biodiversity Enhancement, Ecological Impact Assessment and other relevant considerations.







Additional considerations

What habitats should be considered irreplaceable in Ireland?

Under CIEEM guidance, BE cannot be considered for certain 'irreplaceable' habitats. This is defined in Technical Note T3 of the CIEEM guidance as follows: *"Irreplaceable habitat is habitat that, once lost, cannot be recreated elsewhere, within a reasonable timeframe. Ancient woodland, active peatland and limestone pavements are widely accepted as examples of irreplaceable habitats. There is less agreement or understanding of what other irreplaceable habitats are present within the UK."*

We do not consider it necessary to provide detailed guidance on what habitats should or should not be considered irreplaceable, because this is usually context dependent. Some features may be common and widespread in one part of the country, but rare and localised in another part of the country. However, in general terms, any features of national or international importance should be considered 'irreplaceable'. This would typically include ancient woodland, active peatland, limestone pavements, freshwater springs/ wetlands, coastal habitats (mudflats, saltmarshes, dunes), and the qualifying interests of designated sites. CIEEM Guidance on Ecological Impact Assessment provides a system for the valuation of habitats at different geographical scales, which takes all relevant factors into account.

Certain habitats may be common and widespread, but may be impossible or very difficult to replace. For example, curlew may nest in semi-improved grassland, and derelict buildings can support roosts of lesser horseshoe bat. It may be possible to replace these features, e.g. through management of surrounding grassland or construction of an artificial roost. However, in some circumstances a key feature for species may be considered 'irreplaceable' in the same manner as the habitats above.

The key is that ecologists should identify potential irreplaceable habitats at an early stage in the project design, and communicate their importance to the design team. Early consultation with statutory agencies (e.g. NPWS, NIEA) is strongly advisable in these cases. The priority should always be to avoid impacts on these habitats, followed by other steps in the mitigation hierarchy. Where impacts cannot be dealt with under the mitigation hierarchy, then impacts on irreplaceable habitats cannot be offset to achieve BE.

Should it be mandatory for all developments?

Large and moderate-scale developments such as infrastructure projects, flood alleviation schemes, renewable energy (wind farms, solar arrays) and large residential developments will almost always have opportunities to achieve BE. Therefore, it would be reasonable and feasible for planning authorities to introduce a mandatory requirement for all such developments to achieve BE, as is the case in Scotland.

However, it may not always be feasible for small and moderate-scale developments to achieve BE. For example, many city-centre developments do not have any soft landscaping, which substantially limits opportunities for biodiversity enhancement (the English Biodiversity Net Gain approach has an exemption for sites consisting only of buildings and artificial surfaces). When redeveloping brownfield urban sites it may be necessary to clear large areas of ruderal vegetation, dry meadow or scrub; all of which could potentially be of local ecological importance in an urban context. It would be impossible to implement enough biodiversity enhancement measures to achieve a net gain, which would effectively make it impossible to develop the site. This may be counterproductive from an ecological perspective, as it is usually preferable to redevelop brownfield sites than to build on greenfield sites. Therefore, for small or moderate-scale developments we suggest that BE should be an expectation rather than a mandatory requirement. Pragmatic exemptions may be considered, notably where a brownfield site has been recolonised by vegetation.

However, reasonable evidence would still need to be provided when a developer requests an exemption from BE. The process should always start with an ecologist's baseline inspection of a site, and liaison with the design team regarding the mitigation hierarchy and review of potential ecological enhancements. Where the ecologist considers it impossible to achieve a BE, their case should be justified in writing (e.g. as part of an EcIA) and provided as part of a planning application.

Should ex-situ offsetting be considered?

The CIEEM guidance acknowledges that BE cannot always be achieved within a development site, in which case impacts can be offset outside the development site. This may involve purchasing additional land solely for the purposes of biodiversity enhancement, or

contributing financially to the enhancement of an area that is managed by a third-party. A formal framework for the latter has been developed in England, in which offsite lands used for BE must be registered on a biodiversity gain register and their usage linked back to a specific planning permission, measured using a standardised biodiversity metric and legally secured for at least 30 years. Some sites are managed by local authorities, and others are managed by NGOs or private companies.

In principle we support this approach, as it increases the quantity and quality of land available for biodiversity. However, this system can only operate reliably when there is a system to coordinate and account for the management of these areas, and such a system does not currently exist in Ireland. Local authorities and the National Parks and Wildlife Service are unlikely to have the resources to coordinate or manage offsetting areas. We do not propose the use of biodiversity metrics in Ireland, so there is not a clear system to calculate the amount of land required for offsetting. We also do not have the necessary systems in place to ensure that offsetting areas are managed appropriately in the long-term.

Therefore, for the Irish model of BE we do not currently consider it feasible to propose financial contributions for ex-situ offsetting. This may become feasible in the future, but it would require a framework to be put in place, e.g. the 'biodiversity gain register' used in England. The framework would need to be developed at a national level by state authorities.

At present developers may choose to purchase additional land for biodiversity enhancement that they manage themselves. However, they would need to provide clarity on the ownership of such land, on its long-term management and monitoring, and on the ecological personnel that will be involved in it. This land would need to be included in the Application Site, and management commitments would need to be provided as part of the planning application. The public authority could use planning conditions to ensure that biodiversity enhancement areas are implemented as proposed.

In certain circumstances a developer may make a financial contribution to the management of a natural area managed by a third party (e.g. an NGO). If this is the case, they would need to specify what the financial contribution would be, what it would be used for, and why it would be relevant to the ecological impacts identified in the BE assessment. However, this is a rather indirect method of compensating for ecological impacts, and would be considered an exception rather than a standard approach.

Marine environments

CIEEM's guidance on BE was developed primarily for terrestrial and freshwater environments. It was acknowledged that marine environments have many differences from terrestrial/freshwater environments, because marine habitats are often highly dynamic, and marine fauna are highly mobile. Therefore, in 2022 DEFRA released consultation documents on Marine Net Gain, which will commence the approach from first principles.

In Ireland and Northern Ireland we recommend that BE is initially considered only for terrestrial and freshwater environments. It is likely that separate guidance will be required for marine environments.

Timescale and monitoring

Ecological compensation and enhancement measures take time to implement, and must be managed and monitored in the long-term. In the CIEEM Good Practice Guidance it is stated that *"Biodiversity compensation should be planned for a sustained net gain over the longest possible timeframe. For development in the UK, the expectation is that compensation sites will be secured for at least the lifetime of the development (e.g. often 25 - 30 years) with the objective of net gain management continuing in the future."*

This is a key issue in ecology, because many ecological features require long-term maintenance to achieve the desired effect. For example, the ecological value of a grassland can be enhanced by managing it as a traditional hay meadow, by mowing it once per year in late - summer/autumn. Over 5 - 10 years the meadow will be colonised by a range of native wildflowers, and will become high quality habitat for pollinators and a range of other species. However, if the habitat is not mowed, it will become dominated by coarse grasses, and the coverage of native wildflowers will decrease. Over 5 - 10 years it will be colonised by scrub (e.g. brambles, gorse, willows), forming a very different habitat than was originally intended. This demonstrates the importance of long-term maintenance, and the periodic monitoring by an ecologist that can address any issues.

Therefore, all BE assessments must include a timeline for the implementation of compensation and enhancement measures, including the following:

- Initial implementation of measures, typically during or immediately after construction
- Planned maintenance over the lifetime of the development, e.g. annual mowing of

meadows, spot-treatment of invasive species, cleaning droppings from bat roosts

- Monitoring of the effectiveness of BE measures, initially on an annual basis, and then at intervals of 3 - 5 years
- Review and adaptation of measures that are not working as expected, to account for unplanned events (e.g. storms, fires), or advances in best practice

From a practical perspective, planning authorities must ensure that land set aside for ecological compensation/enhancement is reserved specifically for that purpose in the long-term. It is particularly important to distinguish between BE areas and recreational areas, because the latter requires management (e.g. regular mowing) that is incompatible with BE, and may involve activities that disturb fauna (e.g. dog walkers). It is also important that BE areas are not simply re-developed after a few years.

Commitments to BE must be recorded in a planning consent, and their implementation controlled using planning conditions. The following may be included as a planning condition: *"The Biodiversity Net Gain commitments will be implemented in full over the timeline set out in the [relevant ecological report]. The applicant will submit evidence that an ecologist and maintenance team have been engaged for the duration of this period. Evidence of ongoing monitoring and maintenance must be provided to the planning authority upon request. Any remedies required during the course of the implementation, monitoring and maintenance of the BE measures will be addressed to the satisfaction of the Planning Authority"*

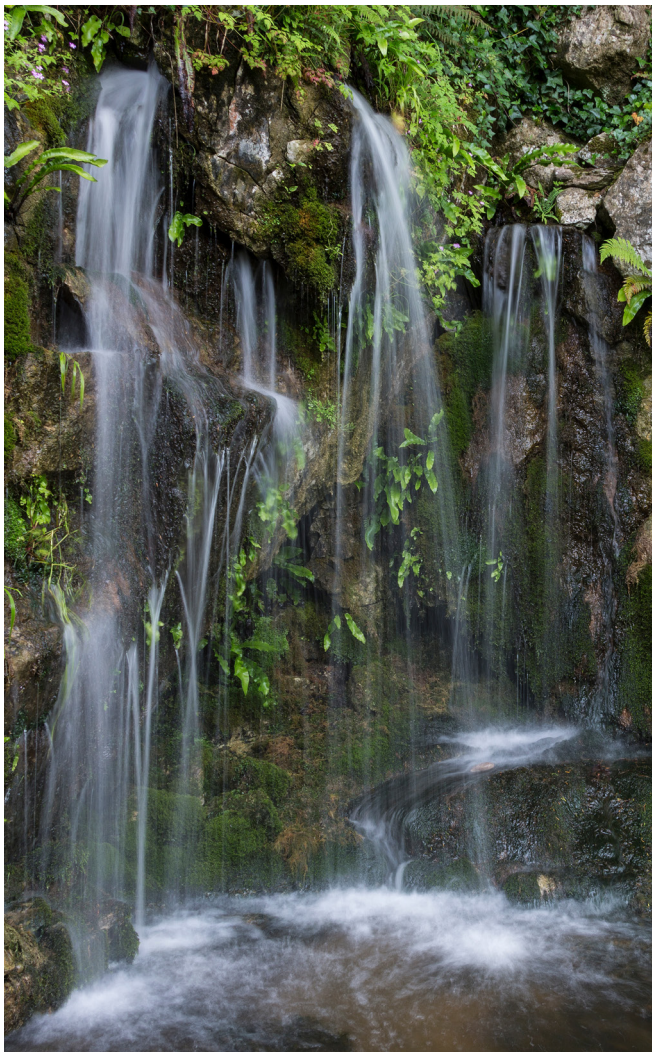
Key considerations for habitat enhancement

As a general measure, we suggest that any habitat enhancements should be based primarily on plant species that are native to Ireland and of local provenance, as they have highest suitability for Irish fauna. Non-native plant species may have some value in certain circumstances (e.g. spring flowers for pollinators), but in general terms they have lower value than native species. Non-native shrubs and flowers cannot be considered as BE measures.

Retained habitats will almost always be of higher ecological value than newly-created habitats. Ecologists should aim in the first instance to retain and enhance habitats that are present at the baseline stage. For example, existing grasslands could be enhanced by reducing mowing and allowing them to develop as meadows. Mature trees should be retained rather than clearing a site and planting immature trees.

If starting with bare/disturbed ground, current best practice under the All-Ireland Pollinator Plan is to allow areas to recolonise naturally rather than sowing seed. Subsoil is often more suitable than topsoil for this purpose, as the low nutrient levels in subsoil favour the establishment of flowering plants rather than grasses. In some circumstances it may be appropriate to sow a native meadow seed mix: if so, it should consist only of native species of Irish provenance, include a mixture of perennial flowers and grasses, and be tailored to the sites' soils and hydrology. Non-native 'wildflower' seed mixes should never be used, as they are typically of low biodiversity value. The ecologist should review species lists for any seed mixes and determine whether or not they are native and appropriate to the site.

Measures should be realistic, implementable, and evidence based. They must include long-term management plans, and details of who will implement them. The developer should consider whether biodiversity areas are 'taken in charge' by a local authority, maintained by a management company, or managed directly by residents.



Suggestions for biodiversity enhancements

Suitable biodiversity enhancement measures for a site should be determined on a case-by-case basis depending on baseline habitat features that can be retained, other habitats surrounding the site, and any species of importance in the surrounding area. In this section we provide examples of some BE that could be considered for a small suburban site:

- Provision of bird boxes, including designs suitable for common garden birds (e.g. finches, tits, blackbirds), or species that nest on buildings (swifts, martins, swallows). Swift nesting boxes should be considered for tall buildings (at least 5 m in height)
- Provision of bat boxes suitable for crevice-dwelling species. These are only suitable if installed in a part of the site that will be in complete darkness, and that are directly connected to potential foraging areas (woodland, freshwater, parks, agricultural land)
- Provision of hedgehog boxes in areas of dense shrubs, and appropriate dispersal corridors (see below)
- Provision of wildlife dispersal corridors to connect green areas outside the site boundary. These would consist of continuous lines of dense shrubs and ground vegetation, which are not obstructed by walls/fences/roads and are not illuminated by streetlights. Gaps should be provided at the base of walls/fences to allow ground-dwelling fauna to move through the site.
- Creation of a pond or similar semi-natural wetland feature with native fringing vegetation. Ponds may also be suitable for frogs/newts. These measures may be feasible for above-ground SUDS features (e.g. attenuation ponds, swales)
- Inclusion of a range of native trees and shrubs, including species that provide berries for birds (e.g. hawthorn, rowan)
- Managing grassland areas as meadows, by mowing only once per growing season and removing cuttings. Guidance is provided in the All-Ireland Pollinator Plan (see above).
- Leaving sections of landscaping for natural succession, with little or no active management
- Removal of invasive non-native species, including both legally-restricted species (e.g. Japanese knotweed, Himalayan Balsam, three-cornered garlic) and other nuisance species (winter heliotrope, cherry laurel)
- Incorporating biodiversity features on the roofs of structures including apartment roofs, cycle shelters, sheds etc. Such features should use the site's soils, and have associated long-term maintenance
- Paths and cycleways should be located in central parts of a development, away from biodiversity features and other site boundaries where treelines/hedgerows/wildlife corridors are located, retained or might be created as part of the design. The infrastructure associated with pathways and cycleways, human disturbance, vegetation management, lighting, etc can substantially reduce the biodiversity value of these features.

Conclusions

There is now a pressing need for national guidance on Biodiversity Enhancement in the Republic of Ireland and Northern Ireland. In this briefing paper we have reviewed the options available for this process, and set out some recommendations on how we would like to see it implemented in an Irish context. We hope that this will be considered by national bodies responsible for the development of BE policy in the Republic of Ireland and Northern Ireland, as part of a broader national debate.

Overall, we make the following recommendations for the ROI/NI approach:

- The primary reference document should be Biodiversity *Net Gain: Good Practice Principles for Development, A Practical Guide* (CIEEM-CIRIA-IEMA, 2019)
- A competent ecologist should be engaged from the start of the design process
- Assessments should be primarily qualitative, and consider all potential ecological features.
- Quantitative assessments based on metrics may be used to support certain aspects of a proposal (e.g. habitat compensation), but should be secondary to an over-arching qualitative assessment
- The mitigation hierarchy should always be followed sequentially. The primary emphasis should always be on avoidance
- BE assessments should be incorporated into other ecological reports (e.g. Ecological Impact Assessment, Biodiversity Chapter of an EIAR) rather than issued as a stand-alone assessment
- BE should be mandatory for all large-scale developments, e.g. infrastructure projects, renewable energy, or those that require Environmental Impact Assessment. BE should be expected for small and moderate-scale developments, although it is important to acknowledge that there will be some situations in which it will be impossible to achieve BE on-site. Therefore, it would be reasonable to provide exemptions to BE in certain cases
- Off-site compensation may be feasible in some cases, but at present it should not be considered as standard practice. A national framework for the management of off-site compensation areas would be needed before this could be implemented
- Ecological Enhancements will require long-term management and monitoring to ensure effectiveness.

Finally, we wish to emphasise that the recommendations in this document are based on the current circumstances in Ireland, but that they may change in the future. We do not wish to permanently rule in or rule out any approaches. For example, we do not currently recommend a quantitative approach in Ireland, but this may change in the future if a metric is developed specifically for an Irish context. Our intention at this stage is simply to contribute to a broader discussion about the approach to BE in the Republic of Ireland and Northern Ireland.

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CIEEM (2023) Briefing Paper: Biodiversity Enhancement for New Developments in Ireland. Chartered Institute of Ecology and Environmental Management, Ampfield.

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Discussion

Reconciling climate action with the need for biodiversity protection, restoration and rehabilitation

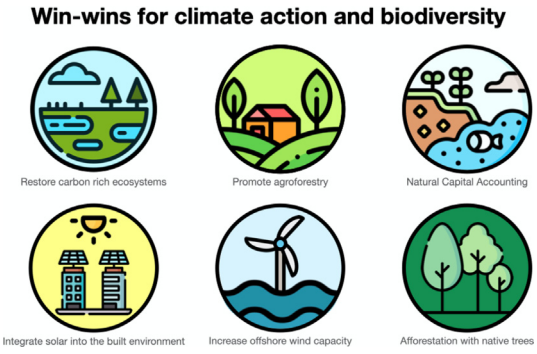
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HIGHLIGHTS

- Climate change, biodiversity loss, and human activity are interconnected.
- Biodiversity considerations should be integrated into climate change actions.
- There are win-win strategies for climate mitigation and biodiversity conservation.
- Climate mitigation should be implemented in a "Right Action, Right Place" framework.

GRAPHICAL ABSTRACT



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ABSTRACT

Globally, we are faced with a climate crisis that requires urgent transition to a low-carbon economy. Simultaneously, the biodiversity crisis demands equally urgent action to prevent further species loss and promote restoration and rehabilitation of ecosystems. Climate action itself must prevent further pressures on biodiversity and options for synergistic gains for both climate and biodiversity change mitigation and adaptation need to be explored and implemented. Here, we review the key potential impacts of climate mitigation measures in energy and land-use on biodiversity, including the development of renewable energy such as offshore and onshore wind, solar, and bioenergy. We also assess the potential impacts of climate action driven afforestation and native habitat rehabilitation and restoration. We apply our findings to Ireland as a unique case-study as the government develops a coordinated response to climate and biodiversity change through declaration of a joint climate and biodiversity emergency and inclusion of biodiversity in key climate change legislation and the national Climate Action Plan. However, acknowledgement of these intertwined crises is only a first step; implementation of synergistic solutions requires careful planning. We demonstrate how synergy between climate and biodiversity action can be gained through explicit consideration of the effects of climate change mitigation strategies, such as energy infrastructure development and land-use change, on biodiversity. We identify several potential "win-win" strategies for both climate mitigation and biodiversity conservation. For Ireland, these include increasing offshore wind capacity, rehabilitating natural areas surrounding onshore wind turbines, and limiting the development of solar photovoltaics to the built environment. Ultimately, climate mitigation should be implemented in a "Right Action, Right Place" framework to maximise positive biodiversity benefits. This review provides one of the first examples of how national climate actions can be implemented in a biodiversity-conscious way to initiate discussion about synergistic solutions for both climate and biodiversity.

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1. Introduction

Globally, we are facing simultaneous climate change and biodiversity crises (IPBES, 2021; IPCC, 2021). Despite this being a worldwide problem, mitigation measures will largely be implemented at national and local scales. Governments recognise that both the climate and biodiversity crises threaten life support systems, livelihoods, and quality of life for people through their direct and indirect impacts on provisioning (food, shelter) and regulating (climate, nutrients, pollination) ecosystem services (Dasgupta, 2021), as well as threats to cultural services (spiritual, aesthetic, relational) (Chapin et al., 2000; Díaz et al., 2006; Jones et al., 2019). The biodiversity and climate crises are entwined in a complex system of feedbacks, with biodiversity part of the Earth system regulating climate, and climate in turn determining biodiversity patterns and trajectories. There is increasing awareness that climate change and biodiversity loss cannot be treated as independent issues (e.g., Zarnetske et al., 2021). For example, the United Nations Sustainable Development Goals (SDGs) directly include combating climate change and halting biodiversity loss, and climate and biodiversity also underpin the other SDGs (United Nations General Assembly, 2015). Accordingly, global consortia such as the InterAcademy Partnership (IAP), continue to work towards synthesising evidence-based solutions to these challenges (InterAcademy Partnership, 2021).

As we move to act urgently on climate change, we need to prevent further pressure on biodiversity and implement options that provide synergistic gains for mitigating both the climate and biodiversity crises. While mitigating climate change via reductions in greenhouse gas emissions generally benefits biodiversity at a global scale (Ohashi et al., 2019), these measures will largely be driven by national scale policies and initiatives. Therefore, it is important that individual governments incorporate biodiversity into their response to climate change. The Republic of Ireland (hereafter Ireland) is developing a synchronised national response to climate change and biodiversity loss by declaring a Climate and Biodiversity emergency and including biodiversity in climate legislation (Houses of the Oireachtas, 2021) and the government Climate Action Plan (Government of Ireland, 2021) in addition to the National Biodiversity Action Plan (NPWS, 2017) and the Biodiversity Climate Change Sectoral Adaptation Plan (Department of Culture, Heritage and the Gaeltacht, 2019). However, recognising that climate and biodiversity change require a coordinated response is only a first step. Implementing synergistic actions requires careful planning to prevent further biodiversity loss and identify and capitalise on opportunities that simultaneously mitigate both the climate and biodiversity crises (i.e., win-wins).

Here, we use Ireland as a case-study to explore and identify synergistic mitigation measures to both the climate and biodiversity crises. We first discuss climate action policy, planned climate actions and the utility of a natural capital accounting approach for planning and monitoring climate actions (Sections 1.1, 1.2). We then address the potential impacts of renewable energy development and land-use change on biodiversity and the biodiversity impacts of all life-stages of renewable energy generation for each of offshore wind (Section 2.1), onshore wind (Section 2.2), solar (Section 2.3), and bioenergy (Section 2.4). In addition, we discuss the potential of afforestation and native habitat rehabilitation and restoration as nature-based solutions for mitigating climate change and biodiversity loss (Sections 3.1, 3.3). This case-study provides a general framework for how climate actions can be implemented in a biodiversity-conscious way and intends to provoke discussion on developing synergistic solutions for the climate and biodiversity crises in other regions.

1.1. Biodiversity and climate goals in Ireland

In May 2019, Dáil Éireann (i.e., the House of Representatives of the Legislature of Ireland) became the 2nd country worldwide to declare a climate and biodiversity emergency (Dáil Éireann, 2019). The status of biodiversity in protected areas, seas and the wider countryside is generally in poor condition and continues to decline (NPWS, 2019, 2017). Climate change is negatively impacting Irish habitats, especially in coastal and upland environments (Gleeson et al., 2013). Expected increases in temperature, changes in precipitation patterns, weather extremes (storms and flooding, sea surges, flash floods) and sea-level rise will affect the abundance and distribution of Irish species. These pressures and threats are likely to increase over the next decade unless substantial action is taken (NPWS, 2017).

Ireland has recognized the importance of conserving biodiversity and has made commitments to increase the protection of species and their natural habitats.[1] The National Biodiversity Action Plan (2017–2021 - currently being renewed) sets out priority actions (NPWS, 2017). The Biodiversity Climate Change Sectoral Adaptation Plan (Department of Culture, Heritage and the Gaeltacht, 2019) recognizes the need to protect biodiversity from climate change as well as considering biodiversity as an adaptation tool for other sectors, with the potential for multiple co-benefits including water regulation and purification and carbon sequestration. It is therefore critical that the economy is decarbonised in ways that support established biodiversity ambitions and obligations.

The recognition for urgent climate action has led to policy actions such as Ireland's participation in the Paris Agreement on Climate Change (UNFCCC, 2015) and legislating for the national 2050 climate objective "to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally-sustainable and climate-neutral economy" (Houses of the Oireachtas, 2021). To meet decarbonisation goals, Ireland has developed a Climate Action Plan (Government of Ireland, 2021), to achieve a net zero carbon energy systems objective by 2050. Specific actions include increasing the amount of electricity generated from renewable sources from 30 % to 80 % by 2030, establishing 8000 ha of newly planted trees (i.e., afforestation) per year, and funding the restoration and rehabilitation of peatlands (Government of Ireland, 2021).

1.2. Natural capital accounting and nature-based solutions

Biodiversity provides ecosystem services and numerous resources for human well-being. For example, wetlands provide water purification, sediment retention, habitat for species as well as cultural enjoyment, and these services should be accounted for (Barbier, 2011; Farrell et al., 2021b). An emerging approach is to think of biodiversity as an asset (part of our natural capital) that needs to be maintained and managed to ensure the sustainable flow of resources and services it provides (Ekins et al., 2003; Mace et al., 2015; Maseyk et al., 2017). Natural Capital Accounting comprises systematic methods to measure and report on stocks (biodiversity, soils, water, geology) and flows (ecosystem services and benefits) of natural capital (Farrell et al., 2022; Maseyk et al., 2017). This quantification and systematization of the value of ecosystems, including the extent and condition of stocks of assets and flows of services and benefits, and tracking these changes over time, can assist in making decisions that benefit the environment, society, and the economy (Farrell et al., 2021a; Hein et al., 2020). Given that the location, quantity, and quality of natural capital stocks (including biodiversity) underpin greenhouse gas regulation in the atmosphere, natural capital accounting methods are strongly recommended for assessment and planning of flows of not only climate regulation services, but a range of interlinked services provided by natural capital.

Current practices for natural resource exploitation are inefficient and unsustainable not only in Ireland, but globally (Dasgupta, 2021). While economic benefits in the short term may be maximized, longer-term economic growth is hindered by unsustainable methods and their negative impacts on natural capital. By explicitly considering natural capital as underpinning economic activity and wellbeing, sustainable Nature-based Solutions can be developed to restore and rehabilitate degraded ecosystems to leverage natural assets for multiple climate and biodiversity related benefits (Keesstra et al., 2018; Maes et al., 2020; White et al., 2021). Throughout

[1] (EU Birds [Directive 2009/147/EC] and Habitats Directives (which provide for the Natura 2000 (N2000) network of protected areas), Marine Strategy Framework Directive (MSFD), EU Water Framework Directive (WFD), and EU Biodiversity Strategy (EC, 1992; EC, 2000; EC, 2008 and EC, 2009)).

this review, and in the context of climate mitigation action, we identify Nature-based Solutions that would be potential win-wins for biodiversity and climate in Ireland. While each country will have its own unique set of challenges and considerations, Natural Capital Accounting and the application of sustainable Nature-based Solutions can serve as general tools for synergistic climate and biodiversity loss mitigation.

While Ireland currently lacks detailed comprehensive land-use maps, we estimate current land-use using information available for specific sectors, and through resources such as the CORINE land cover database (European Environment Agency, 2018) (Fig. 1). Agriculture dominates land use in Ireland, with between 56 % (European Environment Agency, 2018) and 58.4 % (Central Statistics Office Ireland, 2020) of total land area dedicated to pasture and a further 11 % to non-pasture agriculture (European Environment Agency, 2018). A high proportion (over 12 %) of the land is classified as peat wetlands (European Environment Agency, 2018), but due to harvesting, drainage and overgrazing only a fraction of these peatlands can be considered functioning ecosystems (Department of Heritage, Culture and the Gaeltacht, 2017). While Ireland's dominant climatic biome is Temperate Deciduous Woodland (Ramankutty and Foley, 1999), and pre-historically 80 % of Ireland's land area was covered by trees (Mitchell, 1994), current tree cover is estimated at between 11 % (Department of Agriculture, Food and the Marine, 2017) and 9 % (European Environment Agency, 2018). Approximately half of current tree cover is plantation forest comprised mainly of non-native conifer species.

2. Development and expansion of renewable energy infrastructure

Ensuring access to affordable, reliable, sustainable and modern energy for all is one of the United Nations SDG's (United Nations General Assembly, 2015). The development and expansion of renewable energy infrastructure will happen within four sectors: offshore wind, onshore wind, solar, and bioenergy. There are three primary life stages of renewable energy facilities: construction, operation, and decommissioning. We outline the main biodiversity impacts identified for each stage within these four renewable energy sectors (Fig. 2) and discuss potential biodiversity mitigation methods. We also make recommendations for the implementation of each renewable energy source and life cycle stage (Table 1), and we identify potential opportunities for biodiversity protection and restoration within each sector.

2.1. Offshore wind farms

Offshore wind is still in early stages of development in Ireland. However, there is a Climate Action Plan target of 5 GW of offshore renewable energy by 2030. Currently, there are seven planned offshore wind projects that combined have the capacity to produce up to 3.8 GW of offshore wind energy. Together these projects plan to add around 260 wind turbines to the Irish Sea and 20 turbines to the Atlantic Ocean. The total size of the developments amount to around 434 km^2 in the Irish Sea, and about 4 km^2 in the Atlantic Ocean. Despite this relatively small footprint, there are potential impacts on biodiversity.

2.1.1. Constructing offshore wind farms

The installation of new wind turbines often leads to the destruction and/or alteration of the seabed, which negatively impacts species living on the seabed (Gill, 2005). Boulders are removed and the seabed is dredged to level it prior to installation and to provide trenching for cables that connect turbines to onshore substations. In the short-term, dredging increases turbidity which can negatively impact sedentary species (Gill, 2005). In the long-term, these construction activities can compact the seabed and alter its morphology. There are potential negative effects of pile driving in key spawning grounds, both from the perspective of fish stocks of interest to humans, and through trophic (food-web) effects on sea birds and other marine organisms (Perrow et al., 2011).

Negative impacts of offshore wind farm construction are, however, generally considered to be minor by most European Environmental Impact Assessment (EIA) reports (Vaissière et al., 2014), as the land needed for construction of wind turbines is considered negligible compared to the total area of the seabed. Additionally, evidence from previous EIA reports show that the seabed is recolonized by animals, algae, and plants relatively rapidly after construction is completed (Leonhard and Pedersen, 2006; Lindeboom et al., 2011; Vaissière et al., 2014). Technology is currently being developed for floating wind farms, in which turbines are placed on floating platforms (e.g., Hywind Scotland Wind Farm; https://www.equinor.com/). Future plans for offshore wind farm construction could employ floating wind farm technology to minimise negative impacts to the seabed.

Construction noise has been shown to negatively impact marine mammals (Madsen et al., 2006). Noise emissions from activities such as pile driving are sufficiently loud that they could cause temporary or permanent hearing loss in animals like the Harbour Porpoise, (*Phocoena phocoena*)

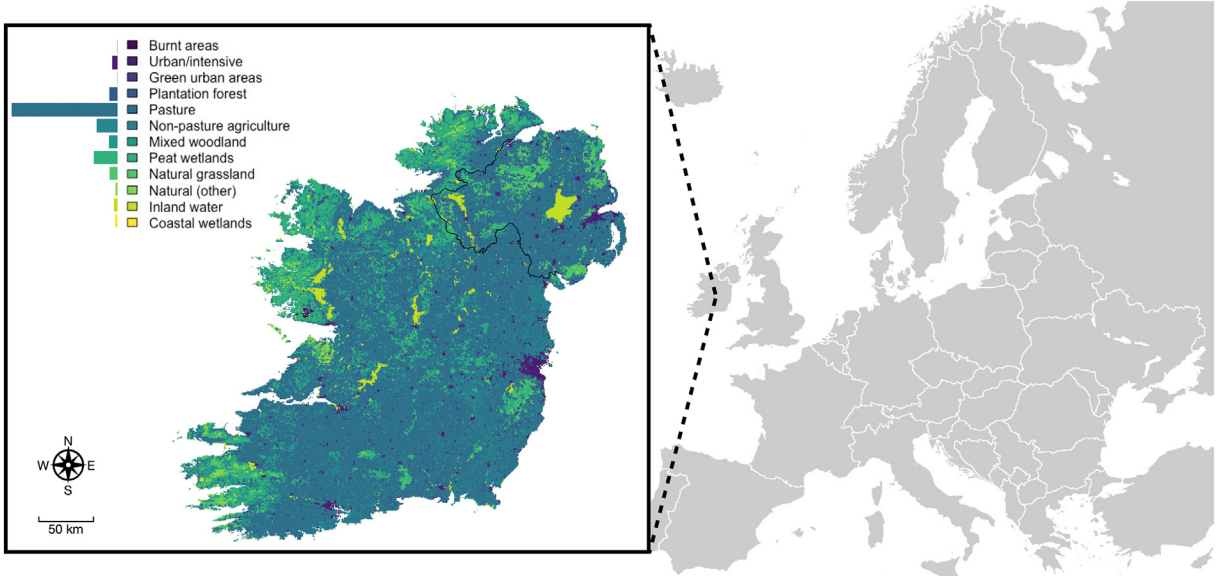


Fig. 1. Map of current land-use on the island of Ireland based on data from the CORINE land cover database obtained between 2012 and 2018. The histogram shows the proportion of land use in each category. The border between the Republic of Ireland and Northern Ireland is delineated with a black line.

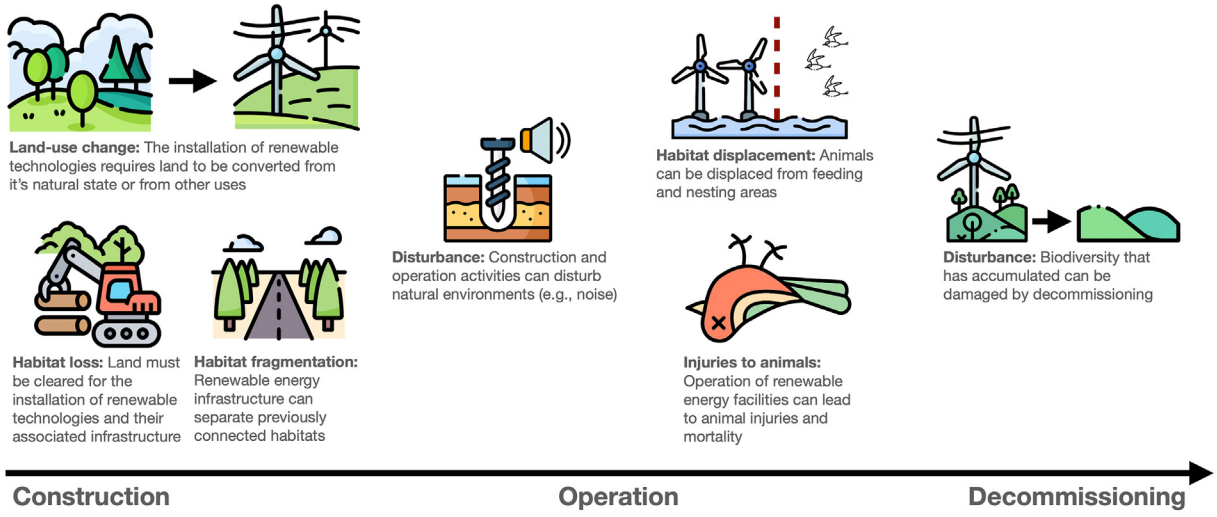


Fig. 2. Mechanisms for climate actions which impact biodiversity. We outline major mechanisms that could impact biodiversity during the three primary life stages of renewable energy facilities: construction, operation, and decommissioning.

(Kastelein et al., 2010; Lucke et al., 2009), if exposed at close range. Harbour seals (*Phoca vitulina*) have also been found to avoid wind farms during the pile driving, but return to the area shortly (within two hours) after the activity is ceased (Russell et al., 2016). The severity of these impacts is determined by the duration of the noise and the spatial dynamics of the marine mammal populations. Negative impacts can be minimised if animals are able to leave the immediate construction area throughout the duration of the pile driving activities. Several technologies exist to mitigate the noise emissions caused by construction activities such as noise reducing barriers (air bubble curtains) (Dähne et al., 2017; Lucke et al., 2011).

There are biodiversity considerations regarding the construction of onshore electrical infrastructure, such as substations. If placed inappropriately, they could disturb sensitive coastal or inland habitats and/or species. Environmentally sensitive areas should be avoided when determining the locations for these structures, which can be identified using existing technology such as sensitivity mapping tools (Burke, 2018).

Negative impacts during the offshore construction phase are short-term and there are several methods that can be used to mitigate negative effects on biodiversity. The use of "no take" exclusion zones around wind farms can mitigate negative effects in the short-term and promote long-term recovery of biodiversity stocks (Haggett et al., 2020). However, avoidance of constructing wind turbines in areas of high biodiversity value and/or important fishing stocks or nurseries should be practiced. Careful land and sea use planning using frameworks such as the National Marine Planning Framework (National Marine Planning Framework, 2021) are necessary to maximise potential positive impacts and minimise potential negative effects on biodiversity and climate.

2.1.2. Operation of offshore wind farms

Negative impacts on biodiversity during the operation stage will last for the entire lifespan of the wind turbine (~25 years). The primary concern relevant to Ireland is the impacts of wind turbines on seabirds, including collision mortality, habitat loss and displacement, and barrier effects (Cummins et al., 2019). Consistent with these potential impacts, offshore wind farms generally have a negative impact on seabird abundance (Stewart et al., 2007), and seabirds tend to avoid turbines during operation (Desholm and Kahlert, 2005; Petersen et al., 2006). This could indirectly result in habitat loss through reduced areas for foraging. Turbines could also act as physical barriers that impact the ability of birds to migrate or forage (Larsen and Guillemette, 2007). Birds can collide with the turbines, though collisions are generally thought to result in minimal mortality of birds in a population (Drewitt and Langston, 2006).

Most negative impacts can be mitigated or minimised by avoiding placement of wind farms in areas with sensitive habitats and populations of key species. In Ireland, more site-specific information is needed, including the distribution of key species, to accurately characterise the risk (Bowgen and Cook, 2018). Sensitivity mapping tools have been developed to identify areas of concern (Burke, 2018). It is especially important to avoid placing wind farms in areas important to seabird foraging and breeding. If sensitive areas cannot be avoided, an alternate solution would be to provide migration and foraging pathways between the wind farms by providing wide (several km) spaces free from turbines between wind farms (Goodale et al., 2019; Krijgsveld, 2014; Wilhelmsson et al., 2010). Regional planning of developments therefore needs to take the location and intensity of multiple wind farms into account.

Monitoring of seabird movements and occurrences prior to and during the construction and operation of offshore wind farms through GPS tagging, direct observation, and remote monitoring (acoustic, video, radar) techniques are needed to determine the potential for negative impacts and identify mitigation methods, including strategic curtailment of operations during times of high seabird activity (e.g., foraging or migration).

2.1.3. Decommissioning offshore wind farms

The decommissioning stage is an understudied component of offshore wind energy. It is, however, generally assumed that impacts will be similar to those in the construction stage (Gill, 2005; Vaissière et al., 2014). Options include complete or partial removal of turbines (Deeney et al., 2021). Complete removal would have similar impacts as the construction phase and could have negative impacts on biodiversity as the plants and animals that colonised the turbine foundations would be destroyed (Gill, 2005; Vaissière et al., 2014). A solution to this might be the partial removal of turbines, leaving the foundations intact. This could preserve the biodiversity that accumulated on the underwater structures. However, this would result in permanent fixtures on the seafloor and potential obstacles to shipping and fishing. An alternative is that the turbines could be continually maintained and upgraded as needed, so that removal is not necessary. Regardless, decommissioning plans should be drafted and continually updated as new technology becomes available and any decommissioning plans should consider potential impacts on biodiversity.

2.1.4. Offshore wind farm opportunities for biodiversity protection & restoration

With careful design, positive impacts relating to the development of offshore wind farms have been reported on marine biodiversity (Inger et al., 2009). Wind turbines and scour protection structures provide habitat and protection for marine wildlife such as fish and invertebrates (Leonhard and Pedersen, 2006; Wilhelmsson et al., 2006). Long-term studies from Denmark have shown that fish species abundance and diversity increased near turbines (Stenberg et al., 2015). Additionally, wind farms can be

Table 1
Key biodiversity impacts common to the four main renewable energy methods (offshore wind, onshore wind, solar, and bioenergy) with recommendations on how to avoid, minimise, and mitigate potential negative impacts.

Life cycle stage	General potential impacts	Offshore wind	Onshore wind	Solar	Bioenergy
Construction	• Land-use change • Disturbance • Habitat fragmentation • Habitat loss	1. Time development to minimise industry-wide impact during the construction of multiple wind farms. 2. Marine planning strategies such as the National Marine Planning Framework that explicitly include marine biodiversity protection and restoration are necessary. 3. Use existing sensitivity planning tools and develop new mapping tools to identify areas unsuitable for offshore wind in advance of construction. 4. Time construction to have the least possible overlap with important Cetacean migration, feeding, or breeding activities. 5. Implement floating wind farm technology to minimise sea-bed disturbance. 6. Assess pile driving effects in key spawning ground for fish stocks and use exclusion zones to promote recovery of stocks. 7. Use existing technology to reduce the noise created by construction activities (e.g., air bubble curtains). 8. Associated onshore support infrastructure for offshore wind should be developed with sensitivity to biodiversity impacts. 9. Design offshore infrastructure to provide habitat for biodiversity (artificial reefs).	1. New wind turbines (and repowering) should only be constructed in appropriate locations that do not compromise biodiversity or WFD obligations. 2. Avoid vulnerable and protected peatland and other nature protected areas. 3. Ensure that the site selection process and turbine placement is informed by the existing Special Areas of Conservations and Special Protected Areas, as well as the functional connectivity of isolated resources necessary for these protected sites. 4. Include migration pathways or commuting/foraging routes for key species in planning processes. Co-locate wind with more intensive agricultural land uses.	1. Solar panels should be incorporated into existing built infrastructure. 2. Farms of solar panels on agricultural or undeveloped land should be discouraged. 3. If utility-scale solar energy systems cannot be avoided, they should be strategically placed to avoid sensitive areas and minimise negative impacts on biodiversity.	1. Major land-use change should be avoided to minimise soil carbon losses (e.g., conversion of unimproved grassland to improved grassland or arable). 2. Avoid natural and semi-natural areas. 3. Prioritise the use of waste products for bioenergy.
Operation	• Habitat displacement • Injuries to animals	1. If a wind farm must be constructed in an important bird migration pathway, alternative migration corridors between wind farms must be available. 2. Monitor risk and risk avoidance measures (e.g., temporary curtailment) should be implemented. 3. Maximise positive biodiversity impacts of wind farm associated fisheries exclusion zones.	1. Encourage energy-environment/PFES/community schemes to promote enhancement of biodiversity in wider local landscape. 2. Real-time/smart monitoring to inform strategic curtailment during times of high bat and bird activity. 3. Community engagement in local biodiversity enhancement schemes.	1. The functional use of land beneath panels should be promoted (e.g., low intensity grazing). 2. Alternatives to herbicide use to manage vegetation below and between solar panels should be developed and used. 3. Management for tolerant elements of biodiversity between, around and beneath solar panels	1. Mandate the protection of important biodiversity landscape features (hedgerows, ponds, buffer strips, woodland edges etc.)
Decommissioning	• Disturbance • After-care or rehabilitation of decommissioned sites	1. Maintain and upgrade wind turbines as necessary to prevent or delay decommissioning. 2. Plan for decommissioning to maintain biodiversity benefits achieved through artificial reef formation.	1. Maintain and upgrade the wind turbines as necessary to prevent decommissioning.		

strategically located to protect areas that suffer from overfishing, as wind farms provide a barrier to fishing boats and trawlers. This would need to be monitored to track potential positive impacts.

2.2. Onshore wind farms

Onshore wind is currently the main renewable energy source in Ireland, with an installed capacity of 4.3 GW, with a planned increase to 8.2 GW by 2030. However, land-based wind farms can have significant negative impacts on biodiversity (Schuster et al., 2015), and there are important biodiversity considerations when placing new wind turbines as well as managing and repowering existing wind farms. While conflicts between wind farms and conservation areas are common, significant negative effects of the development of renewable energy infrastructure on biodiversity can be avoided with appropriate policy and regulatory controls (Dunnett et al., 2022). Appropriate siting of wind farms and early mitigation of key impacts during the construction stage have the greatest potential to reduce negative effects on biodiversity.

2.2.1. Constructing onshore wind farms

Wind farms are not as land intensive as some other sources of renewable energy (e.g., bioenergy). Determining the appropriate placement of wind farms is critical for avoiding the worst negative impacts. For example, inappropriate siting of a wind farm and failure to perform an EIA led to a major

peat slide in county Galway in 2003, which severely impacted terrestrial and aquatic ecosystems (ECJ, 2008) with further slides in northwestern counties where wind farms were in the construction phases on peatlands. It is essential that wind farms and associated infrastructure, such as service roads, are placed in appropriate locations to avoid both direct and indirect impacts on biodiversity and water quality and that EIAs consider environmental risks such as peat slides to avoid future occurrences. This includes avoiding placement of wind turbines on deep and/or vulnerable peat soils. However, to be effective, wind turbines must be sited in areas where average wind speeds are high. This often leads to proposed sites in upland areas that can overlap with important habitats for birds (Drewitt and Langston, 2006).

Potential biodiversity impacts of onshore wind turbines and associated infrastructure such as service roads and buildings include vegetation disturbance, habitat loss, and habitat fragmentation. Construction of wind farms requires land to be cleared for infrastructure installation and ongoing servicing and vegetation such as trees and their associated biodiversity to be removed (van Haaren and Fthenakis, 2011). Grid connections require further development of land surrounding the wind farm.

2.2.2. Operation of onshore wind farms

The potential impacts during the operation phase are generally considered less severe than those caused during construction (Pearce-Higgins et al., 2012). The primary concerns are negative impacts on birds and bats, which are disproportionately affected by windfarms (Laranjeiro et al., 2018; Rydell et al., 2017; Schuster et al., 2015). Impacts include habitat loss and/or fragmentation, displacement from feeding or nesting areas, and injuries (including barotrauma and collisions) from turbines. Direct collisions are of particular concern as they can result in lethal and sublethal injuries affecting population viability (Grodsky et al., 2011). Bats are particularly vulnerable to fatality due to collisions (Rydell et al., 2017; Schuster et al., 2015), however the reasons for this are still poorly understood (Cryan and Barclay, 2009). In North America, the risk of bat collisions has been shown to be strongly influenced by weather (Arnett et al., 2008; Baerwald and Barclay, 2011), indicating that curtailing wind farm operation during certain weather conditions could potentially prevent fatalities, but this requires testing. Additionally, turbine placement has some influence on fatality risk, as the highest fatality rates are generally attributed to turbines located at the ends of turbine strings (Arnett et al., 2008). Ireland has nine species of bats, all of which are protected under the Wildlife Acts 1976–2021 and Annex IV of the Habitats Directive. Three bat species are considered high risk in relation to turbines (EUROBATS, 2014; Mathews et al., 2016), with Leisler's bat (*Nyctalus leisleri*) considered internationally important as Ireland is a stronghold for the species (Marnell et al., 2009).

It is important to obtain damage estimates from all levels of wind farm operation to mitigate negative impacts on-site and to inform future development. Estimates of the number of fatalities per turbine and per wind farm, are needed so that cumulative, industry-wide, damage to populations can be predicted. Total national population estimates should be continuously updated based on the results of action-based monitoring. Differences in life histories between birds and bats (Healy et al., 2014) mean that effort is needed to identify impact threshold limits which are appropriate for different groups of species.

Some birds are vulnerable to habitat loss, displacement, and increased mortality due to collisions. In Ireland, the Hen Harrier (*Circus cyaneus*) is a particular species of concern. Hen harriers are raptors that live and breed in upland areas that often overlap with existing and potential wind farms (Fernández-Bellon et al., 2015). This species is listed on Annex 1 of the EU Birds Directive, so Ireland is responsible for maintaining its favorable conservation status. Generally, bird mortality has been found to be relatively low due to collisions with wind turbines (Drewitt and Langston, 2006), however long-term, active monitoring is needed to determine whether these low mortality rates are more significant for long-lived species with slow maturation and low reproductive rates, such as raptors. Studies of the interactions between raptors and wind farms outside of Ireland have found that raptor abundance decreased 47 % after the construction of wind turbines (Garvin et al., 2011), and that raptors often demonstrate avoidance behaviors at wind farms that could lead to habitat loss via displacement (Dohm et al., 2019; Garvin et al., 2011; May, 2015). There is some evidence that these negative impacts are diminished over longer time scales (Dohm et al., 2019). It is also possible that the Hen Harrier could be negatively impacted by a reduction in available prey species due to wind farms (Fernández-Bellon et al., 2019), further indicating the need for active monitoring of prey populations and associated habitat management throughout the lifespan of wind farms.

Appropriate site location is considered to be the most important method for mitigating negative impacts on birds and bats (Hötker et al., 2005). For example, sites in areas with high occurrence rates of raptors should be avoided as wind farm sites (Hötker et al., 2005). Mortality due to collisions could potentially be lessened through modifications in turbine design, placement, and operation (Dai et al., 2015). Turbine height and placement have a significant impact on collision risk, with taller turbines and turbines at higher elevations resulting in higher collision mortality (Lucas et al., 2008). Strategic arrangement of turbines within the sites can further reduce negative impacts (Drewitt and Langston, 2006).

Impacts to birds and bats could be potentially mitigated during operations; however, these are less well developed. Temporary curtailment of turbines during high-risk conditions for bat and bird collisions may help to reduce fatalities (Arnett and May, 2016; Lagrange et al., 2013; Smallwood and Bell, 2020) without compromising turbine performance and energy output (Rogers, 2020).

2.2.3. Decommissioning onshore wind farms

In the decommissioning phase, similar disturbances as found in the construction stage can be expected if the turbines are removed. Extending the lifespan of turbines through retrofitting and repowering can also minimise displaced construction impacts at new sites. Repowering can present challenges however, as sites that were previously licensed may subsequently be recognized as unsuitable, due to biodiversity and habitat impacts. Active habitat restoration and/or rehabilitation may be needed to mitigate negative biodiversity impacts of decommissioning.

In terms of long-term impacts on habitats, where road infrastructures are maintained on upland peatland sites this can lead to ongoing degradation due to drying out of the peat and fragmentation of the habitat. Overall, the general consensus is that to avoid impacts on habitats – through all stages – peatland areas should be avoided (Renou-Wilson and Farrell, 2009). Where existing peatland site are being decommissioned, an appropriate rehabilitation and restoration plan should be legally required and implemented.

2.2.4. Onshore wind farm opportunities for biodiversity protection & restoration

When implemented appropriately, the development of onshore wind presents opportunities for biodiversity restoration and protection (Fig. 3). Mitigation by avoidance is key for vulnerable habitats and species; followed by mitigation by rehabilitation and/or creation of habitats in areas surrounding wind turbines. Those areas previously functioning as carbon sinks that help regulate climate (i.e., peatlands) can be managed to provide habitat for various plant and animal species. The ecological potential of each site will vary according to its natural state, level of degradation, and constraints on biodiversity imposed by the wind turbine operation, therefore optimal rehabilitation and management practices need to be developed for each site. However, rehabilitating degraded habitats can be done in a way to not only promote biodiversity, but with good ecological guidance can also considerably reduce potentially negative impacts for climate and water quality.

Wind farms could also be co-located with areas already under intense land-use, such as agriculture or forestry. However, the availability of wind energy and willingness of landowners/managers to support wind farm installations on land with higher productivity value need consideration.

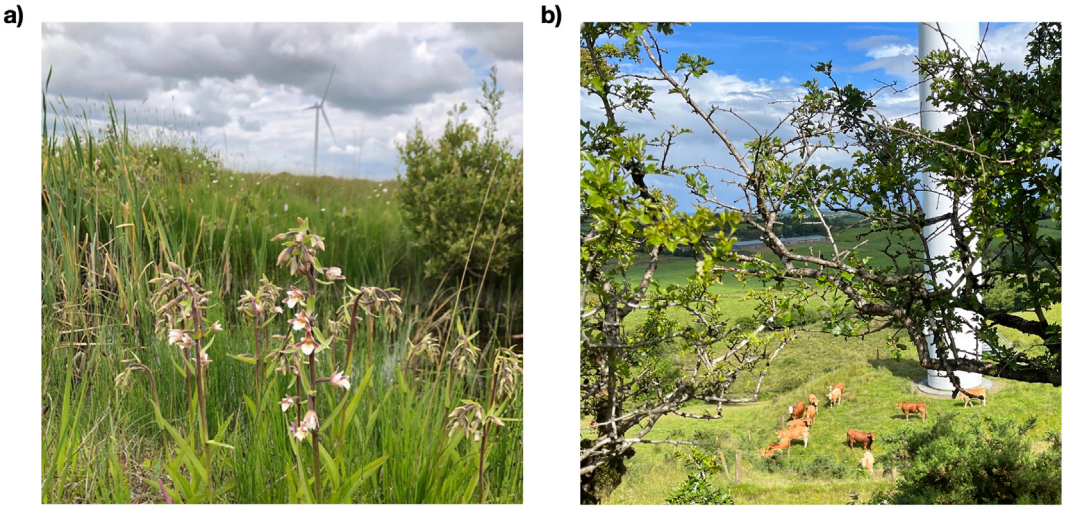


Fig. 3. Opportunities for biodiversity restoration and protection. a) photo of an Irish wind farm where the natural habitat surrounding the wind farm was rehabilitated; b) photo of an Irish wind farm that is co-located with intensive agriculture.

2.3. Solar photovoltaics (PV)

The 2021 Climate Action Plan includes increasing energy produced via solar photovoltaics (PV) to 1.5–2.5 GW of installed capacity by 2030 from a relatively low base of 0.024 GW in 2018, a 63–104 fold difference (SEAI, 2020). The scale of PV installations varies greatly, from distributed solar energy systems installed on rooftops of residential houses or commercial buildings, to utility-scale solar energy systems that occupy large areas of land. Distributed solar energy systems are relatively small in capacity (<1 megawatt [MW]) and are generally built into existing infrastructure, where they are likely to have negligible adverse impacts on biodiversity (Dale et al., 2011). Therefore, initiatives such as the micro-generation grant scheme for PV designed to promote the installation of solar panels on individual homes (Government of Ireland, 2021) should continue to be developed and supported. However, utility-scale solar energy systems are large-scale, high-capacity (>1 MW) operations that have far greater potential to affect biodiversity due to land-use change. It is estimated that current PV technology requires about 1.4–6.2 ha of land per MW of electricity production (U.S. Department of Energy, 2012; Walston et al., 2016). According to these estimates, if Ireland was to employ only utility-scale solar energy facilities to reach their Climate Action Plan target of 1.5 GW of capacity, a minimum of 2250 ha of land would be needed. The large land area requirements of solar PV have many potentially negative impacts on biodiversity (Hernandez et al., 2014; Macknick et al., 2013), including key impacts such as habitat loss and fragmentation.

2.3.1. Construction of solar PV farms

The construction of utility-scale solar facilities requires the conversion of existing agricultural areas to solar farms, or the diversion of other land-uses. There are potential consequences for biodiversity for either of these land-use options since land-use change to more intensive uses generally has negative impacts on biodiversity (Newbold et al., 2015). The conversion of existing agricultural land to solar farms could displace previous agricultural activity to less intensively farmed or semi-natural areas (Hernandez et al., 2014), with negative consequences for native plants and animals through resulting habitat loss and fragmentation (Fahrig, 2003; Hernandez et al., 2015b). The negative impacts of habitat loss and fragmentation are potentially exacerbated further during the construction of transmission lines and corridors (Andrews, 2014). However, the effects on biodiversity could be positive when converting low diversity land-uses, such as arable fields or intensive pasture, to solar farms, if wildlife management is prioritized (Montag et al., 2016).

Siting solar facilities in areas already degraded and/or developed by humans (such as the built environment) can reduce the magnitude of adverse impacts (Hernandez et al., 2015a). Outside of the built environment, care must be taken so that land use change, habitat loss, and habitat fragmentation are minimised and that solar farms are not placed in sensitive areas or areas acting as carbon sinks as solar panels reduce productivity through light and rainfall interception (e.g., peatlands and semi-natural grasslands in Ireland) (Hernandez et al., 2015a, 2014).

Construction of utility-scale solar energy systems requires land development, including clearing the existing vegetation and grading the soil (Macknick et al., 2013), leading to direct environmental impacts such as soil disturbance, habitat loss, degradation, and fragmentation (Hernandez et al., 2014; Macknick et al., 2013). Construction can have indirect impacts such as changes in water quality due to soil erosion, herbicide application and facilitating the spread of invasive species.

Some negative impacts of solar PV installation could potentially be mitigated through actions such as the promotion of functional land use beneath the panels and maintaining natural habitat within the landscape matrix. For example, planting native plant species which can tolerate the altered conditions beneath and between solar panels can create habitat for pollinators (Graham et al., 2021). However, direct and indirect habitat loss is much more difficult to mitigate. Some habitat loss could potentially be mitigated through compensation by restoring and/or rehabilitating natural areas elsewhere. This kind of offsetting should, however, be considered only as a last-resort (Simmonds et al., 2020). To guide policymakers there should be a clear view of trade-offs between the benefits of semi-natural habitat versus clearance for solar installations, as it is likely that grants to install solar sites could drive further habitat loss.

2.3.2. Operation of solar PV farms

The potential negative impacts of utility-scale solar facilities on biodiversity are significant during the operation stage (Hernandez et al., 2014). The installation of solar panels alters the composition of plant species that can colonise and persist in solar farms, as they reduce the amount of available light and water and influence microclimate beneath the panels. Arrays of solar panels can also cause seasonal and diurnal variation in air and soil microclimate that could scale up to affect plant-soil processes and carbon cycling (Armstrong et al., 2016, 2014). Both above-ground plant biomass and plant species diversity are lower under solar panels, and these differences can be explained by variation in microclimate and vegetation management (Armstrong et al., 2016).

Facilities regularly apply herbicide during the operation stage to prevent the regrowth of vegetation that was cleared during construction to

avoid shading of the panels, pests, and reduce the risk of fires (Macknick et al., 2013). There are several potential negative impacts associated with regular herbicide use, including off-target effects in wild plant communities (Russo et al., 2020), detrimental effects on pollinators (Cullen et al., 2019; Zioga et al., 2020), and water pollution (Abbasi and Abbasi, 2000). There are also concerns that these systems could generate even more problematic water pollutants as several toxicants are used during operation and maintenance, including coolants, antifreeze, and rust inhibitors (Abbasi and Abbasi, 2000; Tsoutsos et al., 2005). The panels themselves contain toxic heavy metals, such as cadmium sulphide, that could potentially leach from the panels (Abbasi and Abbasi, 2000). Clearly, monitoring the impacts on existing solar sites would inform the potential risks in future sites.

It is possible that birds could collide with solar panels. However, previous work found that mortality due to collisions was negligible relative to population sizes (McCrary et al., 1986, Mojave Desert). The impacts of utility-scale solar energy facilities on avian mortality in the United States are, however, estimated to be similar to those in the wind energy sector (Walston et al., 2016). As the development of utility-scale solar is in its infancy in Ireland, more work is needed to be able to accurately predict the effects of these facilities on Irish birds.

2.3.3. Decommissioning solar PV farms

The primary impact of concern during the decommissioning stage would be pollution of the environment with toxic materials contained within the solar cells due to damaged cells or improper recycling (Fthenakis et al., 1984). However, these risks can be prevented almost entirely by following waste handling regulations (Fthenakis, 2000).

2.3.4. Solar PV opportunities for biodiversity protection & restoration

The development of solar PV offers limited opportunities for biodiversity protection and restoration. There are, however, opportunities to create functional space beneath solar panels to support pollinator communities (Blaydes et al., 2021; Dolezal et al., 2021), but this would have to be considered on a site by site basis. However, almost all potential negative impacts of developing solar can be avoided by limiting its deployment to the built environment. This includes incorporating solar panels into existing infrastructure such as buildings, car parks, and residential houses. Initiatives such as the micro-generation grant scheme for PV are already in place to promote the installation of solar panels on individual homes in Ireland (Government of Ireland, 2021), and such programs should continue to be developed and supported. For larger developments, siting solar facilities in areas already degraded and/or developed by humans can reduce the magnitude of adverse impacts (Hernandez et al., 2015a). Therefore, taking a “right action, right place” approach by limiting solar facilities to the built environment could be a significant win-win for climate and biodiversity in Ireland (Joshi et al., 2021).

2.4. Biofuel cultivation

Biofuels, such as biogas and biomethane, are emerging technologies that could be used as a climate mitigation strategy. Biogas is produced from the decomposition of organic materials (i.e., feedstocks) such as energy crops, residues, and wastes (Weiland, 2010). These feedstocks are placed in a digester system that takes advantage of naturally occurring anaerobic digestion to break down the waste and produce gases, such as methane. This process produces a renewable biogas that can be used for a variety of applications such as producing heat and power (Achinas et al., 2017). The biogas can be further refined into biomethane, which can then be injected into natural gas pipelines or used to fuel vehicles. Ireland's bioenergy resources consist of forestry by-products, organic wastes, and energy crops. Energy crops with potential to be cultivated for biomass in Ireland include wheat, oil seed rape, short rotation coppice, willow, *Miscanthus*, and grass silage (Sustainable Energy Authority of Ireland).

Several lines of international evidence indicate that bioenergy has potential to be poorly implemented, leading to this sector directly and indirectly producing even more greenhouse gas emissions than traditional fossil fuels (Dauber et al., 2010; Searchinger et al., 2009). For example, the conversion of carbon rich ecosystems (e.g., tropical forests or peatlands) into biomass plantations leads to the release of previously sequestered carbon into the atmosphere, resulting in a carbon debt that could take >100 years to pay back (Gibbs et al., 2008; Searchinger et al., 2008). The production of bioenergy crops could also lead to increases in greenhouse gas emissions via land-use change, as bioenergy plantations often displace agriculture into natural habitats such as forests and grasslands (both locally and internationally) (Searchinger et al., 2015, 2008). Farmers may also attempt to replace agricultural land lost to biofuel by increasing the yields from remaining croplands, leading to increased usage of water and fertiliser (Searchinger et al., 2015, 2008).

There is a pressing need for short-term sources of sustainable liquid and gas fuels, particularly for transport, with electrification of the heating and terrestrial transport sectors likely to largely displace biofuels in these sectors in the medium term. In the Climate Action Plan, bioenergy is classed as an emerging technology with need for targets for production to be set according to feedstock supply issues. The development of bioenergy could have significant negative impacts on biodiversity depending on which land-use it replaces, what bioenergy crop is grown, and how it is managed. The primary concerns are that the cultivation of bioenergy crops and creation of biomass plantations are land-use intensive (Beringer et al., 2011; Fritsche et al., 2010). It should be noted that agricultural land-use, with associated habitat destruction and nutrient leaching, is currently the most prevalent threat to habitats, biodiversity and freshwater quality in Ireland (NPWS, 2019) and globally (IPBES et al., 2019). It is likely that expansion or intensification of agricultural land-use through bioenergy cultivation will further impact biodiversity.

2.4.1. Conversion of land-use to bioenergy crops

Of renewable energy sources, the biomass cycle has the greatest demand for land (Fthenakis and Kim, 2009). In Ireland, existing agricultural land would need to be converted to produce bioenergy crops, additional land developed for agriculture, or existing feedstocks (grass) diverted from livestock to biofuel production. Converting existing agricultural land to produce bioenergy crops and/or developing additional land for agriculture would bring significant land-use changes, which generally expedites biodiversity loss (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2018; Newbold et al., 2015; Sala et al., 2000). Negative biodiversity impacts are generally expected when natural and semi-natural areas (e.g., unimproved semi-natural grasslands) are converted to biomass plantations. The conversion of existing grass feedstocks from livestock to biofuel production might seem the best option for climate and biodiversity, if livestock farming is not displaced to other areas resulting in the intensification of high nature-value farmland and that imported feedstocks are not used as a replacement to sustain livestock instead.

There are several advantages to using grass as a feedstock in Ireland. For example, arable land is not needed for growing grass and farmers are already familiar with growing it, as over 90 % of Ireland's agricultural land is under grass (Smyth et al., 2009). Were livestock production systems to be disincentivised due to their high methane production to meet Climate Action Plan targets for the agricultural sector, then alternative land-uses for former pasture will need to be considered. There are, however, potential biodiversity impacts of grass to biomethane systems. The main concern is that the higher value of grass crops due to waste valorisation may drive further land-use change and intensification.

2.4.2. Operation of biofuel cropping

The cultivation of bioenergy crops, as with other intensively farmed arable crops, can negatively impact soil by increasing erosion, reducing soil organic carbon, and therefore decreasing soil fertility. Soil organic carbon is an important indicator of soil quality and productivity, with higher values corresponding to better soil water retention, higher soil biodiversity, and higher productivity. Soils are also important carbon sinks, as the soil organic carbon is sequestered instead of being released into the atmosphere. There are three main ways that the cultivation of energy crops can

negatively impact soil: land-use change, tillage, and residue removal (Wu et al., 2018). For example, the initial conversion of undisturbed soil to tilled can result in 20–40 % loss of soil carbon during the first 5–20 years of cultivation (Davidson and Ackerman, 1993), however, this is not universal (Zimmermann et al., 2012). Furthermore, harvesting crop residues (i.e., dead plant material left after harvesting) can also lead to soil erosion, have negative impacts on soil fertility, and reduce soil carbon, resulting in carbon dioxide emissions (Liska et al., 2014). Some of these negative impacts could potentially be mitigated by locating bioenergy crops in areas with already degraded soils and using conservation tillage practices that leave a percentage of crop residues in place to be broken down naturally (Hoekman et al., 2018).

The impacts of bioenergy crop cultivation vary in type, magnitude, and scale, depend on the crop grown, and are difficult to generalise. For example, responses to bioenergy crops differ among pollinator taxa (Stanley and Stout, 2013), and effects on species vary depending on which crops were replaced by bioenergy crops (Stanley and Stout, 2013). Further context specific research on taxa and landscapes is clearly needed to better understand how the development of bioenergy through different land use changes could impact local biodiversity. Due to the large areas of land that would be required to meet energy production targets via bioenergy, the spatial layout and distribution of such areas would determine the extent of negative impacts (Dauber et al., 2010).

Optimisation of biomethane production from grass would likely require the inputs of fertiliser, herbicide, and lime to agricultural fields (Smyth et al., 2009). These inputs would negatively impact native plants and animals, and result in additional detrimental impacts to aquatic ecosystems and groundwaters (Abbasi and Abbasi, 2000). More research is needed on the quality of the biomass inputs for biomethane production (e.g., single species versus multi-species swards) and sustainable management practices that avoid fertiliser and pesticide use. Some negative impacts could potentially be mitigated by incorporating the protection of important biodiversity landscape features, such as hedgerows, ponds, and buffer strips, into plans to expand the development of bioenergy.

2.4.3. Biofuel opportunities for biodiversity protection & restoration

The development of bioenergy in Ireland provides some opportunities for biodiversity protection and restoration. For instance, the development of this sector in Ireland may generate further pressure to develop innovative methods for sustainable agriculture, which could be beneficial for other renewable energy projects. Additionally, there is the possibility of incorporating biodiversity landscape features into bioenergy land uses, which should generally be encouraged.

3. Afforestation and habitat restoration as climate mitigation strategies

Forests account for about 10.8 % of the land area in Ireland (Department of Agriculture, Food and the Marine, 2014). The Climate Action Plan aims to plant 8000 ha of new forest each year to reach an ultimate target of 18 % cover by 2046 (Government of Ireland, 2021). This will be achieved through planting and natural regeneration (Government of Ireland, 2021).

3.1. Afforestation through plantations, woodland restoration, hedgerow retention, management, and expansion

Reforestation and afforestation are considered to be relatively cost-effective climate mitigation strategies (Fuss et al., 2018) as forests can slow the accumulation of greenhouse gas emissions by sequestering carbon (Rudel et al., 2005). In addition to the short-term carbon sequestered during tree growth, there is also the potential for long-term carbon storage in urban structures by replacing carbon-intensive materials such as concrete and steel with engineered timber (Churkina et al., 2020). If appropriate tree species are planted on the right soils, this afforestation target could have substantial positive impacts on biodiversity and water quality. Implementation is, however, key to maximising these positive effects (Allen and Chapman, 2001; Sacco et al., 2021).

Like other climate mitigation methods, siting is critical for increasing the positive biodiversity impacts of afforestation and minimising the potential negative impacts (Sacco et al., 2021). For example, afforestation of naturally open areas of high biodiversity value (e.g., peatlands and semi-natural grasslands in Ireland) could have adverse impacts on the ecosystem and potentially result in the loss of distinctive species (Abreu et al., 2017; Wilson et al., 2014). In Ireland, the Hen Harrier is a sensitive species that has already experienced habitat loss due to afforestation of large areas of natural open habitat (O'Leary et al., 2000). Current afforestation is heavily weighted towards monocultures of non-native species harvested for timber use with short usage lifespans which has limited value for both climate change mitigation and biodiversity. There are plans to continue to afforest areas of open habitat in Ireland with commercial non-native species, which would likely cause further damage to Hen Harrier habitat with limited positive biodiversity impacts. Rehabilitating and restoring degraded forests to natural and semi-natural states would be much more effective for conserving biodiversity while also contributing to climate mitigation targets.

It is estimated that about a third of peatlands are drained for forestry in Ireland (Connolly, 2018). Several of these sites have resulted in low-productivity forests, or failed plantations on deep peat and heathland slopes, some of which are carbon sources (Jovani-Sancho et al., 2021). In addition to ceasing afforestation efforts in habitats with peat soils, restoration of peatlands where possible would benefit both biodiversity and climate by reducing soil carbon emissions and promoting native biodiversity. Some work has been carried out on restoring peatlands post-felling of conifer plantations in Ireland and the UK, and this work should be supported and monitored to set realistic targets based on restoration trials (Andersen et al., 2017).

When sited appropriately, it is also important to consider the species used for afforestation. Native Irish forests consist of primarily mixed deciduous tree species (Cross, 1998). However, current afforestation schemes (except The Native Woodland Establishment Scheme) plan to plant monocultures of commercial, non-native, coniferous trees, such as Sitka Spruce (*Picea sitchensis*). A wide body of evidence shows that monocultures provide limited biodiversity value (Altieri, 1999; Felton et al., 2010; Iezzi et al., 2018) although, they can host species of conservation concern (Irwin et al., 2013). Furthermore, their effectiveness at sequestering carbon over long timescales has been questioned (Körner, 2017; Lewis et al., 2019). Commercial monocultures may be effective at carbon sequestration in temperate environments (Forster et al., 2021), but depends on the soils (Jovani-Sancho et al., 2021). Monocultures are more vulnerable to natural disasters such as pest outbreaks than mixed forests (Verheyen et al., 2016), which makes them risky as a carbon storage mechanism. Alternatively, forests composed of native mixtures have a high capacity to promote biodiversity through creating habitat for wildlife and attracting pollinators and seed-dispersing animals (Sacco et al., 2021; Twining et al., 2022) and could be more resistant to pests (Verheyen et al., 2016). The resilience of forests to natural disasters, such as pest outbreaks, is an important consideration for both climate mitigation and biodiversity. To maximise future resilience, it is important to not only plant a diversity of species, but also to identify genotypes and species that might be particularly robust to threats and/or changing climatic conditions. A balance of commercial monocultures and mixed native forests could be a bet hedging strategy for climate mitigation and biodiversity. However, afforestation efforts would have the greatest positive impact on biodiversity if a mix of native trees were used (Lewis et al., 2019; Sacco et al., 2021).

The species used in afforestation projects also impact the surrounding environment, including freshwater ecosystems. For example, afforestation can have an acidifying effect on streams, largely due to the abilities of forest canopies to act as 'pollutant scavengers' (i.e., they enhance the capture of acidic pollutants such as nitrogen and sulphur). Coniferous trees, such as Sitka Spruce, are particularly problematic as they are efficient pollutant scavengers and also form an acid litter layer (Department of the Environment, 1991; Nisbet and Evans, 2014). This is especially harmful in "acid-sensitive" areas where the natural geology (e.g., shale, granite, and sandstone) already has an acidifying effect on streams (Collier and

Farrell, 2007). Commercial coniferous plantations have the potential to exacerbate existing water quality issues, which could compromise obligations to improve water quality via the EU Water Framework Directive (2000/60/EC).

Increased afforestation could lead to a higher frequency of forest fires that would damage biodiversity and release carbon into the atmosphere. This could happen for several reasons. For example, if wetland areas (e.g., peatlands) that have a naturally low risk of fire are afforested, trees can dry up the wetlands via transpiration and increase the risk of fire in previously wet habitats. Commercial monocultures are particularly at risk for severe fires (Odion et al., 2004), highlighting another advantage of planting native mixtures. Current Common Agricultural Policy rules incentivise the removal of scrub (e.g., gorse and heather) to keep land in good agricultural condition for eligibility of farm payments. This leads to fires being set to clear land and these fires can spread to forests, leading to erosion of peat soils, and carbon release. It would be beneficial for biodiversity and climate mitigation if the Common Agricultural Policy rules could be adapted and enforced to protect sensitive habitats from fire and provide for buffers around at-risk sites (i.e., disincentivise clearance of land with biodiversity value). Buffer areas might also function as corridors for native plants and animals that could promote biodiversity (Altieri, 1999).

Hedgerows and other woodland habitats are an important part of the Irish agricultural landscape accounting for ca. 5 % of the area of intensive farms (Larkin et al., 2019) and up to 11 % on extensive farms (Rotchés-Ribalta et al., 2021), providing a valuable ecological network and habitat in the agricultural landscape. The ecosystem services delivered by hedgerows include carbon sequestration and storage, pollutant remediation, shelter for livestock and aesthetic appreciation of the landscape. Given the large areas under hedgerow, treelines, woodland copses, and scrub, the carbon storage and sequestration ecosystem services at a national scale are substantial. Hedgerows have annual carbon sequestration estimates of 0.5–2.7 tCO_2/ha/yr (Black et al., 2014; Green et al., 2019). The carbon estimated to be stored in hedgerows and woody habitats represents a significant store of carbon at the national scale that needs to be appropriately managed to ensure the stored carbon is not released back into the atmosphere.

More research is needed to assess whether hedgerow management is an effective land-use mitigation strategy (Green et al., 2019). Resolving this uncertainty is a priority as the potential for hedgerows and woodlands on agricultural land to be an effective mitigation strategy is high. Data from LiDAR surveys can be used to quantify the carbon sequestration of hedgerows ("Farm Sustainability Plan - Teagasc | Agriculture and Food Development Authority," 2021). Annual surveys throughout the lifetime of the project would generate the most useful data, estimating carbon sequestration in woodland, hedgerow, and scrub farmland habitats to build certainty.

3.2. Afforestation opportunities for biodiversity protection & restoration

There is high potential for agroforestry (i.e., the intentional integration of trees and shrubs into crop and animal farming systems) to provide climate and biodiversity benefits. The goal of agroforestry is to combine agriculture and forestry in a mutually beneficial way. Agroforestry can increase landscape diversity and promote biodiversity. Additionally, it has positive benefits for water, as it provides for land drainage through increased transpiration, hinders nutrient runoff, and reduces sedimentation in aquatic systems near farms. Agroforestry can also have positive impacts on livestock by providing shade and shelter from rain and wind. Agroforestry can increase soil health by enriching soil organic carbon, improving soil nutrient availability and soil fertility, and promoting soil microbial diversity and activity (Dollinger & Jose, 2018). It can also increase the availability of foraging resources and habitat for wild bees (Kay et al., 2020). Incorporating flowering trees into grassland agriculture could, therefore, promote pollinator diversity and enhance pollination services available in agroforestry systems. However, the implementation of agroforestry is key for optimising the positive biodiversity benefits. The use of native trees in agroforestry practices should be encouraged, together with trees planted to increase landscape connectivity and act as buffers along riparian margins.

Hedgerows and woody habitats on farmland represent a vital ecological network supporting biodiversity in the agricultural landscape. Meeting the EU's 2030 Biodiversity Strategy's target of 10% of farmland area being 'high diversity landscape features' would thus represent a protection of existing biodiversity, restoration of biodiversity on intensive farms where habitat cover tends to be particularly low, and an increase in the sequestration and carbon storage associated with hedgerows and woody farmland habitats, increasing further the effectiveness of these semi-natural habitats as an important land-use mitigation strategy.

3.3. Restoration and rehabilitation of native habitats

3.3.1. Peatland restoration and rehabilitation

Peatlands are biodiversity hotspots that provide habitat for unique plant and animal species. Ireland is a global hotspot for peatlands, and peatlands and peat soils extend to over 20 % of its land area. Peatlands are complex ecosystems that have aided in climate regulation for millennia by acting as large carbon sinks (Joosten et al., 2016). While healthy peatlands store large amounts of carbon, damaged peatlands are a major source of greenhouse gas emissions and it is estimated that they will be responsible for 8 % of anthropogenic CO_2 emissions by 2050 (Urák et al., 2017). Their significance for biodiversity conservation and climate mitigation, however, has not always been realised, and longstanding efforts to drain and use peatlands for agriculture and forestry has resulted in large scale degradation of peat habitats throughout Ireland. This has resulted in the loss of unique species, and ultimately decreased the potential of Irish peatlands to contribute to climate mitigation through loss of soil carbon due to drainage and planting (Jovani-Sancho et al., 2021).

In addition to the peatland areas that were drained for agriculture and forestry, about 5–6 % of peatlands have been drained for industrial peat extraction. Negative impacts of peat extraction for climate and biodiversity have long been recognized and peat extraction for fuel on state managed lands has recently ceased. Many of the state owner industrial extracted areas will be decommissioned and rehabilitated as part of a state funded program to reduce greenhouse gas emissions, with the added benefit of regeneration of semi-natural wetland habitats. This equates to only ca 5 % of the national peatland resource, so a full inventory of peatlands should be considered in terms of potential wins for rewetting (Farrell et al., 2022).

There is, however, still demand for, and extraction of, horticultural peat at a commercial scale. Smaller scale regional and domestic turf extraction is also ongoing for use in home heating. Cessation of commercial extraction could displace peat extraction to bogs that lack licensing and regulations with negative impacts for both biodiversity and climate mitigation. Regulation of peat extraction (including turf for fuel) would help prevent the expansion of extraction, and resulting consequences for climate, water, and biodiversity (Farrell et al., 2022). Furthermore, the rehabilitation of decommissioned bogs should be a top priority for climate mitigation and biodiversity conservation in Ireland as this is a Nature Based Solution that would deliver multiple co-benefits for the environment (Farrell et al., 2021b). Policy to enable a just transition from peat extraction to other economic activities and to alleviate fuel poverty in regions where peat is used for heating are urgently needed.

3.3.2. Rewetting drained soils

A large proportion of farms in Ireland are located on land that is poorly drained due to natural factors such as soil type, topography, and climate. Teagasc estimates that 30 % of the 3.18 million hectares of nationally managed grassland is imperfectly or poorly drained (Teagasc, 2021). Such poorly drained soils are suboptimal for farming as they remain wet for prolonged periods, resulting in shorter grazing seasons, and lower productivity and profitability. To improve the profitability of grassland farms on heavy soils, Teagasc implemented a 'Heavy Soils Programme' that aims to drain 10 % of Ireland's total grassland by 2030 to increase the quality of agricultural land. It has also been suggested that this program will be beneficial for climate mitigation as the drainage of mineral soils can result in a direct reduction of N_2O emission. However, the benefits for climate mitigation are

limited, as draining organic and/or peat dominated soils results in significant emissions of the CO_2 that is naturally sequestered in such soils. The drainage of mineral soils could also lead to an increase in N leaching (Teagasc Greenhouse Gas Working Group, 2019). There are also substantial potentially negative impacts that could result from this scale of soil drainage due to the significant overlap between heavy soils and high nature-value farmland ("HNV Distribution," 2015). Draining of heavy soils and subsequent intensification of livestock farming will likely reduce the distribution and coverage of high nature value farmland, and therefore negatively impact biodiversity.

Teagasc have included rewetting 40,000 ha of organic grassland soils (out of a total 370,000 ha of drained organic soils) as a possible climate mitigation method in the second iteration of the Greenhouse Gas Marginal Abatement Cost (Teagasc Greenhouse Gas Working Group, 2019). This action would likely have positive effects on biodiversity and climate. For example, Teagasc has estimated that stopping drainage and restoring natural water tables for 40,000 ha of grassland would result in an emissions savings of 0.44 metric tons of carbon dioxide equivalents (CO2-e) per annum (Teagasc Greenhouse Gas Working Group, 2019). As a significant number of emissions (1.4 Mt CO2-e) are generated from drained sites within protected areas, it would be especially beneficial for both climate and biodiversity to rewet protected sites. As an alternative to stopping drainage and completely rewetting 40,000 ha of grassland, Teagasc proposes that converting 65,000 ha of nutrient-rich managed grasslands from deep drained to a shallow drained state could result in a similar amount carbon savings. Were ambitions increased and both of these measures applied, there would be substantial benefits to both climate and biodiversity. The rewetting of peaty agricultural soils could be a large land use abatement measure and would also provide habitat for many native plant and animal species.

4. Conclusions

Major action is urgently needed to prevent the devastating impacts of unimpeded climate change, but these measures must be implemented in a way that does not put further pressure on biodiversity. Here, we provide a set of considerations for the achievement of biodiversity goals through climate actions. While the optimal implementation of these actions will vary nationally and regionally, we have identified several considerations that are consistently important for maximising the potential benefits for climate change and biodiversity loss mitigation. The synergies presented here are not exhaustive and there are other win-win actions, especially regarding societal changes to combat climate change that would undoubtedly have a positive impact on biodiversity. For example, building a sustainable food system with climate- and biodiversity-friendly agricultural practices, responsible food trade, and equitable food distribution (InterAcademy Partnership, 2021) would benefit biodiversity. Future discussions should detail these potential co-benefits.

Ultimately, the solutions to the climate and biodiversity crises must be integrated, and biodiversity considerations should be incorporated into land use management through a natural capital accounting approach. This requires that we bring ecological considerations for all renewable energy plans and projects to the design phase. This strategy facilitates avoidance of biodiversity conflicts with national strategic infrastructure works, as obstacles can be eliminated in advance.

Biodiversity-friendly renewable energy can be achieved by prioritising renewables that are least damaging and ensuring that infrastructure development is carried out as sensitively as possible to protect, restore, and enhance biodiversity. We should promote renewable energy methods with the lowest negative ecological impacts, such as offshore wind and the incorporation of solar into the built environment. Additionally, appropriate location of sites is critical for all renewable energy projects. It is important that projects are implemented so they do not compromise biodiversity and have unintended negative effects on carbon emissions. To ensure best practices and accountability, we need action-based monitoring for all measures. The monitoring processes need to focus on an action response model if impacts are identified, rather than the current scenario where damage is recorded year after year with little to no action.

This case-study provides one of the first examples of how climate actions can be implemented in a biodiversity-conscious way. With careful planning, we can synergistically mitigate both our climate and biodiversity crises.

CRediT authorship contribution statement

Courtney E. Gorman: Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Project administration, Visualization. **Andrew Torsney:** Conceptualization, Investigation, Writing – review & editing. **Aoibheann Gaughran:** Conceptualization, Investigation, Writing – review & editing. **Caroline McKeon:** Conceptualization, Investigation, Writing – review & editing, Visualization. **Catherine Farrell:** Conceptualization, Investigation, Writing – review & editing. **Cian White:** Conceptualization, Investigation, Writing – review & editing. **Ian Donohue:** Conceptualization, Investigation, Writing – review & editing, Funding acquisition. **Jane Stout:** Conceptualization, Investigation, Writing – review & editing, Funding acquisition. **Yvonne M. Buckley:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Data availability

No data was used for the research described in the article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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