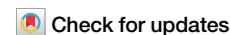


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Realizing multispecies justice through a capability approach to promote nature-based solutions



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The design and implementation of nature-based solutions (NBS) in cities are often limited by an anthropocentric approach that prioritizes utilitarian goals instead of the diverse needs and abilities of multiple species that would support ecological flourishing. This paper starts from the premise that multispecies justice (MSJ) thinking provides a needed biocentric approach to NBS, and explores how a Capability Approach (CA) can be a bridge to integrate MSJ into urban NBS. The premise was tested through an embodied methodology used to design and deliver multi-city workshops in urban novel ecologies; settings often described as abandoned and hosting novel ecosystems. This research improved the understanding of participant's awareness and knowledge of more-than-human agencies in shaping space and time, and in identifying social and environmental vulnerabilities and opportunities that can foster or hinder multispecies flourishing. We conclude by exploring how the CA can bridge NBS and MSJ and argue for the potential of marginal, less-valued novel ecologies as important elements of socially and biodiversity-rich urban futures.

In an era of climate change and rapid urbanization, Nature Based Solutions (NBS) are becoming an essential part of urban sustainability agendas worldwide. NBS are held to offer systemic ecosystem management solutions to address complex urban challenges by delivering multiple social-ecological co-benefits¹. NBS provide opportunities for better living amidst climate change.

While ecological solutions like NBS are increasingly valued and advocated in urban settings, they are typically designed and implemented in an anthropocentric way, often cast through the language of ecosystem services (ESS), which prioritizes the needs and wants of humans and casts other species in mainly instrumental ways^{2,3}. This is problematic because it limits the scalability and effectiveness of NBS as holistic urban solutions³; and it is unfortunate because ESS was meant to give greater recognition to nature, the species, and relations that make it up, and its functions⁴. For example, researchers caution this approach may significantly compromise the health and wellbeing of both human and nonhuman communities, posing a serious challenge to urban resilience and future city design—particularly in the face of emerging threats from climate change, social

inequities, and economic impacts on multispecies livelihoods and equity⁵. We here propose that recent discussions about how to adequately take into account justice considerations in the design, implementation, and governance of NBS^{6–8} is a promising vector through which to address this issue. The consideration of justice is necessary to ensure NBS can be effective, but so far, the needs and capabilities of nonhuman species remain largely overlooked in these discussions.

In recent years, the field of multispecies studies has emerged to address pervasive anthropocentrism and its related issues. This perspective considers the needs, agency, and freedoms of other species as equally important to those of humans, offering a path toward a more inclusive and equitable approach to planning and ecosystem management^{9,10}. Within this framework, the concept of multispecies justice further emphasizes the rights and capabilities of nonhuman communities, supporting a vision of urban environments where all species can thrive. The call for multispecies justice seeks to expand ethical, political, and social considerations beyond humans. It is an evolving terrain of thought, with the focus of justice varying from individual animals to species, ecosystems, and the planet¹¹. While a diverse

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and emerging body of scholarship, its various branches are connected by a deep moral concern for the plight of nonhuman life in a world increasingly inhospitable to its existence, whilst sharing a commitment to ethical reflection that respects the complexity and interconnections of life on Earth¹⁰.

For NBS, a multispecies justice approach encourages responsibility and care in processes of co-learning and co-becoming¹². The MSJ perspective also supports the long-term effectiveness of NBS as it offers alignment with ecosystem dynamics and biodiversity needs rather than imposing technofixes that emphasize interventionist approaches. Despite this recognition, challenges remain in operationalizing and putting into action multispecies justice, as it needs to go against deeply entrenched anthropocentric biases and rethink the subjects and procedures of justice anew^{11,13}.

To address this gap, we explore how the Capability Approach (CA)—an approach to justice widely applied in social and public policy to evaluate human wellbeing and justice, as exemplified by the Human Development Index—can serve as a bridge to operationalize multispecies justice in NBS design and implementation. This framework, when used from a multispecies perspective, provides a method for identifying the functionings of nonhuman species—which are reflections of an organism's ability to be or do something crucial, such as reproduce, make use of habitat, and engage in interspecies interactions—and assessing the conditions and opportunities necessary for their survival and well-being¹⁴. Our research employs theoretical reasoning by applying the capability approach to develop a framework that embeds multispecies justice into urban NBS, expanding beyond anthropocentric planning towards biocentric forms of planning. This framework is then applied through empirical fieldwork to investigate how multispecies perspectives can enhance NBS implementation across multiple cities including Dublin, Ireland, New York City, USA, and Melbourne, Australia.

Through embodied, participatory experimental workshops ($n = 8$) and engagement strategies, we explore ways to involve communities in envisioning and designing NBS that acknowledge and support nonhuman beings. This approach fosters awareness, empathy, and imagination around multispecies justice and more-than-human worlds¹⁵ and is an effective way to engage diverse stakeholders and communities in urban planning, design, and decision-making processes that meaningfully and critically consider the needs of nonhuman species, the interconnectedness of people and ecosystems, and the goal of mutual flourishing. A place-based understanding of more-than-human awareness and interdependencies can generate ecological empathy, a relational practice which creates pathways to restore human-nature connections¹⁶. Field research was conducted in novel ecosystems—self-sustaining urban environments that emerge without direct human intervention. These landscapes, common in cities, offer a valuable testing ground for multispecies approaches, as they already function as informal NBS, requiring minimal maintenance while supporting biodiversity. By studying these environments, we examine how NBS can be designed to work with, rather than against, ecological processes.

We thus propose a critical conceptual move for NBS to become less anthropocentric and more biocentric in its design and application. Using the CA, we move from functions to functionings, which decenters the needs of humans vis-a-vis ESS and instead centralizes the needs of nonhuman beings. Thus, honing in on ecosystem capabilities instead of ecosystem services, we pave a way where the needs of nonhuman species are on equal footing with those of humans. Through this interdisciplinary approach, we argue that integrating multispecies justice and the CA into NBS design can significantly enhance their effectiveness, affordability, and long-term viability. Our findings contribute to a growing body of research that challenges the status quo of urban resilience planning, advocating for governance models that incorporate the diverse needs of human and nonhuman communities alike. By rethinking NBS from a multispecies perspective, we offer a framework for creating more adaptive, scalable, and ecologically attuned solutions that ensure mutual survival in an increasingly complex and changing world.

To create a link between multispecies justice and the CA, in what follows, we review literature to discuss the roots, key concepts, and empirical operationalization of the CA. Originally conceived by Amartya Sen and subsequently developed by Martha Nussbaum and others, the CA is rooted in the Aristotelian concept of “flourishing”. The fulcrum of this approach is desired “beings” and “doings”¹⁷ (p.91), such as being healthy, playing, and procreating. These “beings” and “doings” are termed “functionings”. The eponymous “capabilities” of the approach are the set of functionings that enable flourishing by the life that pursues it¹⁸ (p. 40). While the ideas of functionings and capabilities are directly related, they are viewed as theoretically distinct within the CA framework to facilitate conceptual coherence¹⁹. The relationship between functionings and capabilities equates to a relationship between outcomes and opportunities. The latter of which emerges as a consequence of an individual's situatedness in a specific context. As noted by Nussbaum, “Functionings are beings and doings that are outgrowths or realizations of capabilities”²⁰ (p. 25). Although conceived with respect to humans, Nussbaum^{21,22} and others²³ have suggested expanding the scope of the approach to encompass a multitude of species. Nussbaum has used the CA to formulate a theory of “justice for animals”. Resonant with the CA's Aristotelian roots, she anchors this justice-oriented work in a trinity of related concepts, namely: sentience, intrinsic value, and striving. She holds “that sentience—the ability to feel, to have a subjective perspective on the world—is a necessary basis for being a subject of justice”²⁴ (p. 97). Being the “subject of justice” is tied to sentience, whereby creatures are seen as “ends” in themselves rather than only as “means” to another's end²⁵. This is because sentience endows a creature with a life that matters intrinsically to them from their subjective perspective. With a life that intrinsically matters to them, all creatures strive to flourish in the species-specific form of life that is natural to them. As a hedgehog strives to flourish by living the form of life that is natural to it, so too a robin strives to flourish in the (different) form of life that is natural to being a robin.

Indeed, it is this concern with “striving” that furnishes the theoretical innovation of the CA. Whereas Kantian-informed justice approaches focus on recognizing the “dignity” of nonhuman animals as “ends” in themselves, the Aristotelian-inflected CA moves beyond respect for the sentient subject as a rights bearer to a concern for the striving of that subject. Consequently, from a CA standpoint an “injustice centrally involves *significant striving* blocked by not just *harm* but also *wrongful thwarting*, whether negligent or deliberate”²⁴ (p. 8 (emphasis in original)). “Agency” is thus core to justice in this animal inflected CA, as acknowledging and respecting the multiple forms of agency expressed by animals qualifies the justice owed them. Accordingly, multispecies justice can be conceived from a CA perspective as actions that preserve and promote the agency of animals in realizing the species-specific forms of life that are natural to them.

While conceiving justice in more-than-human terms is a welcome development in CA thinking, the “animal justice” advanced by Nussbaum is limiting. This is because it inadvertently imposes a form of anthropocentrism in profiling the subjects of moral standing—the very anthropocentrism that Nussbaum criticizes Korsgaard²⁵ and Wise²⁶ for espousing. To fasten moral standing on sentience as the ground of subjectivity, is to perpetuate a centering of morality on the heightened sense of self that is definitive of humans. This is evident in Nussbaum's conclusion that humanely killing fish for food is normally permissible as they don't have a well-developed sense of themselves as subjects existing across time (cf.²⁷). For Nussbaum, they are seen to experience pleasure and pain, but not “themselves” as experiencing subjects. The choice to delimit moral value to animals with an abstractly rationalized subjectivity is thus to privilege certain forms of striving. This view arbitrarily marginalizes the agency of much life on our planet. Should a focus be placed on the “striving of life”, rather than the subjectivity of that life, a more expansive moral horizon comes into view. This decentering of the CA from an implicit human pivot can be assisted by an engagement with biocentric philosophy. As this perspective's most noted advocate, Paul Taylor argues for a biocentrism that is sensitive to how each organism is a “center-of-a-life” that is “pursuing its own good in its own way, according to its species-specific nature”²⁸ (p. 45). With

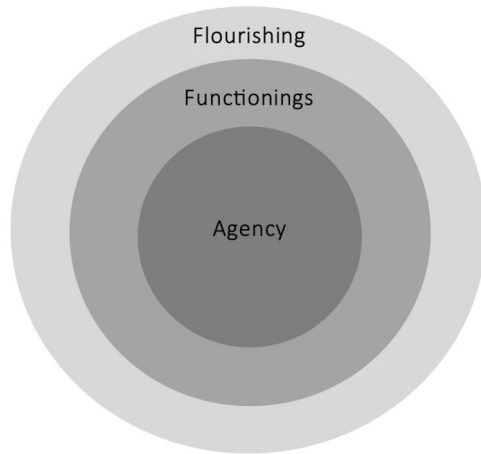


Fig. 1 | Conceptual diagram of the capability approach: justice as agent flourishing via functionings. This diagram illustrates a conceptual representation of the Capability Approach through agency—ability to influence, shape, relate, be, and do—as central to the processes and outcomes of justice. It is via functioning that agencies can be enacted (or not) within the constraints of the environmental conditions, allowing for organisms to flourish.

considerable systematicity, he reasons an “attitude of respect for nature” that is orientated by nonmaleficence and noninterference. Such respect for the agency of life fashions a corrective to justice thinking in this space by producing a biocentric CA (BCA) that is more “multispecies” in its concerns.

Although both Nussbaum’s animal-centered CA and Taylor’s biocentrism are essentially individual in their moral ontologies, this does not discount the value of ecosystems. Afterall, life is shaped by its evolutionary history and the character of the environment in which it finds itself. Capabilities are the outcome of an organism’s ability to express its agency in interaction with the environment. “Naturalness” is not what matters—thriving is a matter of resources, opportunities and constraints an environment affords the individual. The history of progress in justice thinking has largely involved expanding recognition of who counts as a subject of justice through a mix of empathy and rationality. Empathy allowed us to imagine ourselves as another, and rationality enabled us to establish principles governing how others should be respectfully treated. From ethnic minorities, women, children and the mentally disabled, expanding this moral circle of inclusion has nonetheless been fashioned by appeals to similarity with those already included²⁹. Multispecies justice is different. It challenges our moral imagination and our ability to “know” different ways of striving. Nussbaum suggests that sympathetic imagining can help us “to extend and refine our moral judgements in this area”¹⁴ (p. 355). In what follows, we present the findings of how such sympathetic imagining can be stimulated by consciously immersing oneself in a space where life is abundantly evident and by storytelling about such life to yield a sense of personal identification with it.

By using an embodied methodology and a vocabulary built on species traits (*sensu*^{30,31}), this study explored human-nonhuman relationalities through a series of interactive activities in eight workshops across different urban locations displaying novel ecological configurations. By drawing on the field of functional ecology^{32–34} and using it as a means for unpacking what is “natural” for different organisms we provide a much-needed link between multispecies justice and ecological science. As will be demonstrated, this facilitates articulation and reflection on what may thwart the form of agency characteristic of an organism and help identify how an injustice may manifest (see Fig. 1). We argue for the feasibility that novel ecological configurations may offer equal or greater opportunities for organisms than would historical ecosystems. It is thereby reasonable to conclude that a novel ecological configuration could theoretically provide an equal level of multispecies justice as a non-novel one. Moreover, it is possible

to conceive that such novel ecologies may actually enhance opportunities for (some) organisms to express their agency in otherwise ecologically denuded landscapes, for example in our urban areas. These emergent ecosystems are a less explored field of urban research and practice^{35,36}. Still, what is known indicates that they can contribute to urban biodiversity conservation^{37,38}, social-ecological resilience^{39–41}, and multispecies justice⁴². This aligns with the study’s findings which demonstrate an enhanced understanding of the role of more-than-human agencies in shaping space and time. They also underscore the potential of novel ecologies to provide valuable insights into fostering opportunities for multispecies flourishing.

Results

Exploring multispecies capabilities using participatory workshops and engagement strategies in these novel ecologies cultivated acts of noticing^{43,44} among participants. This enabled them to better situate the connections between human-nonhuman species, envision positive uses of greenspaces, and more generally embrace a multispecies approach to NBS planning and design. These acts of noticing helped participants cultivate newfound appreciations of the interconnection between species, soil, insects, rubbish, roads, and other human-made structures which they connected through memories, stories, and experiences.

The results highlight how local communities can actively envision and design NBS that support and acknowledge nonhuman species through three key ideas: agency, vulnerabilities, and opportunities. In the first instance, the workshop improved understanding of the role of more-than-human agencies in shaping space and time. Secondly, it helped participants’ understanding of social and environmental vulnerabilities through issues like displacement, ownership, and misrecognition. The third finding highlighted the potential of novel ecologies to offer valuable insights for fostering opportunities for multispecies flourishing. Understanding more-than-human agencies, which can be understood as the functions and capacities of expression of living organisms in relation to others, and the vulnerabilities that hinder those agencies, presents pathways to cultivate and design strategies that allow those agencies to thrive and flourish.

More-than-human agencies

More-than-human agencies were conveyed through two key components: niche creation and encounter-interaction. Niche creation was expressed as a capability of individuals within ecological systems to realize their own functionings or expressions in shaping and co-shaping their environment, in crafting their “home” and space. Species agencies in these novel ecologies were seen as taking over space. In some instances, their agencies were suffocating or preventing other species from thriving. Species like that are “creepers”, “climbers”, and can “carpet the ground”, because they “...aren’t indigenous species [...] they’ve really overtaken and [are] strangling out some of the trees there as well” [W07]. The agency of plants and animals in these spaces seemed to be reliant on their nativeness, particularly in Melbourne [W06, W07, W08]. Despite this, towards the end of the workshops, the agencies of these niche creators were considered as stabilizers of the riverbanks and an expression of what is possible in the confined spaces that occur between hard borders (roads, fences and footpaths) and soft borders (soil in the banks) and highly disturbed landscapes. Novel ecologies were seen as being protectors and refugia. The density, thickness, and different levels of plants and trees create hiding spaces for snakes, birds, and other critters. Natural processes of decay and weathering form a “tangle of branches and fallen trees [which] create a small inaccessible place where the trimmer could not go. So, it leaves a potential refuge for small animals and birds” [W05] and a sense of safety and a nest for people [W08, W05]. Agency was also expressed as the capacity to connect or of novel ecologies as conduits, providing space for movement, reproduction and other functions to occur.

Agency as encounters-interactions emphasized humans, plants, animals, soils, trees, roads, water and other elements as being with each other and reacting to each other in ways that encourage or thwart their agencies. Within these novel ecologies, abiotic elements function as platforms for

growth, for life to grow. Some of these included “big rocks with the fungi growing or the moss growing, lichen, and stuff like that...” and rubbish and weeds as preventing this growth [W08]. Certain elements such as soil, water, the river and certain species, are life-supporting elements; whilst the interactions with the built environment and some of its negative effects such as compacting and industrial contamination, as preventing growth [W07]. Living with signs of abandonment, however, was also part of these environments, with “...the sense that there are all these sort of industrial degraded areas that are being reclaimed by plants” [W08], or that “piles of rubble and other unknown material were making the site in a particular kind of way, more wetter” [W04], or with rubbish like “...aluminium cans and chunks of PVC pipe, there's an entire bed head, which was kind of interesting, and that's embedded in the organic garbage. It's like a weed” [W06].

Study sites that included rivers or nearby waterbodies showcased both niche creation and encounter-interaction. Rivers were seen as agents in themselves and as having agentic forces. Sometimes as a threat, with the agency of the river causing conflict and disturbing the thriving of human-nonhuman species: “[t]o me the creek is a kind of a menace, really [...] It's [a] polluted thing that sometimes rises and wrecks what we're trying to do” [W08]. However, when the river is able to flood and extend itself, it is able to support much more wildlife [W07]. But niche creation and encounters-interactions went beyond river systems and extended to notions of water as a vital force that continuously shaped the landscape and arguments for water to be allowed to flow freely and adapt to the site, functioning as water retention places, as a rising force [W02] and the interaction of water with abandoned sites to shape each other into the future [W01,02,07,08]. Like water, long-lived intergenerational beings such as River Redgum trees were perceived as having powerful agencies which allow them to experience the landscape “like a history book”, revealing its spatial-temporal changes and transformations [W07].

Vulnerabilities: (il)legality and misrecognition

Vulnerabilities, threats, impacts and risks to individuals, species and social-ecological communities were identified as barriers to multispecies flourishing in these novel ecologies. Being vulnerable to land use changes, and having unclear boundaries and ownership, often leads to contestation with little room to consider the lives of nonhuman beings inhabiting these spaces. A first understanding of vulnerability came from the idea of displacement and erasure. This was evident through underlying conflicts and ambiguities around notions of ownership and land-use regulations at each site where the workshops were conducted. Ownership was expressed by participants, particularly in locations like Melbourne and NYC, as a deep-rooted problem that promotes focusing on self-interest and suppressing consideration for multispecies collectives. These conflicts, tensions, and trade-offs between urban development needs and the formation of novel ecosystems emerge primarily because these spaces are not recognized as NBS or as having social-ecological value in their present form. This misrecognition, stemming from environmental governance and legislation and the public, in general, ends up creating narratives of (il)legality—what is allowed and expected to “be” in a space. Thus, who “owns” the space and under which legislation and governing authority dictate how life unfolds in these spaces. An abandoned parking lot in Ireland was a site sitting between different ownership statuses, positioning it in a space of ambiguity between legal constructs of private ownership and the river and its edges, considered a commons [W01].

Vulnerabilities were also conveyed from misrecognitions that highlighted the time span of living beings. While some species were revered for their life spans, with long-lived species considered “majestic” [W01] and “wise” [W08], fast-lived species did not seem to have these recognitions—unless they were pollinators. Fast-lived species, like the ones typically found in novel ecologies, such as *Taraxacum officinale*, *Artemisia vulgaris*, and *Plantago* spp., because of their abilities to withstand harsher and more inhospitable environments, were recognized as being a manifestation that matched the reality of anthropogenic, novel habitats. Time was also viewed as a vulnerability from an intergenerational sense. The loss of species and ecosystems was also tied to the fragility in which these ecologies always seem

to be, which is in a state of transition, and ultimately, loss. Participants reflected on the sadness that arises when considering the loss of access to these species, particularly in relation to the experiences that children can no longer have in these spaces. This was related to accessibility and knowledge exchange because “... if you don't have access to these things, there's no one then showing you the things that they used to do as a child. And it all just gets erased.” [W04].

Multispecies capabilities to promote the agency of living beings

Preserving and promoting the agency of living beings in realizing the species-specific forms of life that are natural to them was identified through four actions: gentle management, pedagogical engagement, novel habitat enrichment, and the creation of new legal protections. Firstly, a strategy expressed by participants was to adopt a gentle management [W01] or a mindful management [W03] approach that allows species to be, giving them space to exist, with some degree of “in between management”. This could take the form of “not weeding as many dandelions, gentle pruning—some of the heavier stuff needs to be cut so some of the lighter stuff can grow—thin it a bit” [W01]. Sometimes this was expressed as a separation between people and what was considered “natural” with a group expressing the need to “leave it alone or semi-managed, keep people separate to make sure that certain species like children and dogs don't get into areas” [W05]. Interestingly, this expression of gentle actions was also expressed through strategies of slow replacement in which the role of non-native or invasive species was recognized as important in the habitat, but with the intention to slowly replace them with native species “because this is what's going to make this place flourish with more biodiversity” [W08]; a less managed space can be helpful and can have benefits but there has to be some level of care and protection [W06]. Participants showcased more radical visions from participants wanting to “give back space” for others to flourish, such as by “abandonment of buildings and space to allow ecosystems to flourish; with notions of science fiction and post-apocalyptic futures” [W06].

This array of opinions, allied by a shared sense of the need for gentle management signals the nascency of thinking on the links between ecological novelty and multispecies justice. As with many debates in nature conservation^{45,46}, this reflects the fact that deliberations on this topic are positioned within evolving value frameworks that are inherently interwoven with unfolding debates at the intersection of conservation science and practice. At this fledgling stage in public conversations about novel ecosystems and MSJ, this diversity of views should not so much be seen as conflict as the airing of ideas on what should be teased out as the twinning of these concepts develops into an intervention agenda. Accordingly, the exchange of such perspectives offers an opportunity for deep learning as the reasoning of others prompts reflection on one's own opinions. Conducted in the cordial fashion exhibited in the workshops, this can facilitate a spiral of collaborative re-learning as participants share thoughts on what was seen, said, and experienced in the walks, storytelling, and role playing game.

Increasing ecological knowledge and awareness through pedagogical engagement as a capability for multispecies flourishing was another key action and recurrent theme expressed throughout all workshops. Engagement, bringing people back to these sites, and showing messy and scruffy ecologies were some of the challenges highlighted for raising awareness. Novel ecologies were also seen as pedagogical spaces, with them becoming demonstration sites [W01/W02]. Although education might seem like a human-centered activity, as participants reflected on their story of a family of wombats and their entangled lives with other species, ecosystems and humans, they highlighted the importance of childhood education and fostering stewardship and ecological knowledge for action, and as such their story reflecting multispecies entanglements in light of climate change and disasters [W06]. Creating a pedagogical landscape to enable multispecies capabilities to flourish also highlights interconnectedness and interdependence, “in which people, wildlife, technology, and infrastructure are part of the landscape” [W05].

Enriching the health, wellbeing, and integrity of novel habitats was the third point of action, in which participants understood river systems and

novel landscapes as entities in and of themselves. A baseline for multispecies flourishing was understood across regions as the need to improve relations of co-existence which would create a base point to allow species to adapt to the local context and climate. This included moving from actions of control to actions of co-existence and working with the river to allow its species to flourish and adapt to an uncertain future, including a hotter climate [W07]. This climate and species-needs adaptation was expressed as “recognizing and adapting to [a] sustainable management regime to the changing climate, and the species lifespans and how that's changing. So being more adaptive to that.” [W07]. Participants in Melbourne gave an example: brown butterflies live a short life, it would be good to provide them with a habitat that is enriching for them, where they can lay their eggs, eat and reproduce, such as wildflowers [W08] and in Ireland as enhancing capacities in water retention; water as a vital element, making the sites as sponges [W03].

Finally, participant discussions from workshops in Melbourne, NYC, and in Ireland revolved around creating new legal protections for these local ecologies. This was proposed as an approach that could create multispecies capabilities. “The legality of things and regulatory frameworks and how they can also be protected, just as we protect and put into law and constitution so many things” [W08] was considered critical for many participants. The idea of community agreements, policies and political agendas was suggested as ways to protect contested sites, such as the abandoned lot in NYC [W02]. This could take the form of “...legislation [that] will allow for space and protection for dynamism within the space” [W02]. Developing protections that “protect the creek from development, which will protect the water supply and make the river ecosystem more resilient to climate change [W08]. Clarifying space ownership could provide better ways of managing the contestation of space. For example, “a community garden or to manage certain areas or friends' groups might work across it. It might be council and then a bit of VicTrack and a bit of... but it'd be interesting because I don't know who would get a permit to get volunteers working right next to a railway. It would have to be a paid role and you'd have to fully go and rip it out and stuff.” [W06]. This also highlights the different actors, agencies and formal/informal arrangements all interacting with these spaces. Finally, and more radically, participants in Melbourne discussed “centering our governing bodies and systems through the lives and needs of other species, like the trees which live for hundreds of years” [W08].

Discussion

Using the CA to understand multispecies justice has given us a tool to explore how novel ecologies and the people entangled with them can help us reframe this emerging nature. As a framework for multispecies development, the CA emphasizes the promotion of wellbeing and multispecies flourishing by enabling humans and other beings to realize their functionings by having opportunities, freedoms to express and enact their “beings and doings”. Enabling capabilities for multispecies flourishing, as we have explored through the embodied and relational processes in the workshops, can assist NBS in cultivating spaces for discussion or consideration of multispecies thriving. This can further be advanced by recognizing and improving our knowledge of other species agencies and integrating this into NBS thinking—planning, design and implementation. In the context of novel ecologies, in the following propositions, we discuss how this can be accomplished:

Implement a “shared vulnerabilities” framework to plan NBS

This research showed that different dimensions of vulnerabilities are key to identifying processes and outcomes that can be unjust. In his work with capabilities and climate change, Schlosberg⁴⁷ (p.458) offers us a practical framework for mapping local vulnerabilities to climate change which “can help us understand the expected environmental impacts and the threats to basic human capabilities that rely on the continued functioning of environmental processes and conditions.” This provides a practical guide to identify risks, disadvantages, and threats at the local level. If we expand our understanding of vulnerabilities as a shared space of relational impacts, shared vulnerabilities across living beings and communities⁹, we can then

start to imagine collectively ways to adapt, repair, and minimize damage, displacement, and suffering. NBS planning tends to focus on environmental benefits and ecosystem services but often overlooks their crucial role in vulnerability reduction or amplification^{48–50}. NBS can find inspiration in applying a “shared vulnerabilities” approach to examining injustices, both in process and outcomes. NBS can integrate relational models for measuring and mapping “shared vulnerabilities”. These models can use existing frameworks that assess vulnerability of social-ecological systems in which threats, vulnerabilities, and adaptation capacities are understood as interconnected variables^{49,51}, and account for multiple exposures⁵², but with a deeper framing that moves beyond understanding ecological systems as providers of ecosystem services. Rather, detailed local assessments of multispecies capabilities can be integrated into these models to account for shared impacts and responses.

Recognize novel ecologies as pedagogical landscapes to bridge MSJ and NBS

Novel ecologies offer an opportunity to examine and advance our understanding of (in)justices in urban landscapes for several reasons. Harms or injustices occur when there is a combination of power dynamics and interests that exert domination, render invisible, and misrepresent⁵³, and this is particularly relevant when looking at the transformation of ecosystems through different socio-economic processes that displace and eradicate the lives of the Other, both human-nonhuman beings¹³. These processes create spaces that are abandoned, deemed as wastelands, and forgotten. With the use of an embodied methodology, through this research, we have shown that it is “possible for the Self to deepen connections with Distant and perhaps even Unknown Others and to begin to grasp the Others' identity, experience, vulnerability, and suffering”¹³ p.284. These unloved others⁵⁴, thus, can function as a bridge to connect NBS with multispecies justice thinking.

When looking at urgent challenges in cities—like water scarcity, extreme heat, and other events, and their compounding and relational impacts and effects on justice, NBS needs to broaden its scope to both: include more-than-human thinking³, but also shift its focus on protecting only landscapes that are deemed ecologically significant and/or restoring areas based on ideals of historical ecologies. Anthropogenic, novel ecosystems containing novel assemblages are passive, resilient, low-cost solutions that can be part of NBS. These marginal ecologies offer alternative opportunities to address these global impacts, and focusing on the capabilities of these passive ecosystems that are already working can offer insights into how NBS can become a more “comprehensive” approach to these challenges. This aligns with similar work that highlights the value of novel ecosystems for their potential to address certain challenges: climate change impacts, supply a series of ecosystem services, provide habitat for biodiversity, including threatened species, and serve as a platform for social-ecological experimentation and enhancing multispecies justice^{38,42,55–59}.

Link capacities, traits, and systemic circumstances

Using life history traits (key factors—such as growth rate and size—that affect a living being's survival and reproduction ability) both for articulating and relating to the otherness of other species and using it to ground and further the capability approach to multispecies justice is still in its infancy. The functionings and capabilities are captured and specified by species-specific traits (e.g., specialized beak of a hummingbird), and the growing information about traits can be used to understand what may constitute an opportunity for who. We see potential for the two perspectives to frame and extend each other's applicability: The work on functional traits helps articulate the otherness and needs of other species, thus providing a much-needed ecological grounding to the capacities, whilst the CA affords an extended discussion about how to think about past, current and future species assemblages. It also establishes a connection between traits and agency, which has been mostly implicit or given an evolutionary meaning in the traits literature. The stronger ecological foundation may help address the still unresolved questions of what “fair

opportunities” may mean when life (defined by traits), is always constrained by environmental circumstances.

Plan and design NBS as creator of capabilities

We found that a recognition of agencies, vulnerabilities, and capabilities of living beings in novel ecologies challenges perceptions and awareness of NBS by helping us rethink the way we relate to “abandoned” or so-called wasted sites in our urban regions. NBS can therefore be understood as *creators of capabilities*: thinking how NBS design interventions can be assessed in terms of human-non-human capabilities (i.e., access to valuable functionalities). This can be for example, through the recognition of more-than-human socialities⁴³, thus creating environments that enable other species to have spaces of engagement, nourishment and sociality. Tsing’s arts of noticing⁶⁰ as a strategy “to appreciate the multiple temporal rhythms and trajectories of the assemblage”⁶⁰ (p. 24) can be an awareness-raising strategy for NBS. Just as NBS initiates participatory and democratic processes with diverse human stakeholders to understand their preferences, values, needs, and capabilities, it can explore and develop new platforms that enable communicative human-nonhuman animal relationships or inter-species communication. This can be done through creative/theoretical ways such as exploration of future fictional futures⁶¹ and improving our knowledge of the needs, vulnerabilities, sufferings, and aspirations of Others, expanding beyond the animal, and considering plants, fungi, and ecosystems. NBS can also work toward embedding intergenerational capabilities in NBS processes. Integrating intergenerational, evolutionary capabilities – as the ability to change or continue into the future—would require considering the lifespan, environmental conditions, projections, and vulnerabilities of multiple beings.

These strategies can cultivate a unique ethic of care, empathy, and understanding of more-than-human worlds and needs. A deeper engagement with an ethic of empathy and compassion that includes the discarded, the unloved, and the stray⁶² provides some guidance to help us navigate the complexity of NBS planning within an MSJ framework. Rather than guided by a technocratic or instrumental framing such as the ecosystem services⁶³, the CA moves away from economic metrics, and instead accounts for shared vulnerabilities and deprivations, looking into the future to cultivate opportunities that allow more-than-human agencies to thrive and flourish.

In conclusion, our work uses the CA framed under a multispecies justice understanding to explore how urban novel landscapes or marginal ecologies provide barriers and opportunities for enabling multispecies capabilities when planning NBS. We examine how an exchange of ideas structured by methods designed to stimulate empathy, relationality, and an embodied understanding of species perspectives elicit deeper meanings through reflection and co-learning that enhance our appreciation of what a focus on capabilities can offer to urban biodiversity conservation, particularly when looking at marginal, novel habitats. Additionally, we identify and unpack how key dimensions of NBS planning, design, and conservation in cities can apply multispecies justice considerations in realizing these. This work does not provide measurements or assessments of capabilities but rather offers new interpretations of how thinking in terms of capabilities supplies scope for identifying synergies between multispecies justice and NBS. Organized around a series of theoretically informed workshops, the research findings reported in this paper emphasize how such participatory methods can be mobilized to prompt, probe, and propose new ways of understanding nature and our relationship with it. By expanding who/what counts as part of the moral community, these methods help reframe what conservation is and could be. This calls forth new decision situations and considerations as the marginal, forgotten, and often disliked spaces of our cities are reconceived. New geographies of meaning are thereby kindled wherein spaces such as “waste ground” are transformed into “novel ecosystems” that provoke ethical reflection previously eclipsed by development agendas. This unlocks opportunities for the identification of NBS interventions as bridges between expanded understandings of conservation and justice in designing and managing the built environment.

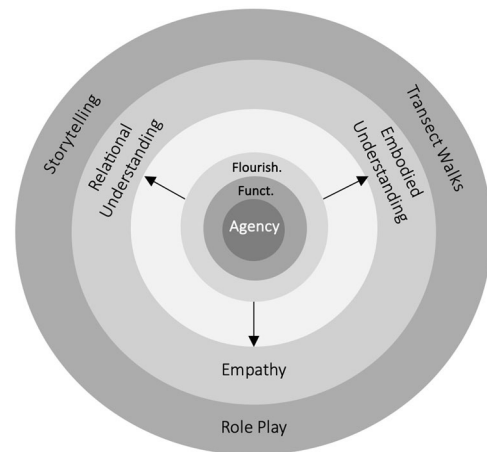


Fig. 2 | Conceptual diagram relating the capability approach to a MSJ research approach. This diagram illustrates the approach to operationalize MSJ through the biocentric understanding of the Capability Approach. Embodiment, relationality, and empathy—essential practices of MSJ—are methodologically explored through transect walks, storytelling, and role-playing.

However, our approach is not without its limitations. Notably, empathizing “with” species experiences is not experiencing “as” species⁶⁴. Seeking appreciation of how nonhuman others may perceive their environment via storytelling and role play is thus an inherently imperfect endeavor. Nonetheless, we contend that these methods prompt a curiosity in striving of non-human life that encourages a moral sensitivity to what a multispecies justice might entail. By inducing reflection on what conceptions of “nature” matter, this approach facilitates dialog on how to exploit and create policies and designs that rethink the nature of our cities by rethinking the natures within them. Doing so can help foment new constituencies among the public, politicians, and professional practitioners to effect change.

Methods

This study used an embodied methodology grounded in the Capability Approach (CA) as well as different theoretical-methodological strategies to cultivate a process of co-learning and understanding^{65–67} (see Fig. 2). While traditionally focused on human well-being, the CA has been expanded to consider nonhuman species, emphasizing sentience, intrinsic value, and the innate drive of all beings to flourish. Using this as both a conceptual lens and methodological foundation, eight participatory workshops with seventy-seven participants were conducted at sites characterized as novel ecosystems in the cities of Australia ($n = 3$), Ireland ($n = 4$), and the USA ($n = 1$).

We intentionally situate this fieldwork within urban novel ecologies—self-sustaining ecosystems that emerge with little or no human intervention—in cities worldwide. These urban ecosystems are often described as vacant, derelict, and host to novel ecosystems (i.e., ecosystems that have been significantly altered by human activity and now exist in new, self-sustaining forms). We consider these ecosystems to be a passive type of NBS, and for this study included river margins, railway corridors, and abandoned and “in-between” spaces in multiple urban locations (see Fig. 4). Given the emergent nature of these spaces, it provides a space to explore how nonhuman beings enact their agency, with little human intervention and control, and flourish and shape these ecosystems. The fact that they host nonnative species, in many cases “unwanted” (labeled as “invasive” species), also offers opportunities to explore how participants reflect on multispecies interactions and the intrinsic value of non-human species in these novel urban habitats.

To facilitate co-learning, relational thinking, and deeper engagement with each site, participants engaged in sensory, experiential, and reflective activities to immerse themselves in urban novel ecologies, observe



Fig. 3 | Photograph depicting one of the workshops conducted in Dublin, Ireland. This site is adjacent to the National College of Art and Design, Dublin 8, Ireland. It is called “The Field” and has been transformed from an abandoned parking lot to a

landscape with a novel assemblage of species and ecological functions. The photograph contextualizes the types of novel ecologies the research focuses on. Author: M. O'Donnell

interspecies interactions, and explore spatial dynamics (see Fig. 3). Through transect walks, they physically experienced these environments, fostering a direct connection with place. Storytelling provided a means to share personal and collective narratives, deepening relational understandings of urban ecosystems, while role-playing encouraged participants to adopt the perspectives of nonhuman species, cultivating empathy and awareness. They fostered reciprocity, care, and responsibility toward shared spaces, recognizing the interconnectedness of humans, places, and nonhuman beings. The study assessed whether these embodied approaches could shift participants' attitudes toward more collaborative, empathetic, and inclusive planning practices that actively consider multispecies perspectives in urban design and planning.

Each workshop brought together diverse local stakeholder groups (see Fig. 4), including communities of practice (e.g., urban planners), epistemic communities (e.g., academics), and interest groups (e.g., residents)⁶⁸. By incorporating diverse perspectives and activities, the workshops provided a collaborative platform for stakeholders to identify the lives of other species, how these ecologies have been formed, and what a multispecies future could look like. This aligns with relational approaches to sustainability transformations that recognize the value in the distinct lifeworlds in “sharing spaces”⁶⁹, potentially able to generate paradigm, policy and practice shifts in green space planning. These workshops also foster an understanding of the novel ecosystem's cultural and relational significance, building empathy toward other communities and non-human species through participatory methods such as storytelling and role-playing^{15,70}. Providing participants with the opportunity to assume other roles and reflect on how to “walk

together in a world of many worlds”⁶⁹ provides a safe space to help advance the quality of decision-making⁷¹, where the future is imagined not only from a social and cultural needs perspective but also considering ecological integrity and the capabilities and agencies of non-human beings.

Embodied activities

The workshops implemented a series of interrelated activities that included: 1) following through walking⁷², 2) sharing and imagining through storytelling as co-learning, and 3) role-playing to de-center our positionalities and understandings of the world (see Fig. 4). The activities were identified through a systematic literature review on co-design⁷³ and chosen based on their role for sympathetic imagining which challenges perceptions, attitudes, biases and allows participants to reimagine the agency, abilities, needs and aspirations of other species¹⁴. These embodied practices encouraged openness, curiosity, and critical self-awareness of others' functionings, vulnerabilities, needs, and opportunities to enhance multispecies livelihoods. These types of methodologies encourage acts of attentiveness⁴⁴ and of cultivating ecological empathy—through embeddedness, fostering more-than-human awareness and perspective-taking across multiple timescales¹⁵. It fosters attitudes of reciprocity, recognizing the interconnectedness between human and non-human beings. Such shifts in attitude may promote deeper collaboration, nurturing care and responsibility towards shared spaces⁶⁹, and cultivating more inclusive and relational ways of understanding and caring for urban ecosystems⁷⁴. The workshops followed the same format throughout each of the locations, however, the species assigned to participants during the role-playing exercise altered, as these “roles” were based

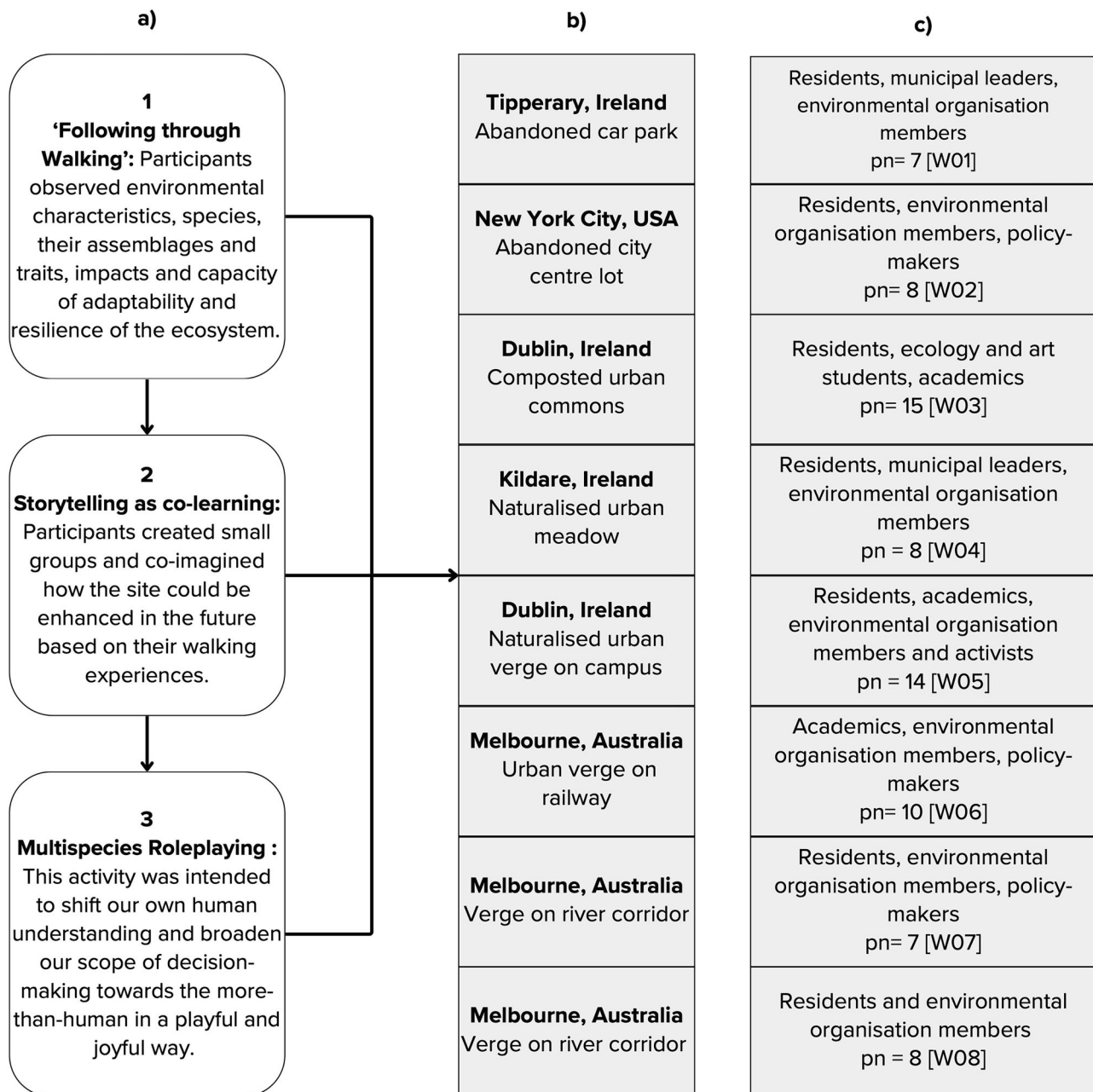


Fig. 4 | Workshop design: activities, locations, and participants. This figure describes: **a** the three activities carried out in the workshops, “following through walking” or transect walks; **b** the location and type of novel ecosystem in each

location; and **c** participant composition, number of participants (pn) per workshop, and the workshop identifier (W01–W08).

upon the participants' interactions during the walk section of the workshop and the human-nonhuman relations that emerged through subsequent discussions.

The first activity consisted of “transect walk” or following through walking practice through a novel ecosystem to observe and experience the wild, spontaneous, and other life forms and characteristics that emerge. This embodied approach allowed participants to understand “*that when experiences are directly inhabited, they produce different meanings and “situated knowledges”*”⁷⁵. Participants were provided handouts with prompts to assist in immersing themselves within the spaces, such as identifying species and environmental characteristics, to try to notice the sensorial aspects such as smells and textures, and to reflect on opportunities and challenges to be discussed as a group following the walk. The second activity consisted of reflecting on the experience of walking and

sharing of participants' feelings and behaviors, and identifying other nonhuman species and elements that formed part of that experience. This then led to a co-learning activity that involved a storytelling exercise. Storytelling offers insight into history, values, knowledge, and culture while encouraging participants to reflect on these elements and engage in forward-thinking⁷⁶. Using a “nature-based desired futures” approach “offers space for reflection, creative exploration, and weaving together of new, hopeful, caring, emancipatory stories”⁷⁷.

The third activity consisted of a role-playing exercise in which participants were asked to imagine how their stories from the previous activity were experienced and enacted not through their selves, but through the experience of another species. Games are widely seen as effective tools for social learning, enabling us to acquire new knowledge and perspectives to affect social-ecological transformations⁷¹. Each participant was assigned a

species identified during the walk, e.g., a particular plant or animal (including human). A round table discussion was then held, and participants were asked to explain their roles, needs, and aspirations in their environment and together collaborate by highlighting interactions and relationships between them and charting future pathways for the story they imagined. To finalize the workshop, we all reflected on the research process, the different activities, how they related to each other, and if there were any learnings or new understandings that had emerged. Each 2 h workshop consisted of 7–15 participants recruited by identifying researchers engaged with local novel ecologies in the different cities and by identifying groups interested in novel ecologies. This assisted in the identification of local sites and inviting participants. At all study sites, workshops were organized with the assistance of local gatekeepers and leaders, mostly from local universities, and community, and environmental organizations. Though working with local gatekeepers or leaders can present challenges, such as limited access and longer research time frames⁷⁸, building these relationships with them was vital to our research process. Given local leaders have an established level of trust within their communities, this was a useful strategy to engage participants in our research process.

Approach to data analysis

Each workshop was fully voice recorded and manually transcribed. In addition, participants made written records of their experiences during the walks and storytelling activities. The researchers facilitating the workshops took notes on observations throughout each of the workshops. All this data was collected, systematized, analyzed, and coded through an iterative process using both deductive and inductive approaches (See coded data in SM1). The purpose of using a deductive approach is that it provides a framework or “start-list” that anticipates certain concepts being in the data aided by existing theory and the research aims and questions⁷⁹. For this analysis, we used a start list with core concepts such as functionings, agency, needs, abilities, and opportunities. However, this analysis is not only a top-down, theory-driven process, but it is also iterative and uses an inductive or bottom-up approach in which the data creates new meanings through a detailed analytical process of coding the text as themes and concepts emerge^{79,80}. Using this two-way process provides a starting framework to understand the data, but also ensures that important and critical meanings are not missed or obscured from initially looking at pre-existing themes⁷⁹.

Similar concepts were then collapsed into similar categories to make the data set manageable and identify relationships between second-order and higher-level themes⁷⁹. (See SM1, Tables 1–3 for the coded data, sub-themes and categories). The Supplementary Material includes 3 tables which correspond to the three workshop activities: 1) activity 1 (walk): coded data into second-level subthemes (e.g., “species being and doing”, species interconnections, and function of space) and higher-level themes (e.g., more-than-human agencies), 2) activity 2 (storytelling): coded actions to improve human-nonhuman relationalities and creating opportunities for multispecies flourishing, and 3) activity 3 (role-playing game): coded to identify functionings and potential opportunities (capabilities) for multispecies flourishing. The initial coding was conducted by the lead author, and the following inductive iterations of the data analysis were interpreted and re-interpreted through reflective discussions amongst all authors.

Data availability

Coded qualitative data is provided in the supplementary information files.

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Author contributions

M.P.P.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing—original draft, Writing—review & editing. M.L.: Conceptualization, Validation, Writing—original draft, Writing—review & editing. C.K.: Conceptualization, Validation, Writing—original draft, Writing—review & editing. M.O.: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Writing—review & editing. E.A.: Conceptualization, Writing—original draft, Writing—review &

editing. K.W.: Conceptualization, Writing—review & editing. M.J.C.: Conceptualization, Writing—review & editing.

Competing interests

The authors declare no competing interests.

Additional information

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