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Education

Language matters for biodiversity

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Abstract

Language is central to the way people learn about the natural world. A salient concern of the biodiversity conservation arena has been to understand how language can be employed by scientists to communicate knowledge to nonexpert audiences and build ecological literacy. The use of analogy and narrative by scientists are prominent techniques. In this article, we consider how these two modes of language-based reasoning extend into ordinary conversational language use by the public, specifically when articulating everyday understanding and experiences of biodiversity. Drawing on a process of public engagement in a UK woodland environment, a typological framework based on principles of analogical and narrative reasoning is developed to characterize the precise character of processes of everyday biodiversity sense making. The implications of the framework are discussed in the context of future biodiversity research, particularly its participatory and educational dimensions.

Keywords: analogy, biodiversity, language, learning, metaphor

Language is fundamental to the process of human cognition (Berwick et al. 2013, Lupyan 2016), so it follows that language provides one essential basis from which reasoning and sense making about the natural world occurs. It is through language that people's experiences of nature are processed and represented in thoughts, and knowledge of nature is constructed and communicated. Understanding how people reason about nature through language can therefore provide insight into the way learning in the biodiversity conservation arena occurs and how learning environments might be enabled to excite interest, captivate imaginations, and inspire commitments and action.

Much of the scholarly interest in language-based reasoning among biodiversity conservationists is in the practices of experts. Most notably, the formal properties of language and its various contexts in scientific and everyday use are subject to concerted—although implicit—attention and scrutiny in the design and evaluation of science communication strategies as part of broader efforts to deepen ecological literacy across civil society (Novacek 2008, Kahan 2010, Bickford et al. 2012). From this vantage point, language is more than just a mechanism to describe a ready-made world. It is a sense-making process that frames and constructs perceptions of nature, shapes values and beliefs about it, and drives environmental behaviors. How language is crafted and used is therefore a key concern of the scientist (Kueffer and Larson 2014), because it potentially serves to ground abstract knowledge in discourses that resonate across civil society and enables people to think and act in desirable ways depending on the role or identity they are assuming—that is, as leaders and decision-makers, as consumers and economic agents, as families and household units, and as citizens and members of communities. Indeed, when scientists write of effective communication, they are tacitly recognizing the social power invested in words (Weil 2020).

There are two prominent, often connected, ways in which language-based reasoning is used to build understanding of scientific knowledge among wider audiences; however, both of these have been subject to critique. First, scientists frequently draw on analogies to help people make sense of nature, using figurative language to build understanding through comparison (Dunbar 2000, Brown 2003). Researchers have specifically examined the analogical dimensions of popular and public-facing science and policy discourse on the environment, especially the use of metaphors. For example, biodiversity declines have been likened to the conflagration of the Great Library at Alexandria (Sayre 2017) or a bioholocaust (Valiverronen and Hellsten 2002). Such metaphors exert their influence culturally but can be out of step with prevailing scientific wisdoms or can obscure scientific nuance and complexity (Ball 2011, Larson 2011, Olson et al. 2019). For instance, Ladle and Gillson (2009) explained how science has increasingly asserted a flux of nature metaphor to characterize ecosystem dynamics, one distinct from the more established and popularized idea of a balance of nature. As Trudgill (2001) argued, metaphor choice is not only culturally significant but deeply value laden and, therefore, open to ethical interrogation. In this vein, recent work in the field of invasion biology has highlighted the way that militaristic metaphors (e.g., a war on invasive species) shape wider perceptions of scientific research and researchers often negatively—for example, implying a xenopho-

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bic stance (Larson 2005, Herbers 2007, Taylor and Dewsbury 2018, Janovsky and Larson 2019). This has led to calls for responsible metaphor management as fields of scientific knowledge integrate into policy, practice, and civil society, recognizing that language choices matter and necessitate reflection (Verbrugge et al. 2016, Kohl et al. 2020).

Second, language is used to build understanding of scientific knowledge through the enactment of narrative, with many analogical devices themselves dependent on a larger narrative frame. For instance, the metaphoric power of appeals to the conflagration of the Great Library at Alexandria is drawn from the recounting of events that form a wider historical narrative. From the oral transmission of ancestral sacred stories about land and environment in the aboriginal cultures of Australia (Chatwin 1987) to the parables of nature in the nineteenth century gothic horror novel (Hammond 2004), sources and forms of narrative are, of course, multiple and diverse within environmental discourse and are important repositories of cultural knowledge. Narrative-based science communication provides a further venue for this universal human practice, an enduring feature of which is to construct causally connected sequences of events from which a substantive scientific dilemma or conflict can be addressed and, to varying extents, resolved (Cobley 2013).

Crucial to the practice of storytelling, the process of narrative construction is viewed by communication scholars as a dynamic tool by which the complexities of scientific information can be rendered meaningful across diverse audiences (Rowcliffe 2004, NASEM 2017). This dissemination model of narrative can be understood to reflect the Western and Eurocentric provenance of science communication, implicitly reinforcing problematic distinctions between knowledge and storytelling not found in other cultural and historical contexts (Orthia 2020). As such, research has shown the way different narrative techniques, such as plot design, causation, and characterization, can be interpreted as forms of persuasion—that is, promoting acceptance of particular ideas, to the extent that storytelling has "a bad reputation within science" (Dahlstrom 2014: 13,614). Although the narration of science may well excite the interest and attention of nonexpert audiences, narrative can be viewed as partial and nonobjective, creating a paradox for scientific researchers—namely, "How can science preserve its credibility as curator of knowledge while engaging audiences with a communication format that is agnostic to truth?" (Dahlstrom and Scheufele 2018).

Overall, the implication is that although practices of analogical or narrative-based reasoning invite lay audiences to find greater meaning in scientific knowledge, these techniques are also tools to influence and popularize, potentially coming at the cost of appreciating the deeper complexities and ambiguities of scientific knowledge production and, at their worst, practices tantamount to propagating fictitiousness, lies, and falsity within scientific practice. For Kueffer and Larson (2014: 719), this situation was symptomatic of an increasingly competitive and congested marketplace for ideas, such that scientists now find themselves inclined—if not compelled—to adopt marketing-inspired strategies "to get their message across."

However, such discrepancies between scientific practice and language-based reasoning can be overstated. Analogy and narrative are not only tools for curating and communicating knowledge but are also epistemic devices for producing, organizing, and advancing knowledge, a point well established in the study and valorization of alternative knowledge systems (Varghese and Crawford 2021) but also in accounts of scientific practice itself (Kuhn 1979, Raymond et al. 2013, Morgan et al. 2022). As such, the issue is not how to protect science from the apparently distorting effects of these modes of reasoning but, rather, how to recognize and harness them as critical resources for learning, experimentation, and collaboration among those without scientific training or interest in the products of scientific knowledge production. Or to put this another way, through the enactment of analogical or narrative reasoning, we are provided with two crucial ways in which expert and lay learning about nature converge.

In the present article, we wish to counterpoint this scholarly emphasis on experts with a focus on conversational language—that is, on language expressed through ordinary lived experience. Building from the assumption that language is a sense-making process from which phenomena in the natural environment are invested with meaning and significance, we specifically explore how the features and attributes of biodiversity make sense to people through these processes of analogical- and narrative-based reasoning and the generalizable elements of those reasoning processes that may have utility for biodiversity education and biodiversity conservation.

In pursuing these goals, we follow the long-standing interest of environmental scholars in understanding the role of alternative knowledge systems—variously described as *traditional*, *lay*, indigenous, and *local*—in contextualizing, informing, and indeed sometimes disrupting scientific wisdom about and framing of environmental phenomena (Johnson et al. 2016, Lam et al. 2020). We also follow the concerns of the divergent field of ecolinguistics, where the broad focus is to understand language use not only as a property of living systems but as an agent of everyday discourse with real environmental effects (Chen 2016). A key preoccupation of this field is to employ critical discourse analysis to understand how everyday communication, in a variety of linguistic manifestations (e.g., the popular media, policy discourse), shapes and reinforces the "stories we live by" (Stibbe 2015: 183). One distinguishing concern of this scholarship is to critique and transform the linguistic basis of discourses that subtly feed environmental degradation. However, in this study, our interest is not in passing critical judgement on the normative content of ordinary language use. Rather, we attend to the contours and patterns of the more capricious and idiosyncratic qualities of language, so as to better understand the way it holds together people's values, knowledge, and assumptions about biodiversity.

We do so thorough a large-scale participatory research process conducted with a diverse public living in England, Scotland, and Wales. Through the analysis and coding of qualitative data from a series of workshop discussions centered on woodlands, we develop a typological framework that characterizes and exemplifies the analogy- and narrative-based reasoning recurring in conversations about biodiversity attributes. The implications of the framework are discussed in the context of future research in the biodiversity conservation arena, particularly its participatory and educational dimensions.

Exploring language use

We held four 2.5-day public workshops during 2019 across the calendar year to encompass seasonal interactions with biodiversity. Overall, we had 194 participants (February, $n = 50$; April, $n = 46$; June, $n = 50$; October, $n = 48$), representing 485 person days. The participants were recruited by a social research agency to maximize the diversity of perspectives. The individuals were recruited from both rural ($n = 62$) and urban ($n = 132$) areas across Britain (England, $n = 173$; Scotland, $n = 11$; Wales, $n = 10$). They varied in age (18–29 years, $n = 59$; 30–59 years, $n = 70$; more than 60 years,

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$n = 59$; prefer not to say, $n = 6$), gender (male, $n = 90$; female, $n = 103$; prefer to say, $n = 1$), ethnicity (White British, $n = 131$; other ethnicities, $n = 60$; prefer to say, $n = 3$) and social grade (AB—higher and intermediate managerial, administrative and professional occupations, $n = 56$; C1—supervisory, clerical, and junior managerial, administrative and professional occupations, $n = 58$; C2—skilled manual occupations, $n = 42$; DE—semi-skilled and unskilled manual occupations; unemployed and lowest grade occupations, $n = 38$). The workshops were delivered in central England to maximize their accessibility from all regions and followed a common process design. The workshops were held at weekends, with participation incentivized by financially compensating the participants for their time in order to reduce the risk of recruitment failure across hard to reach social cohorts. To avoid recruitment of self-selecting participants (e.g., nature enthusiasts, environmentalists), background information on the workshops was strictly limited to include information about its broad purpose (i.e., a research workshop led by a university) and approach (i.e., that participation would involve spending time outside).

During the workshops, an emphasis was placed on learning from the participants about their general reactions to and interactions with British woodlands, as opposed to priming the participants with information about woodlands provided by experts and specialists. Each workshop involved a combination of indoor and outdoor activities, delivered under different levels of direction. The participants were told that the project was focused on learning about public perceptions of woodlands and the animals, plants, and fungi found within them. The participants were divided into five groups, which they remained within for the course of the workshop. They were supported in their activities by a group facilitator, who clarified instructions and structured the discussion, and a technical assistant, who managed the recording of data.

The data were gathered using two techniques. First, they were gathered in group-based discussions, after visits to a broadleaved and a mixed woodland, where the participants were asked to pay attention to what they noticed about these environments and to make a written record of some of the things they encountered in terms of smell, texture, color, sound, and shape. Working alone, the participants were instructed to note their initial reactions—likes and dislikes—to what they observed. Alongside use of their personal phones, the participants were provided with access to instant cameras to record any attributes of interest as photographs. These materials were then used as resources for participant recall in a 1-hour group discussion, led by the facilitator, who prompted the participants to describe and explain in their own words what they had noticed. Overall, this process produced approximately 60 hours of group discussion.

Second, the data were collected using image-based Q methodology to explore preferences for encountering woodland species (see Austen et al. 2021 for more detail). The participants were presented with four image sets to stimulate responses: vertebrates ($n = 32$ species images), invertebrates ($n = 43$), trees ($n = 32$), and understory plants and fungi ($n = 32$). The invertebrate image set was larger to capture the range of diversity within this taxonomic group. The images were presented on A5 cards against a blank, white background to minimize the influence of context and artistic style. The images were selected to embody a diverse mixture of biodiversity attributes, including colors, morphologies, textures, sounds, smells, and behaviors. All of the species were associated with the British woodland and represented species found in different woodland layers (e.g., understory, canopy), active at different times (e.g., diurnal, nocturnal), and linked with ecosystem services (e.g., food provision, pollination, cultural significance). Individual and group discussions were focused on the thoughts and reactions to the species and their attributes. Overall, this process produced approximately 80 hours of discussion, the transcripts of which were uploaded to NVivo (version 12).

During the workshops, the participants were never instructed to interpret and represent their thoughts about woodland biodiversity in analogical or narrative terms. The focus was on what, how, and why people notice biodiversity in woodlands, particularly in terms of what they are drawn to and like or dislike. The presence of analogies and narratives in the participants' understanding of biodiversity was noted informally by the research team during the data collection phase but did not feature within our initial approach to coding qualitative data, which followed what Braun and colleagues (2018) term a *codebook* approach to thematic analysis. In the present study, the data were organized deductively according to different dimensions of human–biodiversity interaction, such as biodiversity attributes (e.g., shapes, colors, behaviors), time (e.g., day, night, season), and well-being (e.g., physical, emotional, cognitive). The final codebook acted as both a set of guidelines by which the text was coded by the research team and a mitigation tool against ambiguity because each code had accompanying descriptions and text examples. The salience of analogies and narrative as themes of potential analysis emerged as the team reviewed the data across these a priori codes. At this stage in the process, several members of the research team noted examples of conversational language that were evidently striking or evocative in their description of biodiversity attributes (e.g., humorous, touching). We consequently searched systemically for all examples of analogies and narratives, grouping and regrouping these into subthemes to form the general framework we describe below. In other words, our specific interest and focus on analogies and narrative emerged reflexively and interpretatively as the cycle of coding, analysis, and theme development iterated (Braun and Clarke 2006).

Analogical reasoning about biodiversity attributes

Varied comparative devices were used by the participants to speculate, explore, and learn about attributes of biodiversity. These included implied and indirect forms of comparison, as in the frequent use of metaphors (i.e., A is B). Direct comparisons were also made, either simply stated, as in the use of similes (e.g., C is like D), or more elaborate analogies with an evident explanatory basis (e.g., A is to B, what C is to D).

In cognitive terms, this analogical reasoning process is based on analyzing the similarities between two domains—a source and a target. In essence, the source domain provides the basis for the analogy. It is a domain of knowledge, understanding, and familiarity used to make sense of the target domain, a domain of doubt and uncertainty (Holyoak and Thagard 1996). In this study, biodiversity attributes represent the target domain. They are the objects of analogical reasoning.

Overall, we found that the participants drew on a diverse repository of everyday social and cultural references to build inferences about the natural world. Our research identified 12 configurations of language that act as source domains in the biodiversity sense-making process (figure 1, supplemental table S1). For example, the wood that protrudes from a tree was a squirrel's "dining table" (analogical domain [AD] 1), the nut in the spiky green shell of the horse chestnut tree (*Aesculus hippocastanum*) was a "Kinder Egg" (a children's confectionary brand) and a "Happy Meal"

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Figure 1. An overview of the 12 analogical domains of biodiversity sense making revealed in the participatory workshops. Each domain represents a repository of everyday social and cultural meaning (source domain) from which inferences about the natural world are created (target domain). For example, under the analogical domain of clocks and timepieces, the phrase *nature's alarm clock* is the source domain for the target domain of the dawn chorus. Likewise, under the analogical domain of animal bodies, the word *elephant* is the source domain for the target domain of tree bark.

(a children's fast food brand; AD2); the tawny owl (*Strix aluco*) had the appearance of a "loaf of bread" (AD3); the dawn chorus was "mother nature's alarm clock" (AD4); the texture of the tree resembled the "skin of an elephant" (AD5); the woodland was like a "cathedral" (AD6); the vertical lines of the silver birch tree (*Betula pendula*) resembled "soldiers" (AD7); the fly agaric mushroom (*Amanita muscaria*) was "channeling some Super Mario vibes" (a computer gaming franchise; AD8); the mushrooms had "fairies" beneath them (AD9); the oak tree (*Quercus robur*) was an "English countryside outline" (AD10); the holly (*Ilex aquifolium*) was "very Christmassy" (AD11); and the sounds of the trees were like "waves crashing" (AD12).

The specific examples that define these analogical domains are perhaps less important than what they indicate about how people give meaning, significance, and value to perceptually abstract, partially noticed, and, in some instances, poorly understood natural phenomena. A key finding is that this mode of reasoning involved four key sense-making processes that cut across the 12 analogical domains.

First, it involves evaluations of ecological quality being made. For example, when the woodland understory was described as "like a carpet" (AD1), it was a positive evaluative statement, based on an aesthetic judgment. When likened to a "fantastic Axminster carpet" (a brand of carpet synonymous with artisanship and luxury), judgments of ecological quality were being further empowered by appeals to cultural taste.

Second, it involves understandings of ecosystem processes being conveyed. For instance, the growth rings of a fallen tree were

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understood as "a clock, a timepiece, documenting the life of the tree" (AD4), whereas the texture of a rotten tree was interpreted as "a bit like when you open a can of tuna. It looks solid, and it looks like it will resist you, but when you put weight on it, it all flakes, and you realize how weak it is" (AD3). Similarly, a tree shedding its bark was interpreted as a metamorphosing process akin to the "Incredible Hulk"—a comic book superhero character—"bursting out of his clothes" (AD8).

Third, it involves wonder and pleasure in nature being expressed. For example, protective plastic packaging was used metaphorically to convey the pleasing texture and sound of walking on leaves in winter: "nature's bubble wrap" (AD2). The meaning of the "Kinder Egg" and the "Happy Meal" (AD2) with respect to the spiky green shell of the horse chestnut tree hinged on the sensation of surprise arising from the small toy found inside.

Fourth, it involves references to the ecological basis of social systems. For instance, metaphors of majesty and grandeur in nature were the basis for assumptions about biodiversity attributes providing inspirations for human design and creativity. Therefore, trees were understood to take on the quality of "Doric columns," whereas woodlands exuded the feel of a "Roman forum" or "a cathedral," informing the practice of biomimicry, because "people have mimicked those natural shapes and tried to order them in architecture" (AD6).

Narrative reasoning about attributes of biodiversity

Whereas analogy alerts us to reasoning about biodiversity using parallels and imaginative allusion, narrative provides a foundation of memory and learning through sequences of events. The creation and recounting of events are the building blocks of stories, which encompass a range of real and imaginary characters and worlds. In the present context, stories are understood as repositories of personal and cultural information that condition, convey, and reproduce particular ways of thinking about biodiversity. Our results revealed four types of narrative.

First, the use of personalized narratives. These were rooted in the encounter between biodiversity attributes and personal memory. In this context, biodiversity functions as an event in wider stories of the self. Microinteractions with nature recounted through experiences of childhood feature prominently. These included embodied and visceral responses to components of nature. For instance, "kicking up" leaves and "climbing" trees were frequently connected with affirmative constructions of childhood and family, such as recalling a formative nature experience (e.g., berry picking with grandparents) or reflecting on the active present (e.g., a parent counting tree rings with his daughter). These narratives were personalized versions of a wider and powerful set of cultural discourses asserting biodiversity and its various surrogates (e.g., countryside, rurality, and nature) as sites and contexts for an idyllic childhood.

Second, the use of popular cultural narratives. These indicated the wider hinterland of cultural stories brought to bear on biodiversity attributes, with reference points in a variety of media and folk knowledge. Allusions to fairies and fairy kingdoms in relation to mushrooms (and specifically the fly agaric) provided a way of emphasizing the cultural allure and fantastical nature of woodland environments. These were made with occasional reference to the mass media and entertainment conglomerate Disney, where woodlands have featured prominently (e.g., the 1959 animation of Charles Perrault's *Sleeping Beauty*), as well as to texts reflecting more specific cultural registers (e.g., Colin Dann's 1979 novel *The Animals of Farthing Wood*, which has a UK focus). These popular cultural narratives are also notable in the way they invited ambiguity and nuance in people's readings of biodiversity. Therefore, components of woodlands were invested with foreboding in the context of the genre of horror, *vis à vis* "The PR [public relations] that [mushrooms] get—you know, 'away with the fairies.' When you see these fairy stories, little fairies underneath. Magical creatures, something magical that takes you to another dimension."

Third, the use of management stories. These concerned narratives of biodiversity arising in the context of wider assumptions about land and habitat management, the events that have shaped and that have continued to shape the setting in which human–biodiversity interactions occur. References to the "manmade" (*sic.*), "constructed," "managed," and "ordered" character of the setting were common. Specific human interactions with attributes of biodiversity were noted (e.g., "the low branches of trees had been taken off") and explained at various scales for significance, from management that is intended to prevent accident or injury for visitors ("health and safety") through to broad characterizations of economic purpose ("commercial") and an associated evaluation of change ("monoculture"). Notably, components of biodiversity were frequently interpreted as the legacy of historical management and shifting demands over time, both within living memory ("planted after the war") and across deeper spans of time ("Hundreds of years ago, people would have managed it, wouldn't they? Because they needed the wood to live.").

Fourth, nature was also constructed as a story in and of itself. With nature as the narrative, woodland environments were rendered meaningful as a setting for an unfolding series of natural events, propelled by their own forces, most notably expressed through temporal cycles of growth and decay over seasonal and generational time (e.g., "It's the circle of life kind of thing, one tree is dead but now these other ones are trying to come from that"). Such cycle-of-life narratives and the sense of drama they evoked intersected with a wider narrative of people's place in a living cycle (e.g., "I've had death in my family this year and the new life of young children and old people dying; it's the whole circle thing, and it's there graphically in front of you. It's just what the tree does in a year, let alone the rest of the forest"). These appeals to life's design were put in conversation with human feelings of insignificance within nature ("the bigger picture") and the ephemerality of human life relative to trees (e.g., "It makes me kind of feel a bit insignificant in a way, because they're there, and they live beyond us!"). The trials and tribulation of ordinary human life were therefore thrown into perspective: The woodland "has been here forever, and it will just carry on… The things we stress about, do they really matter?"

Conclusions

Analogies and narratives are crucial conceptual resources in the process of making sense of biodiversity. Ordinary language use among a diverse public reveals analogies serve to convey assumptions about how nature works, assert judgments about ecological quality, express awe and wonder about processes in nature, and make wider inferences about the ecological basis of human societies. These analogical processes are rooted in a wider set of everyday references that people actively bring to bear on their encounters with biodiversity, from the aesthetics of carpet to the sounds of protective plastic packaging. In turn, these sense-making processes work in conjunction with a diversity of narratives that link biodiversity to deeper repositories of personal experience and cultural memory, from affirmative stories of childhood and fantasti-

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cal constructions of mass and folklore culture, through to stories of human management and life itself. When analogies and narrative converge, we are offered powerful glimpses of how attributes of biodiversity are framed as meaningful and knowable entities. These sense-making dynamics are at the very center of immediate and visceral—in a word, *relational*—nature-based experiences.

It has been suggested that "language must not only be adequate for environmental scientists but must also be socially adequate if the goal is to engage diverse groups in environmental research, decision-making, and action" (Raymond et al. 2013: 537). Although the heuristic, nonexhaustive, and nonprescriptive status of our framework and findings must be emphasized, it is notable how a socially, culturally, and geographically diverse public builds conversational discourse about biodiversity through a common set of analogical and narrative resources. That these resources are enabled by the ordinary everyday worlds of junk food, comic book characters, and interior decoration tells us something important about what it may mean for language to be socially adequate.

In one respect, it is tempting to speculate that, in our respondents' choice of analogies, we see reflected a broader alienation of people from nature in late modernity (Hailwood 2015), an evident disconnection or lack that needs correcting (Soga and Gaston 2016). However, we also contend that these reasoning processes could equally be viewed as potent reminders of humans' capacity to engage and connect with the natural world in terms that exemplify lived experience. Is this analogical and narrative tendency revealed in contemporary publics so radically different from the localized folk taxonomies that have served science so well in the naming, identification, and classification of living organisms (Berlin 1973) or the songlines used in aboriginal cultures to sing the land into existence and chart a map through otherwise unknowable terrain (Chatwin 1987)? Care has to be taken in drawing overly simplistic parallels between languages rooted in deep, stable, and embodied engagements with the natural world and the rather more ephemeral signifiers of biodiversity arising in this study. There is nonetheless the need to understand better how processes of biodiversity sense making take shape in the language communities and lived realities of everyday publics, be that as individuals residing in material locales or as consumers sewn into deeply liberalized commodity chains.

It was noted earlier that reference to narrative and analogy excite interest and concern in equal measure when mapped onto the norms of scientific practice, with one implication being the need for scientists to reflect carefully on the framing devices they use. But such an evaluative need means little in the context of ordinary conversational use of language, where sense making draws on any cultural resources and experience an individual deems necessary to reason about biodiversity. The question is not to seek the correct conceptual framework but to use a diversity of these frames to develop in people the capacity for environmental sense making; as Bell (2006: 66) said, "We make most progress—we learn most—when we work cooperatively to deliberate and discuss new and existing conceptual and metaphorical frameworks and the relationships among them."

The focus of Bell's (2006) point is on sense making among environmental experts, but we suggest that this is true of the sense-making process that occurs more broadly between and across expert and lay discourses of biodiversity. The implicit provocation of this article is that, if we want to appreciate how people understand and reason about the natural world, and assign it meaning and significance to their lives, we must start with the way language is put together and used in these ordinary, everyday, and diverse ways. The framework we have produced was developed in the context of a diverse British public but points to generic categories that warrant testing, elaboration, and qualification across contrasting and divergent cultural and ecosystem contexts and at larger spatial scales. There is also potential to extend the analysis to a consideration of language use across a variety of nonconversational media. Such endeavors would proceed from the assumption that, through attention to language, biodiversity researchers and educators can become more fluent in the values, knowledge, and assumptions people hold about nature. It is time to reengage with what Abram (2006: 273) described as the "earthy intelligence" of our words.

Supplemental Material

Supplemental data are available at *BIOSCI* online.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

Author contributions

Robert D. Fish (Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – original draft), Gail E. Austen (Data curation, Formal analysis, Investigation, Project administration, Writing – review & editing), Jacob W. Bentley (Visualization, Writing – review & editing), Martin Dallimer (Conceptualization, Funding acquisition, Investigation, Methodology, Writing – review & editing), Jessica C. Fisher, Katherine N. Irvine (Conceptualization, Funding acquisition, Investigation, Methodology, Writing – review & editing), Phoebe R. Bentley (Investigation, Writing – review & editing), Maximilian Nawrath (Investigation, Writing – review & editing), and Zoe G. Davies (Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing).

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