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Exploring the ins and outs of biodiversity in the moral community

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ABSTRACT

If moral concern for nonhuman nature underpins conservation, it is essential to understand how individuals populate their "moral communities," a core concept from environmental ethics, with various elements of biodiversity. Using data from an online survey of the United States public ($N = 1331$), we investigated the extent to which respondents' moral communities align with four worldviews discussed in the environmental ethics literature: anthropocentrism, zoocentrism, biocentrism, and ecocentrism. Each worldview provides a vision for how the moral community should be constituted. To assess inclusion in terms consistent with ethical theory, we measured whether and the extent to which respondents included abstract sets of entities (humans, sentient/subjective entities, living organisms, entities with vital interests). To assess inclusion in terms relevant to conservation, we measured whether and the extent to which respondents included specific kinds of entities within those sets (e.g., Americans, cougar, fungus, rainforest ecosystem). Roughly half the sample could be affiliated with anthropocentrism, zoocentrism, biocentrism, or ecocentrism, but these respondents did not always include the specific entities they were expected to include based on ethical theory. However, respondents with more inclusive worldviews did believe more entities are included in the moral community, and also professed those beliefs more strongly than respondents with less inclusive worldviews. If strength of inclusivity beliefs is associated with other pro-conservation attitudes, intentions, and behaviors, then people with larger, more diverse moral communities may more strongly support biodiversity conservation.

1. Introduction

Biodiversity conservation requires an understanding of the biological and physical properties of ecological systems. But increasingly conservationists also recognize the importance of understanding the social properties of those systems, including human values and beliefs (Bennett et al., 2016). Extensive scholarship in the social sciences relates human values and beliefs to conservation behaviors; however, values and beliefs are also the subjects of philosophical inquiry. The philosophical literature in environmental ethics is especially relevant to conservation, as environmental ethics is the field most directly concerned with understanding the values of and obligations owed to nonhuman nature.

Many environmental ethicists are particularly interested in what sorts of entities have intrinsic value, i.e., value for their own sake, beyond any benefits they may provide others (Batavia and Nelson, 2017). Entities attributed with intrinsic value have direct moral standing as members of the "moral community," a central metaphor in environmental ethics. In plain language, the moral community is composed of all the entities who count, morally, in and of themselves (Nelson, 2009). More specifically, the moral community includes all the entities to whom humans may have direct moral obligations or responsibilities. Our most basic obligation is to acknowledge these entities as bearers of intrinsic value and consider how our actions may affect them; but there may be more exacting obligations as well, e.g., to respect them, protect them, or actively promote their interests (Goodpaster, 1978; Taylor, 1981; Rolston, 2012). Thus, an individual who includes some entity in their moral community will also consider that entity worthy of conservation.

For decades, environmental philosophers have suggested an ethical paradigm shift is necessary to conserve Earth's biodiversity and life-supporting systems (Leopold, 1949; White Jr., 1967; Routley, 1973; Mathews, 1991; Callicott, 1989; Crist, 2019). They argue that including nonhuman nature – or some elements thereof – in the moral community is an essential foundation for long-term conservation success. The proposed relationship between an inclusive moral community and pro-

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conservation behaviors (Batavia et al., 2019) has been assessed in a growing body of scientific research, which relates certain morally inclusive values and beliefs (e.g., pertaining to individual animals or wildlife) with attitudes and behaviors that are relevant to conservation (e.g., Jacobs et al., 2014; Lute et al., 2016; Bruskotter et al., 2019; Manfredo et al., 2020). Far less research has empirically investigated the moral community concept itself (but see Crimston et al., 2016).

The membership of the moral community is well theorized, if highly debated, in the environmental ethics literature (see 1.1 below). However, theory in environmental ethics is normative, rather than descriptive; that is, it does not purport to describe whom people include in their moral communities, but to determine whom they ought to include, as rational moral agents. Yet empirically, humans are known to be neither strictly rational nor singularly moral. We are influenced as well by emotion, intuition, and social norms, among other things (Kahneman et al., 1982; Haidt, 2007). As such, it is reasonable to question the extent to which normative theory in environmental ethics is also valid as an empirical description of human values and beliefs. The core thesis – i.e., that an inclusive moral community is an ethical cornerstone for conservation – is predicated on philosophical conceptualizations of moral inclusion. For conservationists seeking to understand and ultimately encourage pro-conservation behaviors, it is reasonable to ask whether philosophical accounts of an inclusive moral community are also accurate as descriptions of people's values and beliefs. Put simply, is ethical theory substantiated by empirical data?

To probe this question, in the present exploratory work we assess the extent to which an influential typology of worldviews in environmental ethics, called extensionism, can be used as a framework for understanding how individuals' moral communities are constituted by various elements of biodiversity.

1.1. Extensionist theory

Western moral philosophers historically pointed to morally relevant traits, such as sentience or reason, as the seat of intrinsic value (e.g., Bentham, 1970; Kant, 2002). The moral community included only humans, as long as humans alone were believed to possess these traits. In the late 20th century environmental ethicists began arguing against this exclusionary conceptualization of the moral community, many employing a line of argumentation called “extensionism” (Nelson, 2009). On grounds of consistency, the argument runs, nonhuman entities possessing whichever trait is used as a criterion of intrinsic value in humans should also be attributed intrinsic value, and therefore included in the moral community.

Scholars of environmental ethics have articulated four “worldviews,” each based on arguments that the moral community should be constituted by certain types of entities, according to four criteria of intrinsic value. An “anthropocentric” worldview takes humanness itself as the criterion, meaning only humans should be included in the moral community (Pinchot, 1910; Baxter, 1974). Semantically a “zoocentric” worldview implies the inclusion of all animals, but usually zoocentric arguments are more selective, basing intrinsic value on criteria such as sentience (Singer, 2011) and/or subjectivity (Regan, 1983). A “biocentric” worldview includes all individual living organisms, on grounds that life itself (i.e., being alive) is the appropriate criterion of intrinsic value (Taylor, 1981; Agar, 2001). Finally, some argue the moral community should include ecological collectives such as species and ecosystems, because, like individual organisms, these entities also have vital interests in persistence and/or flourishing (Johnson, 1992; Rolston, 2012). Possessing such vital interests is the proper criterion of intrinsic value according to an “ecocentric” worldview.

Because extensionist theory is predicated on the imperative of consistency, one's moral community should (theoretically) include every entity meeting one's acknowledged criterion of intrinsic value. Thus, if one subscribes to a biocentric worldview, believing the moral community comprises entities who meet the criterion of “being alive,” then every living thing should be included in one's moral community. A biocentrist should not include individual American pikas (*Ochotona princeps)* but exclude individual whitebark pines (*Pinus albicaulis*), for example, as doing so would represent a failure to consistently apply the morally relevant criterion (in this case, to all kinds of individual living organisms).

Anthropocentrism, zoocentrism, biocentrism, and ecocentrism can be understood as a series of accretions, such that the moral community of each worldview lower in the series is nested within the moral community of each worldview higher in the series. For example, if a person acknowledges sentience as the appropriate criterion of intrinsic value, then their moral community should include many nonhuman animals in addition to human beings (who also, of course, meet the criterion of sentience). In this way, a zoocentric worldview builds upon an anthropocentric worldview. Because the moral community simply expands as it diversifies, according to extensionist theory, worldviews can be distinguished by their comparative levels of “moral inclusivity,” with anthropocentrism being least inclusive and ecocentrism being most inclusive.

1.2. Objectives of this study

To our knowledge, research has not investigated the extent to which people define their moral communities in ways that are consistent with the four extensionist worldviews. Our first objective, therefore, is to empirically assess the proportion of people who can be classified as anthropocentrists, zoocentrists, biocentrists, and ecocentrists.

Our second objective is to empirically assess how the moral communities of anthropocentrists, zoocentrists, biocentrists, and ecocentrists are constituted by specific kinds of human and nonhuman entities. Extensionist theories characterize the moral community in terms of abstract, criterion-based sets of entities (e.g., individual living organisms), but do individuals who include such abstract sets also include specific instances of those sets? For example, does a person identified as a biocentrist include the pika and the whitebark pine, as well as a human backpacker observing them, but not the collective montane ecosystem? From a conservation standpoint it is also (if not more) important to understand how and why the moral community comprises such specific elements of biodiversity.

2. Materials and methods

To pursue our objectives, we developed an empirical measure of moral inclusivity. Although similar to Crimston et al.'s (2016) scale of “moral expansiveness,” and Opotow's (1993) “scope of justice,” the items we developed are more explicitly informed by the literature in environmental ethics, consistent with our aim to empirically evaluate philosophical conceptualizations of the moral community. Our measure of moral inclusivity, described below and available in full in Online Appendix A, was embedded in a larger survey designed to investigate the value basis and effectiveness of conservation outreach efforts. The study was approved by the Oregon State University Institutional Review Board, which oversees the ethical conduct of research with human subjects.

The survey was administered online to a non-representative sample of the American public in August 2017 ($N = 1331$) using panel services provided by Qualtrics, LLC. Panelists were generated from a database of individuals contracted with Qualtrics to take surveys for compensation. Because the panel was a form of convenience sample, comprising self-selected participants with access to the internet and time to complete surveys (Hays et al., 2015), they do not necessarily represent the larger population. However, the sample was deemed sufficient to meet the objectives of the present exploratory study.

Only panelists who passed a series of attention checks were included in the final sample. To further assess data quality, we individually examined responses from participants who completed the survey in less

Table 1
Breakdown of anthropocentrists, zoocentrists, biocentrists, and ecocentrists. Composites of criterion-based inclusivity items (shown on the left) were created for animals, plants, and collectives. Items marked (R) were reverse coded for analysis. Respondents were affiliated with a worldview based on their scores on two individual human items and the animal, plant, and collective composites, based on specifications shown in the top line of each cell on the right. The bottom line of each cell on the right shows the mean and standard deviation (M, s.d.) for each item or composite, by worldview.

	Anthropocentric	Zoocentric	Biocentric	Ecocentric
	n = 94	*n* = 112	n = 30	*n* = 427
People (philosophical criterion: human)				
Every person has value above and beyond his or her usefulness for others.	≥**5** (5.84, 0.85)	≥**5** (5.96, 0.81)	≥**5** (5.97, 0.85)	≥**5** (6.33, 0.77)
As a basic principle, people ought to demonstrate respect for other individual people.	≥**5** (6.29, 0.67)	≥**5** (6.41, 0.73)	≥**5** (6.30, 0.75)	≥**5** (6.82, 0.46)
Animals (philosophical criterion: sentience/subjectivity)	< 5	≥**5**	≥**5**	≥**5**
Cronbach's α = 0.81	(3.72, 0.83)	(5.76, 0.75)	(5.97, 0.74)	(6.52, 0.62)
The wellbeing of an individual animal matters, even if it does not affect the wellbeing of people.				
Every individual animal possesses a dignity that deserves respect.				
Plants (philosophical criterion: alive)	< 5	< 5	≥**5**	≥**5**
Cronbach's α = 0.71	(2.73, 1.15)	(3.56, 0.90)	(5.38, 0.50)	(6.04, 0.76)
The wellbeing of individual plants is not a matter of moral concern to me. (R)				
Every plant deserves respect as a living creature.				
Collectives (philosophical criterion: vital interests)	< 5	< 5	< 5	≥**5**
Cronbach's α = 0.88	(3.96, 0.87)	(4.35, 0.61)	(4.55, 0.28)	(6.46, 0.58)
People have a moral obligation to consider how their decisions might harm or benefit a species, even if the species has no apparent use.				
It makes no sense to talk about respecting a species. (R)				
When people cause the extinction of a species, they have committed a moral wrong against the species.				
People have a moral obligation to consider how their decisions might harm or benefit an ecosystem, even if the ecosystem has no apparent use.				
It makes no sense to talk about respecting an ecosystem. (R)				
When people cause the loss of an ecosystem, they have committed a moral wrong against the ecosystem.				

than two standard deviations below the sample median response time. No obvious issues emerged.

2.1. Moral inclusivity

Moral inclusivity was measured in two parts. The first is "criterion-based inclusivity," i.e., the extent to which respondents' moral communities include broad sets of entities, as characterized by the four philosophical criteria of intrinsic value: humanness (three items), sentience/subjectivity (two items), life (two items), and vital interests (six items). Instead of identifying sets of entities by their respective criteria explicitly, we used familiar proxies for these sets. "Animals" represented the set of sentient/subjective beings; "plants" represented the set of individual living organisms; and both "species" and "ecosystems" represented the set of collectives possessing vital interests. Before replying to the three "species" items, respondents read a short block of text describing species as cohesive and integrated entities, to focus their attention on the collective, per se, rather than its individual members. Similar text was presented before the three "ecosystem" items.

The decision to use proxies instead of explicitly naming philosophical criteria was motivated by two concerns. First, the philosophical criteria are relatively abstract and somewhat technical; "sentience," for example, may not be a familiar concept for many people. Second, naming the criteria explicitly may have confounded measurement. For instance, items referring to "individual living organisms" may have elicited a mental representation of a sentient nonhuman animal, or even a human being. Agreement with items so phrased would not necessarily have indicated biocentric beliefs.

The second measure of moral inclusivity is "entity-based inclusivity," i.e., the extent to which respondents' moral communities include specific kinds of human and nonhuman entities. In this part respondents were presented with two prompt statements. The first prompt (henceforth "harm") stated, "If I had to decide whether or not to do something that would harm _____, I would be making a moral decision." The second (henceforth "value") stated, "_____ has value above and beyond any use it may serve for others." Respondents were asked to fill in the blank, one at a time, with a battery of specific entities supplied in a matrix following each prompt. For each entity, respondents indicated the extent to which they disagreed or agreed with the prompt. The matrices listed 13 specific nonhuman entities of three different types, which mirrored the philosophical criterion-based sets: five nonhuman animals (dog, bald eagle, cow, cougar, fly), four vegetative organisms (oak tree, houseplant, fungus, poison ivy), and four ecological collectives (endangered elephant species, local mosquito species, tropical rainforest ecosystem, agricultural ecosystem). Nonhuman entities were selected to vary in familiarity, harmfulness, and utility, attributes that have been found to predict the moral standing of nonhuman animals (see Discussion). For baseline comparison we also presented four specific human entities (myself, my family, other Americans, people in other countries) in the matrix following the harm prompt. Because some of these items were grammatically incompatible with the value prompt, they were not included in the value matrix (for example, "myself has value above and beyond any use it may serve for others" is not a grammatically correct formulation).

All items employed bipolar response scales ranging from 1 to 7 (strongly disagree to strongly agree). Conceptualizing moral inclusivity categorically, such that an entity is either included in the moral community or not, scores of 5–7 indicate the entity is included and scores of 1–3 indicate the entity is excluded. A score of 4 indicates the entity is not actively included, but neither is it actively excluded.

Our measures allowed us to conceptualize moral inclusivity as a continuous variable as well, although it is unclear how the range of scores should be interpreted. For example, scores closer to the anchor points on the scale may indicate a belief that is more important to sense of personal or social identity, or a belief held with greater certainty (e.g., Krosnick et al., 1993). This ambiguity is a limitation of the study, which warrants assessment in future research. Of each respondent we can only infer that higher scores indicate relatively stronger beliefs that an entity is included in the moral community (or, for scores below five, relatively weaker beliefs that it is not included); whereas lower scores

indicate relatively weaker beliefs that an entity is included (or, for scores below five, relatively stronger beliefs that it is not included). We refer to this as a continuum of belief strength, leaving the precise meaning of "strength" unspecified.

2.2. Data analysis

Data manipulation and analysis were conducted in SPSS (v.25). Because our analysis has several steps, we provide a supplemental flowchart depicting the major stages of analysis in Online Appendix B, Fig. B.1.

First we used the criterion-based inclusivity items to affiliate respondents with worldviews (Table 1). We tested internal reliability of the items associated with each of the four criterion-based sets. Cronbach's alpha met conventional levels of acceptability for animals ($\alpha = 0.81$), plants ($\alpha = 0.71$), and collectives ($\alpha = 0.88$), so respondents' individual item scores were averaged to create a composite measure for each set. Reliability for humans fell below acceptable levels ($\alpha = 0.46$), with the second item in particular performing differently than the other two. Omitting this item only increased alpha to 0.50, which still falls below conventionally acceptable levels (Vaske, 2008). For the present analysis it sufficed to use the two relatively consistent human items independently, as described next, but future work should refine these items to enhance their internal reliability.

We next created four groups (hereafter "worldviews") representing anthropocentrists, zoocentrists, biocentrists, and ecocentrists (Table 1). Affiliation with a worldview indicates a respondent included certain sets of entities in the moral community (i.e., scores of five or above on relevant items or composites), and did not include the other sets (i.e., scores lower than five on relevant composites). Respondents with scores of five or above on the two human items and below five on the animal, plant, and collective composites were classified as "anthropocentrists." Respondents with scores of five or above on the two human items and the animal composite, but below five on the plant and collective composites, were classified as "zoocentrists." Respondents with scores of five or above on the two human items, the animal composite, and the plant composite, but below five on the collective composite, were classified as "biocentrists." Respondents with scores of five or above on the two human items and all three composites were classified as "ecocentrists."

Next, to reduce the number of entity-based inclusivity items for analysis, we tested internal reliability of the harm and value items for each specific nonhuman entity listed in the two matrices (e.g., harm and value items pertaining to a dog, a bald eagle, etc.). Reliability scores were generally acceptable ($\alpha = 0.64$ to 0.79), so we averaged the two scores for each entity, producing 13 harm/value composites: five nonhuman animals (henceforth "animals"), four vegetative organisms, and four collectives. Because the four specific human entities were presented only in the harm matrix, we did not create human composites.

To produce estimates that would allow us to assess the inclusion (or not) of specific animals by anthropocentrists, zoocentrists, biocentrists, and ecocentrists, we used mixed-model analysis of variance (ANOVA), with worldview as a between-subjects factor and specific animal as a within-subjects factor. Respondents' scores on the harm/value composites for each of the five specific animals were the response variables. The analysis estimated mean scores for each specific animal overall and for each worldview overall, and also tested for a significant interaction between kind of animal and worldview. Finding a significant (animal * worldview) interaction, we used simple effects analysis to estimate mean scores for each animal separately by worldview. We repeated this procedure three times, first using scores on the harm/value composites for the four specific vegetative organisms; then scores on the harm/value composites for the four specific collectives; and finally scores on the four specific human harm items, as response variables. We separated specific entities in this way (by type) to keep assessments manageable.

Using estimated means as indicators of categorical inclusion, exclusion, or non-inclusion (as specified above), we assessed whether respondents included specific entities according to theoretical expectations, which are as follows: anthropocentrists include all specific humans and do not include any specific animals, vegetative organisms, or collectives; zoocentrists include all specific humans and animals, but do not include any specific vegetative organisms or collectives; biocentrists include all specific humans, animals, and vegetative organisms but no specific collectives; and ecocentrists include all specific humans, animals, vegetative organisms, and collectives.

ANOVA also tested for statistically significant differences in mean entity-based inclusivity scores between entities overall and between worldviews overall. Simple effects analyses estimated differences both between entities within each worldview and between worldviews for each specific entity, using Bonferroni-adjusted pairwise comparisons to correct for familywise error. We explored these results, treating entity-based inclusivity as a continuous measure of belief strength.

3. Results

94 respondents were classified as anthropocentrists (7.1%), 112 as zoocentrists (8.4%), 30 as biocentrists (2.3%), and 427 as ecocentrists (32.1%). The four worldviews cumulatively accounted for 49.8% of the sample. Additional descriptive information about the sample is in Online Appendix B, Table B.1. Because roughly half of the sample was not affiliated with a worldview, we used visual assessment and summary statistics of criterion-based entity scores from the remaining respondents to create an analytical procedure representing a fifth worldview, which has no analogue in the environmental ethics literature. These respondents included humans, animals, and collectives (i.e., scores of five or above on both human items and animal and collective composites), but not plants (i.e., scores below five on the plant composite). 402 respondents (30.2%) were affiliated with this "atheoretical" worldview.

3.1. Inclusion of specific entities, by worldview

Respondents affiliated with all four worldviews included all four specific humans, consistent with theoretical expectations. However, the inclusion (or not) of specific nonhuman entities was not always consistent with theoretical expectations (Fig. 1). Anthropocentrists generally included one specific animal (dog).[1] Zoocentrists generally excluded one specific animal (fly) but generally included three specific collectives (endangered elephant species, rainforest, agricultural ecosystem). Biocentrists generally did not include three specific animals (bald eagle, cow, cougar) and one vegetative organism (oak tree); and generally excluded one animal (fly) and three vegetative organisms (houseplant, fungus, poison ivy). Ecocentrists generally did not include one specific animal (fly) and one specific vegetative organism (fungus); and generally excluded one specific vegetative organism (poison ivy plant) and one specific collective (local species of mosquito).

3.2. Belief strength by entity and worldview

Within each worldview, mean entity-based inclusivity scores varied between entities of any given type (Table 2). Three specific nonhuman entities (fly, poison ivy, local mosquito species) were rated significantly lower than other entities of their types (animals, vegetative organisms, and collectives, respectively) among respondents affiliated with all four worldviews. For zoocentrists, biocentrists, and ecocentrists, a fungus

[1] Although the estimate for a bald eagle fell just below our cutoff value for inclusion, differences between a dog and a bald eagle were not statistically significant among anthropocentrists.

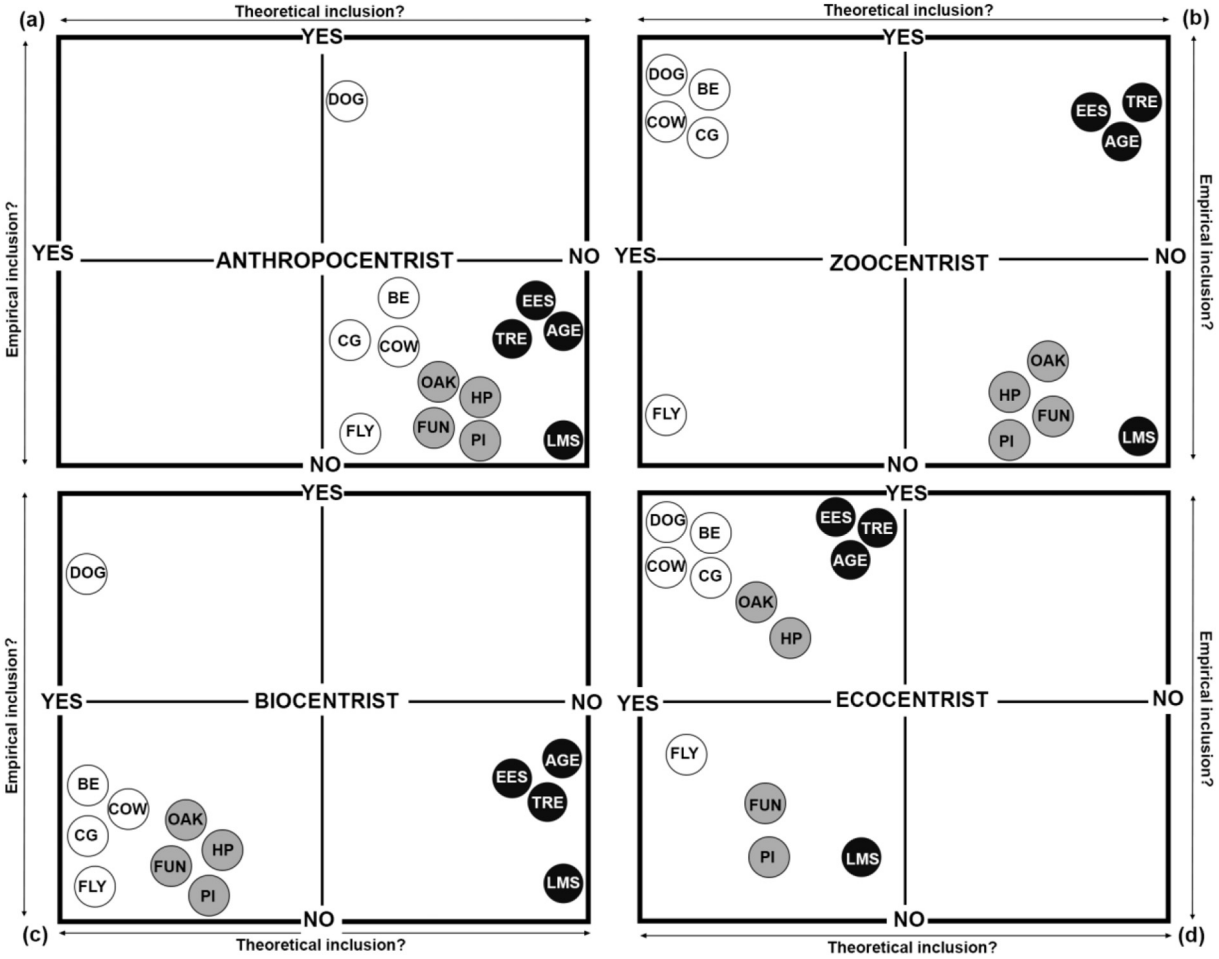

Fig. 1. Inclusion of specific nonhuman entities by worldview. For (a) anthropocentrists (b) zoocentrists (c) biocentrists and (d) ecocentrists, each specific nonhuman entity is plotted in one quadrant based on two factors: whether it should be included in moral community, according to ethical theory (left quadrants yes, right quadrants no); and whether it was included in the moral community by respondents affiliated with that worldview (top quadrants yes, bottom quadrants no). For each worldview, (non-)inclusion of entities in top left and bottom right quadrants matched theoretical expectations, and (non-)inclusion of entities in top right and bottom left quadrants deviated from theoretical expectations. Animals (white): DOG = dog, BE = bald eagle, COW = cow, CG = cougar, FLY = fly. Vegetative organisms (grey): OAK = oak tree, HP = houseplant, FUN = fungus, PI = poison ivy plant. Collectives (black): EES = endangered elephant species, LMS = local mosquito species, TRE = tropical rainforest ecosystem, AGE = agricultural ecosystem.

also on average received significantly lower scores than both a houseplant and an oak tree.

Noteworthy differences between worldviews emerged as well (Table 2). For nearly all of the specific entities – human and nonhuman – mean entity-based inclusivity scores were significantly higher among ecocentrists than anthropocentrists, zoocentrists, or biocentrists. Only for a mosquito species were mean scores among ecocentrists statistically equivalent to scores from respondents of another worldview (biocentrism). Zoocentrists reported higher scores than anthropocentrists for most specific nonhuman entities, although differences between zoocentrists and anthropocentrists were statistically insignificant for a fly, fungus, poison ivy, and mosquito species. Biocentrists, on the other hand, did not report higher scores than anthropocentrists or zoocentrists for any specific nonhuman entities. Biocentrists' scores were statistically equivalent to anthropocentrists' scores for a bald eagle, cougar, fungus, poison ivy, elephant species, and rainforest ecosystem; statistically equivalent to zoocentrists' scores for a houseplant, mosquito species, and agricultural ecosystem; and statistically equivalent to both anthropocentrists' and zoocentrists' scores for a dog, cow, fly, and oak tree.

4. Discussion

Less than ten percent of respondents were classified as anthropocentrists, based on our analytical procedure. Although we did not recruit a representative sample, our findings echo similar results in extant research, which also suggests non-anthropocentric beliefs are more prevalent than anthropocentric beliefs (e.g., Lute et al., 2016; Bruskotter et al., 2019; Manfredo et al., 2020). This will be welcome news for those conservationists who, like many environmental philosophers, believe nonhuman entities must be included in society's moral community, as a critical precursor to enduring conservation success (e.g., Leopold, 1949; Mathews, 1991; Crist, 2019).

And yet, our results also suggest an inclusive moral community may not be constituted as theorized by extensionists in environmental ethics. Only half our sample could be classified as anthropocentrists, zoocentrists, biocentrists, or ecocentrists, and these respondents did not reliably include all and only the specific types of entities they should have, based on criteria identified by extensionist theories. For example, our results suggest even "zoocentrists," as classified by measurement items consistent with ethical theory, may include certain specific species while excluding certain specific animals. These results invite alternative explanations for why individuals include different elements of biodiversity in their moral communities, if not by the consistent

Table 2
Results of mixed-model ANOVA, separated by type of specific entity (animal, vegetative organism, collective, or human). Worldview affiliation is a between-subjects factor and specific entity is a within-subjects factor. Scores on entity-based inclusivity harm/value composites (for animals, vegetative organisms, and collectives) or individual harm items (for humans) are the response variables. Mauchly's test indicated non-sphericity in all four analyses, so reported F-values use the Greenhouse-Geisser correction. Horizontally, different superscript letters indicate estimated means differ significantly between worldviews ($p < 0.05$). Vertically, different superscript numbers indicate estimated means differ significantly between entities of a type ($p < 0.05$).

		Anthropocentric	Zoocentric	Biocentric	Ecocentric	$F_{between}$	$\eta^2_{pbetween}$
Animals	Overall	4.17 (0.09)^{a}	4.81 (0.08)^{b}	4.47 (0.16)^{a,b}	5.89 (0.04)^{c}	135.55	0.38
Dog	5.64 (0.05)^{1}	5.06 (0.10)$^{a/1}$	5.71 (0.09)$^{b/1}$	5.28 (0.17)$^{a,b/1}$	6.52 (0.05)$^{c/1}$		0.28
Bald eagle	5.46 (0.06)^{2}	4.94 (0.10)$^{a/1}$	5.54 (0.09)$^{b/2}$	4.88 (0.18)$^{a/2}$	6.48 (0.05)$^{c/1}$		0.30
Cow	5.10 (0.07)^{3}	4.37 (0.12)$^{a/2}$	5.09 (0.11)$^{b/3}$	4.77 (0.21)$^{a,b/2,3}$	6.18 (0.06)$^{c/2}$		0.28
Cougar	5.01 (0.07)^{3}	4.32 (0.12)$^{a/2}$	5.07 (0.11)$^{b/3}$	4.43 (0.21)$^{a/3}$	6.21 (0.06)$^{c/2}$		0.30
Fly	2.97 (0.10)^{4}	2.15 (0.17)$^{a/3}$	2.66 (0.16)$^{a/4}$	3.00 (0.31)$^{a/4}$	4.08 (0.08)$^{b/3}$		0.18
F_{within}	384.17						
$\eta^2_{pwithin}$	0.37	0.27	0.31	0.08	0.53		
Vegetative organisms	Overall	2.67 (0.13)^{a}	3.14 (0.12)^{b}	3.37 (0.23)^{b}	4.78 (0.06)^{c}	109.73	0.33
Houseplant	3.83 (0.08)^{1}	2.75 (0.15)$^{a/1}$	3.47 (0.13)$^{b/1}$	3.73 (0.26)$^{b/1}$	5.38 (0.07)$^{c/1}$		0.36
Oak	4.49 (0.07)^{2}	3.56 (0.13)$^{a/2}$	4.21 (0.12)$^{b/2}$	4.13 (0.22)$^{a,b/1}$	6.04 (0.06)$^{c/2}$		0.42
Fungus	3.08 (0.10)^{3}	2.40 (0.18)$^{a/1}$	2.75 (0.16)$^{a/3}$	2.98 (0.31)$^{a/2}$	4.18 (0.08)$^{b/3}$		0.16
Poison ivy	2.56 (0.10)^{4}	1.95 (0.18)$^{a/3}$	2.14 (0.17)$^{a/4}$	2.63 (0.32)$^{a/2}$	3.51 (0.08)$^{b/4}$		0.13
F_{within}	192.90						
$\eta^2_{pwithin}$	0.23	0.12	0.19	0.03	0.56		
Collectives	Overall	4.02 (0.09)^{a}	4.52 (0.08)^{b}	4.23 (0.16)^{a,b}	5.74 (0.04)^{c}	143.48	0.40
Elephant species	5.38 (0.06)^{1}	4.89 (0.11)$^{a/1}$	5.41 (0.10)$^{b/1}$	4.72 (0.19)$^{a/1}$	6.50 (0.05)$^{c/1,2}$		0.31
Mosquito species	2.59 (0.11)^{2}	1.87 (0.18)$^{a/2}$	2.15 (0.17)$^{a,b/2}$	2.87 (0.33)$^{b,c/2}$	3.50 (0.09)$^{c/3}$		0.13
Rainforest ecosystem	5.28 (0.06)^{1}	4.66 (0.11)$^{a/3}$	5.30 (0.10)$^{b/1}$	4.65 (0.19)$^{a/1}$	6.52 (0.05)$^{c/1}$		0.35
Agricultural ecosystem	5.26 (0.06)^{1}	4.66 (0.11)$^{a/1,3}$	5.24 (0.10)$^{b/1}$	4.68 (0.20)$^{a,b/1}$	6.46 (0.05)$^{c/2}$		0.32
F_{within}	472.50						
$\eta^2_{pwithin}$	0.42	0.25	0.32	0.04	0.61		
Humans	Overall	6.11 (0.11)^{a}	6.09 (0.10)^{a}	5.69 (0.19)^{a}	6.52 (0.05)^{b}	12.08	0.05
Myself	6.07 (0.08)^{1,2}	5.97 (0.13)$^{a/1,3}$	6.12 (0.12)$^{a,b/1,2,3}$	5.77 (0.24)$^{a/1,2}$	6.43 (0.06)$^{b/1,2}$		0.03
My family	6.31 (0.06)^{3}	6.39 (0.11)$^{a,b/2}$	6.29 (0.10)$^{a/1}$	5.90 (0.19)$^{a/1}$	6.67 (0.05)$^{b/3}$		0.04
Americans	6.14 (0.07)^{1}	6.15 (0.12)$^{a/1}$	6.12 (0.11)$^{a/2}$	5.73 (0.20)$^{a/1}$	6.55 (0.05)$^{b/1}$		0.05
People in other country	5.89 (0.07)^{2}	5.94 (0.13)$^{a/3}$	5.84 (0.12)$^{a/3}$	5.37 (0.23)$^{a/2}$	6.43 (0.06)$^{b/2}$		0.06
F_{within}	20.80						
$\eta^2_{pwithin}$	0.03	0.06	0.04	0.02	0.08		

application of morally relevant criteria.

4.1. Inclusion in the moral community

Although the present study was not designed to explicitly assess why people include (or not) various elements of biodiversity in the moral community, other studies provide insights. Bastian et al. (2012), for example, showed that animals are more likely to be included in the moral community when their similarities with humans are emphasized. This research suggests the inclusion of animals in the moral community depends in part on the extent to which they are perceived as similar to humans. The perception that a nonhuman animal is similar to humans, in turn, is based on a number of factors, including its perceived phylogenetic relatedness or physical resemblance to humans, its behaviors in context, and the degree to which it is familiar or attached to humans (Eddy et al., 1993; Mitchell and Hamm, 1997; Harrison and Hall, 2010). Animals seen as similar to humans along one or more of these dimensions are perceived to have advanced mental capacities, including agency, experience, intention, and/or intelligence (Eddy et al., 1993; Urquiza-Haas and Kotrschal, 2015), which in turn form the basis for moral standing (Gray et al., 2007; Bastian et al., 2012; Piazza and Loughnan, 2016; Manfredo et al., 2020).

In our study, for example, respondents affiliated with all four worldviews included a dog, an animal that past research has found to be perceived as highly similar to humans in terms of its mental capacities (Eddy et al., 1993). The same study found eagles, cows, and cheetahs were perceived as moderately similar to humans, perhaps explaining why, in our study, a bald eagle, cow, and cougar (analogous to a cheetah) were included by zoocentrists and ecocentrists, and also rated at the high end of non-inclusion among anthropocentrists and biocentrists. On the other hand, one animal that was unilaterally excluded from (or at best not included in) the moral community was a fly. Although Eddy et al. (1993) did not specifically assess perceptions of flies, they did find other insects were perceived as highly dissimilar from humans. As such, perceived dissimilarity may explain, at least in part, why flies were not readily admitted to the moral community by our respondents.

The empirical observation that moral standing depends largely on perceived similarity with humans in some ways echoes the basic premise of extensionist theory; namely, that nonhuman entities who are similar to humans in morally relevant ways should be included in the moral community. It is also interesting that the mental capacities found to be psychologically salient to perceived similarity, and therefore moral standing, generally overlap with the zoocentric criteria for intrinsic value (i.e., sentience or subjective experience). But whereas philosophers use reason to 1) identify morally relevant traits, 2) identify the kinds of entities possessing such traits, and 3) conclude such entities should be included in the moral community, in everyday experience, people likely rely less on reasoned arguments than on immediate perceptions of the entity in question. Although perceptions may align with reasoned consideration in some cases (dogs, for example), in other cases they may diverge. For example, evidence for the sentience and subjectivity of insects (Barron and Klein, 2016; Tiffin, 2016) suggests flies may not be entirely dissimilar to humans in morally relevant regards. Yet many animals, like flies, may be excluded from the moral community because they are not obviously or intuitively seen as similar to humans, even though they are still important elements of biodiversity. Building moral concern for such entities, to establish a basis for conservation interest, will require research on effective design and delivery of species-specific outreach strategies.

Although inconsistent with ethical theory, the finding that most of the specific vegetative organisms received low inclusivity scores from respondents of all four worldviews was unsurprising. There are well-documented taxonomic biases in conservation, whereby certain species

(mostly mammals) receive disproportionate conservation attention, and even funding (Clucas et al., 2008; Smith et al., 2012). If moral concern is a precursor for conservation attention, it would make sense to find the kinds of entities that do not receive conservation attention, such as plants (and insects), also do not tend to be included in the moral community. Research suggests plants and other vegetative organisms may be perceived as inanimate objects (Santi et al., 2015); and, as perceived inanimate objects, they are not likely to be attributed intentional states (Urquiza-Haas and Kotrschal 2015). It is not clear, then, why biocentrists and ecocentrists professed inclusion of "plants" as a general set. We would hypothesize that some mechanism other than perceived similarity with humans explains the moral standing of plants. Based on our results, however, it seems this mechanism is not the recognition that plants are alive, as even biocentrists and ecocentrists either excluded or did not include most of the specific vegetative entities, all of which were living organisms.

Perceived similarity also does not obviously explain the inclusion of ecological collectives, which at face value appear categorically dissimilar from humans. And yet, not only ecocentrists but also zoocentrists included an endangered elephant species, a rainforest ecosystem, and an agricultural ecosystem; while anthropocentrists and biocentrists indicated non-inclusion (rather than active exclusion) of these collectives. Although we repeated instructions to envision species and ecosystems as collectives prior to the entity-based inclusivity items, it is possible that respondents conceptualized species and ecosystems in terms of their individual constituents (e.g., individual elephants, rather than an elephant species), in which case the perceived mental capacities of those individuals may explain our findings. But specific ecological collectives may also have been included because they were perceived as cohesive wholes. This is called "entitativity," i.e., the perception that a collection of individuals is an integrated unit, or "entity," rather than an aggregate of individuals (e.g., Smith et al., 2013). As perceived entities, specific collectives may have been attributed quasi-intentional states, analogous to the extensionist criterion of "vital interests" (see Effron and Knowles, 2015). Alternatively, collectives perceived as entities may also have been perceived to possess certain holistic qualities, such as interconnectedness or evolutionary continuity (e.g., Callicott, 1989; McCord, 2012), and valued on those grounds.

Yet research shows perceptions of species and ecosystems depend on a number of factors, including perceived endangeredness, nativeness, or naturalness (Fischer and van der Wal, 2007; Buijs, 2009; van Eeden et al., 2020). Given these and other considerations, people may not include species or ecosystems in the moral community even if they are perceived as collective entities. For example, in our study one collective, a local mosquito species, was excluded by anthropocentrists, zoocentrists, biocentrists, and ecocentrists. The perception that invasive species may negatively impact cultural, economic, or ecological values has been found to predict negative perceptions of the species (Shackleton et al., 2019). Researchers have also found that perceived (dis) utility or potential to cause harm can inform the moral status of nonhuman animals (Opotow, 1993; Hills, 1995; Piazza et al., 2014). Such negative perceptions may explain why not only mosquitos, but also poison ivy, a fly, and a fungus, were overwhelmingly left out of the moral community, since all these entities are likely to be perceived as harmful or low in utility.

We do note that flies, fungi (generally defined), poison ivy, and mosquitos are not threatened or endangered species, or members thereof. As such, their low inclusivity ratings may partially reflect the lower value attached to (particularly unattractive) entities that are not at risk (Gunnthorsdottir, 2001). We do not believe this is a key driver for the patterns we observed, as many respondents also reported high inclusivity scores for other non-endangered and non-charismatic entities (e.g., a cow, an agricultural ecosystem). Nonetheless, additional research is needed to disentangle the qualities of nonhuman entities that inform whether or not they are included in the moral community.

4.2. Moral inclusion: scope and strength

Environmental ethicists suggest people should hold certain beliefs, but do not generally specify with what degree of conviction those beliefs should be held. As such, based solely on ethical theory, we would not expect inclusivity belief strength to vary systematically between worldviews and/or specific entities. However, comparing mean inclusivity scores between worldviews revealed a notable trend of increasing belief strength. Respondents affiliated with more inclusive worldviews not only included a relatively higher number of specific entities, but also generally reported higher mean inclusivity scores for any specific nonhuman entity, compared to respondents affiliated with comparatively less inclusive worldviews. For example, both anthropocentrists and ecocentrists included a dog, but ecocentrists rated a dog significantly higher than anthropocentrists. Conversely, anthropocentrists and ecocentrists both excluded a mosquito species, but ecocentrists again rated a mosquito species significantly higher than anthropocentrists.

Biocentrists are a notable exception, being indistinguishable from anthropocentrists and/or zoocentrists in inclusivity scores for all specific nonhuman entities. The deviation from an otherwise pronounced trend, paired with the relatively small number of biocentric respondents ($n = 30$), leads us to suggest the theoretical worldview "biocentrism" is not an empirically significant pattern of belief. On the other hand, people affiliated with an atheoretical worldview (i.e., who included humans, animals, and collectives, but not plants) fell squarely along the observed gradient, such that inclusivity beliefs were stronger among zoocentrists than anthropocentrists; among atheorists than zoocentrists; and among ecocentrists than atheorists (Online Appendix B, Table B.2).

Substituting atheorists for biocentrists, our data suggests a correspondence between the size of the moral community and the strength of inclusivity beliefs, whereby respondents affiliated with more inclusive worldviews not only professed to believe that larger sets of entities are included in their moral communities, but also professed those beliefs more strongly than respondents affiliated with less inclusive worldviews (Online Appendix B, Fig. B.2). Although we cannot comment on mechanisms for this relationship, or the direction of influence, our results suggest the possibility that moral inclusion may increase simultaneously in strength and scope.

This encourages us to think more broadly about the conservation implications of inclusive moral communities. Although a person's worldview, as conceptualized by environmental ethicists, may not reliably predict the moral standing of specific elements of biodiversity, people with relatively more inclusive moral communities may more strongly affirm the moral standing of elements they include (and less strongly deny the moral standing of elements they do not include). If it is reasonable to hypothesize that stronger affirmations of moral standing correlate positively with other pro-conservation values, beliefs, and attitudes, which in turn predict pro-conservation intentions or behaviors (see Crimston et al., 2016), then it may be that people with more inclusive moral communities are, in fact, more likely to be allies of conservation.

5. Conclusions

This is an exploratory study, so it is only tentatively, as hypotheses and questions for future research, that we offer the interpretations above. However, this work does provide initial evidence that the moral community may be messier than is envisioned by environmental ethicists. From one angle an individual may look like an anthropocentrist, yet still include a familiar mammal in their moral community; or an apparent ecocentrist may still exclude a noxious species. However, if anthropocentrists and ecocentrists do not necessarily populate their moral communities in line with philosophical standards of rational consistency, it does seem the latter are more inclusive, by both number

and degree, than the former. And if greater inclusivity is associated with stronger conservation support, then continuing to cultivate larger and more diverse moral communities may be beneficial to conservation.

Widespread training in multi-cultural environmental ethics could familiarize people with the breadth of arguments for the moral standing of various aspects of biodiversity, and over time this could change how the moral community comes to be constituted. This is a testable hypothesis. In the short term, however, people may most effectively be convinced to include nonhuman entities in the moral community by highlighting qualities such as their ability to think, feel, and/or experience in ways similar to humans. There is no reason to believe sentience- or consciousness-based arguments need be restricted to nonhuman animals, as research suggests some of these qualities may also be shared by plants (Trewavas, 2016). More generally, though, understanding why or under what conditions plants are included in the moral community is an important avenue for future research, as plants are a critical yet under-valued (and under-funded) component of biodiversity (Negrón-Ortiz, 2014). Species, ecosystems, and other ecological collectives, on the other hand, may be admitted to the moral community if people are encouraged to focus on their holistic qualities, such as interconnectedness, integrity, or homeostasis. However, more research on the moral standing of ecological collectives is needed as well, especially as these are the elements of biodiversity that are often of foremost interest to conservationists.

And yet, we would also highlight how many respondents included individual nonhuman animals (general and specific) in their moral communities. These findings corroborate with research demonstrating widespread moral concern for individual animals (Bruskotter et al., 2017; Manfredo et al., 2020). Lethal methods used in conservation (e.g., for population control or management of introduced species) often unreflectively neglect and override the interests of individual nonhuman animals. These approaches are not only ethically problematic, but may also compromise the long-term viability of conservation if they are at odds with prevailing social values (Bruskotter et al., 2017; Wallach et al., 2018). Conservation efforts that demonstrate moral concern for nonhuman animals at both individual and collective levels would be both more aligned with social values and more morally appropriate, although they may be difficult to achieve (Wallach et al., 2018; Manfredo et al., 2020). Recognizing and learning to arbitrate a moral community constituted by individuals and collectives across biological taxa is perhaps one of the greatest practical and ethical challenges facing conservation now and in the future.

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CRediT authorship contribution statement

Chelsea Batavia:Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, Writing - original draft, Writing - review & editing.**Jeremy T. Bruskotter**:Conceptualization, Methodology, Supervision, Writing - review & editing.**Julia A. Jones**:Formal analysis, Supervision, Visualization, Writing - review & editing.**Michael Paul Nelson**:Conceptualization, Methodology, Project administration, Supervision, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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