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Revisiting two dogmas of conservation science

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Abstract

Conservation science is a morally motivated field, with implicit and explicit values built into its practice. As such, conservationists must engage with conservation ethics to interrogate underlying values. We examine cutting-edge ecological science and contemporary ethics to revisit two conservation norms that have become dogmatic in the field: ecological collectives, but not individual animals, are valuable and anthropomorphism should be staunchly avoided. Emerging studies demonstrate that individuals and their intraspecific variation can be instrumentally valuable for conservation science, and there is an emerging consensus within environmental philosophy around the moral worth of individuals. Thus, we suggest conservation science should explicitly recognize the value of individuals. We also argue that avoiding anthropomorphism is detrimental to conservation because critical anthropomorphism enables a more nuanced scientific approach—allowing conservationists to ask enlightened questions with creativity and compassion. We provide evidence that both dogmatic norms are scientifically and morally outdated and propose new normative values to push conservation towards more robust science and ethical practice.

KEYWORDS
animal ethics, anthropomorphism, applied ethics, conservation ethics, environmental ethics, environmental philosophy

Revisión de dos dogmas de las ciencias de la conservación

Resumen: Las ciencias de la conservación son un campo con motivaciones morales y valores implícitos y explícitos integrados en su práctica. Por lo tanto, los conservacionistas deben trabajar con la ética de la conservación para interrogar los valores subyacentes. Analizamos la ecología de vanguardia y la ética contemporánea para revisar dos normas que se han convertido en dogmas dentro del campo: los colectivos ecológicos, pero no los animales individuales, son valiosos y el antropomorfismo debe evitarse a toda costa. Los estudios emergentes demuestran que los individuos y sus variaciones intraespecíficas pueden tener un valor instrumental para las ciencias de la conservación y que existe un consenso emergente dentro de la filosofía ambiental en torno al valor moral de los individuos. Por lo tanto, sugerimos que las ciencias de la conservación deberían reconocer de forma explícita el valor de los individuos. También discutimos que evitar el antropomorfismo daña a la conservación pues el antropomorfismo crítico permite una estrategia científica más matizada—lo que permite que los conservacionistas hagan preguntas informadas con creatividad y compasión. Proporcionamos evidencias de que ambos dogmas son científica y moralmente obsoletos y proponemos nuevos valores normativos para guiar a la conservación hacia una ciencia más sólida y una práctica más ética.

PALABRAS CLAVE
antropomorfismo, ética ambiental, ética animal, ética aplicada, ética de la conservación, filosofía ambiental

重新审视保护科学的两条规范
【摘要】保护科学是一个道德驱动的领域, 其实践中包含了许多潜在和明确的价值观。因此, 保护工作者必须参与到保护伦理学中, 以审视潜在的价值观。我们研究了最前沿的生态科学和当代伦理学, 以重新审视在保护领域已经被奉为教条的两条保护规范:认可生态集体(而非动物个体)的价值, 以及对生物拟人化的严格规避。新的研究表明, 个体及其种内变异对保护科学具有利用价值, 且环境哲学中也正在形成对个体道德价值的共识。因此, 我们建议保护科学应该明确地承认个体的价值。我们还认为, 避免生物拟人化不利于保护, 因为批判性的拟人化能够使科学方法更加细致入微, 使保护工作者能够有创造性和同理心地提出开明的问题。我们提供的证据表明, 这两种教条式的规范在科学上和道德上都已过时, 我们还提出了新的价值规范, 以推动保护工作走向更有力的科学和道德实践。
【翻译:胡怡思;审校:聂永刚】

关键词: 应用伦理学, 动物伦理学, 拟人化, 保护伦理学, 环境哲学, 环境伦理学

INTRODUCTION

Conservationists are tasked with conserving the living world—a biota facing habitat destruction, climate change, species extinction, and increased nonhuman animal mortality. This task is morally motivated, with inherent values built into its practice (Noss, 2007; Soulé, 1985). The values of conservation science (e.g., biodiversity is good, human-driven species extinction is bad) and the norms of conservation science (e.g., foster biodiversity) guide research and practice (Noss, 2007; Soulé, 1985). Conservation science can even be seen as the expression of such values, with goals defined by values rather than the pursuit of scientific knowledge (Robinson, 2006). Conservationists also must grapple with ethically charged situations (Sommer & Ferraro, 2022; Wallach et al., 2018), such as decisions over which entities or collectives to prioritize. We use the term *conservationists* to refer to scientists and practitioners informed by conservation science and biology and the norms enshrined within.

In response to the moral challenges conservationists face, environmental and conservation ethics have emerged as disciplines to help guide human interactions with, and management of, the living world. Broadly defined, environmental ethics examines the moral relationship between humans and the natural environment (Des Jardins, 1997). Conservation ethics is a subdiscipline of environmental ethics focused on the applied question of how to best practice conservation (Ferraro et al., 2021).

When important but assumed norms are accepted as incontrovertible, they become dogmas that are difficult to identify and assess (Nelson et al., 2021). As the field of conservation ethics grows, scientists and philosophers are reconsidering long-held—often blindly accepted—values and norms that guide practice (Ferraro et al., 2021; Nelson et al., 2021; Rohwer & Marris, 2021; Wallach et al., 2020). Given the inherently ethical nature of conservation, conservationists must meld ethics and science to reassess the values and norms of conservation science in light of new developments in both fields. We examine two such dogmatic normative values: first, that ecological collectives (genotypes, species, populations, biotic communities, ecosystems, biomes) are valuable in conservation (Callicott et al., 1999; Soulé, 1985), but individual nonhuman animals (hereafter, individuals or animals) are explicitly not valuable and, second, that all anthropomorphism ought to be avoided. For both, we demonstrate these norms are scientifically and ethically outdated by melding current philosophical theory and ecological science.

THE DOGMA THAT INDIVIDUALS ARE NOT VALUABLE IN CONSERVATION SCIENCE

Brief history

In the field-defining paper "What is Conservation Biology?," Soulé (1985, p. 170) proposed four normative postulates to serve as the "value statements that make up the basis of an ethic of appropriate attitudes" for conservation: diversity of organisms is good (1); ecological complexity is good (2); evolution is good (3); and biotic diversity has intrinsic value (4). He further explicated postulates 1, 2, and 4 as: diversity of species is good; diversity of habitats is good; and species have intrinsic value, respectively. The first two postulates have become the following norm: biodiversity, understood to be the diversity of ecological collectives, is valuable (Callicott et al., 1999; Noss, 2007). Sustaining and enhancing these collectives has become the motivation for research and application of conservation science (Callicott, 2018; Robinson, 2006). Soulé (1985, p. 731) was careful to convey what conservationists need not value: "Conservation is engaged in the protection of the integrity and continuity of natural processes, not the welfare of individuals" because "the ethical imperative to conserve species diversity is

distinct from any social norms about the value or the welfare of individual animals or plants." Thus, in the context of conservation, any concern about the value or welfare of individuals is of less importance than, and independent of, conservation goals.

Although *animal welfare* and *valuing individual animals* are often used interchangeably (even in Soulé [1985]) and are inextricably linked, they are not the same. One might value individuals for the following, not mutually exclusive, reasons: instrumentally (the value of individuals stems from their contribution to a desired end, such as their role in ecosystem function) or intrinsically (individuals have value in and of themselves, independent of their instrumental value [Zimmerman & Bradley, 2019]). If animals have only instrumental value, then the welfare of those individuals is of no concern insofar as it does not detract from their instrumental value. However, if animals have intrinsic value, they are of moral concern, and conservationists must consider an individual's welfare (e.g., health, freedom from gratuitous pain, capacity to engage in routine life). What constitutes animal welfare (Heeger & Brom, 2001) and determining the appropriate use of the term and to whom it applies is beyond the scope of this paper. However, the stance Soulé (1985) takes on the intrinsic value of animals is implied: if conservationists need not be concerned with their welfare, it follows that individual animals have no intrinsic value.

Even before Soulé (1985) articulated the moral motivations for conservation, environmental ethics had moved away from recognizing the intrinsic value of individuals—a split succinctly discussed by Jamieson (1998), Fraser (2010), and Campbell (2018). This canonical schism was cemented by Callicott (1980), who argued that environmental ethics ought to value the "integrity, stability, and beauty of the biotic community" (Leopold, 1949, pp. 224–225) and that the value of an individual is a function of its role in an ecosystem. Callicott (1980) further argued that because the value of individual animals does not stem from any trait (e.g., sentience, agency, intrinsic value), their welfare is not something conservationists need be concerned about.

Although Callicott (1980) may or may not have inspired Soulé (1985) directly, this was the predominant position in environmental ethics at the time (Campbell, 2018; Jamieson, 1998). Consequently, it is unsurprising that Soulé (1985) followed the contemporaneous tradition when explicating the values he thought should underpin conservation. Although animal welfare and conservation are similar in aim (valuing and caring for the animate world), animal welfare, animal ethics, and the intrinsic value of individuals have been excluded from mainstream conservation (Santiago-Ávila & Lynn, 2020; Wallach et al., 2018).

Soulé's (1985) explicit emphasis on the intrinsic value of ecological collectives and his implicit dismissal of the intrinsic value of individual animals led to the dismissal of any value of individuals (instrumental or intrinsic) in mainstream conservation. Thus, conservation-related ecological research has largely operated at population, species, community, and ecosystem scales, ignoring individuals and individual variance within these collectives (Bolnick et al., 2003; Clark et al., 2011). The dogma that conservationists need not recognize the value of individuals (Nelson et al., 2021) has permeated the field so profoundly that conservationists have long viewed individuals as mere parts of a given ecological whole (Bolnick et al., 2003; Wallach et al., 2018). As a result, certain processes at the relevant scales remain unstudied. For example, although conservation biologists often study species interactions, species themselves do not compete; rather, individuals interact with other individuals (Clark et al., 2011). The dogma is so engrained that even the diversity among individuals has been ignored. For example, the International Union for the Conservation of Nature omits individual diversity, recommending the conservation of biodiversity at the levels of genes, species, and ecosystems (McNeely et al., 1990). Of course, much of what there is to know about ecosystems must be explored at the collective level. Still, the dominant (and borderline sole acceptable) route of inquiry has been into collectives as fundamental units (Wallach et al., 2018).

Due to the rejection of individual animal value, conservationists have historically ignored the instrumental value of individual diversity and individuals as well as the intrinsic value of individuals. We contend that moving away from this dogmatic approach will allow conservation scientists to find ecologically and ethically sound solutions to conservation problems.

Deconstructing the dogma with scientific evidence

Claims that individual diversity and individuals are instrumentally valuable for conservation science (e.g., to ecosystem function, to population success) are empirical. Although the historical trend has been to ignore individual variance (Bolnick et al., 2003; Clark et al., 2011), modern science definitively shows that there is diversity among individuals of the same species in how they move (Nilsson et al., 2014), what they eat (Araújo et al., 2009), and how they manage risk (Richmond et al., 2022). In fact, diversity is essential in answering questions spanning the entire discipline (Bolnick et al., 2003; Table 1). For example, in evaluating whether a population is large enough to sustain itself, there is a rule of thumb that an effective population size of 50 individuals is needed to circumvent genetic homogenization due to inbreeding and 500 individuals are needed to minimize genetic drift (Franklin, 1980; Soulé, 1980). Although the actual number of individuals needed in a population to approximate the effective population size depends on traits of individuals (Frankham et al., 2010), intraspecific variation is essential.

This is evident in conservation practice, albeit tacitly, in projects aiming to avert extinction through "genetic rescue" (Tallmon et al., 2004) or "genetic restoration" (Hedrick, 2005), wherein conservationists introduce specific individuals to increase genetic diversity. Intraspecific variation is also important to community viability and ecosystem function and provides ecologically explanatory value (Modlmeier et al., 2014). It can have effects so large they rival the effects of species removal or replacement (Des Roches et al., 2017). Thus, the diversity of individuals—their unique genetic and phenotypic traits—is important for genetic diversity, the trajectory of

TABLE 1 Evidence that demonstrates valuing individuals promotes better science

	Example	Description	References
Conservation practice	Endangered species translocation	Managers select not only source groups that would increase genetic diversity, but also individuals that are most likely to survive, breed, and contribute to the effective population size.	Johnson et al., 2010
	Genetic rescue	Specific individuals are selected to breed with an at-risk population and are chosen for their genetic differences from the at-risk population.	Bell et al., 2019; Hedrick, 2005; Tallmon et al., 2004
Ecological phenomena	Keystone individuals	Particular animals can have roles or functions of high importance, underpinning dynamics at the full ecosystem level, such as alphas in social groups or pioneer individuals.	Modlmeier et al., 2014
	Animal personality	Behavioral tendencies that are consistently different from other individuals of the same species.	Bremner-Harrison et al., 2004; Myles-Gonzalez et al., 2015; Nilsson et al., 2014; Sommer & Schmitz, 2020
	Plasticity, G×E interactions	Trait expression is the product of an individual's experience in different environments; not all organisms have the same trait expression in different environments.	Miner et al., 2005; West-Eberhard, 1989
	Intraspecific variation	Variation among individuals within a population can have effects on ecological dynamics equivalent to or greater than the effects of species removal or replacement.	Des Roches et al., 2017

populations and species, community composition, and ecosystem function (Des Roches et al., 2017; Violle et al., 2012), all ecological scales relevant for conservation. Yet conservationists do not always consider individual variation. For example, ecological niche models ignore intraspecific variation in individuals' plasticity, behavior, and adaptive potential, which can exaggerate faulty predictions (Razgour et al., 2019).

One could argue that any example of the importance of individual diversity could be boiled down to genetically determined traits. In this view, the value of individual diversity is encapsulated in diverse gene pools, which are already recognized as valuable. However, as the reader will see below, there is independent scientific value in the particular instantiation of genes in individuals (phenotypic diversity), and the claim that the value can be placed solely in the gene pool is neither scientifically nor philosophically justifiable (Figure 1).

It is not just individual diversity that can be important, but also the existence of specific individuals. Increasingly research indicates individuals can disproportionately affect group dynamics or ecosystem function (Des Roches et al., 2017). For instance, keystone individuals can underpin dynamics at the population or ecosystem level, and the removal of these individuals can have lasting, conservation-relevant effects. Examples include alpha individuals in social animal groups, highly connected individuals in a population, decision makers, or individuals acting as pioneers (Modlmeier et al., 2014). These discoveries are in conflict with, and hindered by, the treatment of all individuals as interchangeable.

Emerging animal personality studies can also be considered. Defined as behavioral tendencies that consistently differ from other individuals of the same species (Wolf & Weissing, 2012), personalities can be important in species persistence, ecosystem function, and conservation practice (Collins et al., 2022; Nilsson et al., 2014; Sommer & Schmitz, 2020). For example, in wildlife introductions and reintroductions, personality traits can help individuals and species establish successfully (Sih et al., 2004). For round goby (*Neogobius melanostomus*), bolder individuals are more likely to establish (Myles-Gonzalez et al., 2015), whereas for foxes (*Vulpes velox*), shyer individuals are more likely to succeed (Bremner-Harrison et al., 2004). In both cases, it matters not only that the species *N. melanostomus* or *V. velox* is introduced, but which round goby or red fox is introduced.

One could object that these studies merely demonstrate definable personality subtypes and that the type of personality is essential for conservation rather than particular individuals. But, in learning which character traits might contribute to different ecosystem functions, one opens the door to understanding how gradients of personality traits may be important. Unique individuals should be expected to have unique impacts on ecosystems and, by extension, on conservation. Therefore, one would expect each individual to have distinct instrumental value or disvalue, and interventions that do not sufficiently consider individual behavior could lead to detrimental outcomes (Edelblutte et al., 2023). Toward our larger point, these discoveries of animal personality and keystone individuals could not have occurred without making the individual the unit of inquiry (Table 1).

With examples from active ecological and evolutionary research (Figures 1 & 2), we show the outdated nature of a postulate that recognizes the instrumental value of species and ecosystem diversity but ignores the instrumental value of individual diversity or individuals themselves.

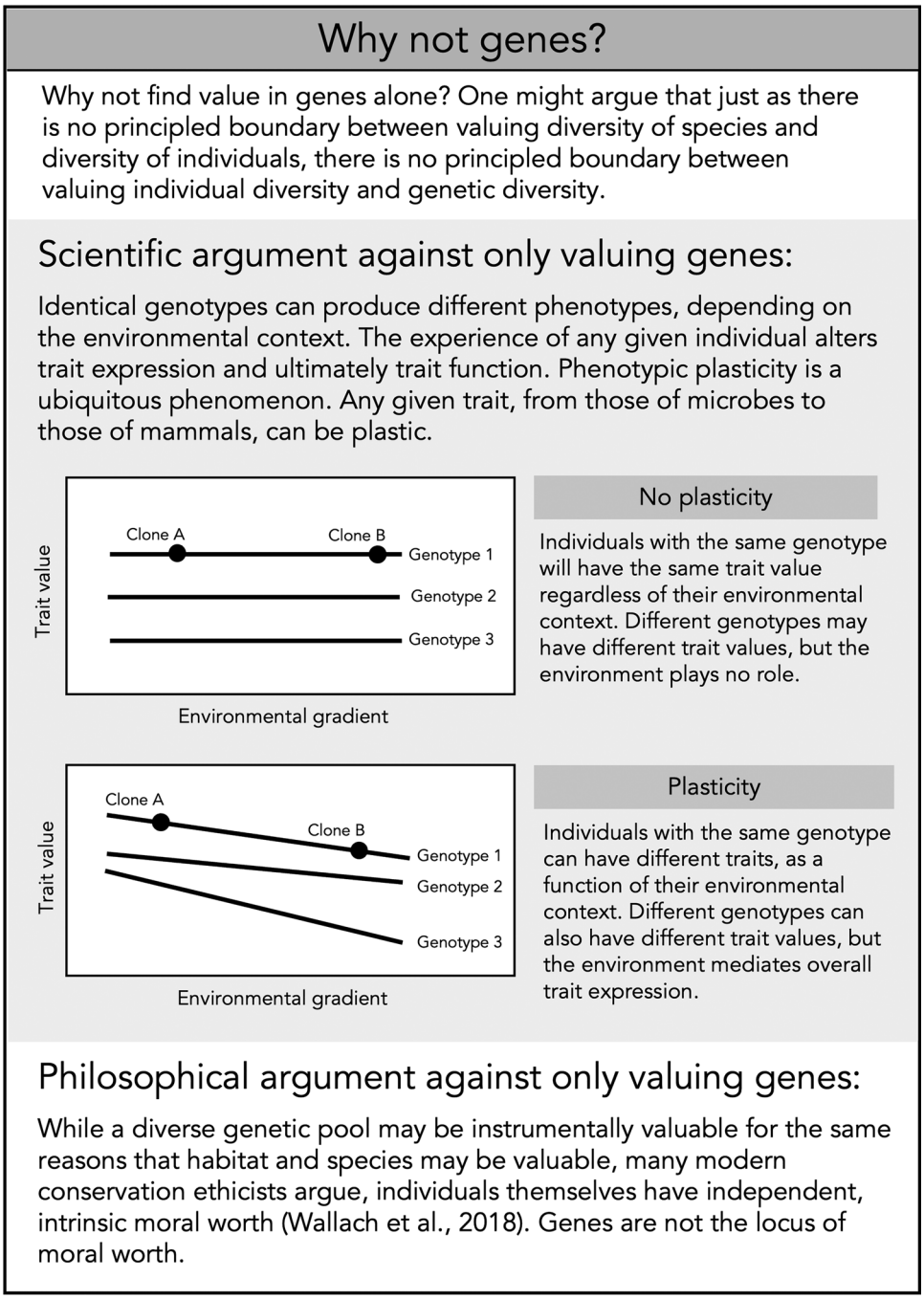

FIGURE 1 Scientific and philosophical justification for why genes alone are not valuable.

Deconstructing the dogma with philosophy

Turning to philosophy, we can further examine the claims that individual diversity and individuals themselves are not valuable. Soulé's (1985) postulates support the claim that biodiversity is the principal value motivating conservation science and practice: diversity is valuable and there is diversity within and among species and ecosystems; therefore, species and ecosystem diversity are valuable. Thus, Soulé (1985) contends that the value of diversity is prior to ecological value: diversity is why conservationists value ecosystems and species (Soulé, 1985). By parity of reasoning, therefore, the diversity of individuals should be of no less value—at least instrumentally—than the value of collectives at scales above and below that of individuals. Some philosophers suggest revisiting ascribing intrinsic value to non-sentient ecological entities or collectives altogether (Justus et al., 2009), but that is beyond the scope of this paper.

If conservationists value distinct ecological collectives insofar as they contribute to biodiversity, then one can recognize the value of individuals for the same reason: because the

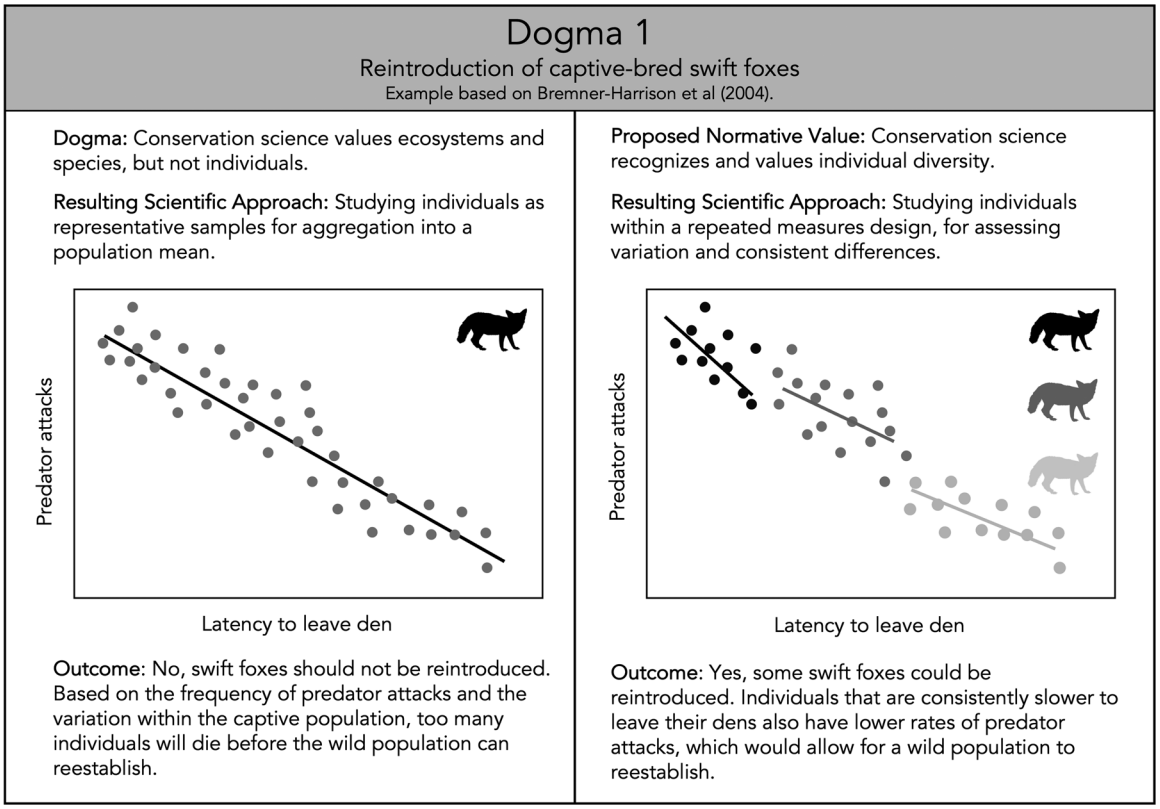

FIGURE 2 Hypothetical application of both the current dogma that individuals are not valued in conservation science and the suggested revised norm that individuals are valuable in conservation science.

differences among them manifest as intraspecific variation and thus diversity (e.g., age, sex, habitat use, food preferences, and personality). Even if species alone are intrinsically valuable, given that individual animals are important in maintaining species, conservationists need to acknowledge the instrumental value of individuals for the sake of species. Thus, we contend that on philosophical grounds alone, conservation ethicists should reinterpret the more fundamental postulate that the value of biodiversity includes the value of individual diversity and individuals.

To instrumentally value individuals and individual diversity is not to value the individuals in and of themselves. However, recent work in conservation ethics suggests recognizing the intrinsic moral value of nonhuman individuals is independently justified (Vucetich & Nelson, 2007). Many philosophical and scholarly perspectives suggest at least some nonhuman individuals have intrinsic value, including traditional animal liberation (Singer, 1995), animal rights theories (Nussbaum, 2023; Regan, 1987), consequentialism (John & Sebo, 2020), biocentrism (Taylor, 2011), universal consideration (Birch, 1993), hierarchical consideration (Kagan, 2019), deep ecology (Naess, 1989), and modified Kantianism (Korsgaard, 2018). Callicott (1988) revisited his claim and believes environmental ethics and animal welfare are theoretically compatible. These developments are reflected in the subfield of conservation ethics, including the emergence of compassionate conservation (Wallach et al., 2018, 2020) and interest-based rights frameworks applied to conservation (Kapembwa & Wells, 2016; Sommer & Ferraro, 2022). Importantly, these ethical frameworks do not necessarily ask conservationists to avoid harm to any individual but instead ask, at minimum, for individuals to be considered and valued alongside ecosystem function or species conservation. Although each ethical theory has its own approach, and sometimes they conflict, these frameworks challenge conservationists to marry conservation goals with the recognition of individual intrinsic value rather than write them off as separate domains of concern.

Developments in understanding animal "sentience and sapience" (Wallach et al., 2018), discussed in detail below, also provide compelling evidence for the intrinsic value of animals. Although we do not subscribe to the view that intrinsic value is necessarily in proportion to the sentience of a being, it seems to be a relevant characteristic in assessing the worthiness of moral consideration.

Moving forward by valuing individuals

The norm against recognizing individual value in ecological research and conservation affects how conservationists approach scientific questions, promotes a disregard for individuals (examples in Ramp & Bekoff [2015] and Wallach et al. [2018]) (Figure 2), and normalizes intentional and unnecessary harm against individuals (Wallach et al., 2018). However,

emerging scientific advances and consensus among philosophers require reevaluation of the dismissal of individual value in conservation. We suggest that conservationists should recognize and incorporate the instrumental value of individual diversity and individuals as well as the intrinsic value of individuals. In doing so, one can devise more scientifically rigorous and ethical guidelines for best practices for conservation.

Of note, the ideas that individual animal welfare and conservation of collectives are always in conflict and that conservationists face a binary choice between the two are widespread (Wallach et al., 2018). On the surface, this may seem to be the case. For example, behaviorally training a population of naive prey to avoid predators prior to reintroduction may result in the death of some of the prey individuals. Yet, if conservationists recognize the instrumental and intrinsic value of individuals and consider the welfare of the prey, they might find creative ways to expose a naive prey population without subjecting individuals to death (e.g., through aversion training [Sommer & Ferraro, 2022]). We suggest that although a goal of conservation may be to conserve ecological collectives, this goal can be achieved in a way that recognizes the instrumental and intrinsic value of individuals.

THE DOGMA THAT ANTHROPOMORPHISM SHOULD BE DISCOURAGED IN CONSERVATION SCIENCE

Brief history

Anthropomorphism is broadly defined as the attribution of human characteristics to nonhuman entities. Concerning animals, however, it is commonly used to mean the inappropriate or inaccurate attribution of human characteristics to animals (Root-Bernstein et al., 2013). The first definition is value neutral; the second definition carries substantial negative connotations in which anthropomorphism, by its very definition, is to be avoided.

The inconsistent use of *anthropomorphism* has led many scientists to avoid anthropomorphizing as part of their scientific practice. Therefore, we distinguish between critical and superficial anthropomorphism. Superficial anthropomorphism leads scientists to falsely attribute human experiences to nonhumans via the attribution of qualities that superficially resemble human qualities (Lockwood, 1986). For example, superficial anthropomorphizing of a chimpanzee grin could lead one to assume the chimpanzee is experiencing joy when a grin can communicate fear or anger (Dacey, 2017). Thus, let us accept that superficial anthropomorphism should be avoided because it can be dangerous and, perhaps most importantly, it leads to wrong conclusions.

By contrast, critical anthropomorphism uses "natural history, …perceptions, intuitions, feelings, careful behavior descriptions, identifying with the animal, optimization models, previous studies and so forth …to generate ideas that may prove useful in gaining understanding" (Burghardt, 2013, p. 73). Darwin used critical anthropomorphism to understand nonhuman beings (Lockwood, 1986), and we join those who argue that critical anthropomorphism is a legitimate scientific tool (Burghardt, 2013; de Waal, 1999; Rivas & Burghardt, 2002).

Rejecting all anthropomorphism is deeply ingrained in scientific practice (Breland & Breland, 1966; Hume, 1957; Urquiza-Haas & Kotrschal, 2015; Wynne, 2004) and has been institutionalized as far back as the works of Pavlov, Watson, and Skinner (Lockwood, 1986). Yet, why is it that all anthropomorphism is considered at best a mild vice (Bruni et al., 2018) and at worst counterproductive and insidious (Kennedy, 1992; Mota-Rojas et al., 2021; Wynne, 2004)? When scientists began to seriously study nonhuman animals in the late 18th and early 19th centuries, two camps emerged regarding animal consciousness and subjective experience. The first, which included Darwin, thought that given evolutionary continuity, it was appropriate to acknowledge the possibility that nonhuman animal experience is similar to that of humans. The second feared that the human propensity to ascribe human experiences to animals would lead scientists astray (see Lockwood [1989] and Kelley [2004] for more history). Ecology and conservation science have historically sided with the general scientific consensus that it is better to be conservative and not reach wrong conclusions through inappropriate anthropomorphism. The avoidance of anthropomorphism is often not explicit, but instead operates as a hidden curriculum in ecology and animal behavior education. It is then socially enforced during project development and peer review.

What is gained by attributing so-called human characteristics to animals? Persuasive arguments by scientists and philosophers have been made repeatedly for appropriate, restrained anthropomorphism (Horowitz & Bekoff, 2007; Keeley, 2004; Lockwood, 1986; Rivas & Burghardt, 2002). The debate here is not empirical, but metascientific (Keeley, 2004). The discussion centers on how data ought to be interpreted (Bekoff & Allen, 1997) and has implications for which questions are asked (Shettleworth, 2010) and how scientific inquiry involving animals is approached. Here, we add additional considerations based on both scientific and philosophical advances.

Deconstructing the dogma with a shifting scientific approach

Detractors of anthropomorphism believe it produces bad science—incorrect theories about the world and misleading interpretations (Kennedy, 1992; Wynne, 2004). However, we contend that the dogmatic avoidance of anthropomorphism is what results in bad science, preventing conservationists from asking pertinent questions, pursuing complete explanations, and employing important conceptual tools (Figure 3). Instead, critical anthropomorphism can improve understanding of how animals interact with their environments and each other, important knowledge for conservation (Table 2). As mentioned above, conservationists now recognize that animals have personalities (Stamps & Groothuis, 2010)—a characteristic often presumed to be only human. Leaving aside the question of what a

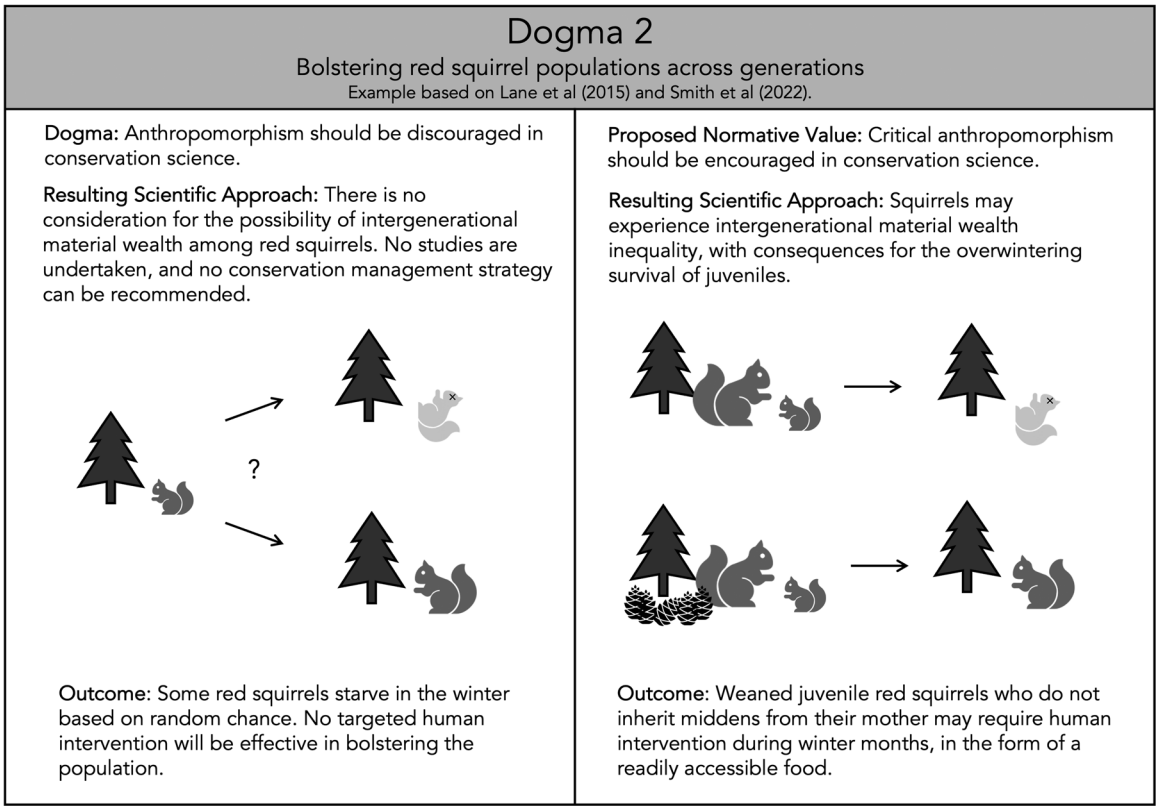

FIGURE 3 Hypothetical application of both the current dogma that anthropomorphism should be avoided in conservation science and the suggested revised norm that anthropomorphism can be useful in conservation science.

TABLE 2 Evidence that demonstrates the use and benefits of critical anthropomorphism

Example	Description	References
Dreaming	Observing jumping spider sleep revealed movement patterns similar to cats and dogs, which prompted further investigation. Cats and dogs are routinely beneficiaries of critical anthropomorphism; it is not so great of a jump to say critical anthropomorphism led to the discovery of REM-like sleep states in spiders.	Rößler et al., 2022
Mourning	Evidence of animals' abilities to experience complex emotional responses, such as mourning, demonstrates the shared experiences between humans and animals that can be discovered with critical anthropomorphism.	Moss, 1992
Complex social structures	Recognizing complex social structures similar to those found in humans has allowed scientists to discover that not only do animals have distinct social groups and friends, but they also have complex social structures that can influence health and reproductive output.	Brent, 2015; McAdam et al., 2022
Personalities	Considering that behaviors may not be purely flexible and could indeed be restrained, as in humans, animal personality has been very carefully defined as behavioral tendencies that are consistently different from other individuals of the same species (Wolf & Weissing, 2012) in an attempt to avoid inappropriate anthropomorphism. Although the field has grown tremendously, this rigid definition may be limiting further scientific discovery.	Cote & Clobert, 2007 (reptiles); Groothuis & Carere, 2005 (birds); Malmkvist & Hansen, 2002 (mammals); Overli et al., 2005 (fish); Sih et al., 2003 (amphibians); Sommer & Schmitz, 2020 (insicts)
Intergenerational wealth	The exploration of how commodities can be passed down from parents or unrelated older individuals (such as territory with access to food) can have ramifications for the beneficiaries' survival, and reproduction has demonstrated how animal's experiences may be shaped in ways similar to that of humans.	Ilany & Akçay, 2016; Smith et al., 2022 (full list of applicable species)
Same-sex sexual behaviors	By looking at shared, historical traits, scientists can describe specific characteristics and traits observed both in humans and animals. As a result, one can apply the null hypothesis of same-sex sexual behavior to explain the occurrence of same-sex behavior in over 1500 species.	Monk et al., 2019 (full list of applicable species)

personality is, assume that the behavioral ecologist definition fully captures animal personality: a consistent suite of behaviors expressed by an individual that make it unique among others of its kind (Carter et al., 2013). The discovery of animal personalities was only possible through scientific approaches that treated individuals as the unit of inquiry, rather than the population, and used critical anthropomorphism to conceptualize that animals may have personalities.

Let us return to the almost Skinnerian definition of animal personality. When one attributes a particular personality to a person, one may expect that personality to be accompanied by consistent behaviors, but one does not define the personality solely as a consistent set of behaviors. For example, if Oscar the Grouch is, in fact, a grouch, one would expect that his dour state of being will consistently lead to particular behaviors (pessimism, frowning, etc.). Still, one connects these external behaviors with an internal (and ontologically subjective) personality—what it is like to be Oscar. Putting aside whether personalities are immutable, the set of behaviors is understood to be at least partially causally derivative of the personality rather than constituting it. Given the role of the concept of personality in one's thinking regarding other people, why should it not then play the same role in one's understanding of animals in ecosystems?

In addition to considering personality and analogous states of consciousness, considering the possibility that species phylogenetically related to humans may possess similar traits is a useful tool in other ways. For example, animals can inherit nongenetic assets from parents or unrelated older individuals, such as territory with access to food (Fisher et al., 2019; Lane et al., 2015) (Figure 3), a form of intergenerational material wealth inequality (Smith et al., 2022). Just as nonuniform access to resources affects humans, this inequality has ramifications for the beneficiaries' survival and reproduction, consequences relevant to conservation.

In applying critical anthropomorphism, it is imperative to avoid human-specific concepts, such as institutional or cultural constructs. For example, animals do not experience inequalities that arise from institutionalized racism and sexism. Monk et al. (2019) warn of this, pointing out the dangers of applying human cultural constructs to animals in their reexamination of the prevalence of same-sex sexual behaviors in animals. They argue that historical hypotheses to explain this behavior focus on how the behavior evolved and persisted despite evolutionary costs rather than exploring the possibility of a null hypothesis, which would shift the question from "Why engage in same-sex behaviors?" to "Why not?" (Monk et al., 2019, p. 1623).

Of note, Monk et al. (2019, p. 1623) explicitly state they attempted to "avoid anthropomorphism," exemplifying how ecologists and conservationists are wary of the act and accusation of anthropomorphizing. However, we suggest they employed critical anthropomorphism in their attempt to shift the perspective of same-sex sexual behavior in other species; they look to shared historical traits to propose their null hypothesis while carefully "[drawing] a distinction between human attributes of gender and sexuality …and the scientific terminology of sex and sexual behaviors, which can be used to describe specific characteristics and traits observed in nonhuman animals" (Monk et al., 2019, p. 1623).

Deconstructing the dogma with philosophy

Conservation scientists may resist the use of critical anthropomorphism in ascribing thought and other cognitive processes to animals because it is impossible to know whether or not animals are thinking and, given that they are thinking, it is impossible to know their thoughts. Let us start with the first charge: can one know if other species are thinking at all? Some Western scientific fields explain animal behavior by referencing mental states, including Darwinian science, early comparative psychology, and classic ethology, but most have historically operated under the assumption that no animal behavior should be explained using mental states (Lutz, 2009). This position has permeated behavioral and cognitive science for decades (Shettleworth, 2010), but advances in animal cognition have begun to put this argument to rest (Bekoff, 2017). Scientists have good reason to believe animals have cognitive abilities and, in some cases, undertake conscious, deliberate action (Table 2), both of which address the broader question of whether animals think. Thus, although the nature of animal cognition and consciousness is still being investigated, there is little dispute that many nonhuman animals are thinking.

Within philosophy, the ontological problem of other minds is an ancient one, and ideas about animal minds can be extended to a skepticism regarding the mental experiences of other humans. It is called solipsism. Because conservation scientists are not typically solipsists and because science gives one reason to believe that at least some animals are thinking, one can address the practical, and harder, epistemological problem: is it possible to know what a member of another species is thinking?

Many conservationists believe that because it is currently impossible to tap into an animal's thoughts, one should not attempt to infer an animal's beliefs, desires, and so forth because it may lead to superficial anthropomorphism. The default scientific rejection of anthropomorphic interpretation can be found in a RadioLab podcast episode called "Animal Minds" (WNYC Studios, 2010). In the episode, several fishers recount an incident in which they rescued a whale from fishing nets. After freeing the whale, they describe how the whale swam up to each of the crew and spent time looking at them and allowing them to touch her: "I know it sounds crazy, but I could see the look in her eye. This 50-ton mammal was literally saying thanks." The RadioLab hosts then discuss the incident with ethologist Clive Wynne, who immediately dismisses the idea: "It shows some interest in the individuals. I'll give you that. But how do we get from that to deducing that the whale is trying to express things?" He chalks the experience up to the whale's disorientation and explains that since he cannot speak whale or know what it is like to be a whale, he cannot say that the whale was expressing gratitude.

How best to understand the minds of others is a difficult question, with no single methodology providing an answer (but

see Jamieson [2009]). However, evolution is a continuum—new forms and traits arise from preceding forms with common ancestry (Stankowski & Ravinet, 2021). Therefore, we suggest it is likely that similarity in experience might also exist along a continuum; thus, one can apply the same tools used to understand the conscious experience of other human beings to understand the conscious experience of other-than-human beings. One may infer that they think and feel something like what humans think and feel when they act something like humans act, all the while accounting for differences of anatomy, sensoria, life history, ecological niche, and so forth. Importantly, however, humans are not the pinnacle of the evolutionary continuum, and critical anthropomorphism is not the interpretation of animal behavior in human terms. It is the tracing of a perspective back to a shared ancestry, and there is "…reason to believe that there is potential for analogous experiences and… a good understanding of the animal's ecological, evolutionary, and individual history" (Lockwood, 1986, p. 193).

Eileen Crist (2002, p. 8) characterizes the so-called problem of anthropomorphism in her defense of an essay exploring the subjective experience of earthworms:

> The question of 'conscious action' in animals is not inherently problematic: not ontologically problematic because it is not rational to presume, prior to inquiry, that the existence of conscious action is unlikely, even among invertebrates; not epistemologically problematic because once the question of conscious action is allowed to be posed, the scientific imagination finds fascinating ways to address it; and finally, not semantically problematic because writing on "The Inner Life of Earthworms" as anthropomorphism commits the deeper … fallacy of anthropocentrism. Such dismissal rests on the presumption of an unbridgeable gap between the ostensibly "highest" of animals (humans) and most other organisms.

Crist indicates that the metaphysical foundations of anthropocentrism are also the foundations of strict avoidance of anthropomorphism. Yet science keeps revealing humans are not as unlike animals as people like to think.

Moving forward by leveraging critical anthropomorphism

Other fields have begun applying critical anthropomorphism with great success. Medical researchers have collaborated with veterinary scientists to explore how shared experiences and anatomies of animals (human and nonhuman) lead to insights (Natterson-Horowitz & Bowers, 2013). As scientists begin to understand more about animal minds, capabilities, and personalities (Bekoff, 2002; Marris, 2021), behaviors and traits once considered inappropriate anthropomorphism (e.g., boldness or the ability to mourn) are now recognized as similarities across species (Table 2). By daring to imagine a shared experience, discoveries informing conservation science will only continue. We suggest that critical anthropomorphism is not only a tool one can use to relate to the world, but also a way to wonder about it. One can appreciate the similarity in experience and the difference. Humans may never be able to experience what it is like to navigate with echolocation, like a bat, or communicate via dance, like a bee. Still, one can appreciate the difference while acknowledging that other animals can and do navigate the world via experiences, communicating in ways inaccessible to humans.

Using critical anthropomorphism to understand other species is a heuristic learning process. Although it may occasionally lead to errors in judgment (Dacey, 2017), the benefits outweigh the risks. Reassessing conservation science's relationship with this tool may allow for a more nuanced application—one that will promote conservation goals and lead to important, enlightening questions asked with compassion and open-mindedness while avoiding the pitfalls of inappropriate anthropomorphism. And, rejecting critical anthropomorphism poses the danger of simply reducing animals to machines; the behaviorist experiments of the 1960s provide evidence of the unethical results of such reduction. Thus, a precautionary principle should be adopted, because the moral risk of not doing so is tremendous. Wouldn't it be better to accidentally ascribe the ability to feel pain to a rock than accidentally not ascribe it to a chimpanzee (Sebo, 2018)?

Finally, critical anthropomorphism evokes an empathetic response and is thus an effective conservation tool (Root-Bernstein et al., 2013). It may further help people appreciate the diversity and moral value of individual beings, eliciting a more compassionate approach to conservation (Castellano, 2018; Manfredo et al., 2020). Thus, critical anthropomorphism has a variety of strengths: it offers a way to begin asking questions to address the problem of other minds; facilitates more rigorous science; creates a more compassionate scientific practice; and helps combat the dogma of not valuing individuals.

CONCLUSION

Given the inherently ethical nature of conservation science, conservationists must reassess norms within the field as scientific data and philosophical advances reveal new insights. This is only possible with intentional collaboration between conservation scientists and ethicists (Ferraro et al., 2021; Nelson, 2021). We used recent ecological research and advances in philosophy to reassess two dogmatic norms in conservation. By revising them, one can do better science and do science better.

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