

REVIEW

Animal agency in wildlife conservation and management

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Article impact statement: Incorporating animal agency into wildlife conservation and management can lead to more effective, nuanced, and just outcomes.

Abstract

Wildlife conservation and management (WCM) practices have been historically drawn from a wide variety of academic fields, yet practitioners have been slow to engage with emerging conversations about animals as complex beings, whose individuality and sociality influence their relationships with humans. We propose an explicit acknowledgement of wild, nonhuman animals as active participants in WCM. We examined 190 studies of WCM interventions and outcomes to highlight 3 common assumptions that underpin many present approaches to WCM: animal behaviors are rigid and homogeneous; wildlife exhibit idealized wild behavior and prefer pristine habitats; and human–wildlife relationships are of marginal or secondary importance relative to nonhuman interactions. We found that these management interventions insufficiently considered animal learning, decision-making, individuality, sociality, and relationships with humans and led to unanticipated detrimental outcomes. To address these shortcomings, we synthesized theoretical advances in animal behavioral sciences, animal geographies, and animal legal theory that may help conservation professionals reconceptualize animals and their relationships with humans. Based on advances in these fields, we constructed the concept of animal agency, which we define as the ability of animals to actively influence conservation and management outcomes through their adaptive, context-specific, and complex behaviors that are predicated on their sentience, individuality, lived experiences, cognition, sociality, and cultures in ways that shape and reshape shared human–wildlife cultures, spaces, and histories. Conservation practices, such as compassionate conservation, convivial conservation, and ecological justice, incorporate facets of animal agency. Animal agency can be incorporated in conservation problem-solving by assessing the ways in which agency contributes to species' survival and by encouraging more adaptive and collaborative decision-making among human and nonhuman stakeholders.

KEYWORDS

conservation in the Anthropocene, human–wildlife interaction, human–wildlife conflict, human–wildlife coexistence, animal geographies, animal legal theory, animal behavior, interdisciplinary conservation

Resumen: Aunque las prácticas de gestión y conservación de fauna (GCF) han partido históricamente de una gama amplia de áreas académicas, los practicantes se han visto lentos para participar en las conversaciones emergentes sobre los animales como seres complejos, cuya individualidad y sociabilidad influyen sobre sus relaciones con los humanos. Proponemos un reconocimiento explícito de los animales no humanos silvestres como participantes activos en la GCF. Para esto, examinamos 190 estudios sobre las intervenciones y los resultados de GCF para resaltar tres supuestos comunes que respaldan a muchas estrategias actuales de GCF: el comportamiento animal es rígido y homogéneo, la fauna exhibe un comportamiento silvestre idealizado y prefiere hábitats prístinos, y las relaciones humano-fauna son de importancia marginal o secundaria en relación con las interacciones no humanas. Descubrimos que estas intervenciones de gestión no consideran lo suficientemente el aprendizaje, toma de decisiones, individualidad, sociabilidad y relaciones con los humanos

de los animales, por lo que llevan a resultados imprevistos y perjudiciales. Para lidiar con estas limitaciones, sintetizamos los avances teóricos que han tenido las ciencias dedicadas al comportamiento animal, la geografía animal y la teoría legal animal que pueden ayudar a los profesionales de la conservación a reformular el concepto de animal y sus relaciones con los humanos. Con base en los avances en estas áreas construimos el concepto de agencia animal, el cual definimos como la habilidad que tienen los animales para influir activamente sobre la conservación y los resultados de manejo por medio de su comportamiento adaptativo, complejo y específico al contexto, los cuales están basados en su sensibilidad, individualidad, experiencias vividas, conocimiento, sociabilidad y culturas, de manera que construyen y reconstruyen las culturas, espacios e historias humano-fauna. Las prácticas de conservación, como la conservación compasiva, la conservación acogedora y la justicia ecológica, incorporan facetas de la agencia animal. La agencia animal puede incorporarse en la solución de los problemas de conservación al evaluar las formas en las que la agencia contribuye a la supervivencia de la especie y al alentar una toma de decisiones más adaptativa y colaborativa entre los actores humanos y los no humanos.

PALABRAS CLAVE

coexistencia humano-fauna, comportamiento animal, conflicto humano-fauna, conservación en el Antropoceno, conservación interdisciplinaria, geografía animal, interacción humano-fauna, teoría legal animal

野生动物保护和管理中的动物能动性

【摘要】野生动物保护和管理的实践历来自各种学术领域,但动物作为复杂生命体,其个性和社会性影响着它们与人类的关系,因此实践者很难跟上关于动物不断涌现的讨论。我们建议应明确承认野生非人类动物是野生动物保护和管理的积极参与者。我们调查了关于野生动物保护和管理的干预和结果的190项研究,并指出目前许多野生动物保护和管理方法的三个常见假设:动物行为是刻板 and 同质的;野生动物表现出理想化的野生行为,喜欢原始的栖息地;相比于动物与非人类的互动,人类与野生动物的关系是边缘或次要的。我们发现这些管理干预措施没有充分考虑到动物的学习、决策、个性、社会性以及与人类的关系,引起了意想不到的有害结果。为了解决这些缺陷,我们综合了动物行为科学、动物地理学和动物法律理论方面的理论进展,这些知识有助于保护专家重新认识动物及其与人类的关系。这些学科深入研究了动物的知觉、适应性、个性、集体决策以及对人类共享环境的参与。基于这些领域的进展,我们构建了动物能动性的概念,定义为动物通过其适应性、特定环境和复杂的行为积极影响保护和管理结果的能力,这些行为是建立在它们的知觉、个性、生活经验、认知、社会性和文化之上的,其方式塑造和重塑了人类与野生动物共有的文化、空间和历史。保护实践,如同情心保护、和谐性保护和生态正义,都包含了动物能动性的各个层面。通过评估动物能动性对物种生存的贡献,以及鼓励人类和非人类利益相关者之间更多的适应性和合作性决策,可以将动物能动性纳入到保护问题的解决方案之中。**【翻译:胡怡思,审校:聂永刚】**

关键词: 人类世的保护,人与野生动物互动,人与野生动物冲突,人与野生动物共存,动物地理学,动物法律理论,动物行为,跨学科保护

INTRODUCTION

In the face of unprecedented transformations to the biosphere, wildlife conservation and management (WCM) must constantly evolve. We define *WCM* as the practice and study of wildlife conservation, management, and human–wildlife interactions that intersect with the broad fields of human–animal studies. (We use *wildlife* and *wild animals* interchangeably to refer to non-human animals that live somewhat autonomously from humans, are self-sufficient, and possess the freedom to reproduce.) WCM draws from diverse disciplines to accomplish its goals

of protecting and preserving wild animals to ensure their survival and well-being while considering the well-being of humans who share landscapes with them. Many WCM interventions—from international policies, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), to national protected areas, to local restoration—are notable successes that can credit their formulation and effectiveness to theories and concepts absorbed from, for example, population dynamics and ecological modeling, monitoring and evaluation, applied statistics, genetics, and geospatial sciences. The practice of WCM has broadened to include humanities and

social sciences (Manfredo, 1989; Moon et al., 2019), engage with various forms of expertise and values (Lawrence, 2010; Tengö et al., 2014), and consider possibilities for coexistence between humans and wildlife in human-dominated landscapes (Carter & Linnell, 2016; Frank et al., 2019; Hodgson et al., 2020; Pooley et al., 2017; Woodroffe et al., 2005).

Yet, WCM practitioners have been slow to adopt key findings from disciplines that engage with the complexity of animals' lives and behaviors, their relationships with each other and with humans, and the ways in which these relationships shape the world humans share with wildlife. Despite the emergence of novel WCM approaches that challenge anthropocentric perspectives (e.g., Brakes et al., 2021; Büscher & Fletcher, 2019; Celermajer et al., 2020; Wallach et al., 2020; Washington et al., 2018) and the celebration of animal personhood by respected conservationists (e.g., Jane Goodall) and in the public imagination (Manfredo et al., 2020), many contemporary WCM policies and practices are still based on assumptions that wild animals respond passively to reconfigurations of complex human systems, without considering their influence in shaping these systems.

We considered explicit acknowledgment of wildlife as active participants in WCM. We did so by surveying recent work in the fields of animal behavioral sciences, animal geographies, and animal legal theory. Though emerging from distinct theoretical and epistemological backgrounds, researchers in these fields share an interest in understanding the complexity of animals, their relations to their environments and to humans, and how these dynamics can and should shape human treatment of nonhuman animals. By highlighting convergences of these fields toward similar sensitivities to animals and human–animal relationships, we examined the implications of considering animal agency an integral part of developing nuanced and effective approaches to the practice of WCM. We define *animal agency* in WCM as the ability of animals to actively influence conservation and management outcomes through their adaptive, context-specific, and complex behaviors that are predicated on their sentience, individuality, lived experiences, cognition, sociality, and cultures in ways that shape and reshape shared human–wildlife cultures, spaces, and histories. The modalities of practice presented here have been part of global communities for centuries because many non-Western traditions attribute agency to animals (Hornborg, 2015; Watts, 2013). However, this holistic definition of agency remains underexplored in the majority of current WCM practices.

We critically evaluated conceptual assumptions that underpin dominant forms of WCM and illustrate the potential for enriching views of animals to improve WCM outcomes. For instance, animal agency shares some influences and positions with compassionate conservation (Wallach et al., 2020), convivial conservation (Büscher & Fletcher, 2019), and ecological justice (Kopnina & Washington, 2020), which grapple with the intrinsic value and personhood of all sentient beings and humans' ethical obligations to them. We argue that animal agency can offer a useful lens to understand the successes, challenges, and spaces for growth in novel and established approaches. In doing so, we aimed to complement and support scholarly work reimagining

more just and effective WCM futures (Ampumuza & Driessen, 2021; Batavia et al., 2020; Bhattacharyya & Slocombe, 2017; Toncheva & Fletcher, 2021).

WHY INTERVENTIONS PRODUCE UNEXPECTED OUTCOMES

Understanding how WCM activities have unintended outcomes for wild animals and humans can help illuminate shortcomings and address future challenges emerging from increased and novel human–wildlife interactions. Table 1 provides a sample of scenarios in which WCM practices produced unanticipated results. We built the table by reviewing, compiling, and synthesizing 190 peer-reviewed publications in which WCM interventions were evaluated. We conducted targeted searches for commonly used intervention methods (e.g., translocation, reintroduction, fencing). Although not a comprehensive list, it is indicative of the diversity of species, practices, and outcomes associated with mainstream WCM. We augmented this review with authors' prior research involving interactions between humans and leopards (*Panthera pardus*), white-tailed deer (*Odocoileus virginianus*), rhesus macaques (*Macaca mulatta*), and wolves (*Canis lupus*). Drawing on the examples in Table 1, we identified 3 common assumptions about animals that unite the examples (full citations to Table 1 sources are in Appendix S1): animal behaviors are rigid and homogeneous, wildlife exhibit idealized wild behavior and prefer pristine habitats, and human–wildlife relationships are of marginal or secondary importance to the goal of species preservation. These assumptions are not held by all conservationists or applied in all management scenarios but, nonetheless, represent pervasive ideas in WCM across species, contexts, and time.

Animal behaviors are rigid and homogeneous (Assumption 1)

Many WCM strategies are based on the assumption that a species or individuals' behavior in one context will remain largely unchanged in another and that individuals of the same species behave uniformly (Table 1). Yet, animals, including wolves, coyotes (*Canis latrans*), elephants (*Elephas maximus* and *Loxodonta* spp.), and leopards, frequently exhibit plasticity of behavior unanticipated by WCM interventions. Testing a predictive habitat suitability model for wolves in Wisconsin developed by Mladenoff et al. (1995), Mech (2006) demonstrated that the model was a “poor predictor of wolf re-colonizing locations in Wisconsin, apparently because it failed to consider the adaptability of wolves. Such models should be used cautiously in wolf-management or restoration plans” (Mech, 2006, p. 874) (emphasis added). Yet such models often underlie wolf management strategies (e.g., Mech, 2015; Michigan Department of Natural Resources, 1997; Wisconsin Department of Natural Resources, 1999).

Relatedly, many WCM efforts are predicated on the assumption that interventions will not fundamentally reshape

TABLE 1 Selected wildlife conservation and management interventions, their intended goals, and actual outcomes

Species, management method	Expected management or conservation outcome	Actual outcome of intervention	References ^a	Assumptions ^b
African elephant (<i>Loxodonta africana</i>), lethal control, multiple locations	Reduction in crop raiding once so-called problem animal is killed. Human communities will be appeased as problem animals are controlled.	Number of raiders did not decrease because other individuals replaced removed raiders. Problem animal misidentified. Continued community hostility toward elephants and conservation efforts.	Hoare, 2001, 2012	A1
African elephant and Asian elephant (<i>Elephas maximus</i>), translocation, multiple locations	Reduction in crop raiding once so-called problem animal is translocated. Elephants will stay at release site and will not occupy or reoccupy new or original sites. Elephants will thrive and cease to break fences if moved to native habitat.	Animals tried to return to their home range. Stressed individuals show PTSD symptoms. Increased mortality. New conflicts around release site. Fence breaking escalated in original location and spread to new location.	Evans & Adams, 2018; Fernando et al., 2012; Hoare, 2001; Pinter-Wollman, 2009; Shaffer et al., 2019	A1, A2
Asian elephant, nonlethal deterrents	Elephants will avoid threatening sounds/spotlights.	Elephants developed tolerance for deterrents and returned to area.	Shaffer et al., 2019	A1
African elephant in south Asia, exclusion through fencing, multiple locations	Elephants will remain outside of fences and not enter human spaces.	Elephants returned to human spaces. Elephants crossed and broke fences. Fences funneled high number of elephants creating conflict with surrounding communities.	Hoare, 2012	A1
African elephant, detusking, Kenya	Once detusked, elephants will not break fences.	Fence breaking reduced but detusked elephants developed new techniques to break fences.	Mutinda et al., 2014	A1
Kangaroo rat (<i>Dipodomys stephensi</i>), translocation, USA	Translocations of individuals to newly restored areas will reestablish populations.	Translocations ignored established neighborhood relationships resulting in low reproduction and survival rates.	Greggor et al., 2016	A1
Rhesus macaque (<i>Macaca mulatta</i>), translocation, India	Translocation from cities to rural areas will provide less disturbed habitat and reduce or remove nuisance macaque population from urban sites.	Individuals quickly colonized nearest human settlements. Individuals continued to behave aggressively toward humans and native macaques. Site of capture (urban New Delhi) was repopulated Residents split over morality of intervention.	Govindrajan, 2015; Kumar et al., 2013	A1, A2, A3
Coyote (<i>Canis latrans</i>), nonlethal deterrents, USA	Use of plastic collars around the necks of sheep will reduce number of attacks on sheep and other domesticated animals.	Coyote adapted their attack behavior to the hindquarters of the sheep.	Blackwell et al., 2016	A1
European badger (<i>Meles meles</i>), culling, UK	Culling will reduce the reservoir of TB infection in wild badgers (considered the underlying source of increased infection rates across species).	Cull survivors explored unoccupied territories and deposit infected feces in new locations, contributing to disease spread.	Cassidy, 2012; MacDonald, 2016	A1
Brown bear (<i>Ursus arctos</i>), hunting, USA	Hunting will control bear population.	Longer maternal care and potentially slower reproduction to avoid hunting exposure.	Van de Walle et al., 2018	A1

(Continues)

TABLE 1 (Continued)

Species, management method	Expected management or conservation outcome	Actual outcome of intervention	References ^a	Assumptions ^b
Black bear (<i>Ursus americanus</i>), translocation, Canada	Translocation will reduce interactions between humans and habituated bears in residential areas.	Low survival of translocated bears. Bears returned frequently to site of capture.	Landriault et al., 2006	A1, A2
Wolf (<i>Canis lupus</i>), translocation, USA	Translocation will reduce predation on livestock and encounters with humans.	Most translocated wolves left release areas and traveled to or through areas of livestock production.	Fritts et al., 1984	A2
Wolf, culling, USA	Culling will reduce predation of wolves on livestock and conflicts with humans.	Predation increased as culling led to social disruption and fragmentation of packs and less efficient hunting.	Borg et al., 2015; Brainerd et al., 2008; Fernández-Gil et al., 2016	A1
Wolf, reintroduction, Europe	Wolves will colonize areas of low human population density across Europe.	Spontaneous rewilding in more densely populated areas.	Drenthen, 2016	A1, A2
White-tailed deer (<i>Odocoileus virginianus</i>), hunting, USA	Hunting will control overabundant deer population.	Deer ranges shifted away from roads during the hunting season, avoiding areas of greater human activity. Altered deer behavior during hunting season affected endangered Florida panther.	Kilgo et al., 1998	A1, A2, A3
Leopard (<i>Panthera pardus</i>), translocation, India	Translocation from peri-urban areas to core of protected areas will reduce leopard population density and minimize attacks and encounters with humans.	Individuals traveled long distances to return to original range. Social disruption at sites of capture and release. Increased attacks on humans.	Athreya et al., 2011	A1, A2
Bengal tiger (<i>Panthera tigris tigris</i>), reintroduction, India	Reintroduce tiger population in undisturbed protected areas.	Tiger reintroduction displaced leopards into human-dominated environments, increasing conflicts with humans.	Mondal, 2012	A1
Bottlenose dolphin (<i>Tursiops truncatus</i>), reintroduction from captivity, USA	Dolphins will thrive in the wild and supplement endangered or threatened populations, or reestablish a population in former range.	Many individuals did not survive.	Wells et al., 1998	A1, A2
Horses (<i>Equus ferus</i>), culling, USA	Removal of feral horses will help restore native habitat.	No removal of horses after years long conflict between Ozark residents and National Park Service. Conflicts between groups emerged from differences in representation of and attachment to horses.	Rikoon, 2006	A3
Multiple species, community displacement, multiple locations	Displacement of human communities from protected areas will reduce detrimental anthropogenic impacts.	Absence of critical anthropogenic activities resulting in loss of landscape and species diversity. Loss of indirect monitoring leading to encroachment by more destructive actors. Increased pressure on natural resources at sites of settlement. Negative attitudes toward conservation.	Fabricius & de Wet, 2002; Cernea & Schmidt-Soltau, 2003; Rangarajan & Shahabuddin, 2006	A3
Beluga whale (<i>Delphinapterus leucas</i>), hunting quotas, Canadian Arctic	Imposition of quotas on beluga whale hunting and tightening of hunting restrictions will maintain robust stocks of beluga.	Hunting above quota in response to restrictions seen as unfair, scientifically unsound, rigid, and ignorant of Inuit perceptions of beluga sentence.	Tyrrell, 2007, 2008	A3

(Continues)

TABLE 1 (Continued)

Species, management method	Expected management or conservation outcome	Actual outcome of intervention	References ^a	Assumptions ^b
		<p>Criminalization of subsistence hunting with detrimental cultural, economic, and nutritional impacts for the Nunavik</p> <p>Inuit—threatening the survival of Inuit culture and relationship with beluga.</p> <p>Other important factors for the decline of beluga populations were underexplored (e.g., disease, pollution, loss of habitat, net entanglement).</p>		

^aComplete references are in Appendix S1.

^bThe 3 common assumptions made in wildlife conservation and management: A1, animal behaviors are rigid and homogeneous; A2, wildlife exhibit idealized wild behavior and prefer pristine habitats; and A3, human–wildlife relationships are of marginal or of secondary importance to other ecological relationships.

animal decision-making (Swaigood, 2010). This assumption can undermine reintroduction efforts of captive-bred individuals because captivity profoundly influences behavior and decision-making and therefore survival rates in reintroduction programs (Jule et al., 2008). Further, disruption of the social fabric of animal communities by culling, translocation, and reintroduction can impair the survival and longevity of targeted species (Teixeira et al., 2007). For example, culling elephants can lead to the breakdown of social systems among the affected population, driving the emergence and spread of hyperaggressive behaviors (Bradshaw et al., 2005).

Wildlife exhibit idealized wild behavior and prefer pristine habitats (Assumption 2)

Much WCM is based on the assumption that animals will return to an idealized state of wildness if offered appropriate environments. Translocation and reintroduction of leopards, macaques, elephants, and dolphins illustrate this point (Table 1). Emerging from the assumption that wild animals inherently prefer undisturbed or pristine habitats and that these preferences are fixed (Osco et al., 2004), habitat preference is understood to be directly correlated with habitat quality, which itself is assumed to have a direct relationship with the level of human disturbance or population density. This relationship is used in wildlife population models that underlie many WCM decisions (Battin, 2004). However, real-world habitat preferences and resource selection among individual animals contradict outcomes predicted by these population models (Nielsen et al., 2002; Osco et al., 2004), as do the results of numerous wildlife reintroduction and translocation programs where animals attempt to return to disturbed sites.

Human–wildlife relationships are of marginal or secondary importance (Assumption 3)

Although human dimensions are recognized and integrated in WCM scholarship and practice (Bennett et al., 2017; Manfredro, 1989; Treves et al., 2006), WCM efforts often fail to consider differences in the ways human individuals, communities, and cultures view and value animals. Most WCM approaches are based on species' biological, ecological, or economic value, thus classifying them as overabundant, invasive, endangered, game, and so forth. However, to many people wildlife are sentient beings, kin, deities, or community members (e.g., Borish et al., 2021; Nair et al., 2021; Tyrrell, 2008). By narrowly considering human–animal relationships, WCM practice often overlooks traditions that engage with wildlife as unique individuals or cultural entities distinct from but related to humans—discounting the shared histories, geographies, and dependencies that create these relationships.

The exclusion of complex human-wildlife relationships from WCM results in unanticipated outcomes that run counter to the objectives of contemporary conservation—to protect threatened species with the support of local communities. For example, the failed removal of feral horses in the Ozark Riverways (USA), intended to restore native ecosystems, was partly due to a disregard for the horses' local historical, cultural, and emotional significance (Rikoon, 2006). In the Canadian Arctic, Inuit cultures consider beluga whales (*Delphinapterus leucas*) sentient beings that are deeply connected to communal practices. However, state-sponsored plans that included rigid quotas on whale hunting ignored Inuit knowledge of and relationships with whales. This engendered a breakdown of Inuit livelihoods and cultural identity and a distrust of comanagement, contributing to decisions to exceed state-imposed hunting quotas (Tyrrell, 2007, 2008).

ACKNOWLEDGING THE ROLE OF ANIMAL AGENCY

Our review of common assumptions and unanticipated outcomes highlighted key shortcomings in conceptualizations of wildlife in WCM that come from a shared historical lineage. Western scientific thought, heavily influenced by Judeo-Christian views of human dominion over nature and Descartes' treaty on animals in the 16th century, has a long history of treating animals as automata (Crist, 2013). Animals are considered inferior and subordinate to humans, lacking emotion, free will, self-consciousness, or personhood. Although societies across space and time—ranging from the European middle ages to contemporary world religions—have acknowledged animal sentience and laboratory studies increasingly demonstrate personality and empathy in animals, the cartesian perspective has carried through to contemporary Western conceptualizations of wildlife. Current WCM approaches perpetuate the idea that humans can control and contain animals. Often when wildlife leave designated spaces or exhibit novel behaviors, they are viewed as overabundant, out-of-place, or problematic. As a result, these approaches often devalue habitats that are not seen as pristine and strive to excise behaviors outside of those observed in idealized conditions. These practices routinely exclude communities that consider animals sentient (Berkes, 2012). In doing so, WCM efforts can delegitimize relationships and spaces characterized by more complex human-animal engagements (Blaser, 2009; Borish et al., 2021) and dismiss forms of knowledge about animals that are not deemed scientific (Saberwal, 2000).

Disciplinary overview

We selectively reviewed recent scholarship in 3 fields that reconceptualize animals and their relationships with humans: animal behavior, animal geographies, and animal legal theory. These fields question many of the premises of contemporary WCM discussed above. We did not conduct a comprehensive literature review; rather, we sought to highlight concepts that could enrich WCM.

Animal behavioral sciences explore why animals act the way they do through studies of expression, intelligence, learning abilities, culture, sociability, cognition, and the range and flexibility of these characteristics. Throughout the 20th century, behaviorism—which considered behavior strictly a response to stimuli—strongly influenced the study of animal psychology. Some branches of behavioral sciences have since taken a more comprehensive view of behavior and its drivers—understood to be influenced by personality, temperament, experience, mood, attitudes, social context, and so forth (Levitis et al., 2009). For instance, the field of cognitive ethology focuses on the study of animal intelligence and demonstrates that animals' thoughts, feelings, and social systems are more developed than previously thought (Bekoff, 2002; de Waal, 1989). Drawing from Darwin's theory that the difference between animals and humans is in degree, not kind, cognitive ethologists engage with “all ways in which animals take in information about the world through the

senses, process, retain and decide to act on it” (Shettleworth, 2001, p. 278). While originating in higher primate studies, animal ethological research has broadened to species ranging from ants to cetaceans (Brakes et al., 2021; MacDonald & Ritvo, 2016; Shettleworth, 2010). These studies contribute to rejecting the static view of animals as passively occupying existing environments (Barua & Sinha, 2017).

Animal geographies have emerged as a rich and heterogeneous subdiscipline (Buller, 2014) to respond to the “deafening silence about nonhumans” in social theory (Wolch & Emel, 1995, p. 632). Building on methodologies and frameworks from geography (including actor–network theory, posthumanist, feminist, Marxist, Indigenous, and cultural geographies), animal geographers also draw from diverse animal-centric fields, including animal ecology and behavioral sciences (Barua & Sinha, 2017; Lorimer & Srinivasan, 2013; Wolch & Emel, 1995). Animal geographers are interested in the multiple ways animals intersect with human societies (Urbanik, 2012) and complicate mainstream views of animals. They reject utilitarian representations of animals as objects and resources under human control with no influence on human lives. By exploring the various temporal, spatial, and place-based relationships among humans and animals, animal geographers consider the geographies of animals, their active participation in the construction of landscapes (Wilbert & Philo, 2000), and their heterogeneous, fluid, intertwined subjectivities (Govindrajana, 2018; Holloway, 2007). They critically examine the ways in which dominant discourses on animals are rooted in capitalist traditions that commodify nonhumans and devalue their relationships to humans (Wolch & Emel, 1995). The literature explores human relationships with companion animals (Haraway, 2008), farmed animal welfare (Miele, 2011), and wild species (Ampumuza & Driessen, 2021; de Silva & Srinivasan, 2019; Dempsey, 2010; Toncheva & Fletcher, 2021). In the context of WCM, animal geographers consider wild animals political actors engaged in WCM through their relationships with humans and other species (e.g., Boonman-Berson et al., 2016; Evans & Adams, 2018).

Animal legal theory has its roots in animal philosophy, which long ago established that animals possess sufficiently similar mental and emotional capacities to those of humans that they should be given similar moral consideration (Jamieson, 2018; Regan, 1983; Singer, 1975). Foundational work in animal legal theory argues for inherent rights for all organisms and questions the Western legal status of animals as objects, solely the property of humans (Francione, 1995; Stone, 1972). Drawing from animal ethics and political animal philosophy, animal legal theorists view animals as sentient beings with moral standing, subjective experiences, and abilities to shape their own and others' lives. Therefore, they possess individual and collective interests that should be represented in human institutions and included in decision-making regarding the governance of spaces (Celermajer et al., 2020; Cochrane, 2018; Garner, 2013; O'Sullivan, 2011; Regan, 1983; Rowlands, 1997; Wise, 2000). Animal legal theory has moved from a conceptual academic interest to a field with tangible consequences for and benefits to animals through its shaping of outcomes in legislation and litigation (e.g., Cohen, 2006; Dunn & Rosengard, 2017). Much of the theory and

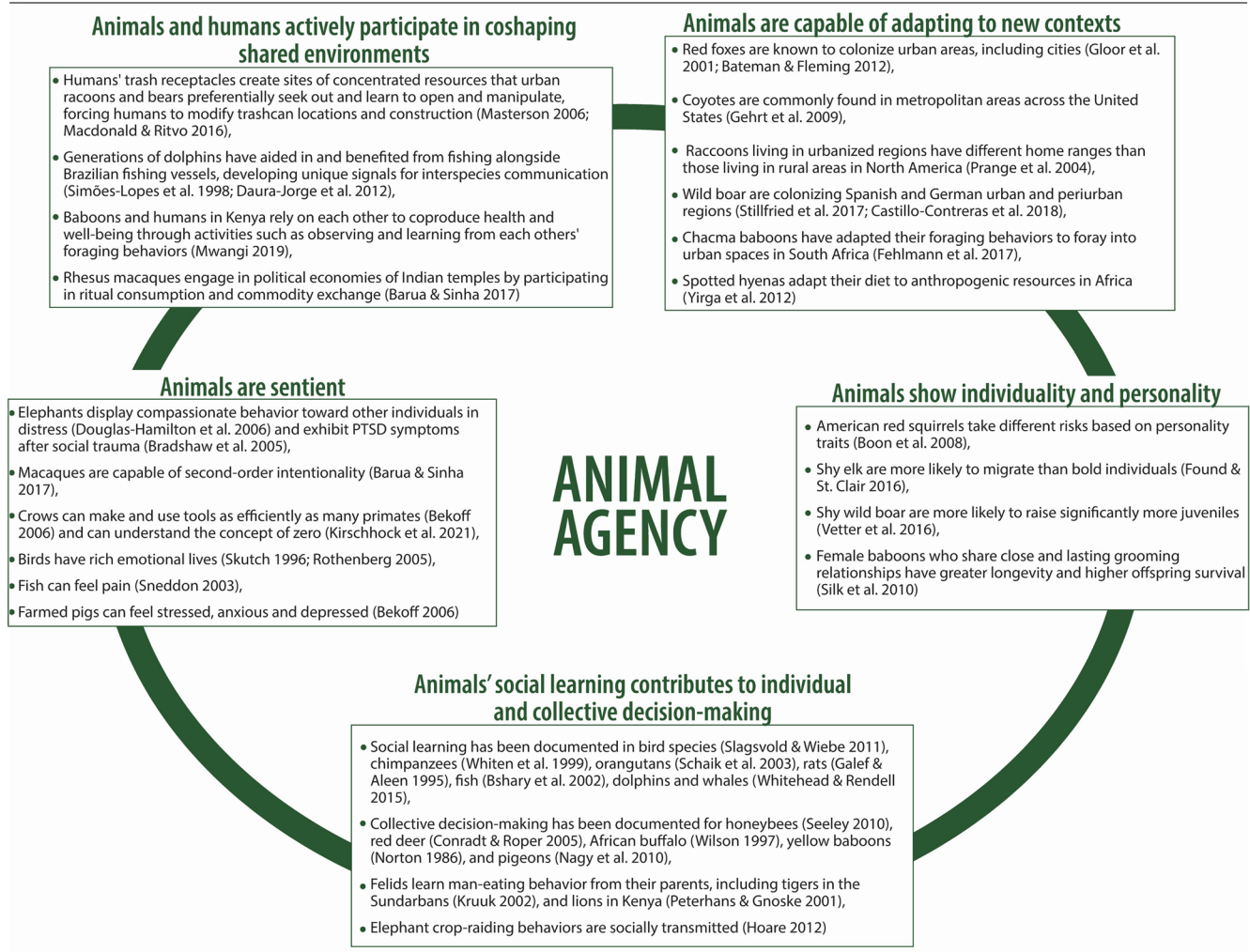


FIGURE 1 Selected examples that illustrate important components of animal agency
Full references are in Appendix S1.

practice of animal law exists on a spectrum from animal welfare on one end (concerning the responsibilities of humans toward protecting animals' best interests) to animal rights on the other (a deontological position that animal interests are inherent and inviolable, which legal systems should be designed to defend, as is the case with human rights). Some animal legal philosophers go further by asserting that animals have agency—they are not only aware of their surroundings and interactions, but also proactively shape them—a concept animal law and philosophy as a whole have been slow to embrace (Jamieson, 2018).

KEY LESSONS FROM DIVERSE DISCIPLINES

The collective findings from these fields challenge assumptions that underpin many mainstream WCM approaches. We considered 5 conceptual contributions that have implications for the ways animals are protected, managed, and treated in WCM.

Figure 1 summarizes selected case studies that illustrate each of these concepts. Full citations to sources in Figure 1 are in Appendix S1.

First, animals are sentient. That is, they have feelings and intelligence. Many species possess a shared sense of morality, empathy, and justice (Bekoff & Pierce, 2017). Numerous behavioral studies of bird and mammal species identify expressions of empathy and emotions, including fear, pain, and distress (Masson & McCarthy, 2016). Animals are also reflective and capable of “remembering the past and planning for the future” (Kaplan, 2016, p. 201).

Second, animals are capable of adapting to new contexts. Their behavioral plasticity allows animals to adapt and habituate to different conditions. Animal behaviorists, geographers, and legal theorists demonstrate that animals can modify behaviors when faced with change, including human disturbance (Griffin et al., 2017), by drawing on past experiences and interests (Donaldson & Kymlicka, 2016; Gullo et al., 1998; Hodgetts & Lorimer, 2015). Generalist species adapt to

anthropogenic changes by finding novel ways to exploit resources in human-dominated landscapes (Devictor et al., 2008; Figure 1). Experiences can also be learned and transmitted over generations (Berger, 2008).

Third, animals show individuality and personality. Individuals from the same population can have personality traits that set them apart from others. Behavioral scientists have established that in most studied species, individuals exhibit idiosyncratic behavioral differences (Blackwell et al., 2016; Dall & Griffith, 2014; Merrick & Koprowski, 2017; Réale et al., 2010). Both genetic and nongenetic factors drive these differences (Honda et al., 2018; Réale et al., 2007) and influence the decisions individuals make (Réale et al., 2010).

Fourth, animals' lived experiences and social learning contribute to individual and collective decision-making. All 3 disciplines provide strong evidence for the sociality of animals, which allows them to develop distinct languages (Bekoff, 2002) and the capacity for collective decision-making. Social behavior varies across time and space producing communication idioms and cultures (Bekoff, 2002; de Waal, 1999; Laland & Janik, 2006). There is growing evidence that animal culture, defined as “information or behavior—shared within a community—which is acquired from conspecifics through some form of social learning” (Whitehead & Rendell, 2015, p. 12), exists in a wide range of wild animals (Brakes et al., 2021).

Finally, animals and humans actively participate in coshaping shared environments. Animal geographers and animal legal theorists understand human–animal interactions as a product of complex relational processes in which humans and animals are active participants. Both fields recognize animals' influence in shaping the natural world—as agents of ecological processes—but also in coshaping humans' socioeconomic, cultural, and political worlds (Dempsey, 2010; Hobson, 2007). For example, female bottlenose dolphins (*Tursiops truncatus*) have had lasting and complex relationships with fishers in Brazil, and individual dolphins have socially learned cooperative foraging tactics that benefit both dolphins and humans (Bezamat et al., 2020; Simões-Lopes et al., 2016). Rhesus macaques (*Macaca mulatta*) participate in the political economies of Indian temples by engaging in ritual consumption and commodity exchange with humans (Barua & Sinha, 2017). Beluga whales, polar bears (*Ursus maritimus*), and caribou (*Rangifer tarandus*) are enmeshed in the cultural and socioeconomic lives of many communities in the Arctic, and over centuries their relationships with humans have endured and developed (Borish et al., 2021; Kishigami, 2005; Tyrrell, 2007). Elephants in Sri Lanka are “companion species” because they have coevolved with people over millennia such that “their genetics, anatomies, behaviors, feelings, social groupings, and wider ecologies all bear a human signature. At the same time, the language, culture, religions, agriculture, and economies of their human coinhabitants carry a pachyderm trace” (Lorimer, 2015, p. 23). Even the activities of slugs (multiple species) in domestic gardens shape fine-scale geographies and humans' relationships with their shared environments (Ginn, 2014).

Animals have been considered guardians, deities, companions, rivals, nations, community members, and coconspirators

that contribute in direct and indirect ways to the survival of both human cultures and wild species (Bhattacharyya & Slocombe, 2017; Blaser, 2009; Lorimer, 2015; Nadasdy, 2007; Nair et al., 2021). These views acknowledge animals' intentions, emotions, and cultures that they share with humans in a common social, spiritual, and ecological world (Umcek-Atleo, 2011). Although often associated with non-Western, precolonial traditions (Berkes et al., 2000), meaningful relationships with animals that engage with their personhood and shared culture also exist throughout Western societies, often in vastly divergent ways (e.g., hunters [Kelly & Rule, 2013], and in animal rights advocates [Rudy, 2011]).

Defining animal agency for WCM

Our review draws attention to the need for greater recognition of wild animals' complexity and intentions in their interactions with humans in WCM contexts. The concept of animal agency captures this complexity. The term *agency* can be broadly understood as “the capacity to produce a phenomenon or modify a state of affairs” (Jepson et al., 2011, p. 230). Although the term agency is used differently across disciplines (Carter & Charles, 2013; Jamieson, 2018; Jepson et al., 2011; Nash, 2005; Steward, 2009; Teubner, 2006), we integrate findings from the 3 fields to build a definition of *animal agency* in WCM contexts that encompasses the complexities discussed above.

We defined *animal agency* as the ability of animals to actively influence WCM outcomes through their adaptive, context-specific, and complex behaviors that are predicated on their sentience, individuality, lived experiences, cognition, sociality, and cultures in ways that shape and reshape shared human–wildlife cultures, spaces, and histories. Adopting animal agency as a lens in WCM helps practice move beyond perceptions of wildlife as manipulable objects, recognizes animals' active participation in WCM, and gives valence to worldviews that have long incorporated dimensions of animal agency in their engagements with the environment.

INTEGRATING ANIMAL AGENCY INTO WCM SCIENCE AND PRACTICE

Barriers exist to incorporating agency in WCM practice. First, incorporating facets of animal agency into predictive models of animal behavior is challenging (Budaev et al., 2019). Quantitative, automata-based methods are well established, scalable, parsimonious, and inexpensive (Budaev et al., 2019) and therefore commonly used in WCM planning. In contrast, acknowledging animal agency introduces nonuniformity, uncertainty, and complexity at the modeling, planning, and implementation stages. Integrating agency into predictive models can require more complex, expensive, and computationally intensive simulations (Budaev et al., 2019). Second, although many practitioners implicitly recognize animal agency (e.g., Boonman-Berson et al., 2016), there are structural and institutional challenges to widespread application in WCM—such as the difficulty in

updating established systems of practice and policy and the entrenchment of cartesian approaches by those in power (Jacobson & Decker, 2006). Despite these challenges, facets of animal agency are already integrated and can be further explored within existing and emergent WCM practices.

Incorporating animal agency in conservation prioritization

Conservationists closely consider metrics that treat animals primarily as quantifiable stock when defining conservation priorities and measuring success (e.g., viability, endemism, population size, genetic diversity [Brakes et al., 2019]). However, WCM efforts that only consider tangible and measurable components of animal life at the expense of less tangible, more plastic aspects (e.g., behavioral traits, cultural diversity) ignore essential characteristics of individuals, groups, and ecosystems that contribute to survival.

Integrating animal agency into WCM strategies can help identify and conserve agentic qualities essential for species' survival (Berger-Tal et al., 2016; Blumstein & Fernández-Juricic, 2010; Greggor et al., 2016; Smith & Blumstein, 2013). Applied conservation behavior research has expanded to explicitly consider how individuality, personality, and learning produce heterogeneous responses across individuals and their implications for ecological and population-scale processes (Brakes et al., 2021; Merrick & Koprowski, 2017). Personalities of animals can influence metrics as fundamental as population estimates. For example, individuals that are less perturbed by human presence are more likely to be counted (Biro, 2013). Bold and exploratory individuals tend to exhibit greater tolerance for noise, human activity, and other forms of disturbance. They are more likely to make use of conservation infrastructures (e.g., nest boxes, artificial habitats, etc.), come into conflict with humans, transmit and acquire zoonotic diseases, and colonize new areas (Found & St. Clair, 2016; Greggor et al., 2016; Honda et al., 2018; Merrick & Koprowski, 2017). Coupling data on personality and behavioral traits associated with habituation to humans and disturbance tolerance with population and genetic diversity data can help identify vulnerable, isolated populations (Riley et al., 2014). Similarly, incorporating learning and behavioral diversity into landscape connectivity and dispersal modeling has serious implications for conservation corridor planning because models have strikingly different results when different behavioral characteristics are included (Elliot et al., 2014). By inquiring how individuals, groups, or populations engage with and respond to landscapes, an agency-based approach illuminates how animals shape contexts to meet their needs under different scenarios, potentially altering conservation outcomes. For example, different populations of brown bears (*Ursus arctos*) have attuned behaviors toward humans based on the varying degrees of protection across Bulgarian regions (Toncheva & Fletcher, 2021). Coupling agency-based framings that consider wildlife's behavioral plasticity and decision-making with well-established practices to understand spatial patterns—such as tracking with GPS collars, wildlife cameras, and satellite

images—is also worth greater exploration to identify vulnerable individuals.

Animal agency can also enrich WCM priorities, including the preservation of animal social systems and culture (Brakes et al., 2019, 2021; Marzluff & Swift, 2017), as advocated for in animal culture conservation approaches (Laiolo & Jovani, 2006). Culture can affect crucial survival skills that contribute to the persistence of social groups and potentially whole populations. For example, accounting for dolphins' and wolves' social systems was key to successful reintroduction programs (Ferguson, 1996; Milstein, 1995; Wells et al., 1998). African elephant matriarchs (*Loxodonta africana*) accumulate knowledge regarding their social and ecological environment, transmitting information crucial to group survival (McComb et al., 2001). Yet traditional approaches prioritize younger individuals' reproductive potential (Brakes et al., 2019). These studies demonstrate the importance of not only protecting genetic diversity and reproductive capacity, but also cultural and social systems for species survival. These ideas are gaining traction in conservation science (Griffin et al., 2000; MacDonald, 2016) and informing human–wildlife conflict management (Brakes et al., 2021; Greggor et al., 2017; Marzluff & Swift, 2017)—such as identifying culturally significant units in the protection of small and endangered populations (e.g., Ryan, 2006; Whitehead et al., 2004). Further, practitioners and conservation institutions recognize the importance of cultural traits at the individual and group levels and at the population and species levels (Brakes et al., 2021). For example, the Convention on the Conservation of Migratory Species of Wild Animals is exploring the implications of conserving cultural traits, such as clan culture among sperm whales (*Physeter macrocephalus*) and nut-cracking culture in banded mongooses (*Mungos mungo*) for the preservation of these species (CMS, 2017, 2018).

Managing wild animals with their agency in mind

Viewing animals as active participants allows one to reconsider how conservationists and wildlife managers can engage in WCM. Practical WCM experiments already include various facets of animal agency (although different terminology might be used); results suggest avenues forward for animal-agency-centered WCM.

Linking cognitive science, animal cognition, and evolutionary ecology, an increasing number of behavioral ecologists incorporate animal personalities, life histories, emotions, learning abilities, and motivations to better model animal adaptive decision-making (Budaev et al., 2019). For example, in traditional husbandry, carcasses of animals killed by predators or accidents are generally quickly removed. However, this may actually limit the ability of domesticated animals to learn about predators and the importance of avoiding dangerous areas (Marzluff & Swift, 2017).

Animal decision-making is also emphasized in the kincentric ecology approach (Bhattacharyya & Slocombe, 2017) that foregrounds multispecies collaborative management in shared socioenvironmental systems. To manage human–seagull conflict, the city of Leiden in the Netherlands experimented with

gull–human collaboration in negotiating nesting locations that met both gull (*Larus argentatus*) and human needs (Meijer, 2016). In doing so, managers acknowledged the role gulls can play in management efforts through “interspecies decision-making” (Meijer, 2016, p. 64). Other examples of humans leveraging the participation of animals in conservation include the involvement of beavers (*Castor canadensis*) in watershed management (Woelfle-Erskine & Sarna, 2013) and captive Asian elephants in mitigating human–animal conflicts (Münster, 2016). These examples illustrate the possibilities that emerge by considering animals as agents of territorialization able to occupy human-modified environments and as creative participants in adaptive experimentation.

Other contemporary management strategies are noteworthy for their consideration of animal agency within more traditional paradigms. Using deterrence mechanisms (strikes), a wildlife management approach in Colorado was intended to teach black bears (*Ursus americanus*) to avoid human spaces. Although this initiative was based on the assumption of uniform bear behavior, managers whose role was to implement strikes often bent the rules and used their intimate knowledge of bear autonomy and individuality to decide which animals to target (Boonman-Berson et al., 2016). This example demonstrates the need to experiment with context-specific, adaptive strategies that leverage existing, carefully nurtured human–animal relationships (Boonman-Berson et al., 2016). It also speaks to recent discussions regarding the moral implications of making decisions in WCM. For example, Batavia et al. (2020) argue for considering the concept of moral residue in WCM, recognizing the ethical challenges of WCM and encouraging conservationists to sit with the emotional dimension of their missions. Finally, this example illustrates that many managers know that animals have agency and implicitly acknowledge it by integrating it into management practice, despite institutional norms and discourses that discount its importance.

Further, viewing animals as active participants in conservation policy-making raises pertinent questions of whose knowledge is valuable in understanding and representing animals’ perspectives, interests, and rights (Toncheva & Fletcher, 2021). Considering agency encourages us to more closely examine worldviews that have been perceived as lacking scientific rigor, but are products of decades or centuries of integration between human and nonhuman lives. Many management practices are rooted in human–wildlife reciprocal relationships and derived from multigenerational experience-based knowledge (e.g., Kideghesho, 2009; Mukul et al., 2012; Toncheva & Fletcher, 2021). For instance, Rayne et al. (2020) show how Indigenous knowledge systems in Aotearoa New Zealand can improve outcomes of conservation efforts, such as the translocation of understudied species. In the Canadian Arctic, Inuit hunters’ knowledge of muskoxen and caribou life histories, population dynamics, and body conditions was crucial to conserve these species (Tomaselli et al., 2018). In Bulgaria, experience-based knowledge of local communities (and especially hunters) is key to cohabitation with bears. There, humans and bears have developed relations of mutual “trust” and “respect” through repeated, nonconflictual, peaceful encounters (Toncheva &

Fletcher, 2021). This type of knowledge can enrich conservation policy-making and potentially inform the appointment of human “trustees” to advocate for animal rights in WCM efforts (Cochrane, 2018). In the same vein as Etuaptmumk (Mi’kmaq for “Two-Eyed Seeing” [Bartlett et al., 2012]), which advocates for the coexistence of various knowledge paradigms, we argue that animal agency can support the development of hybrid deductive and inductive reasoning and address complex issues with all available and critical sources of information necessary to face the ongoing loss of global biodiversity. Further, recognizing the many ways of being with and viewing animals is necessary to avoid trivializing or alienating communities directly affected by WCM interventions. This is particularly important in the case of Indigenous Peoples who have been marginalized through centuries of colonial conservation approaches, resulting in the loss of shared human–animal worlds. Although it is crucial to be attentive to the ways local knowledge can be misunderstood, simplified, or instrumentalized, centering animal agency in conservation practices can contribute to efforts that respect and recognize the approaches of Indigenous Peoples—who currently manage or have tenure rights over one-quarter of the world’s land surface, representing about 40% of the world’s terrestrial protected areas (Artelle et al., 2019; Garnett, 2018).

Finally, integrating animal agency into conservation allows more nuanced discussions of, and can potentially augment, existing and emergent practices. WCM will always be an endeavor held in tension by different goals, worldviews, and ontologies of what is worth conserving and how to conserve it. Engaging with animal agency will not remove the challenge of balancing different views or easily solve ecologically, politically, and culturally fraught conservation challenges that inherently involve trade-offs (see, for example, Oommen et al. [2019] and their critique of compassionate conservation). The degree to which each facet of the animal-agency concept needs to be engaged may vary among species, ecological systems, and local contexts. For these reasons, we argue that considering animal agency can draw attention to and spur conversations about fundamental questions and tensions that often go unspoken in mainstream WCM. Driving questions may include: How will humans and wildlife engage with and affect different WCM efforts? Is there room for WCM plans to adapt as diverse humans and animals learn from each other? How can plans incorporate more than the biological value of a species? Are the human communities most closely engaged with animals able to contribute and increase their knowledge and expertise under this management regime? How can their relationships be honored, maintained, and supported? What animal cultural traits and relationships does this make room for, and what does it inhibit? How will these interventions produce new interspecies relationships, cultures, and politics? We encourage managers and stakeholders interested in exploring the ramifications of an animal-agency lens to ask these questions within contexts described in Table 1.

These questions have relevance regardless of whether managers use mainstream WCM approaches or emergent practices and can help WCM practitioners evaluate plans, develop scenarios, engage with other stakeholders, make room for surprises,

and imagine multiple futures. We thus present animal agency as a concept with the potential to connect wildlife, Indigenous and local communities, scholars, conservationists, and wildlife managers to enhance context-specific and adaptive WCM practice. These approaches have the potential to create spaces for better collaboration, inclusion, and well-being for both animals and humans.

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