

Bringing social values to wildlife conservation decisions

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Humans regularly exert a powerful influence on the survival and persistence of species, yet social-science information is used only sporadically in conservation decisions. Using data obtained from a survey of 46,894 US residents, we developed and applied a spatially explicit “sociocultural index” to inform decision making through an understanding of public values toward wildlife. The classification is defined by opposing values of mutualism and domination, which have been previously shown to be highly predictive of attitudes on a wide range of policy issues. We developed state and county maps that can be used to represent public interests in policy decisions and inform management actions that target human behavior, such as education. To illustrate, we present findings indicating a supportive social context for gray wolf (*Canis lupus*) reintroduction in Colorado, an issue voted on and passed through a November 2020 citizen ballot initiative. Although the results are particularly relevant for the US, the technique is broadly applicable and its expansion is encouraged to better account for human factors in conservation decisions globally.

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Sustainable conservation of wildlife is contingent upon the human context in which it occurs. Either through unintentional action that transforms the natural environment and selectively displaces species or through intentional action to protect or eliminate species, humans are the most powerful proximate force dictating the presence and persistence of wildlife globally (Ripple *et al.* 2014; Diaz *et al.* 2015). Furthermore, habitat loss is often characterized as “the single greatest threat to biodiversity”, and human action is the primary driver of that loss (Wilcove *et al.* 1998). However, although human actions are a pervasive influence on species’ distributions, persistence, and richness (Linnell *et al.* 2001; McKinney 2008), conservation decisions routinely emphasize only biological and physical factors.

In a nutshell:

- Human activities are the primary driver of biodiversity loss and the most important determinant of species persistence in the Anthropocene
- However, wildlife conservation decision making continues to focus primarily on biological and physical factors
- A sociocultural index depicting the mix of social values, applied across all 50 US states and corresponding counties, provides useful data for wildlife conservation policy and management
- As a specific illustration, we show how sociocultural data can inform gray wolf (*Canis lupus*) recovery efforts

Despite repeated calls for better integration of social and ecological approaches (eg Berkes *et al.* 2000; Ostrom 2009), the practical application of social-science information has been scarce and uneven, with generalizations limited across time and location. This point was emphasized in a recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) publication, in which it was stated that “the design of governance, institutions and policies rarely takes into account the diverse conceptualization of multiple values of nature and its benefits to people” (IPBES 2018). The authors of that article suggested a need for better understanding of the values concept to more adequately represent the diversity of interests and benefits, to identify and anticipate social conflicts, and to empower typically underrepresented voices in decision making.

Following that line of thinking, we introduce a “sociocultural index” relying on values as a foundational sociocultural variable to inform wildlife conservation decision making in the US. We were guided by three critical considerations. First, there is a need for a sound and clear concept and associated measurement method to guide representative assessments of the US public; second, the concepts used must have strong predictive validity and inform different conservation strategies based on different types of values; and third, findings must be widely available and spatially explicit to allow cross-location comparisons and integration with other social and biological data. As such, our approach provides a base from which practical experience and added information could facilitate improvements in application of this policy tool. Here, we present the results of an analysis of an extensive sociocultural dataset used to map wildlife values across all 50 US states and corresponding counties, and briefly illustrate how this technique can inform conservation efforts via consideration of gray wolf (*Canis lupus*) reintroduction into the state of Colorado.

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■ Why social values are useful in wildlife conservation decision making

Human behavior is driven by many different factors, and the social sciences report a host of concepts that both explain and allow prediction of behavioral variation. The concept of social values has had an enduring and central role in that regard. It has been useful in describing the cultural core of societies (Kitayama 2002), and theorized as a foundational force driving individual thought and behavior about specific topics (Homer and Kahle 1988). A widely used model in the environmental and natural resources literature advocates a hierarchical value–attitude–behavior approach to behavioral prediction that suggests behaviors are driven by norms and attitudes that are in turn driven by values (Homer and Kahle 1988). Values are defined as core motivational goals that influence patterns of behavior among people and society (Schwartz and Bilsky 1990). They direct behavior across many situations, whereas norms reflect the social influence of important reference groups and attitudes reflect individual evaluations of a specific action or object (Homer and Kahle 1988; Steg 2016). Values are ubiquitous in daily life; they are deeply embedded in our surroundings, including verbal and nonverbal symbols, moral judgments, communication patterns, daily routines, material culture, social institutions, and the ways in which we relate to our natural environment (Kitayama 2002).

Although other social variables could (and in certain cases would) be useful to consider in informing wildlife conservation decisions, we selected values to guide our approach for several reasons. First, social values are a well-established concept borne from the social sciences with broad-based applications relevant for wildlife conservation (Manfredo 2008). Second, research on wildlife values has shown strong predictive validity of the concept in explaining variation in people's behaviors and attitudinal positions across a wide range of wildlife-related topics (Manfredo *et al.* 2009, 2016; Teel and Manfredo 2009). Third, as suggested by the IPBES (IPBES 2018; see also Diaz *et al.* 2015), information about values can give voice to a broadly representative public in a geographic region, helping to anticipate and explain how the public will respond to management and policy actions; this is important because it is not uncommon in wildlife governance to hear only from highly involved or affected stakeholder groups that do not necessarily reflect the broad interests of the public. Fourth, knowledge of values can assist in finding mediated solutions to social conflicts over wildlife-related issues; indeed, such efforts often begin with identification of common values among ostensibly diverse groups (Madden and McQuinn 2014). Finally, values are enduring and typically change only in adaptation across generations to shifts in the social–ecological context (Manfredo *et al.* 2017; Inglehart 2018). Such durability exists because values are generally formed in one's youth and typically change little over the course of one's lifetime. In that regard, our findings would likely remain relevant for a decade

or more. Notably, however, the past 70 years have experienced unprecedented shifts in values due primarily to increased urbanization, education, and overall economic well-being in post-industrialized societies (Schwartz 2006; Inglehart 2018). This cultural-level shift has had a profound effect on human relationships and interactions with wildlife, is the mechanism behind US declines in hunting that have impacted the funding base for wildlife conservation at the state level, and is redefining the social context of wildlife conservation (Bruskotter *et al.* 2017; Manfredo *et al.* 2020a,b).

■ A sociocultural index using values information

To construct our sociocultural index, we used two key value dimensions that pertain to wildlife conservation. First, *domination* is a defining cultural ideal of the US, borne from the Lutheran Reformation and associated with Judeo-Christian religious traditions (White 1967). Domination advances the view that natural resources, including wildlife, are available for whatever uses benefit humans (Manfredo *et al.* 2009). As modern lifestyles remove people from direct contact with wildlife, and wildlife tend to be perceived through processes of anthropomorphic attribution, they are increasingly viewed as human-like and therefore worthy of respect (Manfredo *et al.* 2019). This gives rise to *mutualism* values, wherein wildlife are regarded as companions in a person's social community and deserving of many of the same rights as humans.

Survey instrumentation for assessing domination and mutualism dimensions was developed in a number of prior studies, in which their predictive validity across many wildlife-related issues was demonstrated (Figure 1). The findings of those studies indicated that the dimensions generate different priorities for wildlife management and levels of tolerance for the treatment of wildlife. For example, individuals with domination values tend to prioritize the economy and private property, whereas those with mutualism values tend to emphasize habitat protection and equal treatment of interest groups in conservation decisions (Manfredo *et al.* 2016). Moreover, mutualists are more likely to support restricting human actions to benefit wildlife, while domination-oriented individuals are more supportive of using lethal means to manage wildlife.

We computed our sociocultural index as the proportion of individuals with predominantly mutualism values out of the total proportion of those with predominantly mutualism or domination values (excluding those that emphasize both or neither of these dimensions) (WebPanel 1). Possible scores on the index ranged from 0 to 1, with higher scores indicating a greater prevalence of mutualism values and lower scores indicating a greater prevalence of domination values. In accordance with a multilevel conceptualization of values (Manfredo *et al.* 2017), we applied this framework across three levels of institutional governance: national, state, and county. A *national*-level overview of wildlife values could inform federal and intergovernmental wildlife

policy through, for example, comparisons with other countries. *State-level* classifications are important for the US, given that most wildlife species are managed through policy mechanisms and government agencies operating at the state level. Finally, depictions at the *county* level provide information on a scale closest to actual wildlife occurrence, and are most likely to be integrated with biophysical information to inform local-level decisions and understand human–wildlife interaction dynamics.

We obtained data through a 2017–2018 national survey of 46,894 residents across the US. We calculated sociocultural index scores at the national and state levels from the raw survey data, and then used a set of demographic and election return variables to develop a random forest model that predicted sociocultural index scores from these data for every US county (WebPanels 1 and 2).

Results

Sociocultural context of wildlife conservation in the US

Nationally, we found that more of the US population is mutualism- than domination-oriented, with 35.3% (95% confidence interval [CI, 34.4%, 36.2%]) having primarily mutualism values and 28.0% (95% CI [27.3%, 28.8%]) having primarily domination values. This resulted in a sociocultural index score of 0.557 for the nation. Reporting at the national level facilitates comparison with similar studies in other countries, which, while currently limited in number, have found varying degrees of emphasis on the two value dimensions (Teel *et al.* 2010). For instance, researchers in Denmark reported a similar pattern, resulting in a national score of 0.582, but with slightly lower percentages of residents emphasizing domination (23%) versus mutualism (32%) values as compared to our US findings (Gamborg and Jensen 2016).

Considerable variation in sociocultural conditions across states was observed, with mutualism values concentrated in more urbanized areas and domination values covering much of the rural expanse of the country (Figures 2 and 3). The prevalence of domination values extended across the country, from the Inland Northwest through the Northern Rockies, the Midwest, and much of the South. In contrast, mutualist locales were concentrated mainly in the Northeast, parts of the Great Lakes, the West Coast, Florida, parts of the Southwest, and Colorado. States with the highest index scores included California (0.741), Rhode Island (0.719), and New York (0.679), while states with the lowest scores included North

Dakota (0.275), South Dakota (0.293), and Mississippi (0.296) (WebTable 1).

The county-level map (Figure 3) reveals finer-scale distributions of wildlife values. The vast expanse of the US is occupied by more domination-oriented areas (primarily in less populated rural locales) with correspondingly low sociocultural index scores, reinforcing prior findings that domination or mastery over the natural world remains a pervasive cultural ideal across vast swaths of rural America (Schwartz 2006). Our past research has shown that modernization factors, including education, income, and urbanization, give rise to growth in mutualism values (Manfredo *et al.* 2020a,b), which is reflected in the prevalence of mutualism in urban and suburban locations.

Variability in county-level sociocultural conditions across the country helps in identifying areas of likely conflict between differing value dimensions. For example, Oregon, Washington, California, New York, Florida, New Mexico, and Colorado all have relatively high index scores and are strongly mutualism-oriented at the state level, but have pockets where domination values are prevalent. The county with the third lowest score in

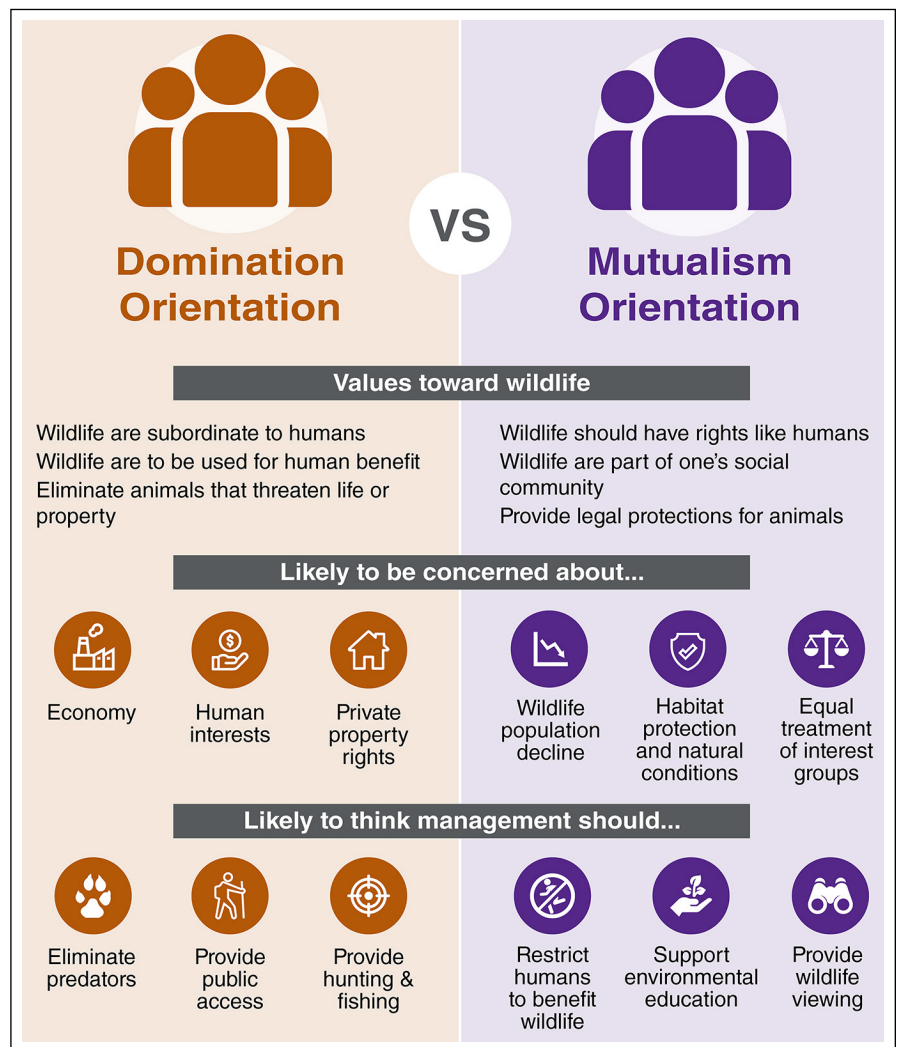


Figure 1. Overview of wildlife value dimensions for the sociocultural index.

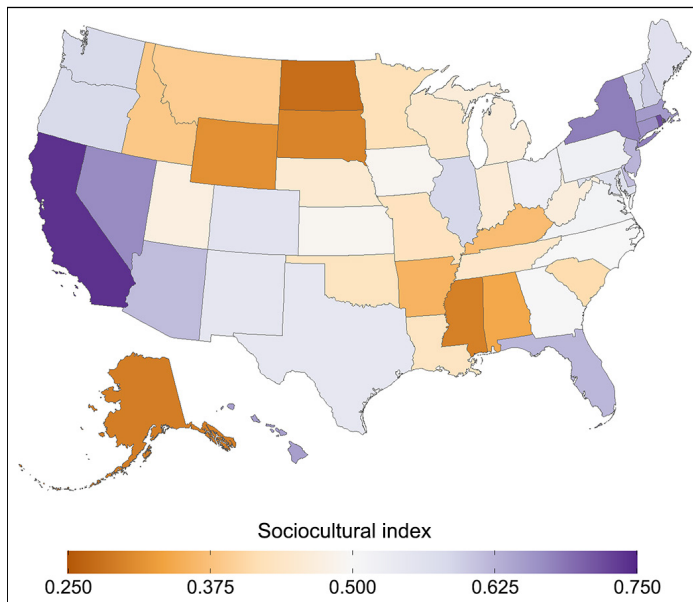


Figure 2. Map of the sociocultural index across US states. The state-level index was calculated from national survey data by dividing the weighted proportion of state residents with predominantly mutualism values by the sum of weighted proportions of state residents with predominantly mutualism or domination values (WebPanel 1).

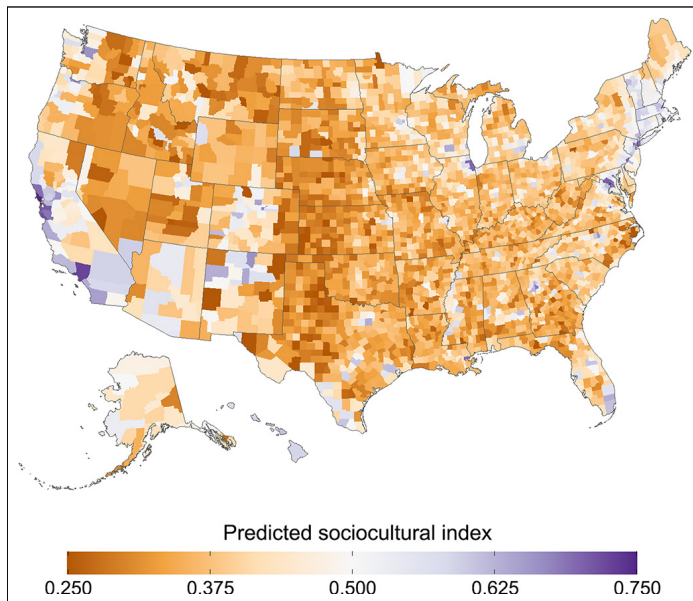


Figure 3. Map of the sociocultural index across US counties. The county-level index was predicted by a random forest model trained on weighted observed values from county-level samples in Washington, California, North Carolina, and New Mexico (WebPanel 2).

the nation – Garfield County, Washington (0.202) – and others, such as Esmeralda County in Nevada (0.232) as well as Crowley (0.228) and Jackson (0.243) counties in Colorado, follow this pattern. Within these states, populous urban counties may desire a shift away from traditional management practices and uses of wildlife (eg lethal control, hunting), but

face strong resistance to change among domination-oriented publics in rural counties.

Social values predict public support for policy and management

Tests for predictive validity found strong associations (Cohen 1988) between state-level sociocultural index scores and support for emphasizing environmental protection over economic growth (Pearson's $r = 0.784$), and for protecting declining or endangered species over private property rights ($r = 0.788$) (WebPanel 1). States with more mutualist values have greater support for these measures, consistent with mutualism's prioritization of concern for wildlife over human needs and interests. Results also showed strong associations between our index and support for management response to address conflicts with predators. In line with domination's anthropocentric emphasis, states with more domination-oriented values exhibited greater support for lethal removal of wolves that kill livestock ($r = -0.907$), black bears (*Ursus americanus*) that attack people ($r = -0.802$), and coyotes (*Canis latrans*) that kill pets in residential areas ($r = -0.877$). We also found a strong correlation between index scores and reports of active participation in consumptive wildlife-related recreation activities. States with more domination-oriented values have higher percentages of current hunters ($r = -0.819$) and anglers ($r = -0.765$). Finally, using data from an outside source (the Animal Legal Defense Fund), we detected a substantial association between our index and the rank of each state on the strength and comprehensiveness of its animal protection laws (Spearman's $\rho = 0.558$) (WebFigure 1; ALDF 2018). States with more mutualist values have higher rankings, indicating a greater level of protection afforded to animals in those states. This finding matches our expectation that, in democratic societies like the US, governing laws and policies should reflect the values of the broad publics they are intended to represent.

Sociocultural index applied to wolf recovery

To illustrate the utility of our approach, and how comparisons across different policy cases can enhance interpretation, we applied our sociocultural index to the issue of gray wolf recovery in Colorado (Figure 4). While once common throughout the country, gray wolves were extirpated from much of their range during the period of European settlement and colonization. The Endangered Species Act (ESA) of 1973 provided federal protection for wolves throughout the US and enabled efforts for recovery of wolf populations across parts of their historical range. The debate over wolf recovery and management has been fraught with conflict (Smith *et al.* 2016). Nonetheless, reintroductions in the 1990s were successful in re-establishing wolf populations in the Northern Rocky Mountain region (Smith *et al.* 2003). Since that time, wolves have migrated into the Pacific Northwest, including areas in Washington, Oregon, and California. Wolf

sightings have been increasing recently in Colorado as well (Blumhardt 2019; CPW 2020), a state that was omitted from federal wolf recovery plans. The issue of wolf recovery in Colorado has also become highly timely with the passing of a citizen ballot initiative in November 2020 to reintroduce wolves to the state (Colorado Secretary of State 2020).

To facilitate interpretation of our findings, we depicted socio-cultural conditions for wolf reintroduction in Colorado relative to conditions in three other states – Minnesota, Wyoming, and Washington – where gray wolves are already present. The social contexts across these states vary in relation to wolf ranges (Figure 5). Minnesota is a domination-leaning state (index score = 0.420), but is more evenly split with mutualism in a substantial portion of wolves' core range. This suggests a social environment more accepting of wolves. In fact, Minnesota's state policy "is committed to a responsible, conservative and science-based management strategy that ensures the long-term survival of wolves in Minnesota [and] recognizes the animal's legacy and Minnesotans' collective interest in and concern for this northwoods icon" (Minnesota DNR 2001). Wyoming, in contrast, is one of the most domination-oriented states in terms of its index score (0.313), which is generally indicative of low tolerance for predators. Consistent with that trend, while wolves are federally protected in certain areas (eg Yellowstone National Park), state policy classifies wolves as "predatory animals" and allows them to be killed on sight across most (~85%) of the state (Wyoming Game and Fish Commission 2011). The state of Washington leans toward mutualism (0.581) due in part to the urbanized areas near the Pacific Coast, but many of the areas in Washington currently occupied by wolves are strongly domination-oriented, revealing a case of "scalar mismatch" whereby the power base of policy decision making is distant from the location of impacts (Carlisle and Gruby 2019). State policy appears to reflect efforts to balance these geographically and ideologically diverse perspectives. Washington's state management plan emphasizes management of a sustainable wolf population through efforts to promote coexistence by minimizing livestock loss while maintaining ungulate populations for hunters (Wiles *et al.* 2011).

At the state level, Colorado is far more mutualism-oriented (0.556) than either Wyoming or Minnesota, and is at a level similar to Washington, suggesting a positive social environment for wolf recovery. Upon closer examination at the county level, with an overlay of the Southern Rockies ecoregion where wolves would be most likely to thrive ecologically (WebPanel 2), the social context in Colorado appears far more positive for wolves than the three states examined above (Figure 6). Although some areas of Colorado lean toward domination, the majority of the ecoregion tends toward mutualism. This conclusion is further supported by the relatively strong opposition to lethal removal of wolves in the region (Figure 6). Colorado stands out among many other states in its lack of support for this strategy (WebFigures 2 and 3). The county-level map shows two main exceptions to this general conclusion: Dolores



Figure 4. Successful recovery of large carnivores, such as the gray wolf (*Canis lupus*), depends critically on human values.

County (index score = 0.301; support for lethal control = 0.690), where ranchlands abut the San Juan Mountains; and Jackson County (index score = 0.243; support for lethal control = 0.725), which could be an important migratory corridor for wolves entering the state from Wyoming.

The wolf ballot initiative has mobilized interest groups and spurred arguments for and against reintroduction of wolves in Colorado (Carswell 2020). In that process, as often happens in contested decisions, claims of what the public desires have frequently been made but not substantiated. Such claims were evident in a proposed rule (Federal Register 2013) made by the US Fish and Wildlife Service in 2013 to remove wolves from ESA protections throughout the conterminous US. The rule asserted that unoccupied portions of historical wolf habitat, including in Colorado, were unsuitable for wolf recovery due to a lack of human tolerance (Bruskotter *et al.* 2014). Our results suggest that this may not be a reasonable assumption. Public endorsement for a policy should not be taken for granted or assumed based on subjective impressions. Management of wildlife "in trust" for the people, a guiding principle of wildlife conservation throughout North America (Organ *et al.* 2010), means that the public should be accurately represented in the decision process. This signifies a critical area where data from our sociocultural index can be useful.

Conclusions

Sociocultural information is critically needed to help guide current and future wildlife conservation decisions. Wildlife management in the US is in a period of transition. Historically, this institution was forged from a strong alliance, and shared philosophy, among hunters, anglers, and wildlife professionals. However, since the 1970s, the proportion of Americans who hunt and fish has declined, resulting in a substantial loss of revenue for state wildlife agencies and an interest in expanding relevance to the broader public. Attainment of this goal begins with an improved understanding of the interests and values

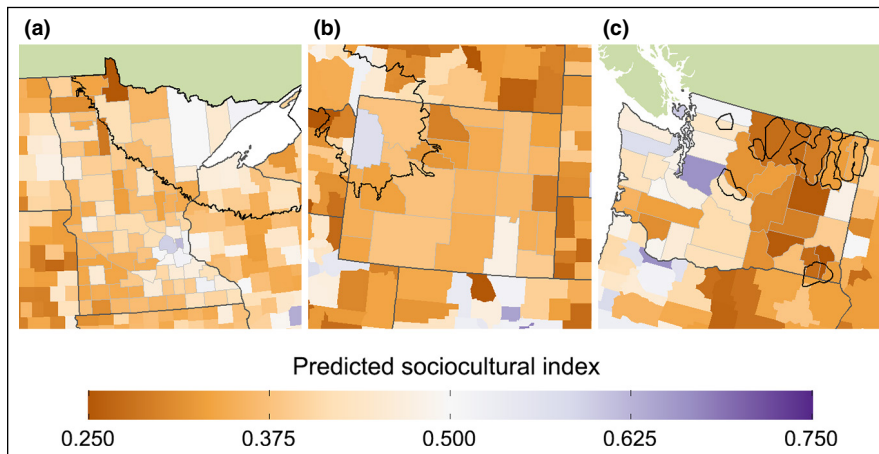


Figure 5. Map of the sociocultural index and present gray wolf range (black outlines) in three US states. County-level index in: (a) Minnesota, which held the last remaining population of gray wolves in the conterminous US in the northeastern part of the state, and from which wolves have expanded their range to that shown since the Endangered Species Act of 1973; (b) Wyoming, depicting the range of wolves extending from the Greater Yellowstone Ecosystem, where they were reintroduced in 1995; and (c) Washington, showing the combined range of all verified wolf packs since 2008, when individual wolves migrating from Canada formed the first breeding pack since their extirpation (WebPanel 2).

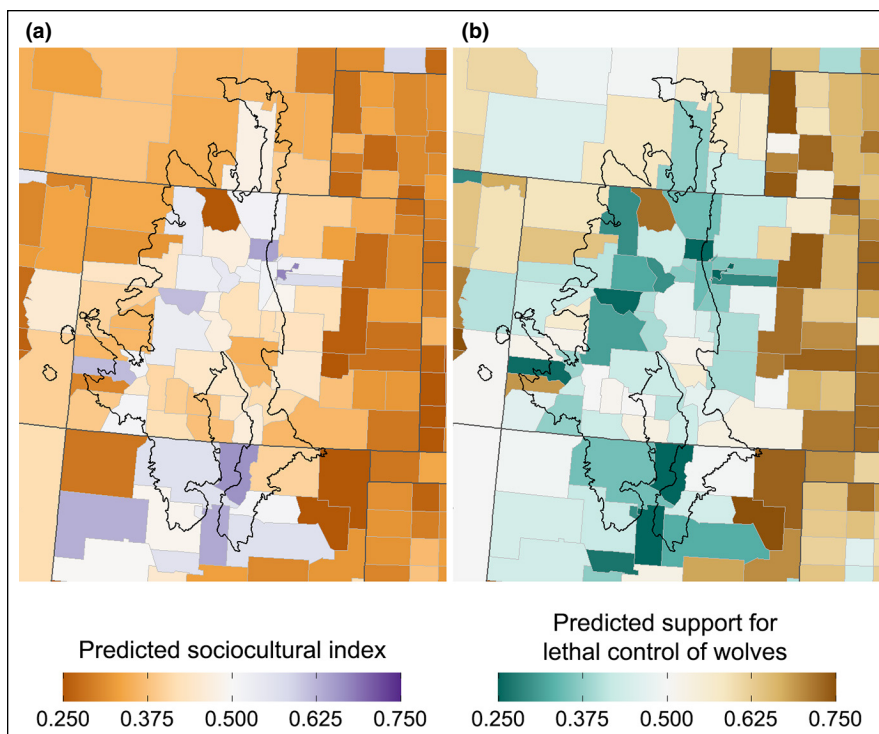


Figure 6. Map of the sociocultural index and attitudes toward lethal control of wolves in the Southern Rockies ecoregion (black outlines) of Colorado and surrounding states. (a) County-level index for the Southern Rockies ecoregion, with index scores identical to those shown in Figure 3; (b) county-level predicted support for lethal control of wolves that kill livestock in the Southern Rockies ecoregion, using data from the national survey (WebPanels 1 and 2).

of new audiences. The need for understanding is reinforced by research showing the values of state wildlife agency employees are dissimilar to those of the majority of the public (Manfredo *et al.* 2018). Because values can profoundly impact what

individuals believe is morally acceptable, factual, and generally desirable, it is critical to obtain accurate information as opposed to relying on potentially biased assumptions about the goals of unfamiliar social groups.

We have developed and demonstrated the use of a sociocultural index for informing wildlife conservation decisions. The data provided could be used in many different stages of the decision-making process, from problem identification and goal setting, to development of policy or specific conservation/management strategies, to structuring evaluations. Because values are a foundational concept that can explain variation in attitudes across many situations, our approach also has implications for a diverse array of decision topics. It is currently unrealistic to conduct broad social assessments for every wildlife-related issue that arises; in lieu of that, our index and associated findings provide important summary data about people in a given area and how they may react to a host of different issues. This information can be accessed as needed, down to the county level, as new issues come to light. As such, our assessment is the first broadly accessible social-science dataset of its kind available to all agencies and groups engaged in the wildlife policy-setting process in the US.

As practitioners make use of these data, examples of their utility will expand. We anticipate the data being valuable in informing many of the top priorities facing wildlife agencies today. In expanding agency relevance, in particular, it will be important to not only recognize the values and preferences of under-represented groups, but also the geographic distribution of different interests (AFWA 2019). Such awareness will be useful in targeting management strategies. For example, current attempts to recruit hunters would be better suited in areas with a higher prevalence of domination values (Price Tack *et al.* 2018). Alternatively, in areas where mutualism predominates, it will be important to develop public engagement strategies that are consistent with desired nonconsumptive interests like educational programs, wildlife viewing initiatives, and virtual activities aimed at building attachment to specific animals or populations.

Finding ways to target and engage different value types in this way will be key to enhancing relevance, which requires development of governance models that ensure representation of diverse interests in decision making. Data from our

sociocultural index can help guide that pursuit and do so at varying degrees of geographic aggregation.

Another growing area of concern is human–wildlife conflict. As our analysis demonstrates, areas where mutualism is prevalent have very different levels of species tolerance than those where domination values are more widespread. Policies that attend to these value differences – that result, for example, in lethal control strategies being preferred in some areas and coexistence techniques in others – may meet with enhanced local support. Moreover, consideration of our gray wolf example reveals a role for values in planning species recovery efforts, the success of which depends on human tolerance.

In future applications, it is important to recognize the limitations of our approach and consider ways to expand its utility. First, our sociocultural index indicates general tolerance of wildlife and wildlife management strategies among residents of an area, but does not reflect more transient non-resident populations, such as tourists and recreationists who may visit the area. Second, although our classification is predictive of broad social trends, general policy directions, and patterns of behavior and preferences, it may not be predictive of more random or isolated incidents and illicit behaviors. In the context of our gray wolf example, these could include the illegal killing of colonizing or reintroduced wolves by individual residents. Third, our classification scheme and data are relevant for wildlife conservation in the US. However, our overall approach, which emphasizes the need for inclusion of social factors in conservation decisions, is not bounded in the same way. For instance, the wildlife value dimensions of domination and mutualism that we used to define sociocultural conditions have been examined in other post-industrial areas of the world, such as Europe (Teel *et al.* 2010; Gamborg and Jensen 2016), showing the potential for applications of our approach elsewhere. We recognize, though, that this approach would need to be adapted for use in non-Western societies to capture different cultural traditions and value systems. Finally, we are not suggesting that our approach be used to the exclusion of other important social variables. Indeed, we encourage applications of our index in combination with other approaches for understanding the social context of conservation, which could include different cultural, political, or economic factors operating at multiple scales (eg national, regional, state, county, local). The most promising areas for future application will involve explicit integration of these social considerations with ecological data to facilitate more holistic and successful conservation efforts.

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