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Predicting the legitimacy of wolf recovery

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Legitimacy is a prerequisite of sustainable forms of governance. Existing structures and functions of large carnivore governance have often yielded legitimacy deficits. In northeast North Carolina, USA, recovery of the critically endangered red wolf *Canis rufus* suffers from a legitimacy deficit, chiefly among its critics. This article operationalizes legitimacy and investigates its predictors in the North Carolina red wolf case. We developed a framework that explores three dimensions of legitimacy (input, output and throughput) to simplify the concept within the red wolf recovery and management system. Our challenge was to identify the relevant predictors of legitimacy in totality to improve governance. We analyzed 2577 survey responses from citizens owning property or living within the red wolf recovery area and used multilevel modeling to analyze the relationships between contextual or individual variables and perceived legitimacy. Results revealed that a higher number of red wolf mortalities in a respondent's county may be an ecological predictor of perceived lower legitimacy. Results also indicate that women, formally educated, and smaller parcel-owning landowners were more likely to find red wolf recovery legitimate. Tolerance of red wolves, normative ethics about red wolf recovery, and the instrumental value of wolves were also strong predictors of legitimacy. We conclude that situating legitimacy at the center of a nested social–ecological system may more accurately reveal expressions of its core elements, criteria, or sources in order to identify and treat the pathologies of large carnivore governance.

Keywords: governance, large carnivore, multilevel modeling

Governance of large carnivores is concerned with creating the conditions for ordered rule and collective action (Stoker 1998). Ideally, governance regimes will be robust, effective at directing, controlling and coordinating individuals, organizations and groups to achieve public purposes (Lynn Jr. et al. 2000). In the large carnivore conservation milieu, existing structures and functions of large carnivore governance have generally fallen short of finding common ground and establishing participatory and representative outcomes (Clark et al. 2005). Results comprise unresolved struggles and deeply entrenched conflict among policy contestants over large carnivore policy.

Negative attitudes toward policy, particularly in rural areas with dense large carnivore populations, have drawn scholarly attention to the importance of legitimacy in large carnivore governance (Ericsson and Sandström 2005, Sandström and Pellikka 2008). The concept of legitimacy is power infused. Exercises of power need to be legitimized, and legitimacy is important for technical and political reasons (Stoker 1998,

Farmar-Bowers 2010). Legitimacy assumes either that the actors who govern, and whose decisions are authoritative are required to legitimize themselves (Pellikka and Sandström 2011). A legitimacy deficit has been cited as one source of the failure of technocratic large carnivore governance efforts (Sandström and Pellikka 2008). Legitimacy deficits are evident in the context of wolf recovery and management (Nie 2003, Borgström 2012, Vitali 2014, Pohja-Mykrä 2016, von Essen and Allen 2017).

In northeast North Carolina, USA, recovery of the critically endangered red wolf *Canis rufus* suffers from a legitimacy deficit, chiefly among its critics (Rauch 1997, Bowlin and Brewer 2002, Responsive Management 2017). Mainland reintroduction of red wolves to North Carolina began in 1987. It was soon after met with local opposition that has steadily grown into a spirited grassroots resistance movement (Serenari et al. 2018). Recent examination of the social landscape indicates varying degrees of support for the program among local residents, with many large landowners and hunters most displeased with recovery efforts, as well as questioning the science and decision-making underpinning recovery (Responsive Management 2017, Serenari et al. 2018). Studies have not explicitly probed legitimacy. Converting legitimacy from a latent concept to a measurable

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construct and exploring its predictors would help authorities better understand why critics believe the red wolf recovery program has failed, authoritative power has eroded, and pinpoint where operational improvements need to be made. Further, it is important that we attend to the linkages between social and ecological systems because human behavior at the local level has influenced biological outcomes (e.g. dissent, red wolf mortality from gunshot), which has then produced feedback mechanisms that impact human thought and behavior (e.g. policy).

To meet this need, this study describes legitimacy, operationalizes the concept, and investigates its ecological, socio-economic, political and managerial variables in the understudied North Carolina red wolf recovery case. We developed a framework (Fig. 1) that captures aspects of normative (legal, moral) and sociological (human perspectives (Weber 1947)) legitimacy and used multilevel modeling (MLM) to evaluate red wolf recovery program governance at the local level, where most attempts to legitimate recovery have occurred.

Theoretical framework

Conceptualizing legitimacy

Legitimacy is a functional requirement of forms of democratic governance (Scharpf 2004:3). As a generalized human cognition, it concerns a myriad of conceptualizations and definitions and is typically treated as a latent concept (Tilling 2004, Lamb 2005). Accepted and encyclopedic definitions and applications include beliefs about, support of, or acceptance for a regime with a political (Beetham 1991, Matti 2010), normative, or moral (Lamb 2005) rightfulness to power. The pursuit for all-encompassing definitions and frameworks may sacrifice the contextualization of legitimacy (MacPherson 1977). This is problematic because the context, including scale and unit of analysis, appears to dictate how researchers frame legitimacy's sources, criteria or dimensions. In this paper we prioritize the local context in which

legitimacy unfolds and the impact individual perceptions have on legitimacy. The emerging psychology of legitimacy research investigates the role of individual actors and their perceptions in the process of legitimacy (Tyler 1997, 2006, Vainio 2011). Individual cognitions are important to the study of legitimacy because, at a minimum, they provide the ideological foundation for social structures and processes (Jost and Major 2001) and, ultimately, societal support or acceptance for a democratic regime (Lamb 2005). Weber's (1978) approach to legitimacy is inclusive of individual-level psychology in that the beliefs, values and norms of the individual become embedded in a collective validation or rejection of some social structure or process (Zelditch 2001).

We consider the constitutive or causal indicators of legitimacy (Gilley 2006) within the red wolf recovery and management system. We also attend to the ideas of Beetham and Lord (1998), who emphasized that measuring legitimacy as a dichotomy (i.e. legitimate-illegitimate) is insufficient and the concept should be treated as a matter of degree (Weber 1947). Sandström and Pellikka (2008) elaborated that researchers must find a way to measure legitimacy's extent or degrees, which allows decision makers to design the best strategy to generate or increase positive legitimacy where it is undesirably deficient.

Legitimacy's dimensions help us compartmentalize the numerous variables that might be used to measure legitimacy (Gilley 2006, Bernstein 2011, Klijn 2011, Hoelting et al. 2013, Valkeapää and Karppinen 2013). Leibenath (2008) divided legitimacy into three dimensions. The first dimension is input legitimacy, which suggests that decision-making should express the preferences of the relevant constituencies and incorporates expert knowledge. Output legitimacy comprises the second dimension, which expresses governance as effective, representative, efficient and able to solve problems. The third dimension is throughput legitimacy, concerned with the quality of governance practices. Accountable, transparent, deliberative, responsive, and reliable are a few of the virtues that comprise this dimension. Further, studies

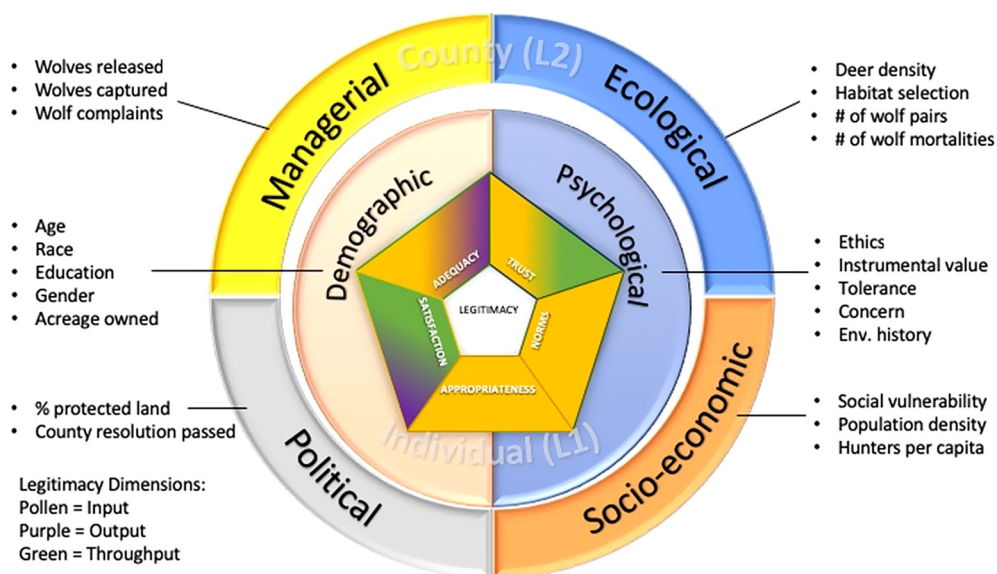


Figure 1. Framework illustrating the social-ecological system as a nested structure and introducing related critical, tested concepts and variables comprising legitimacy in the red wolf case.

suggest that conceptualizing legitimacy as a categorical and unidimensional concept hinders the capture of legitimacy's social or spatial heterogeneity (Lamb 2005). To best conceptualize legitimacy in northeast North Carolina (NENC), we selected variables from the state-, environmental- and large carnivore management-legitimacy literature that represented each of the three dimensions and captured legitimacy's complexity. We incorporate the three dimensions of legitimacy, and the variables we employed are often used by researchers to measure or predict legitimacy. This gave us confidence that the variables we chose for our framework were suitable.

Model development

Appropriateness. We focus on input legitimacy. It captures the legality, justification and consent of authoritative red wolf governance. We concentrated our statements on the U.S. Endangered Species Act, because the Act, which stimulates and governs red wolf recovery, represents the demarcation line between consent or support and opposition or discontent.

Satisfaction. We address output and throughput legitimacy in this instance (van Buuren et al. 2012). Satisfaction with red wolf recovery is linked to sentiment that wolves should exist in NENC and at a population level that sustains them (USFWS 2016).

Trust. This focal area targets output and throughput legitimacy. The literature tends to treat legitimacy and trust as separate units in large carnivore contexts (Frank et al. 2015). However, research on the association between trust and legitimacy (Gilley 2006, Bernstein 2011) suggests that trust of local government and state and federal wildlife agencies and staff is not just related to but underpins legitimacy in the red wolf case.

Norms. Drawing from Sandström and Pellikka (2008) and Lamb (2005), we attend to input legitimacy and the normative justifiability of red wolf recovery and a conservation reliance approach. Life on North Carolina's rugged Albemarle Peninsula (AP) is distinct from other places in the state (Mansfield 2001, Serenari et al. 2018). The red wolf recovery context mirrors other studies that explore the nexus of human assumptions about nature and resource management preferences. These studies refer to a 'Mother Nature knows best' view to reflect a normatively justifiable preference for a hands-off management approach (Rolston III 1991, Creighton et al. 2002, Hull et al. 2002, Johnson 2014).

Adequacy. This domain emphasizes input and output legitimacy, focusing on information on which decisions are made about red wolf recovery and the necessary condition of shared beliefs (Hoelting et al. 2013). Divergent value orientations toward large canids, contested science that authorizes the program, and elements of efficiency are salient to the red wolf case (Serenari et al 2018).

Level 1 predictors: psychological effect

There has been substantial scholarly effort to model and understand the role of individual cognitions in explaining human-environment interactions. Cognitive variables are useful in these models because they are strong predictors

of behavior under certain circumstances (Newhouse 1990). They are also often targets of management interventions toward carnivores (Decker et al. 2006, Bruskotter et al. 2009). Because our understanding of cognitions can be improved by understanding them within the broader context (Manfredo et al. 2009), we examined the following: concern, ethics (collective notions of right and wrong action), instrumental value, tolerance and views of environmental histories.

Concern. Threats to human safety, property and wildlife fuel concern about red wolves (RWC et al. v. United States Fish and Wildlife Service 2016). Human populations demonstrate various levels of concern about wolves (Olson et al. 2015) and, therefore, measured respondent concern about red wolves.

Instrumental value. Affective reactions toward wolves can be powerful predictors of intentions to vote in favor of and support wolf reintroduction (Bright and Manfredo 1996, Slagle et al. 2012). Values such as aesthetic or experiential values, provide something of worth to people. They can generate psychological states within people, such as satisfaction and joy (Vikka 1997). Instrumental values are substantial to those living on the AP because they provide meaning and layers to culture (Mansfield 2001, Serenari et al. 2018).

Ethics. 'The ultimate reasons why we should conserve carnivores at all in such landscapes are based on personal or social ethics, and our perception of what is right and wrong' (Linnell et al. 2000, p. 863). The characteristic of being legitimized is underscored by a view that something is right and proper (Tyler 2006). A principal ethical complaint from critics in the red wolf case is that the ESA encroaches on civil liberties.

Tolerance. Support for predator conservation is strongly associated with levels of tolerance (Treves and Bruskotter 2014). Tolerance is often studied by researchers interested in evaluating wolf conservation and recovery policy globally (Karlsson and Sjöström 2011, Browne-Núñez et al. 2015). The USFWS recognized the need for tolerant residents in the early stages of red wolf recovery (Phillips and Parker 1988).

History. Environmental histories also play an important role in human perspectives about wolf conservation (Biehler 2011, Skabelund 2013). In the case of the red wolf, natural resource conflict in the area has less to do with blood-thirsty wolves than the amount of public land that exists or USFWS-induced variations in Lake Mattamuskeet water levels (Serenari et al. 2018).

Level 1 predictors: demographic effect

Case studies demonstrate that demographic variables are important influences on how humans perceive large carnivores and their recovery and perceive legitimacy (Langin and Jacobson 2012, Smith et al. 2014, Eriksson 2016). Understanding the influence of demographics on the legitimacy of red wolf recovery will enable managers and policy makers to understand, for example, which constituencies require sophisticated engagement tactics. This analysis included age, race, income, education level achieved, and acreage owned.

Additionally, research demonstrates demographic characteristics influence attitudes toward wolves and other large carnivores. In the US, females tend to have favorable attitudes toward wolves, while in Europe they tend to have negative attitudes (Williams et al. 2002, Dressel et al. 2015). Those accomplishing higher levels of formal education generally have positive relationships with wolves (Williams et al. 2002, Dressel et al. 2015). Those owning or conducting livelihood activities on large parcels, such as ranchers and farmers, tend to hold negative attitudes (Williams et al. 2002).

Level 2 predictors

Variables included capture the context and are county-specific. We incorporated a range of ecological (e.g. wolf mortalities), socio-economic (e.g. social vulnerability), political (e.g. county resolution rejecting red wolf recovery), and managerial variables (e.g. wolf releases) (Fig. 1). Descriptions of these variables can be found in the Supplementary material Appendix 1.

Measuring predictors of legitimacy

Ordinary least squares (OLS) regression is commonly used to analyze predictors of legitimacy and governance in general (Heinrich and Lynn Jr. 2000, Gilley 2006). However, research suggests that OLS alone is insufficient for analyzing governance regimes that involve processes and structures (variables) within a hierarchical or nested structure. Multi-level modeling is aptly suited for this type of analysis and, thereby, more likely than OLS to yield precise and extrapolatable results that improve causal explanations of dynamics at other levels of governance (Lynn Jr. et al. 2000). Viewing red wolf recovery as a nested system (individuals [level-1] living within a county situated within the Red Wolf Recovery Zone [level 2]), we account for the role of context or setting by employing MLM to explore how the legitimacy of red wolf recovery, in totality, is associated with individual and county characteristics.

Interactions between structural factors and human cognitions (e.g. institutions-attitudes, context-attitudes) are not often studied but critical to improving decision making (Kansky and Knight 2014). Research attending to these interactions highlight the feedbacks between social (e.g. social conditions, Kühl et al. 2009) and ecological (e.g. wildlife foraging patterns, Carter et al. 2014) processes and human cognitions. To further advance our understanding of the relationship between multi-level variables within social-ecological systems we first identified variables for their predictive power and then employed MLM to answer the following research question: how do variables at multiple levels explain variance concerning citizen perceptions of legitimacy about red wolf governance in NENC?

Methods

Study area

In 1967, red wolves were listed as endangered, and recovery of the species began with the passage of the Endangered Species Act of 1973. The first attempt by humans to release an apex predator back into the wild after being declared extinct

in the wild, mainland red wolf recovery began in North Carolina in September of 1987 (Phillips and Parker 1988). The red wolf population reached a peak range of 130–150 individuals, but has declined since the mid-2000s. At the time of this writing, approximately 30 wolves remain on the landscape. Over 30 years, the red wolf recovery program has experienced resource deficits, eroding support of locals and the state of North Carolina for red wolves on the landscape, rising anthropogenic-induced mortality, an influx of coyotes to the recovery area, political pendulum swings, and lawsuits, among other factors (Serenari et al. 2018).

The red wolf recovery area, formerly known as the Red Wolf Recovery Zone (RWRZ) (Vaughan et al. 2011) or the Red Wolf Non-Essential Experimental Population Area (Bohling et al. 2016), is comprised of five counties (Beaufort, Dare, Hyde, Tyrrell and Washington) on North Carolina's Albemarle Peninsula (AP). The recovery area encompasses public and private lands, totaling 6648 km². Ecologically, this biologically-rich region of North Carolina is comprised of wetlands, lowland forests and large agricultural fields. Socially, there is a strong hunting culture, particularly in Hyde County (Mansfield 2001), where hunt clubs and hunting leases are said to be an important part of the local economy. There is also a prevailing frontier and anti-government spirit among some residents, common in rural areas of the US (Serenari et al. 2018). According to the North Carolina Dept of Commerce, these five counties, excluding the Outer Banks and Ocracoke in Dare County, also encompass some of the most rural, remote, and economically depressed landscapes in the state.

Operationalizing the model

Legitimacy is the dependent variable in this exploratory study. The data for this paper was part of a larger landowner study conducted by the NCWRC (Responsive Management 2017). The results of the NCWRC's study of the red wolf recovery area helped us conceptualize and contextualize legitimacy as the aggregate of the following constructs: appropriateness, satisfaction, trust, norms and adequacy. We measured 18 statements using a 5-point scale of 1 = strongly disagree to 5 = strongly agree, except for Q130, which was measured with a 5-point scale of 1 = strongly oppose to 5 = strongly support, each with a don't know option. We operationalized the following constructs with more than one statement to obtain a mean composite score for that construct. We then calculated the average of those scores to gauge legitimacy of red wolf recovery via a legitimacy score. Higher scores translate to mean that a respondent perceived a higher degree of positive legitimacy concerning red wolf recovery. Where scale deviances occurred, we provide question numbers as a guide. We measured appropriateness with three statements, satisfaction with two statements, trust with five statements, and adequacy with six statements (Table 1). Without a valid or reliable measure of the 'Mother Nature knows best' sentiment to capture normative preferences for natural resource management options, we used one culturally contextualized statement that captures normative sentiment about the red wolf's conservation reliant classification. A response of 5 equated to a hands-off management approach.

Table 1. Reliability and PCA analysis of legitimacy and level 1 constructs. *denotes that we also, or instead, report the mean inter-item correlation for the construct.

Construct	Construct total correlation	Alpha if deleted	Cronbach's alpha (mean inter-item correlation)	PCA score
Appropriateness*			0.633 (0.368)	0.752
Q168. The Endangered Species Act should limit landowners' use of their land to protect endangered species.	0.460	0.510		
Q172. I support the Endangered Species Act.	0.436	0.550		0.754
Q175. Private landowners should bear some responsibility for helping achieve public conservation goals.	0.437	0.546		0.775
Satisfaction*			(0.581)	
Q119. There should be more red wolves on the AP.				0.889
Q130. Do you oppose or support having wild red wolves on the AP?				
Trust			0.884	
Q167. I trust USFWS biologists to manage red wolf impacts.	0.717	0.861		0.825
Q174. I trust USFWS's administration to manage red wolf impacts.	0.827	0.834		0.905
Q176. I believe USFWS officials when they communicate results of red wolf research.	0.677	0.869		0.796
Q169. I trust my county government to manage coyote impacts.	0.591	0.889		0.719
Q173. I trust the NWCRC to manage coyote impacts.	0.803	0.840		0.888
Adequacy			0.855	
Q116. Red wolves are a species worthy of protection under the Endangered Species Act.	0.731	0.813		0.829
Q124. Money is not wasted on red wolf recovery on the AP.	0.741	0.813		0.840
Q113. Red wolves are native to North Carolina.	0.593	0.839		0.721
Q129. Red wolves are essential to maintaining the balance of nature.	0.535	0.850		0.667
Q122. Red wolves do not reduce small game populations, such as rabbit or quail, below acceptable levels.	0.630	0.833		0.756
Q128. Red wolves do not deplete deer numbers to unacceptable levels.	0.626	0.833		0.754
Instrumental value*			(0.391)	
Q114. Seeing a red wolf in the wild would be one of the greatest outdoor experiences of my life.				0.865
Q117. I would enjoy seeing red wolves on my property or near my home.				
Ethics*			(0.305)	
Q123. Residents on the AP should bear some of the burden of protecting the red wolf.				0.808
Q168. The Endangered Species Act should limit landowners' use of their land to protect endangered species.				
Tolerance*			(0.307)	
Q125. Red wolves do not cause me any problems.				0.808
Q157. If red wolves are using private land, tolerating red wolves be...				
History*			(0.322)	
Q179. The red wolf is not a problem, the US government's history of mismanagement of natural resources is a problem.				0.813
Q181. We have too many government-led wildlife conservation projects on the AP.				

Level 1 predictors

Employing a total of 15 statements, we averaged responses to obtain a mean composite score for each variable. We measured respondent concern about red wolves using a 5-point scale, with 1 = not concerned and 5 = very concerned, and with a do not know option. We addressed seven concerns: the potential risk to yourself in a face-to-face encounter, a child being attacked, a pet being attacked, regular presence on your property or near your home, damage to property, such as livestock or crops, spreading rabies and damages to local wildlife. A higher score indicated increased concern for human interests regarding red wolves. We measured the instrumental value of red wolves with two statements. We employed a 5-point scale for Q114, where 1 = strongly disagree to 5 = strongly agree, and 1 = unacceptable and 5 = acceptable for Q117. A higher mean score indicated

increased instrumental value for red wolves. We measured ethical behavior (i.e. right and wrong action) about red wolf recovery with two statements. We employed a 5-point scale, where 1 = strongly disagree to 5 = strongly agree. We measured tolerance of red wolves using private lands with two statements. We employed a 5-point scale for Q125, where 1 = strongly disagree to 5 = strongly agree, and 1 = unacceptable and 5 = acceptable for Q157. A higher mean score indicated increased tolerance for red wolves. We used a 5-point scale, where 1 = strongly disagree to 5 = strongly agree with a don't know option, and two statements to examine the role of environmental histories. A higher mean score translated to respondents believing that the government's involvement in local conservation projects was problematic. Our analysis also included sex (male/female), age, race, income range, highest level of

formal education achieved, and acreage of largest parcel owned on the AP.

The following paragraphs will outline our order of operations. First, we summarize the nature of sampling and survey administration conducted by Responsive Management, Inc. for the NCWRC. Then, we discuss scale creation and our use of Cronbach's alpha and principal component analysis (PCA). Our third paragraph describes our use of MLM to explore how ecological and socio-economic, political, and managerial variables influence legitimacy scores. The final paragraph details post hoc analysis via OLS, which was used to pinpoint which operationalized legitimacy constructs had the most influence on legitimacy of red wolf recovery.

A note about sampling and survey administration

Beaufort, Dare, Tyrell, Hyde and Washington county residents aged 18 years of age and older comprised the target population for this analysis. It included those who own land on the Peninsula and live there, those who own land on the Peninsula but live elsewhere in North Carolina, those who own land on the AP but live outside of North Carolina, homeowners who rent the land on which they reside (because they tend to make decisions about land use), and those who rent homes but do not own the land. The use of random sampling ensured that landowners and renters were represented proportionately within the five counties. Within strata population error estimates were $\pm 10\%$ error at a 90% confidence level. Following Dillman et al. (2014), the research team used a multi-modal contact approach to ensure complete coverage of the population (telephone [landline and cellphone], email, postal mail). Accompanying details about study methods and the sample can be found in Responsive Management's report (2017).

Scale reliability analysis

Because most variables employed to measure legitimacy required multiple items (e.g. trust had five items), we used Cronbach's alpha reliability coefficients to determine reliability and internal consistency of our scales (Table 1). We set our criterion for good scale reliability at 0.65 and item-total correlations near or greater than 0.40 suggested by Vaske (2008). Our exploratory scales are small (less than 10 items) and, thus, our results were prone to low Cronbach's alpha values. This was the case with the Ethics scale. Therefore, we deferred to and report the mean inter-item correlation for most analyses and adhered to the optimal range of 0.2–0.4 suggested by Briggs and Cheek (1986). We also conducted PCA to assess unidimensionality and assess validity for these scales (Hattie 1985, Cortina 1993). We used PCA with Oblimin rotation because we were reducing variables into fewer components and creating new variables rather than identifying what each factor represents or what caused responses.

Multi-level modeling. We used MLM (Raudenbush and Bryk 2002) to analyze 2577 responses, which is a desirable analytic technique because it allowed us to investigate the influence of different variables on legitimacy using a nested design. We used 'county' as our nesting variable where we examined the between- and within-county variance in legitimacy,

explained by including different predictor variables in our models. An advantage to MLM is that it allows for missing data while not having it impact the results (e.g. if not all participants answered all questions), and does not remove the participants with missing values from the dataset. A missing individual data point does not impact the results because it is just not considered in the calculation of the estimate value for that predictor. For example, the analysis can be performed with people who have different numbers of responses without impacting the results. This occurs because the analysis does not generate an estimate value for each specific data point (e.g. individual); it generates an estimate for the predictor as a whole. We assessed our models using different predictor variables to determine the association between these variables and legitimacy, both between and within counties. With MLM, we obtained additional insight into whether certain variables within the social-ecological system influenced how residents in the red wolf recovery area perceive policy legitimacy.

For our models, we clustered variables into four sets of level 2 (between-county) variables, where the level 2 variables were categorized as ecological, political, socio-economic and managerial. We chose to create these clusters because it was not feasible to include many predictor variables into a single model and this was an exploratory attempt at statistically examining the association between legitimacy with these variables. We combined one of these level 2 clusters with a series of demographics variables, for a total of four models. For each model, we obtained the association between each variable and legitimacy, as well as the percent variance explained by these models. Specifically, these models explained the variance based on our intraclass correlation coefficient calculated from our fully unconditional model. A fully unconditional model is a model without predictor variables used to determine if there was sufficient variance in legitimacy between different counties and within individuals of one county. This is required because we used MLM to estimate this variance in legitimacy, and the fully unconditional model confirms our variable has variance at multiple levels, indicating it is an appropriate analysis. In addition, the fully unconditional model helps us to calculate the intraclass correlation coefficient, which provides the numerical amount of variance explained at the within- and between-county levels. The fully unconditional model used in this study revealed that 86.5% of the variance in legitimacy was within-counties, and therefore the percent within-county variance explained by these models explained the amount out of the 86.5% explained by that model.

Our first model combined ecological and demographics variables. A second model combined political and demographics variables. The third model combined socio-economic and demographics variables. Our fourth model combined managerial and demographics variables. We also examined the relationship between some level 2 variables and psychological level 1 variables with legitimacy. This model included two level 2 variables (wolf mortality and resolution) and psychological variables at level 1.

We conducted a post hoc analysis via OLS to determine which components of legitimacy explained the variability

the response. Statistical tests were performed with IBM SPSS Statistics 23 and SAS ver. 9.4 (SAS Inst.). Statistical significance for all tests was set at alpha (α) = 0.05. Informed consent was obtained from all individual participants included in the study.

Results

Sample characteristics

The reported response rate for the study was 17%, with county sampling error calculated between 2.52% and 10.30%. The sample averaged 64 years of age. Most of the sample owned land in the recovery area (89.2%), while few (4.7%), only leased land (4.8%), both owned and leased land (4.7%) or rented a residence (1.3%). Most landowners owned 50 acres or less (79.7%). Respondents achieved at least a high school degree or G.E.D. (94.6%), and were male (52.5%). The mean legitimacy score was 2.96, and the data returned a normal distribution (see Table 2A for reporting of means).

Scale development and model results

Our Cronbach's alpha reliability analysis returned acceptable levels for each of the exploratory scales (Table 1). We did not remove single items from PCA because we did not detect rotated factors loadings below 0.40 (Hair and Black 2000, Vaske 2008) (Table 1).

We first ran a fully unconditional model (i.e. model with no predictor variables) to determine if there was sufficient between- and within-county variance in legitimacy. Results revealed significant between ($\tau_{00} = 0.1026$, $z = 4.48$, $p < 0.0001$) and significant within-county ($\sigma^2 = 0.6926$, $z = 32.68$, $p < 0.0001$) variance in legitimacy. Inspection of the intraclass correlation coefficient revealed 13.5% of the variance in legitimacy is between counties and 86.5% is within counties. Based on these results, it was sufficient to proceed investigating the association between predictor variables and legitimacy using fully conditional models. Fully conditional models are used to inform us of which variables explain this variance in legitimacy. This next step was sufficient because we determined that legitimacy scores do vary within individuals in one county and between counties, and conditional models determine the factors impacting this variance in legitimacy scores. We ran non-randomly varying slopes models where we did not allow the slopes to vary because the models would not converge with that many variables. As this is a first attempt at numerically identifying predictors of legitimacy, it was appropriate to run models that could account for many predictor variables, and not models that estimated variance in all predictor variables. In other words, a non-randomly varying slopes model allowed us to incorporate many variables with fixed effects where variance was examined at the random-effects level (overall between- and within-county variance). A model that would allow slopes to vary would include variance for fixed effects, thus allowing the slope of each predictor variable to vary, but would limit the amount of fixed effects we use because models with many variables would not converge.

We wanted the flexibility of including many fixed effects to determine which ones were associated with legitimacy.

Exploring the demographic effect model at level 2, we found a significant association between wolf mortality and legitimacy for model 1 (Table 2, Ecological model). For this model, results indicate that an increase in wolf mortality was associated with decreased legitimacy scores. The between-county variance was not significant. Results revealed that for all four level 1 models, there was a significant association between legitimacy and with education, gender, and acreage owned for all four models (Table 2). Specifically, an increase in formal education level and a decrease in acreage owned were associated with higher legitimacy scores. Females were more likely to have higher legitimacy scores as well. The results explain between 0.07% and 0.13% of the within-county variance.

Results from our models exploring the effect of individual cognitions revealed significant associations between legitimacy and ethics, instrumental value and tolerance (Table 3). Specifically, an increase in these three variables was associated with an increase in legitimacy scores. Overall, this model explained 30.9% of the within-county variance in legitimacy, and the between-county variance explained was not significant. We found that the effect of tolerance had a lower t statistic when the model included ethics and instrumental value, compared to a model with tolerance alone. Employing a parsimonious psychological model that only included statistically influential psychological variables (tolerance, ethics, instrumental value) rather than an extended model including the remaining level-1 variables (demographic information, concern, history) revealed that including the relationship between instrumental value and legitimacy in the model was strong enough to reduce a statistically significant association between wolf mortality and legitimacy to insignificant.

To identify what aspects of legitimacy were most influential at level 1, we conducted post hoc analyses. Satisfaction (adjusted $r^2 = 0.496$, $p < 0.0001$) followed by trust (adjusted $r^2 = 0.389$, $p < 0.0001$) explained the most variability in the response for the psychological model. Analysis also revealed that satisfaction (adjusted $r^2 = 0.077$, $p < 0.0001$) followed by trust (adjusted $r^2 = 0.067$, $p < 0.0001$) explained the most variability in the response for the demographic effect model.

Discussion

The number of wolf mortalities in a respondent's county may be an ecological and evaluative variable that predicts legitimacy. Wolf mortality has some degree of influence on policy legitimacy (Treves et al. 2017), situating our research within literature suggesting a relationship between legitimacy and expectations of ecosystem function and health (Rowe and Frewer 2000, Anderies et al. 2004, Bansal and Clelland 2004). In some wolf contexts, high anthropogenic mortality is often attributed to stakeholder resistance to illegitimate governance systems (e.g. poaching) (Kaltenborn and Brainerd 2016). In the red wolf case, motor vehicle crash and accidental gunshot mortality distinguish it from other wolf recovery projects (Hinton et al. 2013); and, when viewed with an institutional lens, insufficient

Table 2. Models 1–4: demographic variables by legitimacy (people nested within county).

Fixed effects	Model 1 (ecological)		Model 2 (political)		Model 3 (socio-economic)		Model 4 (managerial)	
	Estimate (SE)	t	Estimate (SE)	t	Estimate (SE)	t	Estimate (SE)	t
Legitimacy								
Intercept	3.25 (0.40)	8.08**	3.28 (0.17)	19.29***	2.73 (1.43)	1.92	3.16 (0.14)	22.00***
Deer density	0.27 (0.16)	1.67						
Habitat selection	-1.19 (0.81)	-1.46						
Wolf pairs	0.066 (0.039)	1.70						
Wolf mortalities	-0.005 (0.0018)	-3.83**						
Resolution			-0.099 (0.075)	-1.31				
Protected land (%)			-0.33 (0.18)	-1.80				
Population density					0.0049 (0.0068)	0.73		
Hunters per capita					0.013 (0.086)	0.15		
Social vulnerability					-0.020 (0.025)	-0.80		
Complaints							-0.0012 (0.0053)	-0.23
Releases							-0.0051 (0.0037)	-1.36
Captures							-0.00008 (0.00059)	-0.13
Age	0.00004 (0.00022)	0.17	0.00005 (0.00022)	0.25	0.00005 (0.00022)	0.24	0.000041 (0.00022)	0.19
Race	0.012 (0.022)	0.54	0.011 (0.022)	0.51	0.011 (0.022)	0.51	0.0096 (0.022)	0.43
Education	0.065 (0.0087)	7.52***	0.065 (0.0087)	7.52***	0.065 (0.0087)	7.54***	0.065 (0.0087)	7.52***
Gender	-0.14 (0.036)	-3.83***	-0.14 (0.036)	-3.80***	-0.14 (0.036)	-3.80***	-0.14 (0.036)	-3.83***
Acreage owned	-0.10 (0.012)	-8.33***	-0.10 (0.012)	-8.23***	-0.10 (0.012)	-8.21***	-0.10 (0.012)	-8.33***
Random effects	Estimate (SE)	z	Estimate (SE)	z	Estimate (SE)	z	Estimate (SE)	z
Legitimacy (τ_{00})	0.044 (0.030)	1.47	0.040 (0.026)	1.51	0.037 (0.025)	1.45	0.047 (0.032)	1.47
Within-county fluctuation (σ^2)	0.69 (0.021)	32.66***	0.69 (0.021)	32.67***	0.69 (0.021)	32.67***	0.69 (0.021)	32.67***
Between-county R ²	57%		61%		63.9%		54.2	
Within county R ²	0.4%		0.12%		0.13%		0.07	

** p < 0.01, *** p < 0.0001.

Table 3. Model 5: psychological variables by legitimacy (people nested within county).

Fixed effects	Estimate (SE)	t
Legitimacy, β_0		
Intercept, γ_{00}	1.19 (0.12)	10.02***
Wolf deaths, γ_{01}	-0.0021 (0.0013)	-1.60
Resolution, γ_{02}	-0.097 (0.091)	-1.21
Ethics slope, β_1		
Intercept, γ_{10}	0.18 (0.017)	10.51***
Instrumental value slope, β_2		
Intercept, γ_{20}	0.35 (0.023)	15.16***
Tolerance slope, β_3		
Intercept, γ_{30}	0.12 (0.016)	7.28***
Random effects	Estimate (SE)	z
Legitimacy (τ_{00})	0.0098 (0.010)	0.96
Within-county fluctuation (σ^2)	0.48 (0.019)	25.07***

*** $p < 0.0001$.

planning and implementation processes may explain the negative relationship between wolf mortality and legitimacy in this study. Establishing a self-sustaining pack of 220 wild wolves in three separate populations within the red wolf's historical range is the USFWS's chief goal, but mortality has outpaced survival (Phillips et al. 2003, Hinton et al. 2013). Thus, an elevated number of wild wolf mortalities in one's county, such as Hyde County (a recovery zone high of 103 over 29 years, USFWS, unpubl.), may have led respondents to associate wolf mortality with the USFWS's inability to meet their program goals, eroding all three dimensions of legitimacy. In practice, identifying legitimate acts, such as limiting the incidence of accidental red wolf mortality and improving efficiency and effectiveness to operationalize those acts (Miller et al. 1994) should help the USFWS rebuild a form of 'legitimate power' (Weber 1978) necessary for red wolf recovery.

Should red wolves continue to exist on the landscape, humans individual characteristics will likely play an important role in shaping legitimacy. Women, in particular, found red wolf recovery more legitimate than men. Our post hoc analysis revealed a need to explain linkages between trust in government and gender and between satisfaction with recovery and gender. We contend this undertaking may be more complex than engaging tautological reasoning (e.g. women generally hold positive attitudes about wildlife or oppose killing large carnivores, Dickman et al. 2013). For instance, rural women have been reported to display trust in an authority entitled to make decisions about wolves even though that authority has demonstrated legitimacy deficits (Pohja-Mykrä 2016). Women can differ from men in their perceptions of government efficacy and preferences for government program structure and employ multi-dimensional reasoning (e.g. societal vulnerability, blame attribution, altruistic tendencies) to assess policy (Schlesinger and Heldman 2001). Rural men may sense political alienation which then comes to affect trust of authorities or satisfaction with red wolf recovery outcomes (Eriksson 2017). Future research will need to explore why gender gaps in assessments of wolf policy exist. Insights from political studies are valuable because they introduce novel concepts and philosophies that help explain how individual characteristics, such as gender, shape perceptions of policy legitimacy.

Our results provide empirical evidence that legitimization of red wolf recovery in North Carolina needs to start with large parcel landowners. They are key partners in recovery in any wolf recovery effort, but particularly important to red wolf recovery because most of the red wolf's historic range is on private lands (Gilbreath and Henry 1998, Dellinger et al. 2013). Unlike women and more formally educated respondents in our study, our findings suggest that large parcel landowners in the recovery area lack trust in government and satisfaction with recovery. Authorities involved in red wolf recovery will want to improve throughput legitimacy via organizational change to address these findings. From here, we require an understanding of what legitimization tactics (e.g. communication, organizational change) authorities should use to gain and repair legitimacy with this group. Future research might employ a managerial perspective to address the problem (O'Donovan 2002) and elicit the potential links between red wolf recovery, the choice of legitimization tactics required to gain, maintain or repair legitimacy among large landowners, and tactic effectiveness.

Our findings evaluating the influence of individual cognitions on legitimacy pose challenges to recent deliberative democratic approaches employed by the USFWS to mend the 'fragmented normative landscape' (Mena and Palazzo 2012, p. 540) in which legitimacy dynamics unfold. Our results indicate that respondent differences about the legitimacy of red wolf recovery were grounded in their norms, values and beliefs, which tend to be stable in adults (Rokeach 2008, Steg 2016), concerning red wolf recovery. These constructs underpin predetermined stakes that stifle the consensus-building and legitimacy-boosting ambitions of a pluralistic approach in wolf contexts (von Essen and Hansen 2015). Given these insights, institutional changes are necessary to accrue procedural legitimacy where barriers to deliberation exist, such as the ESA's rigidity or ideological differences about red wolf recovery. Habermas's (1990) deliberative concept of democracy offers a transformative pathway towards a legitimate recovery program. Stakeholders could instead be considered policy contestants (Serenari et al. 2018) and provided a forum for and process by which to present and debate rational, compelling arguments concerning red wolf recovery. Authorities would attend and use these debates to inform decisions and provide mechanisms to facilitate collaboration, bargaining, or negotiation to reach optimal outcomes and increase legitimacy (Mena and Palazzo 2012).

Our findings complement studies demonstrating the utility of the input/output/throughout legitimacy framework to reveal the ways by which democratic legitimacy may be established, extended, maintained, defended, or lost (Leibenath 2008, van Buuren et al. 2012, Bernauer et al. 2016). Red wolf governance is transitioning from a paradigm emphasizing output legitimacy (achieving a self-sustaining population of wolves) to a hybrid form of governance that balances the importance of all dimensions (USFWS 2016). All three dimensions are germane to human perceptions of legitimacy in the red wolf case. Thus, there is a critical need to formalize this new institutional paradigm by establishing congruence between the USFWS's values and those of the larger social system to establish and extend legitimacy (Tilling 2004, van Buuren et al. 2012). Humans within the larger red wolf social system also consider ecological factors

important to legitimacy. Grounding the framework within a nested social–ecological system can provide a sophisticated contextualized model of legitimacy for the study of wildlife governance contexts to accounts for these values.

Our research helps build the case for a continuous conception of legitimacy (Haack et al. 2014) about large carnivore governance. Increasing degrees of legitimacy is key to sustainable outcomes (Stoker 1998). The study of legitimacy suffers from an illegitimate–legitimate (i.e. all or nothing) dichotomy (Stoker 1998, Borgström 2012), which does not make clear where or with whom legitimacy deficits originate and implies the only path to policy success is unlikely extensive change. Situating legitimacy at the center of a multilevel framework provided a way to identify important ecological and social variables that influence, to varying degrees, how residents evaluate red wolf recovery. Future research exploring contextualized forms of legitimacy in this way may more accurately reveal expressions of its core elements, criteria, or sources in order to identify and treat the pathologies of large carnivore governance. Our approach requires validation, expansion and critique, but offers a conceptual innovation in which to improve large carnivore governance in North Carolina and elsewhere.

Limitations

A few limitations of this exploratory study are worth mentioning to assist future research efforts. First, psychological and demographic variables were adequate predictors of legitimacy. However, due to the volume of predictors tested in this study and to isolate each domain, we forego an analysis of interactions. Future analyses should include both demographic and psychological variables in their models to examine if interactions increase the within-county variance explained. Second, though three of our original level 2 variables were unique, they were collinear (red wolves captured, percent public lands, wolf mortalities). We excluded the former two from our analysis. Researchers may want to consider these variables in future study designs because they may be important. Additionally, we used a single item to measure the ‘Mother Nature knows best’ sentiment and account for normative justifiability. Researchers should consider ways to establish a valid and reliable scale by which to measure this sentiment. Finally, we were constrained by the fact that only five counties made up the recovery area. This detail may have reduced the impact of contextual effects. The number of groups is more important for unbiased estimates and model performance, but the adequate number can range widely (Maas and Hox 2005, Bickel 2007). Future research using MLM for similar purposes will want to ensure the group size adequately captures variability in the response.

Conclusion

We emphasized the role of the human perspectives to modeled multilevel variables within a social–ecological system to determine which dimensions of legitimacy matter most for public support of red wolf recovery. The red wolf recovery program cannot satisfy all interests, stakeholders, or actors, but authorities can take steps to improve organizational

activities and accrue legitimacy. To increase legitimacy of red wolf recovery, we suggest treating the concept as a product of measurable constructs which organically transforms legitimacy from an unproductive success–fail binary to a matter of degrees. Our findings suggest that positive change will come as authorities attend to input (e.g. competence in knowledge, representativeness), output (e.g. problem-solving, cooperation [not to be conflated with financial incentivization]), and throughput (e.g. quality of governance practices) legitimacy. We posit that minimizing red wolf mortalities will be a litmus test of how well these dimensions were attended to and if organizational legitimacy has been repaired among critics. Gains in procedural legitimacy should support or reinforce legitimacy gains at the individual level that are currently encumbered by human cognitions. It is more difficult to secure cognitive or moral legitimacy, but once achieved, the cultural support for recovery attained is more likely to be self-sustaining (Suchman 1995).

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