

**Private land conservation towards large landscape goals: Role of relational values,
property rights orientations, and perceived efficacy in ranchers' actions**

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Abstract:

1. Many of the world's iconic, endangered, and endemic species rely on large, contiguous landscapes for their survival.
2. In the US West, working ranches are integral to large landscape conservation goals and there are numerous influences on ranchers' conservation actions, including their relational values, perceived self-efficacy, and property rights concerns.
3. Using survey data from 681 ranchers in eastern Idaho and western Montana, we sought to answer the question: how do relational values, property rights orientations, perceived efficacy, and public lands dependence affect reported conservation actions on private ranch lands?
4. Conservation adoption varied widely by action, with invasive plant removal having the highest (92%) and conifer removal the lowest (21%) rates of adoption.
5. Conservation adoption was higher among ranchers who believe they are responsible for conserving nature, believe their land should be used to provide environmental benefits to the region, have higher perceived self-efficacy, lower property rights concerns, and higher incomes.
7. Programs encouraging the adoption of conservation on private lands could benefit from message framing that resonates with the worldviews of landowners and land managers.

1 INTRODUCTION

2
3 Many of the world's iconic, endangered, and endemic species rely on large, contiguous
4 landscapes for their survival, yet most globally important migration corridors are unprotected.
5 Spurred by dramatic declines in global biodiversity, the landmark Kunming-Montreal Global
6 Biodiversity Framework was adopted in 2022 with an ambitious target to increase the global
7 coverage of protected areas and other area-based conservation measures to at least 30 percent by
8 2030 (Convention on Biological Diversity, 2022). This framework incorporates
9 recommendations from scientists and practitioners arguing that protected areas are not sufficient
10 to slow biodiversity loss (e.g., Maxwell et al., 2020). Indeed, recent studies suggest that
11 increasing conservation activities on private lands rather than adding protected areas may be
12 more effective at ensuring species migration connectivity (Brennan et al., 2022) and reduce
13 trade-offs between agriculture and biodiversity conservation (Mehrabi et al., 2018). Yet private
14 land conservation requires tremendous social and political engagement informed by social
15 science to steward private lands in ways that meaningfully include the people who own and use
16 resources (Sandbrook et al., 2023).

17 Agricultural land (including land used for cropping, ranching, and pastoralism) covers
18 almost half of the Earth's habitable land area (Ellis et al., 2010). Conservation adoption by
19 agricultural landowners and users is influenced by many different variables, with few consistent
20 predictors (Prokopy et al., 2019). These variables include financial incentives (Mills et al., 2018);
21 farmer reputation (Mills et al., 2017); information about conservation practices (Eanes et al.,
22 2017); perceived self-efficacy and response efficacy (or the perceived ability of an individual or
23 practice to achieve goals) (Gebrehiwot & van der Veen, 2015; Perry & Davenport, 2020); beliefs
24 about property rights (Jackson-Smith et al., 2005); and farm characteristics such as size and land

tenure (Ranjan et al., 2019). Despite the variety of conservation actions that contribute to landscape-scale conservation initiatives (Jackson-Smith et al., 2010), most studies on conservation adoption amongst farmers and ranchers since 1982 focus on one or two actions (Floress et al., 2018; Liu et al., 2018), limiting our ability to make inferences across actions or understand drivers of conservation adoption broadly (but see Cooper (2003) and Rode et al. (2015) for exceptions).

Some scholars argue that the reason so much research on conservation adoption fails to find consistent predictive variables is because it overlooks a critical way people value nature: relational values. While past work on farmers and ranchers engaging in conservation has measured the effects of their value orientations on decisions (Page & Bellotti, 2015; Swagemakers et al., 2017), the authors primarily conceive of these values as either intrinsic (valuing nature for nature's sake) or instrumental (valuing nature in terms of its benefits to people) (but see Sweikert & Gigliotti, 2019 for an exception). Chan et al. (2016) argue that these value orientations neglect the values reflecting relationships with nature and other people associated with a "good life." These "relational values" include cultural identities associated with place, nature as an opportunity for social cohesion and social responsibility, and individual opportunities to embody stewardship and fulfillment. A relational framing of conservation practice adoption on agricultural land would focus not on the cost of implementing that practice, but on the contribution to the farmer's well-being derived from doing work in accordance with their individual, family, and community values (Chapman et al., 2019; Kreitzman et al., 2022). While the relational values framework holds promise for explaining conservation decisions on agricultural lands, its application is currently limited. Applying the framework to an array of

agricultural and other conservation contexts requires understanding how it relates to other theoretical, practical, and contextual concerns (Klain et al., 2017).

In the United States (US), private land ownership and action dictates many conservation outcomes (Burger et al., 2019). This study asks: how do relational values, property rights orientations, perceived efficacy, and public lands dependence affect reported conservation actions on private ranch lands in the US West? We focus on these variables because less attention has been paid to them in studies of agricultural conservation adoption (for instance, they were not assessed by Prokopy et al. (2019), the largest recent literature review of drivers of agricultural conservation adoption in the US) and because they are specifically relevant for US ranching operations. We answer this question through analysis of a survey of ranchers in an important wildlife corridor in the US West called the High Divide region. This region and group of people offers a useful case study to explore how these values and perceptions affect conservation actions by private individuals for several reasons. First, as we describe further in the Study Area section, the High Divide region is globally recognized as a critical habitat zone for multiple species and has a long history of conservation programming (Chester, 2015). Second, ranchers in the US West make decisions affecting a vast amount of both private and public leased land (Lien et al., 2017) that supports an abundance of large landscape dependent species (Havstad et al., 2007). In this context, ranchers' support for and participation in these land, water, and wildlife conservation efforts can affect the success of landscape-scale conservation goals (Brunson & Huntsinger, 2008; Sheridan et al., 2014). Ranchers in the US West have diverse beliefs about conservation (Jackson-Smith et al., 2005), which can affect management decisions.

Hypotheses

Using data from a survey of ranchers in the High Divide region of Idaho and Montana, USA (Figure 1), we quantified the relationship of conservation adoption to 1) ranchers' relational values; 2) private property orientations; 3) perceived self- and response efficacy; 4) relative dependence on public lands; and 5) demographic and agricultural operation characteristics. We evaluated seven conservation actions commonly included in landscape conservation initiatives and with varying effects on wildlife and ecosystems throughout the study region (Table 1). We chose these seven actions based on years of experience working with ranchers by our practitioner partner organization, Heart of the Rockies Initiative and conversations with regional stakeholders at multiple workshops hosted by the Initiative in the study area and attended by all authors. Including several conservation actions in a single statistical model allowed us to identify variables that impact conservation adoption in general while also evaluating differences in adoption rates and predictors among actions. Based on our literature review and experience within the study region, we hypothesized the following relationships.

Table 1. Conservation actions included in our study, meeting a variety of landscape conservation goals within the study region (Bestelmeyer et al., 2011).

Conservation Action	Description	Conservation Implications
Conifer removal	Mechanical or burning treatments to remove woody species such as juniper and pinyon pine	Conifer encroachment degrades sagebrush-steppe systems and can lead to increased fire risk and decreased habitat for sagebrush-obligate wildlife (Miller et al., 2014).
Invasive plant removal	Control of exotic grasses and forbs such as medusahead (<i>Taeniatherum caput-medusae</i>) and starthistle (<i>Centaurea spp.</i>)	Critical to the protection of rangeland function and vegetation dynamics (DiTomaso et al., 2010) and has been promoted across the western U.S. through educational outreach and cooperative prevention systems (Goodwin & Jacobs, 2007).
Conservation easements	A land preservation tool for private lands in which a landowner voluntarily	Landowners continue to own and use their land subject to the agreement restrictions in order to protect the

	extinguishes (through a bargain sale and/or donation) the development rights to their property	land's conservation values (e.g. rangeland, agriculture, open spaces, wildlife habitat, etc.) (Rissman et al., 2007).
Cost-share programs for fish and wildlife habitat improvement	Fund conservation actions and to develop and improve fish and wildlife habitat	Incentivizes rangeland management intended to benefit particular species (Briske, 2017); they may overlap with other conservation actions.
Riparian fencing	Fencing to exclude livestock from streams and riparian areas	Reduces the impact of livestock and ranch activities on streamside vegetation and soil, thereby protecting riparian habitats, limiting erosion, and maintaining water quality (Kauffman et al., 2004)
Riparian buffers	Vegetative buffers and additional plantings along stream and river banks	Reduces the impact of livestock and ranch activities on streamside vegetation and soil, thereby protecting riparian habitats, limiting erosion, and maintaining water quality (Kauffman et al., 2004).
Wildlife-friendly fencing	Flagging, smooth wiring, height, seasonal electric fence, wire suspension fence, drop down fence, lay down fence	Allows for safe passage and increases fence visibility, thereby improving wildlife habitat by decreasing mortality related to collisions and granting access to food, water, and shelter (Jakes et al., 2018).

Relational values. Relational values have been associated with willingness to engage in conservation actions among farmland owners and tenants (Chapman et al., 2019; Klain et al., 2017; Kreitzman et al., 2022). For ranchers, moral responsibility to steward the land influences conservation behavior and can be a central motivator of conservation adoption (Lien et al., 2017; Pape, 2023; Wilmer et al., 2019). For example, the study of ranchers in Arizona and New Mexico by Lien et al. (2017) found a common sense of responsibility to steward land among all participants, regardless of their views of government programs. Following our interest in connecting the relational values framework to agricultural conservation adoption literature and existing literature on the stewardship ethic in agriculture, we home in on the responsibility

component of the framework. We hypothesized that ranchers holding stronger values regarding responsibility to conserve nature and responsibility to use land to provide environmental benefits to the region (two components of relational values scales), would report higher levels of conservation adoption.

Private property orientation. In most cases, ranchers with public grazing permits are required to own sufficient private rangeland near the allotment to sustain their livestock for part of the year and these ranches can provide important buffer areas for public lands when managed with landscape goals in mind (Talbert et al., 2007). Rancher beliefs about property rights are frequently considered among the most important factors shaping rancher decisions to engage in conservation (Jackson-Smith et al., 2005; Kreuter et al., 2006; Lubell et al., 2013; Yung & Belsky, 2007). Kreuter et al. (2006) found that ranchers who think their own property rights are eroding may be less likely to undertake ranch management consistent with conservation goals for the greater good (Kreuter et al., 2006). Thus, we hypothesized that a stronger belief that private land-use decisions are solely the responsibility of the landowner is negatively related to conservation adoption.

Perceived efficacy. Self- and response efficacy have been positively associated with agriculturalists' conservation adoption in multiple studies (Gebrehiwot & van der Veen, 2015; Perry & Davenport, 2020; Wilson et al., 2018). Perry and Davenport (2020), for example, found that Minnesota farmers' expressed self-efficacy regarding their ability to measure and achieve conservation outcomes influenced their subsequent goal-setting and stewardship activities. Here, we focus on self-efficacy in relation to financial feasibility as past studies have found that concerns about financial well-being can be a barrier to conservation adoption (Gutwein & Goldstein, 2013; Toledo et al., 2013). We hypothesized that a stronger belief that financial well-

being conflicts with conservation is negatively associated with adoption of conservation.

Regarding response efficacy, we hypothesized that a stronger belief that actions on private land have little regional impact is negatively associated with adoption of conservation (see Eaton et al., 2018, 2019).

Public land dependence. We hypothesized that ranchers' dependence on public land positively affects voluntary conservation adoption on their private lands. Ranchers do not necessarily partition management responsibility or conservation actions based on public-private land boundaries, meaning that landowners who hold public grazing permits are likely to carry over the required or encouraged conservation actions onto their private holdings (Ferranto et al., 2013; Svancara et al., 2015). Kreuter et al. (2006) found that ranchers who were more dependent on public land for grazing in Colorado and Utah were more likely to control noxious weeds and to protect water resources, riparian areas, and species habitat than ranchers in predominantly private land grazing states (e.g., Texas). Ranchers' reliance on public land for forage and other ecosystem services may also endow them with a sense of social responsibility that can lead to conservation action (Jackson-Smith et al., 2005; Kreuter et al., 2006).

Additional variables. In addition to the variables above, we expected that the following variables would affect conservation actions among our respondents based on a systematic review of variables associated with agricultural conservation adoption in the US (Prokopy et al., 2019). We expected that respondents who were younger, with larger properties, more formal education, and higher incomes would be more likely to take conservation actions. Additionally, we expected that local resident-owners would be more likely to take action (Ranjan et al., 2019)

We integrated our data into a Bayesian multi-level model, which accounts for aggregate effects across actions while also enabling inference on how adoption varies among individual

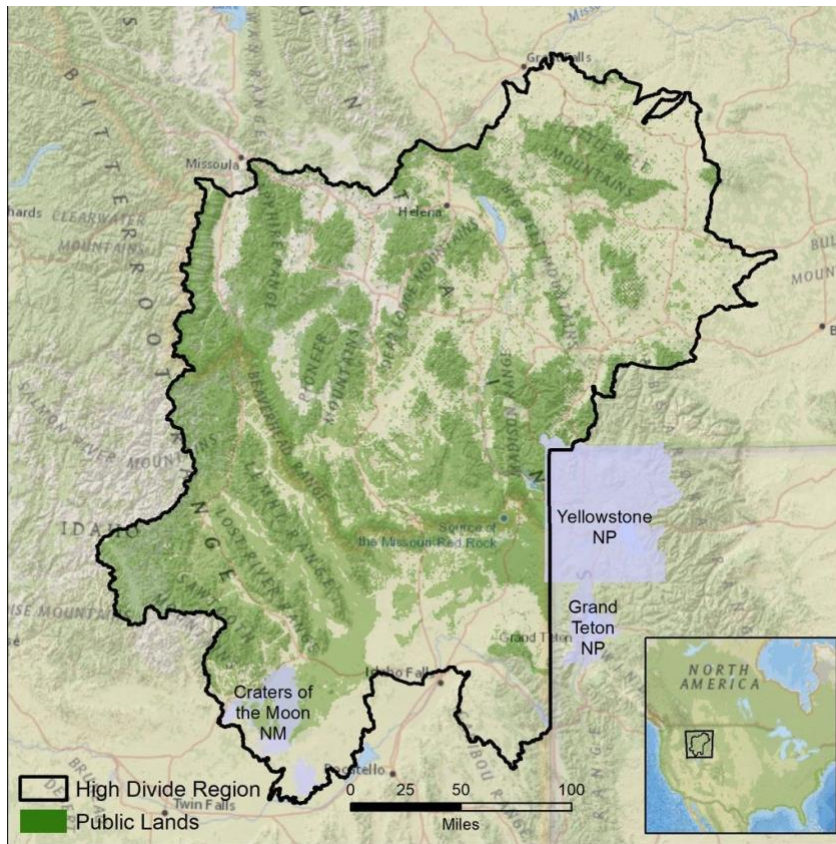
actions. Our results therefore provide insights on the underlying drivers of rancher decisions and suggest ways to increase rancher participation in landscape-scale conservation by better incorporating beliefs and values into conservation programming.

METHODS

Study Area

The High Divide Region, situated between the globally significant Greater Yellowstone Ecosystem and Crown of the Continent Ecosystem, is vital for maintaining current and future habitat connectivity in the Rocky Mountains and as the headwaters of the Missouri and Columbia Rivers (Carroll et al., 2012; Chester, 2015; Shafer, 2015). Public lands represent ~60% (80,000 km²) of the total land area, with the remainder of the landscape in private ownership (Figure 1). Approximately 68% of privately-owned lands within the High Divide Region are permanent pasture and rangeland, and beef cattle ranches are the most common type of farm in the region, representing 32% of total farms (Bureau of Economic Analysis, 2017). The US Department of Agriculture has supported agricultural conservation in this region, with an average of 166 agricultural operations per county in our study area participating in USDA conservation programs over the period between 1995-2021 (Environmental Working Group, 2023). In addition to constituting a primary land use in the High Divide Region, ranching is integral to the economic and social fabric of the region, contributing a significant portion of the approximately \$570 million in net farming income derived from agriculture (Bureau of Economic Analysis, 2017), while also contributing to regional culture and community identities (Gosnell et al., 2006).

Figure 1. Map of the High Divide Region of western Montana and eastern Idaho. Like much of the US West, the region comprises public lands (dark green) interspersed with privately owned rangelands.



Mail survey questionnaire

We developed a questionnaire to survey rangeland owners across 18 counties in the High Divide region about their perspectives on conservation and land management. We used publicly available cadastral data to select landowners of parcels containing 50 acres or more of rangeland, as determined from zoning codes (in Montana) or from GIS vegetation data and zoning codes (in Idaho). The 50-acre cutoff was used to exclude landowners whose land holdings were too small to provide meaningful use as a ranch. From the initial list of rangeland owners, we randomly selected 2400 landowners, stratified by county population density. We used common pre-testing techniques to review the final survey instrument, including cognitive interviewing (n=8), which elicits the mental pathways respondents take when processing and answering questions, and

informal expert review (n=3; Beatty & Willis, 2007). Our instrument and protocol were reviewed for complying with ethical standards, including informed consent, and approved by Idaho State University's Institutional Review Board (IRB# 170). We deployed the mailing in January through May 2018 using a three-wave tailored design (Wave 1: introduction letter and full paper survey; Wave 2: reminder card; Wave 3: full paper survey) and an identical online option (link provided with physical mailings) with a target response rate of 20% (Dillman et al., 2014). To incentivize response, we entered all returned surveys into random drawing for 1 of 2 \$500 gift cards. We assessed differences in response rate among counties (Table A2), compared respondent demographics with demographics of the study area using 2010 U.S. Census data (the most recent national census at the time of data collection), and assessed nonresponse bias by comparing demographics and responses between each mailing wave using Kruskal-Wallis tests (Dillman et al., 2014).

Variables

Conservation adoption was determined by respondents' stated use of seven conservation actions on their privately-owned land (Table 1) and was modeled as a logistic outcome, taking on "1" if a respondent reported currently using an action and "0" if not. Public land dependence was characterized using survey responses and spatial data. First, we asked respondents to indicate the importance of public land grazing access to their ranching operation by rating "the contribution of public land grazing to your operation" along a 5-point scale including "no," "minor," "moderate", and "major" contributions to "our ranching operation depends on it." Additionally, we asked respondents if they currently held permits to graze livestock on any public (i.e., state or federal) rangelands. Next, we calculated the proximity to any state or federal public land, regardless of use designation, as an additional proxy for public lands importance to an operation

(e.g., Kreuter et al., 2006). We used cadastral parcel data and maps of public land designations to measure the Euclidean distance from the edge of the landowner's parcel to the nearest public land boundary. For respondents with more than one parcel, we calculated the median distance to public land across all their parcels. Relational values, property rights orientation, and perceived efficacy were measured by respondents' level of agreement with survey statements, or "items," using a 4-point scale (1 = strongly disagree; 4 = strongly agree). Relational values were measured by two items, "I am responsible for conserving nature" and "I think my land should be used to provide environmental benefits to the region;" property rights orientation was measured by one item, "How land is used should be determined only by the person who owns it;" and efficacy was measured with two items, "The actions I take on my land have little impact on regional environmental problems;" and "My financial well-being conflicts with conservation." We note that while we did not frame the two items categorized as relational values as such when writing the survey instrument, we realized the appropriateness of the framework during the analysis and writing process. Rancher and ranch characteristics were reported by respondents and included resident/non-resident status, age, education, income, number of acres owned or managed, and the typical number of livestock managed.

Each record in the conservation adoption data set corresponds to a respondent who provided answers to multiple survey questions, and, in some cases, item non-response led to the challenge of a substantial number of missing values. Between 1 and 12% of the values for the variables used in this study were missing in our conservation adoption data set (i.e., questions lacked a response), but these were scattered across the respondents (Table A1). We addressed the missing data using the multiple imputation (MI) method, implemented using R package *mice* (van Buuren & Groothuis-Oudshoorn, 2011). MI provides an alternative to complete case

analysis and generates m copies of the data set, each replacing the missing observations with random draws based on the imputation model (Madley-Dowd et al., 2019). MI is robust under the assumption that data are missed at random (Little & Rubin, 2020; Madley-Dowd et al., 2019). We generated 20 (m20) imputations data sets with replaced missing data following (Van Buuren, 2018). This MI procedure is commonly used to fill in missing data by chain equations, and, theoretically, MI can be combined with any other statistical method (Little & Rubin, 2020). In this study, we used each of the m data sets in our statistical analysis of conservation adoption and pooled the results to generate parameter estimates (as described below).

Statistical analysis

We assessed whether certain conservation actions are adopted together (i.e. co-occur) using a Bayesian probabilistic model implemented using the cooccur R package (Griffith et al., 2016) to assess pair-wise patterns. This method determines the probability that the observed co-occurrence frequency is greater than would be expected under random co-occurrence (positive association), less than expected (negative association), or approximately equal to expected (random association).

We used a Bayesian generalized multilevel model (GLMM) to estimate the influence of public land dependence; conservation and private property beliefs; rancher socio-demographics; and ranch characteristics on conservation adoption. The model was estimated according to:

$$\begin{aligned}
 y_{(i,j)} &\sim \text{Bern}(p_{(i,j)}) \\
 \text{logit}(p_{(i,j)}) &= \beta_0 + \alpha_{\text{practice}_{(j)}} + \alpha_{\text{id}_{(i)}} + \mathbf{x}'\beta \\
 \beta &\sim t(7, 0, 2.5) \\
 \beta_0 &\sim t(3, 0, 2.5) \\
 \alpha_{\text{practice}} &\sim N(\beta_0, \sigma_{\text{practice}}) \\
 \alpha_{\text{id}} &\sim N(\beta_0, \sigma_{\text{id}}) \\
 \sigma_{\text{practice}} &\sim t(3, 0, 2.5) \\
 \sigma_{\text{id}} &\sim t(3, 0, 2.5)
 \end{aligned}$$

where $y(i,j)$ denotes the presence or absence of a conservation practice (j) for individual (i) which occurs with Bernoulli probability $p(i,j)$ and is a logit-transformed function of the average probability of adopting any conservation practice (β_0) modified by the average probability of adopting practice j ($\alpha_{practice}$) and individual i 's average probability of adopting any practice (α_{id}) along with a vector of regression coefficients (β) multiplied by each predictor's value (x). This model structure allows for the situation where an individual's participation in a given conservation action is both a function of their willingness to participate in any action we considered and their willingness to participate in the specific type of action along with a series of demographic controls and hypothesized predictors. This allows us to take advantage of information about participation in conservation across all actions while still modeling the probability of participation in the action of interest (i.e., partial pooling; McElreath, 2020). Partial pooling is particularly useful for estimating coefficient values within categories where sample size may be limited (e.g., conservation easement adoption).

To incorporate responses where some of the demographic information was not reported, we fit models to each 20 imputed datasets using the *brm_multiple* function of *brms* R package (Bürkner, 2017). These models generated posterior estimates of regression coefficients based on each imputed sample and then pool them in order to generate a posterior estimate that is robust to missing data (Zhou & Reiter, 2010). This function pools the posterior coefficient estimates across each of the 20 imputed datasets and draws a final posterior estimate from the mixed draws. All models were fit using the *brms* R package (Bürkner, 2017), a wrapper to the Stan Bayesian estimation software (Goodrich et al., 2022). Stan uses Hamiltonian Monte Carlo to generate samples of the posterior distribution more efficiently than traditional Bayesian

inferential software especially with complex posterior geometries. We fit models to all 20 imputed datasets using 6 chains run for 2000 iterations and evaluated model convergence using visual inspection of trace plots, estimates of R-hat (less than 1.1), and effective sample sizes. The prior distributions of all predictors were set as weakly informative (student's tdf = 7.0, location=0, and scale =2.5) which places the bulk of probability at values near 0 but allows for values as large as $|5|$ (Kennedy et al., 2017). We evaluated the performance of the model using the area under the receiver operator characteristic curve (AUC) and posterior predictive checks (Gelman et al., 2014). AUC ranges from 0 to 1 and provides an aggregate measure of model performance. A model whose predictions are correct 100% of the time has an AUC of 1.0, while a model whose predictions are wrong all the time has an AUC of 0.0. In addition, we report the Kappa statistic which provides an indicator of model fit.

We present the median posterior coefficient estimates along with the 90% high density interval for each of our predictor variables. The values within the HDI have a higher probability density (i.e., credibility) than values outside the HDI. Thus, the interpretation of the 90% HDI is that there is high credibility that the true effect estimate (e.g., β) is within the interval, given the evidence provided by the observed data (Kruschke, 2014). Variables for which the 90% HDI does not overlap zero are considered to have substantial support as predictors of conservation adoption. We also present the probability of direction (pd), a value which varies between 50 and 100% and can be interpreted as the probability that a parameter (described by its posterior distribution) is strictly positive or negative (Makowski et al., 2019).

Finally, we used the GLMM to explore how predicted probabilities of adoption varied by action and across variables with strong support as predictors of conservation adoption. To do this, we used the *tidybayes* R package (Kay, 2020) to fit the predicted probability of adoption for

each action and global probability of adoption across the range of each predictor of interest, while holding all other predictors at their median (for numeric variables) or most frequent (for categorical variables) value.

RESULTS

Out of the 2,400 addresses in our sample, 81 were undeliverable. We received sufficiently complete responses (meaning all but some demographic information was complete) from 681 individuals, giving us a 28% usable response rate. 32 of these usable responses were received online. In total, we received 1,058 surveys, including partial responses ($n = 105$) or responses that indicated refusal or did not meet our eligibility criteria (e.g., operation size) ($n = 272$). We saw no difference in income (Kruskal-Wallis $H = 1.87$, $P = 0.60$) or education ($H = 3.83$, $P = 0.28$) between the 3 mailing waves or between the paper mailings and online respondents, however, online respondents were younger than paper respondents ($H = 12.3$, $P < 0.001$). We saw no difference in income or education between the 3 mailing waves and online respondents, although the latter tended to be younger. The distribution of our responses reflected our sampling distribution by county (Table A2).

The majority of survey respondents identified as male ($n=531$), resided within the region, and had annual household incomes greater than \$70,000 (Table 2). The average age of respondents was 64.4 years old and most held at least an Associate's degree. For reference, demographics of agricultural producers in Idaho are 61% male and 58% over 54; and in Montana are 60% male and 64% over 54 (National Agricultural Statistics Service, 2017)). Ranches varied widely with respect to area owned and managed and the number of livestock (Table 2). Public lands are relatively close in distance to respondents' private lands (mean: 1.2 km), and the importance of public land grazing access varied across respondents (Table 2). Forty-three

percent of respondents reported having a grazing permit for public land, and, on average, respondents reported that public land grazing access provided a minor contribution to their operation (mean = 2.26; 1 = no contribution, 5 = ranch completely depends on it).

Table 2. Survey items used in the analysis of rancher participation in conservation and their descriptive statistics. Numerical variables are summarized as their mean (sd; range). Binary and categorical variables are reported as percent of respondents in each category. Response scale for the statements is 1=strongly disagree to 4=strongly agree.

	Variable		<i>n</i>
Conservation action	Reported use of:		
	1. conifer removal	Yes (20.5%)	n = 586
	2. conservation easements	Yes (23.4%)	n = 597
	3. cost-share programs for wildlife habitat improvement	Yes (20.6%)	n = 607
	4. invasive plant removal	Yes (92%)	n = 664
	5. riparian fencing to exclude livestock	Yes (60.2%)	n = 610
	6. riparian buffers (vegetative)	Yes (41%)	n = 631
	7. wildlife-friendly fencing	Yes (55.9%)	n = 621
Relational values	"I am responsible for conserving nature"	3.30 (sd = 0.59)	n = 658
	"I think my land should be used to provide environmental benefits to the region"	2.57 (sd = 0.79)	n = 622
Property rights orientation	"How land is used should be determined only by the person who owns it"	3.01 (sd = 0.81)	n = 637
Perceived efficacy	"The actions I take on my land have little impact on regional environmental problems"	2.52 (sd = 0.83)	n = 650
	"My financial well-being conflicts with conservation"	1.91 (sd = 0.68)	n = 636
Public land dependency	Importance of public grazing access to ranch operation (scale: 1-no contribution, 5-depends on)	2.26 (sd = 1.52)	n = 665
	Permittee status (binary)	Yes (43%)	n = 674
	Distance to public lands (km)	1.2 (sd = 1.1)	n = 661
Rancher & ranch characteristics	Local resident	81.5% local resident	n = 674
	Age (years)	64.4 (sd=12.6)	n = 651
	Education Level		n = 648
	High school	20.4%	
	Some college	16.2%	
	Associate's degree	5.4%	
	4-year college degree	35.3%	
	Advanced degree	22.7%	
	Income		n = 599
	Less than \$20,000	3.8%	

	\$20,001 – \$50,000	14.7%	
	\$50,001 – \$70,000	14.2%	
	\$70,001 – \$100,000	16.9%	
	\$100,000 – \$150,000	15.9%	
	More than \$150,000	34.6%	
	Privately owned/managed acres	5039 (sd= 11759.6))	n = 665

Regarding relational values, on average, rancher respondents agreed or strongly agreed that they were responsible for conserving nature but were split between disagree and agree regarding whether their land should provide environmental benefits to the region (Table 2). Respondents agreed, but not strongly, that land use should be determined by the person who owns it. Respondents disagreed that their financial wellbeing conflicted with conservation (self-efficacy, measured in the inverse) and disagreed that actions taken on their land have little regional environmental impact (response efficacy).

Analysis of Conservation Adoption and Hypothesized Key Variables

We found that average conservation adoption reported by respondents was 44.5% across all actions. Nearly all respondents (92%) reported participating in invasive plant removal on their private properties, whereas only 21% of respondents reported removing conifers on their private property. More than half (60%) of respondents used fencing to exclude livestock from riparian areas whereas vegetative riparian buffers were less commonly used (41%). Use of wildlife-friendly fencing was reported by 56% of respondents, while conservation easements and cost-share programs for wildlife habitat improvement were used by 23% and 21% of respondents, respectively (Table 2). Most respondents adopted two actions (23%), three actions (20%) or four actions (17%), while only 6% adopted six actions and 1% reported adoption of 7 actions. Only 4%, or 27, of respondents reported not adopting any of the seven conservation actions. Our results revealed primarily positive associations among conservation actions, and none were

negatively associated with one another (Figure A1, Conservation Practice Co-occurrence Matrix).

Our model of conservation adoption by ranchers had an overall accuracy of 81% (AUC: 90.8%) and Cohen's $\kappa = 0.67$ indicating that our model fit the data well. Model intercepts varied widely among conservation actions, which reflects the varied adoption rates (Table 3). The probability of adopting the conservation actions considered here ranged from 0.16 for participation in cost-share programs to 0.96 for invasive species removal though these probabilities are further modified by respondents' values and beliefs (Table A3).

Relational values. A stronger sense of responsibility for conserving nature was strongly and positively related to conservation adoption, as we expected ($\beta = 0.43$, Table 3). Ranchers who strongly agree that they have a responsibility to conserve nature are 18% more likely to adopt conservation compared to those who strongly disagree that they have a responsibility to conserve nature. Further, our model indicated that a stronger belief that private land should be used to provide benefits to the region had a 97% probability of being positively associated with conservation adoption (probability of direction (pd) = 0.97; Table 3) with ranchers being 45% more likely to adopt conservation when they strongly agreed with this statement.

Private property orientation. A stronger belief that private land use should be the sole decision of the landowner was negatively related to conservation adoption ($\beta = -0.20$) as was a stronger belief that individual actions on private land have little regional impact ($\beta = -0.24$). The pd (0.98 and 0.99, respectively) and 90% HDI (not overlapping zero) indicate substantial certainty that these effects are negative. Ranchers who strongly agreed that private land use should be the sole decision of the landowner as compared to those who strongly disagreed with this statement were 45% less likely to adopt conservation actions.

Table 3. Coefficient estimates and the 90% high density interval (HDI) for Bayesian logistic regression model of ranchers' conservation adoption. **Bold** indicates substantial support for a predictor variable, i.e., estimates where the HDI does not include zero.

Variable	Coefficient Estimate (90% HDI)	Probability of Direction (pd)
Intercept	-1.81 (-3.64, 0.01)	0.97
Intercept (conifer-removal)	-1.60 (-2.80, -0.41)	0.99
Intercept (cost-share)	-1.63 (-2.83, -0.45)	1.00
Intercept (easement)	-1.39 (-2.59, -0.21)	0.99
Intercept (invasive removal)	3.24 (2.03, 4.45)	1.00
Intercept (riparian buffer)	-0.34 (-1.54, 0.83)	0.72
Intercept (riparian fence)	0.71 (-0.48, 1.89)	0.89
Intercept (wildlife fencing)	-0.49 (-0.71, 1.66)	0.80
<i>Values, beliefs</i>		
I am responsible for conserving nature (Relational value)	0.43 (0.19, 0.66)	1.00
I think my land should be used to provide environmental benefits to the region (Relational value)	0.20 (0.01, 0.39)	0.98
How land is used should be the sole decision of the owner (Property rights orientation)	-0.20 (-0.37, -0.03)	0.99
The actions I take have little impact on regional environmental problems (Response efficacy)	-0.24 (-0.41, -0.07)	0.99
My financial well-being conflicts with conservation (Self-efficacy)	-0.14 (-0.35, 0.07)	0.90
<i>Public land dependence</i>		
Public land permittee	-0.15 (-0.53, 0.22)	0.79
Importance of public grazing access to ranching operation	0.10 (-0.02, 0.22)	0.95
Distance to public land	-0.04 (-0.17, 0.08)	0.75
<i>Rancher/Ranch Characteristics</i>		
Resident owner	0.43 (0.09, 0.78)	0.99
Age	-0.08 (-0.21, 0.05)	0.88
Education level (reference level: high school)		
Some college	0.27 (-0.14, 0.68)	0.90
Associate's degree	0.01 (-0.60, 0.62)	0.51
4-year college degree	0.22 (-0.15, 0.58)	0.88
Advanced degree	0.19 (-0.22, 0.60)	0.82
Income	0.12 (0.04, 0.21)	1.00
Acres owned/managed	0.14 (-0.01, 0.29)	0.97
No. of livestock head	0.06 (-0.08, 0.21)	0.80

Perceived efficacy. Ranchers who strongly agreed that their actions have little regional impact are 38% less likely to adopt conservation actions than those who agreed that individual land use actions have regional impacts. Our model indicated that a strong belief that conservation conflicts with financial well-being has an 90% [*pd*] probability of negatively affecting conservation action adoption. However, the HDI contains zero indicating that these effects are somewhat uncertain (Table 3).

Public land dependence. We did not find support for the hypothesis that ranchers' dependence on public land significantly affects conservation adoption. The effect of increased contribution of public lands to ranching operations, as measured by ranchers' responses, has a 95% probability [*pd*] of being positive. However, as with the other metrics of public land dependency, like ranchers' public land grazing permit status and the distance of ranchers' private lands to public land, the 90% HDIs included zero indicating moderate uncertainty regarding these effects (Table 3).

Regarding rancher and ranch characteristics, we found that the probability of conservation adoption was higher for resident versus non-resident owners (meaning those owners who lived and worked on the ranch versus those who owned the ranch but lived elsewhere), and for ranchers with higher income (Table 3).

Conservation action-level variation

We report on overall conservation adoption and variation by action. We accounted for variation by including individual action-level random effects in our GLMM. For belief or values variables with strong support as predictors of global conservation adoption ("I am responsible for conserving nature" (relational value); "I think my land should be used to provide environmental benefits to the region" (relational value); "How land is used should be determined only by the

person who owns it” (property rights orientation); and “The actions I take on my land have little impact on regional environmental problems” (negative perceived self-efficacy)), we also examined how predicted probabilities of adoption varied by action and globally (Figures 2-5). We found low (<50%) probability of adoption for conifer removal, cost-share program enrollment, and use of conservation easements and high (>75%) probability of adoption for invasive species removal regardless of beliefs or income. However, for three actions (i.e., use of riparian buffers, riparian fencing, and wildlife-friendly fencing) a landowner’s relational values, property rights orientation, or perceived efficacy made an apparent difference, in some cases shifting the average probability of adoption above 50% (Figures 2-5). For instance, ranchers who strongly agreed that they are responsible for conserving nature were 29% more likely to use fencing along riparian areas and 28% more likely to use wildlife-friendly fencing than those who strongly disagreed that they have responsibility for conserving nature (Figure 2).

Figure 2. *Relational value (responsibility to nature) and conservation adoption.* Marginal effects of a ranchers’ belief that they are responsible for conserving nature (relational value) related to predicted probability of adoption for each of 7 conservation actions and for adoption of any of the actions investigated. Plots show the median estimated probability of adoption (solid line) across the scale of ranchers’ belief and the 50% and 90% confidence interval around the estimate. Estimates are based on holding all other predictors at their “typical” value, varying the relational value across its range, and including the posterior estimates for each practice’s varying intercept.

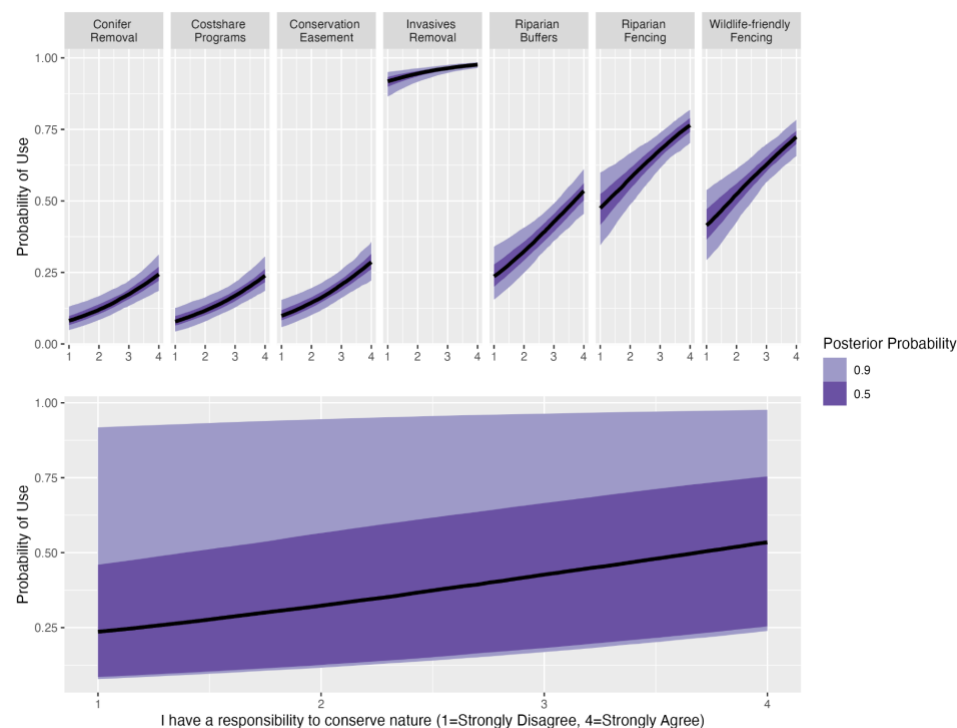


Figure 3. *Relational value (provide benefits to region) and conservation adoption.* Marginal effects of a ranchers' belief that their lands should provide environmental benefits to the region (relational value) related to predicted probability of adoption for each of 7 conservation actions and for adoption of any of the actions investigated. Plots show the median estimated probability of adoption (solid line) across the scale of ranchers' belief and the 50% and 90% confidence interval around the estimate. Estimates are based on holding all other predictors at their "typical" value, varying the relational value across its range, and including the posterior estimates for each practice's varying intercept.

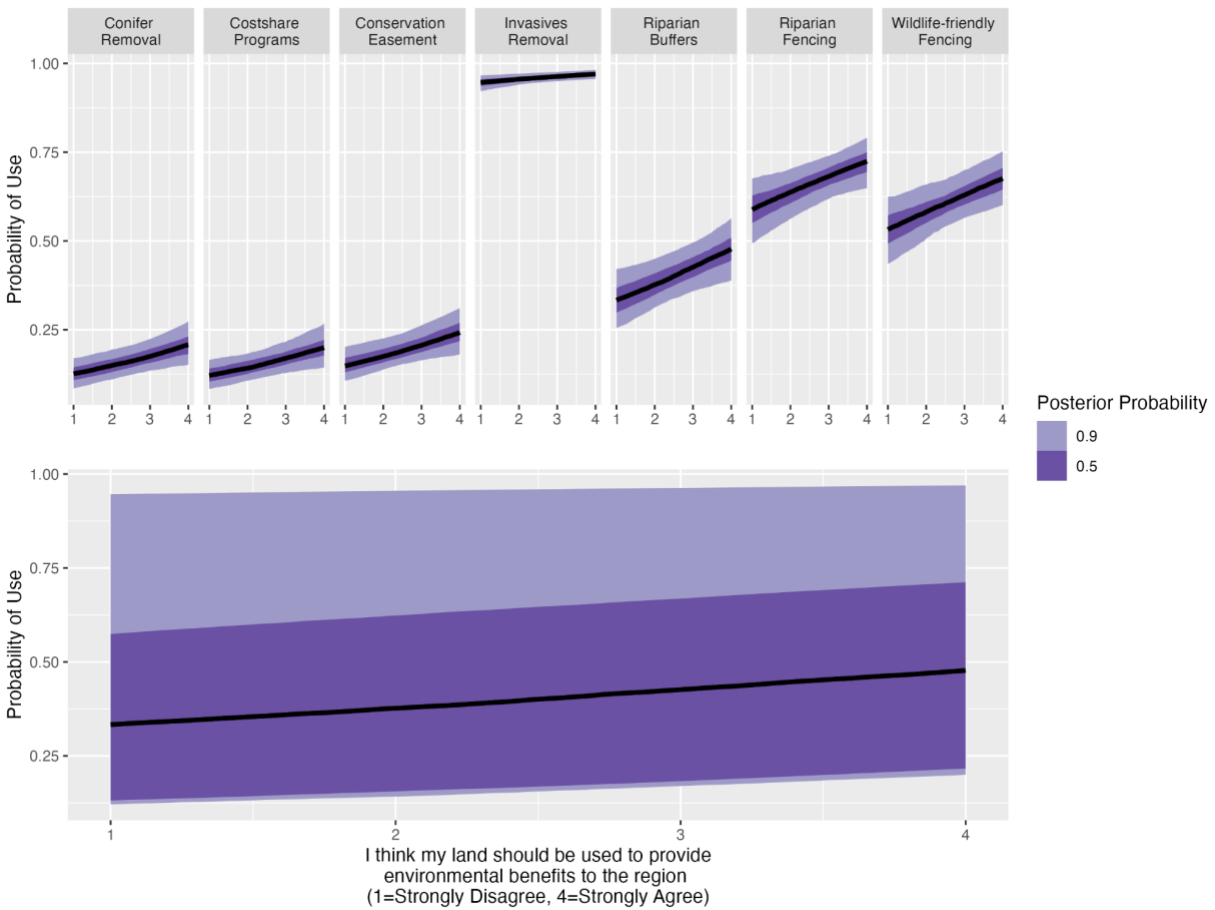


Figure 4. *Property rights orientation and conservation adoption.* Marginal effects of ranchers' belief that land use should be at the sole discretion of the owner (property rights orientation) related to predicted probability of adoption for each of 7 conservation actions and for adoption of any one of the actions considered here. Plots show the median estimated probability of adoption (solid line) across the scale of ranchers' belief and the 50% and 90% confidence interval around the estimate. Estimates are based on holding all other predictors at their "typical" value, varying the property rights value across its range, and including the posterior estimates for each practice's varying intercept.

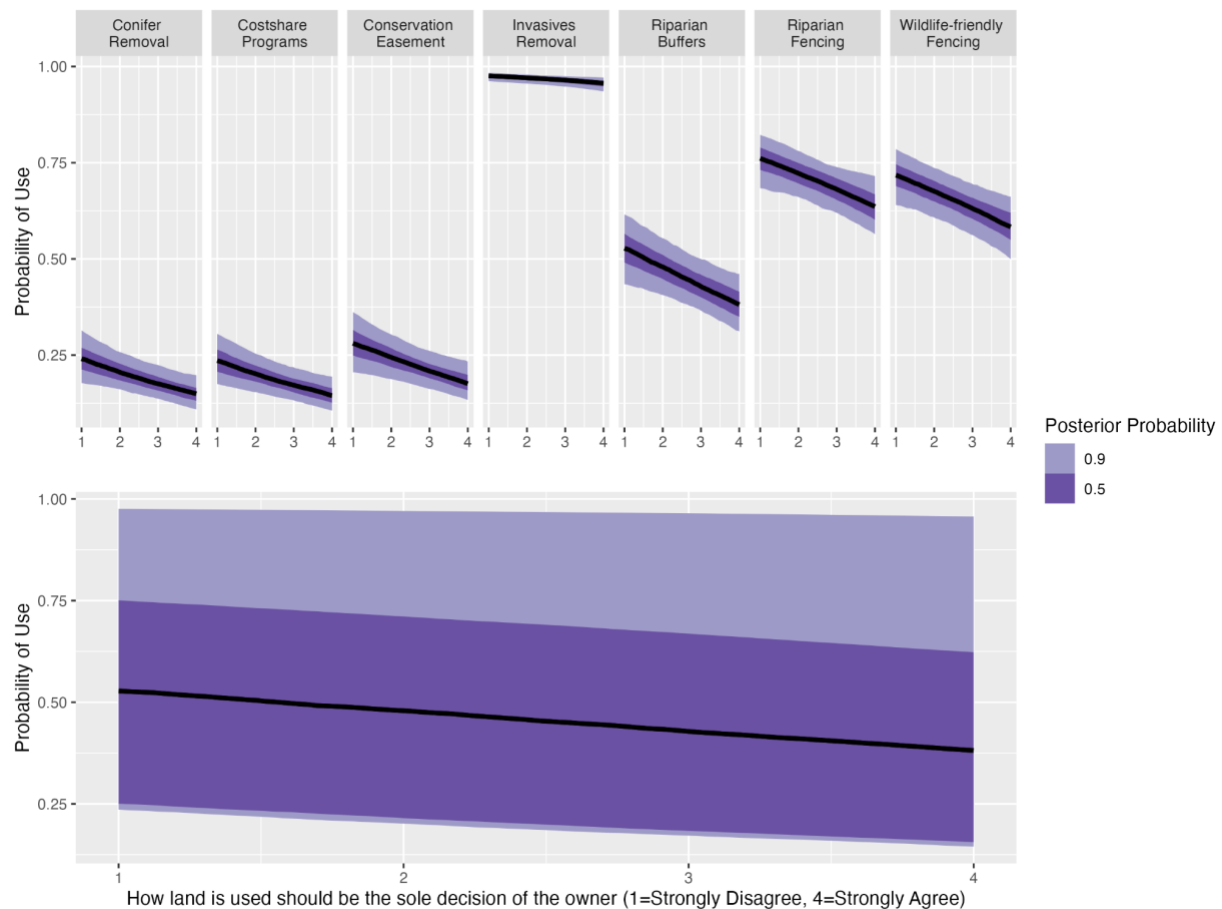
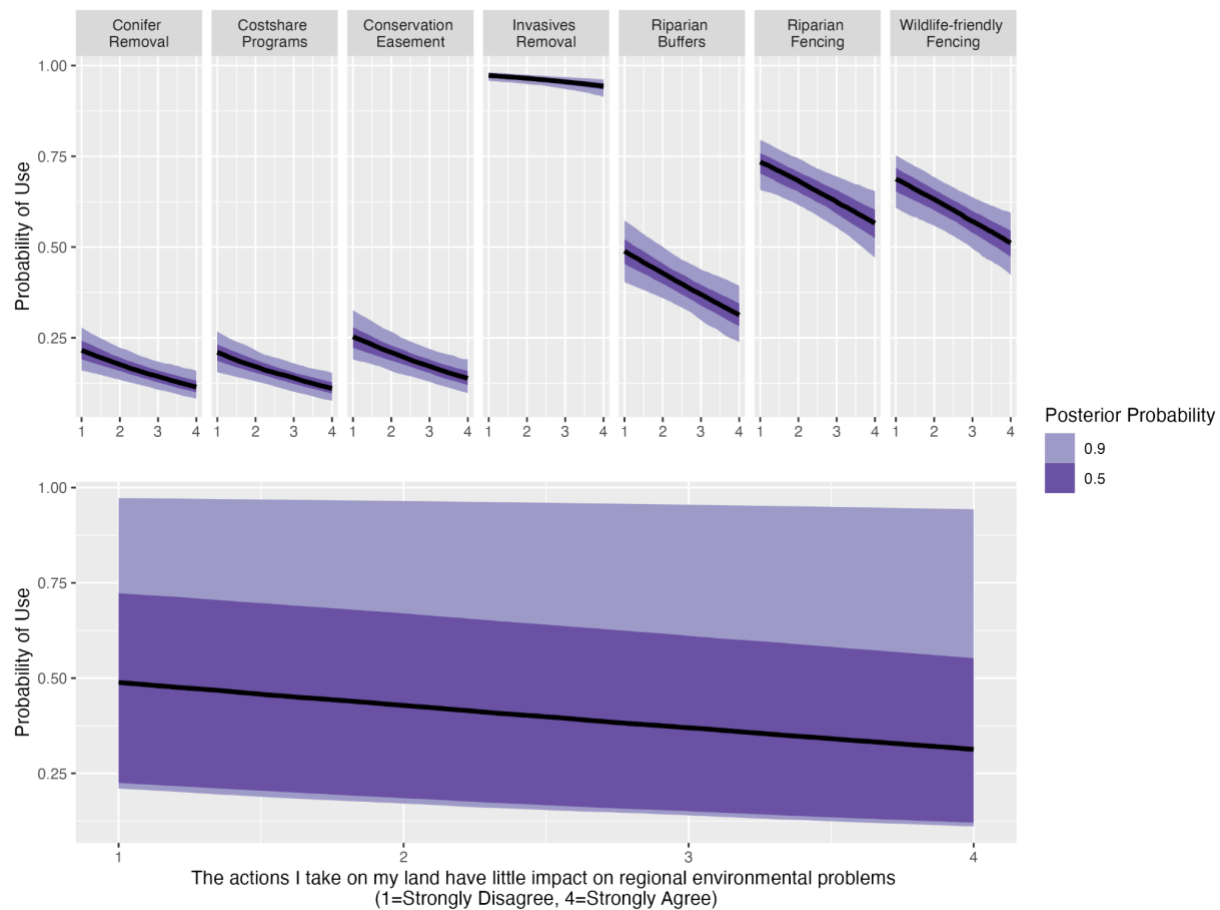


Figure 5. *Perceived response efficacy and conservation adoption.* Marginal effects of ranchers' belief that actions taken on their land has little regional environmental impact (negative self-efficacy) related to predicted probability of adoption for each of 7 conservation actions and for adoption of any one of the actions considered here. Plots show the median estimated probability of adoption (solid line) across the scale of ranchers' belief and the 50% and 90% confidence interval around the estimate. Estimates are based on holding all other predictors at their "typical" value, varying the regional impact value across its range, and including the posterior estimates for each practice's varying intercept.



DISCUSSION

Meeting global conservation targets, such as those laid out in the ambitious Kunming-Montreal Global Biodiversity Framework, requires landscape-scale conservation, including private lands. Most programs promoting conservation on private lands are voluntary, so tailoring program practices, design, and messaging to the populations they are intended to engage is crucial. In this study of conservation adoption by ranchers in the US West, we found that

relational values with the land—in this case, personal responsibility to conserve nature and belief that one’s land should provide environmental benefits to the region—were key predictors of conservation adoption. These values often went hand in hand with lower levels of concern about the primacy of private property rights in land use decisions and higher perceived efficacy regarding the regional environmental benefits of actions taken on private land. Focusing on actions specific to biodiversity and watershed conservation on range and pasturelands, we found that some actions, particularly those that directly benefit a rancher’s operation (e.g., removing invasives to improve forage quality), were most adopted. The actions that required longer commitments (e.g., conservation easements) or possibly more complexity and involvement with government agencies and programs (e.g., participation in government cost share programs) were less common. Programs encouraging the adoption of conservation on private lands could benefit from message framing that resonates with the worldviews of landowners. We suggest that programs aimed at landscape-scale conservation undertake intensive engagement efforts, such as one-on-one landowner visits, local workshops, and transparent ecological monitoring. These activities could provide opportunities for dialogue to allay concerns and increase understanding of how conservation implementation on individual properties contributes to socially important environmental goals.

Relational values are a core part of many farmers’ and ranchers’ identities (Chapman et al., 2019). These values, reflecting inextricable human-environment and individual-community relations, include moral responsibility towards ecosystems and cultural places carried out through landscape stewardship (Chan et al., 2016). Relational values are embodied in agricultural producers’ land management decisions, such as showing care by keeping field edges tidy (documented in “good farmer” literature (Burton et al., 2021)). We found that ranchers who

feel a stronger sense of responsibility to conserve nature were more likely to adopt all the actions on our list, with adoption rates particularly high for riparian buffers, riparian fencing, and wildlife-friendly fencing (Figure 2). These three actions have clear benefits to larger watersheds and wildlife corridors, contributing to relational values on this landscape. This finding follows other research outside the relational values literature indicating that agricultural landowners and managers are more likely to adopt conservation actions with regional or global benefits when they believe their land use decisions carry social responsibilities (Childers, 2015; Eaton et al., 2018; Lubell et al., 2013; Thompson et al., 2015). Given slightly more than half our respondents agreed or strongly agreed that they have a responsibility towards nature, our findings highlight the potential benefits of developing conservation programs that tap into relational values.

Relational values likely conflict with individualist property rights orientations, but there has been little research including both potential predictors of conservation adoption. Our respondents who more strongly believed private property land use decisions should be determined only by the landowner were less likely to adopt the conservation actions included in this study. Riparian fencing and wildlife-friendly fencing showed the steepest effect of individualist property rights beliefs, which, like the effect of relational values, indicates that practices whose primary goals are to influence landscape-level outcomes like water quality and wildlife passage are particularly affected by this orientation. This finding is partially in line with Kreuter et al. (2006), who found that concerns about threats to individual property rights were negatively associated with willingness to adopt conservation actions (though when a stated threat to rights was not included, individual rights orientations did not significantly predict adoption in this 2006 study). Property concerns are very important in debates about grazing in the US West, where conflicts over the use and management of public grazing lands are longstanding and

sometimes violent (Childers, 2015). Future research could assess the interactions between these variables, and with different conservation practices, to better assess the relationship between property rights orientation and relational values. As a management implication, these results suggest that concerns about infringement on private property rights may be a key bottleneck in the widespread adoption of landscape-scale conservation. Conservation agencies and organizations should consider frank conversations with landowners about their property rights concerns, and carefully frame conservation communications such that messaging does not conflict with private property orientations.

Ranchers who believed the management actions they take on their land have little regional impact (e.g., they perceived a low response efficacy to their actions) were less likely to have adopted any of the conservation actions in our study. Slightly more than half of survey respondents agreed that their actions have little regional impact. From a practical perspective, this finding highlights a challenge for organizations whose aim is to increase regional and large landscape conservation activities through outreach to private landowners. This finding speaks to the need for investment in landscape-scale monitoring—while staying sensitive to property rights concerns—to provide evidence of the effects of ranch-level conservation on regional ecosystem processes. Such evidence could potentially be used to develop communication materials to demonstrate to ranchers how actions private landowners take on their properties provide regional benefits (Pressey et al., 2017). Recent leveraging of satellite and wildlife camera data to conduct monitoring across our study region (for instance, by the Yellowstone to Yukon Conservation Initiative) shows promise.

In addition to the relationship of ranchers' values and beliefs to their adoption of conservation, we found that adoption was more likely for residents versus non-resident ranchers.

This finding is consistent with work on absentee agricultural or ranch landowners (Haggerty & Travis, 2006; Ulrich-Schad et al., 2016), and research indicating ranchers are influenced by their social groups. The influence of neighbors and local social networks play an important role in ranchers' participation in conservation actions (Sorice et al., 2011), and thus ranchers who live among other ranching neighbors may be more likely to engage in behaviors that benefit the wider community. Similarly, ranchers' lived experiences in landscapes are motivating for conservation (Knapp & Fernández-Giménez, 2009). We see a significant opportunity to connect literature specific to ranching communities' conservation actions to the relational values literature. Because ranching communities in the US West are experiencing rapid change due to high levels of outside investment and changing demographics (Epstein et al., 2022; Gosnell & Abrams, 2011), there is an immediate need for research to understand how new and old members of these communities might share and contribute to conservation through relational values.

Contrary to our expectation, our results provide little empirical support for public land dependence as determinant of ranchers' conservation actions. There are several potential explanations for this finding. Ranchers who hold public land grazing permits often find the grazing management plans and requirements on those public lands to be overly restrictive and costly (Charnley et al., 2018) and thus may be unwilling to transfer some practices to private lands. Furthermore, ranch-level decision-making requires complex accounting of financial and ecological factors across multiple scales, which makes decision-making difficult to predict (Wardropper et al., 2021; Wilmer et al., 2018; Wilmer & Fernández-Giménez, 2015). For example, differences in the timing of grazing on private versus public lands may limit the utility and influence the cost of some management actions across jurisdictions (Torell et al., 2014). Unlike public land dependency, we found that capacity, measured by income, was significantly

associated with higher conservation adoption, which is consistent with research suggesting larger ranches may be more able to try new management strategies (Lubell et al., 2013; Thurow et al., 2000). This finding points to equity concerns that should be seriously considered by conservation practitioners. If there is an income barrier to implementing certain conservation actions, program designers could consider changing eligibility requirements, adjusting payment rates, and tailoring outreach to give more agricultural land managers the opportunity to participate.

We acknowledge several limitations of this work and associated avenues for continued research. First, our results indicate substantial overlap and mostly positive associations between conservation actions but we must note that cost-share program participation, which we include as a conservation action in our analysis, may influence the adoption of other actions included in our study (Briske et al., 2017). For example, people who receive cost-share may be more likely to undertake one or more of the other conservation actions because the program pays them to do it, or because their familiarity with funded program actions increases their comfort level and willingness to participate in others due to decreased perceived risk of new actions or due to habit formation (Dayer et al., 2018; Didier & Brunson, 2004). However, program payment offerings do not consistently motivate adoption of conservation among farmers (Baumgart-Getz et al., 2012), and it is outside the scope of our study to draw causal conclusions based on these associations since we did not ask respondents for specific details on the cost-share programs in which they participated. Second, we acknowledge that measuring each conservation action without weighting them with criteria like relative effort, cost, or expected ecological outcome is unsatisfying and future research should explore opportunities for these additional analyses. Third, we only measured two dimensions of relational values—responsibility towards nature and responsibility to provide environmental benefits to the region—but a more robust scale is needed

for future measurement and analysis of the role relational values play in conservation actions (Klain et al., 2017). When focused on agricultural producer and landowner values, this scale development should consider synergies with existing work on this population's values, such as measures of stewardship values and "good farmer" orientations.

Finally, our study provides important insights into conservation behavior during a snapshot in time, but the relationships between the independent and dependent variables in our models cannot show causal direction or change over time. The US West is a dynamic and changing landscape and any conservation programs will need to adapt not only to shifting conservation needs but also changing social norms. To address temporal dynamics, researchers should collect—and funders should support—longitudinal survey data. Adding qualitative methods would also allow for a deeper, contextual understanding of ranchers' decision-making, which could provide more nuance to inform approaches to increase conservation adoption.

AUTHOR CONTRIBUTIONS

All authors conceived the ideas and designed the methodology for this study; Graves led data collection with assistance from all authors; Graves and Williamson analyzed the data with assistance from Hillis; Wardropper and Graves led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

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612

613 **CONFLICTS OF INTEREST**

614 The authors have no conflicts to report.

615

616 **DATA AVAILABILITY**

617 Because the data used in this study are protected under a human subjects research protocol, they
618 will be archived at Idaho State University. The authors will release aggregated data by request to
619 the corresponding author

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Appendix for “Private land conservation towards large landscape goals: Role of relational values, property rights orientations, and perceived efficacy in ranchers’ actions”

Figure A1. Conservation practice co-occurrence matrix. Most practices were positively associated with each other.

Conservation Practice Co-occurrence Matrix

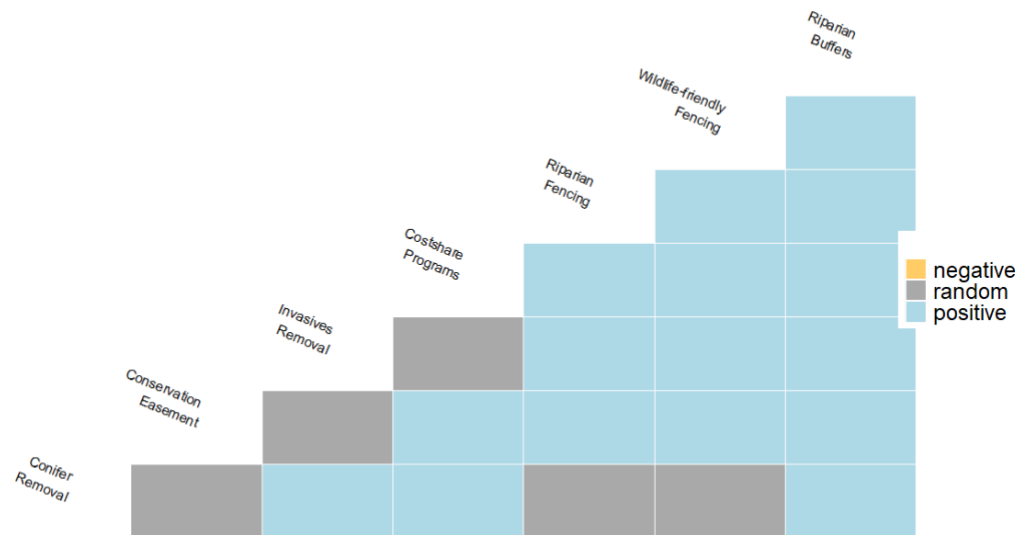


Figure A2. Maximum likelihood factor analysis using a varimax rotation implemented in the stats R package. The 6 variables are relational values, property rights, efficacy, public land dependency, and ownership items from the s. We identified the optimal number of factors (3) by comparing the scree plots produced by factors in the observed data to those produced by random sampling of the data matrix (using fa.parallel in the psych package). Although most variables load onto the first factor, the loadings are less than 50% in most cases and the second and third factors are primarily a single variable.

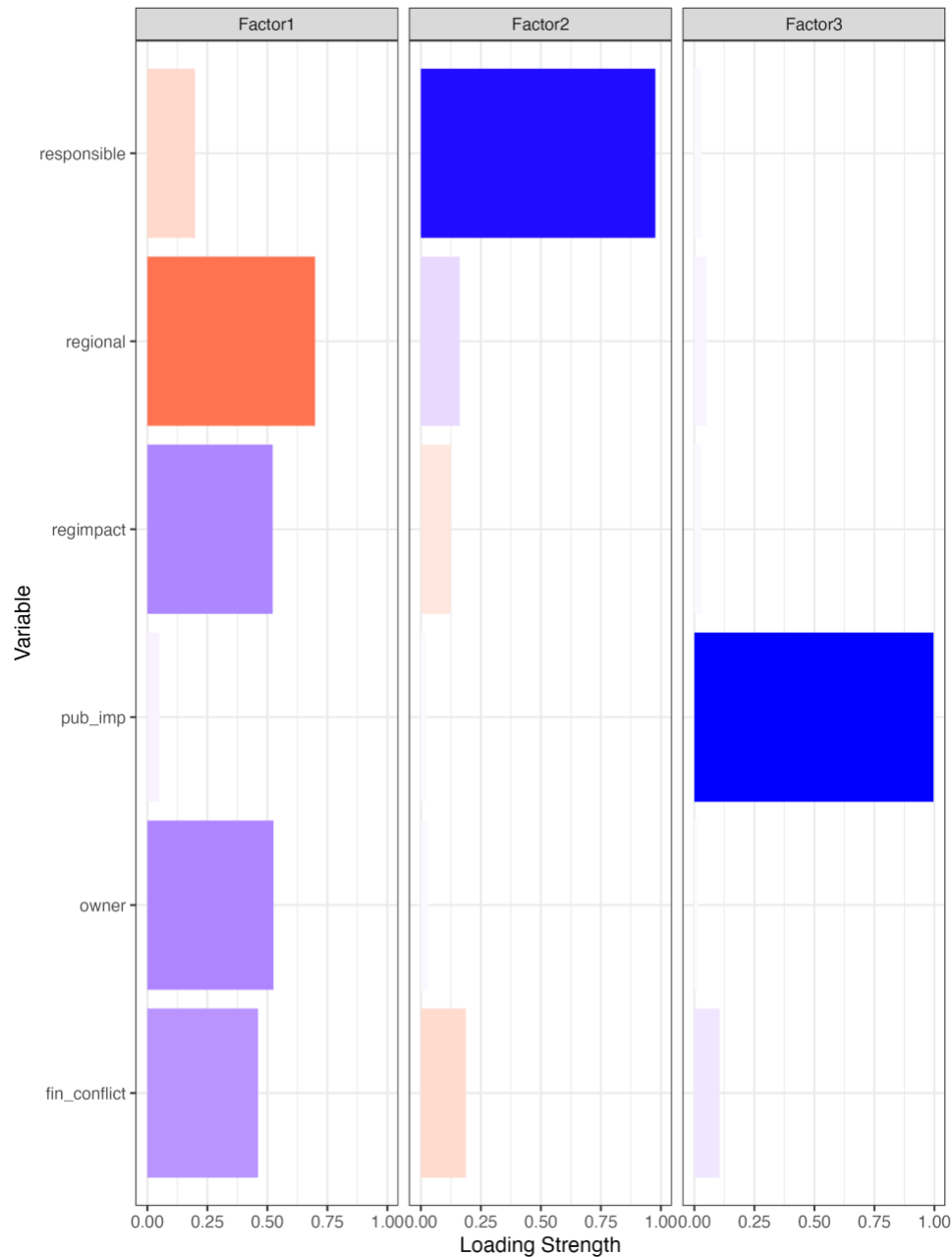


Table A1. Summary of missingness in predictor variable data across n = 681 respondents. Variables are sorted by proportion of missingness.

Variable	Proportion Missing
Income	0.12
Belief that land should be used for regional benefit	0.09
Belief that conservation conflicts with financial well-being	0.07
Belief that owner should have sole responsibility for decisions on private land	0.06
Education level	0.05
Belief that actions on private land have little regional impact	0.05
Age	0.04
Number of livestock	0.04
Belief that they are responsible for conserving nature	0.03
Distance to public land	0.03
Acres owned/managed	0.03
Importance of public land to ranching operation	0.02
Gender	0.02
Public land grazing permittee status	0.01
Local vs. non-local resident	0.01

Table A2. Distribution of surveys in sample frame and responses by county within the High Divide study area. While response rate varied among counties, there was no significant clustering of responses and differences in response rate among counties was not significant.

County	Proportion of Total Surveys	Proportion of Completed Responses	County Response Rate
Beaverhead	0.08	0.09	0.39
Broadwater	0.05	0.06	0.36
Clark	0.03	0.03	0.34
DeerLodge	0.03	0.02	0.29
Fremont	0.01	0.01	0.64
Gallatin	0.14	0.12	0.29
Granite	0.05	0.05	0.30
JeffersonMT	0.06	0.06	0.34
Lemhi	0.06	0.08	0.46
LewisClark	0.04	0.03	0.25
MadisonID	0.03	0.01	0.16
MadisonMT	0.13	0.12	0.29
Meagher	0.05	0.04	0.29
Park	0.10	0.09	0.30
Powell	0.03	0.04	0.41
Ravalli	0.06	0.04	0.23
SilverBow	0.03	0.03	0.30
Teton	0.04	0.05	0.38

Table A3. Predicted probability of adoption depending on ranchers' beliefs. Conservation adoption was predicted for each of 7 conservation practices (i.e., among practices) and for conservation adoption in general (i.e., across practices).

	Strongly Disagree	Disagree	Agree	Strongly Agree
<i>I have responsibility for conserving nature</i>				
Conifer removal	4.3%	6.4%	9.6%	14.1%
Cost-share programs for wildlife habitat	5.0%	7.4%	11.0%	16.0%
Conservation easement	6.1%	9.0%	13.1%	18.8%
Invasive species removal	76.9%	83.7%	88.8%	92.4%
Riparian buffers	14.0%	19.6%	26.9%	35.7%
Riparian fencing	30.0%	39.0%	48.9%	58.9%
Wildlife-friendly fencing	24.8%	32.9%	42.4%	52.4%
Adoption across practices	23.0%	28.3%	34.4%	41.2%
<i>How land is used should be the sole decision of the owner</i>				
Conifer removal	14.3%	11.7%	9.6%	7.8%
Cost-share programs for wildlife habitat	16.2%	13.4%	11.0%	9.0%
Conservation easement	19.0%	15.8%	13.1%	10.8%
Invasive species removal	92.4%	90.8%	88.8%	86.5%
Riparian buffers	35.9%	31.2%	26.9%	22.9%
Riparian fencing	58.9%	54.0%	48.9%	43.8%
Wildlife-friendly fencing	52.6%	47.5%	42.4%	37.5%
Adoption across practices	41.3%	37.8%	34.4%	31.2%
<i>The actions I take have little regional impact</i>				
Conifer removal	12.3%	9.6%	7.4%	5.7%
Cost-share programs for wildlife habitat	14.1%	10.9%	8.5%	6.6%
Conservation easement	16.6%	13.1%	10.2%	8.0%
Invasive species removal	91.3%	88.8%	85.7%	81.8%
Riparian buffers	32.5%	26.9%	21.9%	17.7%
Riparian fencing	55.5%	48.9%	42.4%	36.2%
Wildlife-friendly fencing	48.9%	42.4%	36.1%	30.3%
Adoption across practices	38.7%	34.4%	30.3%	26.6%