Drivers of social acceptance of natural-resource management: a comparison of the public and professionals in California

Max Eriksson[a,b], Mohammad Safeeq[a,c] , Lace Padilla [a], Tapan Pathak [a,c], Anthony O'Geen[d], Benis Egoh[e], Jaquelyn Lugg[a], Roger Bales[a]

[a]University of California, Merced. 5200 Lake Rd, Merced, CA 95343
[b]Vrije Universiteit Brussel, Brussels. 5 Bd de la Plaine, Brussels 1050, Belgium
[c]University of California Agriculture and Natural Resources. 2801 2nd St, Davis, CA 95618
[d]University of California, Davis. 1 Shields Ave, Davis, CA 95616
[e] University of California, Irvine. Aldrich Hall, Irvine, CA 92617

Email: M Eriksson (max.eriksson@vub.be), M Safeeq (msafeeq@ucmerced.edu), , L Padilla (lace.padilla@ucmerced.edu), T Pathak (tpathak@ucmerced.edu)A O'Geen (atogeen@ucdavis.edu), B Egoh (begoh@uci.edu), R Bales (rbales@ucmerced.edu)

Corresponding author: Max Eriksson, meriksson2@ucmerced.edu

Keywords: Natural resource management, forest management, social perceptions, attitude differences, public trust, multiple benefits

Abstract

The social impacts of natural resource management are challenging to evaluate because their perceived benefits and costs vary across stakeholder groups. Nevertheless, ensuring social acceptance is essential to building public support for adaptive measures required for the sustainable management of ecosystems in a warming climate. Based on surveys with both members of the public and natural-resource professionals in California, we applied structural-equation modeling to examine how psychological factors impact individuals' attitudes toward management's capacity to reduce the impacts of disturbance events, including wildfires, smoke from wildfires, drought, water shortages, tree mortality, and utility failure. We found the members of the public more optimistic than natural-resource professionals, perceiving management capacity to be on average 3.04 points higher (of 10) and displaying higher levels of trust of the government on both the state (Δ =11%) and federal levels (Δ =19%). Personal experience with natural-resource events had a positive effect on perceived management in both the public (1.26) and the professional samples (5.05), whereas perceived future risk had a negative effect within both samples (professional = -0.91, public = -0.45). In addition, higher trust and perceived management effectiveness were also linked with higher perceptions of management capacity in the public sample (1.81 versus 1.24), which could affect the acceptance of management actions. Continued social acceptance in a period of increasing risk may depend on managers sharing personal experiences and risk perception when communicating with the public. The contemporary shift toward multi-benefit aims is an important part of that message.

Introduction

In recognition of the wide variety of ecological, economic, and social benefits that nature-based solutions and their associated ecosystem services provide to society, researchers are increasingly examining natural resources as an interactive part of an encompassing social-ecological system (Born and Sogzoni 1995; Ostrom 2007; Virapongse et al. 2016). On a policy level, the emergence of this holistically informed management perspective contributes to a broadening of national and international agreements and development goals (Pinstrup-Andersen and Pandya-Lorch 1998), codified in documents such as Agenda 21 and the Millennium Ecosystem Assessment (2005). This establishment of well-defined development plans and goals has pressured the natural-resource-management community to apply more holistic approaches to model the complexities of the managed systems (Laniak et al. 2013). However, acceptance of those changes in natural-resource management by both the public and resource professionals is not assured.

In the management of public lands, the USDA Forest Service is a particularly good example of this change towards holistic management, because it has gradually moved away from a singular focus on timber production and sustainable yields to management approaches that integrate a more comprehensive range of economic, social, and ecological benefits (Kessler et al. 1992; Sheppard et al. 2020). Adopting a holistically informed management paradigm is crucial to accurately describe the impacts of natural-resource management (Turkelboom et al. 2018; Hirsch et al. 2011). However, accounting for multiple management goals on a landscape scale also presents challenges in terms of governance, value trade-offs, and available knowledge (Eriksson et al. 2022; von Gadow et al. 2001; Hickey 2008). These challenges are particularly problematic for managers since they must understand how different management practices and associated trade-offs affect outcomes (Hirsch et al. 2011).

California is a particularly informative example of interactions between different resource-management challenges, including water resources, drought, flooding, forest health, wildfires, and electricity distribution. The intersection of past forest management actions, climate warming, increasing wildfire severity, aging infrastructure, and resource demand pose unprecedented challenges to managers in the State (Bedsworth et al., 2018).

Within the classical management paradigm, managers have discretionary power to maximize one or a few well-defined goals based on sector-specific technical expertise (Raik 2008). However, because of expanding management goals, managers must make more decisions, incorporating a broad spectrum of interconnected social, economic, and ecological factors, and resolve conflicts for which stakeholder groups disagree with the chosen strategy (Eckerberg and Sandström 2013; Mills et al. 2001; Mola-Yudego and Gritten 2010; Pahl-Wostl et al. 2007). These additional managerial responsibilities, in combination with the need to resolve stakeholder conflicts, have contributed to an increased focus on procedural and technical mechanisms to ensure the social acceptance of resource-management decisions (Raik 2008; Ribe 2006; Shindler et al. 2002). One such mechanism is direct stakeholder involvement in decision-making, which can aid in understanding and mitigating value-based conflicts (Charnley et al. 2017; Sexton et al. 2019), possibly increasing social acceptance. For example, researchers found that institutional governance-based solutions, such as participatory management and co-management, can improve a decision's credibility, equity, and social acceptability (Drininger et al. 2019; Muro and Jeffrey 2008; Lockwood et al. 2010; Reed et al. 2018). Unfortunately, studies also show that governance solutions that focus on increased stakeholder participation have sometimes resulted in less efficient management (Allen and Gunderson 2011), and have aggravated existing social conflicts. Success of these methods depends on case-specific factors such as stakeholder selection and degree of inclusion, which limits their potential for application in cases in which stakeholder roles are unclear, overlapping, or vary geographically (Conley and Moote 2003; Ostrom 2007; Singleton 2000).

In response to the need for heuristics and rules to improve and monitor social acceptability in ways that do not vary across management contexts, some researchers have applied methods from social psychology to identify the processes underlying acceptability judgments concerning natural resources (Decker et al. 2021; Muhar et al. 2018; Reynolds 2002). Scholars in psychology define *acceptability* in terms of an individual's attitude (positive or negative) toward a management strategy (Eriksson et al. 2018). The definition of *attitude* and how attitudes form is the subject of an ongoing debate (for a review, see Hitlin and Piliavin 2004). Among the different perspectives, there is some consensus that attitudes are one's propensity to respond favorably or unfavorably (Vaske and Donnelly 1999) to a specific system, phenomenon, issue, institution, person, or object (collectively referred to as social objects; Hitlin and Piliavin 2004). Several theories suggest that one's *values* and *beliefs* are related but independent concepts that contribute to the formation of the world view of an individual (Dietz et al. 2005; Vaske and Donnelly 1999; Schwartz 1992). The definition of *values* is also debated, with one camp focusing on values as guiding principles about how individuals should behave (Schwartz 1994) and the other focusing on values as preferences for specific environments or situations (Parks and Guay 2009). In either case, values are multifaceted (Schwartz and Cieciuch 2022), formed early in life, and relatively consistent over a lifetime (Konty and Dunham 1997), reflecting stable personality traits (Hitlin 2003). *Beliefs* are more specific than values, reflecting one's thoughts about general classes of social objects for a given domain (Jacobs et al. 2018), including information about the properties of social objects (Schwartz and Bardi 2001). *Cognitive Hierarchy Theory* formalizes the relationship between these concepts (e.g., values, beliefs, and attitudes) into a system where our values and beliefs form the foundation of attitudes toward social objects (e.g., a management intervention's social acceptability) (Fulton et al. 1996).

Using cognitive hierarchy theory, previous studies have established several factors as particularly relevant to social acceptance in natural-resource management. For instance, the perceived effectiveness of management (Eriksson et al. 2018) has been shown to be central to the acceptance of management actions (Steg et al. 2005; Ford et al. 2014). Other well-established predictors are trust, risk perception, and personal experience (Stern and Coleman 2005), with trust sometimes being broken down into social trust (i.e., trust in other people) and institutional trust (i.e., trust in the competence of an agency; Vaske et al. 2007). Prior research has also shown that risk perception and personal experience with risk factors shift beliefs about the expected consequences of management actions (Ford et al. 2014).

We apply the factors detailed above that prior work has shown affect social acceptance of resource management to survey data collected in California to gain insight into the main psychological factors driving social-acceptability judgments of natural-resource management. Expanding on the existing literature, we explore how the formation of social acceptability of resource management differs between the general public and natural-resource professionals. Building on the California experience, we discuss potential ways for resource managers to enhance the public social acceptance of their actions.

Methods

Data collection. We collected data through online questionnaires during the fall of 2020, applying two sampling strategies. The general public data were collected using Amazon Mechanical Turk (MTURK, https://www.mturk.com) web panel consisting of individuals living in California, with each individual given an incentive of $3. The second sample (hereafter referred to as professional sample) was collected through snowball sampling (Wright and Stein 2005) among professionals working with natural resources in California. We asked central actors with agencies, universities, and corporations connected to the management of nonurban non-agricultural land in California to distribute our questionnaire in their respective networks, with each respondent receiving up to three contacts, a survey, reminder, and a thank you email, following the approach laid out in Dillman (2014). All data were collected with Qualtrics using the built-in bot-detection tool to exclude fake respondents from the public sample (https://www.qualtrics.com). Participants who responded to less than 10% of the questionnaire were excluded from the analysis.

Measurements. The online questionnaire focused on challenges facing resource managers in California related to wildfire, water, and power provision (Lofman et al. 2002; Mitchell 2009; Mann and Gleick 2015), and thus included both nature-based and other socio-technical solutions. Measurements were developed based on a combination of existing literature and discussions within the Center for Ecosystem Climate Solutions (CECS) and designed to reflect five latent constructs in our assumed model: management capacity, management effectiveness, risk perception, trust, and personal experience (Figure 1). We selected the latent constructs by identifying the most impactful and consistent components revealed by the previously described research.

Management capacity was measured by two questions focused on capacity to mitigate the risks (Q1) and effects (Q2) of natural-resource disturbance events. Building on Ford et al. (2014) and Eriksson et al. (2018), these questions were constructed to differentiate between risk-prevention and risk-mitigation perceptions. Three questions measured the effectiveness of different management strategies to reduce the risk of forest fire (Q3), water shortages (Q4), and utility failures (Q5). Forest-wildfire and water-shortage measurements were adapted from Cortner et al. (1990), adding additional items related to water restrictions and low water use infrastructure based on Makropoulos and Butler (2010). Utility-failure items were developed based on recommended future changes to the power grid (Clark and Lund 2001). Risk perception was measured using the standard format "To what extent do you think the risk of the following will change in California over the next twenty years?" (Q6). A 20-year period was used to ensure that sufficient time would pass to detect changes in the studied natural-resource disturbance events. Trust and personal experience were both measured using one question each (Q7 and Q8, respectively). The trust measure was based on Urslaner (2015), and experience items are based on a standard format discussed in Dillman (2014). We also collected demographic data (Q9 to Q11) for comparison with census data. Respondents answered 11 questions. Questions 1-5 and 8 contained subquestions related to the following objects: wildfire, smoke from wildfire, drought, water shortage, tree mortality, and utility failure. System capacity (Q1 and Q2) was measured on a 1-10 (low to high) scale, and the remaining questions were measured on 5-degree Likert scales with a neutral middle alternative. A full overview of all questions is available in Table S1.

Analysis. Structural equation models (SEM) enable researchers to test relational hypotheses. SEM rely on theory to identify likely structural relationships between latent constructs, a combination of confirmatory factor analysis. Multiple regression is then used to test these assumptions empirically (Brown & Moore 2012; Little 2013). As a first step, the reliability of each latent construct is independently tested using confirmatory factor analysis, after which multiple regression is used to connect the latent constructs according to the assumed structural relationship. The assumed structure of the SEM is then adjusted based on changes in model chi-square given alternative structural assumptions, often using modification indices (AKA. the LaGrange Multiplier, or Score Test, MacCallum et al. 1992).

The model structure presented in Figure 1 builds on theoretical assumptions of the cognitive-hierarchy model (Fulton, Manfredo, and Lipscomb 1996) and reflects previously observed patterns. In line with Jacobs et al. (2018), we treat perceived management capacity as an attitude and understand it as the perceived ability of the overall capacity of management to govern the system. This attitude is assumed to be affected by other more general and stable cognitive traits and beliefs about the world (Stern, 2000; Schulz et al. 2005). No behavioral measures are included in this model, as the cognitive hierarchy framework and related theories have been unreliable in their ability to predict behavior (Keske et al. 2021). Consistent with prior work (Biek et al. 1996; Eagly and Chaiken 1993), our model specify that personal experience impacted all other parts of the model, whereas trust impacted all latent constructs except for personal experience (Charnley et al. 2017). We also specified that management effectiveness and risk perception impacted management capacity.

We tested the reliability of all latent constructs using Cronbach's alpha and confirmatory factor analysis, using the Kaiser criterion ($k > 1$) to determine the dimensionality of the measurement items within each construct. Factor retention was determined based on an item having a sufficiently strong (>0 .4) factor loading (Hair et al. 2019; Nunnally 1994). The identified factor solutions were then used as a basis for the SEM (Little 2013). Reliability testing indicated that the measured items had good internal consistency, and the confirmatory factor analysis indicated that all items could be fairly represented as one-dimensional latent constructs. Alphas ranged between 0.74 (trust) to 0.98 (management capacity), and removing any single item did not have a meaningful impact on the average Alpha. All items had factor loadings over 0.40, with 0.45 being the lowest factor loading (vegetation clearing) and 0,92 being the highest (drought risk).

The public sample was used for model calibration. Modification indices suggested the addition of an effect going from risk perception to management effectiveness and the addition of correlations between error terms of measurement items with similar objects, such as in the case of items measuring “wildfire” and “smoke from wildfire.” After adding these structural components, we applied the resulting model structure (Figure 1) to each sample separately. (The full model applied to the public sample is shown in Figure S1.)

Results

Data collection resulted in 1147 usable data points from 216 respondents in the professional sample and 931 in the public sample. The two samples had different demographic profiles, with the public sample being younger and containing a higher proportion of Caucasian men than the professional sample. Compared to the California census, both samples had a slightly higher median age and a lower proportion of White and Hispanic respondents, and the public sample also contained a larger proportion of Black respondents than the census data (Table 2). We included the demographic data in an exploratory version of the analysis. However, the demographic data did not meaningfully impact the results, so we removed them from the results reported in the following passages.

The public sample perceived the capacity of management to both address the risk of adverse events occurring and mitigate negative outcomes (effects) to be higher than the professional sample, with respective mean values of 5.7-6.5 and 2.4-3.9 across items (Figure 2). Perceived management capacity to control smoke from wildfire and mitigate the risk of drought was the lowest across both samples, whereas the capacity to address utility failures was perceived to be greater. Beyond indications that professionals could better differentiate between risk and effects of disturbance events (narrower difference on Figure 2), there were no meaningful differences between samples in perceptions of overall capacity to mitigate either risk or effects of any single natural-resource event.

With respect to the effectiveness of specific management actions, professional respondents perceived management actions aimed at reducing risks for forest fires, water shortages, and utility failure as being more effective than did public respondents (Figure 3). Support for practices that reduce wildfire risk such as vegetation clearing, prescribed burning, and underground cables were supported by 89%, 92%, and 82% of professionals, respectively, compared with 76%, 75%, and 71% of public respondents. A larger proportion of the public sample (61%) believed insurance subsidies to be an effective method to reduce the risk of forest fires than in the professional sample (26%). Burn-day restrictions, fire-hazard mapping, and restrictions on private water use were other forms of management that the public believed to be more effective than did respondents in the professional sample.

Most respondents believed that the risk of adverse events would increase over the next 20 years (Figure 4), with a much larger proportion of the professional sample expressing that concern. Respondents in the public sample had similar concerns across the six risks (wildfire, smoke from wildfire, drought, water shortage, tree mortality, and utility failure), with increases in utility failure in the next 20 years being the lowest (67%) and drought risk increasing being the highest (74%). Professionals were least concerned about tree mortality (75%), with their greatest concern being an increased risk of wildfire (92%) and smoke from wildfire (90%).

Both samples displayed higher trust levels toward people than state government, with the federal government being the lowest (Figure 5). A larger proportion of the public sample reported that they trusted the state (48%) and the federal government (59%) than in the professional sample, where the corresponding numbers were 32% and 51%. Levels of trust in "people in general" were similar in both samples (67 and 68%, respectively).

The public reported higher levels of personal experience with negative events than did the professional sample, with 47% having experience with smoke from wildfire during the last 12 months. Other adverse events were experienced by between 35 to 39% of the sample (Figure 6). In comparison, 42% of the professional sample had direct experience with smoke from wildfire and 28% experienced wildfire. Differences between the samples were related to the four non-wildfire events, with the professional sample having lower rates of personal experience of drought, water shortage, tree mortality, and utility failure over the last 12 months.

In terms of model fit, the structural-equation model was slightly more accurate when applied to the public sample compared to the professional sample (comparative-fit index 0.92 vs. 0.89, Tucker-Lewis index 0.91 vs. 0.88, standard root mean residual 0.06 vs. 0.88, root mean square error 0.055 vs. 0.06). The model (Table 3) shows positive effects of personal experience on management capacity in both the professional (1.26) and public samples (5.05), whereas risk perception shows statistically significant negative effects (-0.91 and -0.45, respectively). The public sample also displayed a positive direct effect on management capacity from effectiveness (1.24) and trust (1.81). Risk perception positively affected management effectiveness in both samples, whereas the public sample also saw a positive effect of personal experience (0.11). Risk perception was affected by personal experience, with professionals showing a negative effect (-1.03) and the public a positive effect (0.22). Trust also contributed to a lower perception of risk in the public sample (-0.071). Personal experience had a positive effect on trust in both samples as well.

Discussion

The results of this study revealed notable differences in how the public and natural-resource professionals perceived the current state of resource management in California. On average, the public had higher levels of belief in management capacity, whereas professionals had higher levels of belief in the effectiveness of several common management actions. Further, the public displayed higher trust and lower expectations of future natural-resource-event risks than did professionals, despite having more experience with multiple forms of disturbance. That is, managers believe they have less capacity to act effectively than the public thinks they have. Managers also perceived their actions to be more effective in reducing risks than did the public. Put simply, managers perceived that they could be more effective with more resources while doing their best with what they have. These discrepancies between professional versus public groups provide an essential distinction not reported in past studies (e.g., Stern and Coleman 2005). According to the *general-deficit model*, public attitudes are often formed based on imperfect information, making them susceptible to change by introducing new information (Sturgis and Allum 2004). Although far from the only potential source of attitude differences between the public and experts (Heberlein 2012; Nadkarni et al. 2009), several studies have replicated these findings in relation to environmental management, reporting positive correlations between environmental knowledge, pro-environmental attitudes, and pro-environmental behaviors (e.g., Decker et al. 2002; Liu et al. 2020). Much of this literature has focused on improving conservation efforts by educating the public since studies have shown that the general public has lower levels of context-relevant knowledge than managers (Decker et al. 2002; Heberlein 2010). If these patterns generalize to our study area, observed differences in how the public and professionals perceive management capacity could be due to less knowledge about managing natural resources among the public. Further work is needed to identify the primary driver of differences between the public and professionals' perceptions of resource management in California.

An additional novel finding of the current study is that personal experience with natural-resource disturbance events was a central driver for a more positive attitude toward management capacity in both samples. Although this finding aligns with past observations (Ford et al. 2014), its structural impact varied across the two groups. Professionals' attitudes toward management capacity were primarily driven by the direct effects of personal experience and perceived future risk. In contrast, respondents in the public sample displayed weaker direct effects from personal experience and risk. Furthermore, trust and the perceived effectiveness of management interventions also affected their attitudes toward management capacity. These fundamental differences highlight the importance of considering differences in prior experience across sample populations.

In aggregate, observed differences in attitudes toward the management system's capacity and the structural relationship of the predictors studied suggest that there could be differences in how likely these attitudes are to change in the future. As described by Cognitive Hierarchy Theory, several psychological factors, such as values and beliefs, influence the temporal stability of an attitude (Fulton et al. 1996). Attitudes more connected to other parts of the system are likely to be more stable over time and often more strongly held (Luttrell et al. 2020). Having direct experience with an object or concept has also been found to contribute to attitude stability (Doll and Ajzen 1992; Tormala & Rucker 2018) because it provides individuals with contextualized subjective knowledge linking a specific situation with an attitude (Glasman and Albarracín 2006). Finally, attitudes held by knowledgeable individuals tend to be more stable over time because they are underpinned by more information about the world (Holbrook et al. 2005), increasing the psychological cost of changing an attitude, while also reducing the chance of holding conflicting attitudes (Brannon et al. 2019). In combination with our findings, prior work on attitude stability suggests that the attitudes of the new managers (those with holistic responsibilities) may be more stable over time compared to past managers (those with singular management goals of timber extraction), as the former are more likely to better account for and understand the complexity or the system they work within. Future work would be apt to examine the relationship between holistic vs. singular management responsibilities and the malleability of attitudes.

Regarding social acceptance, our results suggest that professionals are likely to continue to believe in the system's capacity if they perceive they can control the outcomes of the disturbance events they experience. The belief system's capacity could change if professionals perceive future risks to increase to such a degree that their perceived capacity to control outcomes will be reduced. The same mechanism could also function for members of the public sample. However, our results indicate that the direct effect of personal experience on management capacity was smaller than in the professional sample. Moreover, the general public's experiences with natural-resource-disturbance events are likely to be qualitatively different from those of natural-resource professionals. That experience is likely contingent on how managers address the situation, relating positive experiences of natural-resource-disturbance events to effective management. Not only does the importance of personal experience imply that continued successful management is key to social acceptance of management among the public, but the negative correlation between trust and perceived future risk observed in the public sample also suggests that a future loss of trust in society could contribute to reduced trust in management. The observed differences between the two samples may also be a symptom of a knowledge gap (Heberlein 2012), with the public's higher levels of belief in management effectiveness and more positive attitudes toward management capacity being the result of uninformed false beliefs about the world. This scenario would mean that social acceptance of natural-resource management in California could change quickly, provided that the knowledge level of the public was increased. Assuming that attitudes of natural-resource professionals are more informed than those of the public, a more informed public could result in lower levels of social acceptance of management. However, our findings also suggest that there might be potential for informing the public about the benefit of specific management measures, such as burying power cables to reduce probability of wildfire ignition and vegetation clearing and prescribed burning to improve water yield, reduce wildfire intensity, and maintain stable carbon stocks.

Additional factors that may impact natural-resource management perception were not the focus of this work but warrant additional exploration. In particular, future work should be apt to examine how perception changes with age and other demographic factors. The current data did not reveal meaningful impacts of demographics. However, as this work was not the main objective, we did not recruit enough participants to have sufficient power to detect possible spatial impacts of demographics. Future work should consider carefully examining the impact of individual differences on natural-resource management perception.

Given these findings, the most promising method of maintaining social acceptance of natural-resource management in California would be for managers to continue building social acceptance for their respective management institutions through the reliable provision of services (Decker et al. 2014), paired with communication emphasizing the fairness and past achievements (Riley et al. 2018) related to their ability to prevent and mitigate adverse effects of natural-resource events. An approach that may be especially relevant if multiple intersecting positive outcomes are maintained and communicated effectively.

Conclusions

Personal experience stands out as a central psychological factor driving social-acceptability of management, with notable differences in how the public versus managers form judgments about management outcomes. High levels of social acceptance for natural-resource management, apparent among the public in California, could enable managers to carry out more effective resource management. With higher levels of perceived management capacity by the public linked to prior personal experience with natural-resource-related risks, prior successful interactions with managers as part of that experience are an important ingredient of social acceptance. However, future public acceptance is likely to be contingent on the ability of managers to be perceived as successfully addressing natural-resource events, a perception that could be adversely impacted by higher future risk. Public recognition of a shift to management actions clearly aimed at multiple beneficial outcomes could help mediate this predicament.

Acknowledgements. The authors thank the following colleagues from the CECS project for contributions to research design, methods, and collaboration leading to the development of this paper: Martha Conklin (UC-Merced), Michael Goulden (UC-Irvine), Stephen Hart (UC Merced), Catherine Keske (UC Merced) and the other members of the CECS project for many constructive discussions. This research was supported by the California Climate Investments program through the Strategic Growth Council (CCR20021) and NSF Award # 2122174.

Credit author statement M Eriksson: Conceptualization, Methodology, Writing – original draft, Investigation, Data curation, Visualization. M Safeeq: Conceptualization, Resources, Writing – review & editing, Supervision, Funding acquisition. T Pathak: Conceptualization, Resources, Writing – review & editing, Supervision, Funding acquisition. L Padilla: Conceptualization, Writing – original draft, Writing – review & editing. A O'Geen: Writing – review & editing. B Egoh: Writing – review & editing. Investigation, Project administration. R Bales: Conceptualization, Resources, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition.

Declaration of competing interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability: https://doi.org/10.5061/dryad.b5mkkwhjg

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Table 1. Question wording and measurement

Question	Wording (SEM Notation)	Management measure	Scale
1	To what extent does the current management system have the adequate capacity to mitigate the risk of the following? (C1-C6)	Wildfire, Smoke from wildfire, Drought, Water shortage, Tree mortality, Utilities failure	1=Low capacity, 10 =High capacity
2	To what extent does the current management system have the adequate capacity to mitigate the effects of the following? (C7-12)	Wildfire, Smoke from wildfire, Drought, Water shortage, Tree mortality, Utilities failure	1=Low capacity, 10 =High capacity
3	How effective do you believe that the following management measures could be in reducing the risk of forest fires? (M1-M7)	Fire ed. programs, Mapping of fire hazard areas, Building material restrictions, Subsidized fire insurance, Vegetation clearing, Prescribed burning, Burn day restrictions	1=Not at all effective, 2=Ineffective, 3=Neutral, 4=Effective, 5=Very effective
4	How effective do you believe that the following management measures could be in reducing the risk of water shortages? (M8-M13)	Water use ed. programs, Mapping of water use areas, Private water use restrictions, Corporate water use restrictions, Agricultural water use restrictions, Low water use infrastructure requirements	1=Not at all effective, 2=Ineffective, 3=Neutral, 4=Effective, 5=Very effective
5	How effective do you believe that the following management measures could be in reducing the risk of utility failure? (M14-M17)		1=Not at all effective, 2=Ineffective, 3=Neutral, 4=Effective, 5=Very effective
6	To what extent do you think the risk of the following will change in California over the next twenty years? (R1-R6)	Wildfire, Smoke from wildfire, Drought, Water shortage, Tree mortality, Utilities failure	1=Decrease a lot, 2=Decrease somewhat,

			3=Neither increase nor decrease, 4=Increase somewhat, 5=Increase a lot
7	Generally speaking, would you say that _____ can be trusted, or that you can't be too careful in dealing with people? (T1-T3)	Most people, State government, Federal government	1=Most people can be trusted, 0=Can't be too careful
8	To what extent did the following impact your life in the last 12 months? (E1-E6)	Wildfire, Smoke from wildfire, Drought, Water shortage, Tree mortality, Utilities failure	1=No impact, 2=minor impact, 3=considerable impact, 4=major impact, 5=extreme impact
9	What year were you born	NA	Year
10	What is your gender?	NA	Male, Female, Other
11	With which racial or ethnic group(s) do you identify?	NA	White, Am. Indian, Asian, NHPI, Black or AA., Hispanic, Other

Table 2. Sample comparison

Demographic	California census 2010	Sample	
		Prof.	Public
Age, median (SD) years	36.5	50 (13.7)	38 (14.9)
Gender, % (SD) female	50.3	48.7 (0.5)	41.2 (0.5)
Race, % (SD) Black or African American	6.5	0.5 (0.1)	16.1 (0.4)
Race, % (SD) White	71.9	43.2 (0.5)	60.2 (0.5)
Ethnicity, % (SD) Hispanic or Latino	39.4	4.2 (0.2)	8.3 (0.3)

Note: All questionnaire respondents younger than 25 years of were excluded to allow census comparison

Table 3. Full effects of latent constructs given assumed structural relationship in the professional (*n* = 100) and the public (*n* = 750) samples. Standard error within parentheses.

Effect of	Effect on							
	Capacity		Management effectiveness		Risk		Trust	
	Prof.	Public	Prof.	Public	Prof.	Public	Prof.	Public
Management effectiveness	0.25 (0.33)	1.24* (0.15)						
Risk in 20 years	-0.91* (0.29)	-0.45* (0.1)	0.44* (0.1)	0.37* (0.03)				
Trust	-1.41 (0.69)	1.81* (0.36)	0.46 (0.26)	0.11 (0.11)	-0.11 (0.32)	-0.71* (0.17)		
Personal experience	5.05* (0.81)	1.26* (0.12)	0.5 (0.19)	0.11* (0.03)	-1.03* (0.23)	0.22* (0.05)	0.18* (0.07)	0.19* (0.02)

* *p* <0.01

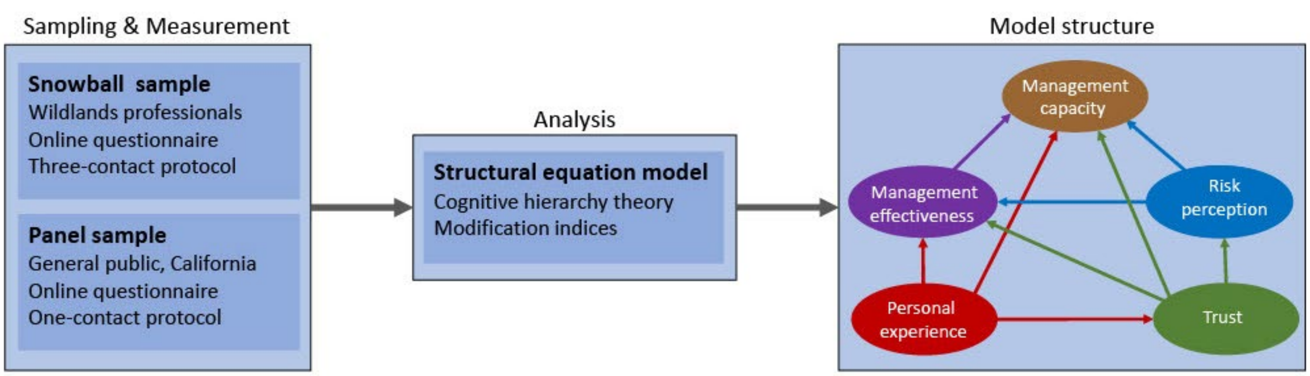

Figure 1. Process overview.

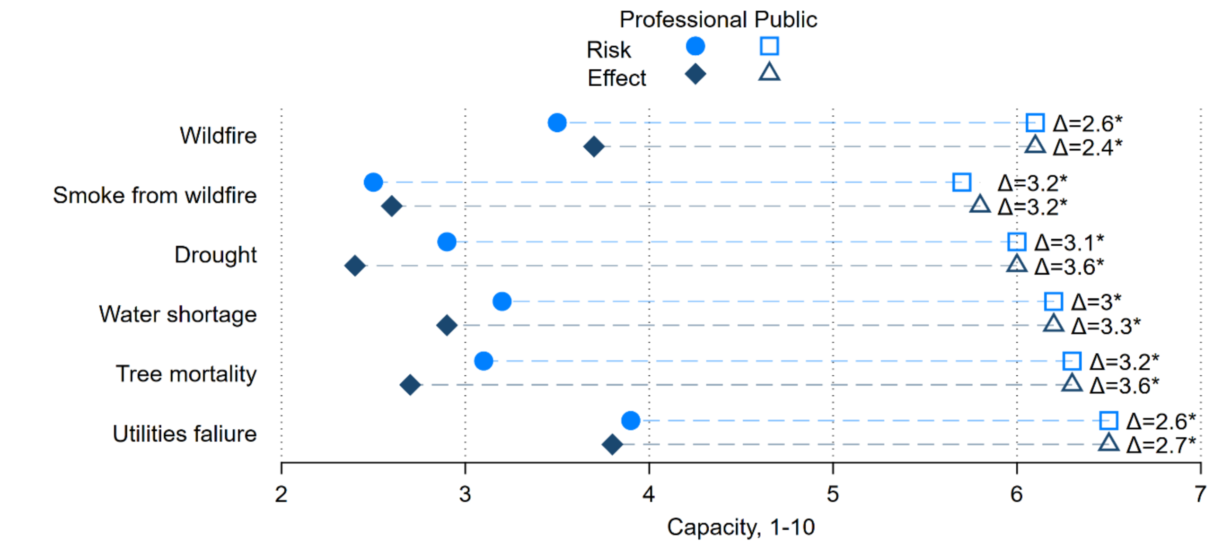

Figure 2. Mean capacity to mitigate risks of and effects (outcomes) from natural-resource disturbance events in the public and professional samples (* indicates a statistically significant difference in sample means comparing the public and professional samples, p < 0.05).

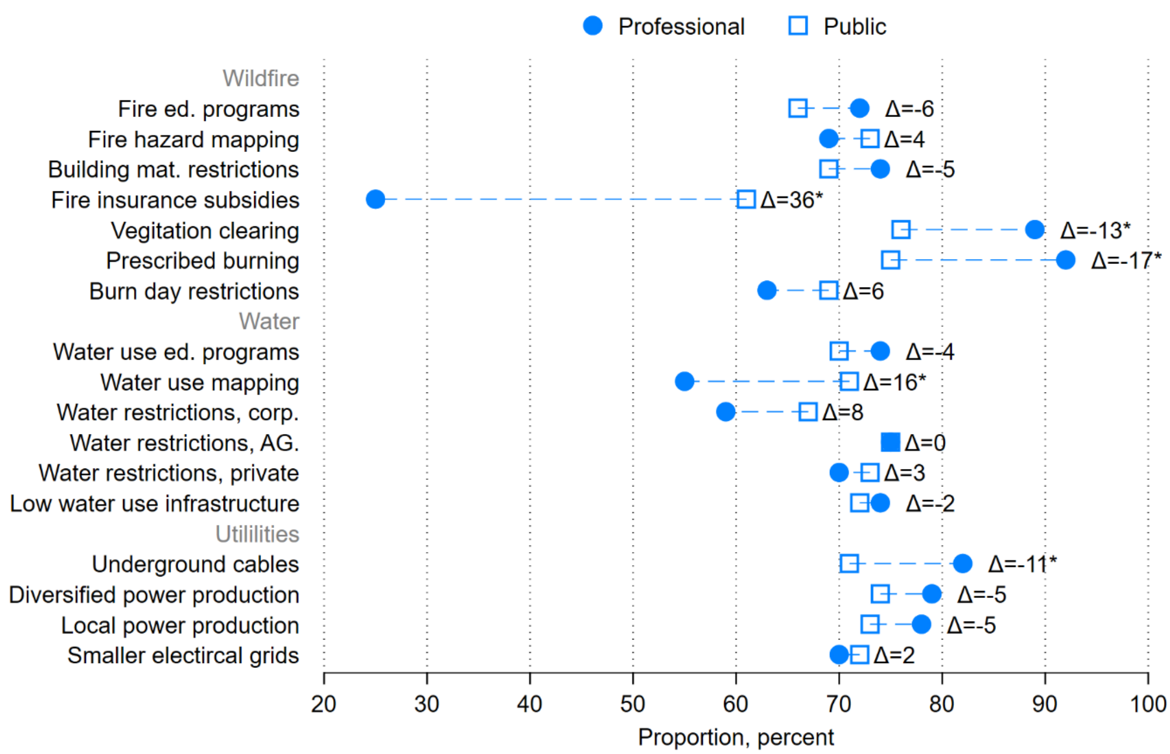

Figure 3. Proportion perceiving management actions as effective in reducing risks of utility failure, water shortages or wildfire damage in the public and professional samples (* indicates a statistically significant difference in sample means, p < 0.05).

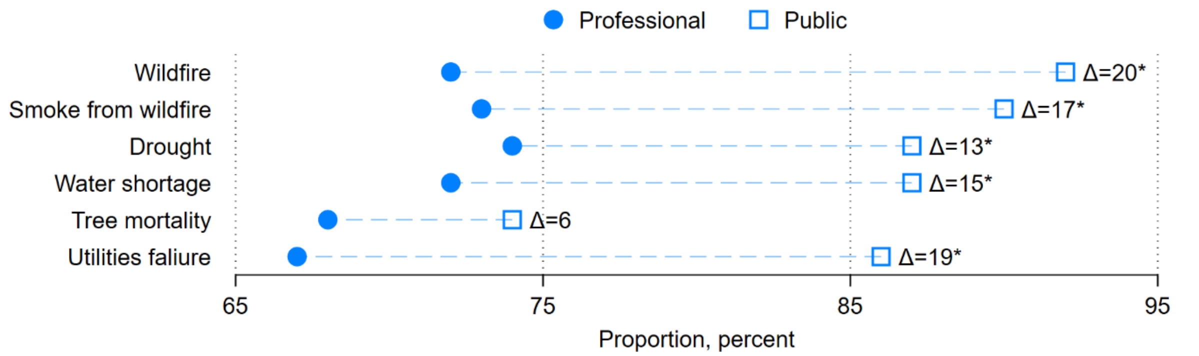

Figure 4. Belief in increased risk of natural-resource events over the next 20 years in the public and professional samples (* indicates a statistically significant difference in sample means, p < 0.05).

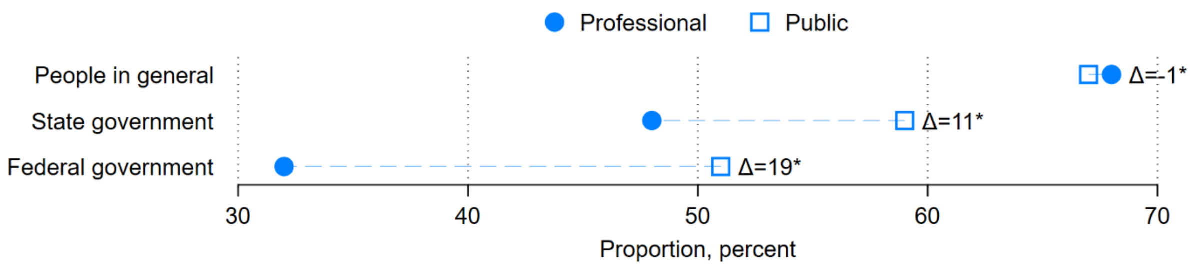

Figure 5. Reported levels of trust in the public and professional samples (* indicates a statistically significant difference in sample means, p < 0.05).

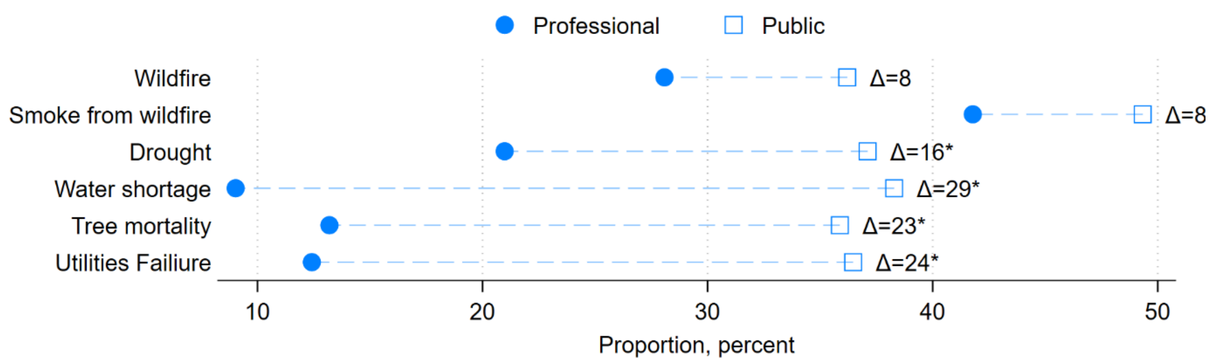

Figure 6. Personal experience with natural-resource disturbance events in the public and professional samples (* indicates a statistically significant difference in sample means, p < 0.05).

Supplemental material

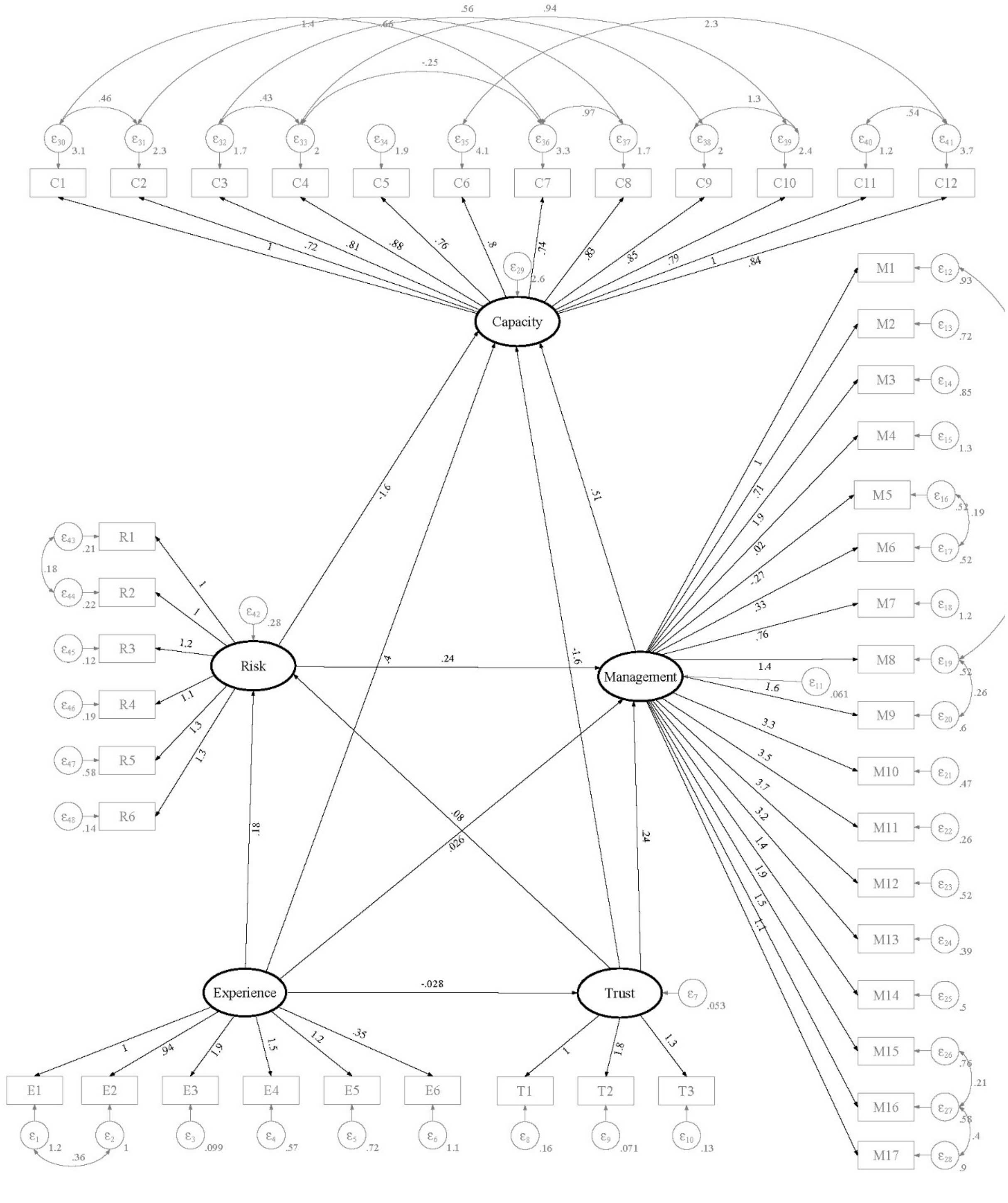

Figure S1 Complete structural model, public sample

Table S1 Mean, standard deviation and N for measurements of capacity to mitigate risks of natural-resource disruption events in the public and professional samples.

	M		SD		N	
Measurement	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.
Wildfire	6.1	3.7	2.7	2.5	861	124
Wildfire smoke	5.8	2.6	3.0	2.0	860	124
Drought	6.0	2.4	2.8	1.9	858	124
Water shortage	6.2	2.9	2.7	2.1	858	124
Tree mortality	6.3	2.7	2.6	1.9	856	124
Utilities failure	6.5	3.8	2.7	2.5	858	124

Table S2 Mean, standard deviation and N for measurements of capacity to mitigate effects of natural-resource disruption events in the public and professional samples.

	M		SD		N	
Measurement	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.
Wildfire	6.1	3.5	2.8	2.2	861	122
Wildfire smoke	5.7	2.5	3.0	2.0	863	122
Drought	6.0	2.9	2.9	2.1	861	122
Water shortage	6.2	3.2	2.8	2.0	860	122
Tree mortality	6.3	3.1	2.7	2.1	863	122
Utilities failure	6.5	3.9	2.7	2.5	861	122

Table S3 Frequencies for measurements of management effectiveness in reducing risks of utility failure, water shortages or wildfire damage in the public and professional samples.

	Not at all effective		Ineffec-tive		Neutral		Effective		Very effective		Total	
Measurement	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.
Fire ed. programs	17	8	52	8	220	20	394	73	179	18	862	127
Mapping of fire hazard areas	8	3	40	7	180	29	389	65	243	23	860	127
Building material restrictions	12	8	47	9	204	16	353	56	238	38	854	127
Subsidized fire insurance	27	27	89	28	218	39	335	24	188	8	857	126
Vegetation clearing	6	0	42	2	156	12	339	53	317	58	860	125
Prescribed burning	4	1	49	4	160	5	353	40	296	76	862	126
Burn day restrictions	6	9	39	13	220	24	349	55	247	24	861	125
Water use ed. Programs	11	5	57	6	191	22	409	74	192	20	860	127
Mapping of water use areas	13	6	44	7	193	44	392	56	218	14	860	127
Private water use restrictions	16	9	69	12	201	31	353	45	220	29	859	126
Corporate water use restrictions	7	8	39	4	165	19	350	44	299	51	860	126
Agricultural water use restrictions	12	9	64	12	152	17	350	35	281	53	859	126
Low water use infrastructure reqs.	8	6	47	4	183	22	383	40	238	53	859	125
Underground cables	10	0	37	4	205	18	389	52	218	51	859	125
Diversification of power production	8	3	40	6	174	17	360	44	276	55	858	125
Local power production	6	2	31	6	198	20	388	51	236	46	859	125
Smaller electrical grids	5	3	41	5	192	30	365	47	251	40	854	125

Table S4 Frequencies for measurements of perceived risk of natural-resource disruption events over the next 20 years in the public and professional samples.

Measurement	Decrease a lot		Decrease somewhat		Neither Inc. or dec.		Increase somewhat		Increase a lot		Total	
	Pub.	Prof	Pub.	Prof	Pub.	Prof	Pub.	Prof	Pub.	Prof	Pub.	Prof
Wildfire	16	0	63	5	164	5	298	24	318	89	859	123
Wildfire smoke	11	0	54	5	166	7	293	25	334	86	858	123
Drought	13	0	50	0	164	16	332	32	299	74	858	122
Water shortage	16	0	55	1	169	15	316	25	302	82	858	123
Tree mortality	14	1	51	11	211	20	308	33	272	58	856	123
Utilities failure	25	0	64	4	195	13	311	34	261	71	856	122

Table S5 Frequencies for measurements of trust in the public and professional samples.

Measurement	Can't be too careful		Most people can be trusted		Total	
	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.
Other people	283	37	563	80	846	117
State gov.	346	57	504	53	850	110
Fed gov.	417	74	434	35	851	109

Table S6 Frequencies for measurements of personal experience in the public and professional samples.

Measurement	No impact		Minor impact		Consider-able impact		Major impact		Extreme impact		Total	
	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.	Pub.	Prof.
Wildfire	169	220	182	219	105	895	169	220	182	219	105	895
Wildfire smoke	27	54	24	27	14	146	27	54	24	27	14	146
Drought	52	164	239	283	160	898	52	164	239	283	160	898
Water shortage	11	36	38	43	18	146	11	36	38	43	18	146
Tree mortality	218	167	163	217	123	888	218	167	163	217	123	888
Utilities failure	68	45	18	8	5	144	68	45	18	8	5	144