

Research article

How a research community constructs and uses naturalness: A case study of the 2023 Lookout Fire and the H.J. Andrews Experimental Forest in Oregon, USA

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ABSTRACT

Wildfire severity is increasing in the western United States. Simultaneously, many recognize that fire is a natural process and advocate for learning to live with fire. Indeed, the *naturalness* of fire can be an important reason provided to increase the amount of fire on a landscape. However, “naturalness” can be interpreted in incommensurate ways, such as the historic range of variability of a system or the absence of human influence. What makes wildfires feel natural or unnatural to the people who experience them, and how naturalness affects reactions to wildfires is underexplored. Using social representations theory, we examine the 2023 Lookout Fire at the H. J. Andrews Experimental Forest (HJA). We use semi-structured interviews ($n = 40$) to explore how the research community associated with the HJA mentally constructs and uses naturalness to emotionally process and make meaning from the wildfire. We find even in a community with advanced training in ecology, respondents use a variety of metrics to determine naturalness, including ignition source, fire behavior, and pre-fire landscape characteristics and fire history. Respondents consider a variety of factors, and there was not consensus on whether the Lookout Fire was a “natural” fire. In general, respondents who described the fire as more natural were able to come to a state of acceptance and excitement for future research opportunities sooner than respondents who described the fire as largely unnatural. This has important implications for wildfire risk communication for scientists and practitioners who want to restore fire as a *natural* process. While fires perceived (or framed) as natural may be more readily accepted, fires perceived as unnatural may take longer to process. Fires perceived as human-caused and especially as climate-exacerbated may be the most difficult for people to process after and during the fire, and may have the most resistance for being managed for purposes other than full suppression.

1. Introduction

1.1. Wildfire and naturalness

In the western United States, relationships with wildfire are changing. Wildfires in the western United States are becoming larger, more frequent, and more destructive (Hagmann et al., 2021; Higuera and Abatzoglou, 2021) due to a legacy of fuel build-up from previous management action (Haugo et al., 2019; Zald and Dunn, 2018), encroachment of the Wildland Urban Interface (WUI) (Radeloff et al., 2018), and climate change (Abatzoglou and Williams, 2016; Halofsky et al., 2020). Simultaneously, there is an increasing recognition of the need to learn to

live with fire: to restore beneficial fire to fire-adapted ecosystems and manage fire for resource benefit using tactics other than full suppression (Calkin et al., 2015; United States Department of the Interior & United States Department of Agriculture, 2014; Young et al., 2020).

Indeed, there is an increased recognition that fires are a “natural” part of ecosystems in the western US. However, “natural” is interpreted and used in multiple ways. We briefly review three: 1) natural as historic range of variability, 2) natural as a fundamental process, and 3) natural as the opposite of, or absence of, the human. In the historical precedence argument, naturalness is in reference to the historic range of variability: for some amount of time in the past, fires occurred on landscapes in the western US such that they were a critical disturbance for shaping the

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ecology of these landscapes. Thus, to exclude fire is “unnatural” because it drives landscapes into a state outside this range. In the process argument, naturalness refers to the fundamental nature or *telos* of an ecosystem: it is the fundamental nature or *telos* of an ecosystem to appear or function a particular way, to experience fire at a certain interval and intensity, or to have a certain assemblage of species. These are how an ecosystem *ought* to be; and to change it from that state is therefore “unnatural.” These two arguments can be brought together: the historic range of variability prior to European colonization but after the last ice age represents the fundamental nature of ecosystems, and land management after colonization has pushed these ecosystems out of this historic range and against their fundamental nature (Ridder, 2007). The third influential argument is the nature-human dichotomy (e.g., Marsh, 1965). In this argument, “natural” is the opposite, or absence, of “human”. Natural areas are those without people, while the human or built environment is unnatural. Historically, this argument has had significant impact on public lands policy and conceptualizations of areas designated as parks or wilderness in ways that exclude the indigenous peoples who lived there for time immemorial (Merchant, 2007; Sapignoli and Hitchcock, 2023).

How we define naturalness is important because biases toward things construed as “natural” are common. Natural products are often seen as preferable to non-natural products even when they are functionally identical (Meier et al., 2019). In ethical reasoning, natural law theory equates naturalness with goodness or ethicalness (see Murphy, 2019 for an overview). Natural law theory plays a critical role in natural resource management and conservation, where what is perceived as “natural” is often used as the goalpost or moral standard to judge conservation actions (Gore et al., 2011).

If an important goal of natural resource management is to increase acceptability of wildfire and the risk that comes with it, framing and internalizing wildfire as a natural process will likely be an effective strategy. Even when the outcomes are equivalent, people demonstrate a preference for natural hazards over human-caused hazards (Rudski et al., 2011). However, as described above, fire regimes are changing in the western US because of human behavior, including direct modification of landscapes and indirect effect due to climate change. This makes wildfire an important hazard to study to understand how thoughts about naturalness affect feelings and reactions to hazards. How is the naturalness of wildfire constructed in our minds, and how is naturalness used to make sense of specific wildfires? To explore these questions, we use social representations theory.

1.2. Social representations of naturalness

Social Representations Theory emphasizes the way our construction of the world is not just an individual cognitive process but a shared social-psychological process, a combination of social construction and cognition (Moscovici, 2001; Moscovici, 1988). Social representations (SRs) are “systems of opinions, knowledge, and beliefs particular to a culture, a social category, or a group with regard to objects in the social environment” (Rateau et al., 2011, pg. 478). SRs are schemas of cognition, and include values, beliefs, attitudes, emotions, and practice (Buijs and Elands, 2013). A key facet of SRs is their function: SRs help people navigate and understand new phenomenon by relating them to familiar things via metaphor (Moscovici, 2001; Rateau et al., 2011). For example, one study examined how members of the Scottish public constructed a social representation of invasiveness and non-nativeness of species (Selge and Fischer, 2011). Members of the public anchored to metaphors such as invasive species “spreading like a fungus” and applied human moral standards (e.g., do no active harm) to evaluating the acceptability of invasive and non-native species. A key implication of this social representation is that *human introduction* played a key role in perceiving invasive species as harmful and unacceptable while non-native, non-invasive species were considered less harmful regardless of ecological impact.

Social Representations is a useful theory for evaluating the complexity of social meaning in human-nature relations because of its ability to explore contradicting beliefs, such as the characteristic “natural” including a historic range of variability and the absence of people or human influence simultaneously (Buijs and Elands, 2013; Cronon, 1996). Indeed, several studies have evaluated SRs of naturalness in different contexts. For example, a study of the British public found respondents described climate change as unnatural because it affects how the weather is “supposed” to behave based on their positive and nostalgic memories (Smith and Joffe, 2013). In this case, climate change is unnatural (and negatively valued) because it causes weather to violate its fundamental telos. Importantly, social representations are not vulgarization, distortion, or diffusion of scientific knowledge, but rather, how objects are understood in the public domain (Moloney et al., 2014). As Buijs (2009) argues, the public does not have separate values, beliefs, and value orientations as separate cognitions for nature. Rather, the public relies on “images of nature” (Buijs et al., 2008). These images of nature include cognitive beliefs about what nature is and how natural processes function, normative values about how nature ought to be judged, and expressive aesthetic experiences about the beauty of nature (Keulartz et al., 2004). For example, “natural” may be a characteristic that signals forest health: forests are healthy when natural, and unhealthy when unnatural (Hull et al., 2001).

Further, the social-psychological nature of SRs means they can be used to understand the relationships different groups—not just the public at large—have with naturalness, risk, and natural hazards. For example, in comparison to the public, natural resource management professionals are more likely to include notions of “ecological aesthetics” such as biodiversity and ecosystem processes in their representations of nature (Buijs and Elands, 2013). Thus, SR theory is a useful framework to understand how groups develop a shared mental model of natural hazards (Breakwell, 2001; Lemée et al., 2019; Stotten, 2024), including wildfire (Plisoff et al., 2020). To examine how a group constructs a representation of naturalness and applies it to the context of wildfire, we conduct a case study of the 2023 Lookout Fire at the H. J. Andrews Experimental Forest.

1.3. The 2023 Lookout Fire at the H.J. Andrews Experimental Forest

The H. J. Andrews Experimental Forest (HJA) is a 15,800-acre (6400 ha) United States Forest Service (USFS) research forest and a National Science Foundation-sponsored Long-term Ecological Research site on the west slope of the Cascade Mountain Range in Oregon. Beginning in the 1950s, portions of the HJA were clearcut and partially cut for research. The forest includes both old growth and secondary-growth stands. The research community at the HJA includes USFS and university researchers (faculty, postdocs, graduate students, etc.) involved in the natural sciences, social sciences, and arts and humanities.

On August 5th, 2023, the Lookout Fire was ignited by lightning near Lookout Peak in the HJA. The fire was managed for full suppression and would eventually be contained at 25,754 acres on October 15th, 2023. Most of the fire was contained in the HJA, and approximately 70 % of the HJA was impacted by the fire. The Lookout Fire provides a compelling case study to examine how a community defines and negotiates naturalness and applies it to wildfire for multiple reasons. First, the initial state of the landscape can be interpreted in multiple ways depending on one’s perception of naturalness: the HJA includes old-growth, which is frequently perceived as more natural, even though some of the landscape has been specifically managed and manipulated for research. Second, while the fire was initially ignited by lightning, the incident management team used a variety of suppression tactics including backburning. Thus, some portion of the fire was directly ignited by humans, and some portion was ignited by lightning, but at the time of the research it was not clear how many acres exactly or where. Finally, compared to the general public, the community at the HJA has a relatively sophisticated understanding of forest ecology, disturbances,

and climate change across a variety of disciplines. Simultaneously, members of the HJA are often deeply attached to the forest. Thus, this is a community with significant attachment to the forest as it is, but in theory an understanding of the role of fire in shaping ecosystems. This provides a unique opportunity to investigate how a community navigates accepting wildfire changing a beloved place. Consequently, this research provides a novel opportunity to social scientifically examine how the philosophical conceptualizations of naturalness matter for how individuals react to and process an ongoing natural hazard.

We are guided by the following research questions.

1. What emotions did the HJA community experience in response to the Lookout Fire?
2. How does the HJA community define the naturalness of wildfire generally, and the naturalness of the Lookout Fire specifically?
3. How does the perceived naturalness of the Lookout Fire impact reactions to it?

2. Methods

To address our research questions, we conducted semi-structured interviews with members of the HJA research community. The HJA research community includes the professional staff, researchers, artists, and agency personnel associated with the HJ Andrews. This includes undergraduate students, graduate students, career professionals, and emeriti and alumni. We considered people to be part of the research community if they had worked on, with, or in support of the research conducted at the HJA, regardless of whether they were currently working with the HJA at the time of the fire.

In total, 40 people were recruited and interviewed through a combination of methods. We chose to use multiple recruitment methods to get more complete coverage of the HJA community. Our goal was to get the full range of beliefs and experiences, rather than proportional representation from different groups in the HJA. Recruitment emails were sent to the HJA community through the "SHORT" listserv. This listserv includes researchers, artists, and agency personnel associated with the HJ Andrews. From this recruitment material, potential participants could answer a survey to express interest. The research team would then follow up with them to schedule an interview. 9 respondents were recruited this way. An additional 10 respondents were recruited through purposive sampling of people closely associated with the HJA. The remaining 21 respondents were snowball sampled from participant suggestions. The final population includes university and agency scientists (including emeriti) and staff, graduate students, agency personnel, undergraduate and post-bachelor research assistants, and artists. Respondents are summarized by affiliation and career in [Table 1](#).

Interviews were conducted in-person (n = 14) and over Zoom (n = 26) from September through November 2023. Interviews lasted between 30 and 75 min, with an average length of 50 min. Interviews were conducted until saturation, i.e., no new information was emerging. During this time, the Lookout Fire had not been fully extinguished but did not grow significantly. Interviews concluded shortly after burn

Table 1
Respondent affiliation and career.

| Affiliation | Number of Respondents |
|---|-----------------------|
| Oregon State University | 20 |
| United States Forest Service | 6 |
| Other including retired personnel, other universities, other agencies, etc. | 14 |
| Employment | Number of Respondents |
| Research including university scientists, graduate students, research assistants, agency scientists, etc. | 26 |
| Other including any non-research position | 14 |

severity maps had been released; thus, our respondents were interviewed at a time when fire activity had largely subsided but the full impacts of the fire on the landscape were unknown and the fire had not yet been extinguished by a season-ending event. The HJA was closed to the public and none of our respondents had seen the landscape in-person since evacuations shortly after the fire started.

The research team used a set of guiding questions during the interviews, but conversation was not confined to those questions and was allowed to proceed organically (Patton, 2002). During the interviews, respondents described the impacts of the fire to their work and personal lives and the emotions experienced during the event, from ignition to the time of the interview. Respondents were asked about their beliefs about science and the environment and how the Lookout Fire may have shaped those beliefs (or vice versa) including what constituted meaningful science, and what constitutes naturalness and whether the Lookout Fire was natural. Finally, respondents were asked a series of demographic questions.

Interviews were transcribed with GoTranscript and coded in MaxQDA. The research team used a multi-step coding procedure guided by the interview protocol but left open for emergent themes. First, the research team developed a preliminary codebook. In the preliminary codebook, the research team created parent codes based on the interview protocol major sections (e.g., Emotions Experienced, Determinants of Naturalness). Next, the research team developed preliminary child codes based on a first pass through the interviews, designed to summarize themes (e.g., "Sadness" and "Anger" or "Ignition" and "Fire Behavior"). In the second pass, two researchers coded 20 % (n = 8) interviews. The two researchers reached 72 % intercoder reliability and 99 % intercoder agreement. Intercoder reliability requires coders to operate in isolation from each other and measures the percentage of matching codes. Intercoder agreement requires coders to reconcile any discrepancies through discussion and measures final agreement after arbitration (See Campbell et al., 2013 for a review of intercoder reliability versus intercoder agreement). The two coders discussed any new child codes, clarification of existing child codes, or merging of child codes. During the intercoder check, child codes were clarified and revised but no new child codes emerged. The research team finalized the codebook in the second phase after the intercoder reliability check. In the final phase, one researcher coded the remaining 32 interviews.

The interview protocol, finalized analytical codebook, and summary of interview results are available in the Environmental Data Initiative Repository ([Rapp and Nelson, 2024](#)).

3. Results

3.1. RQ1: the HJA community experienced a variety of negative and positive emotions over the course of the fire

Respondents described complicated and fluid emotions in response to the fire. Every respondent experienced a negative emotion at some point during the fire, though there was no universal emotion experienced by all 40 respondents. When the fire first occurred, many respondents expressed shock and incredulity a fire would happen in the HJA at all, denial that the fire would grow large or not be contained, and disbelief or numbness when the fire grew to a large size. As the fire progressed, nearly all respondents experienced sadness, loss, depression, or grief, often intensely. Respondents expressed empathy for their fellow community members and many sought out community members as part of their processing. Some respondents who attributed the fire in part or wholly to climate change or management choices also experienced anger or frustration at the social systems that had contributed to climate change and fuel accumulation.

Respondents provided insight on what they felt had been lost or would be negatively altered in the Lookout Fire, which included personal connection, old growth scarcity, and aesthetic value. Respondents had a deep connection and meaningful relationship with specific entities

within the Andrews, including meadows, streams, and individual trees. For example, respondents described the grief associated with knowing a specific tree or grove might have burned in the fire, or that a familiar trail would be gone or altered. Some respondents described feeling sadness or grief for the animals that died in the fire. Respondents were also attached to the HJA as a unit: respondents acknowledged that even though fire was a part of the system, and that ecological systems inevitably change, there was a sense of loss that the system would be altered for the rest of their lives. Another source of loss derived from the fear that old growth specifically was being lost in the fire. Many respondents highlighted that it was particularly negative or tragic that the Lookout Fire was happening in old growth forest because old growth forests are scarce and rare. In that case, the loss was not associated with the Andrews per se but with the old growth trees and stands within the HJA. Finally, some respondents expressed a sense of loss over the aesthetic value of the HJA. These respondents described the HJA as pristine, lush, ancient, beautiful, and “nature at its finest”, characteristics that disappeared when affected by fire. Importantly, these sources of loss, personal connection, old growth scarcity, and aesthetics, were rarely distinct for respondents. For example, a respondent might describe that they built a personal connection with the forest because of the aesthetic value of old growth. Consequently, they felt a sense of loss when the aesthetics of the forest changed, and they believed their relationship with the forest would change with it.

By the time of the interviews, over half of respondents also described themselves at some stage of acceptance. This could range from full acceptance and an eagerness to move on to research opportunities, deep resignation and emotional detachment, or an emotional flux that included moments of acceptance and grief. Over half of respondents also expressed curiosity about the fire impacts, including an eagerness to begin working on fire-related research, hope for the potential benefits to research, and general scientific curiosity about how the fire would shape the landscape.

Notably, respondents could hold multiple, sometimes conflicting emotions, feeling for example an excitement about future research opportunities and grief about the fire impacts on the forest. Respondents universally recognized their emotions had changed from the time of the ignition to when they were being interviewed, and many expressed they imagined their feelings about the fire would continue to develop.

3.2. RQ2: the HJA community did not have a unified theory of naturalness

The research team was interested in how respondents defined naturalness of fires, whether the Lookout Fire was natural, and how that impacted thoughts and emotions about the fire (Table 2). Respondents were largely resistant to label the Lookout Fire as either and exclusively natural or unnatural, with the majority of respondents either describing naturalness as a spectrum, and a smaller number rejecting the premise of naturalness outright. Of the 40 respondents, 6 rejected the idea of categorizing the Lookout Fire as either natural or unnatural, either arguing nothing is unnatural (for example, because people are a part of nature), nothing is natural in a climate changed world, or they do not perceive the delineation to be meaningful or useful.

For those who took a dichotomized position (either fully natural or fully unnatural), two key arguments emerged. First, some respondents argued because the fire was lightning-ignited, that categorically made it a natural fire. Conversely, some respondents argued because the fire was climate-exacerbated, it could not be natural. More commonly, respondents considered a variety of factors when determining naturalness.

3.2.1. Ignition

37 respondents mentioned ignition. Frequently, ignition was the first factor mentioned. With few exceptions, respondents categorized lightning ignition (as in the case of the Lookout Fire) as natural. In comparison, human ignitions, especially negligent ignitions or arson, were

Table 2
Summary of criteria used by HJA community to construct naturalness.

| Characteristic of Naturalness | Natural | Unnatural |
|-------------------------------|---|--|
| Ignition | • Lightning Ignition | • Human Ignition |
| Landscape Condition | • Old-growth | • Former clear-cuts |
| Fire History | • Fire as an ecological process in the PNW | • Climate-exacerbated fuel dryness |
| Fire Behavior | • Fire as a fire-adapted system | • Climate-driven changes in the PNW fire season |
| Fire Suppression Activities | • Fire as an intrinsic part of the landscape (e.g., the landscape "wants" fire, or was "meant" to burn) | • Behavior outside the historic range of variability |
| | • Backburns | • Behavior exacerbated by climate change |
| | | • Backburns |
| | | • Control lines |
| | | • Activities that mitigate fire behavior (e.g., water and retardant drops) |

perceived as unnatural. Fires set intentionally for ecosystem health and function (e.g., prescribed fires, historical burning) were more complicated to respondents. There was no consensus about the naturalness of these fires, and some respondents actively expressed they were not sure or had conflicting beliefs about the naturalness of these fires.

3.2.2. Landscape condition

22 respondents mentioned the landscape condition on the HJA, including the forest structure and conditions of the fuels before the fire occurred. Naturalness of the Lookout Fire could be influenced by the naturalness of the landscape in two ways. First, if a landscape was perceived as (un)natural, that property transferred to the fire-i.e., fire in an (un)natural landscape would be categorically (un)natural by definition. Second, the condition of the landscape could affect fire behavior, which in turn was natural or unnatural largely depending on how predated the fire behavior was (see section 3.2.4).

The HJA landscape includes both old-growth stands and former clearcuts regrown as second growth forest. Some respondents described the HJA as wholly or partially natural because of the presence of old-growth. For a subset of those respondents, the naturalness of the landscape transferred to the fire; because the fire occurred in natural old growth (and was not human-ignited), the fire itself was thus natural as well. In comparison, other respondents highlighted the myriad ways the HJA landscape deviated from their perception of naturalness: former clearcuts, plantations that had not been thinned, the exclusion of fire, the presence of roads, etc. contribute to the unnatural (or non-naturalness) of the landscape, and that property transferred to the fire.

Most commonly, landscape condition influenced perceptions of naturalness through the perceived indirect effect forest structure and fuels had on the fire's behavior. Most respondents who mentioned the indirect effect of landscape conditions on naturalness through fire behavior highlighted the ways the landscape contributed to the unnaturalness of the Lookout Fire. In those instances, historic fire suppression and lack of management (i.e., lack of thinning plantations and old clear cuts) contributed to fuel load, which in turn increased the severity and probability of the Lookout fire. For these respondents, fuel load increased fire severity, and higher severity fires were perceived to be more unprecedented, and thus more unnatural. Similarly, respondents recognized climate change dried out fuels through long-term hotter and

drier conditions, affecting fire behavior.

3.2.3. Fire history

21 respondents mentioned the fire history of the HJA. Fire history refers to the perceived role of fire on the landscape and the historic frequency and intensity of fire over time. For example, many respondents described the way the fire regime in the PNW is changing due to climate change, including longer and more severe fire seasons. The more the Lookout Fire was perceived to have happened as part of the larger trend of increasing fire frequency due to climate change, the less natural it was perceived to be.

In comparison, respondents also described fire as an important part of the ecosystem of the PNW and the HJA, and believed the Lookout Fire was a part of that history. Some respondents described it in ecological terms, highlighting the role of fire as a natural disturbance, or describing the HJA as a fire-adapted system, while others described fire more abstractly, as the HJA was “meant” to burn, or the landscape “wants” fire. These respondents were more likely to perceive the Lookout Fire as natural based on the role of fire in shaping the HJA over millennia.

Importantly, respondents could also be in the process of changing their beliefs about fires’ role in ecosystems, and this in turn impacted how they evaluated the Lookout Fire. For example, some respondents, primarily students or people from areas where fire is less common, described how they had recently (within the last several years) perceived fire as a largely negative thing, but through experiences and education associated with the HJA came to learn about the role of fire in the ecosystem. For these respondents, processing the Lookout Fire could be difficult as they worked through their changing understanding of fire in the PNW.

3.2.4. Fire behavior

18 respondents mentioned fire behavior. While fire history covers the perceived role of fire on the landscape, fire behavior covers the literal speed, direction of travel, and intensity of the Lookout Fire. Most commonly, fire behavior was contextualized through historical precedence. The more respondents believed the Lookout Fire fire spread and intensity mimicked historical fire behavior, the more natural respondents tended to perceive the Lookout Fire. At the time of the interviews, respondents did not know the fire severity. Instead, respondents considered fire behavior from the speed and spread of the fire and their beliefs and intuitions about how severely it was burning based on speed. Respondents could use the same standard, precedence, and shared understanding about the fire footprint and come to different evaluations of naturalness because there was not consensus about whether the Lookout Fire matched historic fire behavior. Thus, respondents could agree on the scale to use to assess naturalness, but not where the Lookout Fire fell on that scale. Differences in evaluations were commonly due to beliefs about the role of climate change in the Lookout Fire. The more respondents perceived the fire behavior to be driven by climate change (through increased temperature and wind speeds and decreased relative humidity), the more unprecedented and thus unnatural the believed the fire was.

3.2.5. Fire suppression activities

6 respondents mentioned the activities conducted by fire managers during the fire, such as line construction, aerial drops, etc. Of those who mentioned it, there was not consensus on whether the management actions contributed to the naturalness of the fire, and if they did, what effect they had. One respondent highlighted that the decision not to suppress it at the smallest possible size contributed to the fire growth, which in turn created a more natural fire. One respondent described that the parts of the final fire footprint started by backburn or intentional ignition were still natural fire. Four respondents stated the fire suppression activities (control lines, water and retardant drops, backburns) altered fire behavior and in doing so made the fire less natural.

3.3. RQ3: constructing the fire as “natural” had positive effects for respondents

Respondents felt a wide variety of emotions about the Lookout Fire, from grief and despair to anger to excitement for future research opportunities. Every respondent experienced a variety of emotions that changed over time from ignition to the time of the interview. For most, though not for all respondents, perceptions of naturalness and whether the Lookout Fire constituted a natural fire affected how respondents felt about it.

In general, the more natural respondents perceived the fire to be, the faster they were able to arrive at a state of acceptance or peace about the impacts of the fire, and the more excitement they felt about the future research opportunities created by the fire. However, this was not universal. For a small number of respondents, the lightning ignition made it harder to process the fire. They expressed that a human ignition with a clear actor to blame and direct anger toward would have been easier to experience. Respondents who felt the fire was wholly or at least partially unnatural because of climate change expressed a variety of negative emotions including anxiety, guilt, and grief as the fire became a symbol of the impacts of climate change. Respondents tended to feel unnatural fires were more preventable if different decisions had been made, and hence if the Lookout Fire was unnatural, they felt more negative emotions about it for longer.

Almost universally, respondents described they would have felt more anger, outrage, or frustration if the fire had been human-ignited, with more anger for intentional arson and less intense anger for accidents. Of those respondents, many would have wanted to see more aggressive suppression activities taken and would have felt more negatively about the fire even if the outcomes on the landscape had been the same. However, this feeling was not universal, with a small number of respondents believing they would not have felt differently, either equally at peace or equally upset, had it been human-ignited.

Importantly, many respondents held multiple beliefs and thus multiple feelings about the fire simultaneously. For example, respondents could feel degrees of acceptance through the natural ignition and simultaneously still feel grief and anxiety about climate-exacerbated (and thus unnatural) fire behavior. Respondents held complicated, multi-faceted, and actively changing beliefs and emotions about the Lookout Fire.

4. Discussion

4.1. Naturalness of the Lookout Fire

Members of the HJA used a variety of criteria when mentally constructing the naturalness of the fire. Respondents varied in what criteria they used, with some relying on simple, binary calculations (e.g., lightning ignition means the fire is natural, climate change means the fire is unnatural) while others considered a variety of factors and did not come to a strong conclusion on the naturalness of the Lookout Fire. Respondents may also use the same criteria and come to different determinations of naturalness. For example, two respondents may consider precedence to be an important determinant of naturalness but disagree about the extent to which the Lookout Fire mimicked the historic fire behavior of the area.

These metrics of naturalness for the Lookout Fire reflect interpretations of naturalness as historic range of variability, fundamental process, and the opposition or absence of humans, sometimes simultaneously. When describing ignition as an evaluative criterion of naturalness, most respondents described lightning ignitions as natural and human ignitions as unnatural. This reflects and perpetuates the human-nature dichotomy interpretation of nature (Cronon, 1996; Ridder, 2007). In comparison, many respondents directly considered precedence and historic range of variability of the landscape and fire behavior when evaluating naturalness. A smaller number evoked ideas of

fundamental process or telos, describing ideas such as that the HJA is “meant” to burn or “wants” fire. Thus, even within this relatively specialized and expert community, we do not see a single unified ontology of naturalness (Fig. 1). Our results are similar to other studies examining ethical and ontological reasoning in NRM, which find people use multiple, often incommensurate philosophical theories to guide NRM decision-making (Batavia and Paul Nelson, 2016; Gore et al., 2011). Our results are similar to previous studies on social representations of nature (Buijs, 2009; Buijs et al., 2008; Keulartz et al., 2004): our respondents did not have separate cognitions of nature, but rather naturalness was a combination of values of how fire ought to be and beliefs about what constituted the proper or precedented state of fire in the HJA.

We do not make an argument for whether the definition of naturalness ought to be historical precedence, fundamental nature, the absence of humans, or some combination thereof. However, our results highlight that these criteria are not consistently applied and many of our respondents had a “gap” in their cognitive schema of naturalness (Jones et al., 2011). Specifically, many of our respondents considered fire behavior to be an important determinant of naturalness and fire: where the fire burned, how severely, and how quickly were especially important. However, relatively few respondents included the effects of fire suppression on fire behavior in their consideration. Fire suppression activities can affect fire behavior in a variety of ways (e.g., Dunn et al., 2017; Gannon et al., 2023), including actively halting fire at constructed containment lines, attenuating fire behavior through water and retardant drops and vegetation removal, and introducing fire where it may not have otherwise been through backburning. Under many respondents’ reasoning, fires that include suppression resources should be perceived as less natural: fire suppression is the direct result of human behavior (nature as non-human) and prevents fires from burning where they historically would have by limiting spread (historic range of variability). Instead, we find at the time of the interviews, most of our respondents simply did not have fire suppression resources in their mental model of the fire.

This has implications for communicating about and building support for less-than-full-suppression strategies. The decision to manage or suppress a fire is based on a multitude of factors (Schultz et al., 2019; Thompson, 2014). Perceptions of naturalness may be playing a role already: human-ignited fires are more likely than lightning-ignited fires to be managed for suppression only (Daniels et al., 2024) and social and cultural beliefs influence fire manager decision-making around less-than-full-suppression strategies (Daniels et al., 2024; Steelman and McCaffrey, 2011). If an important avenue for increasing willingness to live with fire is increasing awareness and acceptance of fire as a natural process (McWethy et al., 2019; United States Department of the Interior & United States Department of Agriculture, 2014), one way to do that may be by highlighting the “artifice” or “non-naturalness” of fire suppression (Calkin et al., 2014; Schultz et al., 2019). While our study examines how one scientific community constructs and uses naturalness, it is worth exploring further how members of the public construct naturalness and apply it to determine the acceptability of different fires and fire management practices.

4.2. Climate change and emotional responses to wildfire

Members of the HJA had multi-faceted and dynamic experiences with the Lookout Fire. Respondents felt a variety of negative emotions, including sadness, grief, anger, and anxiety, and felt loss of individual entities, systems, and relationships (Masterson et al., 2017). Respondents experienced ecological grief (Benham and Hoerst, 2024) as the Lookout Fire disrupted their sense of place. Similar to previous studies (Brown, 2022; 2023), our work highlights how wildfires disrupt sense of place by altering the symbolic relationships respondents had with the forest. Respondents could simultaneously acknowledge wildfire as a natural process and that the attributes they valued about the forest would not be the same without fire, and still experience solastalgia-distress from seeing degradation, harm, or negative change to a valued place (Albrecht et al., 2007; Galway et al., 2019). Adaptive and transformative resilience to wildfire requires accepting fire as a

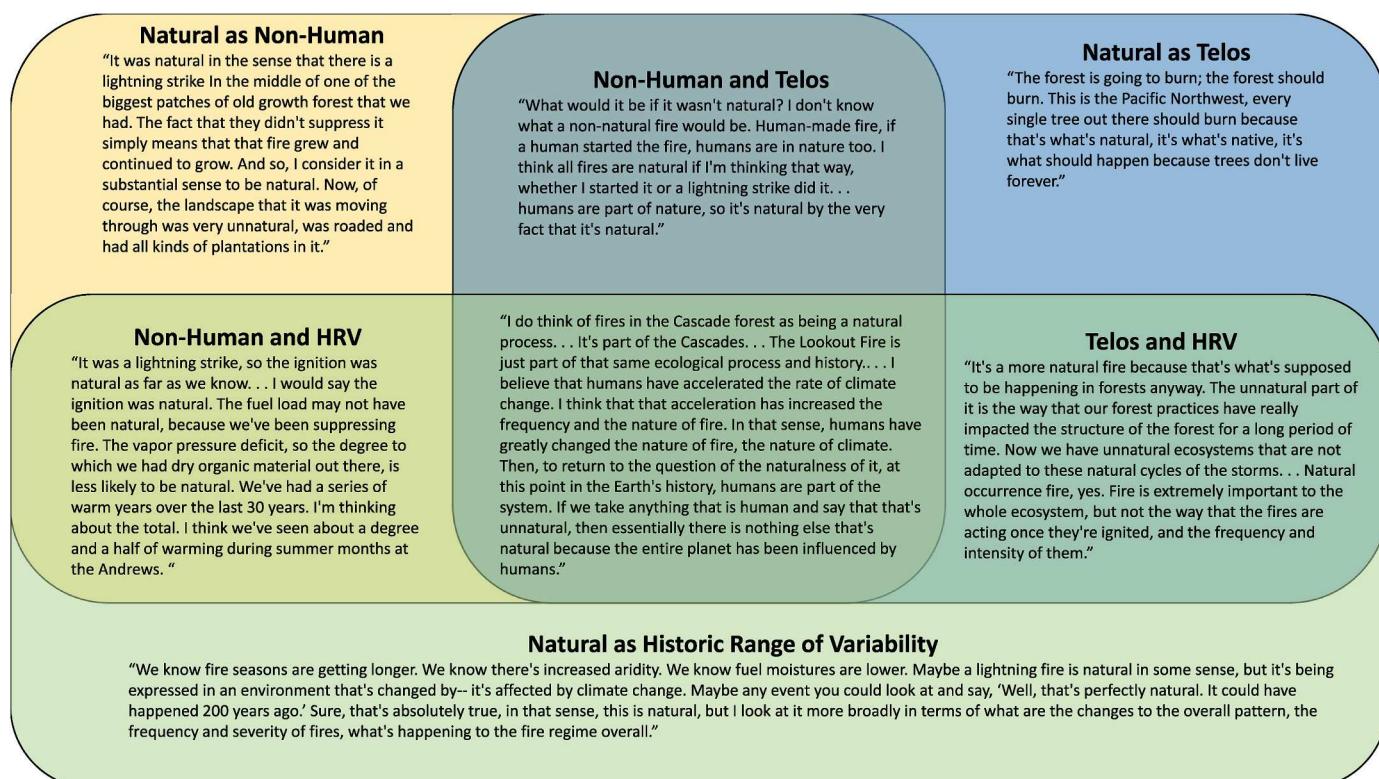


Fig. 1. Examples of naturalness from respondents.

hazard and accepting that it will occur on the landscape (McWethy et al., 2019). Perceiving fire as natural is not a panacea for grief or a way to preclude negative emotions. Rather, construing fires as natural may provide a way to process negative emotions and ultimately come to a sense of acceptance.

Further, Social Representations Theory emphasizes that how risks are constructed and perceived is a social process that serves an important anxiety-reducing function (Breakwell, 2001; Joffe, 2003). We see that reflected in our results: at the time of the interviews, respondents who perceived the Lookout Fire as natural had fewer negative emotions and were more excited about future research opportunities than respondents who perceived the Lookout Fire as largely unnatural. Natural fire was perceived as categorically different and better than unnatural fire, in line with previous studies on naturalness and hazards (Meier et al., 2019; Rudski et al., 2011).

However, climate change played an important role in how respondents perceived the naturalness of the Lookout Fire. For some respondents, the omni-presence of climate change shaped their perception and thus reaction to the Lookout Fire. These respondents experienced the stress inherent to dealing with a wildfire event and additional negative emotions about climate change. The Lookout Fire became a symbol or example of climate change and a climate changed world. This was particularly pronounced for respondents who experienced grief over the HJA as they knew it being “lost” to a fire that may not have happened without anthropogenic climate change. Recent work on place attachment after wildfires suggests at least for the general public, some but not all connect extreme wildfire behavior to climate change (Morales-Giner and Mook, 2025). However, there is increasing acknowledgement of the emotional toll and sense of loss people experience due to climate change (e.g., Cunsolo and Ellis, 2018; Ojala et al., 2025). As climate change affects fire behavior, people may increasingly experience wildfires as symbols of climate change and a “New Normal” (Kroepsch et al., 2018). This may create a communication challenge. Fires may be increasingly perceived as unnatural, and thus unacceptable, at a time where learning to live with fire and increasing the amount of fire on the landscape is an important adaptation to climate change. It will be important to communicate messages about returning fire to landscapes carefully and empathetically to audiences who perceive fire as fundamentally altered by climate change.

5. Conclusion

There is widespread scientific recognition that wildfire is an important disturbance in ecosystems in the western United States, and fire exclusion and suppression decrease the health and resilience of these ecosystems in the long-run. However, learning to live with fire and accept it on specific landscapes can still be difficult, even for individuals with sophisticated understanding of forest and fire ecology. In our case study, we found the perceived naturalness shapes evaluations of the acceptability of wildfire and the corresponding emotions one experiences about its impacts. We also found our respondents used multiple criteria to determine naturalness, and those who used the same criteria could still come to different conclusions. Respondents considered a variety of human and biophysical characteristics, but relatively few respondents mentioned fire suppression activities; we consider this a potential gap or internal inconsistency in people’s cognitive schema of fire. While our results provide a detailed look at how a community with ecological knowledge experiences fire, our results may not be indicative of the general public. Future research should explore both perceptions and uses of naturalness by the public at large and how highlighting the “non-naturalness” of suppression could affect the acceptability of less-than-full-suppression fire response.

Perceptions of naturalness may also play an important role not in preventing negative emotions after wildfire, but in processing them and coming to a state of acceptance. However, for fires that are perceived as symbols of climate change or a “New Normal”, affected individuals may

have to process fire impacts and climate grief simultaneously. As anthropogenic climate change lengthens fire seasons and intensifies fire behavior, fires may become an important symbol of climate change. How this complicates efforts to build a culture that is willing to live with fire and put more fire on the landscape will be a critical question to answer. Consequently, while managers and practitioners should be cautious about communicating callously, understanding how audiences construct and use naturalness in the context of wildfire may be an important avenue for building support for living with fire, and rebuilding attachments and relationships to treasured places after fire.

CRediT authorship contribution statement

Claire Rapp: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Michael Paul Nelson:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

Data statement

The interview protocol, finalized analytical codebook, and full summary of interview results are available in the Environmental Data Initiative Repository (<https://doi.org/10.6073/pasta/352aaa3a7881f8ec23569135ce4c7057>).

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Claire Rapp reports financial support was provided by National Science Foundation. Co-author former Principal Investigator for the H. J. Andrews Experimental Forest Corresponding author partially funded through the NSF Grant LTER8-DEB-2025755 while conducting this research, which is a primary funding source for the H. J. Andrews Experimental Forest. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data that has been used is confidential.

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