RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration

RESEARCH ARTICLE

Public perceptions of ecological restoration within the context of Norwegian landscape management

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Ecological restoration is poised to become an increasingly important component of landscape management in the coming years as countries work to halt the rate of biodiversity loss. The success of future restoration projects will depend equally on both achieving biological objectives and on producing conditions that meet public expectations. Yet we often know very little about either how the public perceives the purpose or goals of ecological restoration, or how restoration might fit into public expectations for landscape management. We surveyed a representative sample of the Norwegian population ($n = 4{,}077$) to determine how familiar the Norwegian public is with ecological restoration, to explore their perceptions of restoration's purposes and goals, and to assess their preferences for types of common Norwegian landscapes. Survey participants generally had little familiarity with ecological restoration, yet they had a greater tendency to view restoration's purpose as enhancing naturalness than as providing benefits for humans. Public attitudes regarding landscape management were reasonably balanced between preserving cultural landscapes and promoting natural landscapes free from traces of human activity. While participants gave agricultural landscapes the highest scores for desirability, the survey did not reveal any conspicuous variation in landscape preferences among the Norwegian public. Policymakers, land managers, and ecological restoration practitioners should use insights from studies such as ours to help identify which future projects are most likely to enjoy widespread support, and to tailor their communication with stakeholders.

Key words: ecological restoration, environmental perception, landscape management, landscape preferences, Norway

Conceptual Implications

- Mapping social preferences for future landscapes is useful for a better understanding of public support or opposition to ecological restoration work.
- Consideration of the public perceptions of restoration's objectives should be incorporated into planning to increase public support for restoration projects. Doing so can also improve people's relationship to their surrounding landscape and their understanding of its long-term ecological quality.
- Communicating restoration objectives can increase awareness of the restoration's broader benefits for both biodiversity and ecosystem services.

Introduction

Ecological restoration represents an elective form of landscape management with human-directed choices (Hagen et al. 2002; Clewell & Aronson 2006; Shackelford et al. 2013). Project designers and practitioners must decide which species and landscape features to remove, suppress, introduce, or otherwise facilitate—and these choices reflect aspects of societal norms and values connected to nature (Higgs 2003; Martin 2017). Ecological restoration's role and prominence within global-scale strategic initiatives for halting biodiversity loss and environmental degradation is expanding rapidly (Fischer et al. 2021). The Convention on Biological Diversity's Aichi targets (CBD 2010), the EU Biodiversity Strategy (EC 2011), the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES 2015; IPBES 2019), and the EU Water Framework Directive (EC 2000) all explicitly call for ecological restoration within land-use policy and management. With 2021 ushering in the United Nation's Decade on Ecosystem Restoration (UN General Assembly 2019), we can hope to see a considerable increase in new restoration projects across a wide range of habitat types (Perring et al. 2018; Fischer et al. 2021). A greater recognition of how societal norms and values influence our approach to restoration can ensure that ecological restoration receives the public support that will be necessary for long-term success.

Author contributions: ES, DH, BPK conceived and designed the research; ES analyzed the data; ES, DH, BJ-K, BPK wrote and edited the manuscript.

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doi: 10.1111/rec.13612
Supporting information at:
http://onlinelibrary.wiley.com/doi/10.1111/rec.13612/suppinfo

For ecological restoration to be successful in broad terms, projects need to both assist in recovering desirable biological attributes (or ecological functions) and demonstrate the resulting societal benefits from restoration that can secure both initial and lasting support (Higgs 1997; Gobster & Hull 2000; Hallett et al. 2013). Many early restoration projects were "product-oriented" (Higgs 2003; Baker et al. 2014), meaning that they were either primarily or exclusively concerned with achieving specific *biotic* goals (Hobbs 2007). Newer restoration projects are somewhat more likely to consider the societal aspects of ecological restoration, including the benefits restored ecosystems provide (Hallett et al. 2013; Wortley et al. 2013). Yet many projects still fail to meet their objectives, in part because they do not sufficiently integrate the social components of restoration in either their planning or implementation (Eden & Tunstall 2006; Hobbs 2007; Naiman 2013).

All ecological restoration projects exist within a social context (Harris & van Diggelen 2006; Junker et al. 2007). The decisions we make about which systems to restore, which systems serve as references, what methods we use, and what goals we have for restoration will reflect ethical and philosophical attitudes regarding humanity's relationship with nature (Hobbs 2004; Martin 2017; Fischer et al. 2021). Determining ecological restoration objectives entails applying social values—either implicitly or explicitly—to ecosystems in ways that can include cultural, economic, political, moral, or religious meanings or contexts (Martin 2017). Several authors therefore advocate paying greater attention to the role personal and collective values have in the ecological restoration planning process (Davis & Slobodkin 2004; Clewell & Aronson 2013; Perring et al. 2018). Controversy can arise when values that motivate restoration clash with conflicting ethical, aesthetic, social justice, socioeconomic, and environmental preservationist values (Soulé & Terborgh 1999; Swart et al. 2001; Prior & Ward 2016).

Ecological restoration's objectives can vary considerably according to the rationale for restoration. Examples including rehabilitation of historical landscapes, assisting recovery of threatened species, meeting regulatory requirements (i.e. compensation and mitigation of habitat loss elsewhere), securing ongoing delivery of ecosystem services, and addressing challenges associated with climate change (Hobbs & Norton 1996; Alexander et al. 2011; Aradóttir & Hagen 2013). In presenting a conceptual tool for assessing the social benefits of ecological restoration, Baker and Eckerberg (2016) attempt to both classify the rationales for restoration and identify the underlying values for each rationale category. Some of the underlying values for biodiversity-oriented ecological restoration objectives can be interpreted as decidedly ecocentric (e.g. recreating habitat to restore ecosystem structure and function, or provide for a species of set of species). The values connected to restoration for enhancing ecosystem services are regarded as more anthropocentric and thus representing a utilitarian view of nature (Matzek & Wilson 2021). Ecocentric and anthropocentric values represent two broad, opposing ethical positions for justifying ecological restoration that stem from conservational philosophy (Callicott et al. 1999; Swart et al. 2001). Baker and Eckerberg (2016) also identify other underlying values—such as nostalgia, regulatory compliance, pragmatism, and moral engagement—that do not fall into the two aforementioned categories. They further acknowledge that the reasons for and objectives of restoration are complex. The underlying values and motivations may conflict or be incompatible implying that some kind of trade-offs must be made among interest groups in order to fulfill the project.

Public acceptance and support for ecological restoration will depend on how well intended and ultimate outcomes of restoration projects match public ideas regarding aesthetics, or how a landscape should look (Junker & Buchecker 2008; Jähnig et al. 2011; van Marwijk et al. 2012). Most current definitions of ecological restoration consistently maintain that restoration is intended to assist in the recovery of ecosystems that have been "degraded, damaged or destroyed" (SER 2004). Yet we cannot expect to find universal agreement regarding what constitutes a degraded or damaged ecosystem, or whether the objectives for ecological restoration activity will represent an improvement over an ecosystem's current aesthetics. Many restoration endeavors entail a greater potential for conflict than traditional conservation. Whereas conservation approaches generally imply preservation of existing conditions, restoration represents an active form of land management that can turn an ecosystem into something that is dramatically different and unfamiliar (Bright et al. 2002), or remove evidence of human activity that some perceive as positive and contribute to their sense of place (Aasetre et al. 2021).

Achieving the biodiversity conservation targets specified in global initiatives will involve applying restoration measures to landscapes across a range of degradation levels (Egoh et al. 2014; Kotiaho & Moilanen 2015), assisting recovery and enhancing ecological attributes of both semi-natural and intensively managed landscapes (Hagen et al. 2013). We can expect restoration of such projects to enjoy broader public support or encounter less social resistance if they seek to improve the ecological status of landscape types the public enjoys and would like to see more of (Junker & Buchecker 2008; Bark et al. 2009; Buijs 2009). Insight into public attitudes toward broad categories of landscapes and attitudes toward restoration can also aid in developing management programs that can (1) identify and integrate social and ecological objectives, and (2) ascertain where opposition to restoration could occur and what factors might explain it. Communication and outreach that clearly articulates a restoration project's intended purpose and societal benefits can further enhance public support (Bright et al. 2002; Bernhardt et al. 2007; Druschke & Hychka 2015).

We often know very little about public attitudes toward restoration outside of the context of a specific project (Zoderer & Tasser 2021). This can hamper our ability to strategically plan for and implement effective restoration that will be necessary to address the challenges of global social-ecological change (Fischer et al. 2021). What are public perceptions of ecological restoration's objectives? Are there possible misconceptions that might need addressing? Do the ecological values align with values that might be underlying potential restoration projects? What landscape types does the public like, and how might variation among these preferences influence restoration priorities in the coming years?

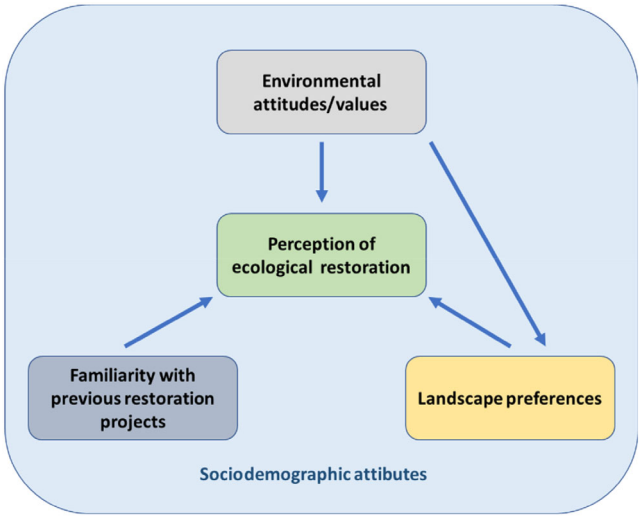

Figure 1. A conceptual model depicting the relationships between factors that form the general public's perception of ecological restoration, with directional arrows depicting effects between variables.

We used information gathered from an internet survey of Norwegian residents to assess the public's overall perceptions of the purpose and goals of ecological restoration, as well as preferences for broadly defined landscape types that are common in Norway. We hypothesized that perceptions of restoration are a function of individuals' environmental attitudes and the values they reflect, familiarity with previous ecological restoration projects, and preferences regarding landscape types (Fig. 1). We further hypothesized that sociodemographic attributes are associated with stated landscape preferences and can help explain variance in valuations of restoration objectives.

Methods

Survey

The present study was part of a broader Norwegian survey dealing with a range of environmental issues, concepts, and values (Kaltenborn et al. 2016; Skogen et al. 2018). The survey included questions that both directly and indirectly pertained to perceptions of ecological restoration and Norwegian landscapes, as described in more detail below. Respondents were drawn from the extensive nationally representative TNS Gallup panel for Norway (http://www.tns-gallup.no/) that consists of approximately 50,000 individuals. In April 2012, we sent survey invitations to approximately 7,000 individuals and received 4,077 completed self-administered internet questionnaires from participants between 18 and 87 years old. The link to the survey closed when it reached a target sample size for a specific demographic, so our 57% effective response rate would have been higher if everyone who wanted to participate had the opportunity to do so. The TNS Gallup panel's sampling methodology enables making adjustments during the course of data collection if researchers observe disproportional distributions in the respondents' demographic attributes. Accordingly, survey participants are largely representative of the general Norwegian population with respect to age, sex, geography, and level of education.

The survey did not provide any primer text on any of the topics the questions addressed. We asked respondents about familiarity with *restoration of nature*. We substituted *restoration of nature* for *ecological restoration* because the Norwegian word for *ecological*, like its English counterpart, has an imprecise meaning in the popular vernacular and is often misused. We then asked what respondents associated with *restoration of nature* by presenting five statements representing interpretations of the concept (Table 1), pertaining to either ecocentric or anthropocentric motives. Respondents indicated the degree to which they agreed with the statements on a 5-point Likert scale ("Completely disagree," "Disagree," "Neither agree nor disagree," "Agree," or "Completely agree," with "Do not know" as an alternative option).

The survey also explored Norwegian public views on a number of environmental issues by asking participants to indicate their agreement with a list of statements pertaining to climate change, pollution, loss of biodiversity, and so forth, using a 5-point Likert scale ranging from 1 = "Completely disagree" to 5 = "Completely agree." From this list, we identified three statements with relevance to the arguments for and against employing ecological restoration in a Norwegian landscape management context:

- Forest regrowth in cultural landscapes is a serious threat to Norwegian nature.
- Evidence of human presence in nature makes for a positive nature experience.
- There is more than enough undeveloped nature in Norway.

The first statement addresses the public debate about how decreases in livestock grazing activity is leading to natural forest regeneration and loss of the biodiversity that depends on open grassland habitats. We reasoned that measures of agreement with these statements would reflect participants' environmental attitudes and the associated values.

The survey explored the Norwegian public's attitudes regarding landscape changes by asking respondents to rate how desirable they would view a moderate increase in five broadly defined, yet common Norwegian landscape types. These landscape types represented both natural landscapes ("natural conifer forests (largely unaffected by forestry)", "unregulated waterways," and "undeveloped areas above tree line"), and managed production landscapes ("planted forests for timber production", and "agricultural lands"). While the survey format did not permit use of photographs in connection with these questions, we do not view this as problematic. We were wary of potentially influencing respondents' attitudes toward these broad, general categories of landscapes by displaying images that might not be representative of typical examples of each category respondents would likely

Table 1. Mean and standard deviations for survey participants' level of agreement with five potential interpretations of ecological restoration, and factor analysis of their responses using principal component analysis of ($n = 4{,}007$). Dimension loadings in bold have absolute values > 0.6.

			Loadings		
Restoration of Nature …	*Underlying Value (Baker & Eckerberg 2016)*	$\overline{X} \pm SD$	*Dimension 1: Enhance Naturalness*	*Dimension 2: Human Benefit*	*Communality*
deals with returning damaged nature back to its original condition	Historical fidelity	4.16 ± 0.97	**0.763**	0.096	0.592
is an attempt to repair or reestablish important functions in nature.	Ecocentric	4.24 ± 0.93	**0.731**	0.189	0.571
is about removing traces of human activity or presence	Nostalgic	3.80 ± 1.17	**0.620**	0.336	0.497
is about measures intended to make the landscape attractive	Utilitarian	3.19 ± 1.32	−0.248	**0.844**	0.774
is an attempt to create smaller natural gems in the areas where people live	Social/economic	3.19 ± 1.37	−0.251	**0.836**	0.763
Eigen value			1.627	1.570	
% of total variance			32.54	31.40	
Total variance expressed by dimensions 1 and 2			63.94%		

encounter. Respondents provided answers along a 5-point Likert scale that ranged from 1 = "Extremely undesirable" to 5 = "Extremely desirable."

Data Analysis

We used demographic and socioeconomic attributes to group participants according to age (15–29, 30–44, 45–59, and 60+ years), gender, education level (basic level, secondary school/gymnasium, trade school, university [bachelors], and advanced university degrees), and place of residence (the Oslo capital with its surrounding county, eastern interior, southern coast, western coast, mid-Norway, and northern Norway). We treated respondents' categorical answers to questions of familiarity and level of agreement (i.e. Likert scale scores) as continuous variables to compare mean scores among groups defined by demographic and socioeconomic factors. We used a general linear model to analyze how age, gender, place of residence, level of education, and all possible interactions might explain variation in familiarity with restoration, interpretations of restoration, attitudes toward future increases in landscape types, and responses to questions about environmental issues with general relevance for restoration. We used factor analyses with principal component analysis to explore both variation of respondents' agreement with five potential interpretations of restoration and variation among attitudes toward future increases in landscape types. We used linear regression to test for relationships between perceptions of restoration and respondents' views regarding both landscape management issues and attitudes toward future increases in landscape types, treating the Likert-scale answers as a continuous variable ranging from 1 to 5. We used Tukey's honestly significant difference to test for differences among groups defined by sociodemographic variables. We used IBM SPSS version 22 for statistical tests, and the data met all appropriate assumptions for the tests conducted.

Results

Self-Reported Familiarity of Ecosystem Restoration

Survey participants generally perceived their own familiarity of ecosystem restoration as quite limited, with 74% of respondents characterizing their understanding of restoration as either "poor" (16%) or "fairly poor" (58%), with far fewer reporting their understanding as either "fairly good" (20%) or "good" (5%). Self-reported understanding of restoration was higher among men than women ($F_{[1,3681]} = 23.42$, $p < 0.0001$), increased with age ($F_{[3,3681]} = 23.86$, $p < 0.0001$) and significantly lower in the Oslo and surrounding area than in mid-Norway ($F_{[5,3681]} = 3.31$, $p = 0.006$). No other factors or interactions were significant at $\alpha = 0.05$.

Perceptions of Ecosystem Restoration's Purpose

Respondents expressed greatest agreement with the statement that the purpose of restoration is to repair or resurrect ecosystem function, and the lowest agreement with two statements concerning either aesthetics or proximity (Table 1). Factor analysis identified an *enhancing naturalness* dimension (ecological function, return to original condition, removing traces of human presence) and a *human benefit* dimension (attractiveness, create gems where people live) for restoration that together explained 64% of the variance for the entire set of statements with low correlation ($r = 0.00$; Table 1). Overall, participants agreed far more with statements that loaded the enhancing naturalness dimension (mean agreement score and 95% confidence interval [CI] = 3.90, 3.88–3.92) than they did with those for the human benefit dimension (mean agreement score and 95% CI = 3.04, 3.01–3.07). Participants' level of agreement with enhancing-naturalness interpretations did not vary by self-reported familiarity with ecological restoration ($F_{[3,3855]} = 0.03$, $p = 0.99$). However, those who stated that they had either "good" or "fairly good" understanding of the topic showed significantly greater agreement with human benefit statements than those who

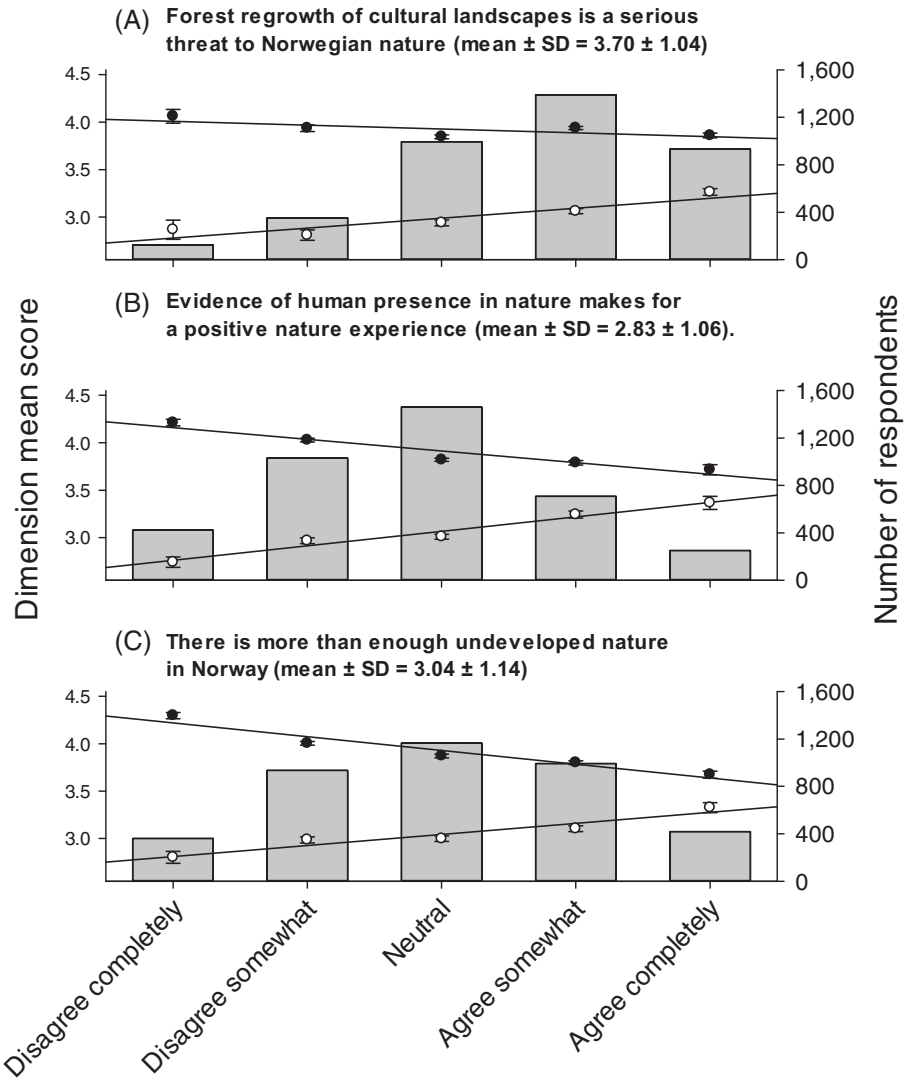

Figure 2. Responses indicating Norwegian survey participants' attitude toward environmental issues relevant to ecological restoration (bars), together with response group mean scores along two factor-analysis-derived dimensions that describe participants' interpretations of the intent of ecological restoration. Dark circles represent scores for enhancing naturalness, and open circles represent scores for human benefit. Error bars are ± SE. Lines represent instances where mean agreement scores for either of these two groups showed a significant linear relationship ($\alpha > 0.05$) with increasing agreement category. (A) Forest regrowth of cultural landscapes is a serious threat to Norwegian nature (mean ± SD = 3.70 ± 1.04); (B) Evidence of human presence in nature makes for a positive nature experience (mean ± SD = 2.83 ± 1.06); (C) There is more than enough undeveloped nature in Norway (mean ± SD = 3.04 ± 1.14).

reported either poor or fairly poor understanding ($F_{[3,3855]} = 11.458$, $p < 0.001$).

The scores reflecting interpretations of ecological restoration's purpose varied among some demographic attributes (Table S1). Enhancing naturalness scores were higher among women ($F_{[1,3739]} = 4.86$, $p = 0.03$), lowest among those over 60 years ($F_{[3,3739]} = 10.87$, $p < 0.001$) and higher in Oslo and its surrounding area than in western Norway ($F_{[5,3739]} = 3.83$, $p = 0.002$). Agreement with human benefit dimension statements declined with increasing education ($F_{[4,3765]} = 23.16$, $p < 0.001$), increased with age ($F_{[3,3765]} = 38.93$, $p < 0.001$), and were greater in the eastern interior, western and northern portions of Norway ($F_{[5,3765]} = 4.09$, $p = 0.001$).

Environmental Attitudes and Perception of Restoration's Purpose

Public perception of the purpose of ecosystem restoration varied according to respondents' attitudes toward environmental management issues (Fig. 2). Respondents showed a general tendency to agree with the statement that natural regrowth of forests in cultural landscape is a serious threat to Norwegian nature (mean ± SD = 3.70 ± 1.04). Agreement with this statement

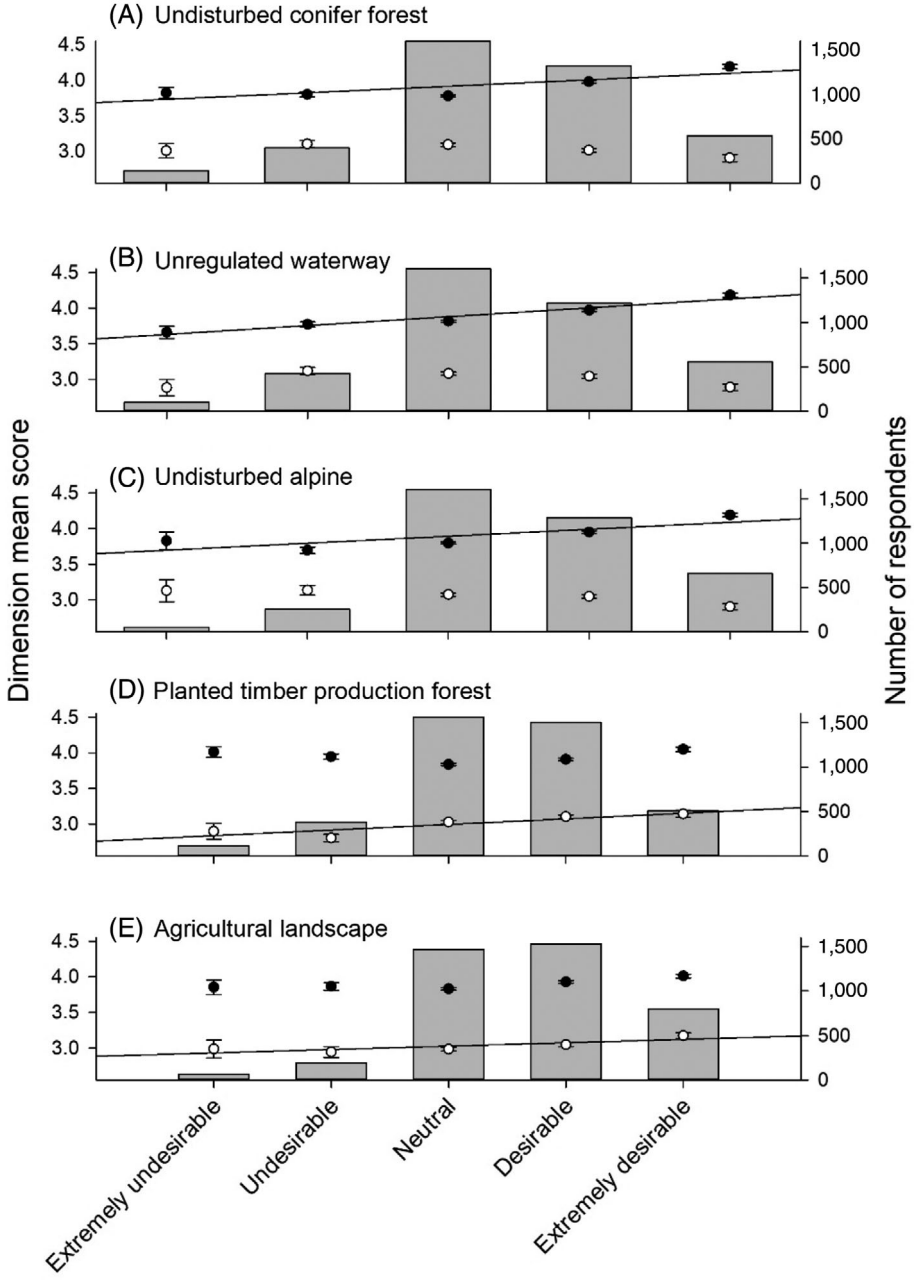

Figure 3. Responses indicating survey participants' attitude toward hypothetical increases in the extent of a range of landscape types (bars), together with response group mean scores along two factor-analysis-derived dimensions that represent participants' interpretations of ecological restoration. Dark circles represent scores for an enhancing naturalness, and open circles represent scores for human benefit. Error bars are ± SE. Lines represent instances where mean desirability scores for either of these two groups showed a significant linear relationship ($\alpha > 0.05$) with increasing desirability category. (A) Undisturbed conifer forest; (B) unregulated waterway; (C) undisturbed alpine; (D) planted timber production forest; (E) agricultural landscape.

increased with age ($F_{[3,3542]} = 43.65$, $p < 0.001$), was greatest among women ($F_{[1,3542]} = 12.24$, $p < 0.001$) and was higher among those attending trade schools than those with advanced university educations ($F_{[4,3542]} = 2.88$, $p < 0.02$). Those who agreed with this statement had lower *enhancing naturalness* scores than those who disagreed ($F_{[4,3717]} = 5.69$, $p < 0.001$; Fig. 2A), with *human benefit* scores also increasing linearly with increasing statement agreement ($F_{[1,3660]} = 70.49$, $p < 0.0001$; Fig. 2A).

Respondents expressed less overall agreement with whether *seeing traces of human activity made for a positive nature experience* (mean ± SD = 2.83 ± 1.06). Agreement that human presence in nature was positive increased with age ($F_{[3,3,691]} = 43.09$, $p < 0.001$), and was lower among those living in Oslo and surrounding areas ($F_{[5,3,691]} = 2.81$, $p < 0.01$). Naturalness dimension scores decreased linearly ($F_{[1,3,731]} = 197.49$, $p < 0.001$) and human benefit dimension

scores increased linearly ($F_{[1,3804]} = 92.51$, $p < 0.001$; Fig. 2B) with increasing agreement that traces of human activity in nature is positive.

Respondents' agreement with whether *Norway had enough undeveloped nature* was also mixed (mean ± SD = 3.06 ± 1.14). Agreement with this statement increased with age ($F_{[3,3691]} = 5.40$, $p = 0.001$) was greatest among men ($F_{[1,3691]} = 7.80$, $p = 0.005$), and higher among trade school and those with general secondary educations than among those with university educations ($F_{[4,3691]} = 6.96$, $p < 0.001$). Increasing agreement to this statement corresponded to linear decreasing in *naturalness* dimension scores ($F_{[1,3731]} = 217.63$, $p < 0.001$) and linear increasing human benefit dimension scores ($F_{[1,3806]} = 52.65$, $p < 0.001$; Fig 2C).

Landscape Preferences

Survey participants were generally supportive of moderate increases in the extent of all listed landscape types (Fig. 3). Preferences for increases in agricultural landscapes were greatest (mean ± SD: 3.69 ± 0.90, where 3 = "neutral" and 4 = "desirable"), followed by undisturbed alpine terrain (3.55 ± 0.94), planted forests for timber production (3.47 ± 0.88), undisturbed spruce/pine forests (3.42 ± 0.96), and unregulated waterways (3.41 ± 0.94). Factor analysis identified two dimensions of landscape types that together explained 65% of the variance with low correlation ($r = 0.00$). Undisturbed conifer forests, unregulated waterways, and undisturbed alpine landscapes comprised the dimension we call "natural." Planted forests and agricultural landscapes comprised the second dimension we call "production."

We found correspondence between landscape type preferences and perceptions of restoration's purpose. Response group mean scores for the *enhancing naturalness* dimension interpretation of ecological restoration increased linearly with increasingly positive attitudes toward moderate increases in all three natural landscape types: conifer forests ($F_{[1,3832]} = 140.37$, $p < 0.001$; Fig. 3A), unregulated waterways ($F_{[1,3903]} = 176.04$, $p < 0.001$; Fig. 3B) and undisturbed alpine landscapes ($F_{[1,3825]} = 191.45$, $p < 0.001$; Fig. 3C), but not in the two human benefit landscape types (Fig. 3D & 3E). Response group mean scores for the human benefit dimension increased linearly with increasingly positive attitudes toward increases in the two production landscapes: planted forests ($F_{[1,3903]} = 18.35$, $p = 0.003$; Fig. 3D) and agricultural landscapes ($F_{[1,3903]} = 18.36$, $p = 0.003$; Fig. 3E). Mean desirability scores for the two production-oriented landscapes that comprised planted timber production forest and agricultural landscapes were higher among respondents in the two older age categories (all respondents over 45 years; $F_{[3,3808]} = 14.71$, $p < 0.001$), but no other sociodemographic factors were significant at $\alpha = 0.05$ (Table S2). *Human benefit* perception scores were highest among those who had the most positive attitudes toward more future agricultural landscape ($F_{[4,4006]} = 48.38$, $p < 0.001$) and production forests ($F_{[4,3999]} = 5.07$, $p = 0.001$). Participants who were most positive to increases in natural landscapes also had lower scores along the human benefit dimension of restoration (conifer forests: $F_{[4,4002]} = 3.99$, $p = 0.003$; unregulated waterways: $F_{[4,3998]} = 4.96$, $p = 0.001$; undeveloped alpine: $F_{[4,3995]} = 4.05$, $p = 0.003$).

Discussion

Public Understanding and Interpretation of Restoration

Participants in our survey generally rated their own familiarity with restoration as either limited or poor. This is hardly surprising, as ecological restoration activity in Norway has been limited within all habitat types (Hagen et al. 2013) and has given the Norwegian public relatively few opportunities for any direct exposure to actual restoration projects. Some projects have been implemented in recent years, including restoring a 165 km^2 military firing range to a national park. This project has received considerable media attention from when it began in 2009 up to its formal completion this year (Hagen et al. 2013; Aasetre et al. 2021). This may explain the greater familiarity with restoration among respondents from this region.

Restore Nature or Restore Ecosystem Services?

With overall low familiarity with ecological restoration, most respondents' answers likely reflect their primarily intuitive understanding that equates restoration with returning nature to an original condition and naturalness. Higgs (1997, 2003) suggests this interpretation can be formed in part by cultural norms. We must also recognize the possibility that the Norwegian phrasing we used (which translates to "restoring of nature") may have been suggestive. Participants indicated far greater agreement with interpretations of restoration as intended to repair ecosystem functions than with restoration to enhance aesthetic quality. This suggests both that the majority of respondents viewed ecological function and aesthetics as two separate attributes of landscapes (Gobster et al. 2007), and that many of them viewed restoration as an activity that prioritizes function over aesthetics (Higgs 1997; van Marwijk et al. 2012; Hallett et al. 2013). Nonetheless, we did find a minority (13%) who either agreed or strongly agreed with statements describing ecological restoration as an activity that is aimed at improving aesthetics and other human benefits, and those who reported greater familiarity with restoration had greater agreement with human benefit dimension statements than those who were less familiar with restoration. What constitutes an attractive landscape varies highly among both individuals and landscape type (Bourassa 1991). For some, increasing a landscape's naturalness can make the landscape more attractive (Purcell & Lamb 1998; Junker & Buchecker 2008), whereas others might view increasing naturalness as unorderly or devoid of care (Nassauer 1997; Nassauer 2011). Respondents who expressed greater agreement with human dimension statements could associate naturalness with aesthetically pleasing landscapes, or they viewed the purpose of restoration as a means of enhancing provision of ecosystem services.

Sociodemographic attributes explained some of the variation in respondents' perception of restoration's intended goals.

Enhancing naturalness dimension scores were generally higher among women, younger age groups, those with more education, and those living in more urban areas. This generalization is consistent with many other studies that explore environmental concern, behaviors, and values in different cultural contexts (for meta-analyses, see Hines et al. 1987; Bamberg & Moser 2007; Gifford & Nilsson 2014). While our results are consistent with these general trends, differences between our group means also were often quite small (<0.1 on a 5-point scale), and statistical significance was likely a result of the large sample size. Our results generally reflect a relatively high degree of homogeneity within the Norwegian public regarding their perceptions of ecosystem restoration.

Landscape Preferences

The public's attitudes toward landscape management were generally balanced between an interest in preserving historically developed cultural landscapes and an interest in protecting or promoting natural landscapes devoid of traces of human activity. We found a general affinity for undeveloped landscape types and a broad appreciation of a natural or wilderness aesthetic, particularly among both younger Norwegians and those living in and nearby the capital city of Oslo where the visual contrast between urban development and areas with natural vegetation is greater. While the majority of Norwegians evidently prefers undeveloped landscapes for their nature experiences, fewer are convinced there is a need for more undeveloped landscapes than those presently existing. While this may seem paradoxical, it is worth noting that Norway has a far higher proportion of undeveloped land than that of its European neighbors. Wilderness-like areas (>5 km straight line from infrastructure development) comprise approximately 12% of Norway's land area, compared with only 1% for all of Europe (Kuiters et al. 2013; Norwegian Environment Agency 2015).

The fact that a large number of respondents viewed natural forest regeneration as a threat to nature suggests that much of the Norwegian public aligns more closely with a "heritage oriented" conservation concept that aims to preserve historically developed cultural landscapes (Körner 2005; Soliva & Hunziker 2009). Beginning around 1950, increased mechanization and specialization in agriculture contributed to a steady decrease in the extent of grasslands and cultural landscapes in both Norway (Staaland et al. 1998) and large parts of Europe. For many, and particularly among older individuals, further loss of open grazing-dominated grasslands to naturally regenerating forests represents a loss of iconic landscapes that have close ties to national identity (Kuiper & Bryn 2013). Management of traditional cultural landscapes has more recently become an issue of international focus, and the restoration of species and habitats in these landscape gets further highlighted through the Aichi targets and the EU biodiversity strategy. This can also explain why respondents who reported greater familiarity with restoration had greater agreement with human benefit statements: these individuals may equate ecological restoration with active management and maintenance of aesthetically pleasing grasslands and other cultural landscapes that provide habitat to an important subset of Norway's threatened species (Kålås et al. 2010).

Our survey did not reveal any conspicuous variation in landscape preferences. Older age groups in our study expressed greater interest in the cultural landscapes (agricultural and production forests), which is consistent with several similar studies in Norway (Strumse 1996), Switzerland (Soliva et al. 2010), and the Netherlands (van den Berg et al. 1998; Van den Berg & Koole 2006). Van den Berg and Koole (2006) posit that this is because (1) older generations' greater physical and psychological vulnerability makes them feel less comfortable in areas without human infrastructure, and (2) there are generational differences in culture and upbringing. This difference may also be a form of nostalgia for the familiar landscapes of the older generations' youth (Soliva et al. 2010), and greater appreciation for history and way of living that often seems to be lost (Naveh 1998). Younger age groups' comparatively stronger preferences for natural landscapes can stem from these groups' greater awareness of threatened species and value of preserving the biodiversity found in natural landscapes (Gifford & Nilsson 2014), and suggest potential for even greater public support for natural landscapes in the decades to come.

Restoration Objectives

We found that perception of restoration to some degree reflected what people might want restoration to accomplish. Individuals who like to see an increase in natural landscapes view the purpose of restoration as more ecocentric, while those who express greater preferences for cultural landscapes view restoration as more utilitarian (sensu Swart et al. 2001; Soliva et al., 2010). An ecocentric and process-oriented perception of restoration (enhance naturalness dimension) was positively correlated with positive attitudes about natural (i.e. undeveloped) landscapes. Indications of a trend for human benefit perceptions of restoration seem to be higher for those who had most positive attitudes about increases in production-oriented landscape types.

Previous studies have documented the relationship between individuals' values regarding nature and conservation and their preferences for landscape types (Kaltenborn & Bjerke 2002; Soliva & Hunziker 2009). There is evidence of a high degree of ecocentrism in Norway, with 83% of 965 individuals saying they "agreed" or "strongly agreed" that all ecosystems have a right to exist (Grendstad & Wollebaek 1998). Yet in the case of our study, this ecocentric attitude did not correspond with either a comparably stronger population-wide preference for natural landscapes over cultural landscapes or a majority who believe that Norway needs more undeveloped landscapes than it presently has. This could reflect a general level of satisfaction with the present extent of natural landscapes—which, as noted earlier, is high relative to other European countries.

Policy and Management Implications

Data from this and similar studies are useful for planning future restoration activities through informing planners, land

managers, and ecological restoration practitioners in two important ways. First, restoration project coordinators can identify how to tailor communication with stakeholders to address particular concerns or gaps in understanding regarding project objectives, scenarios, costs, impacts, and benefits (Matzek & Wilson 2021). Second, it can help identify habitat types and project categories that might be likely to enjoy widespread public support and minimized resistance. Social acceptability is particularly important because most restoration projects require public resources to fund substantial labor and capital investments, and because ecological restoration must compete for priority with both other worthy environmental projects and social programs that may have more obvious links to human health and well-being (Hull & Gobster 2000). For example, public interest in using natural and semi-natural areas for recreation activities continues to grow (Pröbstl et al. 2010), and restoration efforts that are perceived to diminish the attractiveness or recreational potential of natural areas can encounter considerable resistance from user groups (Buijs et al. 2011). In many cases, the sociocultural obstacles to implementing restoration projects can be even more difficult to overcome than the biophysical challenges (Holl et al. 2007).

The Norwegian public primarily views restoration as a means to achieve natural, or perhaps even wilderness-like, characteristics in ecosystems. Restoration of degraded systems that does not intend to return a landscape to its natural state may not be intuitively recognized as ecological restoration and might require different outreach/public participation approaches. We found no evidence that either natural or production-oriented landscape categories are dramatically more or less popular among groups defined by geographic or other sociodemographic factors. Accordingly, we found no compelling reasons for prioritizing potential restoration projects of a given landscape type based on their inherent local desirability.

The evidence of similar preferences for both natural and production-oriented landscapes indicates a potential for either acceptance or even support for employing ecological restoration to achieve a wide range of management goals: including rehabilitation of disaster areas, preservation of threatened species, and securing continued supply of specific ecosystem services (Benayas et al. 2009; Comín 2010; Bullock et al. 2011). We see that respondents who claimed to have more familiarity with restoration tended to have greater agreement with human benefit motivations. While self-reported understanding of concepts should be treated with caution, one interpretation of this result is that individuals who had greater familiarity with restoration were also more aware of its broader benefits for both biodiversity and the services ecosystems provide to humans—which include improving landscapes' aesthetic appeal.

Public support for any given restoration project is bound to be heavily dependent on conditions that are specific to that project. At this point, ecological restoration is still a novel part of landscape management—both in Norway and many other countries in the Convention on Biological Diversity who have pledged to use ecological restoration to slow and ultimately halt the rate of biodiversity loss. As we enter the UN's decade on restoration, we can and should expect that greater exposure to restoration projects in the coming years will increase public familiarity with a wide range of restoration objectives and methodology. Restoration practitioners, advocates, and policymakers have a unique opportunity to help shape public support for restoration by aligning project objectives with stakeholders' values, and communicating the positive effects that restoration has on human benefits and landscape multifunctionality (Hallett et al. 2013; Martin & Lyons 2018; Matzek & Wilson 2021). In addition to providing the opportunity enhance public support through greater familiarity, a greater prominence of new restoration projects might also reveal greater regional variation in public preferences for restoration projects' outcomes. Monitoring and assessing how local public perceptions evolve will continue to be an important part of tailoring restoration activities to meet societal expectations as ecological restoration assumes its more prominent role in land management policy.

Acknowledgments

This research was funded by the Research Council of Norway (NFR project number 208434) and the Norwegian Institute for Nature Research.

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Supporting Information

The following information may be found in the online version of this article:

Table S1. GLM describing variation in mean scores for two dimensions of a factor analysis.

Table S2. GLM comparing mean scores along two dimensions from a factor analysis.

Coordinating Editor: Matthias Gross

Received: 21 September, 2021; First decision: 2 November, 2021; Revised: 26 November, 2021; Accepted: 27 November, 2021