Revised manuscript (JNC-D-15-00239R1)submitted for publication considerationin ***Journal for Nature Conservation***

Cross-cultural values and management preferences in protected areas of Norway and Poland

[Word count: Approximately 7,500]

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Acknowledgements

This work was supported by funding from the Polish-Norwegian Research Programme operated by the National Centre for Research and Development under the Norwegian Financial Mechanism 2013-2016 in the frame of Project Contract No POL-NOR/196105/2/2013.

Cross-cultural values and management preferences in protected areas of Norway and Poland

Abstract

Protected areas provide importantecosystem servicesglobally but few studies have examined how cultural differencesinfluencethe distribution of cultural ecosystem values and management preferences.Weusedinternet-basedpublic participation GIS (PPGIS) in the countries of Norway and Poland to identify ecosystem values and management preferences inprotected areasheld by regional residentsand site users.We found significant differences in the type and quantity of ecosystem values with Norwegians mapping more values relating touseof resources (e.g., hunting/fishing, gathering) and Polish respondentsmapping moreenvironmental values such as scenery, biological diversity, and water quality. With respect to management preferences, Norwegiansidentified more preferences for resource utilization while Polish respondents identified more preferences for conservation.Norwegian respondents were more satisfied with protected area management and local participation which can be explained by historical, legal, and cultural differences between the two countries. For Norway, biodiversity conservation in protected areas will continue to be guided by sustainable use of protected areas, rather than strict nature protection, with management favoringlocal board control and active public participation.For Poland, change in protected area management to enhance biodiversity conservation is less certain, driven by national environmental values that conflict with local values and preferences, continuing distrust in government, and low levels of civic participation. Differential efficacyin PPGIS methods—Norwaywith greater participation from household samplingandPolandwith greater response using social media—suggest different strategieswill be required foreffective public engagement in protected area planning and management.

Keywords:cross-cultural; ecosystem values; PPGIS; protected areas; conservation; public participation

1. Introduction

A primary objective of cross-cultural research is to move beyond simple description of social phenomena to identify patterns across geographic contexts and human populations. Cross-cultural comparisons can vary across four dimensions of geographic scope, sample size, primary or secondary data collection, and time period (Ember, 2009). The most basic assumption of cross-cultural research is thatpatterns in incidence, distribution, or causes can be identified. Cross-national comparisons, a subset of cross-cultural research, are narrower in scope than cross-cultural studies, but can be valuable in understanding how particular global trends and ideas,such as the designation of protected areas, are implemented and managed in different countries. While cross-national studies generally use secondary data for comparison, this study used primary data collected from spatially-explicit, public participation GIS (PPGIS) methodsthat identify ecosystem values and management preferences associated with protected areas intwo economically, historically, politically, and geographically contrasting European countries — Norway and Poland. The purpose of this research was to identify cultural similarities and differences in place-based ecosystem values and management preferences for protected areas that can influence conservation and development outcomes and public acceptance of protected area governance systems within the two countries.

Protected areas comprise nearly 15% of world's land area (WDPA, 2014) and provide global benefits for ecosystem services including the protection of biological diversity (e.g., Bruner et al., 2001; Naughton-Treves et al., 2005), reducing the impacts of climate change (Dudley et al., 2010), and providingsignificant economic benefits (Balmford et al., 2002).However, there is significant variability in the management effectiveness of protected areas globally (Leverington et al., 2010; Schindler et al., 2011) which is driven, in part, by the social and political context for protected area designation and management within different countries.The extent to which local and regional residents accept the designation and management of protected areas is a key element of management effectiveness and may be influenced by the governance structure implemented for managing the protected areas, including the degree of local autonomy and participation in management.

Social values within a country may influence support for protected areas and conservation. Cross-national surveys such as the World Values Survey (WVS), European Social

Survey (ESS), and the Eurobarometer providea general frame for this comparative study between Poland and Norway. Four types of information collected in cross-national surveys appearrelevant to this study of parks and protected areas: (1) general concern for nature and the environment, (2) willingness to prioritize environmental protection over economic growth, (3) attitudes toward biodiversity,and (4)increasing the areas for nature protection. The degree of concern for the environment varies between countries and within countries (Franzen and Meyer, 2010), with early 1990's cross-national comparisons in WVS indicating that protestant European countries, such as Norway, express stronger support for environmental protection, as evidenced by willingness to pay, than Eastern European countries such as Poland (Inglehart, 1995). More recent waves of the WVS completed in Norway (2007) and Poland (2012) asked about the importance of caring for nature. Poles more strongly identified with these values than Norwegians (69.5% versus 56.3%)[1] (WVS Waves 5 and 6), a finding consistent with the latest European Social Survey (ESS) conduced in 2012 (ESS Round 6). The ESS asked a similar question about the importance of caring for nature and the environment. The inter-country difference in caring for nature and environment values was even larger (86.9% Poland versus 52.9% Norway) (ESS Round 6, 2012). However, positive values toward the environment are not the same as a commitment to environmental protection when confronted with trade-offs. In the WVS, when asked about environmental protection versus economic growth, 76.3% of Norwegians prioritized environmental protection over economic growth compared to only 37.6% of Polish respondents (WVS Waves 5 and 6).

The 2013 Eurobarometer survey on attitudes toward biodiversity included Poland and the Scandinavian countries of Sweden, Denmark, and Finland (Norway was not included). Polish responses to questions about the seriousness of habitat and diversity loss, the moral responsibility to look after nature, and theseriousness of biological diversity losswithin the respondents' country were very similar to responses from Sweden and Denmark, with greater concern for biodiversity loss than expressed by Finland respondents (Eurobarometer, 2013). In Poland, 91% of respondents agreed that areas in Europe where nature is protected should be increased, a result similar to Sweden (91%), Denmark (83%), and Finland (83%)[2] (Eurobarometer, 2013).

[1]Combined percentages for responses to "Very much like me" and "Like me".
[2] Combined responses to categories "Totally agree" and "Tend to agree".

Western conservation science has evolved from a focus on protectedareas "untouched" by humans to conservation within working landscapes and stronger integration of nature with people (Kareiva&Marvier, 2012; Mace, 2014). In rural landscapes in Europe, conservation has largely revolved around protecting ecosystems shaped by small-scale land use over long time (Plieninger et al., 2006; Hirschnitz-Garbers, M. & Stoll-Kleeman., 2011; Hausner et al., 2015). In the case of Norway and Poland, the designation of protected area has followed different historical and institutional trajectories that can potentially manifest in different expectations regarding their purpose and value.PPGIS can provide the empirical data of the relative importance place-based ecosystem values in different national contexts, which is necessary to understand how cultural dimensions may influence support to protected area management. We first provide a brief overview of the historical, legal, and cultural background of protected areas management in the two countries of Norway and Poland, followed by a brief review of PPGIS methods for assessing ecosystem values and management preferences in protected areas perceived by various groups such as local residents, visitors, and stakeholder groups.

1.1 Protected area management and governance in Norway

Conservation in Norway deviates from other countries bythe weight put on sustainable use of resources rather than wilderness protection, and by the strong local involvement in protected area management (Hovik et al., 2010; Fauchald et al., 2014). Similar to many other countries, protected areas have historically been established on remote, unproductive, and state-owned land, with goals set by the Ministry of the Environment and implemented by state agencies. However, local traditional uses, including hunting, fishing, collection of berries, mushrooms and plants, reindeer husbandry, and livestock grazing have continued as beforein national parks (NOU 2004:28). In 1989, the Nature Conservation Act was amended so that public participation would follow the same rules as the regulations developed for land use planning legislation (Ot. prp. nr. 51 (1987-1988), 1987). Although public hearings, notifications, and consultations with right holders were practiced before this amendment, the formalization of participation was significantly strengthened by a two-step process with both local and national public hearings.Reindeer herders, farmers, landowners, and other right holders were provided with stronger participatory status early in the planning process. The participation rules

containedin the2009 Nature Diversity Act relating to the management of biological, geological, and landscape diversity replaced the old Nature Conservation Act from 1970.

Local community involvement in conservation increased throughout the 1990s through a series of environmental policy reforms, including municipal control over management of forests, wildlife,and small nature reserves (Falleth&Hovik,2009). In 2009,community-based conservation was implemented for large protected areas, and the decision-making authority over clusters of national parks, protected landscapes, and nature reserves were transferred from the county governor to more than 40 local management boards represented mainly by locally elected politicians (Fauchald &Gulbrandsen, 2012). In northern areas with Sami land rights, the Sami Council was guaranteed early involvement in the establishment of protected areas and a place on the local boards. Although rare, nonpolitical organizations are sometimes represented in the local boards, such as the Skjåkbygdealmenning (common property)in Breheimen and the Swedish reindeer herders in ØvreDividalen. In addition, professional advisory committees have been established including local stakeholders such as reindeer herders, landowners, tourism businesses, and recreation interests to provide input to the board (Risvoll et al.,2014).

When fully implemented the community-based conservation reform will provide local control over 75% of the protected areas in Norway. The local boards are responsible for the development of management plans and for permits to conduct different activities within the parks (Fauchald et al., 2014). The decision making by the local boards are, however, limited by the goals and rules negotiated with stakeholders in the establishment of the parks. Therules are more flexible in terms of local sustainable use and traditional outdoor recreation than many other countries.Most protected areas allow local traditional uses such as grazing, hunting, fishing, berry picking, and access by foot or ski, but rules for motorized use, commercial tourism, and cabin development varies among parks(Hausner, 2005). For instance, strict rules for commercial tourism have applied for national parks in our study, Jotunheimen and Saltfjellet, until the ban was removed in a budgetary decision by the Parliament in 2003 (“Fjellteksten”).

1.2 *Protected area management and governance in Poland*

Environmental protection in Poland has a long tradition. Historically, management of protected areas was regulated by the Nature Conservation Act of 1949 (Official Journal No. 25, Item 180). After the national political transition in 1989, protected area management evolved to

reflect global trends, principles, and directions set by the International Union for Conservation of Nature (Makomaska-Juchiewicz et al., 2003).As a result of EU requirements for accession and commitments toimplementEuropean directives, namely Habitats (Council Directive 92/43/EEC) and Birds (Council Directive 2009/147/EC) Directives, a new Nature Conservation Act was enacted in 2004 (NCA, 2004). The law provides for ten legal forms of nature conservation, classified into three categories:protected area types (national parks, nature reserves, landscape parks, areas of protected landscape, Natura 2000 sitesconsisting of Special Protection Areas (SPAs) and the area of Special Areas of Conservation (SACs), forms of protection for natural and cultural objects (nature monuments, documentary sites, ecological sites, nature and landscape complexes), and forms of species protection (plants, animals, fungi). All national parks are included in Natura 2000 which results in the practical overlap of those two forms of protected areas (Radecki, 2006).

Nature conservation governance in Poland hassignificantly evolved over timefrom a hierarchical, centralized, and expert-based system in the communist era (Tickle &Clarke, 2000) when local land management was practically ignored (Lawrence, 2008),toa less top-down approach today.TheEU accessionresulted in the most significant changes by opening-up nature conservation policy-making and forcing attitudinal changes(Stringer &Paavola, 2013; Niedziałkowski et al.,*in press*). Legal obligations set by EU directives strengthened environmental commitments and encouraged considerably wider public participation, e.g., through environmental impact assessments(Hicks, 2004). Public engagement in environmental governance encouraged professionalization, specialisation, and improved co-ordination among state and non-state actors (Apostolopoulou et al., 2014). Over the last two decades there has been a shift from state-domination of governance to a situation where various non-state actors (includinglocal governments) have increasing formal power to influence decision-making in protected areas (Niedziałkowski et al.,*in press*). The degree of non-state actor influence varies by type of protected area. National parks and nature reserves remain dominated by governmental actors, while landscape parks and protected landscapes have shifted towards regional self-government authorities. The European Ecological Network- Natura 2000 - the most recent form of nature conservation in Polanddifferswidely from previous conservation systems both in aims and governance. The main aim of the program is to reconcile environmental protection with reasonable use of natural resources consistent with sustainable development principles

(Grodzińska-Jurczak &Cent, 2011; Grodzińska-Jurczak et al., 2012). Natura 2000 network governance presents a novel challenge for both state and non-state actors in both participation and decision-making processes (Wesselink et al., 2011).

Natura 2000 sites are managed attwo levels: national and regional. Similar to protected areas management in Norway, participation in Natura 2000 was originally planned as a two-step process: negotiation on designation, boundaries, and management plansat the local level before regional and ministry approvals. In practice, local participation in the process in Polandhas been ineffective due to insufficient information provided to communities, local authorities, and nature conservation professionals, resulting in general distrust of the program(Cent et al., 2014).Further, the two-step process does not strictly apply to Natura sites 2000 that overlap with national parks. In these situations, the preparation of management plans still place greater emphasis on specialists' expertise than input from local representatives (Cent et al., 2014).

Despite the obvious changes inprotected area governance in Poland,its actual implementationconfronts many obstacles. Top-down thinking still prevails among policymakers and some nature conservation professionals, few of whom have expertise and willingness to include the general public and local residents into decision-making processes (Blicharska et al., 2011). The cooperation between state and non-state actors is often insufficient, not only for lack of capacity, but as a result of the top-down implementation of EU legislation, especially related to the Natura 2000 network (Pietrzyk-Kaszyńska &Grodzińska-Jurczak, 2015). Other historical barriers to protected area governanceincludelack of trust, exclusion of local communities in decision-making processes, and the lack of specialized non-governmental organizations (Paloniemi et al., 2015). The historical reluctance of local communities towards nature conservation in Poland can be also attributed to conflict over property rights. Before the political transition in1989, protected areadesignation, especially the designation of national parks,includedprivate property expropriation. The current trend is toward reconciling conservation goals with human activities and property rights (e.g.,on Natura 2000 sites), but past historical experiencesare significantlyaffecting the effectiveness of these initiatives (Kamal et al., 2015).

1.3 PPGIS methods for measuring ecosystem values and management preferences

Public participation GIS (PPGIS) and participatory GIS (PGIS)describe methods that generate spatially-explicit information in participatory processes for a variety of applications(Rambaldi et al., 2006; Sieber, 2006; Brown & Kyttä, 2014). PPGIS/PGIS has been increasingly used to identify social and cultural ecosystem values (see Brown &Fagerholm, 2015) for national forests (Clement-Potter, 2006; Beverly et al., 2008; Brown & Reed, 2009), national parks (Brown & Weber, 2012; van Riper et al., 2012), wilderness areas (Brown & Alessa, 2005), regional conservation lands (Brown & Brabyn, 2012), general public lands (Brown et al., 2014a), and urban areas (Tyrväinenet al., 2007; Brown, 2008).The identification of ecosystem values in PPGIS, when combined with spatially-explicit management preferences, provides an opportunity to model the potential for land use conflict (Brown &Raymond, 2014) and differences in stakeholder group preferences (Brown et al., 2015).

PPGIS methods have significant potential to inform future protected area management, but the methods are sensitive to participatory process, sampling approach, and the cultural context in which the methods are employed. For example, volunteer participants in a PPGIS process for national forest planning mapped different types of values and preferences when compared to randomly sampled households (Brown et al., 2014b)whileinternet-based PPGIS methods generated different spatial results from workshop-basedPPGIS methods involving the same sampling communities (Brown et al., 2014c). Researchindicates that PPGIS participants translate their non-spatial values and preferences into behavioral choices when mapping place-specific values and preferred uses (Brown, 2013).To date, there has been no research to examine the potential influence of cultural differences in the empirical mapping of ecosystem values and management preferences for protected area application using PPGIS methods.

1.4 Aim of the study

This study seeks to provide insight into cross-cultural values and management preferences associated with protected areas in the countries of Norway and Poland using the novel methodology of public participation GIS (PPGIS). The study was guided by the following research questions: (1) what ecosystem values and management preferences do Norwegian and Polish residents associate with protected areas, (2) are these values and preferences related to participant characteristics and general opinions about protected area management, (3) how effective areinternet-based PPGIS methods for encouraging participation in protected area

planning and management in the two countries, and (4) what legal, historical, and cultural explanations can account for similarities and differences in the empirical results?

2. Methods

2.1 Study locations

Two protected areas were selected in the alpine areas of northern and southern Norway.In the south, we selectedJotunheimen National Park (NP), one of the most popular national parks in Norway covering an area of 1,150 km². JotunheimenNP has the largest concentration of mountains higher than 2,000 meters in Northern Europe and is a major destination for outdoor recreation activities such as hiking, skiing, and climbing. The national park that also contains significant "state commons"land with local usufruct rights to grazing, hunting, fishing, and associated facilities and tourism income.Jotunheimen NP has a long history of participatory management, withan advisory committee composed of local stakeholdersfor more than 20 years.

In southern Norway, we selected Saltfjellet–Svartisen National Park, one of the largest national parks in Norway at 2,100 km^2. The parkincludes alpine mountains as well as mountain plateaus and forested valleys. SaltfjelletNP is located in the northern Sami land use areas and the Sami parliament is therefore represented in the board.

In Poland, Tatrzański County [*powiat*] in the Małopolska region was selected as the study region (471,62 km^2). Almost half of the region (212 km^2) is protected as Tatra National Park which is also included in the Natura 2000 network (Fig. 3).The park isalso designated as a UNESCO transboundary (Polish-Slovakian) biosphere reserve demonstrating its environmental significance. TheTatra range is the only high-mountain physiographic region in Poland and is subjectto pressure for strict nature protection and preservation of national heritage, as well as human use activities (e.g., skiing, climbing, and mass tourism). The national park is the most visited in Poland,however, the park's core infrastructureis limitedto a ski complex at KasprowyWierch, a few tourist shelters, and a network of marked trails. The park is bounded to the north by the town of Zakopanethat exerts increasing urbanization pressure. The park has acomplicated history of relations between governmental bodies managing the park and residents of the Tatrzański County that favor local uses such as the harvesting of wild products and

transport development. Controlled sheep grazing, with historical and cultural connections to the region, is permitted by authorities within the park boundary.

[Insert Figures 1, 2, 3]

2.2 Data collection and sampling

The research team designed, pre-tested, and implemented internet-based PPGIS websites in Norwegian and Polish language for data collection.[3]There were smalldifferences in the websites based on the country-specific context, but the applications were otherwise identical in structure and content. The websites consisted of an opening screen for participants to either enter or request an access code, followed by an informed consent screen for participation, and then a Google® maps interface where participants could drag and drop digital markers onto a map of the study area. The mapping interface consisted of three "tab" panels. The first tab panel contained 14 ecosystem values, the second panel contained preferences to increase selected activities in the region, and the third panel contained preferences to decrease the same activities located in the second panel (Tab. 1). The list of markers was developed by a joint Norway/Poland research team with the goal of identifying ecosystem values and management preferences common to both countries. Threespecific preferences were included on the Norway website (helicopter access, snowmobile use, boating) that were not included on the Polish website based on their relevance to the study area.

The instructions requested that participants drag and drop the markers onto map locations that are important for the ecosystem values listed and places where the different types of activities should be increased or decreased. The different types of markers and their spatial locations were recorded for each participant in a web server database, along with other information including a timestamp of when the marker was placed, the Google® map view at time of marker placement, and the Google® map zoom level (scale) at which the marker was placed. Participants could place as few or as many markers as they deemed necessary. Following completion of the mapping activity (placing markers), participants were directed to a new screen

[3]The study websites can be accessed and viewed at the following URL locations:
http://www.landscapemap2.org/norwaynorth (North Norway study-- access code 101-0101);
http://www.landscapemap2.org/norwaysouth (South Norway study-- access code 101-0101);
http://www.landscapemap2.org/poland (Poland study-- access code 101-0101).

and provided with text-based survey questions to assessparticipant socio-demographic characteristics, participant reasons for visiting protected areas, frequency of visit/use, and their opinions about protected area management and governance.

The non-spatial survey questions about protected area management were developed by the joint Norway/Poland research team. Some questions asked about protected area management in general to provide directcross-national comparison, while other survey questions were specific to the governance structure found within each country. For example, the Sami Parliament and local park boards are unique aspects of the protected area governance system in Norway. Participants were asked about their level of satisfaction with the current management of protected areas, their level of trust with country-specific organizations and institutions responsible for their management, the organizations and/or institutions that should be responsible for management regardless of the current governance structure, and satisfaction with the participation and consultation process.In our analysis, we compared the responses on survey questions that asked about protected area management in general using statistical analysis appropriate for the level of variable measurement (nominal or interval).

[Insert Table 2]

Household sampling was the primary method used to recruit participants in all three study areas with volunteer recruitment through social media implemented as a secondary strategy. In the southern Norway study area, the municipalities of Voss, Sogndal, Luster, Skjåk, Vågå, Aurdal were sampled and 10% of the adult population (>18 years) were randomly drawnfor a potential 3,104 participants. Selected individuals were sent a letter of invitation and a reminder two weeks after the initial invitation. Parallel to household recruitment, regionalstakeholder organizations were contacted either by email or Facebook® to inform them about the study to encourage participation. In total, 274 organizations were contacted.

In northern Norway,households in the municipalities of Bodø, Fauske, Saltdal, Gildeskål, Sørfold and Beiarn were randomly sampled for a potential of 3,054 participants. Similar to southern Norway, a volunteer recruitment strategy was used to contact a total of 216 organizations to inform them of the study and encourage participation.

In the Poland study area, random household sampling was implementedusing addresses within five municipalities (Koscielisko, Zakopane, Poronin and BukowinaTatrzanska Bialy Dunajec) covering the target study area of Tatrzański county (*powiat).* Invitations to participate were sent to 3000 households at the beginning of the study with a follow-up reminder after about 2-3 weeks. The recruitment of volunteer participants was based on the internet pages such as Facebook® and web pages of the Tatra National Park, municipalities, local associations, institutions, and local media sources.Information about study was also broadcast onthe Polish Radio.

2.3Analyses

2.3.1 General participant characteristics

We assessed the representativeness of participants in Norway and Polandwith available census data on the variables of age, gender, education, income, and family structure. We also examined the geographic distribution of participants' domicile based on postcode and their primary reasons for visiting/using protected areas.

2.3.2Association of ecosystem values and management preferences by protected area

The mapped spatial data—ecosystem value and management preference locations—were clipped to the study regions for the purpose of comparing the distribution of mapped attributesby participant characteristics (described below), and then clipped again to the three national park boundaries(Jotunhiemen NP,Saltfjellet–Svartisen NP, and Tatra NP) for the purpose of comparing inter-park distributions. Cross-tabulations were generated to examine the distribution of mapped values and preferences containedwithin each national park. We calculated chi-squared statistics and standardized residualsto determinewhether the number of mapped points differed significantly fromthe number of points that would be expected in each park. Residual analysis provides a way to assess the strength of association between two categorical variables and is often done following a statistically significant chi-square result to determine which pair-wise categorical relationships most contribute to the overall significant association.A standardized residual is calculated by dividing the residual value by the standard error of the residual. Standardized residuals are a normalized score similar to a z score without units and if greater than +2.0, indicate significantly more ecosystem values or management preferences than would

be expected, while standardized residuals less than -2.0 indicate significantly fewer values or preferences than would be expected. Larger absolute values of residuals indicate greater deviation from expected values.

Because a significant proportion of Poland study participants were found to live outside the designated study areaof Tatrzański County, we performed additional chi-square analysis on the Poland spatial datato compare the responses of those participants living inside the study region with those living outside the study. This was not necessary for Norway because the large majority of Norway participants lived within the designated study areas.

2.3.3. Relationships between mapped ecosystem values and participant characteristics

An important feature of PPGIS data collection methods is the ability to examine potential associations between participants' place-based values, expressed through mapping behavior, and their non-spatial characteristics such as their opinions about protected area management and their demographic characteristics. We examined whether there were significant relationships between the number and type of mapped values and management preferences and multiple participant variables. The type of statistical test performed was determined by the level of variable measurement. For example, an independent samples t-test was used to determine whether the number and type of mapped ecosystem values and preferences differed by gender and non-parametric correlation analysis was used to determine whether respondent age was related to the number of markers mapped, after confirming that age distribution was continuous and not unimodal. Thespecific variables examined in these analyses included recruitment (mail vs. social media), reason for park visit/use, frequency of park use, satisfaction with park management, satisfaction with the consultation process, length of residence, age, gender, education, and income.

2.3.4Non-spatial opinions about protected area management

Norwegian and Polish participants were asked a set of general (n=5) and specific (n=5) non-spatial survey questions related to the protected areas management within their countries. The general questions were applicable to protected area management in both countries and asked about level of satisfaction with the current management, level of satisfaction with the participation and consultation process, level of government control over protected management,

the need to include local experience and knowledge in management, and the number of organizations and/or institutions that should be responsible for management. The frequency distributions of responses were tabulated and chi-square statistics were used to compare responses between countries.

3. Results

3.1 Study response and participant demographic profile

In Norway, a total of 440 and 486 participants accessed the South and North study websites respectively, placing one or more markers from November 2014 to January 1, 2015 (Tab. 2). The response profiles for the two study areas were similar. The estimated response rates, after accounting for non-deliverable letters of invitation, was 14 percent in the South and 16.3 percent in the North. Other sources of recruitment, including social media, accounted for about 10% of total participation. A total of 19,134 markers were mapped across both study areas.

[Insert Table 2]

In Poland, the response to the household PPGIS recruitment strategywas low with an estimated response rate of 1.2%. A total of 295 individuals accessed the study website and placed one or more markers, with 87% of these participants coming from social media recruitment efforts. About 23% of participants (n=69) placed only one marker whereas the remainder of participants placed two or more markers. A total of 6,083 markers were mapped in the Poland study.

The large inter-country difference in response usingthe two PPGIS recruitment strategies affected the study participant profile.In Norway, the mean age of participants was 49 years, with more males, higher levels of formal education, and higher self-reported household income than comparable Norwegian census data. About half of the participants were from families with children. We also mapped the geographic distribution of participants by plotting the number of participants by their post code (Fig. 1 & 2). In Norway, study participants were distributed throughout the two study areas in approximate proportion to their geographic sampling.

In Poland, the mean age of participants was 33 years, with more femalesthan males participatingwith significantly higher levels of formal education. The annual household income

and family structure variables are not directly comparable with available national census data in Poland, as they do not align with response categories in the survey question. However, estimates of participation by census income category suggest that the annual household income of participants wassomewhat higher than average national household income (Tab. 2).The higher participation rate of younger individuals in Poland appears to be the result of participant recruitment through social media rather than household sampling. The greater effectiveness of social media recruitment in Poland also had a significant effect on the geographic distribution of study participants. In Norway, all but a few study participants lived within the defined study areas, but in Poland, 73% of participants reported living outside the TatrzańskiCountystudy area,and 54% lived outside the Małopolska region.

Study participants in both countries were provided a similar list of potential reasons for visiting protected areas. In general, the frequency distributions of responses were similar with the most common reasons being to "enjoy nature", to experience "solitude/peace", and to engage in "traditional recreation activities" (Tab. 3). However, there were two categories of reasons that differed between the two countries. The harvesting of resources emerged as an important reason in Norway in both study areas (18% and 14% respectively) but was not important in the Poland study area (2%). The use of cabins by Norwegians in protected areas was also indicated by a higher percentage of respondents (3%) than use of cottages in Poland (less than 1%).

[Insert Table 3]

3.2Association of ecosystem values and management preferences by protected area

The distribution of mapped ecosystem values in the three national parks in Norway and Poland appears in Table 4. The overall chi-square association was significant (X^2=928.5, df=26, $p < .001$) indicating association between certain types of mapped ecosystem values and the specific national park. The residuals forJotunheimen NP (Norway) show that hunting/fishing (4.2), recreation (6.0), and income (4.5) values were significantly over-represented, while biological diversity (-2.6), water quality (-3.5), and social (-4.6) values were under-represented. InSaltfjellen-Svartisen NP (Norway), hunting/fishing (22.6), gathering (8.5), cultural identity (7.0), and naturalness(3.2) were significantly over-represented in the park, while grazing/pasture (-3.6), scenic (-7.5), income (-2.1), water quality (-2.6), social (-6.8), and spiritual (-4.0) values

were under-represented. In Tatra NP (Poland), grazing/pasture (4.0), scenic (6.7), biological diversity (3.4), water quality (4.7), social (8.9), and spiritual (4.3) values were over-represented, while hunting/fishing (-21.9), gathering (-7.6), recreation (-4.5), cultural identify (-5.5) and natural (-2.5) values were under-represented.

Given that a significant proportion of mapped ecosystem values for Tatra NP (Poland) originated from individuals living outside the study area, a separate chi-square analysis was run to compare the ecosystem value distribution of "locals" versus "non-locals". The association was significant (X^2=165.0, *df*=13, p < .001) indicating that some ecosystem values were mapped more or less frequently based on proximity of residence to the national park. Specifically, locals mapped proportionately more grazing/pasture (7.7) and water quality (3.3) values, and significantly fewer scenic (-4.8), social (-3.0), and therapeutic (-2.1) values than non-locals.

[Insert Table 4]

The distribution of mapped management preferences (Tab. 5)also indicate significant association by national park (X^2=735.8, df=34, p < .001), although caution is warranted in the interpretation given that the number of mapped preferences was significantly fewer than mapped values, and 28% of the cells have expected counts less than five. InJotunheimen NP (Norway), there were disproportionately more preferences to *increase* tourism (4.8), industrial/energy development (3.1), logging (4.5), fishing (2.9), and hunting activities (2.1). InSaltfjellen-Svartisen NP (Norway), there were disproportionately more preferences to *increase* motorized use (4.8), predator control (15.1), fishing (7.8), and hunting (5.9), and to *decrease* industrial/energy development (10.5). Participant preferences for predator control in Saltfjellen-Svartisen NP were somewhat polarized with a significant proportion of participants also expressing preferences to *decrease* predator control (2.0).InTatra NP (Poland), mapped preferences exhibited a strong conservation and anti-development orientation. There were significantly fewer preferences in support of industry/energy development (-2.7), logging (-3.6), motorized use (-5.2), predator control (-13.7), fishing (-8.7), and hunting (-6.6), and significantly more preferences to decrease residential development (2.8), tourism development (6.3), logging (10.5), motorized use (4.2), and hunting (2.3). Overall, there was greater participant support to

increase utilization and development of park resources in the Norwegian national parks, and greater participant support in Poland to increase conservation and limit development.

[Insert Table 5]

3.3Non-spatial opinions about protected area management

Study participants in Norway and Poland were provided with questions to express their opinions about the management of protected areas in their respective study regions. There were four significant differences in responses between Norway and Poland (Tab.6). Although a plurality of Poland respondents (47%) was satisfied with the management of protected areas, a larger percentage of Poland respondents (39%) were dissatisfiedcompared with Norwegian respondents (15-16%).Similarly, a plurality of Poland respondents (39%) was satisfied with the participation and consultation process for protected areas, but a largerpercentage of Poland respondents (35%) were dissatisfied compared with Norwegian respondents (14-16%). Poland respondents also expressed greater disagreement (48%) that there are too many organizations and institutions managing protected areas compared to Norwegian respondents (8-10%). And there were significant differences in opinions about the inclusion oflocal experiences and knowledge in protected areas management. Norwegian respondents agreed there needs to be more local knowledge included (79-84%) compared to Poland respondents (36%). Interestingly, Poland respondents living in the study area proximate to the protected area were significantly less supportive of the need to include local knowledge (25%) than those living outside the study area (40%). Respondents in both countries were ambivalent about whether government has too much control over protected area management withmany respondents lacking sufficient information to answer the question or neither agreeing or disagreeing.

[Insert Table 6]

In the country-specific questions about protected area management, Norwegian respondents expressed more satisfaction than dissatisfaction with local boards' management of protected areas, with individuals in the southern Norway study area expressing somewhat more satisfaction (55%) than the northern study area (42%). Norwegians in both study areas agreed

(67-75%) there is a need to strengthen biological knowledge to effectively manage protected areas. In Poland, more respondents expressed dissatisfaction (53%) than satisfaction (38%) with how Tatra National Park was being managed, with a large percentage disagreeing (86%) that more knowledge is needed for effective management. Poland respondents were not sufficiently informed, or otherwise ambivalent, about how the Regional Directorate of Environmental Protection in Kraków manages Natura 2000 sites in the study area.

In summary, there were inter-country differences about the effectiveness of protected areas management. The Norwegian respondents appear somewhat more satisfied with current management of protected areas, but believe management effectiveness could be improved with greater inclusion of local knowledge and experiences, as well as biological knowledge. The Poland respondents were less satisfied with current management of protected areas, but this is not due to lack of sufficient knowledge, but speculatively, current protected area management policies or practices.

3.4Relationships between mapped ecosystem values and participant characteristics

We examined the potential influence of participant variables on the number and type of markers placed by participants. The variables included method of study recruitment (household vs. social media), frequency of visit/use, satisfaction with protected area management, length of residence, and demographic variables (age, gender, education, and income). Statistically significant relationships are reported in Table 7. The method of recruitment had relatively little influence on mapping behavior. One exception was in Poland where mail participants who were residents of the TatrzańskiCounty mapped more pasture/grazing values in the region than respondents living outside the region.

[Insert Table 7]

The frequency of visits/use of protected areas had a relatively strong influence on the number and types of values and preferences mapped by participants, but the effect was country-specific. In Norway, greater use of protected areas was related to stronger values for hunting/ fishing, recreation, scenic, and natural values, and stronger preferences for increased development of cabins and tourism facilities, more predator control, and less snowmobile use. In

Poland, greater use of protected areas was related to stronger cultural identity value, and increased preferences for motorized use and predator control.

The level of satisfaction with protected area management had a relatively strong influence on mapping behavior in Norway, but not in Poland. Overall, the majority of Norwegian respondents were satisfied with protected area management, but those respondents that were less satisfied with management mapped more preferences to increase logging, motorized use, boating, and predator control, while decreasing tourism development.

Of the four demographic variables (age, gender, education, and income), age and gender had the greatest influence on the number and type of mapped values and preferences.In Norway, older respondents hadstrongercultural connection to traditional grazing practices with less interest in tourismincome, and thus opposed uses that potentially conflict with grazing such as industrial development, helicopter, and snowmobile use. In Poland, the interpretation of significant correlations based on respondent age is less obvious and could potentially be an artefact of the PPGIS sampling bias in Poland. A large majority of correlations between respondent ageare marker counts in Poland were negative, suggesting that younger respondents contacted through social mediacould simply be morefamiliar and comfortable with thePPGIS digital technology, and thus more likely to map more of all types of attributes. In Norway, respondent gender had a relatively strong influence on mapped values and preferences. Traditional male roles in Norwegian society were expressed through the mapping of more hunting/fishing values, and preferences that favor these activities such as predator control and increased access. In contrast, Norwegian females mapped more scenic and therapeutic values than males.The influence of gender on mapping behavior in Poland was not significant.

4. Discussion

The challenge for comparative, cross-cultural research forprotected areasis providing accurateand meaningful attribution of resultsgiven the variability in placesettings, diversity in sampled populations, and thecountry-specificlegal, historical, and cultural antecedent conditions. To provide some degree of research control, we selected protected areas in both countries with similar opportunities for resource use, conservation, recreation, and tourism, and we implemented similar PPGIS data collection and sampling protocols. In theory, this would allow attribution of empirical differences from the cultural context of protected areas in the two

countries.In practice, the differential acceptance of the PPGIS research methods in the two countries adds complexity to interpretation of the results.

Despite the sampling challenges encountered in this study, there were consistencies with previous cross-national comparisons.Similar to the European Social Survey and Eurobarometer survey results about concern for nature and biodiversity, Poland respondents identified strongly with conservation values by mapping scenery, water quality, and biological diversity. However, the value of scenery and biological diversity do not necessarily correspond to wilderness concepts originating in North America. Upland meadows and pastures formed by traditional land uses such as grazinghave created distinctive biological diversity that is emphasized in protected area management in Europe (Oszlányi et al. 2004; Plieninger et. al, 2006; Daugstad et al., 2014; Hausner et al., 2015). In many European protected areas, human activities such as agriculture, forestry, livestock grazing, and hunting, fishing, and gathering activities are considered an integrated part of conservation (see review by Linnell et al., 2015),and conform to the "people and nature" frame for conservation (Mace, 2014).This was evident in the Tatra NP region in Poland with local support for grazing, and in Saltfjellet NP in Norway where hunting, fishing, gathering, and cultural identity were mapped together with naturalness.In Poland, the difference in support for grazing between local and non-local residents suggests that the "people and nature" frame may be less universally accepted than in Norway, at least for iconic protected areas such Tatra NP.

The different levels of satisfaction with protected area management in the two countries reflect the general historical and institutional legacies in Poland and Norway. Scandinavian countries such as Norway are at the upper end with regard to trust in public institutions, while post-communist countries such as Poland rank lowest (Marozzi, 2015). This fits with the broader context of distrust for public institutions in Central and Eastern European (CEE) countries (Mishler& Rose, 2001) and the limited willingness of citizens to participate in decision-making concerning nature conservation (Cent et al., 2014; Paloniemi et al., 2015). Civic participation, interpersonal trust, economic conditions, and perceptions of local and global environmental conditions influence the level of trust in government (Cin, 2012). In Norway, civic participation and recent reforms toward community-based conservation appear to be well received by residents who are generally supportive of local protected areamanagement boards.Our results are consistent with Fauchald et al. (2014) suggesting strong norms of sustainable use are embedded

in Norwegian conservation policies. In contrast, management of protected areas in Poland has traditionally been top-down with centralized authority. TatraNP region residents were less supportive of protected area management, including the use of local knowledge. This may be a result of the long-term negligence of local communities in national park management, resulting in their reluctance to engage in participatory processes. Further, the years of a commonly-accepted, exploitiveattitude toward nature, limited and undemocratic environmental regulation, the lack of widely available information aboutenvironmental conditions, and the lack of biodiversity inventories comprise the political history of countries such as Poland (Turnock, 2001). Poland has required years to alter the approach to nature and society's role in environmental protection (Vanek, 2004).

What are the implications of this study for biodiversity conservation and naturalness in protected areas in Norway and Poland? For Norway, biodiversity conservation in protected areas will continue to support the "people and nature" frame emphasizing sustainablelocal use of protected areas, including hunting, fishing, and grazing, rather than strict nature protection. The devolution of protected area control to local management boards, in combination with the willingness of local residents to participate in planning and management processes, suggests that changes in protected area management is likely to be small and incremental, with local values, preferences, and governance structures favoring the status quo. More radical management to achieve greater naturalness in protected areas such as "rewilding" that include reintroduction of predators would be strongly resisted. Our argument is supported by another cross-national comparison with Sweden which shows that predator conflict is rooted in large scale cultural differences rather than local environmental conflicts (Gangaas et al., 2015). For Poland, changes in protected area management appear more conceivable. The emergence of strong national values toward nature and the environment as evidenced in cross-national studies, the differences in management preferences between local and non-local residents as evidenced in this study, and EU pressure to enhance biodiversity outcomes through systems such as Natura 2000, all point to greater potential conflict over protected area management. Whether this conflictresults in change, for example, to restrict or exclude traditional uses such as grazing, the regulation of nature-based tourism, and the implementation of biodiversity enhancement schemes such as "rewilding", remains to be seen. What appears more certain is thatsocial acceptance of change

by local residents will be hindered bylower levels of trust in government and a lower propensity for civic participation.

4.1 Participation in protected area management using PPGIS

The difference in PPGIS participation rates and response to the recruitment strategies, in part, reflect general historical and cultural factors toward public participation. The Norway participation rates were typical of response rates reported in other PPGIS studies.The PPGIS participation bias toward more highly educated and higher income males was consistent with other reported PPGIS studies in developed countries (Brown &Kyttä, 2014).The males in our study preferred to increase hunting, predator control, energy and industrial development, and preferred more access to protected areas by snowmobiles and helicopters. In contrast, there was ahigher participation rate from youngerfemales in Poland through social media recruitment rather than household sampling. One interpretation is that the younger generation of Polish people appear more open to public participation than previous generations, and to nature conservation in particular. Further, the increased interest in Tatra NP by Polish non-locals shaped the collected PPGIS data, influencing the results toward stronger pro-conservation preferences. The ineffectiveness of PPGIS household recruitment in Poland does not appear unusual. In a recent PPGIS process conducted for an urban park plan in Poznan, Poland, the household response rate was also less than 2%, whilesocial media recruitment was much more effective in obtaining public participation (Jankowski, 2015).

What are the implications of our findings for future public participation and consultation in protected area management in the two countries? Are there different lessonsfor the two countries?Residents were receptive to the use of PPGIS technology in the consultation process for protected areas in Norway. Study participants were more satisfied with current protected area management and the opportunities for consultation, but there were also strong preferences for greater inclusion of local and scientific knowledge in management. PPGIS could be a tool for investigating diverse local values and preferences, but further study should also include the non-local participants to evaluate the national support for the “people and nature” frame in Norwegian protected areas. An emphasis on local participation would likely see continued support for the “people and nature” frame for protected areas such as hunting/fishing, gathering, and grazing, resource uses that are typically more restricted in national parks outside Europe.

In the case of Poland, the PPGIS process was the first in the country implemented for non-urban, protected areas. The limited willingness among local residents to participateusing an internet-based PPGIS process suggests the need to trial other alternatives to obtain meaningful and effective participation for protected area management.Other PPGIS methods are possible such as interviews and community workshops that don't involve digital, internet technology. However, effective participation and engagement in Poland appears less about the participatory mapping methods and technology,and more about building the trust and empowerment required for local residents to invest the time and effort to participate in conservation planning.The EU requirement to develop Natura 2000 management plans in Poland provides an opportunity to implementnew participatory methods for nature conservation, but our results suggest that until there is longer term cultural experience with public participation that provides better communication and increases trust with local residents, the effective application of PPGIS for conservation planning will be limited.

Acknowledgements

The research leading to these results has received funding from the Polish-Norwegian Research Programme operated by the National Centre for Research and Development under the Norwegian Financial Mechanism 2013-2016 in the frame of Project Contract No POL-NOR/196105/2/2013.

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Table 1. Ecosystem values and management preferences with operational definitions.

Ecosystem Values	Operational definition
Hunting/fishing	Areas are important because of hunting and/or fishing.
Pastures/grazing	Areas are important because they are used for haymaking and pastures for reindeer, sheep, cows
Gathering	Areas are important for berries, mushroom or collecting herbs/plants here.
Water quality	Areas are important because they provide clean water.
Biological diversity	Areas are important because they provide a variety of plants, wildlife, and habitat.
Recreation	Areas are important for outdoor recreation activities (e.g., camping, walking, skiing, alpine, snowmobiling, cycling, horse riding etc.)
Scenic areas	Areas are important because they include beautiful nature and/or landscapes.
Culture/identity	Areas are important because of their historical value, or for passing down the stories, myths, knowledge and traditions, and/ or to increase understanding of the way of life of our ancestors.
Income	Areas are important because they provide tourism opportunities, mining, hydroelectric power or other potential sources of income.
Naturalness	Areas are relatively untouched, providing for peace and quiet without too many disturbances.
Social	Areas are important because they provide opportunities for social activities (e.g. associated with fireplaces, picnic tables, ski –or alpine arrangements, shelters, shared cabins, cabin complexes).
Spiritual	Areas are important because they are valuable in their own right or have a deeper meaning; emotionally, spiritually, or religious.
Therapeutic/health	Place are valuable because they make me feel better, either because they provide opportunities for physically activities important for my health and/or they give me peace, harmony and therapy
Special places	Please describe why these places are special to you.
Preferences (increase/decrease)	**Operational definition**
Development	Increase/decrease development of homes or holiday homes in this area.
Tourist facilities	Increase/decrease tourist facilities and accommodation in this area
Industry/energy	Increase/decrease mining (e.g.,minerals, stone, sand, gravel, etc.) or energy development (e.g., windmills, power plants, dams, power lines, etc.) in this area.
Logging	Increase/decrease logging in this area.
Helicopter transport	Increase/decrease access to helicopter transportation of tourists in this area.
Roads/all-terrain vehicles	Increase/decrease access to the area by roads or all-terrain vehicles
Snowmobiles	Increase/decrease the use of snowmobiles in this area (including snowmobile trails and/or extended seasons).
Boating	Increase/decrease access for use of boats in this area.
Grazing	Increase/decreasegrazing in this area (e.g., sheep, reindeer, cows).
Predator control	Increase/decrease in predator control in this area.
Fishing	Increase/decrease access to fishing in this area.
Hunting	Increase/decrease hunting in this area.

Table 2. Participation statistics and respondent characteristicsfor three studies.

Participation Statistics	Norway South	Norway North	Poland
Number of participants (one or more locations mapped)	440	486	295
Number completing post-mapping survey	380	409	178
Number of locations mapped	9,039	10,095	6083
Range of locations mapped (min, max points)	1 to 276	1 to 527	1 to 748
Mean, median of all locations mapped	20.5, 14	21.6, 13	20.6, 6
Mean, median of values and places mapped	14.7, 9	14.9, 9	15.1, 5
Mean, median of preferences mapped	5.8, 1.5	6.3, 1.0	5.5, 0.0
How participants learned of study			
Mail	91%	89%	13%
Other organization/social media	9%	11%	87%
Overall response rate	14.0%	16.3%	N/A

Demographic Statistics							
		Study Participants	Census Data	Study Participants	Census Data	Study Participants	Census Data[b]
Age (mean)		48.7	50.5	49.9	48.2	33.2	41.1
Gender	Male	57%	50%	57%	52%	44%	48%
	Female	43%	50%	43%	48%	56%	52%
Education (highest level completed)							
Primary		3%	27%	6%	33%	1%	21%
Secondary		37%	49%	38%	43%	22%	58%
Higher		60%	24%	56%	24%	77%	21%
Household income (annual)[a]							
Norway	Poland						
0 - 200,000	0 - 2000	9%	7%	6%	8%	16%	
200,000 - 300,000	2000 - 3000	3%	11%	1%	11%	17%	
300,000 - 400,000	3000 - 4000	12%	11%	7%	11%	11%	3,647(mean)
400,000 - 500,000	4000 - 5000	15%	11%	14%	11%	7%	
500,000 - 600,000	5000 - 6000	12%	15%	12%	10%	8%	
More than 600,000	More than 6000	40%	47%	48%	49%	11%	
Not disclosed	Not disclosed	10%	N/A	12%	N/A	28%	
Families with children		50%	41%	45%	40%	30%	N/A

[a]Figures are in Polish Zloty and Norwegian Krone.Census income categories do not align with categories in survey question. Census data was estimated to match survey data.

[b] Poland census figures reported for entire country, Norwayfigures for study area.

Table 3.Primary reasons for visiting/using protected areas.

Norway North		Norway South		Poland	
Reason	Pct.	Reason	Pct.	Reason	Pct.
Enjoy nature	23.4%	Enjoy nature	23.9%	Enjoy nature	28.8%
Harvest resources	17.8%	Traditional outdoor recreation	18.4%	Traditional outdoor recreation	21.4%
Solitude/peace	14.5%	Harvest resources	13.6%	Solitude/peace	19.7%
Traditional outdoor recreation	14.1%	Spend time with family/friends	12.0%	Spend time with family/friends	13.5%
Spend time with family/friends	9.8%	Solitude/peace	11.3%	Camping and/or overnight stays	6.8%
Camping and/or overnight stays	8.9%	Camping and/or overnight stays	7.1%	Modern outdoor recreation	4.6%
Modern outdoor recreation	5.4%	Modern outdoor recreation	6.7%	Harvest resources	2.3%
Have rights to cabin	2.6%	Have rights to cabin	2.7%	Other	1.5%
Motorized recreation	2.4%	Have grazing rights	2.2%	Have rights to cabin	0.8%
Other reason	0.7%	Motorized recreation	1.1%	Have grazing rights	0.6%
Have grazing rights	0.5%	Other reason	1.0%		

Table 4. Association of mapped ecosystem values by national park by (a) all study participants mapping one or more markers in the national park, and (b) domicile location of Poland participants (inside versus outside study area). Overall chi-square association is significant (X^2=928.5, *df*=26, p < .001) with standardized residuals ≤ -2.0 (pink) or ≥ +2.0 (green) indicating significant over/under representation of the ecosystem value. The distribution of mapped ecosystem values forTatras NP (Poland) is significantly associated with location of domicile(X^2=165.0, *df*=13, p < .001).

Ecosystem value		(a) Study Area				(b) Poland Study		
		Jotunheimen n=136	Saltfjellen n=120	Tatras n=231	Total	Live Inside Study Area n=41	Live Outside Study Area n=138	Total
Hunting/fishing	Count	38	147	1	186	0	1	1
	%	7.6%	18.7%	.0%	4.1%	0.0%	0.0%	0.0%
	Residual	4.2	22.6	-21.9		-.5	.3	
Pastures/grazing	Count	16	16	169	201	97	64	161
	%	3.2%	2.0%	5.2%	4.5%	12.2%	3.2%	5.7%
	Residual	-1.4	-3.6	4.0		7.7	-4.8	
Gathering	Count	11	44	29	84	12	15	27
	%	2.2%	5.6%	.9%	1.9%	1.5%	0.7%	1.0%
	Residual	.6	8.5	-7.6		1.6	-1.0	
Recreation	Count	145	154	564	863	149	332	481
	%	29.1%	19.6%	17.5%	19.2%	18.8%	16.4%	17.1%
	Residual	6.0	.4	-4.5		1.2	-.7	
Scenic	Count	109	100	824	1033	133	582	715
	%	21.9%	12.7%	25.6%	22.9%	16.8%	28.8%	25.4%
	Residual	-.6	-7.5	6.7		-4.8	3.0	
Cultural identity	Count	21	75	117	213	38	69	107
	%	4.2%	9.6%	3.6%	4.7%	4.8%	3.4%	3.8%
	Residual	-.6	7.0	-5.5		1.4	-.9	
Income	Count	28	12	77	117	13	61	74
	%	5.6%	1.5%	2.4%	2.6%	1.6%	3.0%	2.6%
	Residual	4.5	-2.1	-1.4		-1.7	1.1	
Biological diversity	Count	21	43	253	317	63	153	216
	%	4.2%	5.5%	7.9%	7.0%	7.9%	7.6%	7.7%
	Residual	-2.6	-1.9	3.4		.3	-.2	
Water quality	Count	28	59	368	455	128	212	340
	%	5.6%	7.5%	11.4%	10.1%	16.1%	10.5%	12.1%
	Residual	-3.5	-2.6	4.7		3.3	-2.1	
Naturalness	Count	44	94	269	407	70	158	228
	%	8.8%	12.0%	8.3%	9.0%	8.8%	7.8%	8.1%
	Residual	-.2	3.2	-2.5		.7	-.4	
Social	Count	9	9	280	298	40	187	227
	%	1.8%	1.1%	8.7%	6.6%	5.0%	9.3%	8.1%
	Residual	-4.6	-6.8	8.9		-3.0	1.9	
Spiritual	Count	9	5	109	123	19	77	96
	%	1.8%	.6%	3.4%	2.7%	2.4%	3.8%	3.4%
	Residual	-1.3	-4.0	4.3		-1.5	1.0	
Therapeutic	Count	8	10	43	61	4	35	39
	%	1.6%	1.3%	1.3%	1.4%	0.5%	1.7%	1.4%

	Residual	.5	-.2	-.2		-2.1	1.3	
Special places	Count	11	17	119	147	70	158	228
	%	2.2%	2.2%	3.7%	3.3%	8.8%	7.8%	8.1%
	Residual	-1.4	-1.9	2.6		.7	-.4	
	Total	498	785	3222	4505	793	2021	2814

Table 5. Association of mapped preferences (increase or decrease use) by national park. Overall association is significant (X^2=735.8, *df*=34, p < .001) with standardized residuals ≤ -2.0 (pink) or ≥ +2.0 (green) indicating significant over/under representation of the preference by park. Note: 15 cells (28%) have expected counts less than 5.

Preference (increase)		National Park				Preference (decrease)	National Park			
		Jotunheimen	Saltfjellen	Tatras	Total		Jotunheimen	Saltfjellen	Tatras	Total
+Residential/cabin development	Count	4	2	11	17	-Residential/cabin development	19	20	132	171
	%	2.8%	.7%	1.2%	1.3%		13.2%	6.9%	14.4%	12.7%
	Residual	1.7	-1.0	-.3			.2	-3.3	2.8	
+Tourism development	Count	16	4	32	52	-Tourism development	8	6	137	151
	%	11.1%	1.4%	3.5%	3.8%		5.6%	2.1%	14.9%	11.2%
	Residual	4.8	-2.4	-1.0			-2.3	-5.5	6.3	
+Industry development	Count	3	2	1	6	-Industry development	14	59	18	91
	%	2.1%	.7%	.1%	.4%		9.7%	20.5%	2.0%	6.7%
	Residual	3.1	.7	-2.7			1.5	10.5	-10.2	
+Logging	Count	4	2	0	6	-Logging	5	2	227	234
	%	2.8%	.7%	0.0%	.4%		3.5%	.7%	24.7%	17.3%
	Residual	4.5	.7	-3.6			-4.6	-8.4	10.5	
+ATV/motorized use	Count	5	15	5	25	-ATV/motorized use	10	17	130	157
	%	3.5%	5.2%	.5%	1.9%		6.9%	5.9%	14.1%	11.6%
	Residual	1.5	4.8	-5.2			-1.9	-3.4	4.2	
+Grazing	Count	12	12	112	136	-Grazing	4	4	11	19
	%	8.3%	4.2%	12.2%	10.1%		2.8%	1.4%	1.2%	1.4%
	Residual	-.7	-3.8	3.8			1.5	.0	-1.0	
+Predatory control	Count	11	74	1	86	-Predatory control	7	21	40	68
	%	7.6%	25.7%	.1%	6.4%		4.9%	7.3%	4.4%	5.0%
	Residual	.7	15.1	-13.7			-.1	2.0	-1.7	
+Fishing	Count	9	26	0	35	-Fishing	5	1	19	25
	%	6.3%	9.0%	0.0%	2.6%		3.5%	.3%	2.1%	1.9%
	Residual	2.9	7.8	-8.7			1.5	-2.1	.9	
+Hunting	Count	5	15	0	20	-Hunting	3	6	43	52
	%	3.5%	5.2%	0.0%	1.5%		2.1%	2.1%	4.7%	3.8%
	Residual	2.1	5.9	-6.6			-1.2	-1.8	2.3	

Table 6. Respondent opinions aboutthe management of protected areas. Statistically significant associations are highlighted in yellow indicating there are differences in the distribution of responses to the question.

General Questions (both countries)	Study Area	Agree	Neither agree or disagree	Disagree	No basis to judge	Significance
In general, I am satisfied with the management of protected areas.	Norway North	55%	18%	16%	11%	X^2=55.1, df=6, p < .001
	Norway South	57%	18%	15%	11%	
	Poland	47%	10%	39%	5%	
There are too many institutions and organizations influencing decisions relating to protected areas.	Norway North	28%	30%	10 %	31%	X^2=171.1, df=6, p < .001
	Norway South	33%	25%	8%	35%	
	Poland	15%	24%	48%	14%	
The management of protected areas should use local experiences and knowledge to a greater extent.	Norway North	79%	11%	5%	5%	X^2=338.0, df=6, p < .001
	Norway South	84%	6%	4%	6%	
	Poland	36%	6%	58%	1%	
The government has too much control over protected area management.	Norway North	35%	20%	24%	21%	X^2=10.0, df=6, p > .05
	Norway South	38%	20%	19%	23%	
	Poland	31%	26%	26%	18%	
I am satisfied with the participation and consultation processes for protected areas.	Norway North	34%	26%	14%	26%	X^2=60.5, df=6, p < .001
	Norway South	27%	29%	16%	27%	
	Poland	39 %	14%	35%	13%	
Specific Questions (Norway)						
I am satisfied with the local boards' management of the protected areas.	Norway North	42%	19%	13%	26%	X^2=22.3, df=3, p < .001
	Norway South	55%	20%	11%	14%	
We need to strengthen biological knowledge to effectively manage protected areas.	Norway North	67%	16%	6%	12%	X^2=6.6, df=3, p > .05
	Norway South	75%	12%	4%	9%	
Specific Questions (Poland)						
I am satisfied with how Tatra National Park manages protected areas.	Poland	38%	6%	53%	3%	
I am satisfied with how the Regional Directorate of Environmental Protection in Kraków manages Natura 2000 sites in the district of Tatra.	Poland	21%	34%	24%	21%	
More knowledge about the Tatras country is needed for effective management.	Poland	9%	3%	86%	3%	

Table 7.Variables that are significantly related ($p \leq 0.05$) to the type and number of ecosystem values and management preferences mapped by study participants in Norway and Poland.

Variable	Country **Norway**	**Poland**	Interpretation
Recruitment method (mail v. social media) (t-test)	Spiritual value (mail > social)	Increase grazing (mail > social)	Recruitment method had relatively little influence on mapping behavior. In Poland, mail participants were residents of study area and support increased grazing.
Frequency of visit (correlation)	Hunting fishing value (positive) Recreation value (positive) Scenic value (positive) Naturalness (positive) Increase development (positive) Increase tourism (positive) Increase predator control (positive) Decrease snowmobile (positive)	Cultural identity (positive) Income (positive) Increase motorized (positive) Increase predator control (positive)	Frequency of visits and use of protected areas influence mapping behavior, but the effect appears country-specific. Only common outcomewasincreased visitation was related to preference for increased predator control.
Satisfaction with protected area management (t-test)	Increase logging (less satisfied) Increase motorized (less satisfied) Increase boating (less satisfied) Increase predator control (less satisfied) Decrease tourism (less satisfied)	No significant relationships	In Norway, less satisfaction with protected area management was positively related to the number of mapped management preferences. In Poland, there was no relationship of satisfaction to number of mapped values and preferences.
Length of residence (correlation)	Scenic value (negative) Social value (negative)	No significant relationships	Length of residence had relatively little influence on mapping behavior.
Age(correlation)	Grazing/pasture value (positive) Income value (negative) Increase industry/energy (negative) Increase helicopter access (negative) Increase snowmobile use (negative)	Grazing pasture value (negative) Recreation value (negative) Cultural identity value (negative) Water quality (negative)	In Norway, older respondents are more likely to have a connection to traditional grazing practices and less likely to favor uses that potentially conflict with grazing, with less interest in tourism income. In Poland, majority of correlations with marker counts were negative suggesting that younger respondents, contacted through social media, more comfortable mapping using digital technology.
Gender (t-test)	Hunt/fish value (+male) Scenic value (+female) Therapeutic value (+female) Increase industry/energy (+male) Increase helicopter access (+male) Increase snowmobile use (+male) Increase predator control (+male) Increase hunting (+male)	Social value (+female)	In Norway, mapped values and preferences reflect traditional male roles in Norwegian societyespecially activities related to hunting/fishing activities and motorized use. Gender influence on mapping behavior not significant in Poland.
Education (t-test) Primary/secondary v. tertiary	Recreation value (+higher) Water quality value (+higher) Increase snowmobile use (+lower)	No significant relationships	Influence of formal education level (on mapping behavior not significant in Poland, small effect in Norway
Income (t-test)	No significant relationships	No significant relationships	There was significant non-disclosure of reported income in both countries. Results unreliable.

Figure 1

Study area in southern Norway showing land tenure and number of study participants by geographic location. Approx. study area size = 15,100 km^2 withJotunheimen NP area = 1,700 km^2.

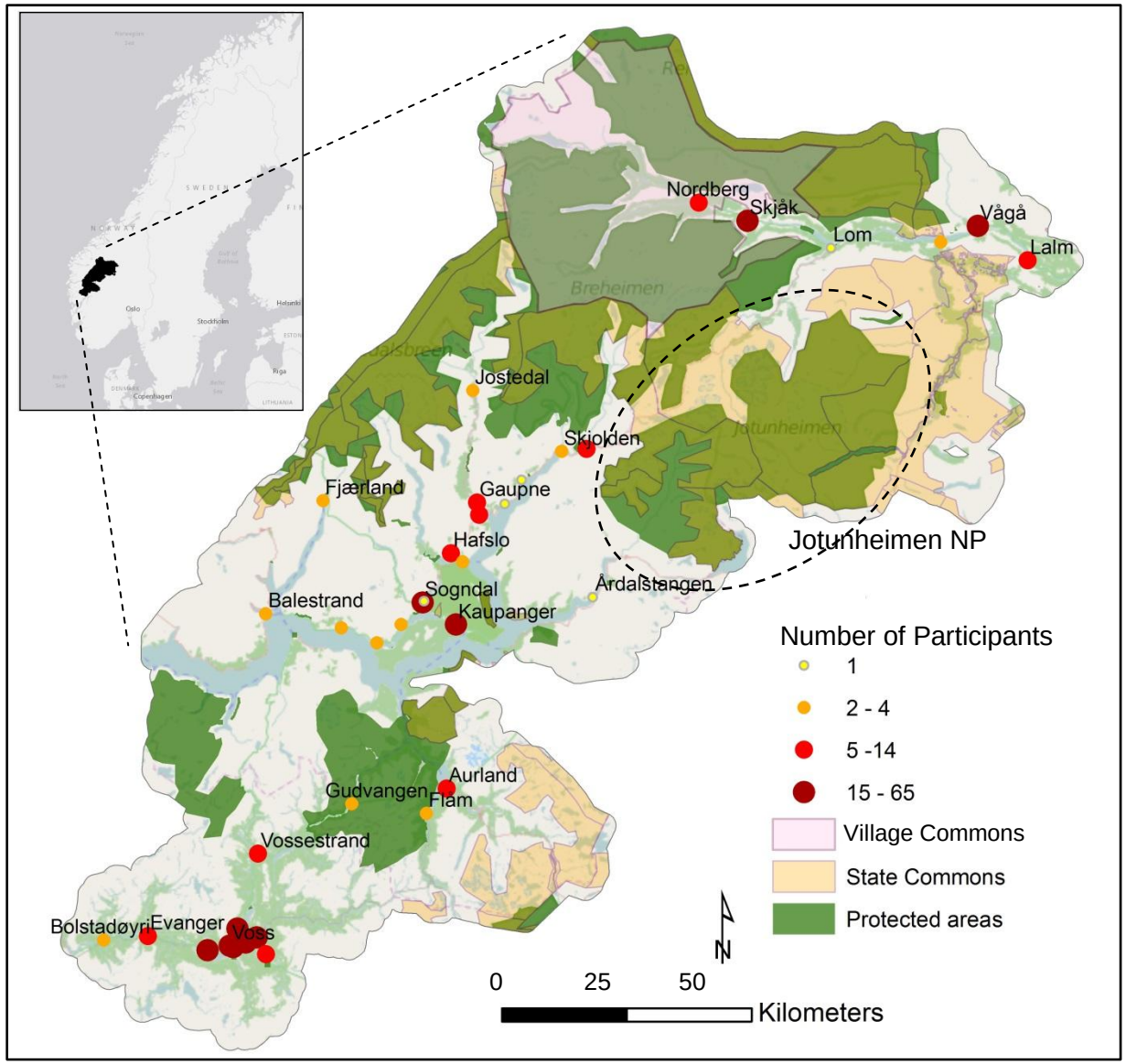

Figure 2

Study area in northern Norway showing number of study participants by geographic location, state lands, and protected areas. Approx. study area size = 13,700 sq km withSaltfjellen NP =1,700 sq km.

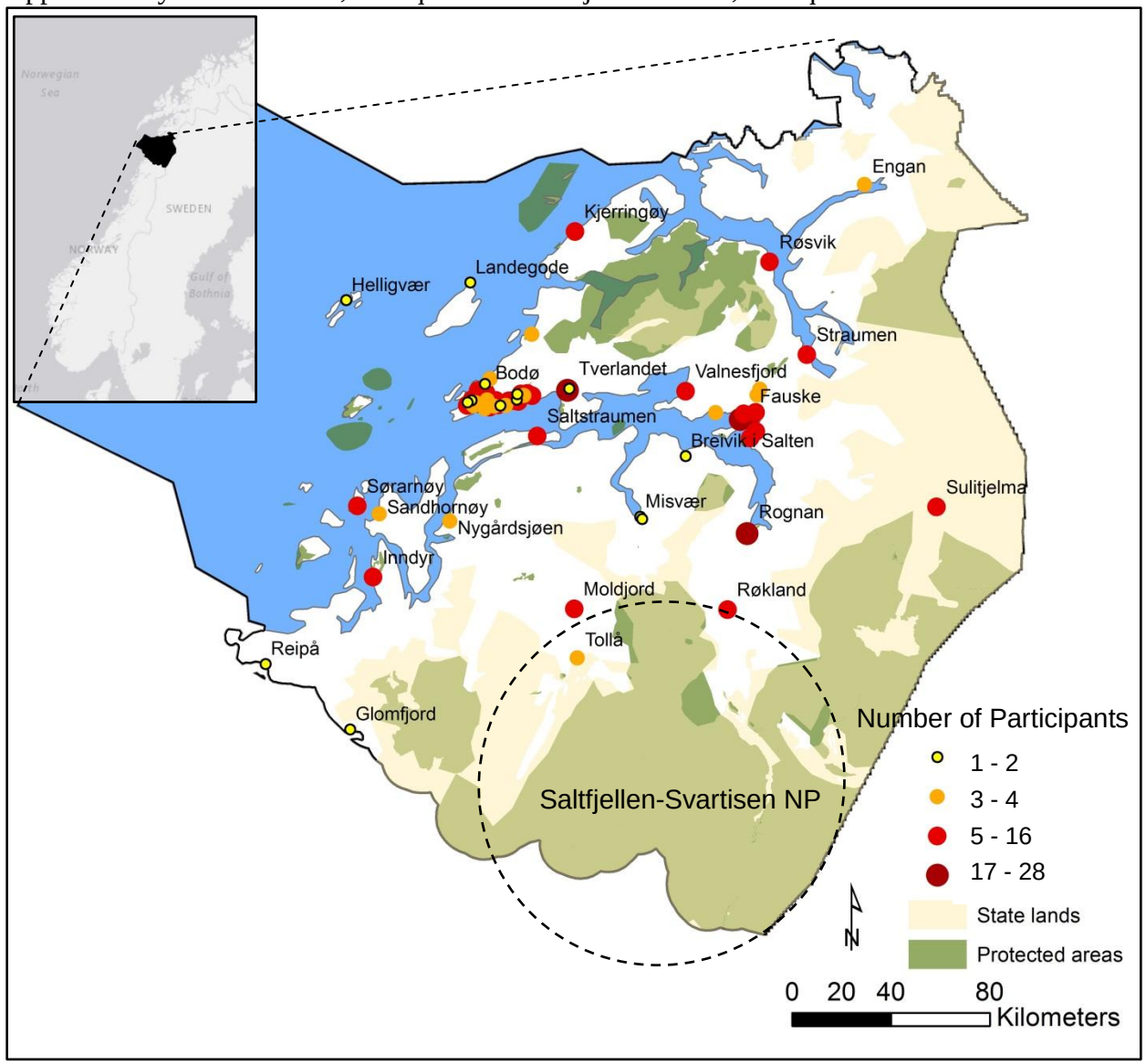

Figure 3

Study area in southern Polandshowing number of study participants by geographic location and protected areas. Inset map shows locations of non-local study participants. Approx. study area = 470 km^2 with Tatras NP area = 212 km^2.