



# Effects of land tenure and protected areas on ecosystem services and land use preferences in Norway



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## ABSTRACT

Prior research has examined the relationship between physical landscapes and ecosystem services, but the distribution of ecosystem services by land tenure and protected areas is less developed. We analyze the spatial distribution of participatory mapped ecosystem values, as indicators of ecosystem services, to determine their relationship with land tenure in southern Norway, a region characterized by private, village, and state commons lands overlaid with designated protected areas managed by local governments. We found land tenure to be a significantly stronger predictor of the distribution of ecosystem values and land use preferences than protected area status. Protected area designations layered on older land tenures exert relatively little influence on how Norwegians perceive ecosystem values and land use preferences. The exception is a few iconic parks located on state commons where participants mapped a higher proportion of biological diversity and undisturbed, natural qualities. Hunting and fishing opportunities were especially important in village commons, whereas social interactions, gathering, and cultural identity clustered near settlements on private lands. The cultural ecosystem values of recreation and scenery were most frequently identified, but were unrelated to both land tenure and protected areas. Cabins, tourism development, and snowmobile use were important land uses to regional residents and most controversial in the commons and protected areas, but the overall potential for land use conflict appears highest on private land. Participants mapped preferences to increase predator control across all tenures reflecting the strong interest in large game hunting and livestock grazing in the region. Overlapping tenures that were in place before the designation of protected areas are important for understanding conservation effectiveness and the potential for land use conflict.

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## 1. Introduction

Ecosystem services describe the contribution and capacity of ecosystems to provide goods and services to satisfy human needs and promote human well-being (De Groot et al., 2010; Burkhard et al., 2012). To date, much research effort has focused on identifying the value of ecosystem functions, goods, and services (De Groot et al., 2002) provided by natural or semi-natural systems (Costanza et al., 2006) for the purpose of integration with landscape planning, management and decision making (De Groot et al., 2010). The spatially explicit mapping or assessment of ecosystem services appears essential for the development of strategies that will ensure their future supply (Martínez-Harms and Balvanera, 2012).

But the scientific underpinning to assess and manage ecosystem services has been limited by a focus on discipline-bound sectors of the full social–ecological system (Carpenter et al., 2009) with greater research emphasis on the ecological and economic components of ecosystem services over the social systems that may enhance or constrain the provision of services.

There is a growing awareness of the importance of institutions for understanding the spatial distribution of ecosystem services. In the recently published conceptual framework of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), institutions take a central role in explaining all aspects of how people and society organize and interact with nature (Díaz et al., 2015). Institutions are defined by IPBES as “all formal and informal interactions among stakeholders and social structures that determine how decisions are taken and implemented, how power is exercised and how responsibilities are distributed” (p. 13). They are perceived as the underlying causes explaining land use and land

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degradation. Protected areas are an example of institutions that aim to protect the supply of global benefits such as biodiversity, but the evidence for the effectiveness of protected areas to supply some ecosystem services is equivocal. For example, sustainable use areas and community-based conservation are, in some cases, more effective in halting deforestation than strict protection (Nelson and Chomitz, 2011; Nolte et al., 2013; Lambin et al., 2014). These results echo decades of research on institutions suggesting that private, public, or common lands alone cannot ensure sustainability over time (Ostrom et al., 2007).

More empirical research on land tenure, defined as the “set of institutions and policies that determine how land and its resulting resources are accessed, who can benefit from these resources, for how long and under what conditions” (Robinson et al., 2014, p. 282), is needed to increase our understanding of how the spatial distribution of ecosystem services may be influenced by land tenure. Institutions influence the supply and distribution of ecosystem services, but they also reflect historical demand for resources. Comparing private, communal, and state land may underestimate the importance of complex land tenure systems with overlapping bundles of historically derived property rights (Holland et al., 2014). Many of these studies try to explain deforestation by land tenure and protected areas, but lack the empirical data to investigate or control for local values and preferences that have evolved in these socio-ecological systems over time. Landscapes shaped by humans over long time periods appear particularly important in the evolution of landscapes in Europe (Netting, 1981; Antrop, 2005; van Gils et al., 2014). Institutions built around shared rights to pastures and other resources traditionally used for subsistence are highly valued today as cultural landscapes (Daugstad et al., 2006a; Soliva and Hunziker, 2009; Rodríguez-Ortega et al., 2014; Plieninger et al., 2015). While pastoral commons in the European lowland was dissolved in the 18th and 19th century, there are still upland agro-pastoral commons in which owners of ancestral farms have a use-share in collectively held land (van Gils et al., 2014). Transhumance is still practiced in some of these agro-pastoral commons, where livestock is moved between the permanent farms and up along altitudinal gradients to summer farms (Daugstad et al., 2014).

In the mountainous region in Norway, land tenure deriving from shared subsistence uses such as grazing, hunting, fishing and gathering has survived since the pre-medieval times. In the last half century, protected areas have been designated that promote different values compared to historical use. In this paper we seek to understand how these land tenure regimes overlaid by protected areas influence the ecosystem values held by local people and the preferences for land uses. Protected areas emphasizing public goods and non-consumptive values could be in conflict with the traditional land tenure systems that have evolved primarily to regulate consumptive uses (Berge, 2006; Kitamura and Clapp, 2013). There has been limited research on the interplay between land tenure and protected areas and their effects on ecosystem values and land use preferences. The context for this investigation is the country of Norway with a historic system of both village and state commons based on use rights that have been overlaid with contemporary protected area designations managed by a local board following governmental reform in 2009 (Fauchald and Gulbrandsen, 2012). We posit that different ecosystem values and land use preferences may be associated with agro-pastoral systems in Norway that have been managed as commons since pre-mediaeval times compared to landscapes that are dominated by smaller, private properties.

### 1.1. Using PPGIS to identify spatially explicit ecosystem services

Public participation GIS (PPGIS) is a term that describes a range of participatory methods and processes that generate spatial

information for urban, regional, and environmental planning applications (see Brown and Kyttä, 2014; Brown, 2005) with increasing use to spatially identify ecosystem values. In their review of PPGIS to identify ecosystem services, Brown and Fagerholm (2015) identified more than 30 empirical studies characterized by case study approaches and methodological pluralism. The mapping of ecosystem services has been operationalized using three typologies—the millennium ecosystem assessment typology (MEA, 2005), a landscape values typology (Brown and Reed, 2000), and a landscape services typology (Fagerholm et al., 2012). The most frequently used typology in PPGIS to identify ecosystem services has been the landscape values typology consisting of 10–13 common values that are adapted to fit the local, regional, or national context of a particular PPGIS study. The landscape values typology is also called the “social values for ecosystem services” typology (Sherrouse et al., 2011) and has been used in more than 15 published PPGIS studies (Brown and Kyttä, 2014). The topology contains cultural ecosystem values such as recreation, aesthetics, history/culture, and spiritual values, but also includes perceived values for provisioning ecosystem services (economic/subsistence value), and supporting/regulating ecosystem services (biological and life sustaining values). For purposes of consistency, we use the term *ecosystem values* to refer to participatory mapped attributes in this study. These ecosystem value locations are indicators of the ecosystem services (“benefits”) received by study participants.

Of particular relevance to this research are PPGIS studies that have examined the spatial distribution of ecosystem values by land use and protected area designation. For example, Brown and Alessa (2005) found that legal “wilderness” areas in Alaska contained disproportionately more ecosystem values associated with indirect and intangible uses such as life-sustaining, spiritual, and intrinsic values while on multiple-use, national forest lands, recreation and aesthetic values were consistently the most frequently mapped values (Brown and Reed, 2009; Beverly et al., 2008; Clement-Potter, 2006). A recent PPGIS study by Brown et al. (2014) examined the spatial distribution of ecosystem values on public lands in Victoria, Australia. The study determined that the general public associated certain classes of public lands with specific types of ecosystem values, e.g., the public disproportionately associated biological values with strict nature preserves, recreation values with community and regional parks, and wilderness values with national parks.

These previous studies, however, were situated in Western countries such as the U.S., Canada, and Australia with reasonably well-defined property rights and governance structure for public lands. This situation is not the case for Norway which has an older land tenure system and decentralized management of protected areas to a local level of governance.

### 1.2. Overview of land tenure system in Norway

The uplands in Norway have functioned as subsistence agroecosystems since 4000–3500 BP (Olsson et al., 2000) and have been perceived as shared pastures since pre-medieval times (Berge, 2006). The village commons that were first described in the old landscape laws from the 9th and 10th century, the *Gulating* and *Frostating*, were formally codified in the “law of the realm” from 1274 (Falkanger, 2009). The usufruct rights allowed farmers shared access to subsistence uses on common land owned by the Crown. The law also allowed farmers to build summer farms and stay there with their livestock throughout the summer. In the 17th century, the King started to sell the land which was bought by private interests or the farms sharing the grazing lands. The remaining land was later designated as state commons in the forestry legislation from 1857 and was distinguished from the village commons (*Bygdeallmenning*; Crown land bought by the village) and village commons (Crown land bought by private owner, but included usufruct rights

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