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Clustering-based typology and analysis of private small-scale forest owners in Slovenia

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ABSTRACT

Small-scale private forest owners (SPFO) have been recognized as a relatively heterogeneous social group; therefore typology and classification have become key to describe their characteristics and differences. Most of Slovenian forest is owned by SPFOs. To understand why these forest estates are relatively poorly managed, the owners' values and objectives were analysed. We conducted a questionnaire-based survey (n=387) and based our typology on three values and four management variables. The typology was constructed automatically, using the k-medoids clustering algorithm. Clustering resulted in two clusters, which were our basis for two types of owners: "engaged" and "detached". We analysed these two types through socio-economic and broader geo-spatial perspectives. We found that multi-objective orientation and high valuation of production function are positively related to active forest management and to the likelihood that the forest will be managed in the future. Conversely, higher value to environmental and social function corresponds to lower management levels. Spatial patterns of owners residencies and forest estates influence managing decisions. Results confirm the importance of spatial factors and owner values and objectives for understanding forest management.

1. Introduction

More than one half of Europe's and two thirds of Slovenian forest is privately owned. Slovenia's 800,000 ha of forest (58% of the territory) are owned by 461,000 individuals which represents a challenge for a nation of only two million (Krč et al., 2015; Malovrh Pezdevšek, 2010; Medved et al., 2010; Schmithüsen et al., 2010). Private forest owners are perceived to play an important role in sustaining forest ecosystems, enhancing rural development and supplying resources to the market (Pulla et al., 2013; Schmithüsen et al., 2010). They have been recognized as a relatively heterogeneous social group with different approaches to forest management (Dhubháin et al., 2007; Ingemarson et al., 2006; Urquhart and Courtney, 2011). Classification or typologies of private forest owners across Europe and North America have been developed to reduce a diverse group of people into smaller and uniform subgroups. They are usually based on assessment of the individual's management behaviour (Broderick et al., 1996; Tuttle et al., 1981), objectives (Hugosson and Ingemarson, 2004; Karppinen et al., 1998; Kline et al., 2000; Kurtz and Lewis, 1981; Lonnstedt, 1997; Marty et al., 1988; Mizaraite and Mizaras, 2005) and forest-related values (Boon et al., 2004; Ficko and Bonina, 2013; Hogl et al., 2005; Karppinen et al., 1998; Richter, 2005). The typologies could practically be used in policy making such as targeted policy approach which takes into account individual subgroup (owner type) (Boon and Meilby, 2007; Dayer et al., 2014; Subjin et al., 2013).

A large body of studies suggests that research on owners characteristics and typology provides meaningful insights when selecting proper instruments to engage the heterogeneous population of owners in forest management. Financial incentives often play a prominent role particularly among production oriented owners and those whose main motivation is to generate financial return from timber management (Dayer et al., 2014; Kilgore and Blinn, 2004; Kilgore et al., 2007). Owners for whom the land is a relatively important part of personal and family identity and who view their forest as a long-term financial investment, would be willing to use assistance programs and other sources of information, which would help them learn about their forest and increase its value (Janota and Broussard, 2008a; Richter and Lewis, 2007; Ross-Davis and Broussard, 2007). Absentee (those that do not reside on their land) and amenity focused owners would be more in favour of conservation policies (Janota and Broussard, 2008a; Kline et al., 2000) and educational, extension and outreach programs

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(Salmon et al., 2006). On the other hand, Dayer et al. (2014) examine the relationship between typologies and policy measures and argue that all instruments may not need to be targeted individually. However they suggest not abandoning the idea of targeting strategies to different types of owners.

1.1. Small-scale private forest owners (SPFOs) in Slovenia

SPFOs as a specific category of owners within private forestry have received increased attention among researchers. Most of privately-owned forest estates are small-scale, although the precise definition of small-scale forest varies from country to country (Niskanen, 2006; Wiersum et al., 2005). A vast majority of Slovenian private forest owners (89%) own estates smaller than 5 ha. These represent more than 40% of total forestland and roughly 25% of the territory of Slovenia (Malovrh Pezdevšek, 2010). The average size of the forest estate is only 2.7 ha per owner and they are very fragmented (although since 2007 Forest Act (Act Amending the Forest Act 2007) prohibits divisions of forest parcels which are smaller than 5 ha). For this reason we focused specifically on owners with forest estate size less than 5 ha. On average, one forest estate contains 2 to 3 spatially dispersed parcels. Furthermore, one third of forest estates have 2 or more owners. The smaller the forest estates are, the greater is the number of co-owners (Medved et al., 2013; Oražem, 2015; Public Forestry Service, 2014).

In Slovenia, privately-owned small-scale estates have predominated since the 1848 land reform and have additionally increased substantially after 1991, due to denationalization, estate inheritance, and old-field succession (Cunder, 1999; Gabrovec and Kladnik, 1997; Medved et al., 2010; Weiss et al., 2012; Žumer, 1976). The annual wood harvest volume in private forests is about two thirds of the allowable cut as determined by forest management plans (Jakša, 2012; Public Forestry Service, 2014). The motivation for management is small and it seems to be correlated with the size of the forest estate (Põllumäe et al., 2014; Poje et al., 2016). Small and fragmented forest land prevents owners from acquiring meaningful economic output from forest (Jakša, 2012; Rametsteiner et al., 2008).

Slovenian forests had been overexploited throughout centuries (Blaznik et al., 1970; Bončina, 2008; Boncina, 2011; Zorn et al., 2015). Due to sustainable forest management (SFM) practice, socio-economic changes (the share of farmers among forest owners decreased, forest owners are less economically dependent on forest resources) and above mentioned old-field succession, the forest area, growing stock and increment have been constantly increasing during the past 50 years (Bončina, 2008). With over 280 m^3 of wood per hectare of forest, Slovenia has one of the fastest growing stocks in Europe (Gale et al., 2011; Kutnar, 2014). From a management (utilitarian) perspective a low annual wood harvest volume is undesirable. Long-standing insufficient timber extraction leads to forest ageing, reducing forest productivity, low timber value (Coulson and Stephen, 2008; Murty et al., 1996) and changes in forest health (e.g. insect outbreaks). Not only profitable management would make owners interested in managing their forests. From the social point of view managed forest is believed to help preventing rural-urban migration and preserving cultural landscape and improves quality of living in the countryside. Managed forests can also provide an abundance of clean air and water, enhanced diversity of wildlife habitat, and improved forest health (for ex. better resilience against bark beetle outbreaks) (Coulson and Stephen, 2008). In urban areas, managed forests provide natural environment for recreation and aesthetics, mitigation of temperature extremes, storm-water management, noise pollution control, an enhancement of local economies, healthy wildlife populations, increased groundwater recharge, and can provide emotional relief from daily urban stresses (Tyrväinen et al., 2003).

1.2. Objective and contributions of this study

SPFOs have been under-represented or excluded from analyses in previous studies, due to their minor significance in timber production (Boon et al., 2004; Ficko and Bonina, 2013; Karppinen et al., 1998; Selter et al., 2009). This paper addresses this gap by focusing specifically on SPFOs in Slovenia. The problem is seen in a lack of management and thus in the question how to reach the SPFOs and how to motivate them. Until now, there was an information gap on the side of policy makers or public forestry service about who these owners are and what their management motivations are. By exploring the characteristics of owners, values related to forest functions, management objectives, residential patterns of owners and spatial distribution of forest estates it also adds a societal and geo-spatial perspectives. We also contribute to the targeted policy approach by suggesting a combination of policy instruments for each type of SPFOs.

This paper aims to identify and describe SPFOs in Slovenia based on various criteria such as owners values and objectives, and to tailor a combination of various policy instruments to improve management in small-scale forests.

1.3. Analytical framework

We used heuristic approach of smart regulation principles as the analytical framework for this study (Van Gossum et al., 2012). We faced different challenges while designing a regulatory framework for improving engagement of SPFOs in forest management. The main challenge was to propose the appropriate mix of policy instruments to target owners with different characteristics. We found smart regulation framework as the appropriate strategy for facing such a challenge as it ensures minimization of coercion and conflicts between private and public stakeholders (Grabosky, 1995). The smart regulation framework could be used as practical guide to design the policy instruments (Gunningham et al., 1999). As suggested by Janota and Broussard (2008b) we classified policy instruments into three groups: regulatory, economic and informational. The choice for which instruments to use was made in accordance to 8 principles of Smart regulation (1. Avoid “perverse” or adverse effects of other (adjoining) policies; 2. Select policy mixes that incorporate a broad range of instruments; 3. Choose policy mixes incorporating a broad range of institutions; 4. Develop or use new policy instruments, when “traditional” instruments fail; 5. Invoke motivational and informative instruments; 6. Prefer less interventionist measures, yet still capable to deliver the identified policy outcome; 7. Use instrument sequencing; 8. Maximize opportunities for win-win outcomes). Our regulatory framework is built in accordance to different types of owners as suggested in Malovrh et al. (2015) and Van Gossum et al. (2009). According to Van Gossum et al. (2012, 2009) such “smartly” formulated regulation should lead into its actual effectiveness.

2. Materials and methods

We focus on SPFOs in Slovenia. The Slovenian landowner registry data were geo-referenced, grouped by owner, and linked with current land-use data. Public owners, owners of ages 14 and younger, owners without or with more than 5 ha of forestland, and owners with missing or incomplete data (31,640) were removed. The remaining 199,561 owners constituted our study population.

We drew a simple random sample of 2012 owners from the study population. For each sampled individual, we recorded total area of owned forestland, the *distance* between location of residence and centroid of forestland area, and *dispersion* of owned forestland areas (average distance from individual parcel centroids to centroid of forestland area).