Forest Ecology and Management 375 (2016) 249–258

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Conservation values of certified-driven voluntary forest set-asides

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ARTICLE INFO

Article history:
Received 23 February 2016
Received in revised form 24 May 2016
Accepted 26 May 2016
Available online 7 June 2016

Keywords:
Biodiversity
Dead wood
Forest certification
Large-diameter trees
Nature reserve
Voluntary set-aside

ABSTRACT

An essential component of many forest certification schemes is that landowners should voluntarily set aside a proportion of their forestland with the main aim of promoting biodiversity. However, the influence on biodiversity of such conservation areas is largely unknown. In this study, we compared the area extent, structural diversity of importance to biodiversity and stand characteristics between voluntary set-asides (VSA[1]) established through certification, formally state-protected nature reserves (R[2]) and managed production forests (PF[3]). We used data from the Swedish National Forest Inventory and focused on forestry company land in boreal Sweden, amounting to about 7 million ha. VSA and R were found to cover approximately the same area (0.6 million ha each) but VSA were more numerous, especially for sizes <10 ha, whereas most areas >10,000 ha belonged to R. VSA also occurred in more southerly locations. VSA were intermediate between R and PF regarding dead wood volume, number of large diameter trees ha^{-1} and value of a composite structural index. VSA had significantly higher volumes of the important broadleaved trees species aspen, rowan and sallow. VSA and R were much older and had lower site productivity than PF, but VSA had higher total standing volumes. Our analysis showed that certified-driven VSA are an important complement to traditional reserves regarding size and structural factors important to biodiversity. Thus, future development of planning models should consider both types of set-asides and their spatial configuration. This will require integration of non-state and state governance processes.

1. Introduction

Conservation efforts in forests have been increasingly directed towards areas allocated to production, with integration of environmental measures into forestry planning, harvest and management, complementing the traditional approach of formally protected reserves (Lindenmayer et al., 2012a). An important driver of this development has been certification, a market-driven, non-state form of governance that has expanded greatly during the last few decades (Auld, 2014). In forestry, about 400 million ha had been certified by 2012 within the two main certification systems FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification), corresponding to about 30% of the world's forests allocated to production (Auld, 2014). Despite large areas being certified there is an evident lack of analyses of the environmental impacts of forest certification (e.g. van Kuijk et al., 2009; Gomez-Zamalloa et al., 2011), and Visseren-Hamakers and Pattberg (2013) stress the need to make such assessments at global scale. Karmann and Smith (2009) in an analysis on social, economic and environmental outcomes and impacts of FSC certification conclude that there is a strong need for more systematic approaches, although numerous verified examples exist of positive impacts on forest management. Some individual studies point to positive contributions of FSC certification to biodiversity conservation (e.g. Gullison, 2003) but others are challenging and debating the FSC (e.g. Bennett, 2001; Brown et al., 2001). Overall, there is a substantial uncertainty regarding how well measures within forestry, as a result of certification, meet biodiversity conservation targets.

An essential component of many forest certification schemes is that landowners voluntarily set aside a proportion of their forestland with the main aim of promoting biodiversity. Certification has in countries with a large proportion of certified forests led to a rapid increase in areas exempt from forestry. Nevertheless, there has been a striking shortage of studies evaluating the extent and quality of such negotiated conservation areas in comparison to state-protected areas and areas with intense wood production.

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[1] Voluntary set-asides.
[2] Reserves and national parks.
[3] Production forests.

http://dx.doi.org/10.1016/j.foreco.2016.05.039
0378-1127/

The relevance and effectiveness of Single Large Or Several Small areas (SLOSS) has for a long time been discussed within conservation biology research (e.g., Tjørve, 2010). Voluntary set-asides are often small compared to formally protected areas (Elbakidze et al., 2011), and thus complement larger reserves (Gustafsson and Perhans, 2010). Set aside areas, irrespective of protection type and form of establishment, can be viewed as fragments in production forest landscapes, relating to the extensive research base and theoretical discussion on patterns and processes of forest fragmentation (e.g., Lindenmayer and Fischer, 2007; Didham et al., 2012) and landscape matrix (Franklin and Lindenmayer, 2009; Prugh et al., 2008). A common view is that habitat amount is more important to viability and long-term persistence of populations than spatial landscape configuration (Fahrig, 2013), but aspects of connectivity are also essential (Andersson and Bodin, 2009) and complex interactions with land-use intensity are likely (Villard and Metzger, 2014).

In order to investigate the relative roles of different types of conservation areas, data are needed on their geographical distribution, stand structures and stand characteristics of importance to biodiversity. The Swedish National Forest Inventory (NFI) has a high sampling intensity suitable for analysis, including extensive data on forest structures and stand characteristics. Spatially explicit information is also available on the locations of sites in the three forest categories: voluntary set-asides established through certification (VSA) and managed production forests (PF) through forestry company databases and formally state-protected nature reserves (R) through conservation authorities' databases.

The overall aim of our study was to evaluate how certification contributes to forest protection and conservation of biodiversity. We used boreal Sweden and company owned land (7 million ha) as a case study because of the extensive data available for these regions. The study was conducted by (i) estimating the total area of three forest categories: VSA, R and PF, and by comparing (ii) forest structures and (iii) stand characteristics of importance to biodiversity between the three categories. Forest structures, such as dead wood, large trees and broadleaved trees, and stand characteristics, such as age, tree composition and productivity, have been shown to be strongly linked to the presence and abundance of many forest species (Berg et al., 1994; Lindenmayer et al., 2012b; Stokland et al., 2012). Our intention was that our study would contribute to a deeper understanding of the role for preserving biodiversity of forest certification.

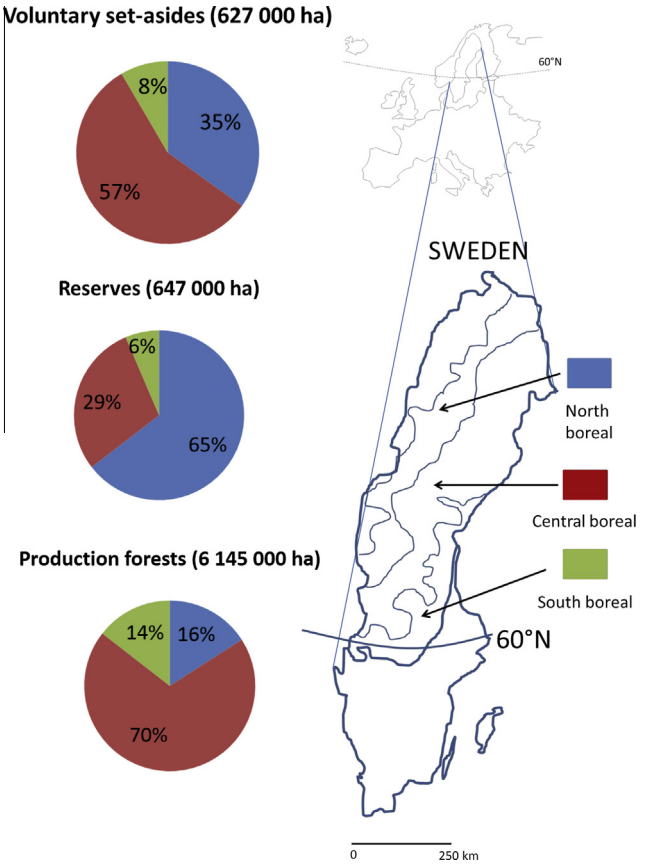

Fig. 1. Distribution of the three forest categories (voluntary set-asides, reserves, production forests) between the three vegetation zones (percentage of total area).

2. Materials and methods

2.1. Sweden as a case study

2.1.1. Forests, forestry and conservation

The study area comprised the boreal vegetation zone (Nordiska ministerrådet, 1984) of Sweden (Fig. 1). This area spans a distance of 1100 km from south to north and has a large variation in productivity primarily as a consequence of the increasingly colder climate to the north, with a mean annual volume increment of 6.4 $m^3\ ha^{-1}\ year^{-1}$ in the southernmost county (Värmland) and 2.9 $m^3\ ha^{-1}\ year^{-1}$ in the northernmost county (Norrbotten) (Forest Statistics, 2014). Along the east-west gradient, from the Baltic sea to the Scandinavian mountain chain, the altitude increases, leading to a harsher climate in the west where the productive forest ends toward the tree line. The forests are dominated by Norway spruce *Picea abies* (L.) Karst. and Scots pine *Pinus sylvestris* L. which comprise about 80% of the standing volume in the region (Forest Statistics, 2014). Privately owned companies own about 30% of the forestland, the state and other public owners (including the state-owned forestry company Sveaskog) own about 30%, and private individuals about 40% (Forest Statistics, 2014).

Industrial forestry has been conducted in the region since the 17th century, starting in the south to primarily produce charcoal for mining and iron production. Expansion of large-scale forestry exploitation toward the north commenced during the second half of the 19th century, when forests were selectively cut for large diameter pine wood (Josefsson and Östlund, 2011). A major change occurred in the 1950s and 1960s, when clear-cutting replaced selective cutting on a large scale (Lundmark et al., 2013). Sweden today has one of the highest wood extraction rates in the world (FAO, 2010) and has a high-intensity forest management system (Levers et al., 2014), which is conducted on >80% of the productive forest land. Rotation times, i.e., times between clearcutting events, vary between 60 and 120 years. The industrial forestry during the last 150 years has resulted in structurally simplified production forests with well-delineated stands of equal age and small quantities of dead wood (Östlund, 1993; Linder and Östlund, 1998) and other forest structures when compared to intact forests. This has led to decreasing populations of many forest species (ArtDatabanken, 2015).

A multi-scaled approach for biodiversity conservation has been applied in Sweden since the 1990s (Angelstam and Pettersson, 1997; Angelstam, 2003; Gustafsson and Perhans, 2010), incorporating areas set aside for biodiversity at different scales, from individual trees and tree patches left at final harvest as part of retention approaches (Gustafsson et al., 2012) up to set aside areas of >1000 ha within forest-owners' planning processes in connection with certification or as state-established reserves. Policy instruments behind this model include both certification and legislation.