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Research article

Governance and management dynamics of landscape restoration at multiple scales: Learning from successful environmental managers in Sweden

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A B S T R A C T

Due to a long history of intensive land and water use, habitat networks for biodiversity conservation are generally degraded in Sweden. Landscape restoration (LR) is an important strategy for achieving representative and functional green infrastructures. However, outcomes of LR efforts are poorly studied, particularly the dynamics of LR governance and management. We apply systems thinking methods to a series of LR case studies to analyse the causal structures underlying LR governance and management in Sweden. We show that these structures appear to comprise of an interlinked system of at least three sets of drivers and four core processes. This system exhibits many characteristics of a transformative change towards an integrated, adaptive approach to governance and management. Key challenges for Swedish LR projects relate to institutional and regulatory flexibility, the timely availability of sufficient funds, and the management of learning and knowledge production processes. In response, successful project leaders develop several key strategies to manage complexity and risk, and enhance perceptions of the attractiveness of LR projects.

1. Introduction

Unabated long-term growth in both the extent and intensity of land use for forestry, agricultural and energy production, and for housing and transport infrastructure, has led to the loss, fragmentation and regulation of natural terrestrial and aquatic ecosystems (Potapov et al., 2008, 2015; Hansen et al., 2013) in both rural and urban settings. Such land use change has had serious consequences for biodiversity (Rieman and McIntyre, 1995; Becker et al., 2007; Angelstam et al., 2011; McNeely, 1994; Villard and Jonsson, 2009), bio-cultural values (Angelstam, 2006; Zaremba, 2012), human wellbeing (Prescott-Allen, 2001) and rural communities (Bostedt and Mattsson, 1995). The result is an increasingly urgent need to not only protect and manage, but also to restore terrestrial and aquatic habitats for wild life and ecosystem services that support human well-being at multiple spatial scales (e.g. Rockström et al., 2009; Grahn and Stigsdotter, 2010; Baker and Eckerberg, 2013). For example, the European Union have set a target of restoring 15% of degraded ecosystems by 2020 with the aim of conserving biodiversity and enhancing the supply of ecosystem services (European Commission, 2011).

The concept of green infrastructure (GI) – occasionally referred to as blue infrastructure when regarding water – has emerged as a European policy response to this complex issue (European Commission, 2013). GI refers to strategically planned networks of natural and semi-natural areas, in both rural and urban settings, designed and managed to deliver a wide range of ecosystem services and protect biodiversity (European Commission, 2013). Functional GI is crucial for the sustainability, adaptive capacity and resilience of ecosystems by providing space and structures to maintain or restore ecosystem functions (e.g. Lele et al., 2013) to support biodiversity and human well-being. Core attributes of GI are functional habitat networks for species and people, and interconnectedness of spatial GI components in an urban-rural continuum at multiple spatial scales (Wright, 2011; Mell, 2012; Allen III, 2012).

Although Sweden is often presented as a country with a high

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quality natural environment for human well-being (e.g. Hsu et al., 2016) the quality and connectivity of habitat networks for species and humans is poor (Angelstam and Andersson, 2001; Nilsson and Götmark, 1992; Angelstam et al., 2011). A long history of maximum sustained yield forestry (Ek, 1995; Halme et al., 2013) has transferred once naturally dynamic forests into an efficient wood production system. The result is the absence of large intact forest areas and the loss of the compositional, structural and functional elements of biodiversity found in naturally dynamic forest landscapes (e.g. Esseen and Renhorn, 1998; Bütler et al., 2004). Regarding aquatic ecosystems, Sweden has retained only four rivers as national rivers with high conservation values (Dynesius and Nilsson, 1994). In contrast, the vast majority of rivers and streams have been successively altered in recent centuries to provide transport infrastructure for timber (Carlgren, 1886; Törnlund and Östlund, 2002), water regulation to harness kinetic energy for sawmills, mines and metal production (Angelstam et al., 2013), and electricity generation (Dynesius and Nilsson, 1994).

In response to these challenges, Sweden has recently established 16 environmental quality objectives, which aim to restore and maintain functional landscapes for conservation, continued human use, and to secure the long-term delivery of ecosystem services (SOU, 2014), as facilitated by functional GI. Ecosystem services must be integrated into economic and political considerations by 2018, and included in community planning (Jaeger et al., 2011; Anon, 2013). Additionally, since 1993 Swedish forest policy gives equal priority to production and environmental objectives (Näringsdepartementet, 2007; Anon, 2016).

However, considering that land and water in Sweden belongs to a wide range of land owner categories and the spatial configuration of land holdings is usually very complex, GI governance and management requires collaboration at the landscape and regional scale (e.g. Andersson et al., 2013). To date such collaboration is very limited (Angelstam et al., 2011; Elbakidze et al., 2015) and the causal mechanisms behind pioneering initiatives at different levels of governance are generally poorly understood (Emerson et al., 2011). Planners and managers have little experience of assessing landscapes in terms of functionality and connectivity (Sandström et al., 2006; Angelstam et al., 2011). Planning and management has traditionally focused on species level protection, precluding conservation of habitat network functionality (Angelstam et al., 2011). Additionally, the long history of use of natural resources in Sweden clearly points to the need for landscape restoration (e.g. Halme et al., 2013) to sustain functional GI for biodiversity and human well-being. A common challenge to both terrestrial and aquatic ecosystems is to define benchmarks for ecological restoration (Degerman et al., 2004; Törnblom et al., 2011; Toledo et al., 2011) and to develop effective planning and management approaches (Reed et al., 2016) based on multi-level collaboration among sectors and land owners (Angelstam et al., 2011; Axelsson et al., 2013). Thus, Swedish national environmental policy implementation, including GI development, is extremely difficult. Successful implementation is dependent upon encouraging innovative landscape restoration (LR) projects (Halme et al., 2013), and the long-term sustainability of restored landscapes requires integrated and adaptive approaches to governance and management (Reed et al., 2016).

LR processes provide a potential means for undoing or offsetting anthropogenic degradation through intentional activities to initiate or accelerate recovery of the functionality of ecosystems from degraded states (Blignaut et al., 2014; Mansourian, 2005). Normative guidelines for LR include socio-economic, technological, ecological, geo-morphological and hydrological perspectives (Van Dover et al., 2014; Blignaut et al., 2014), and emphasise place-based considerations, including biophysical conditions and multiple stakeholder perspectives and requirements (FAO, 2008; Van Oosten, 2013; Berrahmouni et al., 2015; Vallauri et al., 2005). Whilst existing studies tend to give more attention to the biophysical aspects than the socio-political contexts of landscapes (Budiharta et al., 2016; Baker and Eckerberg , 2013), the integration of governance and management contexts into restoration planning has a strong impact on cost-effectiveness and efficiency of LR projects (Budiharta et al., 2016; Jellinek et al., 2014; Stanturf et al., 2014). Multiple recent studies underline the fundamental importance of an integrated, adaptive governance and management approach for successful LR (e.g. Sabogal et al., 2015; Berrahmouni et al., 2015; Janishevski et al., 2015). However, whilst learning is a key facet of an adaptive approach that can be scaled up, the success of previous LR efforts remains poorly, documented, evaluated and disseminated (Sabogal et al., 2015; Thomas et al., 2015; Coello et al., 2015). In addition, a landscape approach to the development of functional GI calls for a new set of holistic, integrated and adaptive governance and management approaches and tools, capable of engaging with the uncertain and complex properties of landscapes as coupled social-ecological systems (SES) (e.g. Gregory et al., 2006; Sayer et al., 2013). There is thus an urgent need to better understand how successful LR projects of different scales take place in complex settings such as the Swedish context.

The aim of this paper is to contribute to a better empirical understanding of the governance and management challenges confronting Swedish LR projects, and to identify key strategies that successful environmental managers utilise. We apply system thinking to explore and map the experiences of three LR project leaders in order to identify common and/or context-specific causal structures concerning how they navigate the governance and management systems within which they are situated. The three LR projects were selected on the basis of satisfaction of three criteria: (1) clearly perceived by diverse stakeholders at multiple governance levels as successfully implemented; (2) representing a gradient of project scales – national, regional and local, respectively; (3) initiated and driven by the same project leader for the entire duration of the project. The critical importance of having a committed person(s) to champion a project has long been documented (e.g. Cash and Fox, 1992; Jang and Lee, 1998; Poon and Wagner, 2001). The environmental managers identified in each of our respective case studies were central, driving actors from the idea conception phase to implementation. They were visionaries, sponsors, project leaders, and holders of key project competences and knowledge. As such these individuals represented a unique source of knowledge for this study.

2. Theoretical framework

Natural resource governance and management are “wicked” problems (Rittel and Webber, 1973) consisting of multi-dimensional interests and competing values among stakeholders and actors (Beall and Ford, 2010) at multiple levels. Traditional approaches based on simple, linear growth optimisation strategies overseen by command/control and sectorial governance have failed to account for the inherent unpredictability and irreducible uncertainty of dynamically complex SES (Brunner et al., 2005).

The adaptive approach is now seen to incorporate both management and governance dimensions, and is well situated within the sustainable development, sustainability, resilience and environmental governance discourses (Dietz et al., 2003; Folke et al., 2005; Walters, 2007; Armitage, 2005; Gregory et al., 2006; Olsson et al., 2007; Pahl-Wostl, 2009; Rist et al., 2012; Garmestani and Benson, 2013; Chaffin et al., 2014; Williams and Brown, 2014). Adaptive management (AM) describes a putative model for managing and engaging with the inherent uncertainty, complexity,