

# Transitioning from even-aged rotation forestry to multifunctional forest landscapes? – A Swedish case study of challenges and actions

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## HIGHLIGHTS

- Learning through evaluation reveals barriers and bridges for forest multifunctionality.
- Qualitative and quantitative data identify core patterns and driving transition factors.
- In spite of five decades of efforts, landscape planning failed to materialise.
- Negative effects of intensified forestry on preferred landscape values.

## ARTICLE INFO

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## ABSTRACT

**Context:** Even-aged forest management is criticised for negative impacts on natural and cultural values, and on value chains dependent on multifunctional forest landscapes.

**Aim:** We identify barriers and bridges supporting the development of multifunctional forest landscapes. Examining five decades of projects aimed at landscape planning in the Swedish Tiveden forest massif, we selected the initiative Collaboration Tiveden for learning through evaluation.

**Methods:** Using document reviews, expert interviews, focus groups and participatory observations, we mapped efforts from the period 1969–2023 encouraging forest multifunctionality. Following the selected collaborative initiative from 2016 to 2023 we collected qualitative and quantitative data. Content analysis using the Institutional Analysis and Development (IAD) framework, and validation using independent data, identified patterns and core driving factors associated to efforts supporting transition from industrial forestry to forest multifunctionality.

**Results:** We identified 11 efforts towards landscape planning. However, in spite of intensified forestry, increased need for protected areas, and pressure from tourists, landscape planning failed to materialise, and alternatives to even-aged forest management was restricted to demonstration sites and not scaled up. Qualitative and quantitative data demonstrate negative effects of intensified forestry on preferred landscape values. Nevertheless, branding using wilderness and narratives of multifunctionality support rural nature-based tourism. However, pressure from tourism on nature increased. Polarisation among actors hampers collaborative learning.

**Conclusions:** Multifunctional forest landscapes require several different forest management systems and landscape planning. This requires learning about multiple forest values, and different forest owners' and users' preferences. While learning through evaluation is important, evidence-based mapping of states and trends of material and immaterial landscape values is not easily accessible, or ignored. Legacies of even-aged forest management are resistant to change.

## 1. Introduction

Climate change, loss of biodiversity and rural development are key

topics in policy and on international political agendas of relevance for forest landscapes (European Commission, 2013, 2020, 2021, 2022, 2023). In response to this, the governance and management of forest

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landscapes have become subject to heated debates about what goods, services and values these landscapes should deliver. As a major supplier of forest goods through intensive even-aged rotation forestry, Sweden is a good example (e.g., Angelstam et al., 2022; Elbakidze et al., 2022). Despite increasing policy attention given to ecological and socio-cultural values of forests, Beland et al. (2017) found that economic monetary dimensions of sustainability are prioritised among the powerful forest actors in Sweden, and concluded that current policies represent an unrealistic “*more-of-everything pathway*.” As a result, both internationally and in Sweden, recent policy developments concerning bio-economy, landscape multifunctionality, rural development and green infrastructure for biodiversity conservation and human well-being have inflamed pre-existing conflicts between different types of forest users and benefits at multiple scales (e.g., Hertog et al., 2022; Blicharska et al., 2020). This has resulted in a deep divide between a traditional industrial forest sector coalition network on the one hand, and an opposing environmental coalition that supports environmental forest policy integration on the other. The former narrative currently dominates in the current national Swedish politics (Chapron, 2022; Österblom and Blasiak, 2022). Similar dynamics have been observed across multiple forest governance contexts in both Europe and North America (e.g., Anderson and MacLean, 2015; Chiasson et al., 2019; Sotirov et al., 2021; Elbakidze et al., 2022).

Fundamentally, the current debate in Sweden encompasses two different worldviews regarding natural resource management (e.g., Leopold, 1949; Angelstam et al., 2022). The current conventional view is about forests as cropping systems, the purpose of which is to maximise the production of raw material for industrial value chains, which generate export income. The alternative view is that forest landscapes are complex ecosystems that should be used so that all goods, services and values are maintained and sustained, thus being sufficiently similar to pre-industrial landscapes (Gadd et al., 2011), and able to withstand disturbances and pressures of various kinds by being socio-ecologically resilient (e.g., Messier et al., 2015). Forest cropping systems aim to reduce variation in terms of number and types of tree species, and the structure of forest stands and landscapes, and do not allow natural disturbances (Puettmann et al., 2008). Adaptations to and mitigation of climate change, as well as biodiversity conservation, all aim to develop forests in the opposite direction through closer-to-nature forest management supporting nature restoration and spatial variation in forest structure (e.g., Kuuluvainen et al., 2021; Larsen et al., 2022).

The development and use of multiple forest management approaches is therefore necessary. This is in line with Swedish forest policy and the strategy for biodiversity and ecosystem services (Regeringen, 2013/14), the EU forest strategy (European Commission, 2021, 2023), and the EU nature restoration law passed in 2024 (European Commission, 2022), as well as existing policy and legislation about habitats, birds, water and climate. These mirror research at both national and international levels (Aszalós et al., 2022; Kuuluvainen et al., 2021; Larsen et al., 2022).

Since the late 1980 s retention forestry and voluntary set-asides are applied in even-aged rotation forestry with the aim to support biodiversity conservation (e.g., Felton et al., 2020). However, the current narrow meaning of multiple-use forestry with a focus on nature considerations in individual forest stands and local areas is insufficient (Kuuluvainen et al., 2019; Muys et al., 2022). Consequently, there are calls at different policy levels for multifunctional forest landscapes (European Commission, 2021; Appelqvist and Mogren, 2023). Triad functional landscape zoning (e.g., Blattert et al., 2023; Himes et al., 2022; Nagel et al., 2025) and integrated spatial planning of large areas (Angelstam et al., 2020) for effective delivery of different goods, services and values, need to include several forest management systems (Puettmann et al., 2008). Examples include rotation forestry based on clear-felling, continuous cover forestry, shelterwood and closer-to-nature forest management that emulate natural disturbance regimes (Eyvindson et al., 2021; Kuuluvainen et al., 2021; Larsen et al., 2022). Additionally, methods used to sustain traditional cultural landscapes

(Vos and Meekes, 1999) and place-based collaboration at multiple levels of governance (e.g., Edge and McAllister, 2009) are needed.

This calls for spatially explicit mapping of the multiple values of nature, i.e. ecosystem and landscape services (e.g., Darvishi et al., 2021), understanding of the different kinds of policy instruments, as well as planning and management systems that are necessary to maintain these values over time (e.g., Angelstam et al., 2023). However, key planning tools such as municipal comprehensive planning are primarily focused on urban infrastructures (Elbakidze et al., 2015), and regional planning of green infrastructure is hampered by weak policy instruments (Angelstam et al., 2023), and resistance among industry and landowner organisations (Sténs and Mårald, 2020).

Countries with strong traditions of rotation forestry with even-aged monocultures aimed at producing industrial raw material, such as Sweden, are challenging contexts for introducing landscape level forest planning involving a diversity of management systems (Sténs et al., 2016; Chiasson et al., 2019; Angelstam et al., 2022; Hertog et al., 2022). Nevertheless, the diversity of forest owner categories in Sweden, and their wide range of values and objectives (Haugen et al., 2016), implies opportunities to expand the use of forest management methods other than even-aged rotation forestry in Swedish forest landscapes. An additional new driver of change in this regard is the continued growth in nature-based tourism as an opportunity for the Swedish hospitality industry. This industry requires “*secure access to attractive nature, where it is also possible to conduct commercial activities*” (SOU, 2017:95, p 271).

Within Sweden as a prime example of a country specialising in high sustained yield of wood, we chose the south Swedish Tiveden forest massif (Fig. 1) in the informal Bergslagen region (Angelstam et al., 2013b) as a place-based case study representing an area dominated by intensive wood production, and with five decades of projects and initiatives aimed at developing and sustaining multiple forest values through forest management and landscape planning. Following Stake (1995), our single case study approach focuses on an in-depth exploration of Tiveden as a specific bounded system in terms of place-bound physical characteristics, organizations, and cultures. To sustain natural and cultural values as a base for human well-being and new value chains, such as nature-based tourism in a landscape historically dominated by intensive forestry, we focus on three aims. First, we examine attempts since the 1970 s to introduce comprehensive landscape planning processes, and alternatives to the clear-felling system. Second, to understand the extent to which a transition towards planning and management supporting multifunctional landscapes is taking place, we analysed qualitative data from focus groups, interviews and

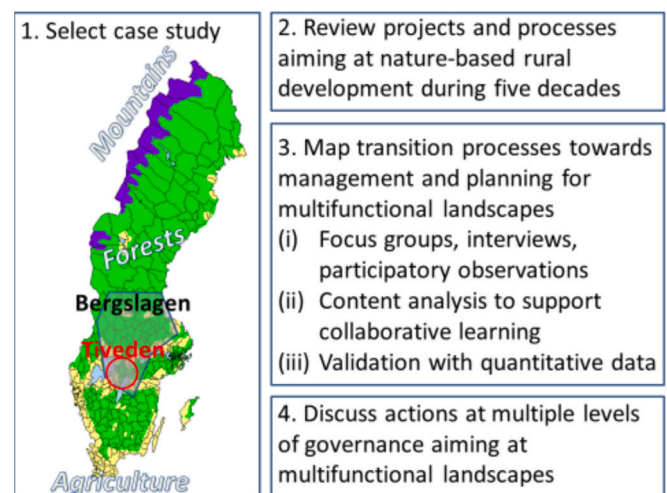


Fig. 1. Illustration of the different components of this study focusing on efforts aimed at supporting transitions towards multifunctional forest landscapes in the forest massif Tiveden in the historic Bergslagen region.

participatory observations concerning the most recent collaborative forest management initiative in the area. Third, we validate key stakeholder opinions using independent quantitative data. Finally, to understand more broadly what our case study results might mean for a shift towards multifunctional forest landscapes, we structure our discussion towards three overarching research questions: 1) What are the main outcomes of initiatives in Tiveden towards multifunctional forest landscapes? 2) What are the main challenges for multifunctional forest landscape initiatives? and 3) Which key actions might support the development of multifunctional forest landscapes?

## 2. Methodology

### 2.1. Overview of this study

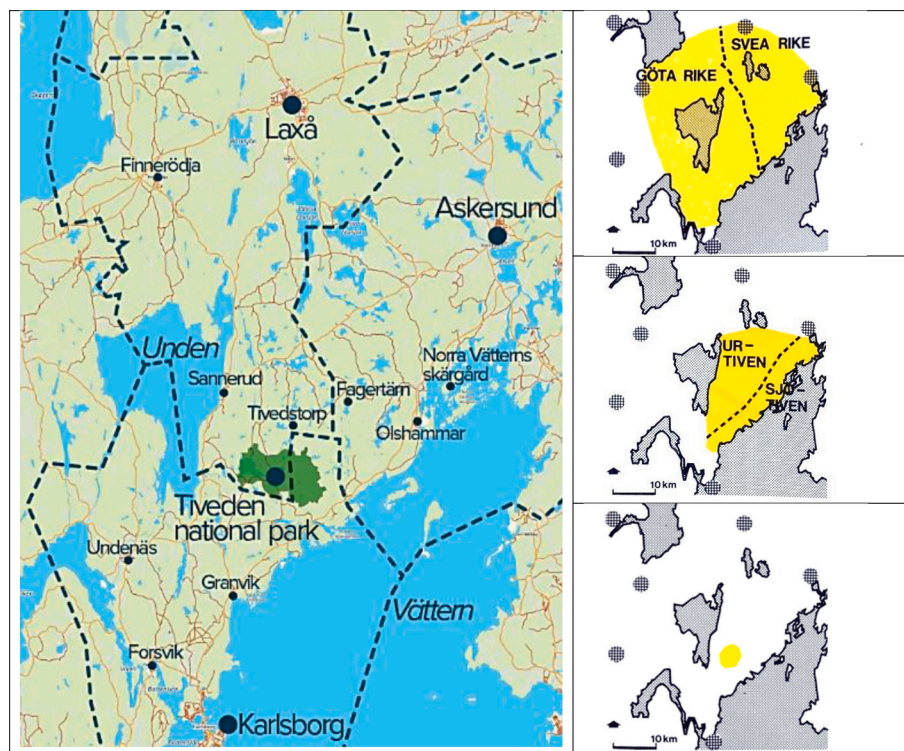
Knowledge production about social-ecological systems requires use of both qualitative and quantitative data, and participation of both researchers and local actors/stakeholders. Thus, being transdisciplinary by integrating research disciplines, as well as researchers and practitioners (e.g., Kläy et al., 2015; Angelstam et al., 2013; Axelsson et al., 2020), this study includes four different steps (Fig. 1). (1) Select the Tiveden forest massif in southern Sweden as a case study of a forest landscape as space and place (Hirsch and O'Hanlon, 1995; Angelstam et al., 2013a). (2) Examination of projects carried out from the 1970s to present time, biographic interviews (Flick, 2018) with local champions of collaborative learning (e.g., Axelsson et al., 2013), and participatory observations, identified 11 successive efforts aimed at supporting nature-based rural development by introducing landscape planning processes, and alternatives to even-aged clear-felling forestry. (3) Use the current collaborative initiative Collaboration Tiveden to collect qualitative data using (i) focus groups, interviews and participatory observations, (ii) content analysis and (iii) qualitative validation using independent data, to understand the extent to which a transition

towards planning and management supporting multifunctional landscapes takes place. (4) Discuss challenges and actions at multiple levels of governance that can support learning towards collaborative planning and management aiming at multifunctional landscapes.

### 2.2. Case study landscape

Across Europe, increasingly efficient extraction of natural resources and abandonment of cultural landscapes have resulted in the exodus of people from rural areas, and simultaneous urbanisation (e.g., Schulp et al., 2019). The historic Swedish mining region Bergslagen (Fig. 1) is a good example (Andersson et al., 2013). Since Medieval times, the focus in the Bergslagen region has been on industries relying on iron ore, watercourses that provide kinetic energy, and forests for charcoal production and mining constructions (Angelstam et al., 2013b). As the iron-based industries closed down, forestry for timber and pulpwood took over forest use.

The Tiveden forest massif encompassing three small municipalities (Fig. 2) in southern Bergslagen, is a good concrete example, which subsequently lost permanent residents and scaled down public services. During the latter part of the 20th century, a large part of the permanent rural settlements became holiday homes. In recent years, the development in rural parts of the Tiveden area has changed from a declining number of inhabitants, an increasingly elderly population, and closed schools on the one hand, to immigration and new firms on the other. Two factors contributing to this is a strong social capital (Angelstam et al., 2021), and the impact of landscape attractiveness on nature-based tourism. Families have chosen to settle permanently in the Tiveden area, which has led to new job opportunities, as well as improved existing service facilities for both residents and visitors. A common feature is that newcomers to the Tiveden area previously vacationed in the area, but then chose to settle permanently. This has resulted in immigration from both neighbouring regions and abroad.



**Fig. 2.** Map of the Tiveden area with its three municipalities Laxå, Karlsborg and Askersund (left) located at the border between the Medieval Göta and Svea kingdoms (rike; upper right panel). Tiveden was referred to as Lilla Tiveden in Bergman's 1759 map of Tiveden (Kardell, 1982), which includes central Tiveden with Urtiven in the northwest and Sjö-tiven along the shores of Lake Vättern in the east (center right). The most inaccessible parts of Urtiven, named Görtiven, is now the core of the Tiveden national park (left, and lower right).

We chose the Tiveden forest massif, where forests cover 75 % of terrestrial land, and in particular Laxå municipality as a case study (Fig. 2 (59° N, 15° E; 737 km<sup>2</sup>)). The historical inaccessibility with rugged topography in the area created an aura of wilderness with high nature conservation values (von Rosen, 1952; Lidman, 1974). These values triggered successive creation of several protected areas in locally inaccessible areas (Stenkälla in 1942, Trollkyrkobergen in 1949, Tärnekullen in 1954), and a proposal to create a national park in the late 1970 s (SOU, 2017). The purpose of creating Tiveden national park in 1983, and extending its size in 2017, reflects Swedish policy promoting area protection for conservation of high nature values, and human well-being and welfare. In the Tiveden area the state-owned forest company Sveaskog is the dominating owner of forests used to provide raw material for the forest industry. Today Laxå municipality sees three major assets: the Tiveden National Park, forest landscapes providing space, and half an hour commuting time by train to the regional capital Örebro. Accordingly, in spring 2017, Laxå municipality declared itself an “ecotourism area”. This has fostered a growing hospitality industry and in-migration by professionals focused on distance work (Jakobsson, 2009).

Using multiple sources, we described successive efforts in the case study landscape Tiveden to support rural development through integrated spatial planning and management towards multifunctional forest landscapes. The three key sources were (1) examination of all initiatives since the 1970 s aiming at planning towards multifunctional forest landscapes (Supplement S1), (2) key informant interviews with local champions, and (3) participatory observations 2016–2023. The results were summarised as narratives (Appendix 1).

2.3. Analysis of the initiative Collaboration Tiveden

To learn about actors’ and stakeholders’ views of what provides well-being and welfare for individuals, firms and local communities, the senior author organised open-ended focus groups and interviews (Flick, 2018) from the time of establishment of the network Collaboration Tiveden in 2016, and until 2023. Using snowball sampling techniques, which initially enrolled transdisciplinary research participants, helped to recruit further subjects for study (Flick, 2018). We identified and invited stakeholders and actors from key societal sectors (e.g., service providers, tourism firms, foresters, farmers, local communities, NGOs, authorities at different levels of governance) across multiple levels (local to national) including several in the area surrounding Tiveden national park and beyond. Interviews and focus groups began by asking actors and stakeholders ‘which factors are important for you and your well-being, and for firms and local communities in and around Tiveden’s forest landscape?’ Subsequent open-ended conversations lasted 1–2.5 h. When the conversation had ended, participants were asked to suggest other actors and stakeholders to be interviewed. Interviewees included a total of 63 persons (21 women and 42 men) representative of public, private and civil sectors (Table 1). In addition, repeated expert interviews were made with the 6 members of the core group Collaboration Tiveden representing Laxå municipality, nature-based tourism businesses, the forest company Sveaskog and research. Participatory observations were made during regular core group meetings held twice yearly 2016–2023. Focus group conversations and interviews were digitally recorded.

**Table 1**  
Representation of interviewees and focus group participants among sectors at multiple levels of governance.

Levels of governance	Public sector	Private sector	Civil sector	Sum
National	1	1	2	4
Regional	8	5	6	19
Local	6	15	19	40
Sum	15	21	27	63

When analyses had been completed, we arranged two workshops with core stakeholders of Collaboration Tiveden to present and reflect on the results.

We used the Institutional Analysis and Development (IAD) framework (e.g., McGinnis and Ostrom, 2014; Ostrom, 2009) as a lens for understanding Collaboration Tiveden as a long-term (2016–2023) initiative aimed at supporting a transition towards a more multifunctional forest landscape. The IAD framework provides a robust approach for analysing and understanding institutional arrangements and their role in governing natural resource management, structuring human behaviours, and resource use, particularly in the case of efforts towards collaborative governance and management. The IAD framework is a basic vocabulary of concepts and terms to organize diagnostic, descriptive, and prescriptive inquiry, rather an explanation of any expected behaviours or functional relationships between variables (McGinnis and Ostrom, 2014). The framework is highly adaptable and has been applied in a wide variety of scientific fields (Partelow, 2018), including forest contexts (e.g. Elbakidze et al., 2022).

The framework is multi-tiered, with three interconnected levels of actions: an operational level concerning day-to-day activities carried out by individual actors; a collective-choice level concerning decision-making processes to establish rules that impact the operational activities, involving various stakeholder representatives; and a constitutional-choice level, where overarching global rules that directly influence collective-choice participation are defined, designed, and modified. Given our focus on understanding the collaboration itself and its consequences on the ground, we concentrate primarily on understanding the main factors at the collective choice level.

We used inductive open-coding (e.g., Cascio et al., 2019) to provide a data-steered process for understanding and categorizing raw data, to identify core themes and the context surrounding them. We then used an iterative process of qualitative content analysis (e.g., Corbin and Strauss, 2008) to structure and analyse our data using the IAD framework’s main components. These included the *contextual factors* that shaped problems concerning forest use and management and collaborative efforts to resolve them, such as biophysical conditions, attributes of the local community and wider society, as well as various formal and informal rules that govern the landscape, namely: *action situations*, which comprised the core actors involved in Collaboration Tiveden and those directly or indirectly influenced by its outcomes, and their objectives concerning use of the Tiveden forest landscape; *interactions* between core actors, i.e., the “how” of the collaboration, and to a lesser degree interactions between actors and the landscape; and the main tangible and intangible *outcomes* on the ground to date.

2.4. Validation of qualitative results

The transdisciplinary approach in this study implies that we rely on qualitative data that represent opinions of and observations by stakeholders and actors regarding both ecological and social systems, but also quantitative data. Given the polarised and even heated debate about forest governance and management in Sweden, it is important to corroborate statements put forward by actors and stakeholders using multiple methods. We therefore collected quantitative data about (1) how forest management intensity has increased over time, (2) examples of effects of this on habitats and charismatic forest biodiversity as natural forest values, (3) the decline of cultural landscape values, (4) development of the human population, and (5) nature-based tourism.

Empirical data about the forest management history and the resulting forest stand age distribution was compiled from multiple literature sources listed in the results. We also compiled data about the spatial distribution of natural forest values from Bubnicki et al. (2024). The dependence on forest landscape structure of charismatic species being attractive to especially international tourists, such as moose (*Alces alces*) is illustrated. To document key cultural landscape value changes, we used grey literature, official statistics and field surveys (Supplement 2).

Finally, statistics of the human population in the Tiveden area and the number of visiting tourists were compiled.

### 3. Results

#### 3.1. A biography of initiatives supporting multifunctional forests

The Swedish state forest company, which had taken over the forests in the Tiveden area after the ironworks bankrupted ca. 1900, began in the 1950 s to develop infrastructure for outdoor recreation and tourism in Tiveden (von Rosen, 1952). Since the emergence of physical planning processes in the late 1960 s (SOU, 1971), Tiveden has hosted a suite of processes encouraging tourism and spatial planning aimed at securing coexistence of wood production as well as natural and cultural landscape values. Already in 1969, the three municipalities forming the core of the Tiveden area (Fig. 2) became aware of the need to coordinate efforts for nature conservation and tourism with a focus on the existing areas of near-natural forest remnants. A key concern was that mechanised and intensified forest management triggered an expanding network of forest roads. The increased access to previously inaccessible parts of Tiveden caused loss of the sense of wilderness, which resulted in a desire to initiate cross-sectoral collaboration (Tivedskommittén, 1974:8-9). We identified a total of 11 subsequent initiatives aiming at spatial planning of different spatial extents towards multifunctional landscapes in the Tiveden area (Supplement 1, Table 2). This study focuses on the still ongoing initiative Collaboration Tiveden established in 2016. All other (10) initiatives had the ambition to encourage landscape planning, which however did not materialize.

#### 3.2. Collaboration Tiveden – a multi-actor platform

##### 3.2.1. Contextual factors

Concerning biophysical conditions, our content analysis identified two main contextual factors influencing the collaboration based on focus group and interview data (Fig. 3). The first was *high natural and cultural values* remaining in Tiveden's forest landscape.

These include old forests, charismatic species and traditional cultural grasslands providing the natural capital upon which diverse sets of actors and stakeholders based their economic activities, as well as supporting the wellbeing of both residents and visitors. Many stakeholders perceived these forest values as being under threat due to the intensive

forest management practices in the area surrounding the national park. Intensified forestry has effectively lowered the age of final felling from 80-100 years, to around 60 years. In particular, local residents and nature-based tourism enterprises were worried by the increasing frequency of clear-felled tracts along the roads providing access to the national park. Not only did such areas reduce the availability of high-value forest for tourism activities and for locals' recreation, but the presence of clearcuts along access roads to Tiveden's forest landscape had a negative impact on visitors' perceptions of the area as a "wilderness".

Thus, the various direct and indirect negative impacts of Sveaskog's intensive forest management system on the natural and cultural values of Tiveden's forest landscape were increasingly identified as a potential existential threat to the objectives of the other primary stakeholder groups in the area, i.e. local residents, tourism entrepreneurs and municipalities. There was also growing uncertainty concerning how climate change would impact the high natural and cultural forest values found in Tiveden. Collaboration Tiveden's vision of a multifunctional forest landscape was therefore shaped and communicated as a strategy to strengthen local resilience to climate change.

Concerning community attributes, a growing *societal environmental awareness* was identified by stakeholders as a key driver of support for a transition away from even-aged forest management practices in Sweden in general, and especially in the few remaining areas with high natural values such as in the Tiveden forest massif. Stakeholders acknowledged that this growing awareness played an increasingly positive role in driving demand for nature-based tourism, and of concern for perceived threats to the natural and cultural values. Long-term societal trends concerning *urbanisation and rural depopulation* were also identified as a core driver. These demographic trends had led to loss of many essential services such as childcare, school and groceries in the Tiveden area, which were now only available in towns further away. Collaboration Tiveden was therefore positioned by municipal actors as a rural development initiative aimed at halting rural decline in the area.

Concerning rules, stakeholders identified a suite of formal and informal economic, regulatory, socio-cultural and technological factors constituting a compact *institutionalised support for intensive forest management* based on clear-felling. This included a strong focus on economic rationality, strong land ownership rights and the Swedish focus on forest education supporting intensive production on raw material for the forest industry. Stakeholders also identified strong legacies of forest management traditions in Sweden that have developed around even-aged forest management, the past importance of the forestry sector in rural forest landscapes such as Tiveden. Stakeholders highlighted that these factors made it difficult for Tiveden's collaborative initiative to compare the potential economic costs or benefits of different management alternatives for a clearcut-free zone around the national park, and thereby difficult to engage Sveaskog's leadership concerning the economic feasibility of scaling up the initiative. Further, *Tiveden national park* attracted many visitors and was therefore a hub for nature-based tourism. Rules concerning ongoing management issues in and around the national park, and plans to enlarge it, were therefore frequently highlighted by stakeholders as an important factor shaping Collaboration Tiveden. However, overtourism negatively affect the wilderness experience and biodiversity.

##### 3.2.2. Action situation

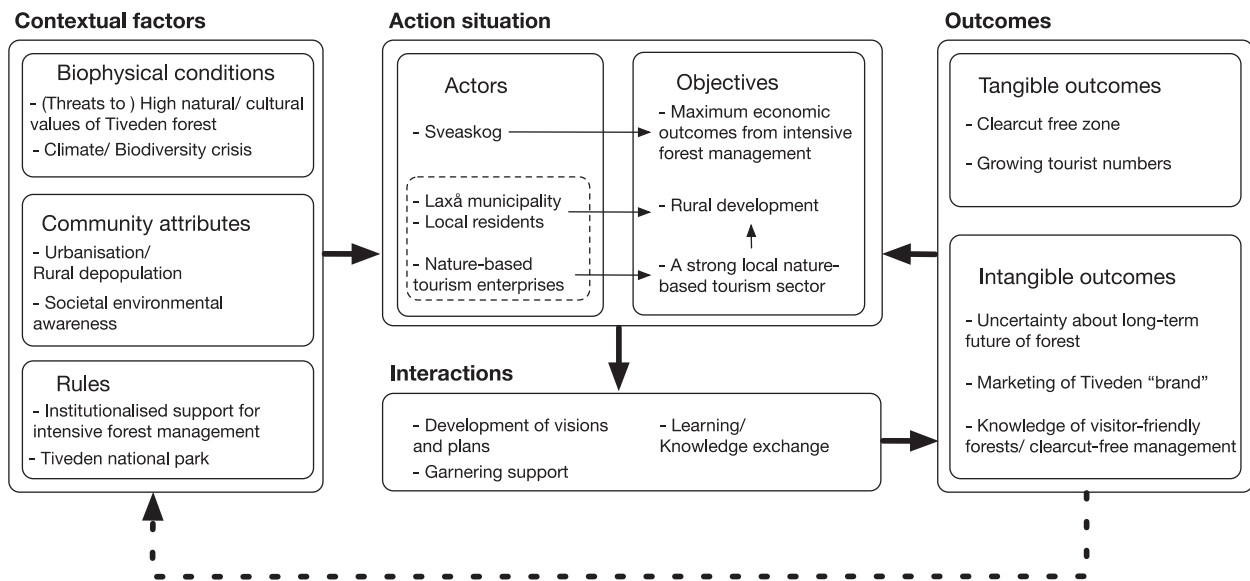
Our analysis of interview data revealed four main groups of actors in relation to Collaboration Tiveden. These were the state-owned forest company Sveaskog, Laxå municipality, local residents and nature-based tourism enterprises. These groups were identified as having three different primary objectives.

For municipal actors and local rural residents, the overarching objective was *rural development*. This included stable growth in both the number of permanent residents in the area, and the number of small businesses. Maintaining a sufficiently robust rural population was a

**Table 2**

List projects and processes aiming a supporting recreation and nature-based tourism (see also Fig. 4, and details in Supplement 1).

Planning project	Aim	Duration
1. Tiveden Committee	Develop outdoor recreation	1969–1974
2. Tiveden General Plan	Create National Park	1978–1979, 1980
3. Tiveden – Göta canal	Create National Park	1982
4. Sustainable Tiveden	Local planning in Tiveden	2004–2006
5. Tivedstorp	Diversify forest management	2007–2016 (2019)
6. Leader Mellansjöländet	Develop nature-based tourism	2009–2011
7. National Park Plan	Extend national park	2013–2017
8. The Church Trail	Engage the main forest owner (Sveaskog)	2014–2016
9. Collaboration Tiveden	Supporting innovative management and planning	2016–2023, ongoing
10. Visitor-friendly Tiveden	Encourage tourism in the municipalities Laxå, Karlsborg, Askersund	2017–2021
11. Rural challenges 2022	Reduce tourism, introduce landscape zoning	2021–22



**Fig. 3.** The main contextual factors, actors, objectives, interactions and outcomes identified from our content analysis of stakeholder focus group and interview data concerning Collaboration Tiveden – a multi-actor collaboration aimed at spatial planning towards a multifunctional forest landscape in and around the Tiveden forest massif in southern central Sweden. The dashed box within Actors indicates that several interviewees were both representatives for tourism enterprises and local residents, with concomitant overlaps in objectives. The dashed feedback arrow from Outcomes to Contextual factors indicates that most identified links between Outcomes and Contextual factors remained potential, or desired, at the time of data collection – no empirical evaluation had been undertaken to date of the actual impact of the collaboration.

critical factor to ensure adequate provision of important local services, such as school, grocery store and public transport. The municipality perceived Tiveden's natural and cultural values as a key resource for attracting and retaining permanent residents, and thereby to grow the tax base for municipal revenues, which in turn could be used to finance local services and other public investments.

For the nature-based tourism sector, the focal objective was the dependence on Tiveden's high natural and cultural values. This rapidly expanding sector represented an increasing share of local employment opportunities, and was therefore considered to make an important contribution to rural development. Not only did tourism jobs attract new residents, but high numbers of tourists during peak season constituted the economic foundation for many local services such as grocery stores and cafés, thereby enabling service provision also to local residents. In many respects, the development of the local nature-based tourism sector and local rural development were seen to be mutually reinforcing. For example, along with a supply of available workers for tourism operators, the growing rural population in the area provided a key supply of entrepreneurs who strongly identified with the forest landscape and were driven to identify and exploit new niches within the tourism sector and/or to start new service-based activities to complement tourism activities.

Several representatives in the formal collaboration meetings were also local residents in Tiveden, typically representing the interests of nature-based tourism operators. In this way, local interests were often conflated by stakeholders with those of the municipality and tourism operators, leading to the development of a coalition between these three groups within Collaboration Tiveden. As this coalition developed, a strong local nature-based tourism sector in Tiveden was increasingly understood as a fundamental strategy supporting rural development.

As the primary forestry sector actor, representatives for Sveaskog repeatedly highlighted during interviews and focus groups that their main state ownership directive was to maximise economic outputs. Sveaskog was therefore mandated to maximise harvest of industry raw materials from the landscape using the most economically rational methods from a forest industry perspective, namely *intensive forest management* based on clear-felling of forest and replanting with monocultures of Norway spruce (*Picea abies*) or Scots pine (*Pinus sylvestris*). A high mechanisation rate and strong reliance on foreign seasonal manual

labour meant that the forestry sector's contribution to local rural development in terms of employment opportunities was very limited. At the same time, the potential negative impacts of societal attitudes to intensive forestry, and climate change on wood production, were stated as driving Sveaskog's growing interest in developing clearcut free methods.

### 3.2.3. Interactions

The main identified interactions between actors in Collaboration Tiveden were *development of visions and plans*, *garnering support* for these visions, and *learning*. In response to perceived threats, and to pursue their own objectives, municipal, local and tourism stakeholders developed a collaborative platform to design and promote an alternative vision for Tiveden's forest landscape. This vision intended to supplant the current "wood production first" function of the forest with a more multifunctional forest landscape. A core component of the vision was to develop a "visitor-friendly forest" zone in the area surrounding the expanded national park. This zone would be managed with alternatives to clear-felling, thereby providing an opportunity for nature-based tourism enterprises whilst still providing an income stream for forest owners (i.e., Sveaskog). The visitor-friendly forest zone would ensure that a sharp border did not arise between the high values inside the national park and comparatively much lower nature values just outside it. This was envisaged to support continued high quality nature experiences for visitors and residents by increasing the total area of forest available for tourism activities and thereby reducing the concentration of visitors in and around the national park. Given their key role as the main forest owner, Sveaskog was invited to the collaboration but initially reticent to participate. It was not until there was solid support for the project amongst other key stakeholders at regional and national levels that they began to engage.

As a shared vision emerged amongst stakeholders in Collaboration Tiveden, increasing efforts were made to garner support for a more multifunctional forest landscape around Tiveden national park, and particularly for a "visitor-friendly" zone around it. The perceived threat that intensive forest management posed to natural and cultural forest values was a powerful motivator of support amongst local residents and businesses that were directly or indirectly dependent on tourism

incomes. An intensive lobbying campaign at multiple levels was also conducted by municipal actors, resulting in support from national level nature-based tourism NGOs, who both provided strategic advice to the collaborative platform, and later of national and regional decision-makers.

Stakeholders identified several knowledge gaps in relation to the visions and plans of Collaboration Tiveden, particularly in its early stages. These included a lack of clearly defined concepts concerning ‘visitor-friendly’ forests, and a lack of knowledge about how to conduct less intensive forms of forest management. Participants in the collaborative platform therefore developed several processes for learning and knowledge exchange. These included gathering and compiling data to better understand the needs of the growing tourism sector, and how to limit the negative impacts of its continued growth on the natural and cultural values of the forest. Given the relative unavailability of contextually relevant research, municipal and tourism stakeholders engaged researchers in projects to evaluate efforts towards a more multifunctional landscape. Representatives of the forestry sector, however, did not carry out any formal evaluation in the development of clearcut-free methods, preferring to apply what they considered practical experiments. Small-scale application of clearcut-free management methods (e.g., shelterwood, thinning from above, small (<0.5 ha) clearcuts) were also conducted by Sveaskog, with other actors invited to view and comment on outcomes at workshops and excursions.

#### 3.2.4. Outcomes: Tangible and intangible

Interviewees attributed a number of tangible and intangible outcomes to the efforts of Collaboration Tiveden. Concerning tangible outcomes, the collaboration was said to have led to the implementation of a zone surrounding the expanded national park, wherein Sveaskog established a ‘clearcut-free zone’. However, given the long delays in forest dynamics, the suitability of these methods for developing a “visitor-friendly forest” remained unclear, and no monitoring was initiated. Collaboration Tiveden’s multifaceted visioning and communication efforts were also credited by stakeholders for continued *growth in tourist numbers*. While this has supported local nature-based tourism enterprises, growing concentrations of tourists at popular local nature spots were a concern. Wear and tear on nature risked belying the perception of “wilderness” for which tourists were coming. Increases in tourism volumes were also identified as degrading available visitation infrastructure, such as hiking trails. Negative impacts of tourism had become an increasing concern for local residents also, who had begun to avoid using many of the most attractive areas of the Tiveden forests during peak season.

Concerning intangible outcomes, many stakeholders highlighted a continued *uncertainty concerning the future of the Tiveden forest*. Despite the implementation of the clearcut-free zone, the collaboration had not managed to secure a formal agreement with Sveaskog concerning the future management of this area surrounding the national park. While Sveaskog was positive to this zoning approach, the lack of formal agreements was interpreted by some stakeholders to allow Sveaskog to change its mind at any time, and revert to clear-felling in this zone. Furthermore, some interviewees suggested that the collaborative platform itself had been interpreted by some powerful higher-level stakeholders as a potential threat to the sovereignty of landowners. For example, the Federation of Swedish Farmers expressed strong concerns that the introduction of a clearcut-free buffer zone around the national park could be used as a precedent for similar practices elsewhere, potentially weakening the management rights of those who owned land close to nature protection areas. On the other hand, the ‘visitor-friendly forest’ vision developed by Collaboration Tiveden was linked to the development of an attractive “brand” for Tiveden. The support of stakeholders at multiple levels for this vision triggered additional investments in the development and *marketing of Tiveden* as an eco-tourism destination. However, a key aspect of the Tiveden area’s attraction for tourists lay in the perception of “wilderness”, which visitors associated

with qualities such as “quiet”, “untouched”, “old growth” forest, and the presence of charismatic species such as wolf (*Canis lupus*) and moose. For this reason, tourism and municipal stakeholders identified that future growth in nature-based tourism was constrained by the availability of such natural values both within and outside protected areas. Finally, through the development of visions and plans for a ‘visitor-friendly forest’ through a clearcut-free zone, Collaboration Tiveden advertised these two central concepts aimed at supporting a more multifunctional forest landscape.

### 3.3. Validation of qualitative data

#### 3.3.1. Intensified forest management

The Tiveden area has a long history of transformation of naturally dynamic forest landscapes towards effective cropping systems that provide industrial raw material. Natural fire-driven forest dynamics began to disappear in the 16th century (Page et al., 1997). This was replaced by forestry aimed at producing charcoal for the mining and metallurgic industries during the 19th century (Anon., 1995). In the mid-20th century the amount of middle-aged forests increased as timber succeeded charcoal production as a desired product (Fig. 4). These transitions are reflected in the dynamic of forest stand age distributions with gradual decline in the proportion of old forest, and an increase in younger forest (Fig. 5).

Currently, the oldest forest age classes are generally formally protected, or voluntarily set aside. Final felling harvests take place in biologically young forest stands. Widespread clear-felling and decreasing age for final felling is gradually lowering the mean stand age. Consequently, the area proportion of older forests popular for outdoor recreation is declining (Fig. 6).

Summarising, the long history of forest use has led to a divided landscape with small remnant islands of near-natural forests in a sea of intensively managed forests. Unless set aside for conservation, felling of middle-aged forest stands 61–120 years is expected to be completed within two decades.

#### 3.3.2. Effects on forest biodiversity

For monitoring and assessments of biodiversity states and trends, and spatial planning, knowledge about the amount and spatial distribution of habitats in terms of different stand age classes, tree species, and landscape structure is crucial. Mapping the relative level of naturalness of forest stands is an additional particularly useful approach (Bubnicki et al., 2024), and illustrates the spatial segregation of forests with different potential for biodiversity conservation (Fig. 7).

The moose is a charismatic species, much appreciated by tourists. It is also a keystone species due to its effects through browsing damages on both economically valuable species like young Scots pine, and the deciduous tree species aspen (*Populus tremula*), oak (*Quercus robur*), rowan (*Sorbus aucuparia*) and willows (*Salix* spp.), which provide habitat for a wide range of lichens, fungi, insects and birds of conservation concern

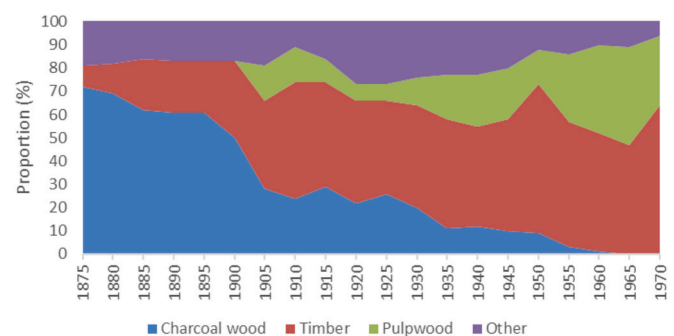
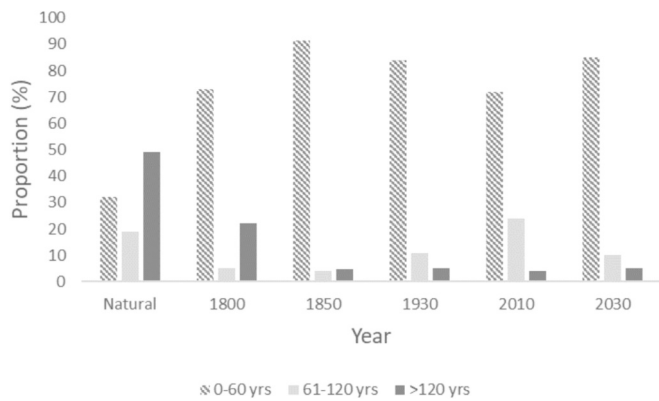


Fig. 4. Temporal dynamic of forest products in the Tiveden area from 1875 to 1970 (Anon., 1995).



**Fig. 5.** Estimated temporal changes of the stand age class distribution in the Tiveden area from when natural fire dynamic ceased 400–500 years ago (Page et al., 1997) (natural) over the past 200 years. Industry wood and bioenergy is the focus in the age class 0–60 years, outdoor recreation and nature-based tourism corresponds to the age class 61–120 years, and biodiversity conservation through protected areas and voluntary set-asides corresponds to forests aged > 120 years. Data compiled from Blohm and Färg (1953), Kardell (1982), Anon. (1995).

(Angelstam et al., 2017). During the past six decades the amount of habitat with young trees providing moose food increased almost three-fold in the late 1980 s, and then declined. The moose population, estimated by the number of harvested moose, has tracked the amount of habitat in young forests providing feed (Fig. 8,  $r = 0.72$ ,  $n = 63$ ).

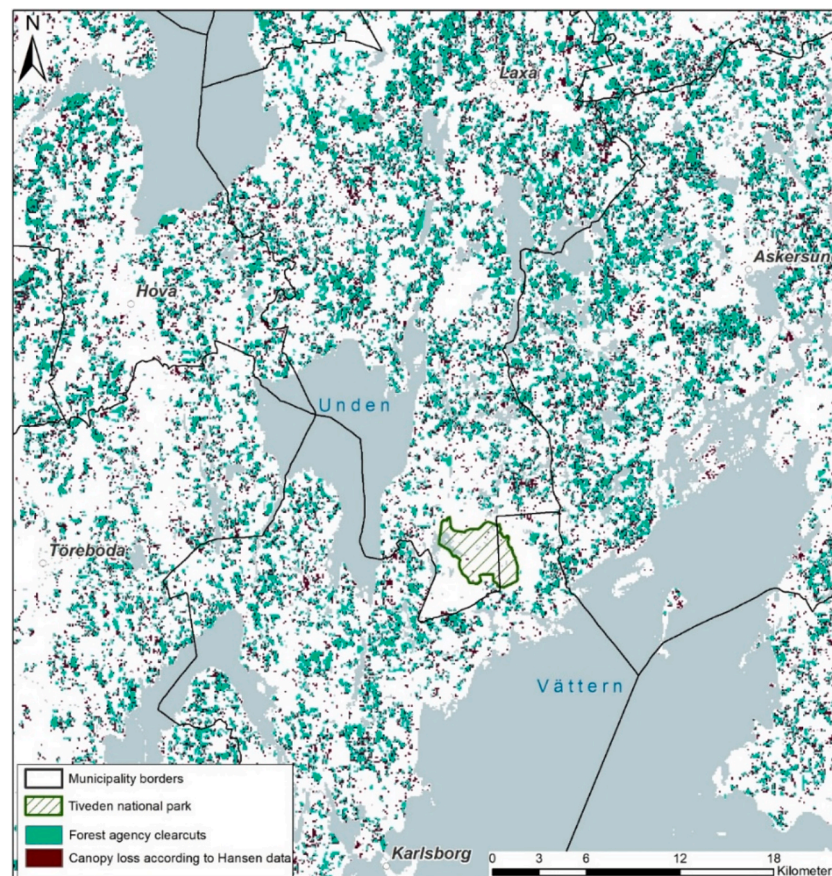
### 3.3.3. Cultural landscape values

Rural livelihoods in Sweden were historically dependent on combining agriculture and animal husbandry, but gradually faded away after WW2 (Gadd et al., 2011). Meadows, pastures and forest grazing by domestic livestock had created a living semi-open multifunctional cultural landscape. Remaining areas with such cultural landscapes are preferred by citizens both for residence and amenity (Elbakidze et al., 2017). Agricultural statistics from 1927, and field surveys published in the late 1980's, show that in the Tiveden area 96 % of the traditional cultural landscape were lost over the past century (sources in Supplement 2). In today's rural landscapes, structural features with high nature values such as old deciduous trees and dead wood typically remain in the edge zone between forests and fields, i.e. on abandoned meadows and pastures of the past cultural landscape (Mikusinski et al., 2003).

### 3.3.4. Human population and tourists

The Tiveden area has experienced several societal transition processes. The establishment of agriculture based on animal husbandry led to a slow population increase from the late 16th century, which accelerated from the mid-19th century when the iron industry grew and forestry focused on charcoal production. However, around 1900 this industry declined, and was partly replaced by forestry focusing on production of timber and pulpwood, but mostly by a thriving metal-lurgic and mechanical industry. Later, also these sectors waned, which led to a rapid population decline (Fig. 9). From ca. 2010 the population has been stable, which coincided with foreign immigration, commuting to the regional capital and return to rural areas.

Since the inauguration of Tiveden National Park in 1983, monitoring of the number of visitors has been carried out. During the four decades that passed since its creation the number of visitors has increased about



**Fig. 6.** Clear-felled areas according to Swedish Forest Agency 2000–2023 in the Tiveden area located in southernmost Örebro county, and the overlapping forest canopy loss according to Global Forest Change 2000–2023 (Hansen et al., 2013).

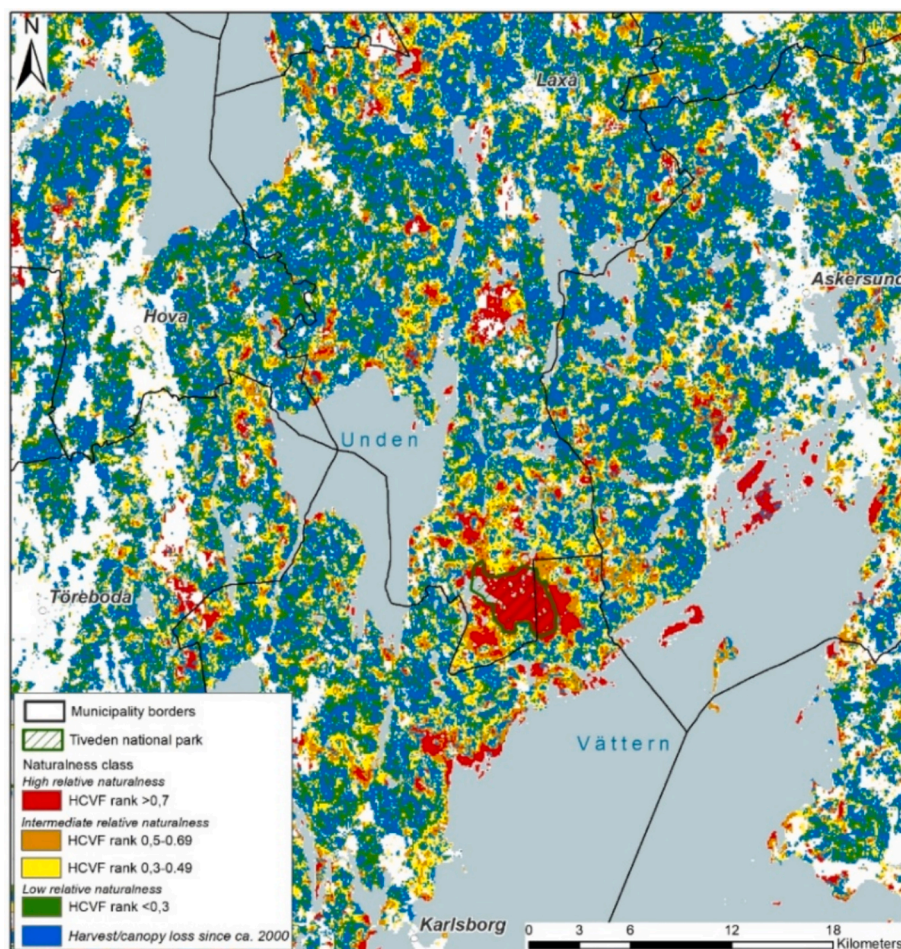


Fig. 7. Map of the relative likelihood that individual 1-ha pixels host forest with different relative high conservation value forest (HCVF) naturalness values from high (1) to low (0) in four groups (Bubnicki et al., 2024).

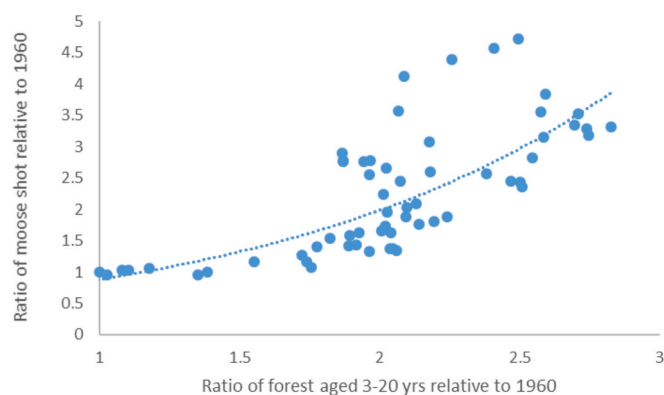


Fig. 8. Changes in the amount of forest stands in different age classes is an important driver affecting the abundance of different species. The relative ratios of young forest area providing winter food vs. the size of the moose population from 1960 to 2022 is a good example. Data from the Swedish national forest inventory and hunting statistics ([www.viltdata.se](http://www.viltdata.se)).

four-fold (Fig. 10, left). The increasing trend continued after the expansion of this national park in 2017 and peaked during the Covid pandemic in 2020 and 2021. Counters along trails in the national park during the period 2017–2023 clearly indicate visits being concentrated to July and August (Fig. 10, right).

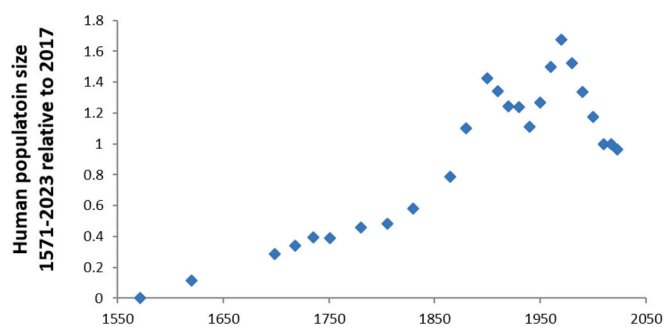
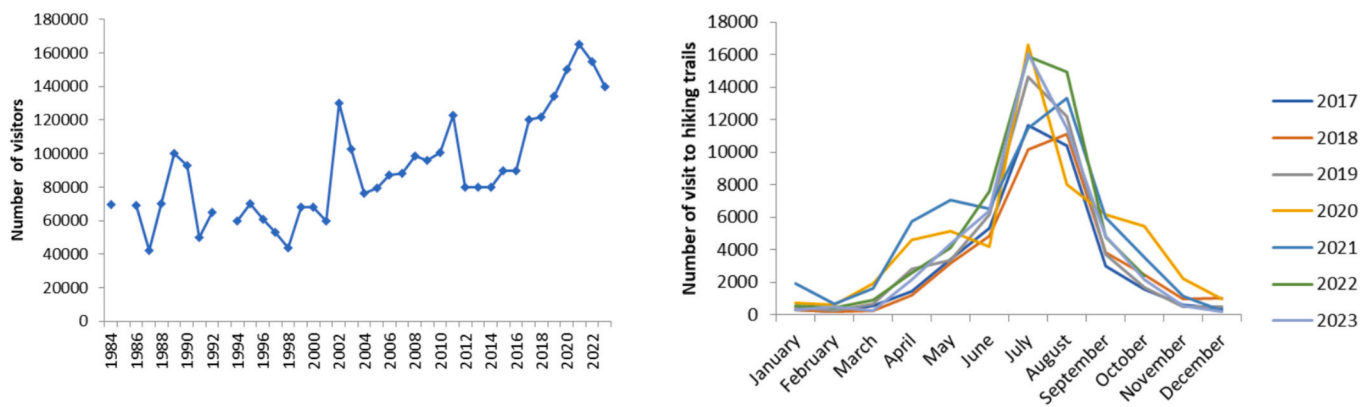


Fig. 9. Human population size in Laxå municipality 1571–2023, relative to 2017 with 5695 inhabitants (data from Andersson Palm (2000) and Statistics Sweden).

#### 4. Discussion

##### 4.1. Eleven failed attempts to realise a multifunctional forest landscape

This study combines (1) a **longitudinal examination** of five decades of projects aiming at promoting innovations in support of multifunctional landscapes accommodating multiple value chains, (2) a **content analysis** of qualitative data capturing the most recent collaborative initiative aimed at supporting a transition from forestry as a cropping system to planning and management supporting multifunctional forest landscapes, and (3) **validation** of qualitative data using quantitative



**Fig. 10.** Number of visitors to Tiveden National Park from the year after its inauguration in 1983 (left), and the seasonal dynamic of visitor counts at Tiveden national park from its expansion in 2017 to 2023 (right) (data from Örebro county administration).

data.

The **longitudinal** part of this study focused on examining 11 efforts in the Tiveden area (Fig. 2) during five decades to support forestry, conservation and nature-based tourism by advocating comprehensive landscape planning, integrated at the level of neighbouring municipalities. The asset in common is the Tiveden forest massif with high natural and cultural landscape values, being located between the two largest urbanised regions in southern Sweden. The motivations in successive projects have transitioned from a desire to improve grey infrastructure supporting increasing tourism activity, via discussions on how to reduce forest management intensity and its negative effects on natural and cultural values as a base for nature-based tourism, and to a desire to limit the increase in the number of visitors. Despite a long history of collaborative efforts aimed at landscape planning spanning several decades, little progress has been made in the Tiveden massif to establish a multifunctional forest landscape. As a remedy attempt, the social platform initiative Collaboration Tiveden focusing on Laxå municipality and Tiveden national park (Fig. 2) was established in 2016, and approaches to “clearcut-free” forest management were demonstrated. Given the limitations of space and the passing of time, we choose to follow this initiative in detail.

Our **content analysis** explored Collaboration Tiveden as a locally-driven collaborative platform initiative aimed at supporting a transition to a more multifunctional forest landscape. The main driver of this initiative was a perceived threat posed by high forest management intensity in the area, and limited area extent and quality of remnant natural and cultural forest values. These land covers support core landscape benefits highly valued by a large number of local actors and stakeholders relating to rural development and nature-based tourism. Our analysis reveals that, despite the establishment of Collaboration Tiveden as a platform for deliberations, and some trials of “clearcut-free” forest management, this initiative remained strongly constrained by higher level drivers that represent a compact institutionalised support for intensive even-aged forest management in Sweden (Hertog et al., 2022; Angelstam et al., 2022). Thus, the state-owned forestry company Sveaskog, being the main owner of forest land in the Tiveden area, was reluctant to fully engage in learning through evidence-based evaluation about how to shift to alternative forest management methods that minimize negative impacts on natural and cultural forest values. In spite of abundant relevant spatial data about multiple forest landscape values, there is a lack of knowledge amongst decision-makers at multiple levels of forest governance concerning natural and cultural forest values and forest ecology. This constrained efforts to gain support for the initiative at higher levels of governance of the forestry company Sveaskog. These findings resonate with Bjärstig et al. (2024) who suggest that collaborative governance initiatives are inefficient when participants are unable to clearly identify shared objectives, have different interpretations

of knowledge and norms, or where there are low levels of trust. More broadly, our findings support previous findings concerning the long-term partitioning of forest stakeholders into two relative stable groups comprising an environmental coalition supporting environmental forest policy integration vs. a forest sector coalition generally opposing it (e.g., Sotirov et al., 2021). This echoes studies of collaborative forest management initiatives in other contexts. For instance, the dominant influence of industrial forestry practices and lack of shared understanding among stakeholder groups are documented barriers to collaborative forestry initiatives across Europe and North America (e.g., Axelsson et al., 2013; Anderson and MacLean, 2015; Chiasson et al. 2019). In line with this pattern, the initiative Collaboration Tiveden involving industrial forestry was paused in 2024 (A. Tivell, pers. comm.).

Our quantitative **validation** focused on the key statements in the content analysis. Empirical quantitative monitoring data confirm (1) that forest management intensity has increased over time, (2) the effects of this on forest biodiversity focusing charismatic species and old-growth structures, (3) the decline of cultural landscape values, (4) the development of the human population, and (5) of nature-based tourism. Empirical quantitative forest monitoring data confirm interviewee’s perceptions and show that (1) the proportion of young forest with low natural and cultural values has increased dramatically over the past 5 decades, (2) older forests supporting naturalness, also being attractive for outdoor recreation, have decreased; (3) high forest management intensity reduces habitat network functionality within the Tiveden area. Future scenarios estimate that the proportion of Norway spruce will increase at the expense of Scots pine, that forests become younger, while the proportion of deciduous trees will remain low (Anon., 2019). The same study concluded that the current level of habitat fragmentation is too high, and habitat quality too low, to host species demanding high levels of forest naturalness. To conclude, the polarisation of forest landscapes between small islands of high nature values, and a surrounding matrix of intensive forestry, have increased and will continue. These changes in forest landscapes have resulted in both winners and losers. The former is exemplified by the dynamics of the moose population over time, and the latter by the negative net result of too limited conservation efforts, and continued fragmentation of isolated remnants of high conservation value forests (e.g., Svensson et al., 2019; Angelstam and Manton, 2021). The state of traditional cultural landscape remnants, which host a range species that rely on mowing and grazing (Eriksson, 2021), is also critical. In the Tiveden area, about 95 % of the past meadows, pastures and wooded grasslands have disappeared. Maintaining and restoring cultural landscape supports nature-based tourism, rural well-being and affects real estate values positively (Andersson et al., 2019). This stresses the need for protection, management and restoration of high conservation value forests and of cultural wooded grasslands.

Declines in jobs offered by agriculture, forestry and industry have resulted in human population decline in Tiveden. This has made the municipality realise the value of attractive forest and cultural landscapes, and thus participation in the initiative Collaboration Tiveden. Increasing numbers of visiting tourists is, however, a two-edged sword in terms of providing both income to nature-based tourism businesses as well as causing wear and tear on nature. Additionally, intensive forest management encroach closer to existing formally protected areas as the few remaining areas with older forest continue to be harvested.

## 4.2. Challenges for multifunctional forest landscapes at multiple levels

### 4.2.1. Even-aged forestry paradigm as an obstacle for multifunctionality

Our case study in Tiveden indicates that bottom-up initiatives to develop and integrate alternative forest landscape objectives are strongly constrained by higher level dynamics. These include a suite of strongly institutionalised traditions at the national level, as well as economic, regulatory, socio-cultural and technological factors. Similar findings have been reported using the IAD framework in other forest contexts (e.g., Brodrechtova et al., 2018; Elbakidze et al., 2022). This has resulted in a strong “business-as-usual” approach supporting intensive even-aged forest management for industrial raw material in Sweden (Angelstam et al., 2022; Hertog et al., 2022), which effectively constrains the emergence of alternative objectives in the forest landscape.

Even-aged rotation forestry based on clear-felling is thus a strong dominating mind-set and lasting paradigm for forest management in Sweden. Supported by coalition alliances of institutional, social, technological and economic drivers, key actors have invested for a very long time not only in the forest management system, but also supply chains, logistics, and industry infrastructure for value-added wood-based products. Together these factors constitute a series of barriers that make transitions towards multifunctional forest landscapes difficult. New, desirable value chains, such as nature-based tourism, carbon storage, and biodiversity credits, could establish the legitimacy for moving towards a new paradigm (e.g., Jonsson et al., 2019).

Systemic change implies institutional reform to redress path-dependent dynamics that entrench support for incumbent forest users (e.g., Bennich et al., 2018). Such institutional reform could take many shapes. For example, new policy instruments to account for externalities of intensive forest management are needed. Degradation of common values viewed as externalities, such as biodiversity, is a good example. Reforms could also be designed to signal a move away from strict economic rationality as the governing paradigm for forest management. In many respects, such a policy shift has already occurred in Sweden through national level policy about biodiversity and ecosystem services (Regeringen, 2013/14). Nevertheless, stakeholders in our Tiveden case study repeatedly underlined that the core objective of Sveaskog was to maximise economic revenues for the state by applying even-aged forestry. This is consistent with the articles of association of the state forest company Sveaskog, which focus on forestry and forest industry, selling land for conservation, and generating financial market return (<https://www.sveaskog.se/om-sveaskog/bolagsstyrning/bolagsordning/>). In contrast, a recent project reaching out to non-industrial forest owners in the Tiveden area has resulted in adoption of management plans presenting alternatives to even-aged rotation forestry (Nystedt and Jonegård, 2024). A growing interest in landscape multifunctionality among smallholders was observed by Westholm (2024), and also by the Swedish Church (Enander, 2024). This illustrates that understanding the roles and values of different forest owner categories representing different value chains (Robert et al., 2020) is key to understanding the opportunities for applying alternatives to even-aged forest management (e.g., Mason et al., 2022). Thus, several forest management approaches need to be applied in a landscape (e.g., Hardy et al., 2023).

### 4.2.2. Limited spatial planning

This study shows that integrated spatial planning at the level of single or multiple municipalities' rural areas has not been realised. This is in spite of the agreed need for adequate knowledge about managing and planning for multiple values towards multifunctional landscapes. The qualitative content analyses, and the quantitative validation, revealed negative effects of intensive even-aged rotation forestry on natural and cultural values, on rural development, and on nature-based tourism. This stresses the need for collaborative planning approaches at the landscape level. This is exactly what was recommended by Tivedengruppen (1978), namely “that a general forestry plan be prepared for Tiveden”. Such a plan must integrate regional planning of formally protected areas, and voluntary set-asides as functional habitat networks, planning at the level of forest management units, and comprehensive planning across different sectors and levels of governance including for example landowners, municipalities and county administrative boards. As shown in our examination of successive efforts supporting such a development, comprehensive planning of multiple forest landscape values has not been realised, in spite of five decades of attempts. Additionally, to reach agreed conservation targets regarding both quality and quantity of different land covers, there is a great need for nature restoration through increase protection, restoration and re-creation of additional areas (Angelstam et al., 2020; Skogsstyrelsen, 2022b). This has to be adapted to different forest owner categories. Sténs et al. (2016) observed differences among those regarding preferred governance modes and management. While biomass and bioenergy sectors advocate business as usual and voluntarism, other stakeholders demand targets and improved landscape planning.

An additional new driver that requires long-term planning is adaptation and mitigation in relation to climate change. Regarding EU Land Use Change and Forestry (LULUCF) regulation of the land use sector the target is to rely on forests' role for reaching the target of no net loss of CO<sub>2</sub> by sequestering carbon. However, due to reduced tree growth and increased harvest rates, during the past decade the sequestered amount of carbon has declined in Europe (e.g., Messier et al., 2022).

Ultimately, as advocated during the era of physical planning of the early 1970 s (SOU, 1971), and currently in terms of triad landscape functional zoning (e.g., Himes et al., 2022; Nagel et al., 2025), application of different land management methods would be an effective approach to support development of multifunctional forest landscapes. The planning themes could include effective production of industrial raw materials, designing visitor-friendly forests and restoring representative functional habitat networks, conserving the cultural landscape, and reintroduce fire and other natural disturbances, as well as encourage climate adaptation and mitigation in forestry. However, while spatial forest landscape planning is a growing area of research (de Jesus França et al., 2022) and relevant spatial data about forest values are at hand (e.g., Bubnicki et al., 2024), our case study shows that implementation on the ground remains challenging. Chazdon et al. (2021) identified three cross-cutting challenges for governing landscape planning that are reflected in our case study results: 1) poor alignment across levels and sectors of government; 2) environmental and social heterogeneity; and 3) lack of enabling conditions and implementation capacity. In the light of recent climate and energy policies and geopolitical developments, Jonsson and Sotirov (2025) showed that forestry fellings are increasing at a faster rate than net annual growth increment in all four studied European regions. This is reflected in recent policy reversals in Sweden (SOU, 2025) and is likely to increase the friction among different forest users.

### 4.2.3. Competition among forest benefits

Key factors driving bottom-up changes in forest management in this study include the integration of alternative activities with strong future outlook (i.e. growth in demand of outdoor recreation and nature-based tourism) that depend on high ecological and cultural landscape values, and that deliver jobs and services as social benefits for local

communities. This is counteracted by the traditional forestry sector's fears for the future, for example due to climate change, decreased mobilisation of wood to harvest, and threat of regulatory change in support of nature restoration and carbon storage. In response to this the government commissioned a revision of the Swedish forest policy (Regeringen, 2024:16). The aim is to develop a future expedient forest policy that promotes a long-term sustainable competitive forestry, increased forest growth and a long-term increased access to sustainable forest biomass. This implies an increased polarisation of already contradictory policy objectives (Beland Lindahl et al., 2017).

Intensified forestry to serve a growing bio-economy does not support rural development in Sweden for two main reasons. First, new inhabitants and new kinds of jobs in rural areas are no longer provided by the mechanised conventional forestry aimed at high wood and biomass production, but rather through amenity migration (Niedomysl 2008), retirement (Lundholm, 2012), home office trends (Smite et al., 2023) and nature-based tourism focused on wilderness and biodiversity (Sievänen, 2013). This means that municipalities strive to sustain their populations and attract new inhabitants by highlighting their valuable nature and cultural landscapes (Eimermann, 2015). This is precisely what municipalities such as Laxå in the Tiveden area has done. Second, the focus on biomass production has lowered the final felling-age of forests and increased the proportion of younger forests far below what is required for biodiversity conservation, as well as appreciated by tourists and rural people (Elbakidze et al., 2017). Furthermore, this has negative effects of forest landscapes' ability to store carbon (Skytt et al., 2021). Also other sectors affect natural and cultural landscape values. Establishing new wind power parks and mining for minerals are two examples. Finally, climate change should be considered. Extreme temperatures and drought, strong winds and flooding can be eased through forest-based adaptations (Blumröder et al., 2021; Messier et al., 2022). Thus, forests should not only be providers of industrial raw materials, but also mediate extremes and stabilize ecosystems to support human well-being and health. Bringing back trees and woods into urban areas and cultural landscapes is one example. However, as long as advice to forest owners in Sweden are provided by industrial forest owners' own wood procurers who prioritize maximum sustained yield forestry (Curtis et al., 2023), and increased harvesting of wood (Regeringen, 2024), application of multiple forest management methods will remain limited.

#### 4.3. Actions towards multifunctional landscapes

##### 4.3.1. Policy instruments: carrot, sermon or stick?

Sweden has a highly diverse forest ownership structure, including public owners at multiple levels, industrial-scale owners, and a large proportion of non-industrial private forest owners. Fewer than 10 % of this latter group see wood production as the main value of their forest holdings (Skogsbarometern, 2023). Instead, the sense of ownership itself, aesthetic and cultural considerations, recreational potential, and increasing real estate value, are key forest values for this group. The large differences in portfolios of desired values stresses the need for landscape planning approaches that are adapted to different forest owner categories. Policy instruments supporting this can be divided into three categories: carrots, sermons and sticks (Vedung, 1998).

An argument against the integration of multiple objectives in forest landscapes is that conventional uses such as timber harvesting are already expected to adapt their activities to maintain forest values for other users. For example, voluntary set-asides and tree retention in harvesting areas is practiced (Felton et al., 2020). This may imply either increased costs or decreased revenues, or both, for owners focusing on sustained yield forestry. As our case study indicates, industrial owners are strongly compelled to maximise economic outcomes and are therefore reticent to voluntarily engage in multifunctional landscape initiatives that are perceived to negatively impact economic performance. One carrot approach is therefore to develop suitable compensation

packages to landowners for lost incomes and/or income-sharing schemes where the supplier of forest values (e.g., the owner of forests rich in natural values) receives payment from the beneficiaries of those values (e.g., nature-based tourism operators) (Michanek et al., 2020). Such payments could be made available from public sources or by mobilising financial markets (e.g., van Oosten et al., 2021; Vedung, 1998). For example, Assmuth and Tahvonen (2018) found that introducing carbon pricing causes a switch from even-aged to continuous cover management rather than vice versa. Similarly, Elsasser et al. (2021) estimated the monetary value of forest landscape benefits in terms of wood production, carbon sequestration, local residents' recreation, nature protection and landscape amenity in Germany local administrative units. Additionally, Brockhaus et al. (2024) highlight the potential of community-led finance to both support forest landscape change and to shift power relations away from short-term, profit-driven forest exploitation towards long-term investments that support multiple objectives. However, Kleinschmidt et al. (2024) observe that, at present, such alternatives are rare.

Regarding sermon, Swedish forestry extension services are a core provider of advice to forest owners in Sweden as in other countries. In Sweden, extension services and forest management planning primarily focus on sustained wood yield (Eriksson, 2022), and is almost without exception carried out by staff linked to the main forest industry actors (e.g., Kindstrand et al., 2008). However, because multifunctional landscapes encompass a wide range of desired goods, services and values, the focus of these services ought to be broadened to include biodiversity components as species, habitats and ecosystem processes, social and cultural values, as well as risks and vulnerabilities affecting the provision of ecosystem services (Eriksson, 2022). This requires both the (re) training of extension service providers and forest planners as well as the development of more holistic analyses concerning forest benefits (e.g., Tyrväinen et al., 2007; Triviño et al., 2015, 2017; Thellbro et al., 2017; Díaz-Yáñez et al., 2020; Angelstam et al., 2022; Pukkala, 2022). To support multifunctional forest landscapes there is therefore a need for mapping of a wide range of values as a base for deliberations involving landscape zoning, and for learning among forest actors and stakeholders at the local level. Adding information layers to forest owners' forest management plans that capture multiple forest landscape values, which describe a wider range of value chains than that of the forest industry's wood procurers (Jonsson et al., 2019; Curtis et al., 2013), is one avenue. Our case study showed that, although collaborative forest management initiatives focus on such learning and knowledge-sharing, learning objectives and engagement in learning processes may not necessarily be shared by all stakeholders. Forest industry representatives in Collaboration Tiveden, for example, were more interested in learning about the practical applications of alternative management techniques than about how to incorporate the values of other stakeholders into management plans. Furthermore, Jamison and Muth (2022) highlight that the efficacy of "sermons" benefits from investments in developing social capital and trust between forest owners and extension services or other advisors.

Finally, stick as a policy instrument is weak in Sweden. The reason is the philosophy of "freedom under responsibility" for landowners, and strong forestry advocacy supporting this (Sténs and Mårald, 2020). To conclude, given strong ownerships rights and institutional context in Sweden, the dominating types of policy instruments have been carrot in terms of the state purchasing land to create protected areas, and sermon in terms of education campaigns and evidence-based analyses of high conservation value forests and their spatial configuration. However, where top-down government legacies prevail, stick-based policy instrument are common (e.g., Naumov et al., 2016; Albulescu et al., 2022).

##### 4.3.2. Future directions to support learning for multifunctional forest landscapes

A wicked challenge for multifunctional landscapes is to cope with the current siloed approaches to policy instruments (Nikolakis and Innes,

2020; Angelstam et al., 2022). Thus, IPBES (2024) argued strongly not to address issues and interlinkages in isolation, resulting in potential misalignment, unintended consequences or trade-offs. Instead, a nexus approach employing a holistic manner to learning, leading to integrated and adaptive decisions that aim to maximize synergies and minimize trade-offs, is needed.

The European continent exhibits dramatic variation in the application of different forest management systems (Mason et al., 2022). Sweden stands out as an extreme, being dominated to 97 % by even-aged forest management based on a rotation of clear-felling, planting, cleaning and thinning (Skogsstyrelsen, 2022a), but in this sense is broadly comparable to other boreal “forestry” nations such as Canada, Finland, Russia, Latvia and Estonia. Given increased concerns about climate change and biodiversity conservation, both research (e.g., Kuuluvainen et al., 2021; Aszalos et al., 2022) and international policy (European Commission, 2021, 2023) stress the need to increase the range of forest management systems applied to maintain heterogeneous landscapes (Duflo et al., 2022). However, the narrow focus on wood production across both conventional even-aged and uneven-aged forest management systems has triggered the need to introduce appropriate closer-to-nature forest management systems (Kuuluvainen et al., 2021; Larsen et al., 2022). At the same time, as our findings indicate, the threat posed to forests by climate change and intensive management, and the potential of regulatory change in support of nature restoration (European Commission, 2022) and carbon storage (Skytt et al., 2021) have generated both fear and enthusiasm among different actor and stakeholder groups.

This study is an attempt to apply learning through ongoing evaluation (Svensson et al., 2009) by studying during seven years Collaboration Tiveden as platform aimed at fostering multifunctional landscapes. Our observations indicate that such a transition in a country like Sweden where even-aged rotation forestry is the norm represents a wicked problem (Hertog et al., 2022). This is illustrated by a continued political focus on wood production above other forest values (Regeringen, 2024:16), and broad political opposition to recent EU nature restoration legislation mirrored in a recent review of how Sweden should meet EU and Swedish policy requirements concerning biodiversity conservation (SOU, 2025).

Evaluation of implementation processes is about what develops between the establishment of an agreed policy or objective and the ultimate impact of subsequent actions in real world social-ecological systems. Rauschmayer et al. (2009) focused on three steps for evaluation, namely (1) the policy process, (2) outputs (e.g., policy instruments, strategic assessments, planning processes), and (3) the consequences in terms of outcomes on the ground such as collaborative learning, and functionality of habitat networks for biodiversity, as well as human well-being and biodiversity conservation. Evaluation thus aims at understanding “what really works”. Evaluation methods can be driven by multiple rationales (Baker and Eckerberg 2016). However, outcomes on the ground commonly take longer time to develop than the duration of most research projects (Axelsson et al., 2020). This study shows that forestry traditions can also be resistant to change for long time (e.g., Puettman et al., 2008; Angelstam et al., 2022). To understand “what really work” calls for systematic analyses of both retrospective and comparative studies of different transition processes aimed at multifunctional landscapes.

A solution is to focus on multiple place-based case studies representing different trajectories in social-ecological systems (Angelstam et al., 2013a). This approach can be seen as a “natural experiment” of a social-ecological situation as it unfolds over time in the real world (Lijphart, 1971; Diamond, 1986; Stake, 1995). Similarly, a comparative politics approach (sensu Hague and Harrop, 2007) can be used for evidence-based comparisons of place-based efforts applying different kinds of forest management systems to satisfy different portfolios of benefits (e.g., Elsasser et al., 2021). The diversity of social-ecological contexts in both Sweden and on the European continent is thus an

important asset for learning. This is illustrated by the large variation across the European continent regarding visions of naturalness vs. cultural landscapes (Muys et al., 2022), continuous cover forestry vs. even-aged rotation forestry (Mason et al., 2022), different types of nature restoration through closer-to-nature forest management (Larsen et al., 2022), re-wilding, restoration ecology and other approaches to nature restoration (European Commission, 2022, 2023), landscape approaches (Sayer et al., 2013) and regional differences in forest governance (Lazdinis et al., 2019).

## 5. Conclusions

Visions of multifunctional forest landscapes constitute a base for sustainable forest management, which encompass effective production of provisioning ecosystem services, social and cultural values, as well as the conservation of biodiversity of naturally dynamic forest and traditional cultural landscapes. This requires engagement of a wide range of actors and stakeholders at multiple levels. In this place-based case study we examine efforts aimed at supporting multifunctional forest landscapes during five decades in the Tiveden forest massif in Sweden, a forest landscape with high natural and cultural values, and a complex multi-level social system setting including municipalities, rural citizens, forest owners and managers, tourism and hospitality firms. Participatory research about the most recent seven-year-long initiative shows that a key challenge is the increasing polarisation between intensive forestry and conservation areas in forest landscapes. There is thus an urgent need for protecting high conservation value forests, conservation management and nature restoration. Effective biodiversity conservation also requires spatial planning approaches of landscapes that are adapted to different forest owner categories. However, integrated spatial planning at the level of single or multiple municipalities’ rural areas has failed to materialise, in spite of the agreed local and regional need for adequate knowledge about managing and planning for multiple values towards multifunctional landscapes. To cope with challenges toward multifunctional landscapes we discuss necessary actions at multiple levels of governance. Empowering planners by providing knowledge about the amount and spatial configuration of land cover patches supplying different forest goods, services and values is a key avenue towards multifunctional landscapes. Supporting evidence-based learning through evaluation of efforts towards multifunctional landscapes, we encourage replication of this place-based case study approach in multiple social-ecological contexts.

## CRedit authorship contribution statement

**Per Angelstam:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Lucas Dawson:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.landurbplan.2025.105439>.

## Data availability

The authors do not have permission to share data.

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