



# Factors affecting governance innovations for ecosystem services provision: Insights from two self-organized forest communities in Czechia and Slovakia

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## ABSTRACT

Self-organized forest communities (FCs) have governed common forests in a sustainable way in Europe for centuries. In most CEE countries, this tradition was interrupted by the communist regime in the second half of the 20th century. The social demand for non-provisioning forest ecosystem services (FES) is increasing nowadays and FCs could play a significant role in their provision. However, FCs are currently facing many challenges, e.g., climate change, loss of income or changing social values. The paper investigates (i) the role of self-organized FCs in innovative forest governance and sustainable FES provision and (ii) specific conditions and fostering/hindering factors affecting implementation of innovative forest governance schemes by FCs in CEE.

Factors influencing forest governance innovations in two FCs in Czechia and Slovakia were identified and discussed during workshops, focus groups and semi-structured interviews with their members and stakeholders. It was shown that self-organized FCs could play a pioneering role in implementation of innovations as they are open to novel solutions and have the ability to flexibly and collectively respond to new challenges. Emphasis on non-provisioning FES, cooperation of actors, strong leadership and introduction of financial compensations are key fostering factors. In contrast, factors related to institutional settings (e.g., current legislative environment) are perceived as hindering.

## 1. Introduction

Forests cover about 31 % of the world land area (The World Bank, 2021) and 46 % of the European land area (Forest Research, 2021). They provide a wide range of ecosystem services (ES) directly or indirectly influencing humans and their quality of life (such as water and air purification, carbon sequestration, recreation, biodiversity or timber and non-timber products). The provision of forest ecosystem services (FES) and their economic value is determined not only by forest location, forest type, ecological zone, forest area (Alamgir et al., 2016; Taye et al., 2021), but also (and maybe to a greater extent) by land-use change and willingness for innovations in forest management practices applied by different types of forest owners (state/private/community owners) or

enforced by a range of actors involved in forest management (Blanco et al., 2017; Juerges et al., 2021; Morán-Ordóñez et al., 2020; Sing et al., 2015; Spangenberg et al., 2014). Nowadays, innovations are seen as iterative social open-ended processes (Rip, 2012) based on learning (Voß et al., 2009) and actors' dynamic involvement in the innovation process (Kluvánková et al., 2021). In our study, innovations in forest governance are seen as novel social practices that seek to improve the sustainable provision of (primarily non-provisioning) FES (Mann et al., 2022) such as implementation of new payment schemes or other measures fostering biodiversity preservation, carbon sequestration, etc. Most of the ES can be seen as public goods or common-pool resources because of their non-excludability and (non-)rivalry in consumption (Costanza et al., 2021; Kluvánková et al., 2019; Loft et al., 2015). It has been shown in many

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cases that neither private property regime and markets, nor state ownership are capable of effective and sustainable governance of such goods and services and that they can often be better governed as commons through collective institutions (Loft et al., 2015; Ostrom, 1990, 2008), in the case of, e.g., urban open spaces (Arvanitidis & Papiagiannitsis, 2020), drylands (Stafford-Smith & Metternicht, 2021) or forests (Gatto & Bogataj, 2015; Kluvánková & Gežík, 2016).

Forests all over the world are currently facing many challenges, such as climate change and natural disturbances, land-use change (deforestation) or changing societal values – increasing social demand for non-provisioning ES (Retallack, 2021; Wei et al., 2017) and the resulting conflicts between environmentalists and “traditional” foresters and industrial forest owners, highlighting the role of forests in the production of basic raw materials (Blicharska et al., 2020) or conflicts among other stakeholder groups (Louda et al., 2021). Innovative forest governance schemes, based on traditional and new forest communities (FCs), seem promising to tackle these challenges (Kluvánková et al., 2018; Melnykovich et al., 2018). Similarly to Gatto & Bogataj (2015), Kluvánková et al. (2018), Primmer et al. (2021) and other authors, forest communities are (for the purpose of this paper) understood as groups of local actors who commonly own/manage a forest or are in another close relationship with local forests.

Many studies support findings about efficiency and sustainability of managing forests by a community as forest commons since the community members often live in the area (Holmgren et al., 2010) and are aware of the environmental and social values of the forest (Hogl et al., 2005; Pröbstl-Haider et al., 2020) as well as experience and site-specific knowledge connected to individual values and attitudes in a local context (Joa & Schraml, 2020). That knowledge and experience affects the attitudes and decisions of forest owners towards public benefits that forests may bring (Bergstén et al., 2018; Lawrence & Dandy, 2014). Elinor Ostrom provided her well-known eight principles for self-governing and management of commons (Ostrom, 1990); however, only little is known about the main conditions and factors for enabling innovations of FCs in forest governance leading to sustainable FES provision, especially in Central and Eastern European countries. That is why our research is focused on two FCs in this region (one in Czechia and one in Slovakia) with the aim to answer two main questions: (i) What is the role of self-organized forest communities in innovative forest governance and sustainable FES provision? and (ii) What are the most important fostering and hindering factors affecting implementation of innovative forest governance and how do they differ between two types of self-organized forest communities in the same region? The paper is organized as follows. The literature review first introduces the different concepts used in the field of forest commons in the world and in Europe and presents the use of innovations in forest management. The third chapter presents the case study areas of two forest commons in Czechia and Slovakia. The analytical framework is then presented. The results of the investigation of the role of self-organized FCs in innovative forest governance and an analysis of factors influencing the development of innovations in forest commons are the main subject of the fourth chapter, which is followed by discussion and conclusions.

## 2. Self-organized forest communities and innovations in forest governance

### 2.1. Different terms, similar principle

Local communities governing natural resources can be found in many countries. Especially in the case of forests, many recent studies from almost all continents exist on the topic of self-governed forest resource management by local communities. Numerous studies analyse the situation of local forest communities in Latin American countries – Argentina (Gabay & Alam, 2017), Brazil (Hajjar et al., 2013), Costa Rica (Kitamura & Clapp, 2013), Mexico (Chhatre & Agrawal, 2008; Hajjar et al., 2013), or in Asia – e.g., studies from China (Zhu et al., 2014),

Indonesia (Maryudi et al., 2012; Schusser et al., 2015) or Nepal (Chhatre & Agrawal, 2008; Chhetri et al., 2012; Lacuna-Richman et al., 2016; Pokharel, 2012). There are also studies from Africa – namely from Cameroon (Yufanyi Movuh, 2012) and Namibia (Schusser, 2013; Schusser et al., 2015). However, most of such scientific papers focus on European countries, where we can read about FCs in Germany (Böhling & Arzberger, 2014; Schusser et al., 2015), Italy (Gatto & Bogataj, 2015; Merlo, 1995; Paletto et al., 2014), Romania (Vasile, 2018), Slovakia (Kluvánková-Oravská, 2011; Šulek, 2006), Slovenia (Bogataj & Krč, 2014; Gatto & Bogataj, 2015; Premrl et al., 2015), Spain (Guadilla-Sáez et al., 2020; Rodríguez-Morales et al., 2020), Sweden (Lidestav et al., 2013), Switzerland (Kissling-Näf et al., 2002), the United Kingdom (Lawrence & Ambrose-Oji, 2015), or a very complex study about different kinds of community forestry in Western Europe (Jeanrenaud, 2001). From time to time, papers comparing community forestry across countries from different continents are published, such as comparative studies focused on Cameroon, Germany, Indonesia, Namibia and Nepal (Schusser et al., 2015) or on forest commons in Bolivia, Guatemala, India, Kenya, Tanzania, Uganda and the USA (Chhatre & Agrawal, 2008).

In the scientific literature dealing with the topic of forests commonly governed by local self-organized communities, researchers use many different terms and concepts, such as *forest commons* (Arts, 2014; Chhatre & Agrawal, 2008; FAO, 2016; Gatto & Bogataj, 2015; Lidestav et al., 2013; Weiss et al., 2019), *community forestry* (Krott et al., 2014; Maryudi et al., 2012; Poffenberger, 2006; Pokharel, 2012; Schusser et al., 2015; Weiss et al., 2019), *community forest management* (Gabay & Alam, 2017; Hajjar & Oldekop, 2018), *community-based forest management* (Gabay & Alam, 2017; Pokharel, 2012), *forest communities* (Cronkleton et al., 2012; Evans et al., 2010; Gatto & Bogataj, 2015) or *communal forests* (Lacuna-Richman et al., 2016; Rodríguez-Morales et al., 2020). Notwithstanding, the basic principle is always the same (i. e., self-organized communities manage their own or long-term leased forests), although some differences in how the concepts are understood or the terms used can be identified. Understanding of the terms/concepts differs mostly according to geographical region or country. The term “community forestry” was previously associated with activities or programmes for rural communities in developing countries, such as programmes initiated by the UN FAO in the 1970 s, which were characterized by devolution of state-centred power and control to local people or communities (Cronkleton et al., 2012; Evans et al., 2010; Gabay & Alam, 2017; Schusser et al., 2015). Until this day, papers studying the situation in Asian countries very often focus on FCs established in the 1970 s (or later) as a part of some official development programme. However, nowadays the term “community forestry” is understood in a broader way. It refers to decentralized governance of community-owned or managed forests (Hajjar et al., 2013) or self-governed forest resource management (Gabay & Alam, 2017) and promotes management of forests as a common-pool resource (Pokharel, 2012). Schusser et al. (2015, p. 92) understand community forestry as “complex collective action by forest users that takes place within a broader network of multiple actors”. Papers focused on community forestry in Latin America, Africa or Asia often deal with communities of indigenous peoples living long-term in the forestland or with rural communities managing the forests using the community-based principles (Cronkleton et al., 2012; FAO, 2016; Gabay & Alam, 2017). Yufanyi Movuh (2012) associated community forestry in Africa with giving the forest back to people in the post-colonial era. Chhatre & Agrawal (2008, p. 13286) defined forest commons as “forests used in common by a large number of heterogeneous users”, Gatto & Bogataj (2015, p. 57) understand forest commons as a specific socio-ecological system, “where the common-pool resource is forestland, the users are a community having rights to the forests, and the associated governance system is represented by the legal-institutional context together with the internal forest commons rules for managing the community and the resource.” A comprehensive overview of papers focused on forest-based commons

can be found in Agrawal (2007).

## 2.2. Forest communities in Europe and rising demand for benefits provided by forests

In the European context, some authors speak about traditional or old forest commons (e.g. Arts, 2014) associated with long-lasting common-pool resource regimes (Gatto & Bogataj, 2015; Kluvánková & Gežík, 2016). There are relatively large differences in the understanding/interpretation of the term “forest communities” depending on the historical and geographical context. In the context of many South American, African or Asian countries, forest communities refer to indigenous populations permanently living in the forests or directly depending on services/products of local forests (Cronkleton et al., 2012; FAO, 2016; Gabay & Alam, 2017). However, the evidence from selected European countries shows that forest communities in those countries are mostly understood as a group of local actors living in rural forest landscape who commonly own/manage a forest or are in another close relationship with local forests (Gatto & Bogataj, 2015; Jeanrenaud, 2001; Kluvánková et al., 2018; Primmer et al., 2021). This kind of forest governance has quite a long tradition in Europe. Scientific literature has described many cases from mostly Western European countries where self-organized communities govern common forests in a sustainable way for centuries without interruption (e.g., Böhling & Arzberger, 2014; Gatto & Bogataj, 2015; Jeanrenaud, 2001; Kissling-Näf et al., 2002; Lawrence & Ambrose-Oji, 2015; Lidestav et al., 2013; Paletto et al., 2014). However, the situation in many Central and Eastern European countries is quite different and, moreover, the scientific evidence of cases from these countries is quite poor (Nijnik et al., 2020). In most Central and Eastern European countries, where community forestry historically existed, such as in Slovakia, this tradition was interrupted by the communist regime in the second half of the 20th century, when private and also community-owned forests were nationalized and managed centrally by the state. After the fall of the communist regime, the FCs were re-established during the 1990s (Šulek, 2006, Kluvánková & Gežík, 2016). The situation is different in Czechia, where community forestry does not have a historical tradition, but newly established self-organized communities in the form of land trusts focusing on buying out and management of degraded or environmentally valuable land began to emerge after the fall of the communist regime in 1989 (Slavíková et al. 2020).

The social demand for non-provisioning ES is increasing (e.g. Retallack, 2021; Wei et al., 2017; Winkel et al. 2022; Wolff et al., 2015). FCs and other forms of common local forest ownership, as well as small-scale forest owners could play a significant role in provision of a broader spectrum of FES (Schaich and Plieninger, 2013; Winkel et al., 2022) since state-owned forests may not provide a sufficient level of non-provisioning FES. This was investigated e.g. in Germany or Finland. In the study from Germany, Schaich et Plieninger (2013) stated that state-owned forests contribute significantly less to selected non-provisioning FES (such as carbon sequestration or provisioning of habitats) in comparison with other types of forest ownership. Juutinen et al. (2014) dealt with recreation as one of the cultural FES. Their study from Finnish state-owned forests (using a choice experiment method) shows that these forests do not show the most preferred levels of forest management attributes. Visitors to Finnish state-owned forests prefer cultural ES above provisioning ES. According to Juutinen et al. (2014), even if legislation regulates the minimum standard of cultural ES provision (such as in Finland), these legislative requirements are not a sufficient tool to ensure the provision of cultural ES on a level that meets the social demand, because it requires specific management practices to increase recreational services for the public.

Different research was conducted in Finland by Tyrväinen et al. (2020) or in Iceland by Brnkafáková et al. (2021) among private forest owners, specifically aimed at forest owners' willingness to participate in a payment for ecosystem services (PES) initiative. PES is another tool

besides legislation for fostering provisioning FES designed as a compensation scheme for forest owners for doing actions that increase the provision of ES (Jack et al., 2008). However, Tyrväinen et al. (2020) show that landowners' preferences for participation in such an initiative are heterogeneous and dependent on the amount of compensation, duration of contract or harvesting restriction as well as on individual characteristics and motivations and according to Brnkafáková et al. (2021) the role and interest of forest farmers involved in the programme — who highly value the culture and the environment of their country and have legitimate and trustworthy relations within the scheme community — is recognized as crucial for sustainable FES provision and long-term PES scheme success. The results of their study suggest that the efficiency of PES in the area depends on individuals involved and that the landowners living in the area and aware of recreational ES have higher willingness to participate in PES initiatives. Research into forest community-ownership in Spain provides evidence on its positive effects on biodiversity conservation (Guadilla-Sáez et al., 2020). According to Guadilla-Sáez et al. (2020), FC management prevents resource depletion compared to other governance systems that occurred during the process of privatization and state interventions in Spain in the 19th and 20th centuries. Gatto & Bogataj (2015) examined the robustness and related adaptation patterns of forest commons in the south-eastern Alps. Their analysis focused on evidence of reactions to disturbances induced by political changes and state actions. Their results confirmed forest commons as robust and adaptive social-ecological systems. However, research of ancient, traditional or recently-established forest commons in the Alps shows that political or economic changes and other factors may still lead to destitution or poor functionality of forest commons (Gatto & Bogataj, 2015). The above studies do not represent an exhaustive list of European FCs but only examples from selected European countries. Nevertheless, they demonstrate how non-state owned forests can contribute significantly to the supply of non-provisioning FES.

## 2.3. Innovations in forest governance

Innovations as drivers of development and competitiveness (Schumpeter, 1934) have been studied mostly in relation to companies, sectors or countries. Innovations in the forest sector have been of growing research interest for almost the last 15 years (Weiss et al., 2020, 2021). However, innovations for provision of sustainable FES are still scarce, which is rooted in the dominance of market orientation of European forestry (Mann et al., 2022). Identification of innovation factors is thus essential for determining key barriers to and the role of EU and national policies in increasing the competitive advantage of European forestry. Innovation can also refer to ongoing changes aimed at addressing societal challenges shared by a wide range of stakeholders. In this case, we can speak of social innovations. Social innovations, defined as reconfiguration of social practices, in response to societal challenges, enhancing outcomes on societal well-being by engagement of civil society actors (Klůvánková et al., 2018), can be seen as essential for community forest management. As the definition implies, social innovation involves diversity of actors collaborating on innovations for societal benefits at the expense of corporate profits (e.g., Lovrić et al., 2020). Other social factors include cognitive barriers (Kilcline et al., 2021; Louah et al., 2017), gender differences (e.g., Pröbstl-Haider et al., 2020; Villamor et al., 2014), cultural context or funding sources (Šterbová et al., 2019; Zhang & Putzel, 2016) or factors affecting collaboration, such as stakeholder capacity, local leadership or collaborative history (McIntyre & Schultz, 2020) and other fostering factors such as communication and transparency (Klenk & Wyatt, 2015). We see a gap in the scientific literature addressing empirical evidence of fostering and hindering forest governance innovation factors, in particular the role of self-organized FCs, which thus constitute the main objective of our paper.

**Table 1**

Forest ownership changes (percentage of forest area of different type of ownership) in Czechia (CZ) and Slovakia (SK).

Type of ownership	SK				CZ			
	% of forest area 1990		% of forest area 2000		% of forest area 2019		hectares of forest area	
State*	92	95.8	42.7	63.1	41.1	54.1	780,718	1,413,914
Commons**			24.8		16.7		326,453	
Municipal		0	9.6	13.6	7.8	17.2	152,255	448,792
Church		0	3.3	0	1.3	5	44,561	130,639
Forest or or agricultural cooperatives	8	4.1	0.2	0.3	0.3	1.2	5,256	31,051
Private***		0.1	14.9	23.0	11.9	22.5	232,563	589,260
Unknown****			4.9		20.9		408,176	
<b>Total</b>							<b>1,949,982</b>	<b>2,613,656</b>

\* Forest in direct ownership of state company Lesy ČR (in Czechia) and Lesy SR (in Slovakia); military forests; school forests; forests in national parks and protected landscape areas.

\*\* Traditional common forest property type in Slovakia established in the 18th century, interrupted by the communist regime in the second half of 20th century. Renewed after 1990.

\*\*\* Forest owned by natural and legal persons. In Czechia these data also include land trusts, NGOs and other types of community forest ownership, but it is only 0.4 % of the total forest area in the country.

\*\*\*\* Unidentified forest ownership in Slovakia. According to (Ambrušová, et al., 2015, p. 6) "this category includes forests of owners who have applied for their property right, but their restitutions have not been completed yet; forest of unknown owners or owners with unknown residence. There is also a group of owners who still have not requested their restitution, refused to associate or have not submitted the required documents relating to their property".

Source: Authors based on Ambrušová, et al. (2015), MZE (2020), NLS (2009, 2020), Simanov (2016).

**Table 2**

Selected characteristics of case studies.

Name of FC	Country	History of forest commons	Area size	Altitude	FES in focus
Land Trust Association Čmelák	Czechia	Established in 1994 (until 1990 s, this type of forestry did not have a tradition in Czechia)	63 ha in total (35 ha of forests)	350 – 850 m a.s.l.	production of seeds; provisioning of habitats; enabling education; eco-tourism and recreation; preservation of nature for future generations
Urbár Hybe	Slovakia	Traditional with long history of self-organized forest communities, established in 1887, re-established after the fall of the communist regime in 1991	5,090 ha in total (4,400 ha of forests)	700 – 1700 m a.s.l.	timber production as a raw material and a source of energy; wild animals and plants used for nutrition; eco-tourism and recreation; preservation of nature for future generations

Source: Authors.

### 3. Study area, data sources and methods

#### 3.1. Study area and history of forest communities in focus

Given the scarcity of empirical evidence and cross-border comparative analyses in Central Europe and the specific development of FCs in CEE, this case study focuses on two forest commons, one in Czechia and one in Slovakia. These two case studies are selected since they represent FCs with different property relations and different historical developments situated in two countries characterized by similar historical, political, geographical and institutional conditions. Both studied FCs have also already implemented partial innovative approaches in forest governance in recent history.

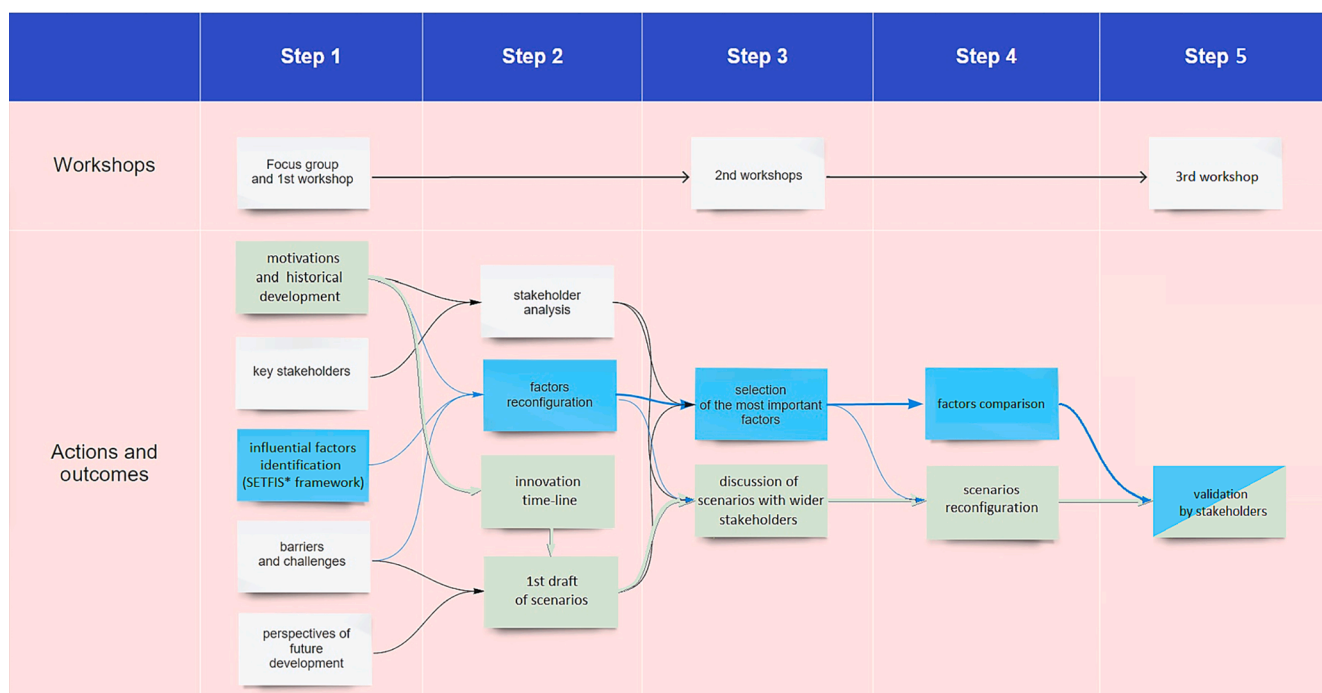
Until the end of World War II, private ownership was the dominant type of forest ownership in both countries, then unified under Czechoslovakia. During the communist period in the second half of the 20th century, almost all forests (including municipal) were nationalized and owned by the state. Only a small part of the originally private forests (less than 10 %) were transferred to forest or agricultural cooperatives, but in fact shareowners of cooperatives have no chance of disposing of their property freely. Since the post-communist transition in the 1990 s and the split of Czechoslovakia in 1993, the percentage of forest area owned by the state has been decreasing (see Table 1). However, the share of privately owned forests in Czechia and Slovakia is still below the European average (according to Živojinović et al. (2015), 60 % of the forest area in Europe is privately owned). In Czechia, over 77 % of the private forest owners (mostly natural persons) own forests covering less than 1 ha; and only 0.3 % of the private forest owners (mostly legal

persons) own over 50 ha (ÚHÚL, 2021). The situation of non-state forest owners in Slovakia is also very similar with highly fragmented forest ownership (Ambrušová et al., 2015).

In Slovakia, forest commons have a long history and the beginning of the self-organised FCs tradition goes back to the 18th century (Klůvanková & Gežík, 2016). At the end of the 19th century, common ownership of forests became an official legal status defining the common forests as "a form of indivisible property owned by a group of local inhabitants and their heirs in the form of ideal portions [equal shares], so-called "land association" or "urbár association" in the Slovak context (Šulek, 2006, p. 3). Today the common forests in Slovakia (with a share of 16,7% in all forests) represent the second largest type of forest ownership, with well-established rules in use and self-governance (Klůvanková & Gežík, 2016). In Czechia, the situation is different because community forestry does not have such a long tradition as in Slovakia. Newly established self-organized communities (in the form of land trusts, NGOs) focusing on buying out and managing degraded or environmentally valuable forest land began to emerge after the fall of the communist regime in 1989. In Czechia, the case study focuses on the newly established forest community LTA Čmelák, which has developed an innovative approach to foster forest biodiversity in the region. The second case study is the traditional forest community Urbár Hybe, which is the largest urbár association in Slovakia. Urbár Hybe faced the natural disasters in recent history, which made them start to rethink current forest management practices. The basic characteristics of the two case studies are summarised in Table 2 below.

The experience of the LTA Čmelák is complemented and contrasted with a similar region in Slovakia: the forest commons of Urbár Hybe.





**Fig. 1.** Sequence of steps (including workshops) for factor identification (blue path) and for description of the role of FCs in innovative forest governance (green path). \* SETFIS = Social-Ecological-Technical-Forestry-Innovation Systems (see chapter 3.2.2). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Collective governance has an even longer tradition in this area (starting from the 1880 s), but is more oriented towards provisioning FES. For example, the members of the forest commons have invested in the construction of their own sawmill. Over time members of communities get knowledge and build trust among each other. Although the studied FCs in the two countries have evolved in different time periods (from the 19th century in Slovakia, from the 1990 s in Czechia), and despite diverse emergence, they both can be seen as long-lasting institutions which enable promotion of innovative activities.

### 3.2. Data sampling

To investigate conditions enabling innovations of FCs in forest governance leading to sustainable FES provision, multiple approaches and methods were used in five steps (see Fig. 1). Within these steps, three workshops/focus groups with FC representatives and stakeholders were organized (steps 1, 3 and 5). In the meantime, individual meetings/consultations with FC representatives took place to discuss specific topics.

The sequence of the workshops and meetings followed a logic structure: In step 1, a workshop and focus group with FC representatives were organized with an objective to investigate innovation barriers and challenges, historical development and future perspectives as well as to identify key stakeholders and discuss a broad set of potentially influential innovation factors. In step 2, stakeholder analysis, factors reconfiguration, innovation timeline and analysis of internal documents and individual consultations with FC representatives were carried out. Moreover, in this step the first draft of alternative scenarios for future development of innovations were performed based on outputs from the first workshop and focus group and confirmed by key FC representatives during individual consultations. In step 3, a second round of workshops was organized with the aim to identify and assess a narrow set of the most important fostering and hindering factors and to discuss the previously designed scenario drafts together with FC representatives and a wider range of stakeholders. Step 4 involved an analysis of the final set of factors and a comparison between both FCs as well as scenario reconfiguration. In step 5, the validation of those scenarios and of the

final set of factors by the stakeholders took place at the third workshop.

To describe the role of FCs on the development of innovation in forestry, a contextual analysis based on examining the motivations and historical development of these FCs and review of internal documents was conducted, followed by mapping of the innovation timeline and creation and reconfiguration of scenarios of future development (green “path” in Fig. 1). Identification and analysis of fostering and hindering factors (blue “path” in Fig. 1) makes it possible to describe the functioning of selected FC because these are dynamic variables that directly affect the implementation and functioning of forestry innovations. FCs and stakeholders can also react to or try to change or influence those factors.

### 3.3. Data analysis

#### 3.3.1. Discovering the role of FCs in innovative forest governance

To describe the impact of forest communities on development of innovations in forestry, perspectives on potential future development and ideas on new innovations in their forests were discussed in step 1. At the same time, barriers, challenges, motivations and historical development of their innovative activities were discussed. At the first workshop (step 1), FC representatives were interviewed to find out their motivations for introducing innovations in forestry and the historical development of activities of their self-organized forest commons.

Based on the outcomes from step 1, a stakeholder analysis of both FCs and an innovation timeline were made in step 2. Data obtained from step 1 were also used to co-design possible innovation pathways for future development in the form of first scenario drafts. The first drafts of scenarios were afterwards discussed during special individual meetings with members of LTA Čmelák and Urbár Hybe. This resulted in the formulation of three basic scenarios, which were further discussed and co-designed in the following steps. The stakeholder analysis further served to include more actors in the next steps of the analysis. The innovation timeline describes key milestones in the history of these forest commons.

Sequence of workshops created a space for FC representatives and stakeholders to facilitate their exploration of the FES governance



Fig. 2. Individual assessment of key influencing factors by stakeholders.

innovations in forms of alternative scenarios for future development (for details see [Sattler, 2019](#)). The process of co-designing scenarios as possible pathways for innovation development is closely interlinked with the process of factors identification and assessment (see chapter 3.3.2). Although the first drafts of scenarios were created based on the discussions from the first workshop and focus group (step 1) and the following outputs from the initial analyses – stakeholder analysis and innovation timeline (step 2), they were subsequently further developed through the integration of continuously identified and analyzed influencing factors. The first scenario drafts represented a short structured summary of three possible future development pathways mentioned by FC representatives which were in step 3 presented and discussed with a wider set of stakeholders. Based on the discussion as well as on the identification of final set of most important factors influencing innovations in forestry, a scenarios reconfiguration was carried out (step 4). At the final workshop (step 5), the scenarios were finally validated by the stakeholders and FC representatives. Scenarios thus represent realistic narratives developed together with FC representatives and stakeholders that were used to discuss conditions and arrangements which could lead to successful future innovation development ([Sattler, 2019](#)). Final scenarios for future development as well as identification of factors affecting implementation of innovative forest governance enable us to describe the role of FCs and their potential in implementation of innovative forest governance and sustainable provisioning of FES.

### 3.3.2. Identification and analysis of fostering and hindering factors

A series of workshops and focus groups with FC representatives and stakeholders in the study areas served to answer the second research question focused on factors affecting implementation of innovative forest governance. The specific aims were to (i) identify the most important influencing factors that foster or hinder the development and implementation of governance innovations in forestry by FCs; and (ii) analyse in depth the relative importance and direction of influence (fostering/hindering) of specific factors and their perception by representatives and stakeholders of both studied FCs. The FC representatives were selected to represent FC management and practitioners (professional foresters, people in charge of harvesting/planting, etc.). Other key stakeholders were identified during the discussion with FC representatives in step 1 and within the following stakeholder analysis carried out in step 2 (see [Fig. 1](#)). Finally, the second and third workshop (Step 3 and 5) attended in addition to the members of the FCs, also representatives of local municipalities, representatives of national nature protection agencies, neighbouring forest owners (private persons, municipalities, state forest company), local environmental NGO, local environmental researchers, professional forest manager, etc.

For the identification of an initial set of potentially influencing factors, which would help reveal the dynamics of FES in order to understand the emergence and development of governance innovations, we used the Social-Ecological-Technical Forestry Innovation Systems (SETFIS) framework developed by the broader international team of experts within the Horizon 2020 project “InnoForEST”. The SETFIS framework is intended to assess processes, multi-level influences, and interacting dimensions and factors in a system-based understanding of FES provision (see [Sorge et al., 2022](#)). The identification of those factors was based on a literature review and interviews with stakeholders from six project case study regions across Europe. It provided an initial set of 82 factors (in the version available in June 2018), which were presented to and discussed with the FC representatives at the first workshop at Urbár Hybe and focus group at LTA Čmelák (step 1).

Based on the contextual analysis (motivation and historical development and discussion about barriers and challenges in innovation development, review of internal documents), the factors were further reconfigured in step 2 to a number of 25 and categorized into four groups:

- S – Stakeholders and relationships.
- I – Institutional settings.
- E – Environment.
- F – Forest management, economy and ES.

During the second workshop (step 3) this set of 25 factors was discussed with a wider range of stakeholders and FC representatives with the aim to select and assess a final (narrow) set of most hindering and fostering factors. The final selection of factors was done in two individual phases. First, workshop participants were asked to collectively identify and decide about a narrow set of key factors influencing forest governance innovations. Participants themselves introduced a voting process for each factor from the list to select the most influencing factors. Second, individual assessment of the importance of factors followed. Each of the participants (FC representatives and local stakeholders) had the opportunity to vote for three factors with the most positive influence and for three with the most negative influence on development of innovative activities in forest commons towards sustainable FES provision. Each participant was given three green self-adhesive dots (positive influence) and three red dots (negative influence). All the stakeholders could individually assess not only the factors from the previously collectively selected and confirmed set of key influencing factors (within the first phase), but they also had the opportunity to assess all other factors from the set of preselected 25 factors – they could agree or disagree with the group decisions. Moreover, the stakeholders had the opportunity to formulate their own factor, if it was missing in the list of 25 preselected factors (see [Fig. 2](#)). The whole

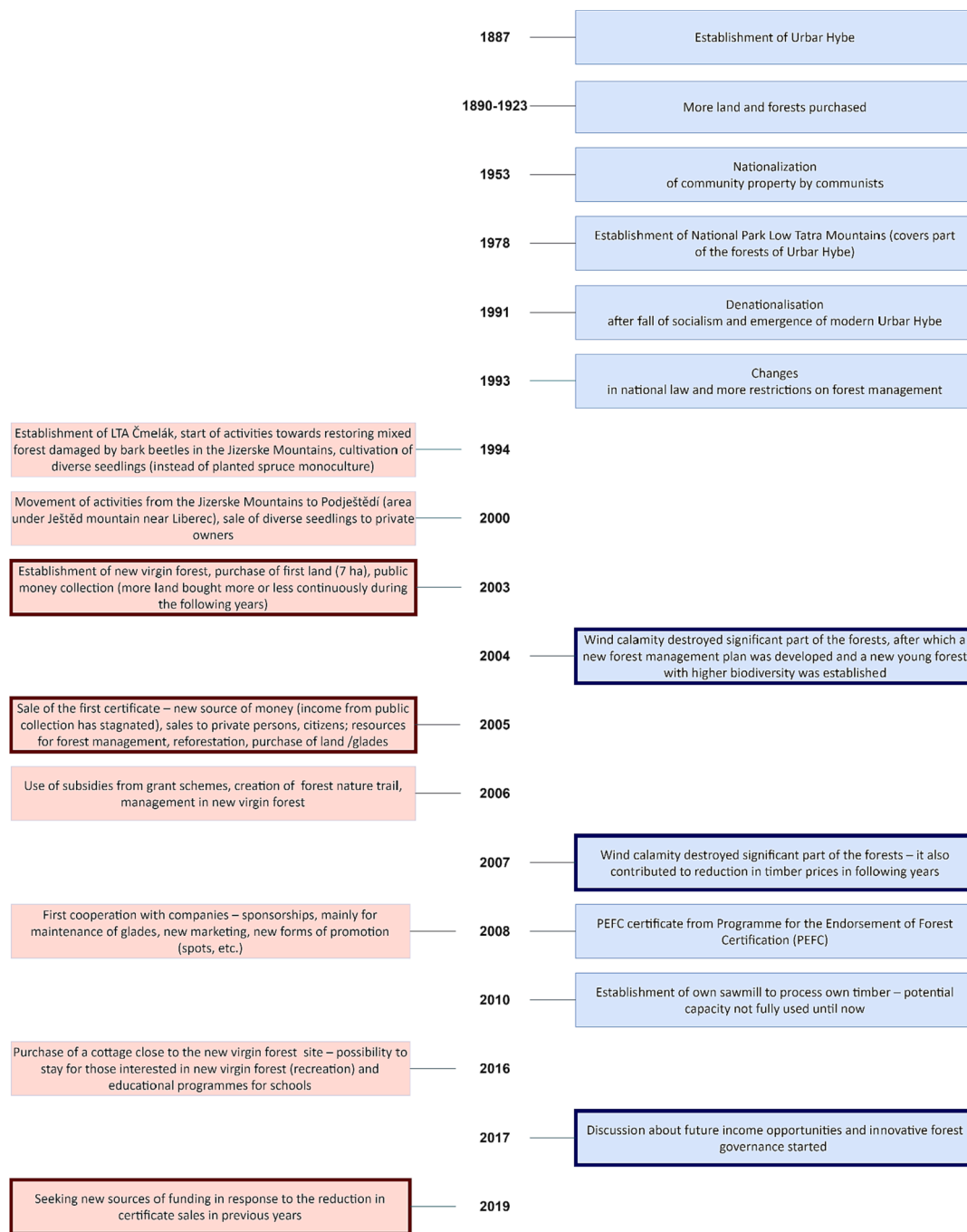


Fig. 3. History of LTA Čmelák (CZ; left) and Urbár Hybe (SK; right), highlighting key milestones for innovation.

process of selection and assessment of key influencing factors was followed by the factor comparison and validation (steps 4 and 5).

#### 4. Results

##### 4.1. Self-organized forest communities in innovative forest governance

The following section presents the results of the analyses that were conducted to answer the first research question: What is the role of self-organized forest communities in innovative forest governance and sustainable FES provision? These results are thus based primarily on mapping of motivations and historical development, and the subsequent innovation timelines with the key milestones for LTA Čmelák and Urbár Hybe identified at the first workshop and focus group. The analysis of the role of FCs in innovation also includes co-design of scenarios for

future development discussed at the second and third workshops which are closely connected with the process of identification of the most influencing factors (see chapter 4.2). Therefore, the scenarios were co-designed not only on the basis of the analysis of current and historical developments in both FCs, but also with regard to the key hindering and fostering factors, which also indirectly contribute to the answer to this research question. Moreover, mapping of motivations and historical development allowed us to identify key milestones in the history of FCs in implementing innovations in forest governance. The history of FCs and key milestones are shown on the innovation timeline in Fig. 3.

LTA Čmelák in the form of an NGO was established in 1994 in order to restore forests damaged by bark beetles in the Jizerske Mountains and cultivate diverse seedlings. In the beginning of the 1990 s, the forests in the Jizerske Mountains were all owned by the state (managed by a state company “Lesy České republiky”) and they were forested mostly with

spruce trees. At that time, LTA Čmelák started to grow their own seedlings of indigenous species typical of this region (no spruce) with the innovative vision (at that time) of helping reforest the damaged mountain forests in a more sustainable way. Since they did not own any forest land there, they offered (for free or for very low prices) the seedlings to the state company to use. However, the state company decided instead to reforest the mountains with spruce again. LTA Čmelák with thousands of seedlings therefore moved its activities to Podještědí near the city of Liberec (in 2000) and started the establishment of a new virgin forest after a public money collection. They bought the first 7 ha of old spruce monoculture in 2003. To raise resources for forest land purchase, in addition to public collection, they introduced the sale of “forest certificates” in 2005. The buyer of the certificate becomes a patron of a certain number of square metres of the new biodiversity-rich area. Among others, the patrons were invited to participate in field trips to the site of the new virgin forest. This kind of highly innovative fundraising could be called a kind of PES, since it perfectly fits the definition of PES by Wunder (2005). Later, LTA Čmelák started to use subsidies from grant schemes and created a forest nature trail (2006) and established cooperation with business companies (2008). It was followed by educational programmes for schools and an eco-tourism possibility in a cottage (since 2016).

LTA Čmelák was established for environmental reasons and one of their goals is also to raise public awareness about the importance of a healthy environment. That is why they are primarily focused on non-timber production FES, such as production of seeds, provisioning of habitats or enabling education, eco-tourism and recreation and preservation of nature for future generations. However, after more than ten years of selling certificates, the sales went down and the collection of donations was only partially successful as the capacity and resources for doing public relations work were not sufficient. Therefore, since 2019 LTA Čmelák is currently looking for new ways to finance its activities in innovative forest governance aimed primarily at providing non-provisioning FES.

The forest commons Urbár Hybe in Slovakia (see Fig. 3) was established in 1887. During the first half of the 20th century, the Urbár Hybe association became the largest forest commons in Slovakia with more than 5000 ha of land. However, the natural development of Urbár Hybe was interrupted by nationalization of the property by the communist regime in the second half of the 20th century. The modern history of forest commons in Slovakia started in 1993, when the Urbár associations in Slovakia were re-established in the process of land re-nationalization (Klůváňková & Gežík, 2016). The Urbár Hybe associations' property (5090 ha of land, of which 4400 ha is forest land) is shared by members (approx. 1000 members) of the community by equal shares. Rules in use follow Ostrom's common pool resource regime principles (Ostrom, 2009). The forest management development in the modern history of the Urbár association was negatively influenced by wind calamities in 2004 and 2007, which destroyed a significant part of the forests and contributed to bark beetle spreads and a decrease in timber prices. On the other hand, these natural disturbances led members of the community to create a new forest management plan, establish a new young forest with higher biodiversity, obtain PEFC certification (2008), establish their own sawmill to process their own timber (2010). The circumstances proved resilience of the Urbár Hybe community, which responded to these external shocks relatively rapidly in comparison with other forest owners in the area (especially in comparison with the state as the major forest owner in the country) and led to support activities for sustainable and innovative forest management (Brnkaláková, 2016). In the last few years, the incomes from timber production have decreased continuously. Moreover, the FC members are aware that, as a result of the calamities, they will not be able to harvest as much timber in the future as before, because there will not be as many mature trees. Nowadays, there are ongoing discussions about future income opportunities and possible innovative forestry solutions, targeting also climate regulation.

From the perspective of FES, Urbár Hybe has been historically focused primarily on provisioning services related to timber production. Until recently, timber from this common forest was used as a primary energy source and building material; today, most of the timber is sold on the market, but the earnings represent an important source of income for local households (FC members). Also some other FES (e.g., eco-tourism and recreation, wild animals and plants used for nutrition, preservation of nature for future generations) are perceived by the Urbár Hybe as important and they are in focus of their daily activities.

The analysis of motivations and historical development presented in the innovation timeline shows the importance of natural disasters (bark beetle calamity, wind calamity) as triggers for the development of innovations in forestry and the sustainable provision of non-productive FES. Based on the analyses, both FCs showed their ability to respond flexibly and collectively to new challenges. Moreover, participants of the focus group and the first workshop indicated that both FCs are currently facing a decrease in their incomes, and they are aware of the financial unsustainability of their activities. The calamity has caused Urbár Hybe not only a price decrease for timber on the market (thus current income decrease), but also a reduction in harvestable timber for the future. LTA Čmelák is facing a decrease of income from the sale of certificates (see above). That is why the FC members and stakeholders focussed on economic aspects in discussions about alternative scenarios of future innovation development.

Originally, three scenario drafts were co-designed with FC representatives during the first workshop, the focus group and follow-up discussions (step 1 and 2). The first scenario built on state regulation, where the forest communities would be compensated for loss of income due to implementation of nature conservation measures to achieve higher FES provision. It was developed based on the expectations of the both FCs that regulation or state intervention is one of the necessary assumptions for further development of innovations. The second scenario focused on local or regional marketization of the wood and other products and services from forests with higher FES provision based on a trusted certification authority who should guarantee the quality and local origin of the wood. In this case both FCs confirmed their interests to expand their activities on the local market and secure customers for their products and services. The third scenario envisaged the development of payment schemes for ES, which should be designed and self-managed by the FCs. Both LTA Čmelák and Urbár Hybe expressed an interest in focusing their future activities on forest governance innovations which will lead to strengthening sustainable FES provision (e.g. carbon sequestration) and biodiversity protection in their forests and which could be a potential source of additional future income. See Appendix 1 for more details about the scenarios.

These first scenario drafts were further discussed, co-designed and reconfigured by stakeholders and FC representatives during the second workshops (step 3 and 4). It resulted from the discussion with stakeholders and FC representatives during the third workshops (step 5) that the preferred future development of the forest commons and for securing additional revenues to provide non-provisioning FES is a combination of state regulatory compensations and voluntary payments schemes for ES (a combination of the first and third scenarios). The stakeholders agreed that the sole implementation of self-managed certificates as local payment schemes for ES (the third scenario) is not enough to secure sustainable financing of the innovative activities towards sustainable forest management on a larger scale. They assumed its combination with more general (national) compensation schemes (the first scenario). Participants in discussions at the workshops expressed their opinions that there seems to be a growing willingness among politicians to support and legislate changes in the forestry sector in the context of the ongoing bark beetle calamities in both countries and changes in natural conditions due to global climate change. However, there is still no systematic state support (financial, technical, advisory) for forest owners who would like to introduce innovative forest approaches and activities focused on non-provisioning FES in Czechia or Slovakia. Both LTA Čmelák and Urbár



**Table 3**  
Twenty-five preselected influencing factors in 4 categories.

Stakeholders and relations	Institutional settings
S1 – Informal relationships – (dis)trust between actors	I1 – Enough information for decision making/capacity to continuously evaluate the information
S2 – Support from public (civic society)	I2 – Traditions, culture, habits (informal rules)
S3 – Diversity of interests of actors (stakeholders) in the territory	I3 – Predictability of the institutional environment
S4 – Sharing information and experience among key actors	I4 – Political support / political will
S5 – Strength and representativeness of stakeholders in the decision-making process	I5 – Legal environment (existing legislation)
S6 – Cooperation of actors/entities in the territory	I6 – External threats (social, economic, political, etc.)
S7 – Responsible leadership/visionary (bearer of new ideas)	
Environment	Forest management, economy and ES
E1 – Emphasis on non-provisioning FES	F1 – Financial compensations (new economic activities) or payments for non-provisioning ES
E2 – Environmental awareness	F2 – Economic profitability (of different types of forest management)
E3 – Natural disturbances (bark beetles, windstorms, floods, etc.)	F3 – Possibility of flexible forest management
E4 – Change in natural conditions (climate change, air quality, water regime, etc.)	F4 – New business opportunities
E5 – Formal nature protection (protected areas, national parks)	F5 – New technologies / new knowledge
E6 – Environmental policy instruments (subsidies, incentives, support for research and development, etc.)	F6 – Forest ownership (state, private, municipal, church, land association, etc.)

Hybe have expressed an interest in focusing their future activities on forest governance innovation which will lead to strengthening the carbon sequestration of their forests.

**4.2. Fostering and hindering factors affecting innovative forest governance**

This chapter deals with the results of an identification and analysis of a narrow set of key fostering and hindering factors for innovations in forest governance and with comparison of similarities and differences of those factors between the two studied FCs (the second research question).

The initial set of 82 factors potentially influencing innovations in forest governance was reconfigured during the first two steps of our analysis. This resulted in a set of 25 preselected influencing factors grouped into 4 categories (see Table 3): (i) Stakeholders and relations (factors S1 – S7, marked yellow), (ii) Institutional settings (factors I7 – I6, marked orange), (iii) Environment (factors E1 – E6, marked green) and (iv) Forest management, economy and ES (factors F1 – F6, marked blue). In this set of 25 factors, it was not indicated whether those factors are positive (fostering) or negative (hindering), since this was assessed by the FC representatives and stakeholders during the next step.

During the workshops within step 3 FC representatives together with stakeholders collectively identified 10 key influencing factors (marked with \* in Table 4) from the set of 25 preselected factors. In the following

individual assessment of key influencing factors by each workshop participant two more factors were considered important – labelled as important by at least two individual stakeholders (marked with \*\* in Table 4). Moreover, in both FCs, one other factor was additionally identified and deemed as very important by the whole group (marked with \*\*\* in Table 4). This resulted in the final list of 13 most fostering and hindering factors which was further compared in both studied regions (see Table 4). The top half of the table shows the fostering (positive) factors, the bottom half of the table shows the hindering (negative) factors, showing first the factors that were identically selected as important in both studied cases.

**4.2.1. Same factors, not always same perceptions**

Although the main focus of the regular activities of both studied FCs is different (see chapter 4.1), 8 factors (out of the 13) were identically identified as most influential for innovations in forest governance by the stakeholders and representatives of both FCs. However, not all of them were perceived equally in both FCs (in the sense of positive/negative influence). Stakeholders of both LTA Čmelák (CZ) and Urbár Hybe (SK) perceived as positive factors: E1 – Emphasis on non-provisioning FES, S6 – Cooperation of actors/entities in the territory, F1 – Financial compensations (new economic activities) or payments for non-provisioning ES and as negative factors: I5 – Legal environment (existing legislation) and F2 – Economic profitability (of different types of forest management). Three other factors selected by both FCs were perceived in opposite ways.

**Table 4**

Comparison of 13 most important influencing factors considered by stakeholders from both case study areas.

	LTA Čmelák (CZ)		Urbár Hybe (SK)
Positive (fostering) factors	E1 – Emphasis on non-provisioning forest ecosystem services*	=	E1 – Emphasis on non-provisioning forest ecosystem services*
	S6 – Cooperation of actors/entities in the territory*	=	S6 – Cooperation of actors/entities in the territory*
	F1 – Financial compensations (new economic activities) or payments for non-provisioning ecosystem services*	=	F1 – Financial compensations (new economic activities) or payments for non-provisioning ecosystem services*
	<i>E3 – Natural disturbances (bark beetles, windstorms, floods, etc.)*</i>		S7 – Responsible leadership / visionary (bearer of new ideas)*
	<i>E4 – Change in natural conditions (climate change, air quality, water regime, etc.)*</i>		S5 – Strength and representativeness of stakeholders in the decision-making process*
	S2 – Support from public (civic society)*		<i>F6 – Forest ownership (state, private, municipal, church, land association, etc.)**</i>
S4 – Sharing information and knowledge among key stakeholders*		Long-lasting institution of self-organization/tradition of collective action of shareholders***	
Negative (hindering) factors	I5 – Legal environment (existing legislation)**	=	I5 – Legal environment (existing legislation)*
	F2 – Economic profitability (of different types of forest management)*	=	F2 – Economic profitability (of different types of forest management)**
	I2 – Traditions, culture, habits (informal rules)**		I3 – Predictability of the institutional environment*
	I4 – Political support/political will*		<i>E3 – Natural disturbances (bark beetles, windstorms, floods, etc.)*</i>
	<i>F6 – Forest ownership (state, private, municipal, church, land association, etc.)*</i>		<i>E4 – Change in natural conditions (climate change, air quality, water regime, etc.)*</i>
	Overpopulated game***		E5 – Formal nature protection (protected areas, national parks)*

\* Original set of 10 most important influencing factors consensually agreed by the group of stakeholders as a whole.

\*\* Factors marked as important during the individual assessment of factors by at least 2 stakeholders.

\*\*\* Factors not included in the SETFIS framework. These factors were formulated and added ex-post to the set of important factors by the stakeholders during the workshop since they are seen as highly influencing.

*In Italics* – same factors but perceived in opposite ways by both forest communities.

While LTA Čmelák (CZ) perceived factors *E3 – Natural disturbances (bark beetles, windstorms, floods, etc.)* and *E4 – Change in natural conditions (climate change, air quality, water regime, etc.)* very positively (it was seen as an opportunity for future), those factors are seen as negative by Urbár Hybe (SK), because they endanger forest existence and thus also the opportunity to innovate forest governance. Also factor *F6 – Forest ownership (state, private, municipal, church, land association, etc.)* was perceived in opposite ways by both FCs. Urbár Hybe (SK) labelled this factor as positive, while LTA Čmelák (CZ) as negative. However, this may be related to different interpretations of this factor. According to follow-up discussions with the stakeholders during the workshop, Urbár Hybe (SK) understood this factor so that if forest owners are the same group of people as forest users (direct beneficiaries of FES), forest ownership could positively influence innovation. Stakeholders of LTA Čmelák (CZ) labelled this factor as negative, because (as they discussed during the workshop) more than 50 % of forest in Czechia is owned by the state (state company Lesy ČR) and the state is not motivated for any innovation in forest governance, since there is no direct connection between FES beneficiaries and the forest owner. So in fact both FCs perceived factor *F6 – Forest ownership* similarly, although it was labelled differently.

4.2.2. Categories of factors

Factors in the category *Institutional settings* (marked orange) are

predominantly perceived by both FCs as negatively affecting innovations in forest governance. Both FCs assessed the factor *I5 – Legal environment (existing legislation)* as negative, which means that current legislation negatively affects innovative approaches. Other negatively assessed factors from this category were *I3 – Predictability of the institutional environment* (in Urbár Hybe) and *I4 – Political support/political will* and *I2 – Traditions, culture, habits (informal rules)* (in LTA Čmelák). The only positive factor from this category was *Long-lasting institution of self-organization/tradition of collective action of shareholders*, which was articulated by the Slovak stakeholders themselves and added to the final set of most influencing factors. On the other hand, factors in the category *Stakeholders and relations* (marked yellow) were always perceived as positively influencing innovations. Factor *S6 – Cooperation of actors/entities in the territory* was selected as important by both FCs, other factors marked as positive were *S2 – Support from public (civic society)* and *S4 – Sharing information and knowledge among key stakeholders* in the case of LTA Čmelák (CZ) and *S7 – Responsible leadership / visionary (bearer of new ideas)* and *S5 – Strength and representativeness of stakeholders in the decision-making process* in the case of Urbár Hybe (SK). Factors from the category *Forest management, economy and ES* (marked blue) were perceived in very similar ways by both FCs (see above), which, however, cannot be said of *Environmental* factors (marked green). The only factor in this category assessed in the same way by both FCs was *E1 – Emphasis on non-provisioning FES*, but factors *E3 – Natural disturbances (bark beetle,*

windstorms, floods, etc.) and E4 – Change in natural conditions (climate change, air quality, water regime, etc.) were perceived exactly in the opposite way.

#### 4.2.3. Additionally supplemented factors

During the stakeholder workshops, the participants had the opportunity not only to assess the preselected set of factors, but they could formulate their own factors, if they felt they were missing. In the first part of the workshops, it seemed that the preselected list of 25 factors was well developed. In both cases, the stakeholders jointly chose 10 most influencing factors (marked with \* in Table 4), and two others were supplemented during the individual assessment of the factors (marked with \*\*). However, during the phase of individual assessment at LTA Čmelák (CZ), one of the attending stakeholders (professional local forest manager) came up with one another factor which was neither among the preselected set of 25 factors nor even in the initial bundle of 82 factors. He suggested adding a new factor *Overpopulated game* as a factor negatively influencing innovative approaches in forestry. Finally, it turned out that, according to the participating stakeholders and FC representatives, this is the most important negative factor. A similar situation occurred in the Slovak case study area, where the factor *Long-lasting institution of self-organization/tradition of collective action of shareholders* was added ex-post to the final set of most influencing factors; it was considered a positive factor. Both these factors marked with \*\*\* in Table 4.

## 5. Discussion

In this paper, we made an effort to determine the role of self-organized forest communities in innovative forest governance towards sustainable FES provision by identifying most important fostering and hindering factors affecting the innovation process and thus impacting on sustainability transformations. In doing so, we identified four thematic aspects: (i) importance of community collaboration, (ii) natural conditions, (iii) institutional capacity and (iv) economics. These are further elaborated below.

### 5.1. Self-organised forest communities as collaborative networks open for innovations in forest governance

Self-organized forest communities are characterized by relatively rapid responses to the various challenges they face in their activities (Bray, 2008; Ostrom, 2011; Brnkařáková et al., 2022). Based on the analysis of innovation timelines, our results confirm that this is also valid for both studied self-organized forest communities. They were able to flexibly react to new challenges, such as a storm calamity in Slovakia or the reduction of biodiversity and demand for new seedlings in Czechia. The willingness to introduce innovative approaches in forest management was observed during the co-design of the possible scenarios, when the FCs were able to build on existing experience with innovative governance approaches and discuss their further possible development. Our analysis confirms that FCs could play a significant role in development and implementation of innovations for sustainable forest management as they are open to novel solutions in relation to the challenges they are facing. This corresponds with the previous findings of Brnkařáková et al. (2022), Kluvánková et al. (2018), Padovezi et al. (2022) or Melnykovich et al. (2018).

Moreover, the results of our analysis of influencing factors also confirm the important role of self-organization patterns in development of innovative forest governance and sustainable FES provision, in particular the importance of cooperation among actors, sharing knowledge and information and leadership. Representatives of Urbár Hybe themselves explicitly emphasise the importance of the “traditional long-lasting institution of self-organization” by adding this factor among the most important fostering factors of innovations for sustainable forest governance.

Similarly to Kluvánková & Gežík, (2016), Nijnik et al. (2020) or Šterbová et al. (2021) in studied FCs, *Cooperation of local actors* is one of the most important fostering factors for innovations in forestry. Both studied FCs are characterized by a self-organization based on their own rules in use and values that their members share and follow (similarly to Arvanitidis & Papagiannitsis, 2020). Knowledge of the local environment, long-term relationships among stakeholders, sharing of common visions and “daily” personal contacts of actors are crucial for sustainable forestry approaches performed by both self-organized FCs. For LTA Čmelák (CZ), who is targeting at innovative activities for forest biodiversity (such as volunteering for close-to-nature forestry, environmental education programmes etc.), enhance civic support and knowledge co-production is seen as important positive factor, which confirmed the findings of Fleith de Medeiros et al. (2022), who mentioned a socio-cultural environment favourable to green innovations and inter-functional and inter-organizational collaboration as a success factor for environmentally sustainable product innovation.

In Urbár Hybe (SK) *Responsible leadership/visionary (bearer of new ideas)* and *Strength and representativeness of stakeholders in the decision-making process* has been confirmed as leading fostering factors. Moreover, they also consider *Long-lasting institution of self-organization/tradition of collective action of shareholders* among the key fostering factors. Even though leadership/visionary was not formally selected for the group of most influencing factors by the second studied FC, LTA Čmelák (CZ), we claim, based on the experience of 3-year cooperation between the authors of this paper and LTA Čmelák, that the leadership/vision of the land trust founder has influenced their innovation potential significantly.

To sum up, knowledge of the local environment, good relations with stakeholders, mutual cooperation of local actors as well as sharing of information and knowledge co-production among key stakeholders have a significant fostering effect on social and governance innovations in forestry (similarly to findings of Kluvánková et al., 2018; Melnykovich et al., 2018; Nijnik et al., 2018). In fact, all the selected factors in the category “Stakeholders and relations” were perceived as fostering factors. This confirms findings that informal institutions prevail in governance regimes with weak legal / formal institutional settings as seen previously in Gatto & Bogataj (2015) or Kluvánková et al. (2018). The self-organized FCs are thus seen as flexible collaborative units open and capable to implement innovations in forest governance.

### 5.2. Ambiguous perception of changing natural conditions

Natural disturbances and changing natural conditions are considered some of the most important factors for innovations in forest governance by both studied FCs. However, the perceptions of those factors differ significantly depending on the primary focus of the FCs (provision of FES respectively). If the most important FES for the FC are provisioning services (such as timber and biomass fuel) and if the community is (to some extent) dependent on those FES (such as Slovak Urbár Hybe in our case study), changing natural conditions and natural disturbances represent factors that hinder their innovation potential strongly. Such FCs could be considered as forest-dependent communities (see Kluvánková et al., 2018; Melnykovich et al., 2018). In such a case, FCs have to deal with their own existential problems (decreasing amount of available timber for future, decreasing price of timber caused by market overcrowding, etc.) and they do not have any capacity (financial and human) to develop and implement innovations. Those findings about the negative impact of natural disturbances are consistent with the conclusions of existing studies (e.g., Kilcline et al., 2021). On the other hand, if the FC is primarily focused on non-provisioning FES or biodiversity conservation, which is the case of LTA Čmelák (CZ), changing natural conditions and natural disturbances could be seen as a very important fostering factor of forest governance innovations. Traditional forest management practices based on spruce monocultures (in Central European context) turn out to be unsustainable in these new

circumstances, which opens the door for innovative forest owners (including FCs) who can implement innovative approaches in forest management not supported until now. Similarly to our findings, [Bussola et al. \(2021\)](#) or [Fernandes et al. \(2017\)](#) claim that crises or calamities can be seen as opportunities for innovations in forestry; in other cases, however, natural disturbances are perceived negatively by forest owners who are not able to solve the problems by themselves (e.g., [Kittredge, 2005](#); [Sonnhoff & Selter, 2021](#)).

### 5.3. Institutional settings matter

The analysis of factors in both FCs showed that when communities selected a factor in the Institutional settings category as important, they always rated it as negative/hindering. Both FCs agreed that one of the most significant negative factors is the legal environment (existing legislation), because the current legislation in both countries does not support innovation in forest management in any way; on the contrary, according to the FCs, the legislation rather complicates innovative efforts. These findings are in line with [Štěrbová et al. \(2019, p. 7\)](#), who stated that current “laws and regulations make the innovation process [in the Slovakian forest sector] impossible” and with [Fleith de Medeiros et al. \(2022\)](#), who found that one of the most important factors for the success of environmentally sustainable product innovation is a policy and legal environment conducive to green innovation, and also with findings of the comparative study of forest commons in Italy and Slovenia ([Gatto & Bogataj, 2015](#)). According to [Gatto & Bogataj \(2015\)](#), forest commons are robust, yet inappropriate political factors or economic changes can lead to poor functioning of forests. This is also related to political support/political will, which was labelled as a significantly negative factor as well. In fact, the Czech FC interpreted this factor to mean that if innovations are not significantly supported either by local or national policy makers, or are not explicitly mentioned in strategic policy documents, it is very difficult to implement them. Implementation of forestry innovations is therefore (at least to some extent) dependent on political support. Consistent or at least predictable “rules of the game” (institutional environment) are another essential factor for long-term innovation planning. If this is not the case, according to the Slovak FC, interest in forestry innovation is declining. Traditions, culture, habits (informal rules) are perceived by the Czech FC as a negative factor. This is because forestry is seen as a very conservative field. Changes happen very slowly. Mainstream foresters refer to traditional ways and habits of management, which were often implemented several centuries ago. Production of spruce timber is still the main objective of most forest owners. However, according to the members of the Czech FC LTA Čmelák, in times of climate change, forest management needs to be approached in a new way. The Slovak FC Urbár Hybe takes a different approach to this factor. They consider traditions, culture and habits more or less as a positive factor, but they perceive this factor in a different context than LTA Čmelák. It is perceived positively because there is a centuries-old tradition of collective action of shareholders. Here, forest shareholders themselves make long-term decisions about how to manage their jointly owned forests and are motivated by long-term sustainability. That is why they also did not select directly factor I2 – Traditions, culture, habits (informal rules) in the set of 13 most influencing factors, but they formulated a new factor ex-post labelled “Long-lasting institution of self-organization/tradition of collective action of shareholders”. In general, institutional settings are an area that FCs themselves cannot directly influence in practice, but successful innovation is highly dependent on these factors, and, as we can see, almost all the selected influencing factors in the Institutional settings category were evaluated negatively by both studied FCs.

### 5.4. Economics and forest management

The factors associated with forest management, economy and ES are the only category of factors perceived very similarly by both FCs

regardless of their primary focus and goal. Both communities completely agreed on both (i) the selection of the most important factors and (ii) the perception of whether the factors are negative or positive. The seemingly different assessment, but de facto identical, of factor *Forest ownership (state, private, municipal, church, land association, etc.)* is explained above. Both studied FCs also see economic profitability as a hindering factor; however, it turns out to be one of the motivating factors for finding innovative ways to ensure sustainable forest management. In our case, this is reflected in the co-design of the preferred scenario, which assumes the further development and implementation of innovative economic instruments in the form of newly established payments for non-provisioning ES. For that reason, financial compensations are seen as a positive innovation factor which can help overcome challenges associated with climate change and natural disturbances. Stakeholders of both studied FCs are very open to introducing innovative PES schemes. These schemes are perceived by the FC representatives and stakeholders as a useful measure to substitute for decreasing incomes from timber production jeopardized by climate change (which is in line with [Fouqueray et al., 2022](#)) on the one hand, and on the other hand, as a tool to promote public perception towards a broad range of benefits provided to the society by the forests. According to the outputs of the contextual analysis, stakeholder workshops and discussion with FC members, successful implementation of innovations in forest governance through collective action of FCs significantly depends on the primary focus of their activities, their goals and different approaches to forest management. If the FCs are (at least to some extent) economically dependent on the forests/provisioning services, economic profitability of alternative forest management approaches plays an important role in the decision-making process. Similarly, to [Mann et al. \(2022\)](#) and [Štěrbová et al. \(2021\)](#), also our research confirms that lack of financial resources and uncertain profitability of focusing on non-provisioning services can significantly hinder the innovation process in forestry.

### 5.5. Overpopulated game hinders innovations in forestry

Spruce monocultures with poor ground vegetation (and therefore low biodiversity) are the typical kind of forests in many parts of Central Europe ([Emmer et al., 2000](#)). Innovative forestry approaches and nature close forestry in particular as primary objective of FC LTA Čmelák are facing many barriers and hindering factors. The most significant hindering factor recognized by stakeholders of LTA Čmelák (CZ) is game management and overabundant wild game respectively. Very costly reforestation of previously degraded spruce monocultures by a mixture of seedlings of native tree species as well as slower natural reforestation is very negatively influenced by damage caused by overpopulated wild game. Inconvenient game management, resulting in increased abundance of wild ungulates in the last decades has contributed significantly to forest degradation in large areas of Austrian forests ([Hasenauer & Sterba, 2000](#)), a decline in natural regeneration of (especially deciduous) forests in Sweden ([Pettersson et al., 2019](#)) or Japan ([Takatsuki, 2009](#)) and had a negative impact on forest structure and functions of temperate forests across the northern hemisphere in general ([Ramirez et al., 2018](#)), as well as on biodiversity, represented, e.g., by songbird populations in the research done in Canada ([Allombert et al., 2005](#)). While respecting the fact that wild ungulates are a necessary component of all forests, their overabundance hinders the motivation of forest owners (including FCs) to introduce innovative forestry approaches leading to higher biodiversity and provision of non-provisioning FES. This is true especially for FCs focused primarily on non-provisioning FES (such as LTA Čmelák in this case study). From their point of view, game hunters are a completely different interest group with adverse goals, since benefits of hunting are closely related to high numbers of game in the forest. In the context of Central European countries, the hunters are not always the same group of people as the forest owners. Very simply said, they have the right (given by public authority) to hunt game in a certain piece of forest regardless of the forest ownership structure. On



the other hand, forest owners' rights are quite restricted in these countries. For example, forest owners must endure general public (including hunters) entering the forests and they are not allowed to fence their forests. This situation causes problems, because if the forest owner wants to protect their forest against deer, they cannot fence it, but they also do not have any effective levers against hunters intensifying hunting (incidentally, hunters are a very strong lobby group). According to the papers cited above and findings of our research, if innovations in forestry are to contribute to higher biodiversity and more non-provisioning FES, the issue of game management should be solved first.

### 5.6. Discussion of methods

Data for our research were obtained systematically in the course of three years of consistent cooperation with the two studied FCs. That enabled us to obtain detailed information about the functioning of the FCs, their historical development, momentums and motivations influencing their thinking about implementation of innovative approaches in forest governance as well as possible (from their perspective) scenarios of future development, which would further promote sustainable forest governance focused on non-provision forest ES. The identification of a small group of most influencing fostering a hindering factors for innovations in forest governance proceeded in several steps, always in close coordination with FC representatives and a wide range of other stakeholders. That enabled us to gain an insight into factors influencing innovations from the point of view of not only the FC representatives, but also the stakeholders (as stakeholders and FC representatives had to agree on the selected factors). At the same time, it turned out that involving a wide range of local stakeholders is necessary for this type study, as they bring experience and important knowledge from various realms of forest management. That became evident, e.g., when compiling the initial set of 82 factors. The set was admittedly compiled based on literature review and interviews with stakeholders from 6 project case study regions across Europe. However, those interviews had not involved such a wide range of stakeholders as our further research. During the workshops with local stakeholders and FC representatives it became apparent, that some important factors had not been included in the initial set of factors and had to be added to the set by local stakeholders ex post ("Overpopulated game" and "Long-lasting institution of self-organization/tradition of collective action of shareholders"). Although the intensive and long-term cooperation with FCs representatives and stakeholders (number of face-to-face meetings, workshops, focus groups, individual consultations with FC representatives) enabled us a very detailed analysis of the two selected FCs, the disadvantage of the chosen method is undoubtedly its time-consuming nature. Another limiting factor of our work (related to the time-consuming nature of the research) is the small scale of the case studies, which does not allow an absolute generalization of our results, and we perceive a need for validation in a broader context.

## 6. Conclusions

This paper determines innovative forest governance for sustainable FES provision and demonstrates the potential of self-organized forest communities to support such transition. Two presented cases located in similar geopolitical space, but facing different institutional, ecological and social challenges, differ in the type of their governance regime. Urbár Hybe represents the largest long-lasting traditional forest commons in Slovakia, while Čmelák is a new commons recently established by a land trust. However, both are flexible forest communities capable of responding to ongoing socio-ecological and institutional challenges and collectively seeking for suitable innovative solutions in forest governance.

By building on the results of our study, we generated arguments as to how collective community forestry regimes can foster sustainable ES governance. In particular, an institutionally robust traditional FC regime

and a flexible land trust seen as a new FC were found effective in addressing the ES dilemma to foster behavioural change and to bridge ES providers and users. As such, we demonstrated the potential of these governance models, whereby the capacity of a mature community and self-organised governance structures enhance behavioural change from sectoral to ES governance. Thus, self-organized FCs could play a pioneering role in implementing novel forest governance in CEE such as financial incentives or other measures, as they are open to developing and implementing innovative solutions and they have an ability to flexibly and collectively respond to new challenges at a cost lower than central regulation (Brnkařáková, 2016). The analysis of the factors then clearly points to common key assumptions for the further development of these pioneers of innovative approaches for sustainable forest management, since emphasis on non-provisioning FES, cooperation of actors/entities in the territory, implementation of new financial compensations (payments for non-provisioning ES) and responsible leadership/visionaries were consistently identified as most fostering factors in both FCs. On the other hand, external institutional settings (such as legal environment, unpredictability of the institutional environment or low political support) as well as overpopulated game could seriously limit the incentives of FCs to implement innovation in forest governance. This poses challenging options for the manner in which commons and community resource management become central to ES policies for meeting global or European climate and biodiversity goals.

### 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.

### Data availability

The authors do not have permission to share data.

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### Appendix 1:. Drafts of scenarios for future development

The scenarios were developed based on the outputs from the first workshop and focus group and further discussions with FC representatives and stakeholders (see also Table 5 for overview):

#### Scenario 1: State compensation for economical management

The first scenario develops the idea of the state support to all forest landowners who are providing FES. Based on the necessary changes in legislation it sets up a governmental compensation scheme to meet Czech/European nature conservation or climate regulation goals. The aim of compensations is to increase provision of non-production FES. This scenario expects valuation of the additional costs of environmentally friendly provision of non-production ES (e.g. biodiversity or climate regulation).

**Scenario 2: Local resources – Local economy – Local and global benefits**

The second scenario expects a creation of a local or regional market for wood or non-wood products providers and their customers (e.g. hotels, restaurants, etc.) with value added which is based on the provision of non-production ES. The scenario is based on support of the local economy and buyer’s willingness to pay for regional but more environmentally sustainable products. In this scenario a creation of a local certification provided by a trusted certification authority is needed for the assessment of sustainable management of the forest reflecting the non-production FES.

**Scenario 3: Payments for FES**

The scenario expects a development of the payments scheme for ES which is designed and managed by the communities themselves. It builds on voluntary ecosystem payment instruments which can provide a long-term source of finance for innovative forestry approaches. This scenario can also be used in the local economy, where these carbon offsets would be bought by local firms or individuals that present themselves as carbon neutral.

**Table 5**  
Scenario drafts overview.

Scenarios/Aspect	Scenario 1: Regulatory (compensations)	Scenario 2: Local market (PES, certificates etc.)	Scenario 3: Hybrid ES governance (FES - community payments)
Actor configuration	Forest owners, forest industry, recreation, nature conservation authority, municipality	Forest owners, forest (and timber) industry, recreation, nature conservation authority, municipality, local market chains and networks	Forest owners, forest associations, nature conservation authority, municipality, recreation and citizens networks
Governance arrangement	Regulatory rules (state, local authority)	Market rules + external authority (e.g. a certification committee which will guarantee the quality/regionalism of certificated goods and services – e.g. certificates for local wood)	Self-governance/self-regulation within the community (the community will determine the purpose of the payments, the price for the services and goods as well as the decision about planting/harvesting/implementation of carbon forestry technologies)
Organisational embedding	Ministry of Environment, Ministry of agriculture and Forestry	Forest owners, landowners unions, external certification committee	Forest associations (subject/agent which supply FES certificates)
Business model	State regulation: harvesting limits, stress on nature conservation, compensation for loss of income (because of FES provision), support of nature conservation	Profit growth/ marketing of added value of local wood => more money for sustainable forestry activities, support of local economy  expected harvesting payments local wood certification for products with added value	(Voluntary) payments to support long-term FES provision  e.g. selling of carbon „indulgences“ – reduction of carbon footprint => selling certificates of CO2 reduction to tourist, local businesses, wide public FES as marketable good – continuous financial resources for wood chipping, planting new trees/forests, other carbon forestry technologies Self-regulation and monitoring
Role of citizenry	Citizens as members of forest cooperative and local community, enviro-activists and networks because of regulation realized by public administration is the role of citizenry very limited	Common planting days (volunteers), users/ citizens  Pushing on local public administration to use local wood (in schools, town hall etc....) Citizen demand (=tourists) for tourism infrastructure equipped with products from local wood (hotels, restaurants, outdoor benches etc.) Customers of local companies – environmental awareness	Citizens as members of forest cooperative and local community => collaborating on setting rules, enviro-activists and networks  As buyers of CO2 indulgences Customers of local companies which are CO2 neutral – environmental awareness
Role of techn. & science	knowledge of ecosystem based solutions vs sectoral science	Technology for sustainable forest management, Virtual marketing	Novel technology for FES sustainable provision, Marketing, evaluation + justification of environmental impacts, approaches for collective action
Discourse context	Lack of financing, legal, institutional misfit: Nature conservation vs forestry	Market price pressure to increase wood production, market competitiveness of local wood (less intensive harvesting/more expensive wood?)  support of local economy	Corporate social responsibility  Carbon footprint
Key trends	Possible new regulations for EU on carbon targets, growing environmental awareness	Possible new regulations for EU on carbon targets, stronger private governance and liberalization, incentives for low carbon (business) environments	Possible new regulations for EU on carbon targets, growing environmental awareness, biodiversity
Uncertainties	Forest damages, real carbon storage, prevent the release of carbon (fires, harvesting etc.).	Rising of environmental awareness + rising demand for local/regional products Demand side (for local timber), demand for certified local wood by local businesses	Collaborative approach for low carbon business model, effective ES governance Rising of environmental awareness Demand for CO2 certificates and profitability of ES innovations
Future prospect	Lack of findings for state nature conservation regime	Market based PFES and regional goods  Focus more on local/regional economy than on FES production	real carbon storage Continuous payments for long term provision of FES regime based on the self-organization of the community  Focus primarily on long-lasting FES provision

Source: Aukes et al. (2020).

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