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Navigating the Complexities of Forest Management Policies in the Czech Republic: The Role of LULUCF Regulation in Mitigating Climate Change

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Declaration

I, Hana Vetráková, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature……..

Date……

Abstract

European policies aim to drastically decrease carbon emissions in the following decades to minimise the devastating effects of climate change. The forestry sector has a considerable role, as the contribution of forests to mitigate carbon emissions can be substantial to achieve the aimed targets. Research suggests that forestry management policies must be more cohesive, and their goals must align.

This research focuses on Land use, land use change and forestry regulation and its translation into the forestry context of the Czech Republic using the concepts of fit, interplay and scale in social-ecological systems. Due to the bark beetle calamity, the Czech Republic faces a dilemma, whether to increase the carbon sinks by planting unstable spruce monocultures and complying with the Land use, land use change and forestry regulation or whether to grow mixed forests and create more resilient forests for the future.

This research used policy network mapping, content analysis and interviews with relevant actors. The findings suggest that there has been a shift in forest management practices, but it is not attributable to the Regulation that was analysed. The Czech actors criticised this Regulation, which may influence the willingness to comply with future regulations. This research contributes to understanding the complex relationships in social-ecological systems and the interplay between European Union and the Czech Republic.

Acknowledgements

Writing a master's thesis is challenging, but the support of the people around me made a significant difference during this process, so I want to acknowledge the people who have stood by me throughout this journey.

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List of Abbreviations

SES	Social-ecological system
EU	European Union
EC	European Commission
LULUCF	Land use, land use change and forestry
DG	Directorate-General
F55	Fit for 55 legislation package
EGD	European Green Deal
AFOLU	Agriculture, forestry and land use sector
FRL	Forest reference level
FCR	The Forests of the Czech Republic

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1 Introduction

Forests can significantly contribute to reducing CO2 emissions by serving as important carbon sinks in climate change mitigation efforts (Ellison et al., 2017; Meyfroidt & Lambin, 2011; Murdiyarso et al., 2015). The process of climate mitigation policies is often transboundary, covering various levels of social and ecological structures. From individuals to entire continents, this process is usually tied to political decision-making at multiple levels. Scientists identified climate change as a critical driver behind the increase in wind disturbances, bark beetle, droughts, and wildfires, yet how the expected continuation of climate change will affect Europe's forest disturbance regime remains unresolved (Acosta et al., 2020). Land use, land use change and forestry are integral to sustainable development, and forests are widely recognised as one of the most critical environmental components that contribute to broader sustainable development efforts. Forest management policies demonstrate the interconnected nature of social and ecological systems and demand interdisciplinary and international approaches.

The European Union (EU) has considered forestry policy an essential element of rural development policy since 1997 (Jarský, 2015). EU is now setting ambitious goals in its climate policy to enhance the ability of forests to absorb carbon and thus help mitigate climate change, creating designed institutional changes in European member states. Being a member of the EU implies adopting a common political culture, norms, values and working methods via standard EU regulations. Thus, standardisation and enviro-mentalisation of economic, political and legal institutional foundations of member states' functioning structures can be observed in Member States (Dankevych et al., 2021). Integrating European policy is a process of Europeanisation of domestic member states' governance structures (Solorio, 2011; Tanil, 2014). The European Union's effect may be filtered and mediated through pre-existing domestic institutions, such as, rules, norms, and political cultures (Tanil, 2014; Tanil & Jurek, 2020). Pre-existing domestic institutions can create considerable differences in performance if member states are to comply with standard EU regulations. Specific social contexts in each member state combined with environmental conditions may result in the problem of social and ecological fit between the policy and the environmental conditions (Folke, 2006; Young, 2002). Topographical and economic factors, as well as forest structure, land use, climate, and latitude, all affect the carbon absorption potential of different countries. These factors limit the potential of forests to mitigate climate change uniformly across all EU member states. Environmental institutions, the processes of (re)design, thus play a role in controlling large-scale environmental changes. Research on institutions can enhance our understanding of the

dynamics of institutional interplay upon which the sustainability of SESs depends (Epstein et al., 2015).

Incoherence, high fragmentation of regulations, and a lack of common goals hinders potential forests' potential to mitigate climate change through carbon sequestration (Aggestam & Giurca, 2021; European Commission, 2021a). This lack of co-ordination arises from the high number of policy domains and instruments that affect forests (Commission et al., 2019; Rukundo et al., 2011). The absence of a dominant policy instrument with a clear pathway for EU forest policy worsens the fragmentation (Kleinschmit et al., 2018; Lazdinis et al., 2009).

For example, forest ecosystem services fall under various policy domains where the EU has competencies, such as energy, agriculture, environment, and climate. Multiple domains with various goals, demonstrate conflicting forest policy objectives, different sectoral perspectives, and implementation tools involving more profound governance challenge (Aggestam & Giurca, 2021). Policy on forest management in the EU has been left mainly on the national responsibility of member states (Lazdinis et al., 2009) following the subsidiarity principle. The research, therefore, suggests it is necessary to understand better how EU political priorities of member states and the EU mix at the national level and whether policymakers can achieve vertical coherence between policy domains and institutions at all (Aggestam & Giurca, 2021; Borrass et al., 2015; Kern et al., 2017). Research on mapping EU institutional arrangement shows a need for improved co-ordination and cooperation in forest decision-making at the member states' community level to limit the institutional constraints in European forest governance (Grassi & Pilli, 2017; Lazdinis et al., 2009; Wydra, 2013).

In the Czech Republic, long-term spruce monoculture combined with extreme ecological events have created challenging conditions to comply with the EU regulations regarding greenhouse gas emissions from forestry. Research suggests Czech policymakers have not paid enough attention to climate change, thus Czech forests grapple with increasing instability caused by windstorms, droughts, and insect plagues. Traditional forest management methods and inflexible and strict approaches prioritising short-term profit over long-term sustainability are not considered comprehensive solutions to address environmental changes (Fanta & Petřík, 2018). Traditional forest management practices may not be sufficient to address the complex challenges posed by climate change, habitat loss, and biodiversity decline. These challenges require innovative and adaptive management strategies considering SESs' dynamic and interconnected nature. Inflexible and strict approaches may lead to unsustainable practices, monoculture plantations and overexploitation of natural resources, harming biodiversity, ecosystem services and local communities (Fanta & Petřík, 2018; Wagner et al., 2014).

Moreover, research in the Czech renewable energy field demonstrates that policymakers implemented crucial EU-level policy institutions to the national legislative framework. Still, political actors and society have not fully internalised these institutions. Thus, the Czech energy policy can be considered an outcome of the EU policy developments rather than the outcome of the autonomous Czech policy debate (Tanil & Jurek, 2020). Mitigation strategies must be internalised at the EU, international and national levels, and especially at the local level to mitigate the adverse impacts of climate change (Czech Environmental Information Agency, 2021).

Various studies have been recently conducted in the Czech Republic on the local level, for example, the role and power of small-scale private forest owners (Dobšinská et al., 2020; Hrib et al., 2018), forests in the Czech public discourse from a sociological perspective (Stachová, 2018), the conceptualisation of forest management (Feliciano et al., 2017), analysis of the sectoral innovation system for Czech forestry (Jarský, 2015) and the formulation of the National Forest Programme in the Czech Republic, including a participatory process with involved stakeholders (Balest et al., 2018). However, a recent study by (Janová et al., 2022) highlights a need for research on the counteractions or lack of action of lawmakers, policymakers and public administration within the forest policies in the Czech Republic.

This study will contribute to filling the above-presented research gaps, specifically in understanding the dynamics of environmental institutions and the interplay between social and ecological systems. I will examine the forest governance of the Czech Republic and the EU forest policy integration and internalisation by actors involved in forestry. As researchers have done many studies on the local forest owners' level, I will focus on the national level. This level is the first level to receive new EU policy proposals and is responsible for transposition to the context of the Czech Republic.

2 Background to the research problem

2.1 Social systems in social-ecological systems

Today's society lives in a complex world of interdependencies and interactions in social-ecological systems (SESs). These interdependencies recognize that humans are not separate from nature but are part of the broader ecosystem and that ecological processes and components link social and ecological systems in complex and dynamic ways (Epstein et al., 2015). We can see such interdependence in how humans relate to and treat ecological ecosystems through environmental policies, representing the interactions between the social and ecological systems. The social system has a crucial role in governing the impacts of climate change, particularly in the current era of climate change.

In a time of climate change, the social sphere is essential in governing the changing climate. The social sphere plays a critical role in SESs, which are complex systems where social and ecological components are interconnected and influence each other (Folke & Berkes, 1998). The social part refers to the human, social and cultural systems that shape how people interact with each other and the environment. In SESs, the social sphere includes a range of factors, such as social norms, values, beliefs, institutions, and governance systems. These factors influence how people use natural resources, manage ecosystems, and respond to environmental change. Understanding the role of the social system in SESs is crucial for developing effective environmental policies. It requires recognizing the interdependence between social and ecological systems and the need to address both in an integrated manner (Epstein et al., 2015). For example, social systems rely on natural resources and ecosystem services, such as clean water, fertile soil, and biodiversity, to support economic activities and human well-being. In turn, human activities, such as agriculture, forestry, and urbanisation, can have significant impacts on the environment, affecting ecosystem functioning, biodiversity, and the climate (Turner et al., 2003).

One way to understand the social sphere is through institutional fit and the sustainability of SESs. This theory focuses on more profound and more resilient aspects of social structures. It considers processes supported by schemes, rules, norms and procedures, which become authoritative guidelines for social behaviour (Halton, 2004). Institutions' definitions vary, but essentially, institutions are humanly devised rules that influence human behaviour. According to Vatn, "environmental problems are, to a large extent, the result of institutional structures" (Vatn, 2015, p.246). Institutional structures can be, for example, policies to mitigate climate change.

2.2 European forest management framework

The climate mitigation policy began in 1992 with the United Nations Conference on the Environment and Development. In 1994 the United Nations Framework Convention on Climate Change to combat dangerous human interference with the climate system was a significant milestone. The Kyoto Protocol in 1997 extended the commitment to reduce greenhouse gas emissions. More recently, the Paris Agreement confirmed this commitment, and it became binding for states to combat climate change and adapt to its effects. In fighting climate change, the EU aims to be the first climate-neutral continent by 2050 (European Commission, 2019). For example, the EU establishes strategies and mechanisms, such as the European Green Deal (European Commission, 2019), the 2030 EU Climate Target Plan (European Commission, 2021b), and the EU Emissions Trading System. The EU also established the European Climate Law (European Commission, 2020b) and the Just Transition Fund (European Parliament, 2020).

The European Green Deal (EGD) is a set of legislative initiatives expected to deliver on various EU policy domains, bringing member states to carbon neutrality by 2050. The EGD provides a coherent and balanced framework to reach the EU's climate objectives while ensuring a just and socially fair transition to a climate-resilient society (European Commission, 2019). To achieve carbon neutrality by 2050, the "Fit for 55" package (F55) sets a milestone to cut at least 55% of emissions by 2030. The F55 includes ambitious updates of legislation in various domains, including Land use, land use change and forestry regulation. This package has received a critique because it does not reflect the current developments of EU forests (Köhl et al., 2021). The recent developments show EU has lost about a quarter of its annual land sector carbon sink between 2002 and 2020 due to harvesting for energy (Booth, 2022). Moreover, forest disturbance damage in Europe has continued to increase in the first decade of the twenty-first century. Thus, damage from wind, bark beetles and forest fires will likely further increase in the coming decades (Seidl et al., 2014).

Forests are a part of the LULUCF Regulation, and carbon removals are a substantial element of the EU carbon sink policies. The LULUCF in the EU's framework consists of cropland, settlements, grassland, wetland, wood products and forests (European Union, 2022). For this thesis, I have chosen to focus on forests because forests are complex ecosystems with many interactions and because all other categories are much broader and outside of the manageable scope of this thesis for various reasons. First, because of the time limitations of the master thesis and second, because of the difficulty of analysing the broad and complex land use elements, including conversion, use and management.

2.3 The LULUCF Regulation

The existing Land use, land use change and forestry regulation (hereafter LULUCF Regulation or the Regulation). adopted in 2018 requires each member state to ensure that "emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory", also referred to as "no-debit rule" in the period 2021-2030 (European Union, 2018, Article 4, p.8; Korosuo et al., 2020). The existing regulation also includes an accounting method for removals on managed forest land based on Forest Reference Level (FRL). The FRL, originating in the Kyoto Protocol, is proposed by each Member state as a part of a National Forestry Accounting Plan (NFAP), which documents the calculation of the FRL. Member states would then compare emissions and removals from managed forest land against this FRL benchmark. The forest greenhouse gas fluxes depend on natural circumstances, dynamic age-related characteristics, and past and present management practices in each Member State. The argument was that using of an individual base year for the forestry sector can thus reflect country-specific circumstances because the net emissions in any given year usually reflect the management practices of a more extended period and may be influenced by exceptional natural disturbances (Korosuo et al., 2020). However, the accounting method has proven to be a too complex baseline for estimating future carbon removals (Böttcher et al., 2021). The challenge also lies in the qualification of released GHG emissions and sinks and how to measure their fluctuations correctly. Emission accounting must make a thorough distinction must be made between natural and human-induced emissions. However, forest carbon fluxes caused by human activity and those influenced by natural processes are difficult to distinguish as they occur simultaneously (Romppanen, 2020; Savaresi et al., 2020).

In the proposal of new LULUCF Regulation, the European Commission states three main problems of the accounting method: (1) decreasing carbon removals in the land sector due to increasing harvesting rates related to wood demand and forest ageing, continued emissions from organic soils, natural disasters and a lack of policy and financial incentives. (2) insufficient integration of the land sector into climate policies because the agriculture sector and LULUCF have no integrated target and are covered by different legislations. (3) accounting, monitoring, and reporting rules in the current LULUCF Regulation presented implementation challenges. In particular, establishing the Forest Reference Levels has proven to be burdensome and lacked the accuracy of estimates in each member state (Böttcher et al., 2021; Council of the European Union, 2021).

The detailed calculation of the FRL is outside of this paper's scope. However, what is interesting is the fact that the Czech Republic's FRL model "was found to lead to an

inconsistent representation" (European Commission, 2020a, p.33) of the practices and led to a recalculation of the FRL (from -7 685 130 t CO_2-eq yr to -6 137 189 t CO_2-eq yr). The recalculation was due to considering wood removal separately for planned fellings[1] and unplanned fellings. The Czech Republic based the wood removal in unplanned felling on the reference period 2005-2009, when this felling type was highest, while the wood removal in planned fellings was based on the whole reference period 2000-2009, as illustrated in Figure 1 (Council of the European Union, 2021; European Commission, 2020a; Korosuo et al., 2020).

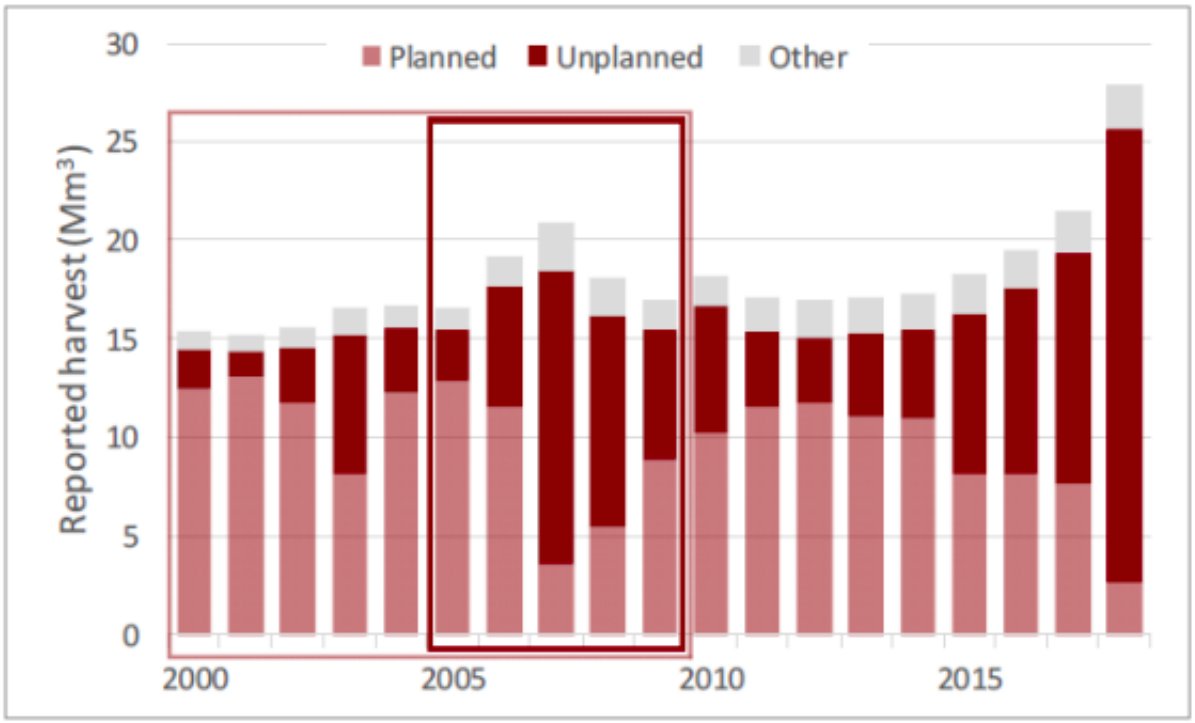

Figure 1 Planned and unplanned volumes of harvest

Figure 1. European Commission (2020). Commission staff working document, Assessment of the revised national forestry accounting plans 2021-2025. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0236&from=EN (accessed: 23.03.2023).

2.4 Revision of the LULUCF Regulation

Presented in July 2021, the revision of the LULUCF Regulation aims to address these challenges and simultaneously increase the existing Union target of 225 Mt CO2 removals to a new target of 310 Mt CO2 (Council of the European Union, 2021). European Parliament proposed national binding targets for increased net greenhouse gas removals in 2030 for each member state in March 2023. National targets are based on recent levels of reductions or

[1] In forestry, "felling" refers to the process of cutting down trees. It is a term used to describe the action of harvesting trees for the purpose of producing timber or other forest products. The felling process can be done manually with axes, saws, or chainsaws, or with the use of mechanised equipment like harvesters.

emissions in the period 2016-2018. The Parliament proposed a binding national target for the Czech Republic of at least 1,228 Mt CO2 (European Parliament, 2023). It would, however, be significantly more advantageous for the Czech Republic if the calculation would also include the year 2019 because the Czech Republic reported high emissions from the LULUCF as a result of the last bark beetle outbreak between the years 2018 and 2019, contributing to the fact that Czech forests have become sources of CO2 since 2018 (Brázdil et al., 2022; Hlásny et al., 2021).

The Commission plans to implement the changes in the following steps. Phase 1 in 2021-2025: Continuation of the current LULUCF architecture adopted in 2018, according to forest reference levels, keeping the "no-debit rule". For 2021-2025, no fundamental changes are proposed in the architecture of the LULUCF Regulation, and accounting will, in principle, continue according to the already approved rules.

Phase 2 in 2026-2030 Change phase: Substantial changes to how emissions and sinks from the LULUCF are accounted for are proposed for 2026-2030. The Member states will no longer apply the complicated and administratively demanding process of establishing reference levels in this period. In 2030, a binding national target of minimum net losses of -1.228 Mt CO2 is proposed for the Czech Republic.

Phase 3 after 2030 Emergence of the agriculture, forestry and land use sector (AFOLU): In the period after 2030, it is proposed to merge emissions and sinks from LULUCF and emissions from agriculture, excluding CO2 emissions which should achieve climate neutrality of this sector at the EU level by 2035 and subsequently create net sinks (Council of the European Union, 2021).

As the European Union demands ambitious goals in the forestry sector until 2030, it is essential to understand how different kinds of institutions influence transformations towards the objectives of EU forest regulations. The institutional interplay in forest SESs in the Czech Republic is thus, at this point, crucial, because the LULUCF play a vital role in the Czech Republic in complying with the EU national removal targets. It is, therefore, necessary to address the institutional dimensions of environmental change and how different kinds of institutions influence transformations towards the objectives of the LULUCF regulations. Because institutions, such as laws, policies, regulations, and governance systems, play a crucial role in shaping how humans interact with the environment.

2.5 The impacts of bark beetle outbreaks on Czech forests

There were several bark beetle outbreaks in Czech history, dating back to 1980 and until the present year 2023. The latest calamity has not culminated yet, and some affected regions are still recovering from the latest outbreak in 2015-2018. The last bark beetle outbreak started in 2003-2004, caused by extreme droughts and an abnormally warm and long summer in 2003. Then between 2007 and 2010, the cause was hurricane Kyril, which devastated around 6 million m^3 of wood (Zahradník & Zahradníková, 2019). In 2015 exceptional drought continued, and the last bark beetle outbreak forced by high temperatures and drought has no documented historical analogue to its scope and its devastating effects on Czech spruce monocultural forests. The continuous trend of extreme ecological events has contributed to the fact that Czech forests have become sources of CO2 since 2018, further increasing the anthropogenic footprint of greenhouse gas emissions (Brázdil et al., 2022).

The bark beetle is usually a permanent component of forest ecosystems but can become a significant stress factor in highly human-influenced forests (Zemek & Herman, 2001) and in combination with extreme events, it creates such conditions for the beetle to spread out in excessive numbers, feeding on the bark of trees. Once the eggs hatch, the larvae live in the tree trunk, feeding on the living tissues below the bark, often leading to the death of the tree if enough larvae are present (Barkley, no date), affecting vast areas of forests and destroying trees, which then need to be mined out to stop the spread (Šimůnek et al., 2020).

When the LULUCF Regulation was prepared and implemented, extreme events took place in the forestry sector in the Czech Republic. The Forest Reference Level assumed, on similar average absorption of CO_2 by forests, if the forest management conditions stay the same as in the reference period 2000-2009. However, a bark beetle outbreak from 2015 to 2018 hit the Czech Republic, resulting in much wood mining and emissions.

The spread of the bark beetle plague affected all parts of the country at altitudes exceeding 900 meters above sea level. Figure 2 shows areas where spruce wood attacked by bark beetle was logged in 2018-2021, marked in purple.

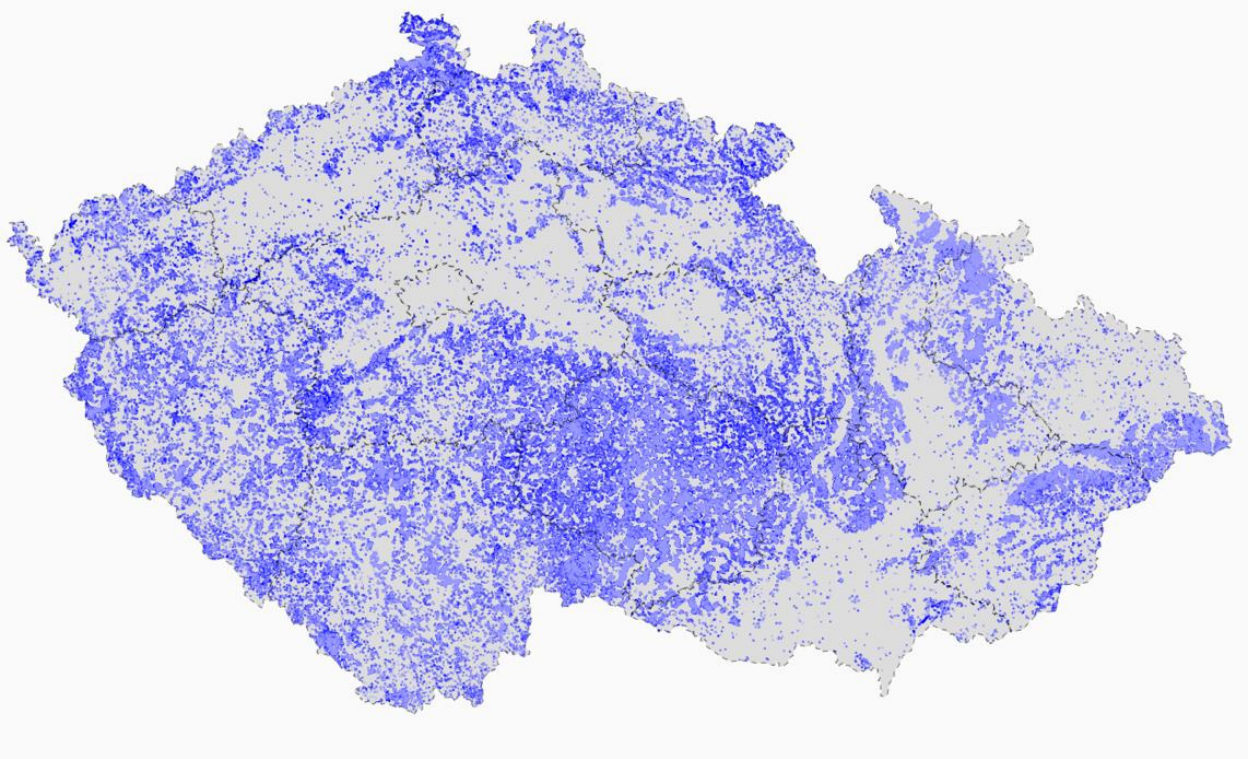

Figure 2 Map of spruce logging 2018-2021

Figure 2. Kurovcovamapa.cz, (2022). Area of spruce logging 2018-2021. Available at: https://www.kurovcovamapa.cz (accessed: 07.05.2023).

Figure 3 shows the wood harvest of spruce trees attacked by the bark beetle, which significantly increased in 2016 and continued rising until 2020.

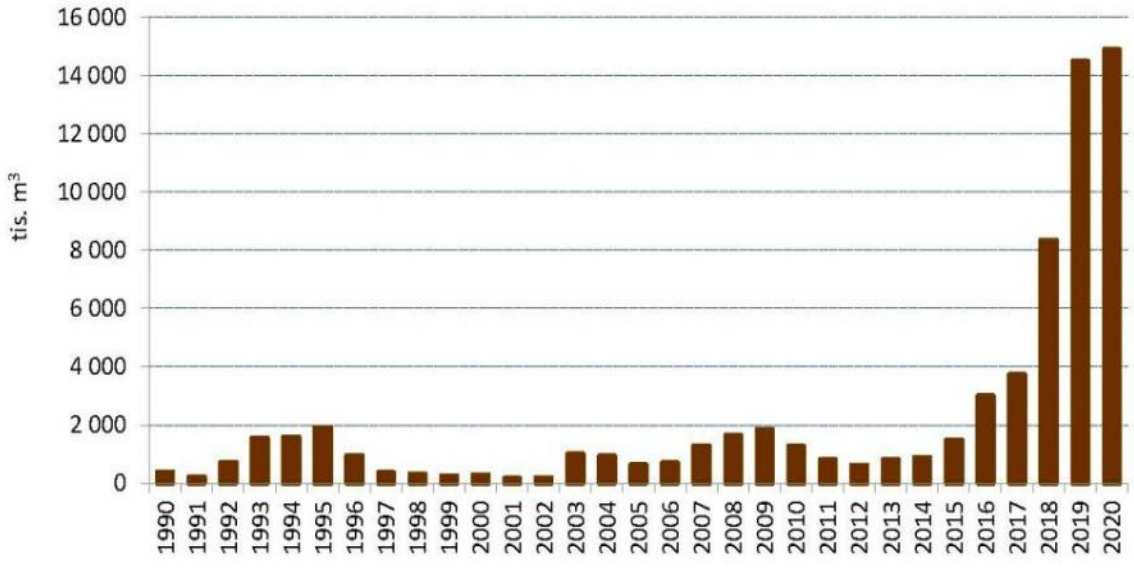

Figure 3 Bark beetle attacked wood logged between 1990-2020

Figure 3. Forestry and Game management institute, (2021). Harmful agents in the forests of the Czech Republic 2020/2021, Available at: https://www.vulhm.cz/files/uploads/2021/05/ZOL_24_2021.pdf (accessed: 24.03.2023).

Figure 4 compares planned and unplanned wood logging. In 2020 unplanned logging increased significantly, reaching 33,91 mil m^3. Of this number, 26,24 mil m^3 was due to insect attacks, 4,60 due to natural disturbances and other causes account for 3,07 mil m^3 (Ministry of Agriculture, 2021). Therefore, total extractions continued to significantly exceed the derived annual quota, i.e., the amount of wood that can be extracted annually.

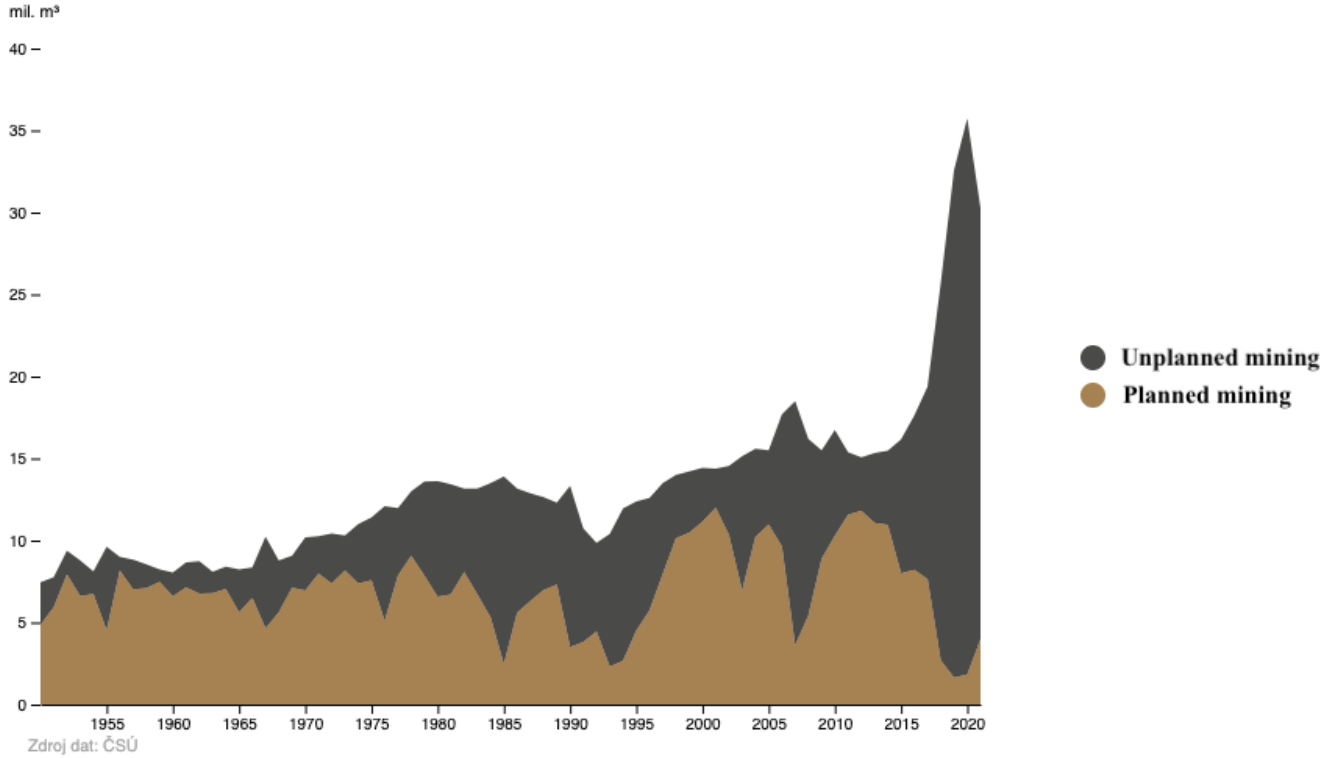

Figure 4 Comparison of planned and unplanned wood mining

Figure 4. Forestry and Game Management Institute, (no date), Growth and logging, Available at: https://info.uhul.cz/Indicators/6 (accessed 07.05.2023).

Figure 5 demonstrates LULUCF emissions in the Czech Republic. It shows that until 2017 the sector was acting as a carbon sink. However, LULUCF started to produce carbon emissions in 2018. The negative values in the graph correspond to net removals. The positive values are net emissions.

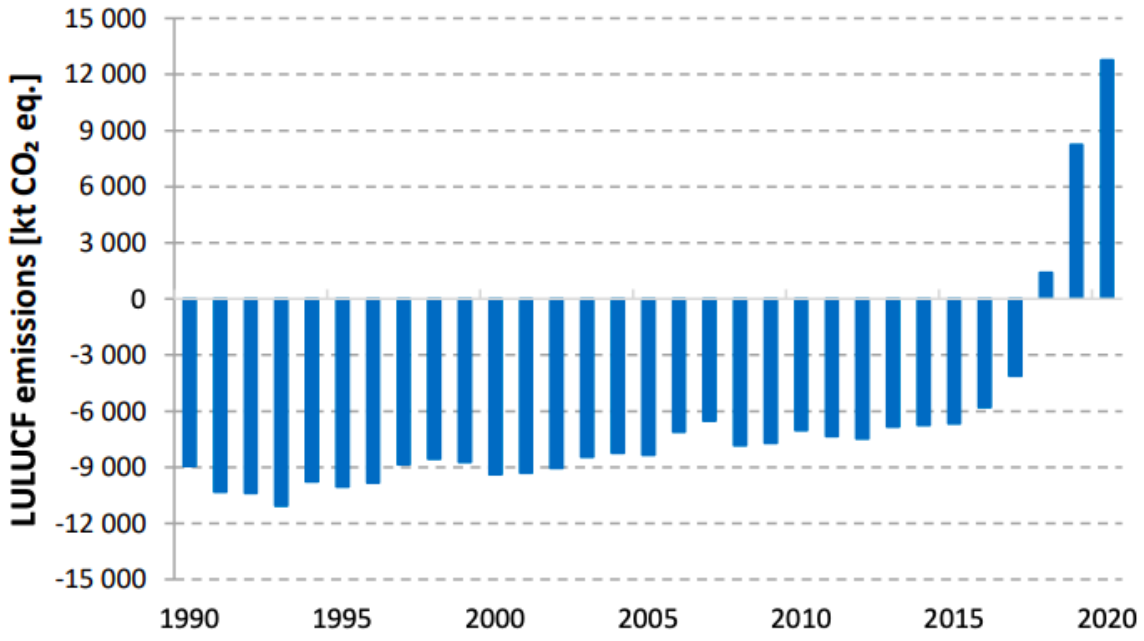

Figure 5 LULUCF emissions balance

Figure 5. Czech Hydrometeorological Institute, (2022). National Greenhouse Gas Inventory Report of the Czech Republic, Available at: https://www.chmi.cz/files/portal/docs/uoco/oez/nis/NIR/CZE_NIR-2022-2020_UNFCCC_complete_ISBN.pdf (accessed: 07.05.2023).

The current composition of Czech forests is around 70 % coniferous trees and 30% deciduous trees (Ministry of Agriculture, 2021). Stemming from history, the trend of planting coniferous monocultures reduced the diversity of Czech forests, exhausted the soil, and increased the susceptibility of forests to natural disasters (Daniel et al., 2013). Increasing temperatures causing droughts make managing extreme events, such as bark beetle outbreaks, difficult. As forests are a long-term generating ecosystem, it is thus difficult to change things quickly. Without monocultures, forests in the Czech Republic would be composed predominantly of oak, beech, and fir. Such deciduous trees are known to be more stable to extreme ecological events (Neuhäuslová et al., 1997). However, in the last two decades, the area covered by spruce monoculture plantations in the Czech Republic has been declining, and mixed forest planting occurred. The development of the forest composition has been changing. Deciduous trees comprised 22,3 % in 2000 and increased to 28,2 % in 2020. On the other hand, coniferous trees made up 76,5 % in 2000 and 70,4% in 2020. Planting more mixed forest reflects the efforts to achieve more mixed forests (Ministry of Agriculture, 2021).

Both natural and human means can cause the spread of bark beetle. Official documents and research on bark beetle calamities in the Czech Republic generally agree that such calamities are induced by recent climate change (Czech Hydrometeorological Institute, 2022; Ministry of

Agriculture, 2021; Štícha et al., 2019) triggered by the compound effect of windstorms, significantly increasing temperatures (Zahradníček et al., 2021) and stable or decreasing precipitation (Figure 6), which results in extreme droughts, because many spruce stands are now located in unsuitable conditions, being more suspectable to various extreme events (Brázdil et al., 2022; Šimůnek et al., 2020). Figure 6 demonstrates monthly accumulated temperature and precipitation anomalies between 2015-2021.

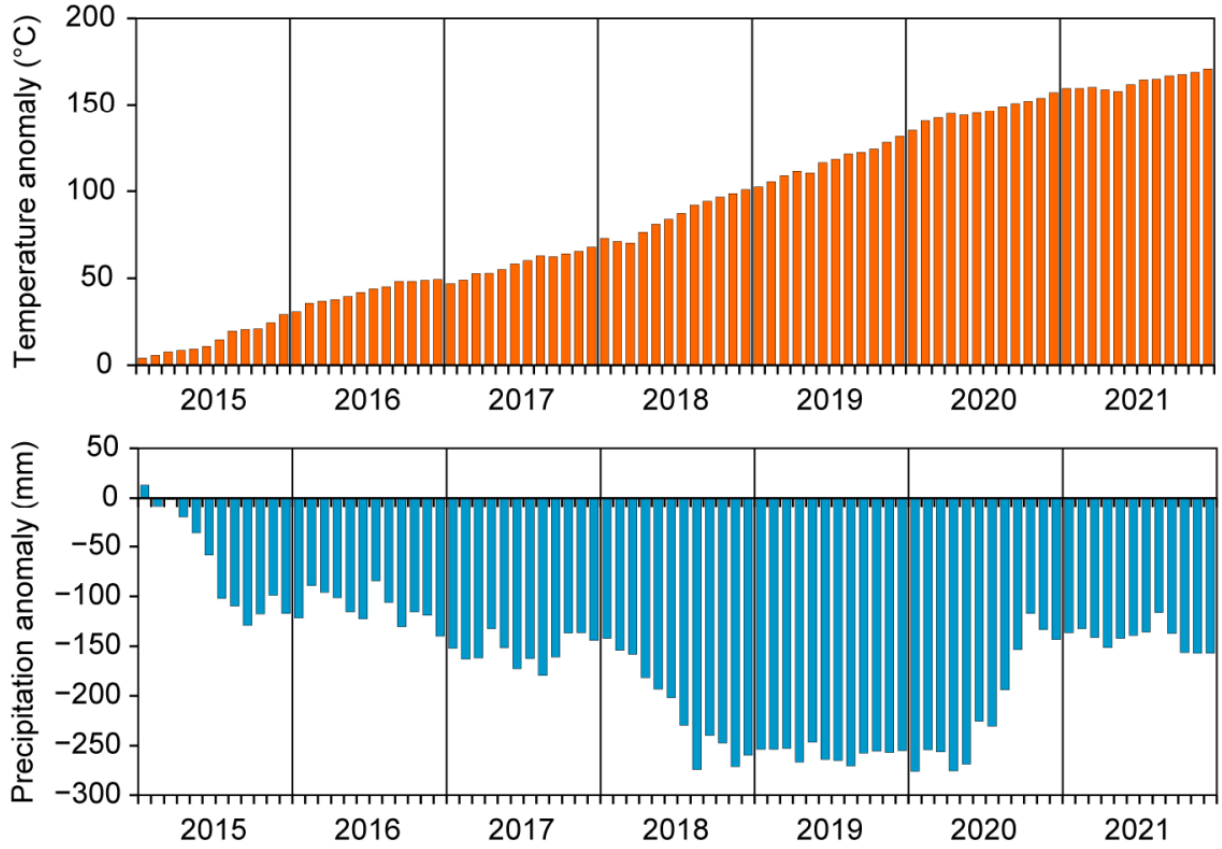

Figure 6 Temperature and precipitation anomalies

Figure 6. Brázdil et al. (2022). Meteorological and climatological triggers of notable past and present bark beetle outbreaks in the Czech Republic, Climate of the Past, 18(9), pp.2155-2180.

Other reasons for the spread of bark beetle are combinations of climatically extreme periods and ineffective forest management systems (Toth et al., 2019). Other vital problems are also late processing of bark beetle-infested trees because of the permanent loss of qualified workforce, the inactivity of many owners and the inflexible public procurement system (Knížek et al., 2021).

3 Aim, objectives, and research questions

This study aims to understand how different kinds of institutions influence transformations towards the objectives of EU forest regulations. This research focuses on the policy regime set by the LULUCF Regulation and how this institutional framework translates into institutions governing emissions and removals from forests in the Czech Republic. Specifically, this research will use the theoretical framework Fit, Interplay and Scale by Oran Young. The general research objective is: How do different kinds of institutions influence transformations towards the objectives of the LULUCF regulations?

The following research questions will help to achieve the objective:

1. What institutional changes are formally being implemented in the Czech Republic concerning the LULUCF Regulation in forests?
2. What are the existing institutions in forest governance that may influence implementing the LULUCF Regulation for forests in particular?
3. What stances do actors in the forestry sector in the Czech Republic have towards the LULUCF Regulation in forests?
4. How have institutional changes happened in the past in Czech forestry, and what does this suggest about the future of the LULUCF?

4 Conceptual and Theoretical approach

4.1 Social-ecological systems and the resilience perspective

In the era of climate change, how society understands social and ecological systems is crucial because the perceptions of social and ecological systems have implications for governing global environmental change and designing environmental policy. As a concept, the social-ecological systems (SESs) consist of a bio-geo-physical unit and its associated social actors and institutions (Glaser et al., 2012). Forests landscapes as social-ecological system (SES) are defined as: "nested sets of coevolving social and natural subsystems connected through feedbacks, time lags, and cross-scale interactions" (Fischer, 2018, p.138).

In the era of climate change, a resilience perspective could be beneficial in understanding the concept of SESs. The resilience perspective says that SESs are dynamic, interactive, and interdependent. Human lives depend on ecological systems and the ecosystem services these systems provide. In resilience thinking, understanding these two entities represents "systems". This understanding is holistic, as it does not focus on a detailed understanding of each part but rather on how key components interact and contribute to the dynamics of the whole system. In practice, some policies are designed assuming these systems have stable equilibrium, and that change can be controlled. The resilience perspective shifts this view towards managing the capacity of SESs to cope with, adapt to and shape change (Folke et al., 2003; Folke, 2006).

Building resilience in social and ecological systems is a journey of how both systems can withstand shocks of any type. Ecosystem resilience describes the capacity of an ecosystem to cope with disturbances, such as storms, fire and floods, without shifting into a different state of being (Folke et al., 2002). Once such shifts occur, the ecosystem may produce different services, goods, self-maintenance, or self-organisations than initially.

An ecosystem's resilience depends on the diversity of components and processes that must be maintained to prevent the ecosystem from shifting into a different state of being. Components such as species, landscape types, knowledge systems, actors, cultural groups, or institutions provide different options for responding to shocks of any type, uncertainty and surprise (Folke, 2006). Ecological processes that must be maintained to avoid a shift into a new state include energy flow, water cycle, nutrient cycles, and community dynamics. For example, food supply relies on local pollination processes, regional water supply and global market trends (Scholes et al., 2013). In the case of forests, many countries lack the broad-scale institutions that are essential to managing regional deforestation, and the resulting haphazard loss of forests can disrupt ecological functions, such as climate regulation, fruit provision, game species populations, and fire regimes (Nepstad et al., 1999 in Cumming et al., 2006).

Social resilience implies the ability of human communities to withstand and recover from stresses, such as environmental change or social disturbances. *Complex adaptive system thinking* is a part of building resilience and emphasises the need to understand complex interactions and dynamics between actors and ecosystems in SESs. Because several different connections co-occur simultaneously on different levels (Biggs et al., 2015), recognizing this complexity, accepting uncertainty and the unpredictability of connections and interdependencies have implications for the governance of SESs. Institutions are part of SESs' governance because it guides rules, norms and procedures that guide decision-making processes and provide a sense of order and predictability. For example, institutions define rules, regulations, and procedures that society must follow to avoid chaos and uncertainty.

Society lives in complex systems, including both the natural and social spheres. It has not been for a long time that the natural and social systems were recognised as coupled. Mainstream ecology had tried to exclude humans from the study of ecology, just as many social sciences had ignored the environment and limited their scope to humans. Thus, the unity of the environment and humanity had been transformed into a simple dichotomy of nature and culture (Berkes et al., 2001). SESs emphasise the integration of humans in nature and stress that delineating between social and ecological systems is only artificial and arbitrary (Berkes et al., 1998).

Focusing on the social or ecological side separately as a basis for decision-making for environmental policy leads to limited and misleading conclusions creating, for example, the problem of fit between social and ecological systems (Berkes et al., 1998; Folke, 2006). For example, ecosystem responses to resource use and the corresponding response of people to changes in ecosystems constitute coupled, dynamic systems exhibiting adaptive behaviour. This recognition underscores the importance of considering linked SESs rather than ecological or social systems in isolation (Berkes et al., 1998; Holling et al., 1995).

Collaboration between and across institutions and different scales is also essential, as collaboration improves connectivity and learning. For instance, well-connected governance structures can swiftly deal with change and disturbances when the right people address them at the right time (Biggs et al., 2015). Networking in governance structures can lead to more scale-responsive environmental management (Carlsson & Sandström, 2008), for example, through stable institutionalised relationships that enable for trust and cooperation but are capable of change (Newig et al., 2010). Nevertheless some hindrances to achieving ideal networked governance include the complex coordination of actions across heterogeneous social-ecological landscapes, including considerable legal and social barriers (Cosens & Gunderson,

2018). Nevertheless, institutions play a central role in management because they inform management with rules, norms, and procedures that guide environmental decisions.

4.2 Institutions in social-ecological systems

Institutions govern our actions about the environment. The understanding of institutions has changed over time and takes various forms. Therefore, agreeing on a standard definition is difficult. New institutionalism takes the definition of institutions beyond the idea of institutions as mere formal rules and focuses on how institutions embody values and power relationships. Veblen identified institutions as "settled habits of thought" (Veblen 1919, p.239 in Vatn, 2005). Bromley (1989, p. 22) defined institutions as "rules and conventions of society that facilitate coordination among people regarding their behaviour". North (1990) understands institutions as humanly devised rules in a society that shape human interaction. Gordon identified institutions as "organised patterns of socially constructed norms and roles and socially prescribed behaviours expected of those roles, which are created and re-created over time" (Gordon et al., 1991, p. 19). Scott defines institutions as: "cognitive, normative and regulative structures and activities that provide stability and meaning to social behaviour" (Scott, 1995, p. 33). According to Vatn, institutions "provide expectations, stability and meaning essential to human existence and coordination. Institutions support certain values, and produce and protect specific interests" (Vatn, 2005, p. 113). Institutions define property rights, set resource use and management rules, and create incentives for or against environmental conservation and sustainability. They also shape the distribution of benefits and costs associated with environmental change, affecting different social groups differently. This thesis will understand institutions as "settled habits of thought" and socially constructed forest management rules rooted in legislation.

4.3 Institutional Dimensions of Environmental Change: Fit, Interplay and Scale

This thesis will employ a framework from Oran Young called "Fit, Interplay and Scale" (Young, 2002) to examine the institutional changes related to implementing the LULUCF Regulation in the Czech Republic. This framework is beneficial because of the complex relationship between the European Union and each member state. It provides a structured way to understand the relationship between European Union and the Czech Republic, emphasizing the problem of fit between environmental policy and the properties of the ecosystem concerned.

4.4 The concept of Fit

The problem of fit is about the interaction between the human and ecosystem dimensions in SESs that are not just linked but truly integrated. The problem of fit has been part of discussions for many years, mostly because of its conceptualisation (Epstein et al., 2015; Folke et al., 2007).

In 1997 as a part of the Institutional Dimensions of Global Environmental Change discussion, Young and Underdal described the problem of fit in the following way: "The problem of fit asserts that the effectiveness and the robustness of social institutions are functions of the fit between the institutions themselves and the biophysical and social domains in which they operate" (Young & Underdal, 1997 in Folke et al., 2007). Further Young elaborates on the effectiveness of social institutions as being a "function of the match between the characteristics of the institutions themselves and the characteristics of the biogeophysical systems with which they interact" (Young, 2005,p. 57). Thus, to be adequate to environmental degradation, institutional responses must fit the attributes of the resources or ecosystems they address. In the case of social fit, institutions' performance depends on the extent to which governing institutions reflect the interests, values, beliefs and psychological needs of groups (Olsson et al., 2007). Many social institutions regarding natural resource management operate according to a particular set of values, including intrinsic and economic values associated with certain ecosystem goods or services. When societal values significantly change anthropogenic activities, institutions often fail to adjust accordingly (Cumming et al., 2006).

Young defines the fit problem as "a matter of the match or congruence between biophysical systems and governance systems" (Young et al., 2008, p. 26). Therefore, the problem of fit concerns ecosystem properties and policy design implications. It focuses on the degree to which an arrangement is compatible with the biogeophysical system it is applied to, and it's capacity to prevent undesirable environmental changes and to solve environmental issues (Young, 2002).

Drawing on this as a base, creating a perfect fit is an elusive task in practice because it has proved challenging to define the territorial boundaries of a natural resource, not least because of its complex interdependence with broader ecosystems. A critique of the concept of fit argues that determining territorial boundaries of natural resources is often complicated because ecosystems are not spatially closed nor static, such as differences in the ground and surface water catchments (Moss, 2003).

According to Young, the problem of fit is a generic, all-encompassing problem, showcasing the common saying "one size does not fit all". Based on the variety of properties in ecosystems and their complexities, diverse misfits of mismatches arise associated with various environmental problems. The complexity of the ecosystem makes it difficult to erase the mismatches between ecosystems and institutional arrangements. Mismatches between the geographical extent of an environmental resource and the territorial scope of the institutions are common. For example, national fishing regulations in international waters by national

governments, without a binding international agreement, will allow each country to overfish, thus depleting fish stocks. Alternatively, local authorities' efforts to minimize air pollution alone are likely to fail, as the pollutants extend far beyond city boarders (Moss, 2012).

According to Young, assumptions about the properties of ecosystems boundaries separating distinct ecosystems are "somewhat arbitrary and may emerge as a barrier to addressing important issues" (Young, 2002, p. 59). Even if one transboundary problem is resolved, it often creates a new problem (Mitchell, 2005). The separation of marine, atmospheric and terrestrial ecosystems can impede efforts in understanding the dynamics of interactions between these ecosystems and mask the tendency of ecosystems to shift from one state to another. This separation makes it difficult to focus on the chaotic and nonlinear behaviour that characterises many ecosystems, as it is emphasised in resilience thinking (Folke et al., 2003; Folke, 2006; Young, 2002). Young admits that no well-specified and widely accepted typology of ecosystem properties exists to anchor a discussion on the problem of fit dealing with ecosystem properties and regime attributes. Nevertheless, he provides a set of illustrative distinctions among familiar categories of ecosystem properties – structures, processes, and linkages (Young, 2002).

The overuse of resources and their depletion may lead to ecosystem changes which can be irreversible or very difficult to replace. Therefore, it is crucial to design institutional arrangements to avoid intervening with natural growth cycles. Changes in ecosystems or institutional arrangements may be envisioned as an adaptive cycle. For ecosystems, changes on the local level may progress slowly, resulting in a rapid change on the global level. For institutional arrangements, changes occur at a slow pace, taking from years to decades.

On top of that, institutions need to follow the technology development trends. Thus, the optimal solution is to design flexible institutions that can adjust quickly to changing circumstances, such as, adaptive management. Adaptive management can help avoid some of the mismatches occurring from the problem of fit (Young, 2002). According to Young, imperfect knowledge, institutional constraints and rent seeking behaviour are the reasons why it is difficult to erase the mismatches between ecosystems and institutional arrangements. (Young, 2002).

Knowledge is vital in matching institutional arrangements governing human actions to the biogeophysical components of ecosystems. Young emphasises the difference between Western scientific tradition, implicit knowledge and the informal knowledge accumulated by indigenous people living close to the ecosystem. Nevertheless, any combination can result in institutional misfits. The practice of creating models to predict the dynamics of ecosystems, for example, models to calculate sustainable yields from individual stocks of natural resources. According to Young, developing models or framings of problems that assume equilibrium

mechanisms rather than nonlinear or chaotic processes is problematic. He argues that as long as we assume a tendency to return to the original state when severe disturbances happen, there is no reason to adopt a precautionary approach in regulating human actions in ecosystems. The point is not that models are wrong but rather that faulty models or misleading framings can go far toward creating institutional mismatches. Institutional constraints can be for example jurisdictional, but constraints can emerge during the implementation from paper to practice, which can be partially a matter of bureaucratic politics (Allison, 1971 in Young, 2002).

Another problem can be path dependence, the tendency of human systems to follow well-defined ways of doing things. Rent-seeking behaviour refers to the conflicts between individual gains and social welfare. In principle, everyone should strive to enhance social welfare, but this principle fails when actors try to improve individual gains at the expense of social welfare. Rent-seeking behaviour can thus lead to mismatches between ecosystems and institutions. For example, by practices termed as "rape, ruin and run" and when there is a lack of rules protecting the public interest so that private actors can exploit natural resources for their benefit (Hays 1959 in Young, 2002).

The problem of fit has been addressed from various perspectives, such as temporal fit, spatial, and functional (Ekstrom & Young, 2009; Falk et al., 2018; Folke et al., 2007; Galaz et al., 2008; Young, 2005), and social-ecological fit in studying the institutional dimensions of global environmental change (Berkes et al., 2001; Epstein et al., 2015; Herrero-Jáuregui et al., 2018). Temporal fit concerns the rate of environmental change and the ability to devise and initiate institutional responses (Epstein et al., 2015), for example, flood governance research (McGlynn et al., 2023). Floods can develop quickly and require rapid institutional responses. Engle and Lemos (2010) examine river basin governance approaches to explore the relationship between governance indicators and adaptive capacity. They conducted a reliability test for governance indicators and used in-depth qualitative data. In addition, Engle and Lemos carried out a cluster analysis. The cluster analysis indicated tensions and trade-offs might exist, especially between decision-making equality and knowledge availability (Engle & Lemos, 2010).

Functional fit is concerned with the alignment between the functional linkages of natural systems, for example, food webs and nutrient cycling (Epstein et al., 2015). Ekstrom and Young evaluated the functional fit between a set of institutions and an ecosystem using a quantitative method creating a network diagram and a matrix for the case of estuarine systems in northern California, Oregon, and Washington. Ekstrom and Young used quantitative analysis in marine management and ecosystem-based principles to help identify institutional gaps and quantify functional fit from a multi-sector perspective. Institutional gaps represent the

links in the target ecosystem, but institutional arrangements do not account for any links. The more institutional gaps, the lower the fit and the higher degree of misfit (Ekstrom and Young, 2009). Moreover, according to Ekstrom and Young (2009), qualitative analysis representing a well-defined set of institutions, such as laws and regulations, together with transcriptions from semi-structured interviews, can generate more complete data for a particular study.

"Spatial fit refers to the congruence between the geographical extents of ecological problems and institutions" (Epstein et al., 2015, p.35). However, a critique of the spatial fit argues that focusing on natural boundaries overlooks a social-ecological system's political, socioeconomic or cultural geographies (Biswas, 2004). Moss (2012) takes a closer look at problems of spatial fit and their resolution in practice to achieve a differentiated and context-sensitive understanding of spatial fit that provides practical value to policymakers. Moss approaches this task in three steps: conceptualizing, institutionalizing, and practising spatial fit using the example of the EU Water Framework Directive and its implementation in Germany. The case focuses on how each involved actor used the opportunities created by the WFD to improve spatial fit in water management. Moss based the analysis on documents relating to the Water Framework Directive implementation and interviews with ten representatives from state administrations, local authorities, and environmental groups (Moss, 2012).

Building on Young's concept of fit, Hukkinen (2012) argues that an essential aspect of fit needs to be included in the analytical focus. As cognitive beings evolved through biology, the concepts humans develop are influenced by the compatibility between our physical surroundings and the abstract ideas we use to think. The evolutionary fit between our material environment and the concepts underpins those notions. This fit is grounded in and structured by the social and material reality in which humans evolve and operate. Hukkinen (2012) makes a distinction between macrolevel and microlevel fit. The macrolevel corresponds to whether institutions fit the ecosystems and how well the theory or models explain it. On the other hand, the microlevel is whether the theory or models fit our cognitive reality or the way we think and feel.

This research will understand the concept of fit, as a fit between the EU regulation and the specific conditions in the Czech Republic. The better the fit, the weaker the pressure on member states to change or adapt the way they do things, while a high degree of "misfit" generates considerable pressure on countries to change their policies or adapt national institutions and processes to EU rules and requirements (Marek & Baun, 2010).

4.5 The concept of Interplay

As referred to by Oran Young, interplay occurs when the results of one or more institutional arrangements are affected by another. It is also a force in evaluating regimes producing sustainable results (Young et al., 2008). Specifically, Young refers to interplay as "the perception that discrete regimes can interact with one another and that such interactions become more common and significant as the number of discrete governance systems grows in any given social setting" (Young et al., 2008, p.26). Given the rapid expansion of institutional arrangements at all levels of social organisation, the interplay is becoming more common, with both positive and negative consequences for environmental governance (Young et al., 2008). Moreover, boundaries or edges of organisations, such as states, levels of government, agencies, or divisions, challenge the management of natural resources. Eddison argues that removing the boundary effects through re-organisation is ineffective, as it is impossible to remove boundaries or edges (Eddisson 1985 in Mitchell, 2005). Mitchell adds "When restructuring organisations, boundaries or edges are moved, not removed" (Mitchell, 2005, p. 1341).

In social dimensions of environmental change, interplay involves cross-scale interactions among different institutions. Land use and sea use are good examples, as their patterns are directly and intimately linked to large-scale environmental changes, such as biodiversity loss or climate change (Young, 2002). In this framework, Young distinguishes between vertical interplay and horizontal interplay.

Research on interplay or institutional interaction is closely linked to the study of the effectiveness of international institutions (Gehring & Oberthür, 2009). It emerged in the global change research agenda when scholars drew attention to an increasing regime density (Young, 1996 in Gakou-Kakeu et al., 2022). Findings on the SES dynamics show the interplay of agency, social networks, organisations, and institutions. However, the causal processes through which the interplay between interactions of people and ecosystems, with social or ecological structures and processes, produce social-ecological phenomena are poorly known (Schlüter et al., 2019). Addressing interplay in SES is critical because it highlights context-specific governance, which arises from internal dynamics, such as feedback, interdependencies, and interplay of components. Aggarwal and Anderies (2023) systematically examined the internal dynamics of sixty irrigation systems in Asia to identify the different social-ecological and infrastructural attributes, their interdependencies and feedback structures and how those promote or detract from the emergence of different types of governance (Aggarwal & Anderies, 2023).

Another research on interplay studied the coupled human-water systems. This study notes an insufficient understanding of the dynamics emerging from the interplay between design and self-organisation. This study addresses the poor understanding by bringing insights from the robustness-fragility trade-off and cultural multilevel selection frameworks to improve the understanding (Yu et al., 2020).

One study examined the interplay between transnational private regulation of sustainable forest certification and legality verification under the EU Timber Regulation in the UK and the interplay with the EU/global levels. The authors used qualitative interpretative research, reviewed scientific literature, and interviewed stakeholders (Dieguez & Sotirov, 2021).

Another example of the examination of interplay is research that studied the interplay between forestry institutions and the REDD+ (Reducing emissions from deforestation and forest degradation) project. This example applied a policy implementation framework and a theory for institutional interaction to determine how REDD+ implementation typologies and interactions with forestry regulations influence the outcomes of three pilot projects in South and West Cameroon (Gakou-Kakeu et al., 2022).

4.5.1 Vertical Interplay

Young first distinguishes between interactions involving adjacent institutions and interactions that involve more remote arrangements. The most common forms of vertical interplay represent links between arrangements that deal with connection issues and are located at vertical levels of social organisation, such as interactions between federal and state-provincial regimes and state-provincial and local arrangements governing the use of natural resources (Young, 2002). In Young's examination of vertical interplay, a definition of vertical interplay would imply interactions across several levels of social organisation. Next, Young focuses on interactions between international regimes dealing with large marine and terrestrial ecosystems and parallel arrangements operating at the level of individual states, which are part of international regimes. Young concludes that achieving sustainability in social-ecological relations demands a commitment to creating arrangements that can manage functional interdependencies continuingly rather than selecting the proper level of social organisation at which to respond to specific problems (Young, 2002).

Within the interactions between international regimes and parallel arrangements operating at the individual member state level, implementation varies considerably based on the resource regime and the member state's political will. Therefore, political representatives often sign an arrangement in good will, knowing it is impossible to implement or allocate resources for

implementation (Young, 2002). Factors influencing vertical interplay Young identifies as competence, compatibility, and capacity.

4.5.1.1 Competence

According to Young, competence is a factor of legal and political authority. Competence is necessary to implement commitments made at the international level, and it is the function of constitutional arrangements prevailing in individual member states. However, there exists no guarantee that commitments embedded in legally binding conventions will always take precedence over domestic laws (Higgings, 1994, cited in Young, 2002).

4.5.1.2 Compatibility

In Young's thinking, compatibility is a matter of fit between institutional arrangements set up under international agreements and social practices prevailing in member states. It concerns standard practices or procedures handling governance issues built up in political systems over time (Young, 2002). In the case of the European Union, given the international society's character, it is generally agreed that individual states should be free to implement international commitments within their legal systems in whatever way they choose. Nevertheless, this implementation freedom does not eliminate the problem of institutional fit, and proposed mechanisms may be unfamiliar to political cultures in many member states, limiting the assimilation into well-understood ways of doing business (Chertow and Esty, 1997, cited in Young, 2002).

4.5.1.3 Capacity

Capacity refers to the availability of social and institutional capital and material resources necessary to perform well on commitments, which member states enter into at the international level (Chayes and Chayes, 1995; Keohane and Levy, 1996 cited in Young, 2002). Often issues of capacity arise in the context of developing countries, but these can also arise in advanced industrial countries. For example, in the United States, international commitments are frequently met by benign neglect when no individual agency is willing to take responsibility for implementing (Osherenko and Young 1989 in Young 2002).

In most cases, national governments have the final say when it comes to subnational governments and can make changes to their rules and procedures to ensure they align with national standards. However, there is still significant variability in the abilities of different member states, and some flexibility in how they implement these standards (Young, 2002).

4.5.2 Horizontal Interplay

Horizontal interplay refers to an interplay on the same level of social organisation. Horizontal interplay stems from “deliberative efforts of individual actors or interest groups to pursue their

objectives by developing competing regimes regarding a single issue" (Young, 2002, p. 111). Thus, linkages among institutions operating at the same level of social organisation are ever-present. The extent and significance of horizontal interplay influence the density of institutional arrangements in society. For example, as the number of institutions in a given social context rises, interactions increase exponentially. Many horizontal interplays are side effects or unintended by-products of actions designed to solve other problems. Young explains horizontal interplay by addressing formative links during regime formation and operational links, interactions once regimes are in place.

4.6 The concept of Scale

In this chapter, Young addresses the matter of spatial-temporal scale regarding local and global environmental challenges and the transferability of experience from smaller systems to global systems. For example, scale issues from local catchment via the transboundary river basin to national and transnational water regulations. Young stresses the transferability of empirical generalisations, causal inferences, and knowledge regarding institutions at various levels of social organisation and looks at scaling environmental challenges through the problem structure, agency, social context, and design implications (Young, 2002). Vatn and Vedeld note that they do not see any apparent reason why Young links scale to knowledge. By doing so, they say, Young avoids the potential overlap with the concept of vertical interplay, specifically the politics of design and management (Vatn & Vedeld, 2012).

Young refers to scale as "the extent to which institutional arrangements are similar and exhibit comparable processes across levels of social organisations ranging from the local to the global" (Young, 2008, p. 26). However, there is no optimal social organisation level to address a problem. Instead, levels are addressed through political framing processes. A process that itself constructs the nature of the problem, its causes, possible solutions and the evaluations of outcomes (Vatn & Vedeld, 2012; Young et al., 2008). Moreover, upscaling resource management to cover a larger spatial area increases transaction costs significantly because of the increased number of actors, scales and administrative interaction (Galaz et al., 2008).

According to the subsidiarity principle, executing policy may involve tasks to be assigned at various administrative levels and times. The principle of subsidiarity implies that social and political issues should be solved at the most immediate or local level. However, it proves to be difficult to translate it into practice and guarantee local control over local issues. In practice, subsidiarity is not always taking place as international organisations control local issues resulting in a loss of sovereignty for local and national governments. Social processes such as changes in land tenure and food production, changes in the human population, shifts in

governance toward nation-states, changes in technology and infrastructure, and changes in values may lead to scale mismatches. On the other hand, ecological processes such as changes in ecological community structure alter the production of particular resources or ecosystem services humans need. Disease outbreaks and predator-prey relations can create spatial and temporal fluctuations in the population sizes of species that humans depend on, and changes in herbivore populations can influence seed dispersal and, thus, plant diversity (Cumming et al., 2006).

The research on the concept of scale has been diverse among social science disciplines. However, achieving a shared understanding of scaling issues is still vital because scale is a concept that transcends disciplinary boundaries. Problems in managing natural resources can arise because of mismatches between the scale of management and the scale of ecological processes managed (Cumming et al., 2006). Cumming et al. (2006) used examples from southern Africa and the United States to find out what is a scale mismatch, how scale mismatches are generated, what the consequences are and how scale mismatches can be solved. Another type of scale research includes multi-scale and cross-scale assessments of SESs and their services (Scholes et al., 2013). Even though Young's framework provides a way of understanding institutional dimensions of global environmental change, it has received criticism. Vatn and Vedeld note an issue of coherence between the three concepts of fit, interplay and scale and their different use across the literature. According to them, the lack of coherence stems from the observation that several issues under interplay and scale can be understood as the problem of fit (Vatn & Vedeld, 2012). This critique aligns with Moss (2003), who says that fit and interplay are distinct but are often interlinked analytical categories in practice. Reordering institutions around one resource or ecosystem can generate interplay problems. Hence problems of fit are solved at the expense of interplay problems.

Vatn and Vedeld further note that a theory about fit demands a theory about human motivation and choice because the interactions between humans and the environment concern human interactions and motivation (Vatn & Vedeld, 2012).

5 Methodology

The research questions should guide the choice of a research strategy and the overarching objectives of the research, as well as reflect the ontological and epistemological understanding and orientation of the researcher (Bryman, 2016). Narrow views of the world are often misleading. Thus, approaching a subject from different perspectives and paradigms or using different methods may help to gain a holistic or more truthful worldview.

In qualitative research, the methodology and the research topic should lead to the choice of sampling strategy rather than the need for generalizability of the findings (Higginbottom, 2004). Qualitative research has an interpretive epistemological position emphasising how study participants see and understand the social world. Rather than focusing on universal and predetermined truths, worldviews and understandings of the social environment, our understanding of the social world is affected by our social context and our interactions. On the one hand, choosing a qualitative research strategy restricts the possibility of generalising to the broader population (Bryman, 2016). However, on the other hand, it opens up the possibility of a more comprehensive understanding.

5.1 Research design

The strategy to ensure the trustworthiness of the research design starts by choosing the best data collection method to answer the research questions of interest (Elo et al., 2014). Therefore, a mixed methodological approach was employed for this study (Johnson et al., 2007) and the design of this research consists of three main approaches. First, rapid policy network mapping was used to create Actor and Instrument maps. These maps provide a convenient way to overview actors and instruments involved in a complex institutional arrangement. Second, the section "Have your say" on EU initiatives was analysed to understand how EU forest regulations are supported or opposed by Czech actors involved. Third, semi-structured interviews were conducted with actors involved in the forestry sector to understand better how different kinds of institutions influence transformations towards the objectives of the LULUCF regulations.

Also, combining different methods, such as feedback analysis and interviews in research, can help overcome fundamental biases emerging from using a single method (Cohen et al., 2002). It also helps to improve the actor and instrument map by looking at comments from citizens, contributing to a better insight into the LULUCF institutional arrangement. Moreover, according to Ekstrom and Young (2009), qualitative analysis of laws, regulations and transcriptions from semi-structured interviews can generate more complete data for a particular study of fit between a set of institutions and an ecosystem.

5.2 Rapid Policy Network Mapping

The rapid policy network mapping (RPNM) method was developed by Bainbridge et al. to "allow non-specialists to quickly establish an understanding of the policy context". This tool offers a simple and accessible way to evaluate a policy process without requiring specialised knowledge or skills. It presents the assessment in a clear format that is easy to understand. (Bainbridge et al., 2011, p.3). Rapid policy network mapping has also been used in other studies on EU frameworks (Alexander et al., 2015; Dutra et al., 2019; Milhorance et al., 2020; Smith et al., 2021). RPNM aims to be information-rich, generating relatively quickly a platform to support policy negotiations, further research, gap analysis, data storage and communication. Mapping allows for visualising regulatory and legal structures inherent in environmental governance, identifying power relations between actors and collaborating on solutions (Bainbridge et al., 2011; Lazdinis et al., 2009). This method creates a policy instrument network map and policy actor network map. Bainbridge et al. (2011) categorised policy instruments into six categories based on marine environmental policy domains, not specifying why in those six categories.

The actor map categorises policy actors into four categories: their responsibility to deliver an output, influence policy development, or make decisions as 'owners' of a component of the policy process. The actors include (1) Influencer, (2) Owner/Decision Maker, (3) Influencer/Deliverer and (4) Deliverer (See Table 1). This approach of categorising policy actors was utilised in the case of the transposition of EU policies into the Czech Republic. At the same time, instrument categories were identified as Strategy, Law, Regulation, Decision, Directive, and Decree.

Table 1 Categories of policy actors

Influencer	An organisation, entity or individual legally, morally, or practically required, invited, or obliged to be involved in the official policy development process. An influencer does not include organisations, entities or individuals responding to a public consultation process or similar if they are not legally, morally, or practically required, invited, or obliged to be engaged in the official policy development process. It is assumed that influencers can affect the outcome of the policy process using legitimate means based on their opinions and views.

Owner/Decision Maker	An organisation, entity or individual with authority to decide which can affect the policy outcome as concerns intellectual or practical components or which owns all, or component parts, of the policy development process within a specified boundary. Most of these actors are responsible and accountable for successfully delivering intellectual and practical objectives, including reporting, data, and legislation. Owner/Decision makers may make decisions following consultation and negotiation; however, it is assumed they have the ultimate authority to decide outcomes.
Influencer/Deliverer	An organisation, entity or individual legally, morally, or practically required, invited, or obliged to be involved in the official policy development process. They can affect the outcome of the policy process using legitimate channels based on their opinions and views and are also engaged in delivering an action, process, or report which facilitates the policy's interpretation, transposition, and implementation.
Deliverer	An organisation, entity or individual legally, morally, or practically required, invited, or obliged to be involved in the official policy development process. They can affect the outcome of the policy process based on their delivery of actions, processes, or reporting, which facilitate the policy's interpretation, transposition, and implementation. They cannot, in principle, affect the outcome of the policy process based on their opinions and views (Bainbridge et al., 2011)

To quickly map out the network of actors involved, I researched the Fit for 55 regulation package and the LULUCF Regulation online. Through this, I identified a member of the LULUCF expert group. The snowball technique, which involves peer nominations, was initiated (Farquharson, 2005). I gathered information on related, linked, or dependent policy actors and policy instruments based on referrals from this source. This snowball technique was applied to other actors as well. If the actor did not recommend anyone else or recommended a person already referred by someone else, the process was terminated, and saturation was deemed to be achieved. This snowball technique is commonly used with other policy network mapping processes identifying important actors (Alexander et al., 2015; Bainbridge et al.,

2011; Farquharson, 2005). For this thesis, the institutional arrangement was examined only from the perspective of the Czech Republic. Thus, national governments and representatives from other EU member states were not considered. In the case of the European Union itself, bodies such as the European Parliament and the European Commission were not consulted, as this is considered outside this research's scope. As a result of rapid policy mapping, I created an instrument map and an actor map, based on Bainbridge et al. (2011). Data collection for the actor and the instrument map started early in the process of starting this thesis. Mapping this institutional arrangement provided information on relevant actors and instruments that influence and govern the forestry sector in the Czech Republic. The maps were considered finished at the end of the data collection, including the feedback and interviews.

5.3 Data collection

This thesis combines public feedback and interviews to analyse how different kinds of institutions influence the transformations towards the objectives set by LULUCF Regulation. The following sections explain how the data were collected and used to help answer my four research questions.

5.4 Public feedback to EU initiatives

To understand the support or opposition of actors involved in the forestry sector (my third research question), internet-based "feedback" (hereafter only feedback) under various initiatives on EU website was analysed. Digitalisation enables online users to actively engage in the creation of online content, as well as scholarly interest in user-generated content established a growing field of research (Naab & Sehl, 2017; Naab & Küchler, 2022). Public EU consultation is a formal process of collecting input and views from stakeholders via responding to questionnaires (Videira et al., 2006). On the other hand, the feedback is a tool to collect general views on a specific document in a shorter deadline. Only feedback classified as Czech or written in the Czech language was considered for this analysis. This way, feedback under different initiatives was collected in a Word document for further analysis.

Data collection for the feedback started with an initiative on LULUCF review of rules in 2020, then an initiative on Greenhouse gas emissions from land use/forestry – CO2 offsets in 2020, then EU forests – new EU Framework for Forest Monitoring and Strategic plans in 2022 and EU Forest Strategy which took place in 2022 (see Table 2 for visualisation of the initiatives). This collection generated 81 written comments. Submitters included environmental organisations, non-governmental organisations, business associations, state enterprises, public authorities, government-established organisations, and Czech citizens.

Table 2 Visualisation of the initiatives analysed

Initiative	Number of comments	Time
Land use, land use change & forestry – review of EU rules	2	October-November 2020
Greenhouse gas emissions from land use/forestry – CO2 offsets	5	August-September 2020
EU forests – new EU Framework for Forest Monitoring and Strategic Plans	4	April-June 2022
Forests – new EU strategy	70	October-December 2022

Czech organisations, identifiable via feedback, were contacted for a semi-structured interview. Czech individuals that submitted their feedback were not contacted as it was out of the scope of this research to contact each individual. It was also impossible in some cases as the feedback could be published anonymously. However, 37 Czech citizens published feedback on the EU Forest Strategy, providing a large sample for this analysis.

A reason for considering and analysing a broader range of EU initiatives was that only a few highly specialised bodies deal with the LULUCF Regulation. So, a broader range was considered as it is still related to forestry or forest management. Moreover, the LULUCF regulation is not isolated but is part of a broader institutional arrangement concerning land use and forestry. Similarly, forests do not consist solely of trees. Instead, a complex ecosystem with different processes and interdependencies must be considered.

5.5 Semi-structured Interviews

This thesis used semi-structured interviews to help answer the research questions. This approach is suitable because of the clear objective of the thesis about understanding the institutional change processes related to the transformations towards reaching the LULUCF objectives. This implies a clear rather than a very general focus of research, suggesting the use of semi-structured interviews so more specific issues can be addressed and detailed information on the research questions can be obtained (Bryman, 2016).

This study utilised a purposive sampling strategy as only actors involved in the forestry sector identified via the EU feedback website were contacted for an interview. This is a strategic way to sample as one ensures that those sampled are relevant actors to the research questions and thus can answer them (Bryman, 2016). Moreover, semi-structured interviews provide room for questions during the interview and further elaboration and to get an insight into the perspectives of the ones that are being interviewed by letting them elaborate on what they find important, as well as partly letting them steer the conversation (Bryman, 2016). A qualitative interview contributed to an understanding of what the interviewees perceived as necessary and how they

explained and understood the issues being discussed; hence, such an approach was deemed the most suitable choice.

An interview guide was created and followed during the interviews (see section 9.5 Appendix 5 – Interview guide in English). The interview guide provides the researcher with a directing list of questions or somewhat specific topics to cover. Before a final interview guide, a pre-interview guide was made and tested with a colleague. Questions were then adjusted to fit the purpose of this research better and to obtain rich data that answered the proposed research questions (Elo et al., 2014). Nevertheless, this thesis planned for flexibility. Although the interview guide is to be followed, the fact that the interviewee has many ways to reply to questions asked, flexibility is vital during the interview. Questions may not have been asked precisely in the same order as the guide suggests, but questions were asked, and a similar phrasing was used (Bryman, 2016). Transcribing semi-structured interviews is a time-consuming task. Thus, it allowed only a limited number of interviewees (Bryman, 2016). There were no fixed sampling size criteria set prior to conducting the interviews. The actors identified in the EU feedback set the sample size of the analysis. Eleven interviews were conducted between the 1st of March 2023 and the 3rd of April 2023.

5.6 Analysis

The analysis for both feedback and interviews was done in the following way. To analyse the feedback and interviews' content, reading and re-reading the transcribed interviews and written feedback data was conducted, and relevant text for further analysis was selected concerning the research objective. The relevant text was highlighted in hand in printed copies of the interviews and feedback data. Repeated ideas of the relevant text were gathered by grouping related passages of relevant text. Repeating ideas were then organised into themes by grouping those ideas into coherent categories (Auerbach & Silverstein, 2003). The organised themes allowed for identifying similarities, differences, support, or opposition in the statements about a particular topic in the interviews and feedback. The data were analysed in an inductive approach, implying that the analysis was done without trying to match the themes into a pre-existing coding frame (Braun & Clarke, 2006), nor trying to match the organised themes of feedback and interviews together. Eventually, themes with sub-themes were created. The findings are presented based on the four research questions and directly discussed in section 6, Findings and Discussion, with the theoretical underpinnings expressed in section 4, Conceptual and Theoretical approach.

5.7 Ethical considerations

Numerous ethical considerations were thoroughly examined in this study. Starting with voluntary participation and free prior informed consent of the interview participants. First contact with interview participants started by email, where the student introduced herself and explained to the participants what the research was about, the purpose of the data collection, information on audio recording during the interview, and how the data will be handled. After an interview was agreed upon, the researcher sent a consent form (see section 9.7 Appendix 7 Consent form) which included information about the project, the aim of the research, the information about audio recording and how the data would be collected and stored. It further required the signature of the researcher and the signature of the participant. The consent form was emailed to participants and affirmed at the beginning of each interview. Not all participants retrieved signed consent forms before the interview. However, they provided explicit written consent that they agreed with the audio recording in the email conversation. If a research project is collecting personal information about participants that could lead to the identification of the individuals, such as interview recording, a notification form must be sent to the Norwegian Agency for Shared Services in Education. The Norwegian Centre for Research Data (NSD) joined the Norwegian Agency for Shared Services in Education and Research in 2022, and this notification form was sent to them. The notification form included information on processing personal data, project information and technical and practical measures to secure the personal data collected. All data in this thesis is presented anonymously, and interviewees were coded under a single letter instead of using their names. The coding of names into letters was done on paper by hand, which only the researcher had access to. This document was destroyed at the end of this project.

5.8 Limitations

This research aims to understand the processes of institutional change related to the transformation towards reaching a set of objectives by the LULUCF legislation. The LULUCF legislation includes various activities relating to converting, using, and managing land and forests. It includes forests, cropland, grassland, wetlands, and wood products. This research focuses on the forests, and other sectors which are included in the legislation updates from the EU are not considered. The focus is exclusively on forests due to the time constraints imposed by the master thesis timeline and interest in forest governance. Regarding the Rapid Policy Network Mapping, one limitation is that the model does not claim to provide a fully comprehensive database and network map of all instruments and actors; another limitation is that the maps do not capture actors or groups with a transitory historical engagement in the

policy process. This problem has been identified by the developers, Bainbridge et al. (2011), and also occurred in my research. For example, forestry actors in the Czech Republic were contacted through their associated institutions under which they published the feedback. It was discovered later that the person no longer worked there for various reasons, such as changing jobs or retiring. That said, those actors' views do not necessarily have to reflect the views of the institution they represented at that time. One limitation of this study concerns the responses provided by the individuals interviewed because their recollection of the sequence of events or changes during the preparation of LULUCF Regulation in 2018 may not be entirely accurate.

6 Findings and Discussion

This section combines findings from the rapid policy mapping, feedback, and interviews to discuss the results based on the conceptual and theoretical approach. First, I present the transposition of the European arrangements process, then the Actor and the Instrument maps. Second, this section answers and discusses the four research questions.

6.1 National transposition of European arrangements

It is essential to provide a brief overview of how the EU's institutional arrangements are transferred to the national governments of its Member States through the legislative process to begin the Rapid Policy Network Mapping. In this section, I reference an email from a forest management department at the Czech Ministry of Agriculture, which I contacted to understand how the transposition to the Czech Republic works formally.

First, the European Commission submits a draft regulation, which is discussed individually by the Council of the EU and the European Parliament. Regarding the Council, the current presidency is responsible for determining which Council formation should handle the proposal (such as DG-ENVI or AGRI) and which relevant working group should address it. Once a decision is reached, the group begins discussing a general approach, precisely the position of member states.

Now comes the moment for the Czech Republic. A decision will be made when the proposal is created on the gestor[2] for the draft regulation and the co-managers, i.e., the ministry responsible for the negotiations and other ministries cooperating on the negotiations. After that, a framework position is created, a national position on the regulation.

The gestor prepares this framework position in cooperation with the co-managers, subordinate organizations or representatives of individual associations and groups affected by the issue. Then, as part of the negotiations in the relevant group, the representatives of the Czech Republic follow the framework position. The representative prepares the meeting instructions, which outline the national approach to the negotiations. The co-managers can provide comments on the instructions and guide the debate accordingly. Within the relevant working group, the delegate follows the direction of the negotiations, finds common denominators of positions with other member states, and cooperates with the presiding country on editing the text or the regulation.

[2] Gestor can be an organization or a person who is entrusted with the performance of a task, so it can perform various functions on behalf of other persons or organizations in their interest, but only within a precisely defined scope.

When the general approach is approved, and the European Parliament reaches its position, the so-called trialogues start negotiations on the final text between the Council of the EU, the European Parliament, and the European Commission. The EU Council is represented here only by the presiding country with a mandate given by the member states. When these institutions agree, the final regulation is formally approved and published (Srbkova, 2023).

6.2 Actor map

The Rapid Policy Network Mapping (Bainbridge et al., 2011) was used to identify relevant actors and instruments relating to forestry. This method investigates policy and legislation within a defined policy boundary. My study aimed to understand how different kinds of institutions influence transformations towards the objectives of the LULUCF Regulation and how this arrangement translates into forestry institutions in the Czech Republic. It was necessary to map the actors and instruments in the current institutional arrangement to achieve this aim. The Actor map is related to the third research question, which asks about the stances of actors involved in the forestry sector in the Czech Republic. In particular, the map provides an overview of actors involved in the forestry sector at all levels of the LULUCF arrangement. The RPNM mapping of actors and instruments provides guidance on which policy actors have a high likelihood of future engagement (Bainbridge et al., 2011) in the LULUCF regulation processes. Understanding the policy context in which Czech actors and instruments operate is relevant as the maps describe the role and structure of institutions, actors, and instruments.

Moreover, regarding the theoretical framework "Fit, interplay and scale" by Young (2002), the Actor and the Instrument map provide a visualisation of interplay within various levels of social organisations. Young perceives interplay as the process when discrete regimes interact, and the interplay between them grows as the number of governance systems grows (Young et al., 2008). Vertical interplay represents links between arrangements dealing with related issues at vertical levels of social organisation (Young, 2002). Vertical interplay involves interactions between multiple levels of social organisations (Young, 2002), which can be analysed using the Actor map approach with four different levels of social organisation. Table 3 provides a simplified overview of the Actor map. The Actor map represents the various levels of social organisation into four levels, international, European, national, and local.

For example, Czech actors at the local level can influence the decision-making processes at the Czech national level. The national level's actors can then influence negotiations on the European level. The rapid policy network mapping process identified at least two actors on the international level, 14 on the European level, 19 on the national level and 18 on the local level, creating a total of 53 actors. This map does not provide a complete overview of all actors

involved. Instead, it gives an overview of the most significant actors identified by the policy network mapping process.

The Actor map also relates to the issues of scale. Young refers to scale as "the extent to which institutional arrangements are similar and exhibit comparable processes across levels of social organisations ranging from the local to the global" (Young, 2008, p. 26). This can imply that the actors and related instruments interact or exhibit comparable processes from the local, through the national, to the European and International level. See section 9.1 Appendix 1 for the full Actor map. See section 9.2 Appendix 2 for a List of actors in the Actor map.

Table 3 Overview of the Actor map

Actor/Level	International	Europe	National	Local
Influencer	-	3	-	14
Owner/Decision maker	2	9	10	1
Influencer/Deliverer	-	1	2	-
Deliverer	-	1	7	3
Total	**2**	**14**	**19**	**18**

The map further divides the actors based on roles within a particular institutional arrangement. Those roles are Influencer, Owner/Decision maker, Influencer/Deliverer and Deliverer. A detailed description of each role is described in Table 1 in section 5.2 Rapid Policy Network Mapping. The Czech actors were identified via the snowball technique, categorised based on their role, as described in Table 1, and placed into a corresponding box in the Actor map. For example, the two actors on the International level are the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC) in the roles of Owner/Decision maker. The LULUCF Regulation is a part of implementing the European Union's commitments under the Paris Agreement adopted under the UNFCCC. The IPCC was placed in this category because obtaining accurate accounts of emissions and removals is rooted in the IPCC Guidelines for National Greenhouse Gas Inventories (European Union, 2018). Additionally, the Czech Republic reports on emissions as a party on its own, via the Czech Hydrometeorological Institute, then as a part of European Union. The European Union further reports to UNFCCC.

These actors thus "own all or components parts of the policy development process within a specified boundary" (Bainbridge et al., 2011, p.5). However, on the European level, there are nine actors in the Owner/Decision maker role, including the European Commission, the Council of the European Union, and the European Parliament. Further, the responsible Owners/Decision makers on the national level responsible for the successful delivery of

intellectual and practical data, including reporting of emissions, are, for example, the Ministry of Agriculture, the Ministry of the Environment, The Forest Management Institute and the Forestry and Game Management Research Institute.

I aimed to understand the transposition of the EU policies into the context of the Czech Republic. Bainbridge et al. (2011) demonstrate the policy process flow as starting at the (1) international level with international agreements, followed by (2) European interpretation and transposition, then (3) national transposition and implementation, devolved level transposition, implementation, regulation, management, and monitoring and (4) sub-national implementation. The flow then goes back by reporting from the fourth to the first level.

6.3 Instrument map

The Instrument map provides a quick overview of the relevant types of instruments on the level of the European Union and the Czech Republic. The instruments are classified according to their type, which includes strategy, law, regulation, decision, directive, and decree. Additionally, these instruments are further categorised based on their development level, which is the International, European, and Czech levels. Table 4 provides a simplified overview of the Instrument map, which helps to understand how many types of instruments were found during the rapid policy mapping process. The instruments were identified through the process of interviews and also through looking at relevant documents, such as the LULUCF Regulation and the revision of this Regulation. Table 4 shows that there are at least two relevant instruments on the international level, at least 36 on the European level and 17 on the Czech level. By organizing the instruments in a map with various levels, significant number of interplays can be identified within those instruments, noting that those are the minimum numbers. With the increasing density of institutional arrangements, interactions increase exponentially (Young, 2002). The map helps to overview all the identified European Strategies, which include a wide range of documents. For example, at the European level, the relevant documents are “Fit for 55“ package, The European Green Deal, Clean Planet for all, Biodiversity Strategy or the EU Strategy on Adaptation to Climate Change. The LULUCF sector is specific, because it is connected to all ecosystems and economic activities relying on the land and the services it provides. Thus the LULUCF Regulation presents interplay with many other EU policies that cover land-related activities, such as agriculture, energy, forestry and the environment (European Commission, 2021a). The instruments follow the same transposition process as described in the actor map above. First, international agreements take place, followed by European interpretation and transposition. After that Czech transposition and implementation takes place, before the local implementation.

To see the complete Instrument map, see section 9.3 Appendix 3 Instrument map. To see a list of the instruments, see section 9.4 Appendix 4, List of Instruments in the Instrument map.

Table 4 Overview of the Instrument map

Instrument/Level	International	Europe	Czech
Strategy	2	16	8
Law	-	1	6
Regulation	-	8	2
Decision	-	3	-
Directive	-	8	-
Decree	-	-	1
Total	**2**	**36**	**17**

6.4 Answering RQ1: Institutional changes in forest governance

The first research question asks, "What institutional changes are formally being implemented in the Czech Republic concerning the LULUCF Regulation in forests?" The answer to this research question consists of three parts. First, the data focuses on understanding the context in the Czech Republic and the causes of the bark beetle calamity. Before addressing the causes, the Czech Republic needed to understand the problem and the possible solutions so that the problematic institutions could be targeted and adjusted. Second, the feedback and interview data suggest that forests in the Czech Republic are undergoing institutional changes related to forest management and conversion from monocultural forests toward mixed forests. However, a need for more profound changes in the legislation persists, considering that the effect of legislation changes often take time, especially in the case of forests. The time for a significant change if forests concerning the LULUCF Regulation is limited. Lastly, perspectives on the current state of Czech forests and the bark beetle calamity are presented. These perspectives suggest more changes need to take place in the Czech forest management concerning the LULUCF Regulation. Initially, institutional changes resulting from the implementation of the LULUCF Regulations were expected. However, after conducting this research, I did not discover any immediate institutional changes in the Czech Republic as a result of the LULUCF Regulation aimed at increasing carbon absorption. Mainly because this Regulation has been reflected only formally. The following sections 6.4.1 to 6.4.3 delve deeper into each of these issues, but first I present information about the feedback and interview informants.

Feedback submitters and interview informants

This research relies on the feedback and the semi-structured interview data to answer my research questions. Under each research question, I present the data combined while ensuring that the feedback and interviews are clearly distinguished. Here I present information about the feedback submitters and the interviews informants.

First, the information about the feedback submitters was found in the "Have your say" section in Published Initiatives on the website of the European Commission. I considered four different initiatives concerning forest management. Various Czech actors submitted the feedback. The relevant feedback was selected either by identifying the country of origin as Czech or the Czech language of the feedback. For example, if the feedback was submitted anonymously but was in the Czech language, it was included in the analysis. Table 5 provides an overview of the feedback submitters. The submitters include various types, such as public authorities, environmental organisations, governmental organisations, non-governmental organisations, academic/research institutions, independent research organisations, business associations, state enterprises and Czech citizens.

Table 5 Overview of feedback submitters

Initiative	Nr. of comments	Type
Land use, land use change & forestry – review of EU rules	2	1 Environmental organisation, 1 Anonymous
Greenhouse gas emissions from land use/forestry – CO2 offsets	5	1 Public authority, 1 Business associations, 1 Non-governmental organisation, 1 Company/business, 1 Academic/research institution
EU forests – new EU Framework for Forest Monitoring and Strategic Plans	4	1 Non-governmental organisation, 1 EU citizen, 1 Academic/research Institution, 1 Authority,
Forests – new EU strategy	70	37 citizens 25 anonymous in Czech language 8 organisations, of which: 2 Academic/research institution, 2 non-governmental organisations, 2 Environmental organisations, 1 Company/business, 1 Public authority

Second, Table 6 provides information about the interviewed actors involved in the forestry sector in the Czech Republic. A total of 11 interviews were conducted with organisations identified in the feedback.

Table 6 Overview of organisation types interviewed

Type of organisation	Number of interviewees	Field of focus
Independent, private, research organisation	1 (Interviewee A)	A –leader of research in a forest ecosystem research organisation
Non-governmental organisation (NGO)	2 (Interviewees G and J)	G – member of a non-governmental organisation for non-state forest owners and administrators J – project manager in environmental NGO with focus on forests
Academic/research Institution	1 (Interviewee C)	C – member of a forest management research institute
Environmental organisation	2 (Interviewees I and K)	I –expert on landscape, water management issues, restoration, and management of ecosystems K – member of environmental organisation and deputy director of centre for environmental issues
Business association	1 (Interviewee B)	B – executive director of forestry associations
State enterprise, company business	1 (Interviewee H)	H – Specialist for forest management
Public authority, governmental organisation	3 (Interviewees E, D, F)	E – Consultant of the EU Forestry Legislation D – Ministerial adviser F – director for forest management and ecology
Total	**11**	

6.4.1 Understanding the causes of bark beetle calamity and lessons for forest management

The Czech Republic has been facing many bark beetle attacks in the last decade, some of which turned into calamities affecting the wood harvest for several years in the future. The bark beetle calamity, which took place during the years of the LULUCF Regulation and its revision, became one of the most extensive calamities in Czech history. According to the interviews, there are several reasons and conditions for why it became such a severe disturbance.

First, the landscape in the Czech Republic was termed by interviewees as *"extremely diverse"*, possessing *"all vegetation stages"*. These environmental conditions interviewees noted as *"both a benefit and a burden at the same time"*. A benefit because of biodiversity, but a burden, because no one management practice can be applied to all types of vegetation stages in the Czech Republic. Extreme diversity can be linked to complex adaptive systems thinking, which is a part of resilience thinking and emphasises the need to understand complex interactions between actors and ecosystems in SESs because the high degree of landscape diversity provides for several connections to occur at the same time on different levels (Biggs et al., 2015).

All the interviewees mentioned the monocultural spruce forests. According to interviewee C, it has been known for over 100 years that spruce monocultures were ineffective for forest management. As he said, this was evident from old information and conclusions from meetings and seminars of foresters. The interviewee acknowledged that it is still a long-term process to

change this trend, but there is a current shift towards this direction, as demonstrated by the changes in legislation.

Interviewee C stated that wood was the primary energy source at a specific time in history, and spruce was chosen as the simplest and most universal wood. Thus planting spruce for energy use led to a situation where the spruce reached the border of its ecological optimum and could no longer tolerate such conditions, making spruce monocultures more prone to extreme events. According to interviewee C, gradually increasing temperatures in the past decades caused a change in the ecological optimal altitude for spruces. Because of the increasing temperatures, suitable spruce sites in the past became unsuitable, making spruce forests unstable and vulnerable to climate disturbances.

As research on the bark beetle calamity indicates and the findings of my study suggest as well, the bark beetle calamity is attributed to the compound effect of windstorms, increasing temperatures and droughts (Nabuurs et al., 2018; Šimůnek et al., 2020; Toth et al., 2020). Interviewees mentioned that droughts and high temperatures were the main reasons the calamity spread into a massive disaster in the Czech Republic's forests. They also stated that the drought was the decisive factor, affecting conifers and other tree species like oaks, beeches, and ash trees. One interviewee predicted that if three dry years come in a row again in this decade, the bark beetle calamity could happen again in stands that have not yet been affected.

Interviewee A stated that the tree species composition in today's forests is different from what would grow in Czech forests naturally due to past forestry activities. Economic trees, such as spruces and pines, dominate the forests. According to another interviewee, a reconstruction of the natural species composition in Central Europe shows that beech forests are the natural composition. Interviewee A's statement and the reconstruction of natural composition correlate with the research of (Neuhäuslová et al., 1997), that without conifer monocultural forests, the Czech forests would be composed mainly of oak, beech, and fir.

6.4.2 Institutional responses to climate change

This thesis understands institutions as “settled habits of thought” (Veblen 1919, p. 239 in Vatn 2005) and socially constructed forest management rules rooted in legislation. This section uses the second part of the understanding, focusing on socially constructed forest management rules rooted in formal legislation, as defined in section 4.2 Institutions in social-ecological systems. The feedback data mentioned changes in forest species composition towards more natural forest composition. However, mixed species composition may have a lower accumulated carbon level per hectare. Nevertheless, continuing the extensive spruce monocultures to

maintain carbon sequestration rates in forests is risky and could be inconsistent with sustainable forestry methods.

The interviewees also said changes in the forest tree composition have been happening. Interviewees B, C and F said that changes in forest management and the trend in transforming the species composition from spruce monocultures to more diverse and mixed forests began even before the bark beetle calamity emerged. Such changes included legal regulations in forest planning for economic purposes, support for non-glade and selective management, and framework management guidelines for forest age classes.

Interviewee D said there had been partial legislative amendments concerning bark beetle calamity as one of the manifestations of ongoing climate change. In 2018, Decree 298/2018 Coll. was passed, which approved a list of appropriate tree species for habitats, along with preparatory tree species that could be utilised in the restoration of forests. Higher mandatory shares of meliorating and reinforcing wood species were also introduced in this decree. The reason for those changes was the bark beetle calamity and the need to speed up adaptation measures. Interviewees C and F said that the calamity could speed the transition from monocultural to mixed forests, as many spruce trees need to be logged out from the forest. Thus, more diverse forests can be planted.

A feedback submitter mentioned that the forestry sector's devastating situation limits the ability to consider increasing carbon targets concerning the 2021-2025 carbon sinks and compliance with the net-zero rule. The feedback also highlighted that the negative public image was also an issue. The Czech Republic perceived it was challenging to explain to the forestry sector and the general public why accepting a reference level that cannot be met does not help with the current situation. Moreover, it would lead to significant additional costs to make up for lost carbon removals. These resources could be better used for forest restoration and their ability to act as a long-term carbon sink.

To discuss this part of the feedback suggests that the calamity situation is limiting the ability of the Czech Republic to increase carbon removals. Thus influencing the capacity to perform well on institutional commitments, such as LULUCF Regulation. Young discusses capacity as the measure of social, institutional and material capital to perform well on international commitments. The situation in the forestry sector is forcing the Czech Republic to compensate for the lost carbon removals, using a lot of money to improve its performance on the LULUCF Regulation. In contrast, the Czech Republic could have used the money for forest restoration.. This suggests institutional changes has been taking place in the sense that spruce monocultures are converted into mixed forests. This finding correlates with the official documents from the

Czech Ministry of Agriculture, which show that the rate of coniferous trees has been decreasing (Ministry of Agriculture, 2021), as elaborated more on in section 2.5, The impacts of bark beetle outbreaks on Czech forests.

Discussing the limited ability to increase carbon targets

Young identifies factors influencing the vertical interplay between international and national regulations of each member state, one of which is capacity. According to Young, capacity is about the availability of social and institutional capital and material resources necessary to perform well on commitments, which member states enter into at the international level (Young, 2002). The situation of the Czech forestry sector is limiting the ability and willingness to consider a potential increase in the carbon reduction target, thus limiting the availability to perform well on this commitment. Even though, according to Young, national governments generally have the ultimate authority over subnational governments to adjust their rules and procedures to ensure that they do not conflict with arrangements established at the national level, authority seems to be taken away from the Czech Republic by the unprecedented calamity. Moreover, the unprecedented bark beetle calamity relates to the problem of fit. The problem of fit concerns ecosystem properties and policy design implications and focuses on the degree to which an arrangement is compatible with the biogeophysical system. The problem of fit also concerns the capacity to prevent undesirable environmental changes and to solve environmental issues (Young, 2002). One could see a contradiction here because the Regulation concerns accounting for carbon emissions in forests and assumes carbon removals will be similar to the previous removals for 2021-2025. The Regulation does not fully account for the complexities of forests as a biogeophysical system, which can present unexpected challenges. This Regulation does not motivate actions preventing undesirable environmental changes, as it could motivate Czech forestry to plant more spruce trees to comply with the targets.

Further, interviewees mentioned that exceptions to the Czech Forestry Act were allowed due to the bark beetle calamity, such as an extension of the afforestation and the retention period and handling of reproductive material. The changes also cover forest clearing, the use of new forest management methods for non-grazing management, the management of ungulates, and support for domesticated and other introduced woody species during the adaptation of forests. Other changes indicated by the interviewees were, for example, increasing the share of deciduous trees at the expense of the hitherto dominant spruce and pine.

Interviewee F mentioned that an amendment to the Forestry Act and the Act on Hunting is being prepared to respond to the newly created conditions regarding EU regulations and

domestic conditions regarding afforestation and forest care. These changes, he believed, could contribute to the LULUCF targets.

Interviewee I saw a lack of incentives for the restoration of floodplain forests and support for the purchase of biomass, such as: *"decaying trees, or the implementation of anti-erosion and water management revitalisation actions"*

The interviewees noted that the Forestry Act is historically strict but not necessarily aligned with nature protection or pan-European strategies. Interviewee D still believed that there is a need for more profound changes in the Forestry Act and to update legislation so that it allows for the adaptation of forest management practices to the specific conditions of a location and to utilise management practices that are more in line with nature. As mentioned by the interviewees, more profound changes in the Forestry Act, legislation and forest management methods are necessary. The findings, however, demonstrate that legislative amendments started before the bark beetle calamity. However, other amendments in connection with the calamity occurred as one of the manifestations of ongoing climate change.

6.4.3 Perspectives on the current state of Czech forests and the bark beetle calamity

According to some interviewees, the current state of the Czech forests could be termed a "crisis". Some completely disagreed. Others say it is not a complete crisis. The handling of the bark beetle calamity was termed chaotic. Interviewee C stated: "This is the worst crisis in at least 200 years". Interviewee E expressed the view that the Czech Republic has addressed climate change within forestry and agriculture in a reserved manner. The interviewee believed addressing climate change issues should be technical and professional, relying on data and experience from both sectors rather than being controlled by emotions and politics. The findings also demonstrate that climate change is a matter of high politics. Negotiations of the LULUCF Regulation included highly technical and professional issues, and sometimes it is instead about politics than expert knowledge. It further proves challenging to push through the expert opinion in the forestry sector.

Interviewee G disagreed with the idea that the current situation in the Czech forests is a crisis. He explained that the political system developed a forest management system over time, and forest owners must comply with strict regulations regarding renewal and restoration.

An interviewee described the biggest crisis in Czech forestry as the clearing of withered monocultures and the creation of extensive clearings leading to soil degradation and vulnerability of the next generation of forests.

Interviewee B suggested that managing the bark beetle calamity should be divided into active and political parts. He further mentioned that the political part did not give enough attention to

the climate crisis. He implied that the active part of managing the calamity was being taken care of, such as dealing with infested trees and replanting. However, the political part, which involved long-term planning and policy-making, was not addressing the root causes of the crisis, such as climate change. Interviewee I perceived the calamity management as "completely chaotic, slow and inefficient". He saw a need for disaster management action plans and the inclusion of forests into integrated water management planning.

Due to extreme weather conditions, such as drought and warm weather, Czech Republic's forest stands were weakened and prone to attacks by insect pests, which resulted in the bark beetle calamity. This caused an increase in salvage logging above the expected level of annual extractions and an increased volume of salvage logging during the reference period of 2021-2025. Consequently, the Czech Republic faces penalties for not meeting the required standards. It was deemed essential to process the affected stands quickly and restore them with suitable trees for the habitat to restore the functions of the forest stands, including their climatic and active carbon balance.

6.5 Answering RQ2: Existing institutions in forest governance

The second research question asks: “What are the existing institutions in forest governance that may influence implementing the LULUCF Regulation for forests in particular?”. The findings suggest forest governance may be influenced by the lack of synergy among regulations’ objectives and the lack of standard EU forest strategy contributing to the institutional fragmentation of forest governance. Additionally, the findings suggest inflexible organisational frameworks, such as the public procurement systems with strict deadlines and bureaucracy, to influence the implementation of the LULUCF Regulation. The role of the state and the subsidiarity principle were also seen as influencing forest management. Further, the current conceptualisation of sustainable forest management and perceptions of forests and the environment. The following sections 6.5.1 to 6.5.3 delve deeper into each of these issues.

6.5.1 Lack of synergy of EU policies and institutional constraints

The European Biodiversity Strategy has emerged as a crucial consideration in the development of the new EU Forest Strategy, according to feedback from respondents, who have emphasised the need for alignment with the broader environmental and sustainability goals of the European Union. The main points from the feedback included the need for coherence and consistency in various strategies related to forests, nature, and land protection and the importance of considering the global level and promoting similar protection and restoration efforts for non-EU countries.

The European Biodiversity Strategy was mentioned the most concerning EU Forest Strategy Initiative in the feedback input. The respondents emphasised that it is essential that the new Forest Strategy, the revision of the LULUCF Regulation, complies with the European Biodiversity Strategy published in May 2020. Other strategies or plans that were mentioned in the analysis were the European Union taxonomy in the bioenergy sector, the Green Deal, and the Treaty on the functioning of the EU. Some of the more relevant contributions welcomed the recognition of the need for a new EU Forestry Strategy because the lack of a standard forest strategy has been contributing to the fragmentation of the EU forest policy (Kleinschmit et al., 2018).

Discussing the European Biodiversity Strategy

The European Commission prioritised the Biodiversity Strategy over the LULUCF Regulation, which has led to calls for compliance with its standards in developing related policies, reflecting a complex web of institutional interactions at both the EU and national levels, according to scholars such as Young.

If we take the European Biodiversity Strategy as an example, it has been given priority over the LULUCF Regulation, which was issued afterwards. That explains why many comments referred to the Biodiversity Strategy and asked for LULUCF Regulation to comply with the standards of this Strategy. This could be further explained by Young's comment on the deliberate efforts of individual EU actors which pursue their objectives by developing competing regimes. The fact that many other regulations influence the forestry sector and change relatively quickly suggests a high degree of horizontal and vertical interplay at the EU and the Czech Republic level (see section 6.2 Instrument map). With every new area regulated by the EU, the number of institutions in a social context is rising, resulting in an exponential increase in institutional interactions. It could also be argued that, according to Young, many horizontal interplays are side effects of unintended by-products of actions designed to solve other problems, such as the Biodiversity Strategy could be designed to solve the problem in the forestry sector.

Other comments highlighted that the EU Forest Strategy must align with the goals of preserving, protecting and improving the quality of the environment and the prudent and rational utilisation of natural resources as stated in the Treaty on the functioning of the EU.

Respondents emphasised the multi-functionality of forests and called for mutual support of European strategies. Furthermore, comments pointed out a need for coordination between EU policies on adaptation and mitigation policies. This observation aligns with a study that discovered that synergies and conflicts between EU policies are not explicitly acknowledged

within or between sectors. (Berry et al., 2015). Feedback respondents also called for ensuring that EU policies do not harm forests overseas, which is essential when considering the scale of environmental issues. Interviewee I expressed his view that European policies are a "crazy mix" of expertly processed documents and ideological madness, such as the LULUCF Regulation, the Water Directive, and the Flood Directive. Thus he did not believe that these policies would work as intended. The lack of synergy among European policies has been identified as a problem by others, too, limiting the potential of forests to mitigate climate change (Aggestam & Giurca, 2021).

The interviewees expressed concerns about forming regulations based on political achievement rather than realistic implementation, considering the constantly changing forest ecosystems. Interviewee C suggested that setting more realistic goals based on expert knowledge would effectively achieve desired outcomes. The interviewees also discussed the contradiction between ambitions versus reality and the need for more realistic definitions in policy goals concerning the role of forests. The need for more “realistic definitions” regarding the ambitious policy goals concerning the role of forests has been identified in the European Green Deal as well (Aggestam & Giurca, 2021).

Discussing the lack of synergy

The results of the feedback analysis demonstrate that various institutions, such as the Biodiversity Strategy, Green Deal, and institutions in the bioenergy sector, are influencing the transformations towards the objectives of the LULUCF Regulations. Because forest ecosystem services fall under various policy domains where the EU has competencies, such as energy, agriculture, environment, and climate, these institutions influence the transformations in several ways. For example, interactions of various regulations trying to govern different areas of the ecological sphere may work in conjunction but may also contradict each other. Different policy objectives, goals, implementation tools and approaches of the strategies may demonstrate the contradiction. The concerns over various objectives of EU strategies, and the inability to resolve trade-offs between policy and sectoral objectives affecting forests demonstrate a core challenge identified across the literature (Aggestam & Pülzl, 2018; Aggestam & Giurca, 2021; Wolfslehner et al., 2020). An article by Köhl et al. (2021) highlights inconsistencies within the EU's approach to sustainable forest management. Precisely, the EU Forest Strategy for 2030, the EU Renewable Energy Directive, and the LULUCF Regulation are not aligned and lack a comprehensive perspective.

Forests demonstrate the interactions between the social and the ecological sphere connected through feedback, time lags and cross-scale interactions. Forest management thus demonstrates

an interdisciplinary framing of biogeophysical and socio-cultural influences that must be considered in forest management. Firstly, it takes decades to significantly change forests and changes within a few years to demonstrate that an increase in carbon sink can be as slight as unmeasurable. Secondly, carbon removals are not only trees in forests but expand spatially to a whole ecosystem, including above-ground and below-ground biomass with other vegetation and the use of wood for products and buildings. This aligns with the thought of Köhl et al. (2021) that the EU is, intentionally or unintentionally, following the narrative that the C-balance of wood should only be considered inside the forest boundaries. The feedback analysis also demonstrates that regulations not adaptable to changing environmental conditions may severely impact the concerned social organisation in the form of infringements resulting in fines. The concerned social organisation may thus be affected two times, as the heavily affected Czech forestry sector by the calamity itself and penalisations by receiving a disadvantageous forest reference level.

The interviewees highlighted a problem with public procurement in the Czech Republic during the bark beetle calamity, with many participants noting that the inflexible procurement system and rigid organisational frameworks contributed to the spread of the calamity and hindered its timely elimination, a problem identified earlier as well (Knížek et al., 2021). The emphasis on the lowest price also led to a further outflow of qualified workers.

Some interviewees identified a problem with small privately owned forest properties due to the need for more prompt responses to calamities and difficulties finding partners for salvage logging. However, interviewees believed private owners should be supported by payments for ecosystem services to encourage positive influence and motivation rather than aversion. One interviewee saw potential in the EU framework for the certification of carbon absorption as a financial incentive for forest owners to strengthen carbon storage.

The forestry sector is facing a lack of workers and experts, which has worsened the handling of the bark beetle disaster. The inflexible procurement system also caused other problems, such as delays in forest remediation due to bureaucracy and contract deadlines.

Interviewee D suggested that the Forests of the Czech Republic (FCR) must follow the law in their procurement processes. However, the system could be better for responding quickly to crises. In recent years, the FCR has strengthened its processing capacities to react more effectively when necessary. However, public procurements have reduced prices for work in the countryside, making it difficult for winning companies without ties to the region to find quality workers for rural projects.

Interviewee C believed that more profound changes are necessary for legislation and forest management methods to transform and decarbonise the European economy effectively.

Interviewee I criticised the slow reaction of the state and The Forests of the Czech Republic to the bark beetle calamity and suggested an alternative way of handling the crisis by leaving the affected stands untouched, which could have saved the soil and created species-rich forests..

These institutional contraints demonstrate that complex adaptive systems thinking would be helpful in times of emergency when quick actions are necessary and that the law of public procurement did not allow for quick action. Bureaucracy and contract deadlines may have contributed to a larger affected area. If the “rules and conventions of society that facilitate coordination among people regarding their behaviour”(Bromley, 1989, p. 22) had been more flexible and could adjust quickly to changing circumstances. The strict system of public procurements also demonstrates a mismatch between the ecosystem and institutional arrangement. This mismatch could be related to the institutional constraints that can emerge during the implementation from paper to practice, particularly bureaucratic politics (Allison, 1971 in Young, 2002).

Interviewees discussed the state's role in achieving the goals of the LULUCF Regulation, mainly because the state in the Czech Republic owns about 50% of the forest area and thus plays an essential role in setting a role model of forest management. Interviewees suggested that the state should set an example in the state forests to promote sustainable forestry practices.

Interviewee B found fault with the slow procedure of the Czech State Administration when considering the impacts of EU policies on Czech actors: "*It is more like a wait-and-see method. Just see what happens as it happens"* and the lack of effort to inform potentially affected entities about the regulations. Interviewee D said that the LULUCF Regulation *"has not yet been reflected in the legislation of the Czech Republic at all, and within measures at the national level only marginally and formally"*. On the other hand, interviewee D thought the European Commission underestimated the possible negative impacts and costs associated with achieving the set goals.

Interviewee C highlighted the significance of wildlife management in managing forest disturbances caused by animals that feed on the bark of young trees. For example, proper wildlife management in state-owned forests can help restore the forest. Additionally, managing the ecosystem's dynamics and animal populations can help maintain forest health and resilience following a disturbance.

Discussing the wait-and-see approach

Being a member of the EU implies adopting a common political culture, norms, values and working methods via standard EU regulations. Thus standardisation and enviro-mentalisation of economic, political and legal institutional foundations of member states' functioning structures occur in Member States (Dankevych et al., 2021). In theory, European strategies should influence the national legislation of the European Union's member states, which could be related to vertical interplay. My analysis understands vertical interplay as links between institutional arrangements that deal with related issues at vertical levels of social organisation and include interaction across several levels. The implementation of institutional arrangements can vary based on the resource regimes plus the political will to implement international commitments (Young, 2002). Based on my research, it appears that while European strategies impact Czech Republic's legislation, it does not fully align with them. The Czech Republic instead takes a wait-and-see approach, also demonstrated by the fact that the LULUCF Regulation has been reflected in the legislation of the Czech Republic only marginally and rather formally. Thus, European Union's effect may be filtered and mediated through pre-existing domestic institutions, rules, norms, and political cultures, as demonstrated by others (Tanil, 2014; Tanil & Jurek, 2020). National-level regimes sometimes promote commodification, which is large-scale, consumptive, market-driven and often represents unsustainable use of natural resources. National arrangements provide arenas for the domination of non-resident players over the interests of small-scale, local users (Young, 2002). Nevertheless, as Young explains on the topic of competence, there exists no guarantee that commitments embedded in legally binding conventions will always take precedents over national laws (Higgings, 1994 in Young, 2002). During the interviews, interviewees emphasised that climate change is a global problem that demands worldwide cooperation and cannot be solved on a national or regional scale.

The interviewees also discussed the role of the EU in the subsidiarity principle and how it has been encroaching on member states' forest management. The subsidiarity principle should ensure that social and political issues should be solved at the most immediate or local level. Generally, interviewees criticised the approach of the EU to the subsidiarity principle. Interviewee E said that forest management has been within the competence of the member states, but the European Union is gradually breaking into dictating member states how to manage forests. Interviewee F believed that the EU should not be involved in forest management due to the principle of subsidiarity. However, they regulate other areas, such as climate change and biodiversity, indirectly affecting forests.

Interviewee E discussed how forestry was previously managed by member states and not considered under the jurisdiction of the European Union. If there were some requirements for forestry, it was not regulated by DG ENVI[3] but always by DG CLIMA[4]. The responsibility changed with the LULUCF regulation, which prompted member states to recognise the need to monitor forestry data. The Biodiversity Strategy also emphasised the importance of biodiversity and nature protection, leading to calls for the LULUCF Regulation to align with the Strategy. The connection between the Biodiversity Strategy and forestry management was also emphasised, with biodiversity protection deemed more critical. The interviewees described the forestry sector as "rigid," "traditional," and "conservative", making it challenging to introduce new ideas, especially if the European Union enforces them.

According to Lazdinis et al. (2009), forest management policy has been member states' national responsibility following the subsidiarity principle. However, my findings show that, in practice, the principle is not followed. Young (2002) argues that the subsidiarity principle is widely accepted, but it is difficult to translate it into practice and guarantee local control over local issues. In reality, the subsidiarity principle is not always taking place, because international organisations control local issues resulting in loss of sovereignty for local and national governments (Young, 2002).

6.5.2 Rethinking sustainable forest management

Overall, the feedback suggests a need for a paradigm shift in sustainable forest management, focusing on ecological and climate goals and incorporating diverse stakeholder perspectives and accessible knowledge.

The feedback submitters considered clear-cutting of forests largely negative, mentioning its harmful effects on forest degradation and fragmentation of habitats, soil degradation, carbon storage, and water retention. Submitters mentioned that the clear-cuts using heavy machinery devastates forest soil and compacts the land. The submitters suggested managing forests by selective logging to preserve a healthy landscape and limiting the use of chemicals and heavy machinery in forestry.

The feedback submitters found the concepts "sustainable" and "sustainable forest management" problematic, with a need for a clear definition that prioritises ecological and climate goals. The current conceptualisation of sustainable forest management was criticised as potentially

[3] DG ENVI refers to directorate-general – environment, a Commission department responsible for EU policies on the environment

[4] DG CLIMA refers to directorate general for climate – this department leads the EU's efforts to fight climate change on the EU and international level

harmful to forests, biodiversity, and climate. There was a call for sustainable forestry to indeed be sustainable, with an explicit acknowledgement of trade-offs and negative consequences.

Further, the feedback showcases that the conceptualisation of the term "sustainable" and "sustainable forest management*"* needs to be changed because it does not align with practice. The feedback submitters called upon the Commission to develop a clear definition which puts ecological and climate goals first. The challenge with sustainable forest management is the balance of economic benefits with environmental and social considerations. For example, conflicts between different stakeholders with competing interests in forest resources, such as forest owners, local communities and conservation groups (Lazdinis et al., 2019). The mis-conceptualisation of sustainable forest management is an interesting finding. The "Fit, interplay and scale" framework does not explain the difference between practice and conceptualisation. However, the microlevel fit between theory or model and our cognitive reality (Hukkinen, 2012) could help explain this mis-conceptualisation. This microlevel fit can be another criterion for assessing the fit between social and ecological systems. The feedback demonstrates the un-fit between the practice and conceptualisation of sustainable forest management. This can be linked to the conceptualisation of sustainability in general. Sustainability has been discussed since 1987 (Brundtland, 1987), and recent research says that the concept of sustainable development has come to mean many things to many people. Thus, it limits its credibility, practical application and connected development goals (Johnston et al., 2007; Leal Filho, 2000).

Feedback submitters called for policies and legislation based on available scientific knowledge. They believed that forestry research and forest restoration could deliver positive results regarding climate change mitigation. Scientific knowledge should be at the core of forest management decision-making. The communication among scientists, activists, and policymakers should be improved so that research findings can inform optimal on-the-ground actions. Interviewees C and E pointed out that there needs to be more in-depth knowledge and opinion, and officials need more knowledge and expertise to estimate what can and cannot be done in the forestry sector.

Discussing knowledge

The feedback submitters suggested creating policies and legislation based on available scientific knowledge. Regarding knowledge, Young focuses on imperfect knowledge about the ecosystem in question and says that "efforts to match institutional arrangements governing human actions to the properties of biogeophysical systems cannot succeed in the absence of usable knowledge regarding the ecosystems in question" (Young, 2002, p.66). He further says

that this knowledge need not be rooted in the Western tradition of formal scientific knowledge. However, informal, practical knowledge by communities living close to the ecosystems over long periods needs more attention because it can play an essential role in efforts to adopt institutions rooted in informal social practices in contrast to formal agreements (Berkes 1989, 1999 in Young 2002). Previously, the formulation of the National Forestry Programme in the Czech Republic was studied. It concluded that one of the most critical difficulties in the discussions on the formulation of the Programme was the different levels of skills and knowledge among participants. This study found that the accessibility to knowledge enables participants to influence their final decisions (Balest et al., 2018).

6.5.3 Perceptions of forests and the environment

Perceptions of SESs can influence the implementation of EU regulations (Villamor et al., 2014). Veblen identified institutions as "settled habits of thought" (Veblen 1919, p.239 in Vatn, 2005), thus institutions, such as individuals' perceptions or the settled habits of thoughts about the interconnectedness of social and ecological systems, can impact their support for and adherence to EU regulations. The success of such regulations depends on community attitudes and prioritisation of environmental concerns (Pascual et al., 2017; Wynberg & Hauck, 2014). Therefore, interviewees were asked about the meaning of forests and the role of humans in the natural environment. They perceived it as interconnected and dependent, which aligned with the thought of social and ecological systems being interdependent. Answers were diverse, ranging from "unique" and "irreplaceable" to "must be protected". One participant said that the environment should be used in *"harmony"* so that humans peacefully coexist with the environment.

The interviews discussed people's different associations with the word "forest". Interviewees mentioned that forests are an essential part of the landscape and serve important functions, such as being an ecosystem that plays an irreplaceable role in supporting life on earth, contributing to water retention, and regulating local climate. One interviewee emphasised the interdependence between humans and the environment, stating that humans could not exist without the environment. However, the natural environment would function without problems without humans. In the interviews, Interviewee C argued that humans and forests are mutually dependent, and their importance is often underestimated. Another interviewee noted that forests are complex ecosystems with functions that must be fully understood and encompass above-ground and underground environments.

Interviewees highlighted several functions of forest ecosystems: production, water and soil protection, climate regulation, carbon storage, hygiene and health, and recreational activities.

One interviewee emphasised the importance of photosynthesis, which produces oxygen and binds carbon dioxide.

The concept of sustainable development was also discussed, with two interviewees outlining forests' environmental, social, and economic functions. Those findings demonstrate that interviewees believed that humans and the environment are interdependent and that human lives depend on the health of the ecosystems and on the services those ecosystems provide. Veblen identified institutions as "settled habits of thoughts" (Veblen 1919, p.239 in Vatn, 2005), the ways individuals perceive SESs. Thus, interviewees' beliefs point toward SESs, and their interconnectedness.

The feedback comments highlighted the importance of diverse and sustainable forests, with many preferring large generic compositions over monocultural forests. Regarding forest management during wood mining, some comments advocate for responsible management, emphasising employing locals instead of large logging companies. There is also an emphasis on whole landscape management, including protected areas and diverse fauna and flora. The idea of humans being part of an ecosystem, not a superior species, is also emphasised.

This feedback suggests a holistic viewpoint of the whole landscape, including forests being an integral part. This aligns with the thought of forest landscapes as units in which many fundamental processes of social and ecological systems unfold (Fischer, 2018). The feedback content asked for considering not only forests but also other natural world features, such as protected areas, water pools, wetlands, and pastures, but also wildlife and their habitat and vegetation. This demonstrates that delineating social and ecological systems is only arbitrarily created. It is viewed holistically as the findings exemplified by this quote: "*Forest is primarily an ecosystem that has an irreplaceable role for life on Earth*".

On the other hand, interviewees also talked about negative human impacts on the environment. Population growth and the development of technology increase the pressure on the environment. Negative impacts mentioned by the interviewees included taking land for settlements, production and business areas, development of transport infrastructure, extraction of mineral resources, intensive agriculture, and fishing. Carbon capture was perceived as necessary in the current era of climate change because forests are an integral part of nature and play a significant role in reducing greenhouse gas emissions through the capture of CO2. Interviewees commonly criticised the utilisation of the economic function of forests in the Czech Republic, which this quote demonstrates: *"Of course, in the Czech Republic, where most of the forests are managed, economic profit is an important role of forests"*.

Interviewee B viewed human society as "*acting very irresponsibly"* concerning the environment, oriented on the values of business and growth. From an orthodox forester point of view: "If there are no forests, there is nothing". The term orthodox forester may refer to those who adhere to the traditional methods of forest management, which typically involve clearcutting, intensive timber harvesting, and the establishment of even-aged monocultures. Orthodox forester prioritises maximising timber production and economic gain from forests over ecological and biodiversity conservation. The interviewee mentioned the notion of humans being part of the environment and the need to realise this.

Further, if people only behave for their benefit, the environment will suffer. However, if people recognise that they are part of the environment, their attitude may change, and there may be a chance for improvement. Those findings about the interviewees' beliefs of negative human impact on the planet and the need to realise humans are part of the environment are essential as the existing institutions or values prevailing among the interviewees, as those govern actions about the environment. According to Young, irresponsible human nature is a conflict between individual gains and social welfare and a potential source of mismatch between ecosystems and institutions. In the absence of rules that prevent private actors from paying attention to social welfare, there are reasons to expect that rent-seeking behaviour will lead to the overexploitation of renewable resources for consumption. According to Young (2002), this reflects that institutional arrangements are poorly matched with the properties of the addressed ecosystem.

6.6 Answering RQ3: Stances of actors in the Czech forestry

The third research question asks: “What stances do actors in the forestry sector in the Czech Republic have towards the LULUCF Regulation in forests?”. The findings reveal that all involved actors were critical to some aspects of the LULUCF Regulation but primarily to recalculating the forest reference level, which was in the feedback and the interviews perceived as unfair and subordinate for various reasons, such as neglect of the specific Czech situation, the modelling approach and unclear interpretation of the Regulation. On the other hand, the revision of the Regulation, according to some, brings positive changes by combining the agricultural and forestry sectors into one sector. However, the interviewees perceived the increase in the carbon removal target to -310 Mt of CO2 as unrealistic based on current carbon removals trends. The following sections 6.6.1 to 6.6.3 delve deeper into those issues.

6.6.1 The recalculation of the Forest Reference Level

The LULUCF Regulation sets out Union-wide rules for including greenhouse gas emissions and removals from land use, land use change and forestry activities in the 2030 climate and

energy framework. The Regulation requires member states to account for emissions and removals from land use, land use change and forestry and to report on their progress towards meeting their targets (European Union, 2018).

The European Commission found the calculation of the forest reference level by the Czech Republic to be an inconsistent representation and thus recalculated by European Commission. The recalculation occurred due to considering wood removal separately for planned fellings[5] and unplanned fellings. The Czech Republic considered the wood removal on unplanned fellings in the reference period 2005-2009, when this felling type was highest. The wood removal in planned fellings was based on the whole reference period 2000-2009 (Council of the European Union, 2021).

Interviewee A explained that the negotiations assumed that individual countries would develop model projections to replicate trends in reported emissions for a given period and make credible projections for the subsequent period. However, the negotiations were challenging, and a consensus was difficult due to technical arguments. Interviewee A noted that the Commission acted unfairly during the negotiations. According to him, the forest reference level for the Czech Republic was adjusted for a subordinate reason because the interpretation of the logging trend that the Czech Republic chose was not allowed. In his words: "*the main technical argument that we contradicted was that we were not allowed to take into account the trend in logging*".

Organisations expressing their opinion in the feedback claimed that the Czech Republic could not accept recalculating the new forest reference level. Moreover, they were critical to recalculating the forest reference level, which the European Commission changed for the Czech Republic. The Czech Republic maintained its logic of calculating the forest reference level with the LULUCF Regulation. For example: “we maintain that our approach to the forest reference level calculation, as presented in the National Forest Accounting Plan of the Czech Republic, which is based on a statistically proven presence of a trend in management practices, i.e., salvage loggings[6], is fully in line with the Regulation (EU) 2018/841”.

The Czech Republic appealed the EU's reassessment of the forest reference level, arguing that it should be based on the current situation and the expected impact of the bark beetle calamity.

[5] In forestry, "felling" refers to the process of cutting down trees. It is a term used to describe the action of harvesting trees for the purpose of producing timber or other forest products. The felling process can be done manually with axes, saws, or chainsaws, or with the use of mechanised equipment like harvesters

[6] Salvage logging refers to removing dead or dying trees from a forest affected by a natural disaster or a forest pest outbreak, such as a bark beetle infestation. The purpose of salvage logging is to save as much economic value as possible from the affected trees before they decay or lose their value and to reduce the risk of forest fires and other hazards that may arise from standing dead timber (Lindenmayer & Noss, 2006)

They called for a new, realistic reference level for carbon removals in the period 2021-2030 that considers the impact of the calamity, as the previous proposal was based on conditions before the onset of the crisis.

Due to the bark beetle calamity, the potential for carbon sequestration in the forestry sector in the Czech Republic was significantly lowered, and forests became pure CO2 emitters. The feedback highlighted that the Czech Republic was unable to stabilise the forestry sector and re-establish carbon sinks in forests before the end of the 2021-2025 period, leading to a massive deficit in compliance with the no-debit rule. Forest owners and managers had no control over the factors that caused the significant decrease in carbon stocks in forest stands, resulting in up to 80% more wood volume being cut than what is sustainable.

Forest owners and managers alone could not influence the spread of the bark beetle because invasive species do not follow administrative boundaries. Thus, efforts are likely to fail because of the dynamics of the calamity, as the bark beetle can extend far beyond local or municipal borders into other forests. Additionally, Toth et al. (2020) show that ten more trees can be affected from one affected tree by the bark beetle.

6.6.2 Criticism of the LULUCF Regulation

When talking about LULUCF Regulation, all the interviewees were critical of the Regulation itself and the modelling approach applied to calculating the FRL for each member state. Interviewees said it was "non-transparent", "problematic", or "technically demanding".

Interviewee D mentioned that the interpretation of the Regulation was not clarified, member states chose different approaches to the reference period and results for individual states were not uniformly processed methodically. The LULUCF Regulation stated that emissions resulting from harvesting and salvage logging activities on land following natural disturbance should not be excluded from the calculation (European Union, 2018). This turned out to be the main problem for the Czech Republic. Interviwee D said: "*we disagreed with the Commission's procedure and the final value for the Czech Republic. As far as the natural harmful factors are concerned, the impossibility of excluding the necessary accidental extractions from the accounting in connection with the bark beetle calamity turned out to be a fundamental problem"*. As emissions from the forestry sector were rising with the bark beetle outbreak, this caused that the Czech Republic was not able to comply with the no-debit rule nor the carbon sink target for 2021-2025.

Interviewees noted that the bark beetle calamity was beginning to emerge during the preparation of the Regulation. Interviewee A mentioned that when the Czech Republic was creating the forest reference level, it was evident that calamity was coming. The forestry sector,

already affected by the outbreak, would face further penalties with an unfavourable reference level.

Interviewee B stated that while he respects the European Union's regulations in the forestry sector, he is also a strong critic. He argued that the uniform application of these regulations across all member states needs to be revised and that the Regulation should consider specific conditions in each country. He highlighted that various countries' forestry and timber industries differ due to varying specificities. He exemplified this: *"forestry and timber industry are completely different in Greece than in Finland or Spain and the Czech Republic and because simply the specifics are there"*.

Country-specific institutions can result in poor compatibility of arrangements and social practices. Country specifics were referred to as climatic conditions, forest management traditions or home wood processing possibilities. For example, forest management rules can consist of the social practices prevailing in the Czech Republic, which align with the role of institutions. The role of institutions is to provide expectations, and stability, support certain values and protect specific interests (Vatn, 2005). However, this can result in poor compatibility between institutional arrangements and social practices.

Furthermore, compatibility in Young's thinking is the fit between institutional arrangements and social practices prevailing in a given member state. Fit concerns the standard methods or procedures handling governance issues created in the political system. Moreover, the Czech political system created inflexible organisational frameworks, as discussed under the second research question, that could not stop or eliminate the calamity in time, resulting in delayed state support to affected forest areas.

To further address the issue of neglecting country-specifics, it is important to note the significant differences in forestry practices among EU member states, such as the example of Czech, Finnish, and Greek forestry. The implementation can also vary greatly based on the governance regime and the member state's political will. Young says that often political representatives sign an arrangement in goodwill, while knowing it is not possible to implement it in their country or allocate the necessary resources for implementation (Young, 2002).

The unprecedented bark beetle calamity demonstrates that some environmental policies assume ecological systems have stable equilibrium and that forest managers can control the change (Folke et al., 2003), particularly considering the period 2000-2009 as a prediction of wood harvest for 2021-2025. On the other hand, the use of a resilience perspective in this regulation could shift the view towards coping with, adapting, and shaping change (Folke, 2006).

Moreover, this LULUCF Regulation shows that a perfect fit between institutional arrangements and ecosystem dynamics is difficult to achieve or does not even exist because ecosystems' states can change quickly. It can be speculated that this Regulation did not recognize the complexity, uncertainty and unpredictability of connections and interdependencies in managing SESs. But this Regulation did not consider extreme natural disturbances that would exceed the estimated carbon balance levels. It instead assumed the carbon balance would remain the same as in the reference period 2000-2009, and forests would continue to absorb carbon. Interviewees mentioned that the calamity was emerging already at the time when the Regulation was being prepared, and the Czech Republic thus could assume that the carbon balance would change in the following years. The salvage logging would exceed the expected levels of annual extraction. Therefore, it can be speculated that the Czech Republic tried to be better off by using different periods in the calculation to increase the carbon removals by using the periods of the highest unplanned fellings, which included natural disturbances. Compared to using the whole period, which would make the average amount of unplanned fellings lower. This could be explained by the heterogeneity in capacity among member states and room to manoeuvre in operationalizing in ways deemed appropriate (Young, 2002).

According to Interviewee C, planting spruce trees for quick carbon sequestration does not lead to stable ecosystems. On the other hand, deciduous or mixed forests may be more suitable for creating stable ecosystems, despite binding less carbon. Interviewee C thought that *"the methodology was incorrect and non-transparent"*. He further expressed his opinion in the following way: *"I see the regulation regarding carbon sequestration in forests as problematic, especially due to the construction of official calculations".* To discuss the problematic construction of the calculations, the problem of fit, knowledge and the resilience approach provides a good perspective on models that assume equilibrium mechanisms, not nonlinear or chaotic processes. Young argues that models based on stable equilibriums are problematic since they do not encourage a precautionary approach to regulating human actions. Young is not arguing that all models are inherently flawed. Instead, he suggests that models or frameworks that contain errors or are misleading can lead to significant problems in institutional settings. In other words, poor models or inaccurate ways of looking at things can result in a mismatch between what is intended and what happens, which can have negative consequences. In this case, the resilience perspective could contribute to understanding how key components interact and create the dynamics of the whole system.

identified an issue in the European Commission's belief that significant changes can be made in the forests by 2030. The interviewees perceived this belief as a short time because forests

are "long-term ecosystems" and "trees grow slowly". Thus only minor changes in carbon sinks would occur until 2030. Moreover, interviewee A said those small changes in carbon sinks could even be "un-quantifiable" or "undemonstrable". The minor changes can be discussed concerning time scale, as the EU has ambitious goals until 2030, which in forests is not a lot of time considering it is 2023 now. Time plays a significant role in forests, as trees take decades or centuries to grow and develop into mature forests that can effectively sequester carbon from the atmosphere.

Additionally, the length of time that forests can store carbon varies depending on factors such as the species of trees, soil conditions, and disturbance events such as wildfires or harvesting. Thus relying on the forestry sector to absorb high amounts of carbon can be challenging because unexpected climate events can occur quickly and affect carbon absorption for many years in the future. Additionally, forests can only absorb a limited amount of carbon dioxide and cannot completely offset the greenhouse gas emissions produced by human activities. As forests grow older, their ability to sequester carbon may decline as the trees reach maturity and their growth rate slows down (Gundersen et al., 2021). Moreover, disturbances such as wildfires, insect infestations, and droughts, such as the Czech forestry situation, can release stored carbon back into the atmosphere, reducing the amount of carbon sequestered in the long term. Therefore, while forests can be a helpful tool in mitigating climate change by absorbing and storing carbon, they cannot be relied on as the sole solution. A combination of efforts across sectors is necessary to address the issue.

Interviewees also mentioned that the absorption target for 2021 - 2025 is not possible to achieve either the no-debit rule and the Czech Republic will have to use the option of flexibility. The interviewees highlighted that certain aspects of the Regulation related to reporting, accounting for carbon sinks, and general instructions had not been incorporated into Czech Republic's legislation and practice. Interviewee D said that the LULUCF Regulation *"has not yet been reflected in the legislation of the Czech Republic at all, and within measures at the national level only marginally and formally".*

6.6.3 Varying opinions on the revision of the LULUCF Regulation

The revision of the LULUCF Regulation, part of the Fit for 55 package, sets a binding national target of minimum net losses of -1.228 Mt CO2 for the Czech Republic. This package also increases the Union target from -249 Mt of CO2 in 2019 to -310 Mt of CO2 in 2030. Further, in this period, the member states will no longer apply the demanding process of establishing the forest reference level., The agriculture sector and LULUCF will become one, AFOLU, with carbon emissions and removals calculated together. The opinions on the revision of the

Regulation were varying, interviewees saw some changes as positive, but there were some caveats as well.

Interviewees were optimistic about the change in the calculation and the creation of the AFOLU sector. However, some interviewees were concerned about the increased target level of -310 Mt of CO2 as a *"figure that is completely out of line"*, considering that the trend of absorbing carbon in forests is decreasing (Gundersen et al., 2021). Interviewee A also mentioned that the ability to sequester carbon in commercial forests in Europe, including the Czech Republic, is decreasing. This trend is thus in contrast with the European Union's ambition. Interviewee A also explained that it is difficult to make changes in a long-term ecosystem like forests, and following the rhythm of the long-term management of forests is vital if changes are to be effective.

Interviewee F believed the binding national target of -1.228 million t CO2 eq. for the Czech Republic by 2030 is achievable if the bark beetle calamity subsides. He also suggested that it is too early to discuss connecting the LULUCF with agriculture and achieving neutrality by 2035. Interviewee D thought the revision was a positive change, but the Czech Republic still faces challenges in fulfilling its obligations during the crucial 2021-2025. However, the new mechanism of solidarity[7] between member states may help cover these obligations in case of a surplus of carbon removals in other member states.

Interviewee B also stated that the revision of the Regulation brings positive changes for the Czech Republic as there is a better baseline for FRL calculating obligations. The new baseline for the 2030 target now includes years 2016, 2017, and 2018, which are more advantageous for the Czech Republic as a starting point, because those include the beginning of the calamity.

Nevertheless, interiviewee E thought the revision was not done well. He expressed concerns about the criteria for forestry, stating that they were insufficient and created without input from foresters. He further noted that these criteria were not discussed in typical forestry forums.

6.7 Answering RQ4: Past institutional changes and the future

My fourth research question asks: "How have institutional changes happened in the past in Czech forestry, and what does this suggest about the future of the LULUCF?". Through interviews with various experts, the responses were wide and varied, covering different periods and aspects of the forestry sector. The findings suggest that institutional changes in the Czech forestry occurred with a change of the political regime, which had different interests regarding environmental issues. The current division of forest governance responsibilities into three

[7] Interviewee D referred to the Effort Sharing Regulation, which sets annual binding limits for each Member State and includes different flexibilities (Graichen et al., 2015).

ministries puts forestry sector into a weak position, not being a strong actor on its own. Concerning the future, Czech forests will become more diverse, sparser, and age-differentiated, binding less carbon but being more stable. The following section 6.7.1 delves deeper into the issues mentioned here.

6.7.1 The transformation of the forestry sector in the Czech Republic

The interviewees highlighted the historical shift in focus in the forestry sector, where the political regime prioritised maximising wood production over other considerations such as natural renewal and species composition. The interviewees also delved into the impacts of property restitution, governance structure changes, and the Forestry Act's amendments on forest management. Finally, the interviewees addressed the implications of climate change and extreme events on forests and the need for adaptation and increased carbon absorption.

Interviewee C stated that wood was the primary energy source at a particular time in history, and spruce was chosen as the simplest and most universal wood. He further highlighted the shift in focus in the forestry sector in the 1970s when the new forest law was introduced, which prioritised the political goal of maximising wood production over other considerations such as natural renewal, variety, and species composition that were advocated for in the previous decade. The maximised wood production can be discussed in the light of rent-seeking behaviour in accordance with Young (2002), as mentioned in section 4.4, The concept of Fit. In the absence of rules that prevent private actors from paying attention to social welfare, there are reasons to expect that rent-seeking behaviour will lead to the overexploitation of renewable resources for consumption. According to Young (2002), this reflects that institutional arrangements are poorly matched with the properties of the addressed ecosystem.

Further interviewees mentioned a transformation of the forestry sector that started after 1989 and lasted until 2022. This transformation was related to the properties and property rights the communist regime confiscated between 1948 and 1990. As a result of this transformation, the restitution process, the return of illegally taken (nationalised) property to the original owners, usually former private owners, churches, and other institutions of the confiscated property and rights, took place. Interviewee C said that property restitution occurred when state-owned forests were denationalised to give opportunities to the private sector.

Furthermore, a re-organisation of the Czech governance structure occurred. According to interviewee C, the Ministry of Forestry and Water Management oversaw the management of forests and water resources until 1990. However, following the transformation, the Ministry of the Environment was created, and forests were placed under the jurisdiction of the Ministry of Agriculture. The timber industry is now within the Ministry of Industry and Trade. Until today,

the responsibility for governing forests has been divided among three ministries, each covering different aspects of the services provided by forests. Thus, forests are not managed by a single, unified entity but instead are fragmented across different actors with varying areas of responsibility and interests. This discontinuity of political development since the middle of the past century has been described in other places, too (Fanta & Petřík, 2018), and is associated with a poor interest in environmental issues, leaving heavy ecological damage to forests from industrial pollution (Hruška et al., 2001; Hruška & Cienciala, 2003).

Other interviewees focused on the more recent history and the amendments of the Forestry Act. The topic of the Forestry Act in the Czech Republic shows that there have been many amendments during and after the calamity. According to interviewee J, the Forestry Act still does not reflect European strategies, even when being the strictest in Europe. Being influenced by historical political development, interviewee C mentioned that foresters 100 years ago knew those spruce monocultures were not a good option for forest management at the time of increasing climate disturbances. But because forests are long-term ecosystems, even what happened 100 years ago still has implications for the foresters today. In the feedback content, submitters emphasised preserving forests as ecosystems with long-term characteristics, including providing the right conditions for regeneration and avoiding clear-cutting and large-scale interventions. Saving forests for future generations, considering the future cost if forests are lost, and the age diversity of trees were also mentioned as necessary. Temporal interactions within SESs relate to the challenges of managing forest landscapes as SESs in and of themselves with interacting sets of interdependent biogeophysical components and associated social actors (Liu et al., 2007; Ostrom, 2009). For example, the Forestry Act came into force in 1995, only 28 years ago. However, considering the long-term nature of forests, 28 years is a relatively brief period for significant changes. The interviewees talked about how Czech forests will become more diverse, sparser, and age-differentiated, binding less carbon but being more stable in the future. Interviewees said climate change would significantly impact, requiring adaptation and increased carbon absorption. However, extreme events such as droughts and fires will continue to threaten forests, as seen in the Czech Switzerland forest fires in 2022. Clear-cut forest areas contributed to the spread of fire, marking one of the worst forest fires in the Czech history (Winkler et al., 2023).

7 Conclusion

The forestry sector is critical in sustainable development and preserving the natural environment. Forests provide a wide range of essential ecological services, including carbon sequestration, water purification, soil conservation, and habitat for diverse species. Moreover, forests are essential for human well-being, providing critical recreational opportunities and supporting the livelihoods of millions worldwide.

The LULUCF Regulation is an example of institutional change in environmental governance, demonstrating that forests are essential to climate change mitigation policies. However, my findings show that effective mitigation policies must consider forests in a holistic view along with other aspects of environmental governance. My research utilised Rapid Policy Network Mapping, feedback analysis and semi-structured interviews. The Rapid Policy Network Mapping provided an accessible overview of the size and complexity of forest governance instruments and actors. The feedback analysis and interviews provided a deeper insight into the dynamics of forest governance between the Czech Republic and the European Union.

Looking on the LULUCF Regulation through the framework of "Fit, interplay and scale" (Young, 2002) was useful for examining the institutional dimensions of this arrangement between EU and the Czech Republic on the macrolevel. The framework provided a useful approach considering the fit between forest ecosystem dynamics and the institutions in forest governance, the interplay with other regulation and the issue of scale, which is crucial in environmental governance issues. The combination of "Fit, interplay and scale" framework with the institutional theory and the resilience perspective of social-ecological systems provided a comprehensive approach to examine this institutional arrangement. However, Young's framework provided poorly on the fit between the theoretical framework and the human cognition of reality. Addressing this type of fit would open up possibilities for facilitating social-ecological transitions toward sustainability (Hukkinen, 2012).

This thesis arrived at the following conclusions from the methodology and the conceptual and theoretical approach I used. Based on my research, ecological systems are unpredictable. Forest regulations should not count on a stable equilibrium of the ecosystem for many years ahead because changes can occur swiftly and be difficult to eliminate if the institutional framework does not allow quick action. Rather a view of complex adaptive system thinking, which recognises the occurrence of different connections at different levels and emphasises the need to understand complex interactions and dynamics between actors and ecosystem components in SESs, should be emphasised.

The problem of fit, interplay and scale between institutional arrangements and the dynamics of ecosystems demonstrates the Czech forestry sector's dilemma in complying with LULUCF Regulation. Due to the bark beetle calamity, the Czech Republic cannot comply with the no-debit rule and achieve the carbon sink target for 2021-2025. Planting coniferous trees provides well on carbon sinks, thus contributing to compliance with the Regulation, but creates unstable forests. Planting deciduous trees delivers poor carbon sinks but creates stable forests. Whatever approach the Czech Republic chooses, it will not significantly help to comply with the Regulation because a change in forests takes significantly longer than the Regulation allows.

After conducting this research, I did not discover any immediate institutional changes in the Czech Republic as a result of the LULUCF Regulation aimed at increasing carbon absorption. Mainly because this Regulation concerns the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework and has been reflected only formally. Institutional changes formally being implemented are the amendments to forest management regulations. However, these changes started before the bark beetle calamity and even before this Regulation came into force.

Regulations related to carbon sinks, agriculture, energy, forestry, and the environment represent the interplay between institutional arrangements that may influence the implementation of the LULUCF Regulation because the LULUCF connects all ecosystems and economic activities that rely on the land and the services it provides.

Actors involved in Czech forestry opposed implementing the LULUCF Regulation because of the FRL's recalculation for the Czech Republic, which the actors considered unfair and based on a subordinate reason. They criticised the forest reference level calculation and neglecting specific member state conditions in the calculation. The negotiations between the Czech Republic and the European Commission were challenging, and they could not achieve consensus. The criticism further came from the problematic modelling approach and unclear interpretation, which resulted in poor transparency among member states. Additionally, discontent arose because it was challenging to clarify to the Czech forestry industry and the public why agreeing to a reference level that the Czech Republic cannot reach would not aid in addressing the bark beetle outbreak. Further, the opposition toward the Regulation might also come from the conservative nature of the forestry sector and the contradiction between ambitions and reality in policy goals enforced by the European Union.

It is essential to recognise the interconnectedness of social and ecological systems and the importance of effective governance institutions to ensure the long-term sustainability of forests. As forests continue to play an increasingly important role in the global economy and society,

there is a need for strong institutions and policies to govern forest management. These institutions must balance economic development with ecological sustainability and social equity, recognising the intrinsic value of forests and the importance of maintaining ecosystem services for future generations. Considering the irreplaceable role of forests in sustainable development efforts and the interconnectedness of social and ecological systems, the importance of forests and the institutions that govern environmental change will only increase as extreme ecological events become more prevalent.

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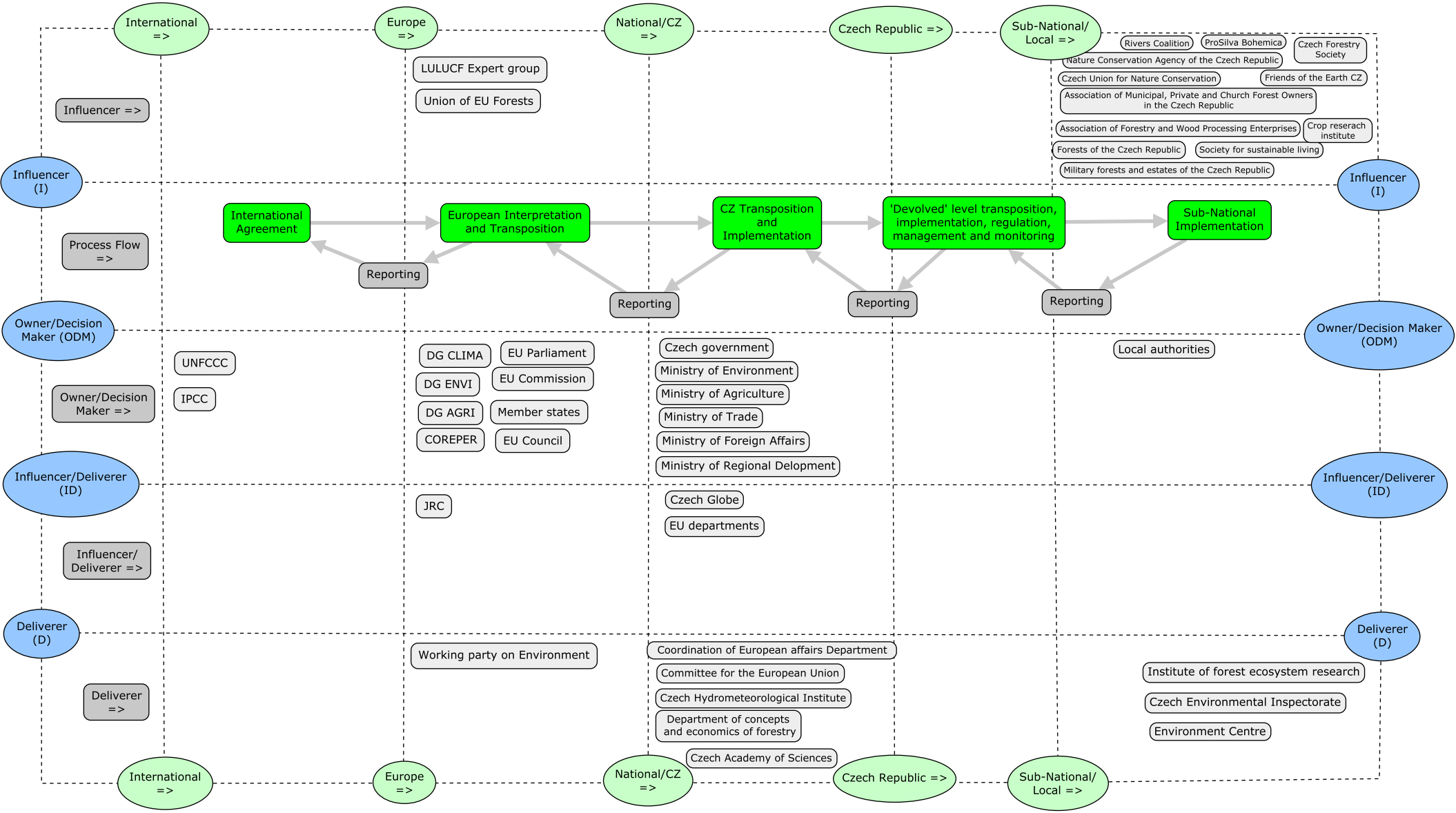
9 Appendix

9.1 Appendix 1 Actor map


International =>
Europe =>
National/CZ =>
Czech Republic =>
Sub-National/ Local =>
Influencer =>
LULUCF Expert group
Union of EU Forests
Rivers Coalition
ProSilva Bohemica
Czech Forestry Society
Nature Conservation Agency of the Czech Republic
Czech Union for Nature Conservation
Friends of the Earth CZ
Association of Municipal, Private and Church Forest Owners in the Czech Republic
Association of Forestry and Wood Processing Enterprises
Crop reserach institute
Forests of the Czech Republic
Society for sustainable living
Military forests and estates of the Czech Republic
Influencer (I)
Influencer (I)
International Agreement
European Interpretation and Transposition
CZ Transposition and Implementation
'Devolved' level transposition, implementation, regulation, management and monitoring
Sub-National Implementation
Process Flow =>
Reporting
Reporting
Reporting
Reporting
Owner/Decision Maker (ODM)
Owner/Decision Maker (ODM)
UNFCCC
IPCC
DG CLIMA
EU Parliament
DG ENVI
EU Commission
DG AGRI
Member states
COREPER
EU Council
Czech government
Ministry of Environment
Ministry of Agriculture
Ministry of Trade
Ministry of Foreign Affairs
Ministry of Regional Delopment
Local authorities
Owner/Decision Maker =>
Influencer/Deliverer (ID)
Influencer/Deliverer (ID)
JRC
Czech Globe
EU departments
Influencer/ Deliverer =>
Deliverer (D)
Deliverer (D)
Working party on Environment
Coordination of European affairs Department
Committee for the European Union
Czech Hydrometeorological Institute
Department of concepts and economics of forestry
Czech Academy of Sciences
Institute of forest ecosystem research
Czech Environmental Inspectorate
Environment Centre
Deliverer =>
International =>
Europe =>
National/CZ =>
Czech Republic =>
Sub-National/ Local =>

9.2 Appendix 2 List of actors in the Actor map

Owner/Decision Maker/International level:

1. UNFCCC
2. IPCC

Influencer/Europe level:

1. LULUCF Expert group
2. Union of EU Forests

Owner/Decision Maker/Europe level:

1. DG Clima
2. DG Agri
3. DG Envi
4. Coreper
5. EU Parliament
6. EU Commission
7. Member States
8. EU Council

Influencer/ Europe level:

1. Joint Research Centre JRC

Deliverer/Europe level:

1. Working party on Environment

Owner/Decision Maker/National level:

1. Czech government
2. Ministry of the Environment
3. Ministry of Agriculture
4. Ministry of Trade
5. Ministry of Foreign Affairs
6. Ministry of Regional Development

Influencer/Deliverer/National level:

1. Czech Globe
2. EU departments

Deliverer/National level:

1. Coordination of European affairs department
2. Committee for European Union
3. Czech Hydrometeorological Institute
4. Department of concepts and economics of forestry
5. Czech Academy of Sciences

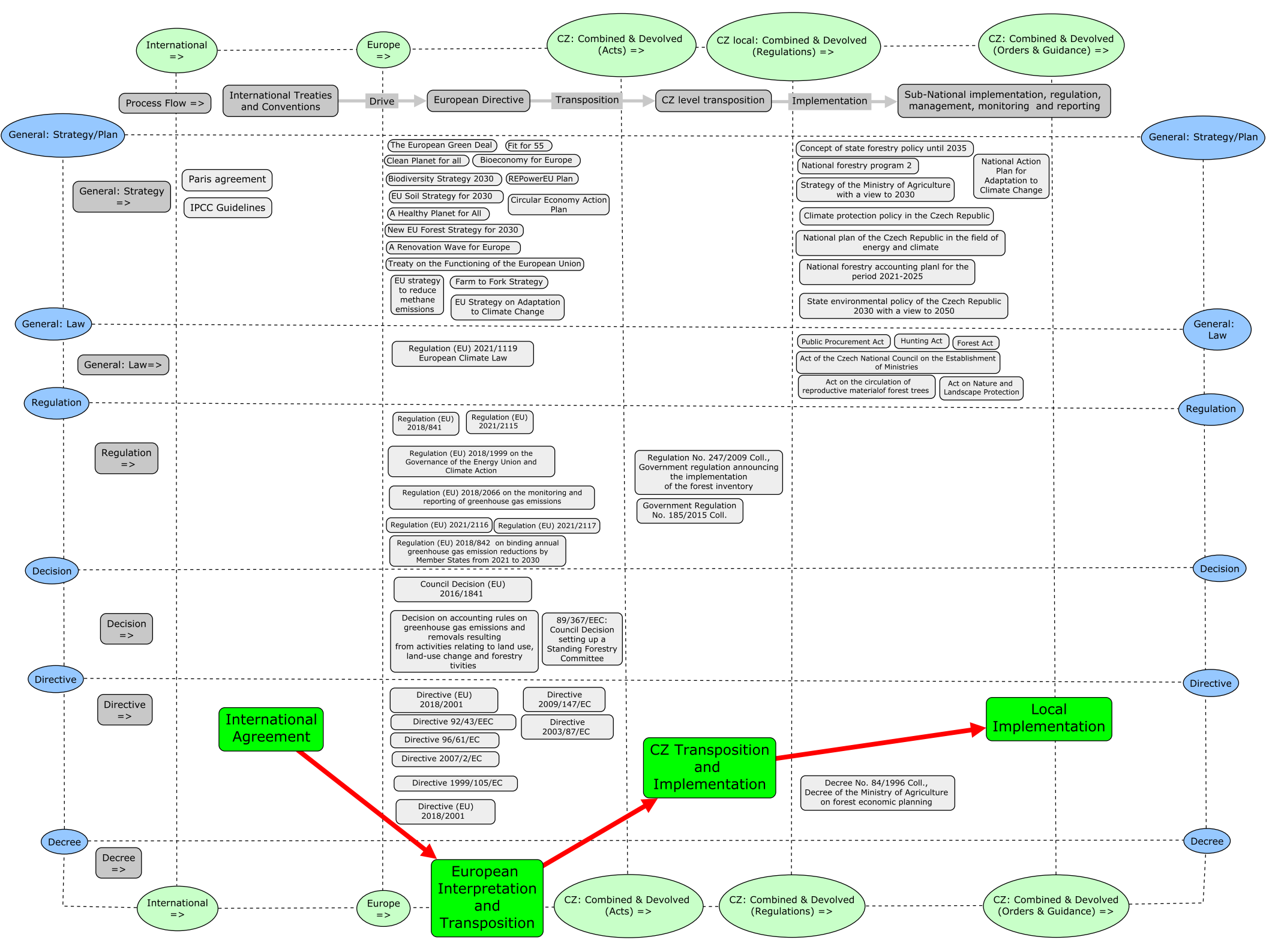
Influencer/Local level:

1. Rivers Coalition
2. ProSilva Bohemica
3. Czech Forestry Society
4. Nature Conservation Agency of the Czech Republic
5. Czech Union for Nature Conservation
6. Friends of the Earth CZ
7. Association of Municipal, Private and Church Forest Owners
8. Association of Forestry and Wood Processing Enterprises
9. Crop Research Institute
10. Forests of the Czech Republic
11. Society for sustainable living
12. Military forests and estates of the Czech Republic

Deliverer/Local level

1. Institute of forest ecosystem research
2. Czech Environmental Inspectorate
3. Environment Centre

9.3 Appendix 3 Instrument map


International =>
Europe =>
CZ: Combined & Devolved (Acts) =>
CZ local: Combined & Devolved (Regulations) =>
CZ: Combined & Devolved (Orders & Guidance) =>
Process Flow =>
International Treaties and Conventions
Drive
European Directive
Transposition
CZ level transposition
Implementation
Sub-National implementation, regulation, management, monitoring and reporting
General: Strategy/Plan
General: Strategy =>
Paris agreement
IPCC Guidelines
The European Green Deal
Fit for 55
Clean Planet for all
Bioeconomy for Europe
Biodiversity Strategy 2030
REPowerEU Plan
EU Soil Strategy for 2030
Circular Economy Action Plan
A Healthy Planet for All
New EU Forest Strategy for 2030
A Renovation Wave for Europe
Treaty on the Functioning of the European Union
EU strategy to reduce methane emissions
Farm to Fork Strategy
EU Strategy on Adaptation to Climate Change
Concept of state forestry policy until 2035
National forestry program 2
National Action Plan for Adaptation to Climate Change
Strategy of the Ministry of Agriculture with a view to 2030
Climate protection policy in the Czech Republic
National plan of the Czech Republic in the field of energy and climate
National forestry accounting planl for the period 2021-2025
State environmental policy of the Czech Republic 2030 with a view to 2050
General: Law
General: Law=>
Regulation (EU) 2021/1119 European Climate Law
Public Procurement Act
Hunting Act
Forest Act
Act of the Czech National Council on the Establishment of Ministries
Act on the circulation of reproductive materialof forest trees
Act on Nature and Landscape Protection
Regulation
Regulation =>
Regulation (EU) 2018/841
Regulation (EU) 2021/2115
Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action
Regulation (EU) 2018/2066 on the monitoring and reporting of greenhouse gas emissions
Regulation (EU) 2021/2116
Regulation (EU) 2021/2117
Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030
Regulation No. 247/2009 Coll., Government regulation announcing the implementation of the forest inventory
Government Regulation No. 185/2015 Coll.
Decision
Decision =>
Council Decision (EU) 2016/1841
Decision on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry tivities
89/367/EEC: Council Decision setting up a Standing Forestry Committee
Directive
Directive =>
Directive (EU) 2018/2001
Directive 2009/147/EC
Directive 92/43/EEC
Directive 2003/87/EC
Directive 96/61/EC
Directive 2007/2/EC
Directive 1999/105/EC
Directive (EU) 2018/2001
International Agreement
CZ Transposition and Implementation
Local Implementation
Decree No. 84/1996 Coll., Decree of the Ministry of Agriculture on forest economic planning
Decree
Decree =>
European Interpretation and Transposition
International =>
Europe =>
CZ: Combined & Devolved (Acts) =>
CZ: Combined & Devolved (Regulations) =>
CZ: Combined & Devolved (Orders & Guidance) =>
General: Strategy/Plan
General: Law
Regulation
Decision
Directive
Decree

9.4 Appendix 4 List of Instruments in the Instrument map

Strategy/International level:

1. Paris Agreement
2. IPCC Guidelines

Strategy/ Europe level:

1. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The European Green Deal COM/2019/640 final
2. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality, COM/2021/550 final
3. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Biodiversity Strategy for 2030 Bringing nature back into our lives COM/2020/380 final
4. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy COM/2018/773 final
5. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Commission Work Programme 2021 A Union of vitality in a world of fragility COM/2020/690 final
6. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe COM/2020/98 final
7. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system COM/2020/381 final
8. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment COM/2018/673 final
9. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Pathway to a Healthy

Planet for All EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' COM/2021/400 final

10. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change COM/2021/82 final

11. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on an EU strategy to reduce methane emissions COM/2020/663 final

12. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS New EU Forest Strategy for 2030 COM/2021/572 final

13. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS REpowerEU Plan COM/2022/230 final

14. Consolidated version of the Treaty on the Functioning of the European Union

15. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Soil Strategy for 2030 Reaping the benefits of healthy soils for people, food, nature and climate COM/2021/699 final

16. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives COM/2020/662 final

Strategy/Czech level:

1. Concept of state forestry policy until 2035
2. National forestry program 2
3. Strategy for adapting to climate change in the conditions of the Czech Republic
4. National Action Plan for Adaptation to Climate Change
5. Climate protection policy in the Czech Republic
6. Strategy of the Ministry of Agriculture with a view to 2030
7. State environmental policy of the Czech Republic 2030 with a view to 2050
8. National plan of the Czech Republic in the field of energy and climate

Law/Europe level:

1. Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (‘European Climate Law’) PE/27/2021/REV/1

Law/Czech level:

1. Act No. 289/1995 Coll., Act on Forests and Amendment of Certain Acts (Forestry Act)
2. Act No. 449/2001 Coll., Hunting Act
3. Act No. 149/2003 Coll, Act on the circulation of reproductive material of forest trees of forestry important species and artificial hybrids, intended for forest

restoration and afforestation, and on the amendment of some related laws (Act on trade in reproductive material of forest trees)

4. Act No. 2/1969 Coll., Act of the Czech National Council on the Establishment of Ministries and Other Central Bodies of State Administration of the Czech Socialist Republic

5. Act No. 137/2006 Coll., Public Procurement Act

Regulation/Europe level:

1. Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (Text with EEA relevance)

2. Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulations (EU) 2018/841 as regards the scope, simplifying the compliance rules, setting out the targets of the Member States for 2030 and committing to the collective achievement of climate neutrality by 2035 in the land use, forestry, and agriculture sector, and (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review, COM/2021/554 final

3. Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (Text with EEA relevance.)

4. Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012 (Text with EEA relevance.), C/2018/8588

5. Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (Text with EEA relevance)

6. Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013

7. Regulation (EU) 2021/2116 of the European Parliament and of the Council of 2 December 2021 on the financing, management and monitoring of the common agricultural policy and repealing Regulation (EU) No 1306/2013 PE/65/2021/INIT

8. Regulation (EU) 2021/2117 of the European Parliament and of the Council of 2 December 2021 amending Regulations (EU) No 1308/2013 establishing a common organisation of the markets in agricultural products, (EU) No 1151/2012 on quality schemes for agricultural products and foodstuffs, (EU) No 251/2014 on

the definition, description, presentation, labelling and the protection of geographical indications of aromatised wine products and (EU) No 228/2013 laying down specific measures for agriculture in the outermost regions of the Union PE/66/2021/REV/1

9.

Regulation/Czech level:

1. Government Regulation No. 247/2009 Coll., Government regulation announcing the implementation of the forest inventory in the years 2011 to 2015

Decision/Europe level:

1. Decision No 529/2013/EU of the European Parliament and of the Council of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities
2. Council Decision (EU) 2016/1841 of 5 October 2016 on the conclusion, on behalf of the European Union, of the Paris Agreement adopted under the United Nations Framework Convention on Climate Change
3. 89/367/EEC: Council Decision of 29 May 1989 setting up a Standing Forestry Committee

Directive/Europe level:

1. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (Text with EEA relevance) PE/48/2018/REV/1
2. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Codified version)
3. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
4. Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (Text with EEA relevance)
5. Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control
6. Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
7. Council Directive 1999/105/EC of 22 December 1999 on the marketing of forest reproductive material

Decree/Czech level:

1. Decree No. 84/1996 Coll., Decree of the Ministry of Agriculture on forest economic planning

9.5 Appendix 5 Interview guide in English

Introduction:

1. Can you tell me a little bit about yourself?
2. What does your organisation do and what is your job title?

Part A: Forest

1. What do you imagine by the term forest?
2. Do you think forests have any meaning? What?
3. How do you perceive the role of humans in the environment?

4. Do you think Czech politicians pay enough attention to climate change?, so Czech forests are facing increasing instability caused by storms, droughts and bark beetles.
    a. Do you agree with that statement?
    b. If not, why?
5. On the other hand, some literature states that forest degradation is caused by forest aging and increased logging. What do you think about it?
    a. Do you think forests are getting old? Do you think mining is high?
    b. What other causes do you see? If you disagree, what is an aging forest to you?
6. Are there any formal changes you've made to forest management in light of climate change
7. Have you noticed any changes in forest management at the national or local level in terms of the LULUCF regulation or climate change mitigation?
8. The EU targets for CO2 absorption with the help of forests are potential, especially in the case of the Czech Republic, the target was set before the bark beetle disaster, and it is not so certain whether the Czech Republic will be able to meet this target.
    a. Do you think that there are any obstacles in the Czech Republic in implementing and achieving obligations towards the EU?
    b. What would help instead?
    c. How should the Czech Republic behave?

Part B: EU regulations

1. Do you know anything about the LULUCF regulation of the European Union on land use and forestry? Full title - Regulation 2018/841 of the European Parliament and of the Council of 30 May 2018 on the reduction of greenhouse gas emissions and removals from land use, land-use change and forestry in the context of climate and energy policy by 2030.
    a. What do you think about it? Do you see any problems with this?
2. Do you know anything about the Revision of Regulation 2018/841 on Land Use and Forestry, which is part of Fit for 55? Full title - Proposal for a Regulation of the European Parliament and of the Council amending Regulation 2018/841 as regards the scope, the simplification of the compliance rules, the setting of Member States' 2030 targets and the commitment to jointly achieve climate neutrality on the land use, forestry, and agriculture sectors of the year 2035, and Regulation 2018/1999 in terms of improving monitoring, reporting, progress monitoring and review.
    a. What do you think about it? Do you see any problems with this?
3. To what extent and how do you think these EU regulations meet the specific conditions of the Czech Republic, or at all? (Specific conditions, e.g. spruce monocultures, bark blight, drought)
    a. If not, then why?
4. How do you perceive the possibilities to comment on decision-making on forest management at the level of the EU and the Czech Republic?
5. Do you think that EU measures influencing national measures/legislation in the Czech Republic?
    a. If so, how?
6. How do you perceive the implementation of the Green Deal for Europe, Fit for 55, or Regulation 2018/841 or the Proposal to amend this regulation?
7. Have there been any formal changes in the legal framework related to forest management in the past with respect to climate change?

a. Who initiated this change?
b. Have the methods of forest management changed in any way? How?

8. The literature mentions the transformation of forestry, a significant decrease in personnel, and an inflexible system of contracts in forestry - how was this reflected in forestry?
9. How do you see the future of the Czech Republic's forests with regard to this regulation and climate change? Does it have any significance for the future?

Conclusion:

1. Is there anything you think is important here that you would like to mention?

9.6 Appendix 6 Interview guide in Czech

Úvod:

1. Můžete mi říct něco málo o sobě?
2. Co dělá vaše organizace a jaká je Vaše pracovní pozice?

Část A: Les

1. Co si představujete pod pojmem les?
2. Myslíte, že lesy mají nějaký význam? Jaký?
3. Jak vnímáte roli člověka v životním prostředí?
4. Myslíte si , že čeští politici věnují dostatečnou pozornost klimatické změně?, a tak se české lesy potýkají s rostoucí nestabilitou způsobenou vichřicemi, suchy a kůrovcem.
    a. Souhlasíte s tím to tvrzením?
    b. Pokud ne, proč?
5. Na Druhou stranu některá literatura uvádí, že degradace lesů je způsobena stárnutím lesů a zvýšenou těžbou. Jaký na to máte názor?
    c. Myslíte si, že lesy stárnou? Myslíte si, že těžba je vysoká? Jaké další příčiny vidíte?
    d. Pokud nesouhlasíte, co je pro vás stárnoucí les?
6. Dochází k nějakým formálním změnám, které jste provedli v souvislosti s lesním hospodářstvím s ohledem na klimatickou změnu?
7. Zaznamenal/a jste nějaké změny v lesním hospodářství na národní či lokální úrovni ve smyslu LULUCF nařízení nebo mitigace změny klimatu?
8. Cíle EU pro pohlcování CO2 s pomocí lesů jsou ambiciózní, zejména v případě ČR cíl byl stanoven před kůrovcovou kalamitou a není tak jisté zda ČR bude tento cíl schopna splnit.
    e. Myslíte si, že existují v ČR nějaké překážky při zavádění a dosahování závazků vůči EU?
    f. Co by naopak pomohlo?
    g. Jak by se ČR měla zachovat?

Část B: EU nařízení

1. Víte něco o LULUCF nařízení Evropské Unie o využívání půdy a lesnictví? Celý název - Nařízení Evropského Parlamentu a rady 2018/841 ze dne 30. května 2018 o zahnutí emisí skleníkových plynů a jejich pohlcování v důsledku využívání půdy, změn ve využívání půdy a lesnictví do rámce politiky v oblasti klimatu a energeticky do roku 2030.
    a. Co si o tom myslíte? Vidíte v tom nějaké problémy?
2. Víte něco o Revizi nařízení 2018/841 o využívání půdy a lesnictví, která je součástí Fit for 55? Celý název - Návrh nařízení Evropského Parlamentu a rady kterým se mění nařízení 2018/841, pokud jde o oblast působnosti, zjednodušení pravidel souladu, stanovení cílů členských států pro rok 2030 a závazek ke

společnému dosažení klimatické neutrality o odvětví využívání půdy, lesnictví a zemědělství do roku 2035, a nařízení 2018/1999, pokud jde o zlepšení monitorování, vykazování, sledování pokroku a přezkum.

b. Co si o tom myslíte? Vidíte v tom nějaké problémy?

3. Do jaké míry a jak si myslíte, že tyto nařízení EU vyhovují specifickým podmínkám ČR, zda vůbec? (specifické podmínky např. smrkové monokultury, kůrovcová kalamita, sucho)

c. Pokud ne, tak proč?

4. MZE se vyjádřilo k inciativám na stránkách EU. - Jak vnímáte možnosti vyjádřit se rozhodování o lesním hospodářství na úrovni: EU a ČR?
5. Myslíte si, že EU opatření ovlivňují národní opatření/legislativu v ČR?

d. Pokud ano, jak?

6. Jak vnímáte realizaci Zelené dohody pro Evropu, Fit for 55, anebo Nařízení 2018/841 či Návrh na změnu tohoto nařízení?
7. Došlo v minulosti k nějakým formální změnám v právní struktuře v souvislosti s lesním hospodářstvím s ohledem na klimatickou změnu?

e. Kdo tuto změnu inicioval?

f. Změnily se nějak způsoby hospodaření s lesem? Jak?

8. Literatura uvádí transformaci lesnictví, významný úbytek personálu, a neflexibilní systém zakázek v lesnictví - jak se toto promítlo do lesního hospodářství?
9. Jak vidíte budoucnost lesů ČR s ohledem na toto nařízení a klimatickou změnu? Má toto nějaký význam do budoucna?

Závěr:

1. Je zde podle Vás něco důležitého, co byste chtěl/a zmínit?

9.7 Appendix 7 Consent form

Informed consent for anonymous data processing

Dear Madam, Dear Sir,

I would like to contact you about cooperation on my master thesis. The research will be conducted by a semi-structured interview and an audio recording will be made from the interview. The research focuses on how relations between the EU and the Czech Republic affect the forest management at the domestic level. The research will therefore focus on the state of the Czech forests and legislative changes that will facilitate the achievement of climate neutrality.

If you agree to participate in the study, attach a signature expressing your agreement with the processing of collected data.

I agree that all scanned data will be processed anonymously, they will only be used for research in the diploma thesis, and the results of the research can be anonymously published.

Name, surname, and signature of the person conducting the research:

Name, surname, and signature of the interviewee for the purposes of the thesis:

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