International IUFRO Symposium

Managerial forest economics and accounting as a base for decision making in a changing world

Book of Extended Abstracts

5.-7. September 2022, Hamburg, Germany

Annual conference of IUFRO Unit 4.05.00 - Managerial economics and accounting and its subgroups

Local organizer: Thünen Institute of Forestry

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Published by Thünen Institute of Forestry

Head of Institute: Dir. und Prof. Prof. Dr. Matthias Dieter

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Content

1 Background and focus area of conference

Climate change and increasing extreme weather events, continuing losses of forest area and forest habitats by degradation and deforestation, intensifying land-use competition by multiple stakeholder groups: the pressure and demands on forests and forestry is strong. Therefore, future challenges for forest owner are, amongst others, that forests must serve as a sound habitat for native plant and animal species, must be adapted to climate change and are vital to achieving climate mitigation targets. They are urged to consider all kinds of societal demands while simultaneously dealing with forest calamities, maintaining economic viability and producing enough timber for bioeconomy. This is also reflected in various rules, regulations and strategies, that can have impacts on forest enterprises, on international and national level (e.g. UNFCCC, LULUCF, CBD).

In order to face the challenges of a changing world, forest owners, scientists, administrational staff and politicians on all levels must make informed choices on future forest management activities. Managerial economics and accounting are important analytical instruments for identifying and evaluating forest management action alternatives and to support knowledge-building and decision-making. Indeed, the interest for the evaluation of forest management options and forest functions strongly increased in the past decades. Against this background, the organizers of this Symposium aim to foster the scientific exchange on recent developments, research and best practices from managerial economics and accounting on regional, national and international level as a base for decision making in a changing world, focussing on the following research fields:

- Managerial economics and accounting as a base for decision making
  - Monitoring, modelling and accounting tools for evaluating climate damages, forest degradation and deforestation, habitat functions and management options.
  - Data generation, data and benchmarking systems as a basis for decision making
  - Decision support systems for adaptation to shifting framework conditions
- Climate change impact assessment
  - Assessments of forest damage after calamities and extreme weather events
  - Effects of adaptation strategies to climate change on forestry, timber industry and bioeconomy
- Policy impact assessment
  - Effects of nature protection strategies and other strategies for safeguarding forest ecosystem services on forestry, timber industry and bioeconomy
  - Effects of forest- and timber-related policies and regulations on forestry and forest value-chains
  - Payments for ecosystem services - assessment and accounting
- Forests and society
  - Role of (small-scale) forest enterprises / forest owner associations in a changing world
  - Inclusion of environmental, cultural and social aspects of forestry in economic accounting
  - Evaluation of conflicting societal demands on forests and forestry
  - Forestry and rural areas - employment in the forestry sector
  - Effects of the Covid19-Pandemic on forestry and forest owners
- Value chains
  - Innovations and knowledge building for maintaining sustainable forest management
  - Traceability of forest products, e.g. deforestation free value chains, FLEGT/EUTR, etc.
  - CO_2-footprints of forest products and value-chains
- Digitization in forestry
- Transdisciplinary research in these fields

2 Conference Programme

4. September 2022

18:00 - 20:00 **Welcome get together,** Palmaille 9, Hamburg

5. September 2022 – Conference Day 1

08:30 - 09:30 **Registration and welcome coffee**

09:30 - 10:30 **Welcome speeches**
MATTHIAS DIETER, Head of Thünen Institute of Forestry
JOHN PARROTTA, IUFRO President (Video-message)
LIDIJA ZADNIK STIRN, Coordinator of 4.05.00 research group
LYDIA ROSENKRANZ, Organizer and Coordinator of Sub-Division 4.05.01

Keynote Speech and Session 1 Impact assessment of Forest Damages
Chair: Jussi Leppänen

10:30 - 11:20 **Keynote speech:**

Challenges for forestry from a European perspective
PROF DR. MATTHIAS DIETER, THÜNEN-INSTITUTE OF FORESTRY

11:20 - 12:30 **Session 1**

1.1 Economic damage valuation of natural disturbances on forestry: State of knowledge and challenges for a continuous economic loss monitoring in Germany
FLECKENSTEIN S, FRANZ K, SEINTSCH B, DIETER M, MÖHRING B

1.2 Analysis of forest restoration costs in areas of large-scale spruce dieback
PULKRAB K, ŠIŠÁK L, SLOUP R, LEUGNER J, PADUCHOVÁ M

1.3 Economic consequences of narrow-leaved ash management in changing habitat conditions
POSAVEC S, MILKOVIĆ I, BELJAN K, VULETIĆ D

12:30 - 13:30 ***Lunch break***

Session 2: EU policies impact assessment
Chair: Vasja Leban

13:30 - 15:00 **2.1 Economic evaluation of different national implementation variants and elements of the EU Biodiversity Strategy 2030 at a national level in Germany**
REGELMANN C, ROSENKRANZ L, SEINTSCH B

2.2 Possible relocation impacts from implementation scenarios of the EU Biodiversity Strategy on forest product markets
SCHIER F, IOST S, SEINTSCH B, WEIMAR H, DIETER M

2.3 Key stakeholder's attitudes on the implementation of the EU Timber Regulation in selected Balkan countries: Comparative case study of Slovenia, Croatia, and Serbia
RADOSAVLJEVIC M, MASIERO M, ROGELJA T, PETTENELLA D

2.4 Does the current Polish State Forest Policy fit in with the European Green Deal?
ADAMOWICZ K, GÓRNA A, JABŁOŃSKI K, POLOWY K

15:00 - 15:30 ***Coffee break***

Session 3: Wood and non-wood forest products
Chair: Mariana Melnykovich

15:30 - 17:00	**3.1 Revealing the hidden economic role of non-wood forest products in Italy using an extended Social Accounting Matrix** DI CORI V, ROBERT N, FRANCESCHINIS C, PETTENELLA D, THIENE M
	3.2 Safeguarding forest natural assets by incorporating participatory approaches to natural capital valuation NIJNIK M, MARTINO S, MARTINAT S, MCKEEN M, WANG C, MILLER, D
	3.3 Wood utilization in Germany: drivers of utilization pathways and respective competition trade-offs SHMYHELSKA L, IOST S, GLASENAPP S, WEIMAR H
18:00 - 19:00	**Harbor Boat trip** Meeting point: Bei den St. Pauli-Landungsbrücken 5, 20359 Hamburg
19:30 - open end	***Dinner (own account):*** *Restaurante Porto, Ditmar-Koel-Straße 15, 20459 Hamburg*

6. September 2022 – Conference Day 2

Session 4: Forest Management
Chair: Maria Nijnik

08:30 - 10:00	**4.1 Family forest owners' consciousness of the use of roundwood sales income in Finland** LEPPÄNEN J
	4.2 New perspectives enable new solutions to forest management in small scale forestry - transaction costs from the perspective of private forest owners in Germany V. ARNIM G
	4.3 How and why forests are often managed collectively: a systematic review of facilitating and hindering factors of collective actions PAGOT G, GATTO P
	4.4 Forest investments as Nature-based Solutions: financing sources and partnership mechanisms BIASIN A, PETTENELLA D
10:00 - 10:30	***Coffee break***

Session 5: Forestry and society
Chair: Lidija Zadnik Stirn

10:30 - 12:00	**5.1 Recapitulation of the provided state services to small forest owners close to urban areas in the Czech Republic** MEŇHÁZOVÁ J
	5.2 Environmental Awareness, Perceived Threats and Opinion on Natural Resource Management Among Local Residents LEBAN V, ZADNIK STIRN L, MALOVRH Š P
	5.3 How to enhance the capacity of forest management to adapt to the multiple challenges? A case of Swiss communal forest MELNYKOVYCH et al.
12:00 - 13:00	***Lunch break***

Keynote Speech and Session 6 Sustainability aspects of forestry and timber use
Chair: Kristin Franz

13:30 - 14:20	**Keynote speech**
	Data needs for next-generation decision-support in forest management PROF DR. CAROLA PAUL, UNIVERSITY OF GÖTTINGEN
14:20 - 14:50	***Coffee break***
14:50 - 16:00	**Session 6**
	6.1 Employment in the forestry and wood sector in Ecuador ALONSO V, LOPES DA SILVA R A, OJEDA LUNA T
	6.2 Gender wage gap in the European forest sector workforce - a statistical analysis DA SILVA E J, LIPPE R, SCHWEINLE J
	6.3 Tracing the origin and sustainability effects of the wood supply chain to the European paper production and consumption POZO INOFUENTES P, BÖSCH M, SCHWEINLE J

16:00 - 16:30	**Closing of conference** LIDIJA ZADNIK STIRN, Coordinator of 4.05.00 research group – wrap-up of the conference VASJA LEBAN, Deputy of Sub-Division 4.05.02 – invitation to the forthcoming 4.05 conference LYDIA ROSENKRANZ, Organizer and Coordinator of Sub-Division 4.05.01 – farewell words
16:30 - 17:30	**Division meeting**
19:00 - open end	***Conference Dinner:*** *Hamburger Elbspeicher, Große Elbstraße 39, 22767 Hamburg*

7. September 2022 – Field Trip

07:45	**Meeting at conference venue, Palmaille 9, for Bus trip to Undeloh**
09:30 - 12:00	Forestry in Lower-Saxony (guided walk in forest)
12:00 - 14:00	***Lunch break***
14:00 - 17:00	Nature conservation in Lüneburg Heath (guided walk in heath)
17:00	**Return to conference venue, Palmaille 9, Hamburg**

3 Organizing Committee of the Thünen-Institute of Forestry

- **Dr. Lydia Rosenkranz**

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4 Scientific Committee

- **Francisco Aguilar** Cabezas, Swedish University of Agricultural Sciences, Sweden
- **Kristin Franz**, Thünen Institute of Forestry, Germany
- **Don Hodges**, University of Tennessee, USA
- **Christian Hoffmann**, European Academy of Bolzano, Italy
- **Kateřina Holušová**, Mendel University in Brno, Czech Republic
- **Krzysztof Jablonski**, Poznan University of Life Sciences, Poland
- **Anže Japelj**, Slovenian Forestry Institute, Slovenia
- **Ljiljana Keča**, University of Belgrade, Serbia
- **Vasja Leban**, University of Ljubljana, Slovenia
- **Jussi Leppänen**, Natural Resources Institute Finland (Luke), Finland
- **Lyudmyla Maksymiv**, Ukrainian National Forestry University, Ukraine
- **Mariana Melnykovych**, Bern University of Applied Sciences, School of Agricultural, Forest and Food Sciences (HAFL), Switzerland
- **Bernhard Möhring**, University of Göttingen, Germany
- **Davide Pettenella**, University of Padua, Italy
- **Jean-Luc Peyron**, Groupement d'Intéret Public Ecosystèmes Forestiers, France
- **Stjepan Posavec**, University of Zagreb, Croatia
- **Lydia Rosenkranz**, Thünen Institute of Forestry, Germany
- **Björn Seintsch**, Thünen Institute of Forestry, Germany
- **Boutheina Stiti**, University of Carthage, Tunisia
- **Lidija Zadnik Stirn**, University of Ljubljana, Slovenia

5 Session Chairs

- **Session 1: Impact assessment of forest damages**

  Jussi Leppänen, Natural Resources Institute Finland
- **Session 2: EU policies impact assessment**

  Vasja Leban, University of Ljubljana, Biotechnical Faculty
- **Session 3: Wood and non-wood forest products**

  Mariana Melnykovich, Bern University of Applied Sciences,

  School of Agricultural, Forest and Food Sciences, Switzerland
- **Session 4: Forest Management**

  Maria Nijnik, James Hutton Institute, United Kingdom
- **Session 5: Forestry and society**

  Lidija Zadnik Stirn University of Ljubljana, Biotechnical Faculty
- **Session 6: Sustainability aspects of forestry and timber use**

  Kristin Franz, Thünen Institute of Forestry

6 Keynote Speakers

Keynote Speech 05. Sept.2022: Challenges for forestry from a European perspective

Dir. und Prof. Prof. Dr. Matthias Dieter

Matthias Dieter holds a PhD in Forest Economics from the Ludwig-Maximilians-University (LMU) Munich and a habilitation from the Georg-August-University Göttingen. He has been employed as a Scientist at the Institute of Forest Economics of the former Federal Research Centre for Forestry and Forest Products (BFH) since 1999. Since 2008 he is Head of the Thünen Institute of Forest Economics, which today is named Thünen Institute of Forestry. Since 2014 he has also been appointed as Professor by the University of Göttingen. He is a member of several high ranking national and international scientific panels, such as, amongst others, the Scientific Advisory Board on Forest Policy of the German Federal Ministry of Food and Agriculture (BMEL), the Managerial Economics Committee and the Extended Executive Committee of the German Forestry Council and International Council of the International Union of Forest Research Organization (IUFRO). As a Head of the Thünen Institute of Forestry he is involved in many research projects. His recent research interests are future challenges for roundwood provision, in particular against the background of climate change mitigation, nature protection and other current political developments.

Keynote Speech 06. Sept.2022: Data needs for next-generation decision-support in forest management

Prof. Dr. Carola Paul

Carola Paul holds a PhD in Forest Sciences from the Technische Universität München, Germany since 2013. She did a Post-Doc at the Technische Universität München focusing on valuation of ecosystem services and assessment of economic consequences on forests in Central Europe. She has also been a Lecturer in Business Administration at the University of Applied Sciences Weihenstephan-Triesdorf from 2014 – 2018. Since 2018 she is Head of the Department of Forest Economics and Sustainable Land Use Planning - Georg August University of Göttingen. Her current research focuses on questions of forest management in a changing world from stand to landscape scales. Her group investigates consequences of climate change on rationale forest management decisions. Another focus is on balancing multiple ecosystem functions and services in land-use decisions. Methodological approaches range from bio-economic simulation and optimization to multi-criteria decision analyses and land-use allocation approaches. She also works on fostering participatory modelling approaches.

7 Extended Abstracts

7.1 Session 1: Impact assessment of forest damages

7.1.1 Economic damage valuation of natural disturbances on forestry: State of knowledge and challenges for a continuous economic loss monitoring in Germany

SIMON FLECKENSTEIN[1], KRISTIN FRANZ[1], BJÖRN SEINTSCH[1], MATTHIAS DIETER[1], BERNHARD MÖHRING[2]

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Key words: forest disturbances, economic losses, economic valuation, forestry sector

Recurring forest disturbance events pose substantial economic challenges for forest enterprises and forest owners. In Germany, for example, prolonged drought periods, storm events and consecutive bark beetle outbreaks from 2018 to 2020 resulted in far-reaching forest dieback. The total forest area affected from 2018 to 2021 was estimated to amount to 501.000 ha (DLR, 2022). Salvaged volumes from 2018 to 2020 amounted to approximately 177 Mio m^3 and in 2019 and 2020 respectively constituted more than 60% and 70% of the total annual timber harvests in Germany (Destatis, 2020, 2021). Resulting economic losses to forest owners and forest enterprises affected by the extreme weather years from 2018 to 2020 were estimated to amount to approximately 13 bn. € (Möhring et al. 2021).

Against the background of accelerating climatic changes, observed developments are expected to intensify in the future which underlines the urgent need for continuous and consistent information on forest disturbance impacts such as on the expectable forthcoming economic losses. This information is crucial to justify investments in adaptation strategies and to inform disturbance-related decision-making processes such as related to the provision of financial resources to forest owners and forest enterprises. However, economic forest disturbance impacts in Germany have thus far predominately been assessed on an ad-hoc base (i.e. after the occurrence of severe disturbance events) and by means of divergent spatial, temporal and sectoral assessment foci and underlying data bases.

As a response to this, the ongoing joint research project "Remote sensing based National Detection System for Forest Damages" aims at laying the groundwork for the implementation of a permanent and unified remote-sensing based damage monitoring system in Germany. The monitoring system further includes economic valuations of remotely sensed physical damages. To do this, a time-differentiating economic valuation framework has been developed based on the national and international scientific literature on forest disturbance economics. The framework builds on individual economic damage components forest owners and forest enterprises can be confronted with in the aftermath of a disturbance event. Also, respective valuation methods were identified and examined regarding their applicability in a national monitoring system based on central data availability. In addition, the timing and extent of the short-term and long-term economic impacts of forest disturbances was analyzed to create a better understanding of the future financial challenges to forest owners and forest enterprises resulting from today´s disturbances. In this context, presented study falls back on valuation results provided by Möhring et al. (2021) as a response to the far-reaching forest disturbances from 2018 to 2020 in

Germany. Findings show that a large share of the economic losses from the extreme weather years from 2018 to 2020 in Germany are expected to incur in the future. Moreover, the need to further develop the necessary data base to enable preferably accurate and comprehensive valuations of forthcoming economic losses from forest disturbances on national level has been identified.

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7.1.2 Analysis of forest restoration costs in areas of large-scale spruce dieback

K. PULKRAB[1], L. ŠIŠÁK[1], R SLOUP[1], J. LEUGNER [2], M. PADUCHOVÁ [1]

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Key words: restoration forests, target species trees, two-phase restoration process, forest management, economic effectiveness

Introduction

From 2017 to 2022, the Czech Republic experienced a bark beetle calamity. The main objective of the project is to establish effective procedures for the restoration of spruce-dominated forests in areas of intensive large-scale dieback with the use of both nurse and target species trees, so that the successive stands are sufficiently differentiated, have a high degree of stability and have production and non-production functions under the changing environmental conditions. The partial aims are to verify the methods of planting the stands and introducing target trees as a two-phase restoration process in rapidly dying forests, planting nurse stands and optimising the thinning of these crops to increase their stability and evaluating the economic effectiveness of the procedures. The goal of the proposed procedures is also to maintain a partial proportion of spruce in these stands.

Material and methods

The research deals with comparing the costs of alternative forest restoration procedures on calamitous clearings. For the selected group of forest habitat types (GFHTs), a comparison of economic measures and direct cultivation costs was made:

(1) so-called standard forms of management ("standard"), when the considered natural input parameters used for the calculations, especially the species composition and production operations, are in accordance with the valid decree 298/2018 Coll., on the processing of regional forest development plans and on the definition of the economic groups. Forestry in the Czech Republic (CR) uses the term forest habitat type which is defined by a typical species combination of the respective phytocenosis, soil features, occurrence in the landscape and the potential yield class of the tree species. The higher typological unit is the group of forest habitat types (GFHTs) grouping the forest habitat types by ecological relationships, expressed by the economically important features of the site. In the framework of the approved and utilised typological system, GFHTs are defined by the altitudinal vegetation zone (vertically) and edaphic (soil) category (horizontally).

(2) fifteen alternative variants of economic measures that were proposed as part of the project being addressed.

Forest regeneration within the first age class (up to 20 years of age) implies the implementation of the following production operations: sowing, soil preparation, artificial regeneration, chemical protection of plantations against game, protection of plantations against game by fencing, protection of young plantations against forest weeds, protection of seedlings against the pine weevil, “juvenile thinning” is divided into two categories according to the tree height, namely up to 4 m, and above 4 m in height. The calculation of the direct cultivation activity costs is based on performance standards (Nouza, Nouzová) under the following assumptions: by including an average and uniform surcharge to the basic standard of 15%, by considering a uniform wage tariff of 15%, by

including a uniform amount of social and health insurance (34% of the wage costs), by including uniform compensation (39% of the wage costs).

Results

The results of the analysis of the selected GFHT be seen in Figure 1 and 2.

Table 1 Overview of the selected forest type set and alternative restoration options

GFHT: 4B	Target tree species composition %	Melioration and strengthening tree species %	Natural regeneration %
Decree	spruce 70, beech 20, larch 5, fir 5	30-35	20
Var. 3	oak 50, hornbeam 25, alder 25	100	0
Var. 7	oak 75	75	25
Var. 8	cherry 50, birch 50	100	0
Var. 13	douglas fir 50, beech 20, cherry 15	50	15

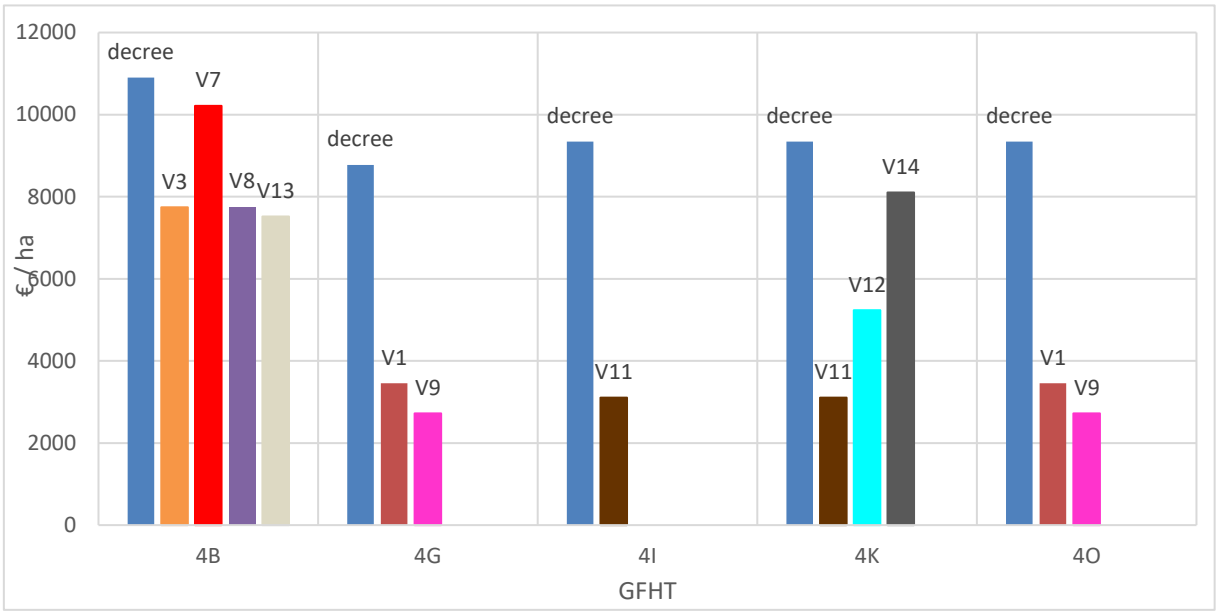

Figure 1 Comparison of the direct cultivation activity costs of the standard and renewal variants broken down according to the GFHTs

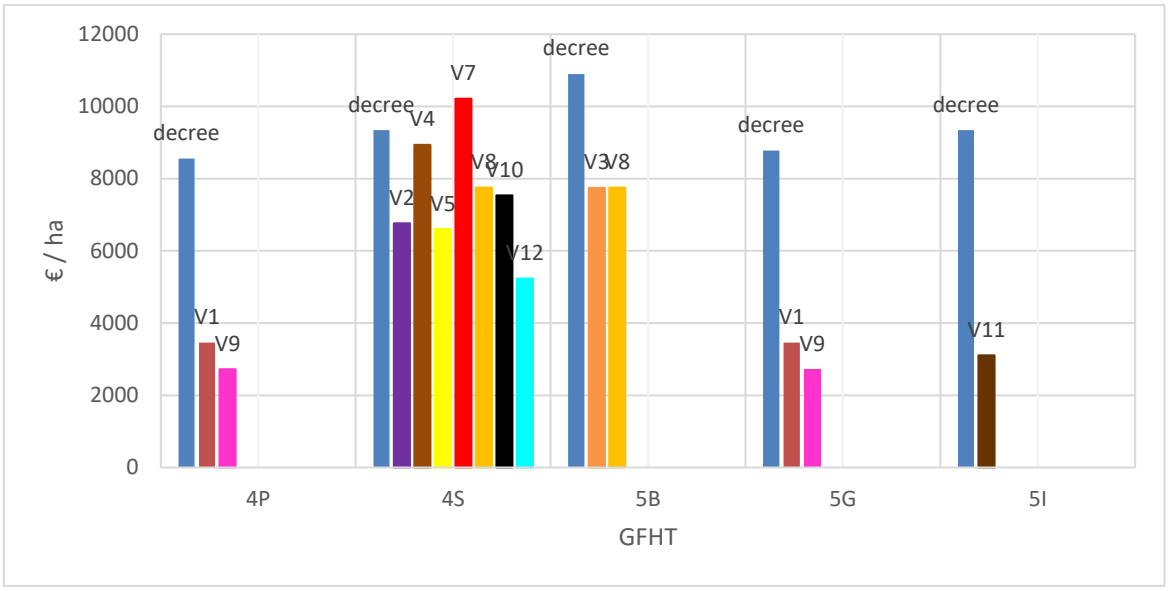

Figure 2 Comparison of the direct cultivation activity costs of the standard and renewal variants broken down according to the GFHT

Conclusions

In all the alternative reforestation options, the proportion of ameliorative and hardening trees was significantly increased at the expense of the spruce. In the standard management practice in the studied GFHTs, a spruce representation of about 70 % is recommended, whereas its representation is considered to be 20-30 % in the alternatives. The direct costs of the alternative reforestation options are, in most cases, lower than that under the standard management. This is due to the increased proportion of the natural regeneration and the minimisation of certain production operations.

This approach is justifiable at the present time, when it is necessary to reforest large calamitous clearings as a matter of urgency. The final reforestation of these woodlands involves a two-stage process, so the proportion of target species (in the case of the analysed GFHTs of Norway spruce) must be prospectively increased, depending on the development of the climatic and habitat conditions. This is an important task, as if the current species composition of these stands and the monetisation ratios of the individual tree species were to be maintained, the economic effect would fall to about 20-30 % compared to the standard species composition.

Acknowledgments

The paper was written in the framework of the research project NAZV QK1810126 "Establishment and education of mixtures of preparatory and target tree species fulfilling production and non-production functions of forest in the area of large-scale dying spruce stands".

References

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7.1.3 Economic consequences of narrow-leaved ash management in changing habitat conditions

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Key words: forest management costs, climate change, ash

Introduction

For many years we have been following the rise in average annual temperatures, witnessing temperature extremes, increased fire risk, changes in precipitation regime manifested as droughts and floods in certain periods. All these conditions contribute to the deterioration of forest health, therefore endangering the forest ecosystem, that is finding it increasingly difficult to adapt to such changed conditions. Tree drying is directly related to climate change. That especially affects ash as a type of wetland habitat. Changed groundwater levels, disturbed forest flooding period, temperature extremes, harmful effects of ash bark beetle and ash weevil (Stereonychus fraxini) cause the biggest problems. Unfavorable effects were manifested in drying and deterioration of the growing stock of ash caused by invasive pathogenic fungus Chalara fraxinea, and the need to rehabilitate large areas of ash habitats affected by decay (Županić et al, 2012). In these adverse conditions the survival of field ash as a species is severely compromised. Forest owners have increased costs of biological reproduction, especially for habitat recovery works. Growing stock in the Republic of Croatia amounts to 418.6 million m^3, of which 315.8 million m^3 is in the state forests managed by Croatian Forests Ltd., 83.7 million m^3 is in the forests of private forest owners and 19.1 million m^3 in state forests used by other legal entities. The annual increment of growing stock in the Republic of Croatia is 10.1 million m^3, of which 7.5 million m^3 is in forests managed by Croatian Forests Ltd., and 2.2 million m^3 in private forests. In the woods managed by Croatian Forests Ltd. annual cut is lower than increment, thus ensuring the future of sustainable management. Annual cut in state forests managed by Croatian Forests Ltd. amounts to an average of 6.4 million m^3.

It is estimated that forests in the EU and its forest-based sector currently contribute to overall climate change mitigation by absorbing around 13% of total EU carbon emissions. (Nabuurs, G. J. et al. 2015). In 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) produced a Global Assessment and found that 1,000,000 species are threatened with extinction, while negative biodiversity trends continue under most scenarios. Various legislative frameworks have been prepared and adopted at European Union level. The European Green Deal, for example, includes a number of policy areas in which forestry could play a key role: conservation and restoration of biodiversity, net zero carbon ambitions, climate adaptation, the circular economy and land use, land use change and forestry (LULUCF). The European Commission has also adopted the new EU Biodiversity Strategy for 2030. It aims to build our societies' resilience to future threats such as climate change impacts, forest fires, food insecurity or disease outbreaks, including by protecting wildlife and fighting illegal wildlife trade (EC, 2021). Extinction of ash in the future will cause deterioration of stand quality, climate change resilience, disease outbreak and lack of biodiversity. The aim of research is to analyse growing stock value, income from felling and exploitation costs of assortments of narrow-leaved ash. Within the prescribed rotation period of 80 years, management costs that occurred in forest management plan attributed to drying will be determined.

Material and methods

In 2021, Croatian Forests Ltd. performed an estimate of 6.08 million m^3 of gross timber. Deviation by tree species in relation to the average prescribed felling in the Forest Management Plan of the Republic of Croatia for the period 2016 - 2025 is present in fir, spruce, narrow-leaved ash and pedunculate oak. Higher felling than the average prescribed for each species is due to the occurrence of natural disasters and invasive pests, which is a direct and indirect consequence of climate change. In total, gross mass of felling of the main income was realized in the amount of 3.76 million m^3, income from thinning 1.4 million m^3, and intermediate income, which includes droughts, windbreaks, snow and ice, illegal logging amounted to 0.92 million m^3.

Professional services of the company established standard technologies for raising stands of individual forest management classes. The cost of raising per hectare is determined by multiplying the price of labor from the price list of works for the accounting year by the multiplicity coefficient for the work and by summing the calculated amounts. For the growing stock above the first age class, the present cutting value method was used. Estimation of the growing stock value by this method is determined according to the value of growing stock with the assumption that all is cut, made into assortments and sold at average prices realized in the accounting year, minus operating costs. Assortments table and the Price list of the main forest products of Croatian Forests Ltd. (2019) are the primary inputs when estimating value.

Results

According to the valid Forest Management Plan of the area (2016 to 2025), even-age or regular management method is prescribed for narrow-leaved ash stands. The majority of ash stands owned by the Republic of Croatia and managed by Croatian Forests are divided into two management classes: commercial field ash high forests (16,057 ha) and special purpose ash high forests (16,472 ha). The total economic value of high forest ash stands management class, determined by the cost method for stands of the first age class and the present cutting value method for stands of other age classes, amounts to EUR 154 million, of which about EUR 32 million refers to the value of stands of the first age class, and about EUR 123 million on the value of growing stock on the stump. The total growing stock of stands of this management class is about 3.86 million m^3 (286 m^3/ha), and the average stumpage value is 31,9 EUR/m^3. The growing stock, and thus the value, is in the IV age class, i.e. the age of 80 years (Table 1).

In the stands of the management class of high forests of narrow-leaved ash in the Forest Management plan of the Republic of Croatia for the period 2016-2025, it is prescribed average annual cut of intermediate income of about 43 thousand m^3, and the average cut of main income of about 81 thousand m^3, which gives a total average annual cut of about 124 000 m^3. The average annual income from the annual cut in the stands of this working class is estimated at around 5 million EUR, what is around 40 Eur/m^3 of gross wood volume. The average annual cost of managing stands in this management class is around 4.24 million EUR.

During 2021, in the forests managed by Croatian Forests Ltd. about 460 thousand m^3 of narrow-leaved ash was felled, of which about 280 thousand m^3 was sanitary felling, mainly as a consequence of drying and decay of ash trees. The sale of felled ash wood resulted in an income of about 42,13 EUR/m^3 gross wood volume with the cost of utilization of 20.7 EUR/ m^3 net wood volume. Stand recovery costs for ash are increasing, especially raising costs for first age class, which affects the justification of investment and management of these forests. The average annual stand management costs of the management class of high forests of narrow-leaved ash is about 4.24 million EUR.

Age class	Area	Wood volume	Total wood volume	Growing stock stumpage value	Total growing stock stumpage value	Raising costs for I age class stand	Total stand value
year	ha	m^3/ha	m^3	EUR/m^3	EUR	EUR	EUR
I.	2 528	-	-	-	-	32 147 901	32 147 901
II.	3 206	155	496 104	17,1	8 498 993		8 498 993
III.	3 818	259	988 804	23,1	22 848 857		22 848 857
IV.	4 146	357	1 482 015	37,8	56 092 201		56 092 201
V.	2 056	381	783 178	39,2	30 682 272		30 682 272
VI.	249	373	92 945	39,2	3 641 272		3 641 272
VII.	53	363	19 247	39,2	754 033		754 033
Total	16 056	286	3 862 293	31,7	122 517 628	32 147 901	154 665 529

Table 1 Economic value of the management class of high forests of narrow-leaved ash stands

Conclusions

In a very short period of time, from 2012 until today, ash has proven to be a species that reacts poorly to climate change, and almost a third of the stand is affected by drying, which, although a number of unfavorable factors have been identified, but is most often attributed to the fungus chalari.

For the needs of the ongoing project, the exploitation costs of assortments of narrow-leaved ash will be identified. Within the entire rotation period all costs that occurred from regular management and changes attributed to drying will be determined. Attention will be focused on the age of the stand at which the highest costs occur. The economic framework of the investment justification, the expected value of the land and the rate of return will be determined. Comparing the economic results of forest management in normal and planned circumstances, with the economic result of management that includes drying, will show the reduction of income and profit for different lengths of rotation period and habitat quality.

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7.2 Session 2: EU policies impact assessment

7.2.1 Economic evaluation of different national implementation variants and elements of the EU Biodiversity Strategy 2030 at a national level in Germany

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Key-Words: economic evaluation, policy impact analysis, nature conservation legislation, forest economic model

Introduction

Environmental degradation and climate change are major causes for the loss of biodiversity and livelihoods worldwide. To help overcome these challenges, the European Green Deal, as a framework and growth strategy, aims to achieve a resource-efficient and fair economy in the EU. The EU Biodiversity Strategy 2030 (EUBDS 2030), with its objectives of conservation and restoration of ecosystems and biodiversity, is an important pillar of the Green Deal (EU COM 2020). The main goal of the EUBDS 2030 is the mitigation of biodiversity and the preservation and restoration of biodiverse and carbon-rich ecosystems (EU COM 2020; BAQUERO ET AL. 2021).

The objectives of the EU-BDS 2030 are assigned to four pillars "i) protect nature, ii) restore nature, iii) enable transformative exchange and iv) EU action to support biodiversity globally" (EU COM 2020, p. 8). The central principle of the first pillar "protect nature" are the following key commitments:

(1) Legally protect a minimum of 30% of the EU's land area and 30% of the EU's sea area and integrate ecological corridors, as part of a true Trans-European Nature Network.

(2) Strictly protect at least a third of the EU's protected areas, including all remaining EU primary and old-growth forests.

(3) Effectively manage all protected areas, defining clear conservation objectives and measures, and monitoring them appropriately.

How these key commitments will be transposed into national law and what economic impact they will have in the long term on the forestry sector remains unknown. Economically, the set aside of forest area, especially of mature stands, leads to a total loss of income from timber. Regulatory constraints such as nature protection measures on the other hand, entail various additional costs and reduced revenues for forest owners, for example, an increase in lower-yield deciduous trees, loss of timber for retaining deadwood and habitat trees and deferred income by prolongations of the rotation age (ROSENKRANZ ET AL. 2014; ROSENKRANZ UND SEINTSCH 2015; DÖG ET AL. 2016).

Material and methods

Within the framework of a policy impact analysis, two scenarios (a moderate and an intensive one) were developed to show different implementation paths. These were computed with a forest economic model (FESIM) to show long-term developments of the important natural and economic figures. The study was based on the following research questions:

(1) What are the long-term economic impacts of different implementation variants and elements of the EU-BDS 2030 on German forestry?

(2) How does the carbon capacity of managed forests develop in comparison to unmanaged forests and how large are the carbon mitigation costs of non-utilization?

Results

The results of this policy impact analysis suggest numerous far-reaching implications for the forestry sector in Germany. Depending on the degree of implementation, the measures (under the assumptions made in the scenarios) are associated with high opportunity costs. In particular, the intensive scenario (ISC) causes a decline in contribution margins to 53% compared to the referencing scenario (BAU). Furthermore, a 44% decrease in timber harvesting is expected in the ISC.

The unutilized forests store more carbon, but a saturation effect arises after a few decades, so that the carbon mitigation costs derived from the opportunity costs rise substantially.

Conclusions

In summary, depending on the scenario, the EUBDS 2030 will have far-reaching effects on forestry in Germany under the set assumptions and will be associated with high costs.

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7.2.2 Possible relocation impacts from implementation scenarios of the EU Biodiversity Strategy on forest product markets

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Key words: EU Biodiversity Strategy; forest sector modelling; forest economics; policy impact assessment; Leakage

Introduction

The EU Biodiversity Strategy (EUBDS) for 2030 aims at recovering biodiversity by strengthening the protection and restoration of nature in the European Union (EU) (EU COM, 2020). In the past, implementation of environmental policies sometimes indirectly caused impacts that counteract the actual aims of this policy, thus reducing its overall benefit.

Material and methods

This study analyses possible effects of the implementation of the EU biodiversity strategy 2030 on the production and trade of forest-based products in EU and non-EU countries in two alternative implementation scenarios. Using a global forest product model (Buongiorno et al. 2003), we evaluate possible country and product-specific market developments over time.

Results

The implementation of defined measures to enhance forest protection and biodiversity restoration would allow a maximum possible roundwood production in the EU of roughly 281 M m3 in 2030 in an intensive biodiversity scenario and around 489 M m3 in a moderate biodiversity scenario. Since in the reference scenario the European roundwood production amounts to 539 M m3 in 2030, this would represent a reduction of minus 48% and minus 9% in 2030, respectively. Until 2050, the production further decreases and accounts for 42 % and 90 % of the production in the reference scenario. Globally, the EU roundwood production deficit is compensated partly (roughly between 50% – 60%) by increasing production of roundwood in non-EU countries (e.g. USA, Russia, Canada, China, and Brazil) while the remaining share of the EU production deficit is no longer produced and consumed worldwide. In the EU, reduced roundwood availability leads to a lower EU production of wood-based products. However, apparent consumption of wood-based products remains similar. This is mainly caused by significantly lower export volumes of wood-based products and, for some product groups, also by significantly increased imports. In part this can be explained by the underlying modelling assumptions on income development which remain unchanged over the scenarios. Lower production and export volumes in the EU lead to a shift of production to non-EU countries. We see that this shift is again distributed to the USA, Russia, and China but also, e.g., Turkey (sawnwood), Thailand (wood-based panels) and Indonesia (papers) are affected. Even though, production in several non-EU countries increases compared to the reference scenario, the overall, worldwide consumption of wood-based products declines. Thus, on a global level, decreased production and consumption of wood-based products could lead to a growing use of non-bio-based resources to substitute wood-products.

Conclusions

Using a moderate and an intensive implementation scenario, our study opens a plausible range of the magnitude of the impacts the EUBDS implementation could have. From our results we conclude that both the production of roundwood and wood products shifts from EU to non-EU countries in varying degrees. A relocation can thus counteract the EU Biodiversity targets since the production could leak to countries with less efficient forest and biodiversity protection measures in place. However, our study shows that the magnitude of effects strongly depends on how much the use of forest resources is actually restricted due to establishment of additional protected areas.

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7.2.3 Key stakeholder's attitudes on the implementation of the EU Timber Regulation in selected Balkan countries: Comparative case study of Slovenia, Croatia, and Serbia

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Key words: timber legality, forest governance, forest policy, EUTR transposition, stakeholder's perceptions

Introduction

About 200 million hectares of forests have been lost across the tropics since the beginning of the century, and even greater areas have been degraded [1]. That makes the deforestation the second-largest source of greenhouse gas emissions and the primary driver of terrestrial biodiversity loss [1]. Over the last decades' many efforts were taken to address deforestation and illegal logging, by the private sector and civil society organizations (e.g. The Sustainable Forest Products Global Alliance, WWF), and political commitments were also made (e.g. COP26, the European Union (EU) Communication on Stepping up EU Action to Protect and Restore the World's Forests). In 2013 the EU Timber Regulation (EUTR) got into force in the EU to address illegal logging on the demand side of timber and timber products. The EUTR obliges importers to implement a due diligence system (DDS) to minimize the risk of importing illegally sourced timber and timber products to the EU [2]. In this way, the EUTR creates a strong market advantage for low-risk countries which are mostly in the northern hemisphere. On the other hand, exporters from developing, high-risk countries might be disadvantaged as EUTR implementation creates administrative burdens and extra costs [3]. Despite the EU efforts to stop the flows of illegally sourced timber and timber products the implementation of EUTR is uneven among the EU Member States and in many cases unsatisfactory [4]. Among high-risk countries are also some Western Balkan countries, which are considered to comprise the corridor of illegal timber and timber products from the East to the West [5]. In general, the Western Balkan countries have high forestry potential that could contribute to their social, environmental, and economic development. As EU Member States, two Western Balkan countries (Croatia and Slovenia) aligned their policies and regulatory frameworks with those of the EU and had to implement EUTR requirements. Other Western Balkan countries (Serbia, Bosnia and Herzegovina, Macedonia, and Montenegro) are still in the pre-accession process to the EU. It is not known how they adapted to EU *acquis communautaire*, and what measures they undertook to comply with EUTR requirements**.** Although some authors [3, 4,5] focus on the legality aspects of timber in the Western Balkan countries, there is limited research on key stakeholders' perceptions of EUTR implementation as well as forest policy adaptation to the EUTR requirements. This study addresses the identified research gaps by investigating key stakeholders' attitudes towards the legality of timber and timber products and EUTR implementation in selected Western Balkan countries (i.e., Slovenia, Croatia, and Serbia).

Material and methods

This research endorses multiple embedded case study designs as it covers three cases (i.e. the three selected countries) and draws a single set of cross-case conclusions [9]. Countries were selected as cases for the analysis as they present a wide range of economic, social, and policy conditions [10]. All of them export a large proportion of their timber and timber products to the EU market. They also reflect the changes that occurred after the breakup of the former Republic of Yugoslavia and with the accession to the EU. Slovenia accessed the EU in 2003,

Croatia in 2013, and Serbia is still in the pre-accession process. There are also several differences between these countries concerning economic development, social-political stability, and new forest policy and regulatory frameworks. The research is based on a literature review, as well as semi-structured interviews with key stakeholders in each country. Key stakeholders are actors involved in policy-making and/or implementation of the EUTR in Slovenia, Croatia, and Serbia. For a preliminary key stakeholder identification, we used policy documents related to the EUTR implementation [11]. In each country, one key informant was contacted to complete the list. To validate our sample, we applied a snowball sampling method, which enabled us to identify new relevant stakeholders. In total, we identified 21 key stakeholders (Slovenia:6, Croatia:7, Serbia:8) including government officials, state forest enterprises, forest policy experts, industry, and non-government organization (NGO) representatives. In total, 20 interviews (one did not respond) were conducted in spring 2022. Interviews lasted 30–60 min, and were fully recorded and transcribed, respecting the highest ethical guidance. Interviews were analysed using deductive coding in NVivo 15 software.

Results

Slovenia

Slovenia has been implementing EUTR since 2013 through the Forest Act. In 2019, 2 851 total illegal activities were recorded on a total area of 577 ha, which is similar to data reported for 2018. In 2019, there were 111 illegal activities in the forests, which is slightly less than in 2018 (120). Illegal activities in 2019 were caused by agriculture (13.7 ha), mining (5.5 ha), and urbanization (3.4 ha), while illegal logging due to the development of infrastructure and other causes accounted for 0.6 ha each [12]. The main responsible organization for forestry is The Ministry of Agriculture, Forestry and Food - the Directorate for Forestry, Hunting and Fisheries. The central professional forestry institution is the Slovenian Forest Service (SFS), responsible for forest management planning. Forestry inspection as part of the Inspectorate for Agriculture, Forestry, Hunting and Fishing is responsible for carrying out checks on operators placing on the market domestic timber, while the Financial administration of the Republic of Slovenia is in charge of operators importing timber.

In the case of Slovenia, all key stakeholders (100%) consider the awareness in the forestry sector on EUTR to be adequate. This can be linked to the educational and awareness-raising workshops that were held by the SFS with private forest owners and timber companies. Information about illegal activities is publicly available in accordance with the policy of the competent ministries and competent bodies for the implementation of the EUTR. About 83% of respondents indicated that the transparency regarding the EUTR implementation is high. They justified this statement by considering the data collection on illegal activities that are carried out in an adequate manner, regular reporting to the European Commission, and, in general terms, reliability, availability, and accessibility of information. They also considered the EUTR implementation in Slovenia to represent an example of best practices for other Western Balkan countries. This consideration was supported by mentioning capacity-building workshops and similar education events that were held by Slovenian experts in other Balkan countries (e.g. in Serbia). As for barriers to a proper EUTR implementation, around 33% of respondents reported an insufficient number of inspectors for the field inspections. This impediment is usually overcome by implementing sound and robust methodologies for sampling entities for on-the-ground checks. Attitudes about the EUTR implementation in the future recognize the need for increased human resources to monitor timber legality (around 66% of respondents). The same number of respondents also referred to the awareness of Green Deal policies and “EU deforestation regulation” and indicate the readiness to transpose forthcoming obligations.

Croatia

Croatia has taken over its obligations for the implementation of the EUTR from the date of accession to the EU in 2013. The Law on the implementation of the EUTR entered into force a couple of months before accession. Recent documents and official data on illegal logging in Croatia are hardly accessible (based on data search in 2020/21). In 2020, a Report on Deforestation in the Republic of Croatia was submitted to the European Parliament by the Croatian NGO VIDRA. The report accuses Hrvatske sume Ltd., i.e. the state forest enterprise,

of performing excessive and illegal logging in Natura 2000 areas all over Croatia [13]). The European Parliament responded that "*The responsibility for forests lies with the member states, and all forest-related decisions and policies in the EU must respect the principle of subsidiarity and member states' competence in this field."* [14]

The main responsible organization for forestry in Croatia is The Ministry for Agriculture and within it the Directorate of Forestry, Hunting and Wood Industry. Hrvatske sume Ltd. is the company that manages 98% of state-owned forests in Croatia (2.024.461 ha). It also manages 37 state hunting grounds with a total area of 331.000 ha. Besides forest management and planning activities, Hrvatske sume is engaged in touristic and recreational activities in state forests and is the largest roundwood supplier for the Croatian wood industry [15]. The Ministry of Agriculture is the Competent Authority responsible for carrying out checks of operators, traders, and monitoring organizations for the aims of the EUTR. The Ministry of finance is also included in the process by providing data for checks. Between March 2015 and February 2017, Croatia did not plan or carry out checks on domestic timber, justifying this with the fact that 70% of the domestic forest is state-owned [16]. Based on the interviews, 85% of respondents stated that awareness of the EUTR within the forestry sector is adequate and that prescribed laws and regulations clearly define the timber legality process. About 42% of respondents indicated that the competence of the state institutions is perceived to be high. Regarding the expected processes in the future, all respondents mentioned the need for improving reporting processes and facilitating procedures.

Serbia

As Serbia is still in the pre-accession period, there is no official obligation to the implementation of the EUTR. In 2019, 26 678 m^3 of timber were illegally logged from domestic forests, while an additional 700 m^3 were damaged by human activities [17] including theft of wood assortments, and other human damage. In Serbia, as well as in other non-EU Western Balkan countries, preparation for the EUTR is proceeding slowly. Due diligence standards and systems are not well developed, **and the timber and wood products industry does not have sufficient collaboration or communication with the government** [18].

Forestry inspection is part of the competent Ministry, namely the Directorate for forests within the Ministry of Agriculture, Forestry, and Water Management. The public enterprise Srbijasume manages state forests and forest lands on a total area of 893 204 ha and carries out professional-advisory service activities in private forests (i.e. forests owned by natural/legal persons) over an area of 1 224 751 ha. The public enterprise Vojvodinasume manages another 129 877.84 ha of forest and forest land in the Autonomous Province of Vojvodina in the northern part of the Country.

All respondents (100%) considered the forestry sector to be aware of the EUTR and familiar with it. At the same time, they mentioned that there is space for a better understanding of EUTR procedures and rules, taking into mind Serbia's candidacy status in the EU. The process of timber legality is prescribed by the Law on Forests, which is not fully aligned with EUTR requirements with respect to the traceability obligation. 25% of respondents reported that cooperation with the competent judicial authorities is unsatisfactory due to the red tape bureaucracy. 50% of respondents indicated that their work is transparent with publicly available information. The same percentage of respondents stressed that the number of qualified inspectors is insufficient, also mentioning the lack of equipment and low salaries for those who should enforce the regulations related to illegal activities. Around 37% of respondents pointed out that the current level of available resources is better compared to levels observed 10 years ago, but efforts should be made to improve equipment for forestry inspection and the professional status of forestry inspectors, in the terms of provided education improvement, salary and employee status. 25% of respondents also indicated that the Ministry is currently improving the forestry information system, which will further contribute to the efficient implementation of the EUTR and strengthen the resources of the Ministry as a future Competent Authority. Regarding the expected future developments, 37% of respondents indicated that final adjustments are underway for the full implementation of the EUTR when Serbia becomes a member of the EU.

Conclusions

In this study, we investigated the perceptions of key stakeholders in the forestry sector in three Western Balkan countries – i.e., Slovenia, Croatia, and Serbia. Our research pointed out that those three countries, although sharing the same history and cultural background, implemented EUTR in different ways – Slovenia through the Forest Act, Croatia through a dedicated Law on EUTR, while Serbia did not yet fully transpose EUTR requirements into the domestic legislation. While interviewed stakeholders in all three countries find the awareness of the forestry sector on EUTR requirements to be appropriate, their attitudes on transparency vary. Transparency, availability, and accessibility of information are of crucial importance for an effective EUTR implementation, and in all three countries, there is room for improvement. The respondents from all three countries found the number of forest inspectors to be low, which is an impediment to an effective EUTR implementation. Both Croatia and Slovenia have no separate budget for EUTR implementation and invest minimal human resources: it would be needed to increase investments on EUTR implementation an ensure this is performed efficiently. This brings us to the conclusion that both Croatia and Slovenia, although with different governance structures, share a similar multifaced problem reflected in the amount of human and technical resources made available to check, monitor, prevent, and sanction illegal logging; the expertise/capacities of the above-mentioned resources, and the commitment of these resources to motivate relevant bodies and actors - including by ensuring appropriate salary levels – in order to avoid/reduce corruption risks. In this light, the EUTR-related forest policy frameworks in both countries can be characterized as many sticks, some carrots, and a few sermons.

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7.2.4 Does the current Polish State Forest Policy fit in with the European Green Deal?

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Key words: forest policy, New EU Forest Strategy for 2030, forest management compliance with EU regulations

For many years, forests and forestry, which are highly diversified on a global scale, have been subjected to many challenges, such as progressive climate change and the accompanying weather disasters, biodiversity loss, the need to ensure the sustainability of forests and forestry and to increase the share of forests as a source of wood to bind carbon and substitute for non-renewable materials as well as an energy source. Since the early 1990s, when the Earth Summit in Rio de Janeiro was held, the non-productive functions of forests, mainly of an ecological and social nature have been increasingly important. The sustainable forestry criteria and indicators have been developed. Forestry understood as human activity, like the natural world itself, is subject to evolutionary processes and is constantly changing its character. Various documents are published aiming at setting development trends and shaping the future of forests and forestry. In view of the above forestry in the European Union countries is influenced in particular by the conclusions of subsequent Forest Europe conferences and by various EU policies and directives. Documents prepared for such a huge mass of land as the joint area of the EU member states, often with different natural conditions, by their nature need to exhibit a certain degree of generality. The variety of conditions, in which forestry is practised in European countries and the resulting principles of forest management are an important feature of European forestry. On the other hand, the legal documents relating to forestry, adopted in Brussels must be respected by all the EU member states. Currently, the European Green Deal and the Fit for 55 climate package, which aims to reduce greenhouse gas emissions by 55% by 2030 and to achieve climate neutrality by 2050, play a significant role in shaping the future of forestry in Europe. One of the Green Deal initiatives is the New UE Forest Strategy for 2030, referring to the EU Biodiversity Strategy for 2030. In general, this Strategy specifies actions to increase the quantity and improve the quality of forest in the EU.

At present, there are different legislative solutions in place in individual countries, under which forest protection and management are practised. This is due to a lack of a uniform EU forest policy, which would define objectives and principles of forest management and reflect various environmental conditions differentiating forests in Europe. Recently, the EU has adopted documents at the level of strategy pertaining to the functioning of forestry. One of the key issues facing science today is the identification of activities undertaken in individual countries, which are consistent or differ from the horizons of forest management in Europe set for the 21st century.

Bearing in mind the above-mentioned facts, the authors made an attempt to identify the currently functioning legislative solutions in Poland in the context of the respective solutions adopted for Europe.

The most important documents regulating forestry in Poland include the Act on Forests and the State Forest Policy. Both documents were developed and adopted in the 1990s and despite their capacity and flexibility, they contain areas where they need to be updated not only to comply with the new EU strategies and regulations, but also to co-create and develop policies related to broadly understood forestry. The analysis of the provisions of the New Forest Strategy shows that many of the postulated actions are already included and implemented in the State Forest Policy.

7.3 Session 3: Wood and non-wood forest products

7.3.1 Revealing the hidden economic role of non-wood forest products in Italy using an extended Social Accounting Matrix

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Key words: Social Accounting Matrix; Multiplier analysis; NWFPs; Bioeconomy; Forest ecosystems

The international community now agrees that forest ecosystem services other than wood are important to the economy, society, and human wellbeing. In particular, non-wood forest products (NWFPs) have a social component, in addition to the market component, which produces a value within the economy, and this value is not currently quantified. There remains a lack of data at national and international level on the impact of this service within the economy, as well as a way to measure the direct, indirect, and induced effect. The aim of this study is to build a tool that makes it possible to quantify the contribution of the flow of NWFPs to households' wellbeing and the induced economic activities, choosing Italy as case study. By doing this, we show how NWFPs (and this can be applied to other ecosystem services in the future) contribute to the production of value within the bioeconomy.

Using a new extended Social Accounting Matrix for ecosystem services (EcosySAM), we found out that the social component of NWFPs is responsible for induced effects on the transport sector, as well as food and beverage activities (mainly restaurants), and accommodation activities. At the same time, we estimated the value of households' environmental services without payment, using the willingness to pay of people to go to the forest and collect NWFPs. Even though it does not represent a real monetary transaction, we inserted it into the matrix to highlight the benefit that forest ecosystem services can bring into the socioeconomic system.

It is critical to assign an economic value to ecosystem services and to understand how forest ecosystems interact with a country's economy, as well as who are the stakeholders involved. This will lead to the most beneficial management for both economic and forest systems.

Introduction

Non-Wood Forest Products (NWFPs) represent a particular category of forest products, characterized by a dual component. On one hand, the market component applies to products that are currently marketed and therefore have a market price. Examples of market contribution are: agroforestry (cultivation of NWFPs e.g. cork, chestnut or truffle); food industry (edible NWFPs as raw material); raw material for industry (e.g. construction); and health, personal care, and medical sectors (essential oils and bio-molecules). At the same time, they also contribute to income generation/diversification, rural economy development, and labour and trade. The social component, on the other hand, can be linked to the social and cultural services NWFPs provide, such as: recreation and tourism;

cultural values; biodiversity conservation (in relation to the social topic of climate change); ecological knowledge, collective forest culture; personal wellbeing; and employment (Wolfslehner et al., 2019).

Due to sparse and incoherent data, determining the true value of NWFPs is difficult. One reason for this is that many of these products are sold on informal markets or are not available for transaction. Furthermore, NWFPs are used and transformed in a variety of economic activities (e.g. in the cork value chain). Finally, the presence of NWFP pickers in rural areas can benefit other activities such as local shops and restaurants, but these effects are rarely quantified. This represents a significant omission in understanding how those forest ES currently having a non-market value can lead indirectly to economic transactions and/or purchase behaviour (Di Cori et al., 2021).

The worldwide System of National Accounts (SNA) partially accounts for activities related to the collection of NWFPs (as well as other ecosystem services), however their overall economic value often go unnoticed in official statistics (FAO, 2020; Sorrenti, 2017; World Bank, 2017). To extend this system, with the aim of representing the link between the economy and the environment, the System of Environmental-Economic Accounting – Experimental Ecosystem Accounting (SEEA EEA) (United Nations et al., 2014) focuses on accounts considering the role of ecosystems and their services. This framework has been implemented by the European Commission through the Knowledge and Innovation Project on an Integrated system of Natural Capital and ecosystem services Accounting (KIP-INCA) in the EU (Vallecillo et al., 2019). Here the ecosystem accounts highlight the value of the flows of ecosystem services to the economy and the impacts of the economy on ecosystem services. However, they do not allow for a deeper analysis of which economic activity benefits from the ecosystem services directly or indirectly. To fill this gap, we proposed to rely on the calibration of social accounting matrices (SAMs) extended to ecosystem services, to account for the interaction of the economy (in our case the European bioeconomy) with ecosystems. We named this new extended matrix EcosySAM (Di Cori et al., 2022).

Starting from the BioSAM (Mainar-Causapé et al., 2018; Stone, 1947), the new EcosySAM highlights how society benefits from NWFPs, through a value chain from the ecosystem to economic activities (forestry sector, industries and services) before arriving to the household. In practice, in the EcosySAM forest ecosystem appear as agent of the economy, supplying goods and services in interaction with other economic agents (Di Cori et al., 2022).

Thus, the aim of this study is to build a tool that makes it possible to quantify the contribution of the flow of NWFPs to households' wellbeing and the induced economic activities, choosing Italy as case study. By doing this, we show how NWFPs (and this can be applied to other ecosystem services in the future) contribute to the production of value within the European bioeconomy. It is important to notice that in this study we are not going to build the entire EcosySAM. This is only a first attempt to uncover one part of the forest ES being NWFPs, specifically its social component.

Material and methods

A SAM contains information about the economic and social structure of a country in a particular year. It is structured as a square matrix, in which each account is represented by a row and a column. Rows show the income, while columns show the expenditure. Each cell shows the payment by column account to the account in the row. However, usual SAMs do not include information on environmental accounts. For this purpose, a SAM can be increased by the modification or extension of its structure or simply by adding additional information by satellite accounts associated.

To build the new EcosySAM, we started from the BioSAM for the year 2015 in Italy developed by Mainar-Causapé and Philippidis (Mainar-Causapé & Philippidis, 2021). The BioSAM has a highly disaggregated agricultural sector, as well as bio-based industry to reflect the new sources and different utilization of biomass. For the purpose of this study, as a first step we aggregated these accounts at a higher level.

Once these sectors were aggregated, the next step was to identify the activities linked to the collection of NWFPs. For this purpose, we collected primary data on the social component of NWFPs, given the lack of available data at international level. Thus, in 2021 we conducted a study to assess two main threads: 1) direct and indirect costs related to NWFPs; and 2) the willingness to pay (WTP) of citizens for NWFPs. For the latter, the assessment relied on a choice experiment (Di Cori et al., 2021; Mariel et al., 2021). The reference year for the collection was 2018-2020, asking the respondents to inform about their pre-COVID pandemic behaviour. A sample of 919 people representative of the population resident in Italy replied.

The first thread was meant to highlight the part of those activities that can be traced back to NWFPs, thus showing the indirect effects of households' expenditure for the social component of NWFPs. This happens when the ecosystem produces a service, in this case the collection of NWFPs, which in turn induces economic behaviour of households towards other services. These services, as we identified them in the study, are e.g. food, restaurants, accommodation, renting of tools/equipment for sport activities, purchase of local products, travel costs. Once the accounts related to these services were identified in the BioSAM 2015, we opened them and added a row for the part of these services linked to NWFPs.

At the same time, the value going from forest ecosystem, passing through the forestry sector, and arriving to the household is measured by the WTP. This value represents the households' environmental services without payment. In order to show these services into the matrix, we opened the households' account. It is important to notice that this value does not represent a real monetary transaction from the ecosystem to the households, but rather a theoretical one, being the value people attach to this service. Nevertheless, we included this value in the matrix because in this way we could investigate whether there was a surplus between what households actually spend for this service and the value they attach to it.

Before inserting the data collected from the survey on NWFPs into the matrix, we first upscaled them at national level. To do so, for each NWFP studied, we estimated the parameters of the distribution function of the quantity of NWFP picked up by each person visiting a forest. Based on this distribution, we estimated the total quantity of each product by the entire Italian population. We use this data in combination with the marginal WTP to estimate the total value of the service from forest ecosystem to households. At the same time, to estimate the average expenses on transport and on non-transport activities, we estimate the parameters of a gamma distribution of the costs per visit per participant, minimizing the least square error between the real cumulative distribution and the cumulative gamma distribution.

Finally, to assess the wealth-generating properties of forest ecosystem as an agent of the economy, we are going to proceed with a multiplier analysis (Li et al., 2019; Mainar-Causapé et al., 2017; Malahayati, 2018; Philippidis et al., 2014). For this purpose, we are likely to employ two main types of multiplier indices: Backward linkage (BL) and Forward linkage (FL), measuring the relationship within different sectors of the economy. Particularly, BL is demand driven, meaning that it examines the network of upstream linkages with intermediate input suppliers, while FL is supply driven, meaning that it follows the distribution chain through subsequent layers of end users (Mainar-Causapé et al., 2017).

Results

From the survey, we estimated that the probability that an Italian resident visited a forest at least one time over the past 3 years was 65.4% (confidence interval at 95%: 4.7%), and 49.8% of those who visited a forest pick up NWFPs (confidence interval at 95%: 8.0%). Out of a population of 60.3 million inhabitants, about 19.6 million people in Italy went to pick up NWFPs at least once over the last 3 years, with an estimated average number of visits of 4.4 over the last three years. We therefore estimate that the total number of visits by Italian residents picking NWFPs is 28.7 (±5) million.

The expenses in euro per visit is reported by classes: 0, 1-25, 26-50, 51-75, 76-100, 101-125, 126-150, and more than 150 euros. On average, in 96.2% (±1.1%) of their trips, the visitors picking NWFPs spend money to travel to

the forest (car, bus, etc.), and in 92.2% (±1.6%) of their trips, they pay for non-transport services (such as restaurants). The number of persons participating in the trip is indicated in the questionnaire. Regarding the average expenses on transport and on non-transport activities, we estimated that travel expenses per person spending and per visit was 18.3 euros for transport and 20.8 euros per visit on non-travel. Taking into account the annual number of visits of Italian residents to the forest per year, and the share of visits that induce expenses, we estimate that the total expenses on travel to collect NWFPs in Italy represent about 508 million euros, and non-transport expenses related to this activity are about 550 million euros. Due to the chained processing of the original data, the confidence level can be hardly estimated.

Expenses related to picking NWFPs are responsible for 0.6% of the 97.9 thousand million euros of overall expenses from households to operate personal transport equipment or to use transport services and 0.5% of the 101.3 thousand million on food and beverage service activities in 2015 according to the final consumption expenditure of households by consumption purpose (Eurostat, 2022). This is represented in the Social accounting matrix in an account which we created splitting the household spending agent account.

We expect the result of the monetary value for the total WTP to be higher than the ones for expenses, and so to find the added value this service actually bring into the economy.

We also expect the results from multiplier analysis to be mainly "backward" oriented, meaning that every euro of intermediate input demand generates more than one euro of economic activity to the upstream input suppliers (Mainar-Causapé et al., 2017).

Conclusions

The need to promote the contribution of multiple values of ecosystem functions on people's wellbeing is one of the current topics highlighted by several international institutions and organizations, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in its latest Global Assessment Report on Biodiversity and Ecosystem Services (IPBES, 2019). In the same way, the European Commission in the new EU Forest Strategy post-2020 (European Commission, 2021), as well as in the European bioeconomy strategy (European Commission, 2018), acknowledges the multifunctional role of forests and their services as a source of innovation and resilience. The calibration of EcosySAMs will provide estimates of the link between the ES flows and the economy, and can become a tool to support the aforementioned international strategies.

The main limitation of this study is that it shows only a small part of the forest ES being NWFPs, specifically its social component. Thus, the EcosySAM is currently far from being complete. Nevertheless, this study shows how it is possible to capture the value added from forest ecosystems into the bioeconomy, highlighting the importance of developing policies that take into account the sustainable management of forest ecosystems and their services.

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7.3.2 Safeguarding forest natural assets by incorporating participatory approaches to natural capital valuation

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Key words: ecosystem services, assessment, stakeholder engagement, policy, impact

Introduction

The rapidly changing climate, the COVID outbreak and other consequences of the unbalancing of socio-ecological systems are evidence of an economic-climate-health crises which requires immediate and effective societal responses. The EU Green Deal introduced aims and measures which are essential for transforming societal courses of action towards long-term sustainability. Such transformations are also reflected in the EU Forest Strategy and related policies, placing nature-based solutions at their core.

Material and methods

This research has the focus on Scotland. The Scottish Government's aspiration is to increase the contribution of natural assets to a broad range of economic and social benefits, with the projections for woodland expansion to cover 21% of land in Scotland by 2032. However, the Dasgupta Report (2021), amongst others, stresses that humanity underestimates the true value of nature, and this results in the 'overconsumption' of natural assets. This points to a need for an improved understanding of the mechanisms to capture the values of natural capital, such as the role of forests in relation to climate change (ClimateChange@Hutton, 2022), facilitating the provision of ecosystem services (i.e., of public goods) and/or enhancing the condition of 'nature', e.g., through rewilding (AECOM, 2022).

In forestry, natural capital valuation can offer a basis for decision-making and monitoring the effects of policies, and land/resource management practices. Therefore, our transdisciplinary research was designed to answer the questions: i) what are the gaps in current natural capital valuation? ii) which of the dimensions of value would it be helpful to consider? iii) how could these value estimates be captured, measured, and assessed to support more robust and end-user friendly participatory planning, knowledge transfer and decision-support systems?

Results

This research is in its initial stage. We are working in a participatory environment in which stakeholder engagement, new technology, and advanced scientific methodologies are being brought together. This integration of methods, using a framework and new knowledge which is co-constructed and tested with end-users from Scotland will enable: i) wider incorporation of inputs from end-users into natural capital valuation, with an added value of spatial analysis of factors which support the interpretation of ecosystem services context in space, and of their changes through time; ii) understanding of the compromises which are required between those stakeholders or individuals who have different sets of values; iii) consideration (and explanation) of trade-offs, complexities and uncertainties that are not yet incorporated into decision-making (Jacobs et al., 2016); and iv) offering more inclusive, comprehensive, and impartial insights into the social value of ecosystem services that humans derive from woodlands.

By bringing in participatory approaches into natural capital valuation we seek to set up a success for Scotland in creating pathways to achieving societal impacts by providing opportunities to embed natural capital thinking into real world situations**.** We believe that an innovative and more participatory natural capital valuation could: i) offer estimates of how ecosystem services contribute to the generation of income and wellbeing; ii) provide evidence of the scale of benefits; iii) inform appropriate levels of payments for ecosystem services (PES) and determine whether a PES scheme is viable.

Conclusions

The outcomes could help inform decisions for policies, and on resource allocation, management, and use. When used in combination with cost estimates, and linked to demand for ecosystem services, natural capital valuation can help resolve potential conflicts, and guide the prevention of damages that inflict costs on society. Pathways to the creation of societal benefits will also be through proposing innovative policy instruments, relevant incentives, and diverse entities as catalysts towards enhancing social innovation and advancing forest policy and management. This paper will explain how this can be undertaken with the use of a new valuation framework, new integrative/mixed methods toolset and techniques, and new practices, social relationships, and deliberative, science-stakeholder collaborations.

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7.3.3 Wood utilization in Germany: drivers of utilization pathways and respective competition trade-offs

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Key words: Wood utilization, trade-offs, wood working industries, energy wood, Germany

Introduction

Wood resource markets show high complexity in their material flows. A comprehensive analysis of wood resource utilization comprises roundwood fellings inclusive of the processing of roundwood into semi-finished wood products such as sawnwood as well as the mobilization and recovery of other wood resources such as wood residues and post-consumer recovered wood to produce products like wood-based panels or wood pulp. In addition, considerable amounts of wood resources are used for energy generation and have to be recognized as well. With our presentation we aim to shed light on factors affecting wood utilization (hereafter referred to as "drivers") in Germany and point out situations that can lead to competition for wood resources (hereafter referred to as "competition trade-offs").

Material and methods

An analysis of such drivers and competition trade-offs has been conducted as part of an ongoing research project[1]. The applied method includes an extensive literature review to trace recent societal and environmental developments that affect the wood-based industries and, consequently, the wood utilization. Based on our qualitative analysis, we categorize political, economic, environmental and logistic drivers affecting wood utilization. We also provide examples for situations with strong competition for wood resources.

In addition, we assessed data on wood supply and demand for the 2000 to 2020 period. In our assessment, we distinguish primary wood resource supplies (roundwood) and wood processing residues. On the demand-side, we differentiate between wood use for energy and material purposes. This structure allows observing the linkage between different drivers and their impact on the demand for specific wood resources. It also allows analyzing which wood utilization pathway – i.e. material or energy - is better suited in terms of competitiveness.

Results

Preliminary findings show that between 2000 and 2010 the use of roundwood for both, material and energy purposes, experienced a considerable increment and since then, has been maintained relatively constant (TI-ESRR, 2022). The primary wood resources that have been used for material purposes accounted for 41.62 Mio. m^3 in 2000 and 55.18 Mio. m^3 in 2020. Increasing use of wood for material purposes can be attributed to drivers, such as increased wood demand in the construction sector, the end-use sectors (e.g. furniture and wood packing) as well as the external trade demand for intermediate wood products (e.g. sawnwood). The utilization of primary wood resources for energy production increased from 8.85 Mio. m^3 in 2000 to 23.62 Mio. m^3 in 2020 in Germany. The strong increment of wood energy generation can be partly explained by drivers such as climate mitigation policies, which support the use of renewable energies, but also by factors affecting wood energy utilization in

[1] Project name: BIOKRAFT - *The availability of woody biomass for the production of advanced biofuels in Germany and the EU-27 by 2040.*

the residential sector. For instance, increasing prices for conventional fuels can put incentives on households to substitute conventional fuels with wood energy.

Conclusions

Identified drivers show an impact on the wood resource market and cause potential competition trade-offs for wood resources among the wood-based industries. We observed that the competition trade-offs for wood are more pronounced among industries that use wood resources for material production. The reasons are various: unlike energy industry, the woodworking industries (e.g. sawmill or wood-based panel industries) usually have higher requirements for wood quality and fewer possibilities for subsidies. Additionally, in specific cases, they do not only compete with the 'wood-for-energy' demand but also among themselves.

Findings of our analysis contribute to understanding the complexity and interdependencies of wood utilization and can be relevant for policy development and future research in this field.

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7.4 Session 4: Forest management

7.4.1 Family forest owners' consciousness of the use of roundwood sales income in Finland

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Key words: Survey, economic consciousness, family forest owners

Introduction

Family forest owners are facing increasing societal demands with insufficient and often with incomprehensible economic information. In the Finnish Family Forest Owner 2020 survey, we focused as one focus area forest owners' assessments on the use of wood sales income and employed profitability measurements (Aalto et al 2022). According to the results, 1/3 of forest owners didn't assess their forestry profitability by any means, like prices, incomes, expenses or return on equity -types of measurements. Moreover, over 1/3 weren't willing to sell their forest property at any price to outside of the family and almost as great share of respondents couldn't assess any price for their forest property.

In qualitative interactive interviews it is possible to recognize and categorize individual responses, for instance if interviewed persons understand questions from different perspectives or respond in different ways. However, due to costs of interviews, qualitative surveys cannot be very large and typically they include some tens or at maximum some hundred interviews. In larger quantitative surveys questionnaires are mostly strictly formed with unified alternatives for responses. To study possible differences in understanding of economic issues, we asked respondents in the Forest Owner 2020 survey to assess rough proportions of their use of wood sales income, including the estimation of paid taxes on forestry income and property.

In Finland, the family forest owners are obliged to fill a separate forestry tax declaration, and the most forestry income is taxed at fixed capital income tax rate. The capital income tax is first withheld at source by a wood or other forestry product buyer. All other taxes forest owners have transfer to the tax authority by themselves, like gift and inheritance tax or tax on property exchange. The most forest owners also apply value added tax calculations and their net transfers to tax authorities on fiscal year basis.

So, the Finnish forest owners meet a mix of direct taxes under withholding and both direct and pass-through indirect taxes transferred to the tax authority by themselves. There is some empirical survey research on tax consciousness. Van Wagstaff (1965) studied wage-earners consciousness of withheld taxes. There were over- and underestimations of paid taxes, but respondents seemed to be aware of the fact that they had paid income taxes. Gideon (2015) reported that many people do not understand the progressive nature of the income tax system.

The objective of this study is to

(1) discuss on the consciousness of family forest owners on the economic issues and

(2) the use and reliability of quantitative survey methods in economic questions in forestry

by reporting the results of the Finnish family forest owners' use of wood sales income.

Material and methods

In the Forest Owner 2020 study, the survey population consisted of forest properties within a province owned by the same natural persons, heirs and tax partnerships. Selected forest properties had to have forestry land at least 5 hectares in Southern Finland provinces, 10 hectares in the provinces of Central Ostrobothnia, North Ostrobothnia and Kainuu, and at least 20 hectares in the province of Lapland.

The sample forest properties by provinces were selected by systematic sampling from the information system of the Finnish Forestry Center. The survey was carried out at the beginning of 2019. The sample of the survey was 15,750 sample forest properties. The survey form contained a common part and three sub-sample theme parts. Our study was based on questions both the common part and a sub-sample of one third with theme on the profitability of forestry.

The final response percentage of the entire questionnaire was 42.4, i.e. a total of 6,542 responses were received. The use of wood sales income was asked on the common part of the questionnaire and responses were analyzed with statistical methods (SPSS). The question and the use of wood sales income proportions (cash basis) to be filled by respondents was asked as follows.

"Estimate how you have roughly used the income from the sales of wood you have received in 2016–18 (stumpage sales, delivery sales and firewood and Christmas tree sales of the tax declaration)? Also try to estimate the taxes you have paid after deductions. Estimate the proportions so that the sum is 100%.

You don't need to answer to this question, if you are a member of a heir or a tax partnership or if you have had no income from wood sales in 2016–18."

For forest property and taxes	
1) agricultural and forestry expenses, investments and management of loans	_____%
3) acquisition of agricultural land	_____%
2) acquisition of forestry land	_____%
4) taxes on forestry incomes or property	_____%
For own use	
5) savings and financial investments	_____%
6) household daily expenses	_____%
7) household investments and management of loans	_____%
8) other business expenses, investments and management of loans	_____%
9) not willing to or cannot respond	_____%
Total	__100_%

Results

The results on the use of wood sales income are presented according to statistically different respondent groups, which were formed and named according to the responses 1) to use of wood income to taxes, 2) to forest property and 3) to not willing to or cannot respond. Gross reporters reported wood sales income used for the forest property, but only part of them reported that they had used wood sales income for taxes. Net reporters reported only own use of wood sales income. Non- and unsure reporters reported partly or fully not willing to or cannot respond. The proportions by groups are presented in the Figure 1. From the respondents, the gross reporters with taxes were 24% of properties and 29% of forestry land (abbreviated later P24/F29). The gross reporters without taxes were P20/F25, net reporters P22/F17 and non- and unsure reporters P16/F15. Additionally, there was a non-respondent group P18/F14, which was also statistically different from respondents

and their subgroups. E.g. forest owner age, education and area of forest property were among significant distinctive factors between groups.

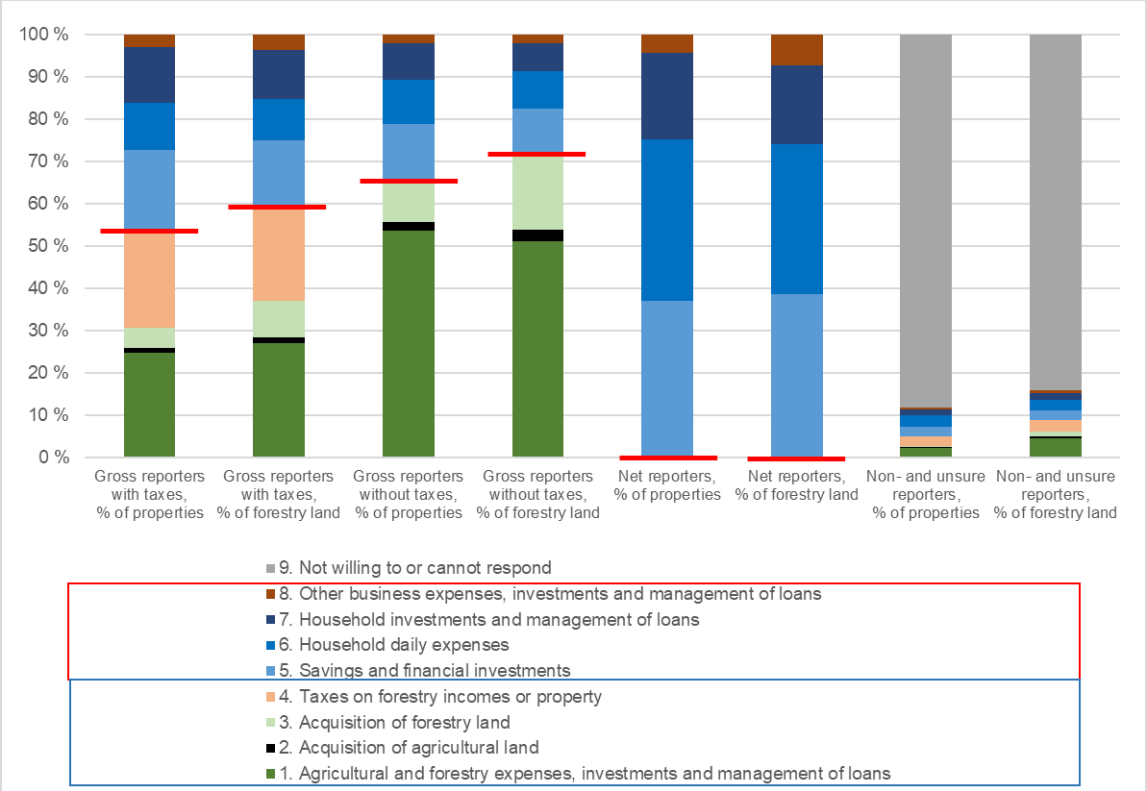

Figure 1 The proportions of the responses by groups on the use of wood sales income, groups by properties and by forestry hectares (n=2613).

Conclusions

In surveys, respondents may understand the given questions from very different viewpoints. To study this phenomenon, we asked Finnish forest owners to assess rough proportions of their use of wood sales income, including the estimation of paid taxes on forestry income and property. This revealed quite interesting features of the quantitative survey, as many forest owners didn't report any forestry expenses or paid taxes and therefore also all other reported proportions were incomparable without grouping the responses. In the Forest Owner 2020 survey we had to ask respondents to fill forestry operational and economic data for further analyses like wood sales and silvicultural activity studies. It seems, that the quantitative survey challenges are greater with economic data than with operational volumes (m^3) and hectares data. However, from the decision support point of view in the changing world, it is crucial for the forest owners to know structures of their forestry incomes and expenses, as well as other management payments like loans.

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7.4.2 New perspectives enable new solutions to forest management in small scale forestry - transaction costs from the perspective of private forest owners in Germany

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Key words: Transaction cost, small scale forestry, non-industrial private forest owners

Introduction

It is known, that small scale forest owners fall short of their forest utilization potential. This is often reasoned by a social-economically driven goal of preserving the forest value for their descendants. However, their behavior could also be explained by the costs they need to incur to participate in the forest market. These costs can be considered as transaction costs. Transaction costs belong to any economic activity, but they are specific, individual and not easy generated – especially for small scale forest owners. Applying the transaction cost theory on small scale forestry could open new solutions for mobilizing forest owners.

Material and methods

Therefore, I used semi-structured interviews to estimate transaction costs of seven differently organized forest owners with varying property sizes in Germany. Additionally, a harvest decision model was used to estimate the impact of transaction costs on the forest owner´s behavior.

Results

The analyzation of the interviews showed that a basic management structure, larger forest area and outsourcing to professionals lead to less transaction costs for the forest owners. In contrast, more owners per forest business or a smaller forest area per forest owner, less education on forests and forest management and a “do-it-yourself” operation strategy results in higher transaction costs. By using the model to quantify the impact of the transaction costs it can be demonstrated that increasing costs reduce the activity of forest owners and intensify the logging.

Conclusions

This study shows the importance of reducing transaction costs for forest owners and further improve market efficiency and access, especially for small scale forest owners.

7.4.3 How and why forests are often managed collectively: a systematic review of facilitating and hindering factors of collective actions

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Key words: Collective actions, forest management, systematic review, ecosystem services

Introduction

In a context where the world is rapidly changing, due to societal and environmental challenges, forest ecosystems play a fundamental role. Forests around the world provide multiple benefits to human societies that derive from Ecosystem Services (MEA, 2005). The level and spectrum of forest Ecosystem Services (ES) provided depends on forest management objectives,(Pukkala, 2016), that in turn is largely dependent on the forest owners, and by the legal framework (Nichiforel et al., 2020). More often than not, forest ownership is divided among different owners, hence the management, along with its effectiveness in improving the ecosystem services provision, of a fragmented forest and landscape is limited (Mitchell et al., 2015). There is growing scientific evidence (Fischer et al., 2019, Kittredge, 2005) that supports forms of management at landscape level, therefore involving several forest owners. These Collective Action approaches (CA) can be the cause of emergence of common pool resources issues. In this context, a key problem faced by policy makers in addressing such issue is understand what are the elements that facilitate or hinder collective action for forest management. Our work is a systematic literature review on the topic. The review scope included many types of CA, from forest owners' associations to participatory forest management, community forests and others.

CA is a voluntary action taken by a group in pursuit of common interests or for the achievement of common objectives (Meinzen-Dick et al., 2004a). CA can be enacted directly by members or through an organization (Meinzen-Dick et al., 2004).

CA in forest management can be instrumental in improving forest quality, generating higher rents, via marketed and non-marketed ES (Luintel et al., 2017, R. A. Bluffstone et al., 2018). CA can grant more investments Bluffstone et al., 2008, Mekonnen & Bluffstone, 2017) and greater social welfare (Beyene et al., 2016, Chhatre & Agrawal, 2009, Bottazzi et al., 2014, Rustagi et al., 2010, Tirivayi et al., 2018). There are specific advantages for a specific type of CA: forest producers' groups and organizations, which focus their actions on promoting economic interests of their members. They also help members to manage common risks for forests, such as wildfires, theft, pests, lowering the costs for management and tree protection and grant freedom to their members in engaging in non-forest work (Wang, 2012).

We had two main research questions: 1) what are the facilitating factors for a CA for forest management? And 2) what are the hindering factors for CA for forest management? Our objective was to understand how and why members of a community or individual forest owners decide to act collectively and initiate a CA to manage forests, according to the existing literature.

Material and methods

We conducted a systematic literature review following the PRISMA protocol (Page et al., 2021). We analyzed two databases of scientific literature, Scopus and Web of Science, and three specific repositories of literature on collective actions and forest management, i.e. AGRIS, CAPRI and CIFOR. The query used for Scopus and Web of Science in "TITLE-ABS-KEY" was "Forest management" AND "collective action*", while "Collective actions" was

the term used for the search on the three repositories. After removing duplicates, 129 documents were finally selected and reviewed. The date of publication of the documents ranged from 29/09/2021 (CIFOR) to the 1/10/2021 (Scopus, Web of Science, AGRIS, CAPRi). Each section of text referring to factors that facilitated or hindered collective action in forest management was inserted in a database. The database was organized in columns reporting authors, article's title, abstract, year of publication, database, type of collective action, facilitating factors, hindering factors, ambiguous factors, no-effect factors, country of the case study, general notes on the paper, methods and methodologies applied. Later the database was uploaded in Nvivo 12 (Release 1.6.2) and the factors' columns, the type of collective action were coded. The analysis of the results is based on such codes.

Results

We identified 46 different types of collective action related to forest management among forest owners, both as individuals and groups, such as villages and communities. The most frequent are those that are formally institutionalised, such as Community forest management (12 references), while collective action for risk management (7) and the creation of user groups for forest management (7) are the second most frequent. Informal types of community forest management, such as collective forest management, are mentioned in 6 of the studies that we analysed. Formal types of community forest management, such as the Joint Forest Management were mentioned 4 times. CA intended as participatory processes due to external opportunities are those linked to REDD+ projects and in participatory forest management. CA for some specific objectives such as sustainable forest management, forest conservation, forest restoration and reforestation account for a considerable number of collective action case studies we analyzed (9).

Facilitating factors accounted for 487 references, while hindering factors accounted for 176 references. Here below we report two Tables (1-2) containing our results in terms of type of factors and frequencies. Table 1 displays facilitating factors and the sublevels. Frequencies are reported in brackets. Table 2 displays the hindering factors, their sublevels and frequencies.

Table 1 Facilitating factors and frequencies

Main facilitating factor category	***Sublevel 1***	***Sublevel 2***
Attitudes and opinions of stakeholders (1)	i) reciprocity expectations (1), ii) shared views and opinions (10)	
Availability of instruments (2)		
CA calls for CA (2)	i) current experiences of CA (6), ii) past experiences of cooperation and CA (5)	
Community characteristics (23)	i) group size (6), ii) role of resource in livelihood (5), iii) socio-demographic trends (4), iv) social dimension (8)	
External influence (20)	i) CA developed in the vicinity (4), ii) external obstacles for accessing resource (1), iii) external support (39), iv) external trends (8), v) lack of support from institutions (1), vi) state-regional policies (31)	iii) external support for social capital development (6), public institution support (13), private support (14), v) collective forest management policies (20), land tenure reform (3)
Governance characteristics (26)	i) management (5), ii) regulation and monitoring (29)	i) management skills (8)
Incentives (1)	i) direct economic incentives (7) ii) Indirect economic incentives (13)	
Leadership (12)	i) leader's action (3), ii) characteristics of leadership and leader (9)	

Perception of risk for the resource (6)	i) threats to resource (15), ii) alignment in risk management (4)
Resource characteristics	i) quality of resource (3), ii) quantity of resource (3)
Secondary data (6)	
Social capital (43)	i) participation and its drivers (22)
Social status (2)	i) social heterogeneity (2), ii) social homogeneity (2),
Wealth status (1)	i) economic heterogeneity (3), ii) economic homogeneity (3)

Table 2 Hindering factors and their frequencies.

Main hindering factor category	***Sublevel 1***	***Sublevel 2***
Attitudes and opinions of stakeholders (14)	lack of shared vision (8)	heterogenuous visions (2)
Community characteristics (7)	i) barriers to market access (3), ii) social dimension (2)	
External influence (5)	i) excess of involvement of a coordinating body (1), ii) lack of external support (1), iii) presence of a strong central institution (7), iv) unsound policy (4)	
Governance characteristics (17)	i)lack of transparency in decision making process (1), ii) land tenure rights (1), iii) no definition of community forest management (1), iv) power dynamics (3), v) regulatory barriers (1),	ii) land use conflict (2)
Illegal behaviour (5)		
Lack of clarity on benefits from CA (1)		
Lack of instruments to protect CA outcome (1)		
Lack of action arena		
Lack of skills (1)	i) lack of management skills (5), ii) lack of skills in conflict resolution (1)	i) lack of coordination skills (1)
Leadership (6)	i) lack of interest on issues from leadership	
Long term commitment to see results (2)		
Market issues (5)		
Negative experiences of CA (2)		
Resource characteristics and dynamics	i) quantity of resource (3), ii) role of resources in livelihood (2), iii) Scale of risk to resource (2), iv) threat to resource (2)	ii) high current dependency on resource (1), small role of resources (5)
Social capital (9)	i) no communication (1), ii) participation issues (12)	ii)wealth heterogeneity and participation (2)
Social status (1)	i) social heterogeneity (12)	
Wealth status (3)	i) economic heterogeneity (3)	
Underdeveloped infrastructure (2)		

Conclusions

While several factors, such as many of those linked to social capital, such as trust and social norms, and community characteristics, such as group size and socio-demographic characteristics, might be well-known, others could be considered more surprising, or at least less considered in literature. A particular example is the category of factors related to external influences, such as the support of NGOs in CA emergence.

Other examples of external influences can be unsound policies by central authorities that limit the ability of forest owners to cooperate. Identifying the complete list of factors influencing the emergence of collective actions for forest management could prove to be an endless task, as suggested for success factors by Agrawal (2001). Nonetheless the results of the review provide useful insights on advancing in the current knowledge and a solid ground for further quantitative research on potential relationships among both facilitating and hindering factors. Through this overview, scientists and policy makers can make better-informed decisions on how to promote collective forms of forest management.

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7.4.4 Forest investments as Nature-based Solutions: financing sources and partnership mechanisms

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Key words: Nature-based solutions, urban forestry, financing

Introduction

At global level, the quality of life in cities is endangered by some correlated dynamics, such as general rapid urbanization (UN, 2019) and impact of climate change effects, that threatens the citizens quality of life.

Nature-based Solutions (NbS), defined as "Living solutions inspired by, supported by or copied from nature and which aim to help societies addressed a variety of environmental, social and economic challenges in sustainable ways" (EC, 2015), can contribute to mitigate these pressures achieving more resilient, livable and sustainable cities (SDG 11.7) (Cohen-Shacham, 2016; Kabisch et al., 2016) and to help in addressing the sustainability and climate neutrality objectives of the EU (EU, 2020).

Several studies show their potential in providing many positive environmental impacts, such as pollution removal and CO2 sequestration (Abhijith *et al*., 2017), heat islands effects mitigation (Koc *et al*., 2018, Aram *et al*., 2019, Stewart and Oke, 2021), water security and treatment (Nika *et al*., 2020, Boano *et al*., 2020, Song *et al*., 2019), disaster risk reduction (Naumann *et al*., 2014, Potschin *et al*., 2014; Terton, 2017, Ozment *et al*., 2019), habitat and biodiversity protection (Parker *et al*. 2020, Chausson *et al*., 2020, MG Hutchins *et al*., 2021). Concerning the social dimension they can also possibly contributing in better physical and mental health conditions on citizens (de Vries *et al*., 2003; Swanwick, 2009; Hansmann *et al*., 2007; Kabisch *et al*., 2016; Kabisch and van den Bosch, 2017; Terton, 2017, van den Bosch and Sang, 2017, Venkataramanan *et al*., 2020) increasing sociability and active lifestyle and in generating economic benefits, aesthetic improvement, cost saving or avoided costs in long-terms; also in comparison with grey alternatives (Terton, 2017; EC, 2015).

But despite the evidence these studies provide, NbS implementation face a significant investment gap. Public funding alone, the most used for these kinds of interventions, are not enough to bridge the financial needs to achieve the climate neutrality objectives that the EU has set and to which NbS contribute (EU, 2020). The possibility of attracting and leveraging private resources has become fundamental (Mayor et al., 2021) but hindered due to some barriers linked to NbS: long term and mostly public perceived impacts (Polzin, 2017; Toxopeus, 2019), difficulties in identifying suitable and standardized performing metrics, in assessing and monetizing the impact of NbS that have generally illiquid characters (Campiglio, 2016), lack of market readiness and difficulties in measuring potential cash flows and risk/return from investment. There is the need to develop strategies to overcome these barriers and enable finance for NbS with alternative financing solutions (Mayor et al., 2021), through coordination across public and private financiers. Furthermore, capturing multiple NbS benefits in valuation and accounting methods (Toxopeus et al., 2021) and allowing the knowledge transfer between science, policy and planning (Chausson et al., 2020). Certainly, some positive trends are emerging, such as the growth of the sustainable finance market (AXA IM, 2020), and new types of effective public-private collaboration that share risk and gain innovation and internalization of externalities by enabling trading mechanisms (Polzin 2017; Mazzucato and Semieniuk, 2018; Geddes *et al*., 2018).

Material and methods

In literature NbS are studied mainly considering the impact NbS provide but there are not comprehensive studies about the link between NbS typologies, ecosystem services potentially provided, nature of the benefit and time

horizon of the impacts. These aspects are relevant in order to find the most appropriate financing sources and mechanisms and to propose innovative (or little explored) public-private collaboration solutions. The framework is tested looking for evidence in the Naturvation ATLAS Database, a comprehensive collection of about 1000 urban NbS cases at European level, with a special focus on forest-related investments.

Results

The results of the paper provide an overview about the involvement of private sector and the private-public partnerships in implementing NbS at European urban level, in particular considering financing sources and types used to NbS funding, class of costs, the environmental and social impacts generated, the beneficiaries and possible monitoring systems used to assess the impacts.

Conclusions

Final consideration and remarks related to the barriers and possible key strategies to foster the involvement and the collaboration between public and private actors are provided, also with the aim of giving indications regarding the needs for future research on the topic.

7.5 Session 5: Forestry and society

7.5.1 Recapitulation of the provided state services to small forest owners close to urban areas in the Czech Republic

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Key words: state service, urban areas, small forest owners

Introduction

Urban and peri-urban forests provide multiple ecosystem services for city dwellers, including water, opportunities for recreation and tourism, climate regulation and habitat provision. Recreational forest management has its peculiarities. Locally competent district inspectors, employees of the land administration of the forest administration and employees of supplier companies encounter situations here that their colleagues do not have to deal with. This is especially the area around Brno.

First of all, there are hundreds of cottages, built from the 50s to the 80s of the 20th century on land intended to fulfill the function of a forest. This land was supposed to be an production forest, but over time it has been transformed into a forest that is intensively used by the city's inhabitants, so it should rather be evaluated as a suburban forest or even urban green infrastracture. Initially mostly as wooden buildings with simple equipment, without electricity, water, with dry toilet. Over time, although forest laws restricted and prohibited this, some cottages turned into year-round habitable brick buildings, which in many cases are also inhabited all year round. And with that come the requirements for the introduction, reconstruction and expansion of power lines, originally intended only for large corporate recreational facilities, of which today are private hotels and guesthouses. The number of requests for approval for the establishment of wells on the land of the Czech Republic is increasing. The city of Brno, which has invested considerable funds in reducing cyanobacteria in the Brno dam, would like to drain the area around the dam. The owners of some cottages want to significantly expand them as part of the renovation. In the vicinity of the cottages, there is an illegal occupation of PUPFL (land intended to fulfill the function of a forest) in order to establish facilities for cottages - warehouses for wood and other materials, outdoor seating and fireplaces, attempts at landscaping.

Forest management in cottage areas is very difficult. Some trees are unminable by conventional technologies, on the other hand, cottagers' requests to cut down trees that cottage owners find threatening are constantly being addressed - perhaps only by leaning in the wind, even if they are OK from a forestry point of view. And they don't understand at all that they should arrange and finance such felling themselves. Thanks to the media, people demand the pruning of tree branches along the lines of urban greenery, without realizing that they are not in a city park, but in a forest. New plantings are intentionally or unintentionally destroyed because they shade the cottages or the cottagers simply do not want to bypass them. Fences need to be repaired more often because children climb into them.

With the advent of the times of recreation, alternative tourism has undergone a rapid development, outdoor recreation has been evolved as one of the core forms of contemporary leisure activities. A growing emphasis is being attached to the impact of recreational activities on economy, environment and social culture. There are lots of differences between outdoor recreation, general tourism and mass tourism in terms of the purpose,

function, efficiency and activity patterns. Based on the concept of “nature-based tourism”, outdoor recreation is committed to the pursuit of certain benefits in most cases (Young, 2007). The forest is an important carrier for outdoor recreation, and is becoming an important tourist destination (Lee et al., 2004). Urban forest also forms an important recreation environment based on its wealthiness in eco-resources and good accessibility for city dwellers relatively (Koo et al., 2013; Rosenberger et al., 2012). In particular, the paper should assess how peri-urban forests are used and what support and services are provided to their owners.

Material and methods

The method of preparation of the paper consists in the evaluation of available information from the state administration and other important research institutions in the Czech Republic. The method involves constructing a conceptual model from the review of related literatures. Cross-referenced citations from papers were initially discovered from a data-base to identify new studies not found via our key-word search. Key words were specifically targeted as urban forestry, arboriculture, urban planning, and geography literatures. There was searched for potential literature to include also using the terms vulnerability, tolerance, and sustain-ability, as these terms are often used to describe the same concept as resilience. Searched titles, abstracts, and keywords and compared those results to searching the whole text, finding that expanding to the whole text did not add relevant papers because these terms had to be central to the paper and thus always appeared in the abstract or keywords. On the end – relevant law was examined for the purpose of this paper.

Results

Procedures for the management of forests with a significant recreational function should be differentiated according to the importance of this function. Staying in the forest is concentrated in cottage locations, which are mostly located in recreational areas. At Brno are the recreational areas of Brno Reservoir, Holedná and Ponávka. The recreational areas have been declared as areas of recreational interest of the city and their boundaries are anchored in the spatial plan. The rules governing the operation in recreation areas and allowing for enforcement are usually part of the operating rules, which visitors to the recreation area have the opportunity to review in a publicly accessible location. Brno recreation areas are currently not equipped with any valid operating rules, therefore the definition of recreation areas. There are no obligations arising from the definition of the recreational areas. Therefore, the only instrument of regulation in recreation areas is the Building Act. The only tool for the recreational areas is the zoning law.

Cottage areas are a special legacy of the past, as with strict respect for the forest law, it would not be possible to build such structures in the forests. Yet even today, the forest law is being circumvented and these buildings are being built under the guise of forestry buildings, but this is not happening on a mass scale. There is great pressure on removal of the land around these buildings from PUPFL and subsequent conversion to another type of land, allowing, for example, for fencing and further construction and expansion, these structures then create pressure on transport services and facilities, thicken traffic in recreational areas, increase demands on road capacity, parking areas, increase emissions and additional forest pollution. Buildings, paved areas and roads disturb the landscape. At the same time, it is dangerous trend that in attractive recreational areas of suburban forests, buildings for individual recreation are gradually being reconstructed into buildings enabling permanent housing with the parameters of a family house and this housing is becoming increasingly expanding, as the Building Act and related legislation allow for this. This makes the original cottage areas and cottage developments in the most attractive and accessible parts of the Brno suburbs recreational forests are being covertly transformed into urban areas with permanent housing and thus gradually reducing the recreation potential in the long term.

The following financial contributions and support programs are available to forest owners, forestry entrepreneurs and users of hunting grounds:

- forest management allowances from the budget of the Ministry of Agriculture,
- forest management allowances from the budget of the regions,
- contributions for selected hunting activities,
- contribution to support the adaptation of forest ecosystems to climate change,
- reimbursement of costs under the Forestry Act,
- services provided to forest owners,
- support for accredited forestry consultancy activities,
- subsidies for the protection and reproduction of the forest tree gene pool,
- selected operations of the Rural Development Programme 2014-2020 and information for the 2021-2022 transition period,
- selected programs of the Support and Guarantee Fund for Agriculture and Forestry,
- refund of tax on diesel consumed in forest management.

Conclusions

Forests in the Czech Republic are open to anyone, whether they are state-owned or not. One inhabitant visits a forest an average of 21 times a year. However, this is far from being the case in many parts of the world, including some European countries, where property rights are placed above the ability of people to enter forests. Moreover, many non-state owners are accommodating visitors by building cycle paths, single track, horse riding trails, car parks, rest areas and viewpoints. For them, this means work and costs beyond the normal management of the forest. Visitors can still make a mess of it. The high number of people during the season brings with it damaged flora and disturbed wildlife, which causes even more damage to the forest crops due to stress. Damaged trees are then less resistant to infections, insect pests, rodents and wind calamities. Every visitor to the forest should therefore be aware that they are visiting and adjust their behavior accordingly.

The social effect of forests expresses the level of fulfilment of human social requirements by forests. Ecosystem capabilities are dominated by the way they are socially utilized. Social requirements and uses are also usually not linked to forest ecosystem units, but to specific areas defined by units of organization and spatial arrangement. This is also related to the links to forest categories, ownership relations, forest accessibility, forest amenities, etc. Social (as well as interest and group) requirements, as opposed to socially necessary (life-sustaining) requirements, are usually defined in actual space and time. The social 'level' of forest functions is therefore called the 'current social effect' of forest functions. Supporting other engineering and policy solutions, urban forests can help address these issues through the provision of regulating ecosystem services (ES) such as heat amelioration (Doick and Hutchings, 2013); stormwater attenuation (Armson et al., 2013); and air purification (Escobedo and Nowak, 2009). There are calls for additional tree cover in cities worldwide in order to improve resilience to climatic changes and enhance quality of life (e.g. Salbitano et al., 2016). However, funding for urban trees and other green infrastructure has declined in many cities, particularly in Europe, exacerbated by government austerity (Van Zoest and Hopman, 2014, Kabisch, 2015).

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7.5.2 Environmental Awareness, Perceived Threats and Opinion on Natural Resource Management Among Local Residents

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Key words: perceptions, traditional ecological knowledge, natural environment, survey, Karst, Slovenia

Introduction

Safeguarding the multiple ecosystem services provided by forests and other land uses that provide numerous benefits to society is a unique challenge from a management perspective (Rolo et al, 2021). When making decisions and taking actions regarding natural resources, decision makers have an obligation to consider available professional and scientific evidence. Moreover, considering the preferences of residents and relevant stakeholders would strengthen and legitimize their decisions (e.g., Barnaud and Van Paassen, 2013; Berkes et al., 2000; He et al., 2018; Tattoni et al., 2017). Since some traditional ecological knowledge and specific needs are limited to local residents, more informed and relevant decisions can be made about natural resource development in the region through feedback from this heterogeneous stakeholder group.

Participatory approaches are now widely used in science and practiced in many real-world places with different strategies and means (e.g., Barnaud and Van Paassen, 2013; Santos-Martin et al, 2017). He et al. (2018) recognized that local communities are one of the main actors in conservation planning. In addition, Nastran (2015) pointed out that landowners usually have decision-making power and control over the activities surrounding their lands. In the case of protected area creation, she noted that visitors often cause damage and noise pollution and put landowners in a hopeless situation due to inadequate laws. Finally, Poltimäe and Peterson (2021) recently found that general environmental awareness is associated with a higher likelihood of taking various management actions. The aim of this work is to analyze some aspects of natural resource management as perceived by local residents, including their perceptions of threats to the natural environment.

Material and methods

We conducted a survey to examine how local residents perceive selected aspects of natural resource management. We focused on a very heterogeneous region in southwestern Slovenia. The survey was conducted anonymously via online questionnaire in spring 2021. The questionnaire was issued to a sample size of 1,000 people from a population of 29,940 adult residents of five municipalities located in the study area: Sežana, Divača, Hrpelje-Kozina, Komen, and Miren-Kostanjevica. The sample was simple random and was prepared by the Statistical Office of the Republic of Slovenia. The units of the sample were randomly selected and the number of units was proportional to the number of inhabitants of the five municipalities.

The questionnaire contained closed questions where respondents were asked to choose an answer on a Likert scale. The questionnaire included questions about respondents' natural environment activities, views on natural resource management, and demographics. The questionnaire was developed based on a literature review (e.g., Baró et al., 2016; Rodríguez-Morales et al., 2020; Schmidt et al., 2017; Wang et al., 2017) and a preliminary study of regional development materials.

We received 170 responses, of which 126 respondents answered the questionnaire completely. Thus, we used 126 respondents' data sets for further analyzes. The data were organized in MS Excel® 2019 and analyzed in JASP v0.14.1 software. Descriptive statistics and nonparametric tests (i.e., Spearman correlations, Mann-Whitney U test, Kruskal-Wallis test) were performed to analyze the data and find relationships between the different questions (e.g., (Wilhelm et al., 2020).

Results

Respondents were on average 51 years old and had lived in the study area for an average of 42 years. The majority lived in the largest municipality, Sežana, followed by Miren-Kostanjevica and Divača. Within the municipalities, the vast majority of respondents (73.6%) lived in rural areas, while the others lived either in the city center (16.8%) or in a suburb (9.6%). High school education predominated among respondents (41.1%), followed by respondents with college degrees (31.5%) and college graduates (20.2%). More than half of the respondents had a permanent employment contract and 8.9% had a short-term employment contract. Fourteen respondents were unemployed or students and 26.0% were retired. Of the employed and retired respondents, 38.5% received an income between 1,000 and 1,500 EUR, 35.4% below 1,000 EUR, and 26.1% above 1,500 EUR. The majority of respondents (62.7%) were owners of at least one property; 32.5% of respondents were forest owners.

Respondents were asked about general changes in the environment since 2000. The majority of respondents agreed or strongly agreed that many agricultural fields have undergone old-field succession, that land use has changed, that tourist visitation has increased, that the extent of infrastructure objects has increased, and that lifestyles have changed. The positive and significant correlation between the change in lifestyle and old-field succession and the change in land use indicates a departure from the traditional agricultural lifestyle. Respondents also perceived that the wildlife population has increased and that the quality of the natural environment has deteriorated. The perceived increase in wildlife population is related to the perceived old-fields succession, leading to the conclusion that abandonment of agricultural fields will trigger succession that will increase wildlife population and increase potential human-wildlife conflicts. Yet, respondents do not see increasing wildlife populations or agricultural activities as a major threat. Instead, respondents see illegal dumping and pollution as a major threat to the natural environment and especially to (underground) water resources. Fires in the natural environment were perceived as a relevant threat, considering that there have been some large-scale (forest) fires in the last two decades.

Regarding opinions on natural resource management, the majority of respondents agreed or fully agreed that human intervention is crucial for the conservation of nature. In addition, the majority of respondents agreed or fully agreed that residents' traditional ecological knowledge of the natural environment is important for the development of the region. In their opinion, ensuring a healthy state and use of the natural environment should be undertaken by public institutions and especially by local communities or municipalities. In order to improve the management of natural resources, respondents on average agreed that conservation requirements are not binding enough and that the implementation of laws and policies is insufficient. In addition, most respondents agreed that agricultural policies are based on the wrong incentives, leading to a questionable state of natural resources and a mismatch between supply and demand for some ecosystem services.

With the exception of a few specific questions, we found no statistically significant differences among respondents' demographic characteristics (e.g., age, gender, place of residence, education level, personal income). Forest ownership did not affect opinion on most statements, nor did gender, place of residence, education level, or personal income. The fact that the study area is essentially rural may explain some similarity in respondents' perceptions. However, respondents who are actively involved in activities to preserve or improve the quality of natural resources tend to be more supportive of the importance of traditional ecological knowledge and ownership of part of the natural environment. On the other hand, they mainly believe that conservation requirements are not binding enough and that public institutions (e.g., municipalities) should ensure the healthy condition and use of the natural environment.

Conclusions

We can conclude that respondents are aware of important potential threats to the natural environment related to perceived changes in the natural environment. Because we did not ask respondents about specific actions and measures they are taking to mitigate the perceived threats, this question remains open for future study. The results also suggest that active participation in conservation activities increases the likelihood of being more environmentally aware. Respondents' attitudes toward supporting stricter regulations are likely a result of their perceived inconvenience to visitors and users of ecosystem services.

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7.5.3 How to enhance the capacity of forest management to adapt to the multiple challenges? A case of Swiss communal forest

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Key words: adaptation, multifunctionality, innovations, climate-smart forestry, wood energy, forest owners' cooperation

Abstract

The increasingly tangible impacts of climate change, accelerating socio-economic dynamics and growing demand of the civil society for forest ecosystem services (FES) call for an adjustment of forest management (FM) and governance practices. Responding to these challenges in a flexible and sustainable way is particularly important for small-scale, communally owned forests in Switzerland, where an increasing engagement of forest-associated stakeholders has been observed. Against this background and focusing on communal ownership regimes in three Swiss case studies, our paper aimed at (i) identifying and analysing current challenges (e.g. climate change, energy transition, stakeholder expectations, and market fluctuations) that communal forest management is facing in three selected case studies in Switzerland; and (ii) investigating how forest management is responding to these challenges and (iii) which factors enhance the capacity to adapt (focusing on e.g., social innovations, new goods and products developments, cooperation strategies and networking). We determine possible opportunities, barriers and trade-offs, and show promising governance options for integrating various social and economic objectives in times of multiple challenges. We found that innovation in forestry (social, organizational, product innovation) as well as application of forest bioeconomy is seen as a way to adapt to the multiple challenges. Our findings lead to recommendations on how communal forests in diverse institutional contexts, complex and dynamically changing political and socio-economic situations can be governed and managed to achieve a sustainable provisioning of ecosystem services.

7.6 Session 6: Sustainability aspects of forestry and timber use

7.6.1 Employment in the forestry and wood sector in Ecuador

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Key words: Labor market; Employment conditions; Forestry Sector; Ecuador.

Introduction

Located in the South America, Ecuador has 12.4 million hectares of forest, accounting for 44.8 % of its continental territory (Ministerio del Ambiente, 2017). The native wood market in Ecuador is mainly supplied by forest remnants, as the production from plantations is small for the country's potential. The regions where most timber from plantations is produced are in the Coast (49%), followed by the Andes (38%) and the Amazon (12%). In addition to its contribution to biodiversity and the sustainability of the country, the forestry and wood sector is a relevant sector in the economy, due to its contribution to the national economy, employment generation, and poverty alleviation. In 2020, the total contribution of the forestry and wood sector (excluding pulp and paper) to the economy was estimated at 1.97% (CFN, 2019, 2021a, 2021b)**.** The contribution to GDP from forestry and logging was estimated at 0.99% in 2020. Followed by wood industries and furniture with 0.68% and 0.30% respectively. The employment generated by the sector is both formal and informal, only the first one is analyzed in this study due to the lack of information on informal employment between 2010 and 2020, the forestry and timber sector created an average of 26 thousand formal employments per year. In 2020, it formally employed 23 thousand people (INEC, 2022).

This study is conducted within the framework of the Wood for Work[2] project. It is aimed to present the main characteristics of employment in the forestry and wood sector in Ecuador. For this purpose, we review national level statistics and literature on employment in the forestry sector, for the period of 2010-2020. From the analyses, we derive conclusions aimed to improve the quality of data for this sector, as well as some insights that could serve as a basis for the development of policies that help to improve the current labour conditions in the forestry sector.

Material and methods

This study was developed for the entire Ecuadorian continental territory. Various public sources of information were used for the analysis: National Institute of Statistics and Censuses (INEC) of Ecuador, the Food and Agriculture Organization of the United Nations (FAO), and the World Bank (WB). The analysis follows the International Standard Industrial Classification (ISIC), at 4-digit level. For this study we considered the following three subsectors: (i) forestry (silviculture and other related activities; timber extraction and sawn wood production); (ii) wood (manufacture of veneer sheets and wood-based panels; and sheets for veneering or plywood or laminated woods); (iii) furniture. We excluded from this analysis the pulp and paper subsector

[2] The project is funded by the German Federal Ministry of Food and Agriculture through the German Federal Office of Food and Agriculture (BLE) due to a decision of the Deutsche Bundestag, and coordinated by Thünen Institute of and UNIQUE land use GmbH, in cooperation with FAO and the Universidad Nacional de Loja, Ecuador.

because there is no significant production in the country. The Directory of Companies (DIEE) compiled by the INEC, provides statistical information on the companies formally established in the country and it only comprises data on formal employment, therefore, the results presented in this study do not address informal employment.

Results

The forestry and wood sector generated an average of 26,000 formal jobs between 2010 and 2020. In 2020, it employed 23 thousand formal employees. Figure 1 shows that the largest number of forest-related jobs was recorded in 2015, with 30 thousand formal workers. The decline is explained by the national economic crisis that has affected the country since the oil crisis of that year and was exacerbated by COVID-19.

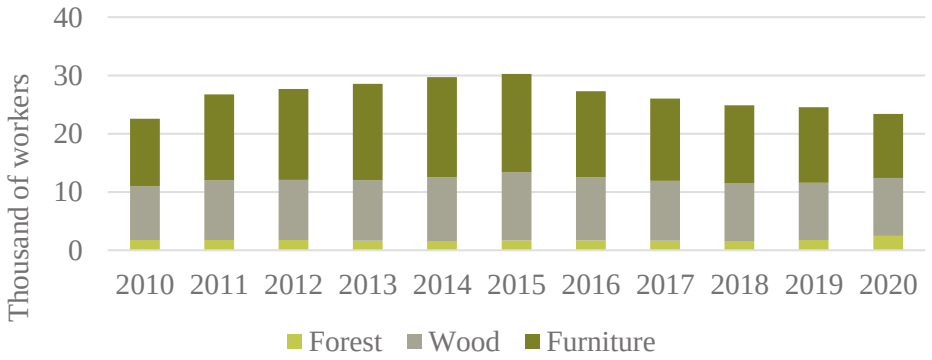

Figure 1: Number of employees (thousands) by type of industry between 2010 and 2020 (Source: INEC, 2022)

The three subsectors had a majority male participation in labor contracts along the ten years analyzed. In forestry, men employees accounted for 87% of the total workers registered in 2020 (2,160 workers out of 2,490) (INEC, 2022). The wood industry showed similar figures, 85% (8,460 out of a total of 9,933). Furniture manufacturing industry registered 77% of male employees. It should be noted that, during the period analyzed, the forestry subsector almost doubled its participation of women (from 198 to 330). The gender situation in Ecuador's forest sector is contrary to the employment trend in other economic sectors, where the incorporation of women into the labor market has been greater than that of men.

The average monthly remuneration of employees in the forestry and wood sector in Ecuador was approximately USD 569 in 2020, which is 42 % more than the minimum wage legally established by the country (USD 400 until 2021) and 36% more than the national average salary (USD 419 in December 2020)(INEC, 2022).

As shown in Figure 2, although female participation is lower in the total registered employment in the forestry and furniture industries, their wage compensation is higher than male employees. In 2020, the gender gap was 39%, having increased by 56% compared to 2010. In the furniture industry, the gap remained stable in the decade analyzed, with female remuneration being 13% higher to the masculine. In the case of the wood industry, women received in 2020 a salary 2% less than men, less than one-sixth what it was in 2010 (12%).

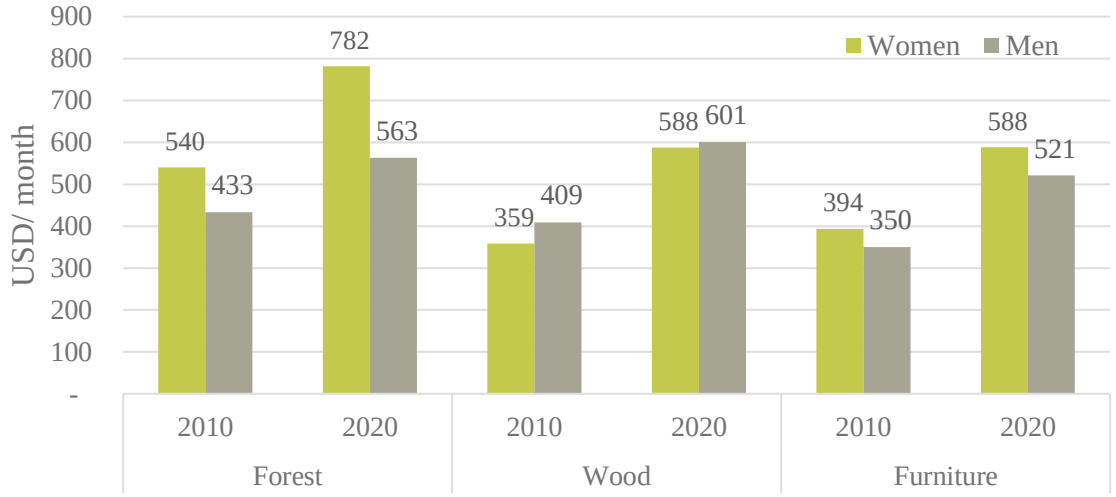

Figure 2: Average monthly wage by gender and type of industry between2010 and 2020 (Source: INEC, 2022)

Conclusions

Job creation in the forestry and wood sector is an important indicator that makes it possible to quantify the contribution of this sector to the economy of a country or region. The Wood for Work project aims to generate reliable information on the employment situation along the forest-related value chain in various economies of the world. In Ecuador, a country where only 33% of people have a decent job, employment in the forestry and wood sector helps to diversify the household income portfolio and to alleviate poverty. On average, approximately 26 thousand employees were employed in the sector between 2010 and 2020, most of them being male employees. However, women earn about the same or more than men. The lack of data on employment in the forestry sector, mainly in the informal segment, highlights the need to conduct in-depth studies focused on subsectors that tend to be overlooked in the national statistics. A forthcoming step of this project will be to conduct a case study of the forestry sector of native timber production, since it is the main source of raw material for the sector. New results are expected to show the general trends described above for the sector.

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7.6.2 Gender wage gap in the European forest sector workforce - a statistical analysis

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Key words: Labour market, pay gap, earnings, job quality, gender equality

Introduction

Female participation in paid work has increased in Europe over the last 20 years (Eurofound 2015) with labour markets often remaining gender-segregated (Mangubhai et al. 2022). This in particular holds true for the forest sector, which is still, to a large extent, male-dominated. Employment statistics of 37 European countries show that at least 2.6 million persons in 2019 were employed in the forest sector (forestry, manufacture of wood, manufacture of pulp and paper), with women accounting for only 18 % (ILO 2022). Besides the gender imbalance of the forest sector workforce, a wage gap between men and women is very likely. This is because women earn considerably less than their male colleagues in most economic sectors, particularly in gender-segregated ones (Leuze and Strauß 2016). While the wage gap between men and women has been well researched, empirical evidence for the forest sector is still scarce. Hence, this study aims to assess the gender wage gap in the forest sector workforce in European countries. The results may support decision and policy processes in the forest sector towards reducing gender segregation and achieving gender equality in the long run.

Material and methods

To quantify the gender wage gap, individual information is taken from the 6th European Working Condition Survey (EWCS). EWCS is performed every five years and interviews persons in employment (employee and self-employed) from different economic activities. The primary objective of the EWCS is to measure job quality in multiple dimensions, with "earnings" being one of them. Besides the job quality indices, EWCS contains a set of sociodemographic and employment-related characteristics at the micro data level. For the purpose of our analysis, we focus on persons employed in the primary forest subsectors, i.e. forestry and logging, manufacture of wood and wood products and manufacture of paper and paper products. Only earnings from a person's main job are considered in the analysis. These earnings are corrected for tax and social security contributions, and adjusted for differences in purchasing power parities between countries (Eurofound 2017). In total data of 455 persons in employment from 35 European countries (27 EU Member States plus the United Kingdom, Norway, Switzerland, Albania, Montenegro, Turkey, North Macedonia and Serbia) are used in our analyses.

We employ the Blinder-Oaxaca (B-O) counterfactual decomposition technique (Blinder 1973; Oaxaca 1973), to identify the gap in the mean hourly wage between male and female forest workforces. A brief walk-through of the B-O decomposition techniques in the following intensively builds on Leythienne and Ronkowski 2018; Nguyen et al. 2022; Fuchs et al. 2021; Jann 2008; Wirba et al. 2021. Technically, the B-O decomposition method consists of two estimation steps. Firstly, the determinants of wages based on the Mincerian human capital earnings function are modelled separately for men and women and can be written as follows:

$$\log(Wage_g) = \alpha_g + \beta_g x + \varepsilon_g \quad \text{; where g refers to male and female group}$$

The dependent variable is the natural logarithm of the hourly wage, derived from the EWCS's job quality indices on monthly income (Euro) and the number of hours actually worked per week. The independent variables (x) utilized in the log-linear model cover sociodemographic, employment-related factors and place of residence, as presented in Table 1. In the second step, a counterfactual equation is estimated by assuming one of the groups

or both is the nondiscriminatory benchmark. In this study, we execute two decomposition models where one considers male earning structure as the nondiscriminatory benchmark, and another employs both men and women (pooled model). The latter case assumes that discrimination can be negative against one group and positive in favour of another. The overall unadjusted earning differential is then decomposed into two components, i.e. explained and unexplained. The explained component reflects the differential caused by, on average, different individual characteristics that male and female hold, considering both groups receive the same wage. The unexplained component, on the other hand, indicates the contribution of difference in coefficients. The unexplained part is often used as a measure for discrimination but also captures the potential effects of differences in unobservable characteristics. Finally, the decomposition analysis in this study is modelled for all three-primary forest-related subsectors due to the limited number of observations.

Table 1 – Explanatory variables used in the earning function

Observed characteristics	Description (Value)
Age	Age of employed person (years and years square)
Dependency ratio	The ratio between persons aged below 15 and above 65 (no income) on the number of working age members in the household.
Education	Level of educational attainment corresponding to ISCED, categorized into basic and less than basic, intermediate and advanced (two dummy variables)
Occupation	Occupation corresponding to ISCO-08: major groups (eight dummy variables)
Employment status	Employee or self-employed (one dummy variable)
Tenure	Tenure at the current organization (years)
Household location	Urban, intermediate and rural (two dummy variables)

Notes: ISCED is the International Standard Classification of Education; ISCO-08 is the International Standard Classification of Occupation.

Results

Figure 1 shows the density plots of hourly wages for male and female workforce in the entire forest sector. The horizontal distance of the density plot at any point indicates the persistence of earning differential between males and females.

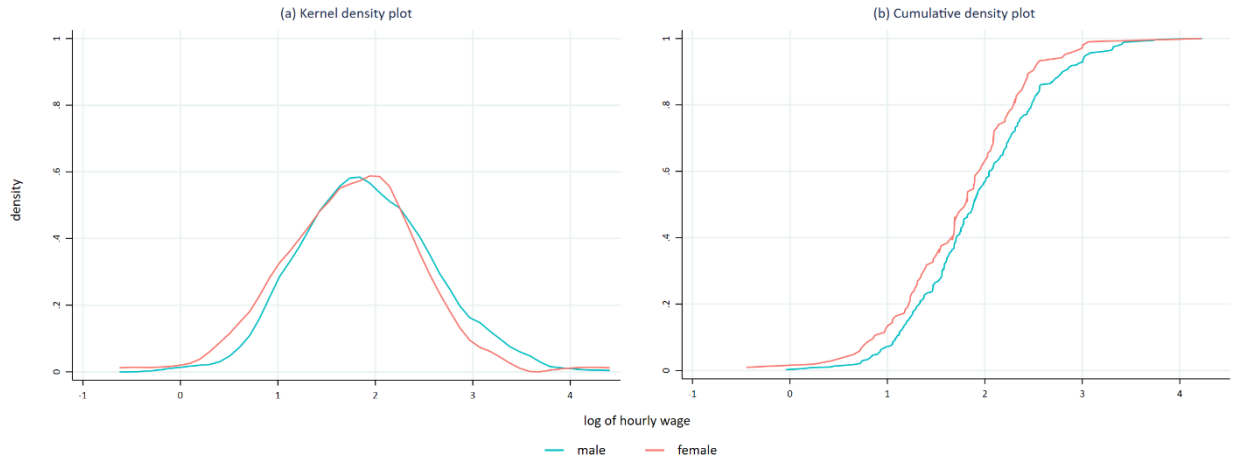

Figure 1 Kernel and cumulative density plots of hourly wages for male and female workforce in the forest sector

The B-O decomposition outputs using the vector of coefficients from the pooled model show that the mean prediction of log wage of male and female yields an earning gap of 0.16 log points and is statistically significant

at 10 %. Having exponentiated the log point, the geometric means of male and female wages are approximately 6.86 and 5.85 Euro per hour, respectively. This amounts to a difference in the gender wage gap of 17 %. As mentioned above, the wage gap is decomposed into two components. The overall explained gap is statistically negative, indicating that there is an attempt to reduce the gender wage gap due to the endowment effect. However, the wage differential is primarily attributed to the unexplained component, which accounts for 77 %. This indicates that wage discrimination against female in the forest sector persists. Among the detailed explanatory factors, some salient points are worth noting here. Age and dependency significantly impact the unexplained component, implying that higher age and dependency ratio could widen the gender wage gap in the forest sector workforce. Notwithstanding, statistical evidence of the concave effect of age based on the earning function indicates a diminishing wage gap for female workers aged over 50 years.

Decomposition analyses are additionally performed to explore the pattern of gender wage gap of two different age-group profiles, i.e. age-group 1 refers to 15 - 50 years old, and age-group 2 covers the workforces aged above 50 years old. The results indicate that the gender wage gap is approximately 25 % and statistically significant for the case of age-group 1. However, the wage gap for the age group 2 is substantially smaller and statistically insignificant. The unexplained component, which reflects the possible discrimination and unobserved characteristics, is also higher in age-group 1 than in age-group 2 (88 % vs 69 %). Findings based on the EU 25 Member States revealed that the wider gender wage gap is generally observed among older employed persons (Eurofound 2021). Conversely, our analyses point out that the gender wage gap is narrower among older workforces in the forest sector. One possible reason to explain this pattern relates to the distribution of the male and female respondents among occupations in each age-group. Females in age-group 2 are more distributed in the high and medium skill level of occupation resulting in higher average wage than those in age-group 1. The increase in average female wage in age-group 2 can narrow the gap, given that the average wage of males in both age groups remains unchanged. However, our interpretation does not imply that smaller gender wage differentials are attributable to higher- or medium-skill level jobs. This particular aspect requires further analyses to assess the wage gap between males and females in each occupation skill level.

Conclusions

Our study findings reveal that a female workforce in the forest sector earned 85 cents for every Euro a man earned on average. One explanation for this estimated wage gap is that fewer women worked in high payed positions or in occupations requiring particular skills. Furthermore, the forest sector remains a gender-segregated labour market, very much male dominated. Two methodological limitations in the present study must be acknowledged. Firstly, the decomposition of the unadjusted gender wage gaps does not capture two significant segregation effects, i.e. labour participation rate and lower number of hours worked, particularly for women. The self-section bias occurs since wage are observed only for people in employment which can be a selective group. The EWCS only interviewed people in employment, which restricts us from correcting the self-selection in female wages and generating the adjusted wage gaps. Previous studies pointed out that accounting for the selection effect could result in a smaller wage gap and share of unexplained effects. Secondly, we could conduct the wage gap analysis only for the entire forest sector due to the limited number of observations. Assessing earning differential of each subsector would further highlight the (dis)similarity of the gender wage gap between the forestry subsector and the wood-based manufacturers.

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7.6.3 Tracing the origin and sustainability effects of the wood supply chain to the European paper production and consumption

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Introduction

In the view of reducing dependency on fossil fuels while achieving a more sustainable economy, bioeconomy has emerged as an alternative in different national and international strategies. Nonetheless, bioeconomy is not sustainable per se, sustainability impacts of a bioeconomic system occur along the complete value chain, most severe impacts, however, are usually located at the site of biomass production. In a globalized economy, biomass is often produced in country A, exported as an unprocessed commodity or semi-finish product to be processed in country B and exported again as a bio-based product to country C. Therefore, an appropriate monitoring and assessment of the sustainability impacts of bioeconomy has to consider both, domestic and foreign impacts along the value chain independent of where they occur. The European pulp demand has been partly met by imports of highly export-oriented pulp factories in South America. This increasing demand of pulp for the paper industry has made *Eucalyptus* the most planted tree species worldwide over the last century. This development has been accompanied by an increasing attention on the sustainability of supply chains in the policy arena, specifically considering deforestation impacts of import commodities. We aim to identify the sustainability impacts in the countries of origin of roundwood for paper production and consumption of the EU-27-member states.

Material and methods

A novel hybrid physical accounting model and material flow approach were used to track wood origin and sustainability impacts of the most important roundwood suppliers in 2018. The physical accounting model allows flows of biomass to be traced along international supply chains to the origin of the commodity, in this case from the European paper production and consumption to the origin of roundwood. The material flow approach aims to assess impacts along the different steps of the supply chain in the three dimensions of sustainability. To trace and quantify sustainability impacts, we used the example of Uruguay a relatively small country of South America, but with a strong connection to the global bioeconomy through forestry trade. Uruguay is a key player regarding the production of roundwood and pulp for the European paper industry and is expected to become the second world largest producer of short-fiber pulp in the next years.

Results

Around one third of the roundwood input present in finish paper products and in the form of pulp was imported. The main origins were Brazil, the United States and Uruguay. The main consumers of foreign roundwood in paper products were Germany, Sweden and France whereas Italy, Germany and Finland were the main importing countries of roundwood in the form of pulp. The assessment of sustainability impacts of the production of roundwood and pulp in Uruguay covers: environmental sustainability impacts including land use change (grassland afforestation), biodiversity loss and GHG emissions, socio-economic impacts including employment and value-added generation. The results reveal synergies and trade-offs between socio-economic and environmental impacts along the supply chain as well as a disproportional share of impacts in the EU-27-member states.

Conclusions

We highlight the need to consider not only territorial sustainability impacts in isolation but also telecouplings through international supply of commodities. This approach captures the impacts along the different steps of the supply chain and bears a potential to identify which sustainability impacts are connected to the production of commodities and in which steps of the supply chain there are opportunities to improve sustainability. We remark the importance to assess impacts in the three dimensions of sustainability in order to have a more holistic overview. Future extensions of the approach might include to cover other commodities, additional impacts along the global chain (e.g. final consumption, post-use) and additional sustainability indicators.

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