

GREEN FOREST JOBS IN THE PAN-EUROPEAN REGION

Emilin Joma Da Silva
Jörg Schweinle



Published by

FOREST EUROPE (formerly Ministerial Conference on the Protection of Forests in Europe)

foresteurope.org

Liaison Unit Bonn

liaisonunitbonn@foresteurope.org

Maximilianstraße 28 B, 53111 Bonn, Germany

Johann Heinrich von Thünen-Institut

Bundesallee 50, 38116 Braunschweig, Germany

www.thuenen.de

Design: Jose Bolaños and Santiago Alarcón. Avatars by rawpixel.com and macrovector_official / Freepik.

Preferred citation: da Silva, Emilin Joma; Schweinle, Jörg. (2022): Green Forest Jobs in the pan-European region. FOREST EUROPE, Bonn. 49 p.

CONTENT

LIST OF ACRONYMS	II
LIST OF ILLUSTRATIONS	III
SUMMARY FOR POLICY MAKERS	2
What are Green Forest Jobs?	1
The European forest sector workforce & Green Forest Jobs	3
Trends, challenges & opportunities of Green Forest Jobs	6
INTRODUCTION	8
Scope & objectives	8
TERMINOLOGIES & DEFINITIONS	10
FACTS & FIGURES ABOUT THE FOREST SECTOR WORKFORCE	15
Forest-related education & training	18
The age of the forest sector workforce	22
Gender balance in the forest sector	23
Working conditions: the occupational health & safety at work	27
Mean weekly hours worked	29
Income opportunities & job security	31
TRENDS, CHALLENGES & OPPORTUNITIES	33
Green Forest Job stimulus	34
Job Creation	37
Job Losses	38
Job transformation & just transition	39
FINAL REMARKS	40
BIBLIOGRAPHY	41

LIST OF ACRONYMS

CSR	Corporate Social Responsibility
FAO	Food and Agriculture Organization
ILO	International Labour Organization
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification
LFS	Labour Force Survey
NFP	National Forest Programme
OECD	Organization for Economic Cooperation and Development
PPP	Purchasing Power Parity
PPS	Purchasing Power Standards
SDG	Sustainable Development Goals
SEEA	System of Environmental and Economic Accounting
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

LIST OF ILLUSTRATIONS

TABLES

Table 1 - Glossary of statistical terms	10
Table 2 - List of Decent Work Indicators	12
Table 3 - Economic activities within traditional forestry and forest based industries	12
Table 4 - Measures to assess job quality according to OECD framework	14
Table 5 - Statistical framework for measuring quality of employment according to ECE framework	14
Table 6 - Source of employment statistics relevant to this report	15
Table 7 - Fields of education and training related to forest goods and services	18
Table 8 - Rate of accidents per 100,000 employed persons in the traditional forest sector	29
Table 9 - Strategies to stimulate employment in rural areas by the European Commission	34
Table 10 - List of communication policies with aim to stimulate sustainability by the European Commission	34
Table 11 - The FSC principle 2 on workers rights and employment conditions	36
Table 12 - Example for online tools for gaining green skills and searching for Green Jobs	39

FIGURES

Figure 1 - Evolution of the employment in the traditional forest sector by economic activity	3
Figure 2 - Share of employment in the traditional forest sector in relation to total employment	3
Figure 3 presents the distribution of employment in the traditional forest sector by economic activity and sex in the pan European region.	4
Figure 4 - The age and sex of the traditional forest sector workforce inside the pan European region	4
Figure 5 - Accidents in forestry and mean weekly hours worked in the traditional forest sector	5
Figure 6 - Mean hourly earnings by sex and occupation (ISCO) in Euro in 2018	6
Figure 7 - Sustainable Development Goals agreed with all United Nation Member States (2015)	11
Figure 8 Schematic relationships between traditional forest sector workforce and Green Jobs	13
Figure 9 The seven thematic areas within the forest sector	13
Figure 10 - Evolution of the employment in the traditional forest sector by economic activity and sex	16
Figure 11 - Share of employment in the traditional forest sector in relation to total employment (same as Figure 2)	17
Figure 12 - Employment in the traditional forest sector by economic activity and sex (same as Figure 3)	17
Figure 13 - Graduates by education level, programme orientation by sex on environmental degrees	19
Figure 14 - Graduates by education level, programme orientation by sex processing of materials	20
Figure 15 Graduates by education level, programme orientation by sex on forestry degrees	21
Figure 16 - Employment in the traditional forest sector by age and economic activity	22
Figure 17 - Employment in the entire traditional forest sector and forestry and logging by sex in the pan European region	24
Figure 18 - Employment in the manufacture of wood and paper products by sex in the pan European region	25
Figure 19 Employment in the printing and manufacture of furniture by sex in the pan European region	26
Figure 20 - Non fatal accidents at work in the traditional forest sector	27
Figure 21 - Fatal accidents at work in the traditional forest sector	28
Figure 22 - Average mean weekly hours worked by sex in the forest sector	30
Figure 24 - Minimum wages expressed in purchasing power standards (PPS) in 2021	31
Figure 23 - Minimum wages in 21 out of 27 EU Member states with a national minimum wage in 2022	31
Figure 25 - Mean hourly earnings by sex and occupation (ISCO) in Euro per year	32



WHAT ARE GREEN FOREST JOBS?

Before the term Green Job emerged, there was already a broader debate about how economies and societies could become 'greener'. The concept of Green Economy (Pearce et al. 1989; United Nations 2012) stimulated more rigorous policies aiming at environmental protection and impacted employment levels. Increasing the number of jobs in environmental protection is an important milestone to stimulate greener economies and greener jobs.

Green Jobs are decent employment in "agriculture, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality" (UNEP et al. 2008). This definition highlights that Green Jobs are only 'green' if they are decent. Decent jobs are those that "are productive, provide adequate income and social protection, respect the rights of workers and give workers a say in decisions which will affect their lives" (ILO 2013b). However, this definition does not explicitly mention what Green Jobs in the forest sector are.

Green Jobs within the forest sector can be described as jobs which "comply with the principles of sustainable forest management, contribute to the green economy, and are involved in the manufacture of forest products and/or in the performance of forest services" (ECE/FAO 2018). No definition is likely to fit all purposes of policymaking, communication or data collection (Harris 2021). For this reason, FOREST EUROPE decided to present a definition of Green Jobs specific to the forest sector. These jobs are called Green Forest Jobs for communication purposes. Furthermore, the purpose of this definition is to create a common understanding about what Green Forest Jobs are. The definition reads as following: Green Forest Jobs provide forest-related goods and services while meeting the requirements of sustainable forest management and decent work.



SUMMARY FOR POLICY MAKERS

Key messages

- The number of persons employed in the pan European forest sector decreased by 7 % between 2010 and 2020;
- The workforce in the pan European forest sector is aging with an average age between 40 and 59 years old;
- Only 21 % of the workforce in the traditional pan European forest sector is female;
- Earnings in the pan European forest sector are often not competitive;

Recommendations

- Working conditions need to be improved and adapted to retain the workforce and to attract youth and female workers;
- The forest sector has the opportunity to be a frontrunner in ensuring decent work as well as competitive and equal pay for all;
- Green Jobs related to forest education and training, provision of ecosystem services, human health and recreation, urban forests, green chemistry as well as new wood based products are an opportunity to attract youth;
- Joint action between government, private sector and unions must be taken to reverse the decline of workforce by improving retention and skills upgrading of existing workers;
- An overhaul of forest education and training to meet changing skills requirements is a major drive to attract new recruits and promote Green Jobs in the forest sector;
- Numerous examples of successful and promising initiatives have been identified to ensure the forest sector will have the workforce it needs and makes full use of its potential to create Green Jobs. Without a concerted effort to make these good practices part of mainstream forest policies and strategies, they are unlikely to have the scale and pace required.

THE EUROPEAN FOREST SECTOR WORKFORCE & GREEN FOREST JOBS

The forest sector includes several economic activities mentioned in the International Standard Industrial Classification (ISIC). The traditional forest sector referred to in this report encompasses forestry and logging (A02), manufacture of wood products (C16), manufacture of paper products (C17), printing (C18) and the manufacture of furniture (C31). The employment in these economic activities is considered to be the traditional forest sector workforce. Additionally, to the traditional forest sector, other economic activities related to forest are emerging. This is referred in the study as new forest based sector. There is no doubt that a significant part of the forest sector workforce holds a Green Job. However, not all jobs in the forest sector are per se 'green'.

The number of persons employed in the pan European forest sector decreased by 7 % between 2010 and 2020 (ILO 2021). Figure 1 shows the evolution of the employment in the traditional forest sector inside the pan European region. The forest sector including the economic activities of forestry and logging, manufacture of wood products and manufacture of paper products provided jobs for at least 2.6 million persons in the pan European region between 2017 and 2019 (ILO 2021). In the same period, other economic activities traditionally related to the forest sector as manufacture of furniture and printing contributed to another 1.6 million jobs and 800 thousand jobs respectively (ILO 2021). Together, these economic activities provided jobs for at least 5 million persons in 36 European countries (ILO 2021).

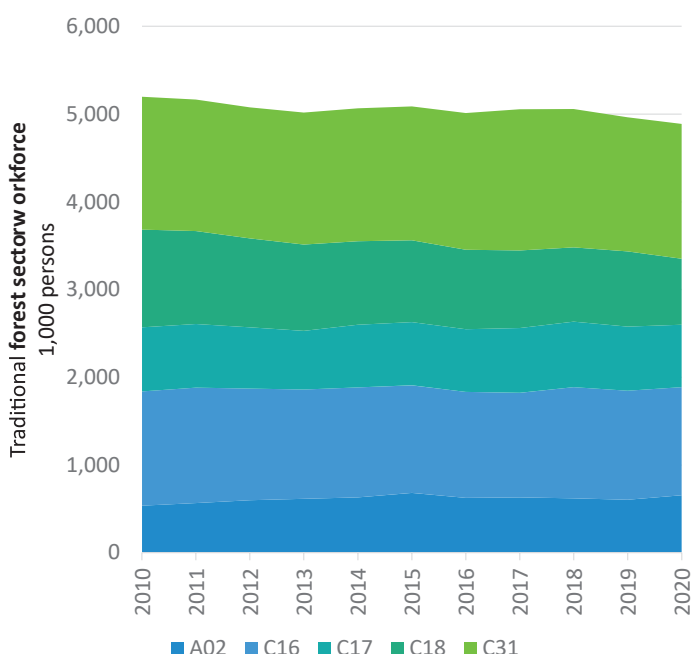


Figure 1 - Evolution of the employment in the traditional forest sector by economic activity (pan-European region)

Note: 36 countries in the pan European region reported employment statistics. The values presented in this figure are an average of employment of the years 2017, 2018 and 2019 ISIC divisions A02, C16, C17, C18 and C31. Sources: ILOSTAT by ILO <https://ilostat.ilo.org/topics/employment/>

The dimension of the forest sector workforce varies substantially from country to country. Figure 2 shows the share of employment in the traditional forest sector in relation to total employment in 36 European countries. The top ten countries in which the forest sector contributes more than 3 % of jobs out of total employment are highlighted in green with values in white.

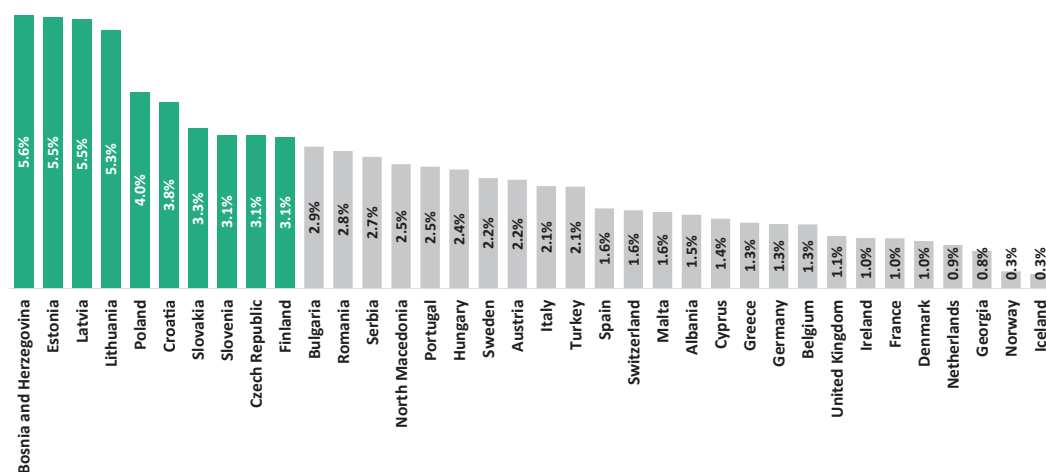


Figure 2 - Share of employment in the traditional forest sector in relation to total employment

Note: 36 countries in the pan European region reported employment statistics. The values presented in this figure are an average of employment of the years 2017, 2018 and 2019 at ISIC divisions A02, C16, C17, C18 and C31. Sources: ILOSTAT by ILO <https://ilostat.ilo.org/topics/employment/>

Figure 3 presents the distribution of employment in the traditional forest sector by economic activity and sex in the pan European region.

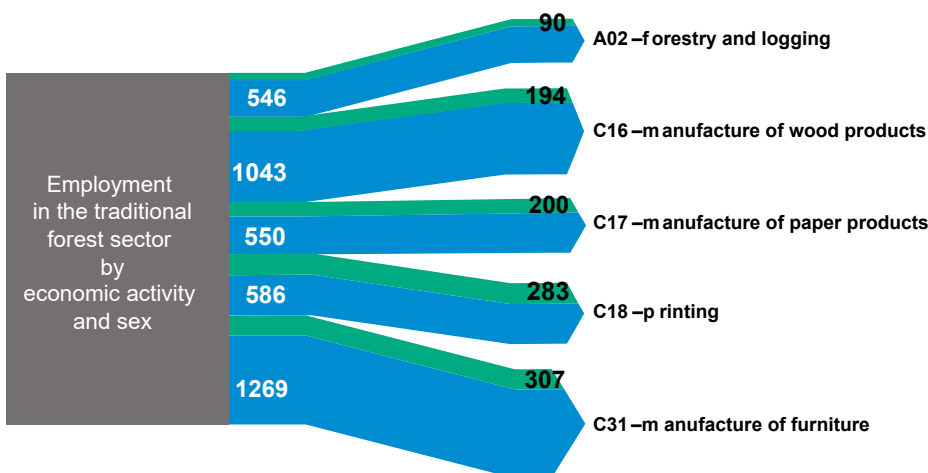


Figure 3 - Employment in the traditional forest sector by economic activity and sex

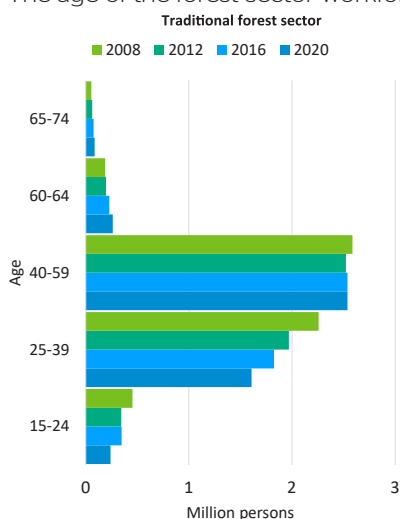
Note: 36 countries in the pan European region reported employment statistics. Values in 1,000 persons. Green arrows with black numbers indicate female workers. Blue arrows with white numbers indicate male workers. The values are an average of employment in 2017, 2018 and 2019 according to the ISIC divisions A02, C16, C17, C18 and C31. Sources: ILOSTAT by ILO <https://ilostat.ilo.org/topics/employment/>

The age profile of the pan European forest sector workforce reveals that the number of workers aged between 15 and 39 is decreasing (EUROSTAT 2020b) sharply along with that of young entrants. The participation of workers aged 50 + also dropped sharply. In contrast, the number of workers aged 60 + increased slightly between 2008 and 2020. The labour shortage is thus imminent, because workers aged 50 + will leave the sector within the next 10-15 years. If this trend is not reversed, the forest sector will suffer from a shortage of workers in the future. Figure 4 a) shows the age profile of the traditional forest sector workforce in the pan European region.

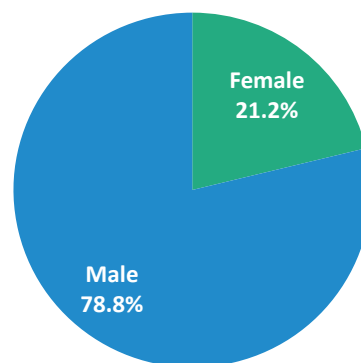
Figure 4 b) shows the gender balance of the traditional forest sector workforce in the pan European region. Although, the gender balance in the forest sector workforce varies in the different economic activities of the traditional forest sector, overall, women occupy only 21% of jobs (ILO 2021). Forestry and logging are the economic activities with the lowest female participation (14%). The largest female participation in the forest sector workforce was observed in printing (32%), followed by the manufacture of paper products (26%) and by the manufacture of furniture (19%).

Figure 4 - The age and sex of the traditional forest sector workforce inside the pan European region

a) The age of the forest sector workforce



b) The gender balance



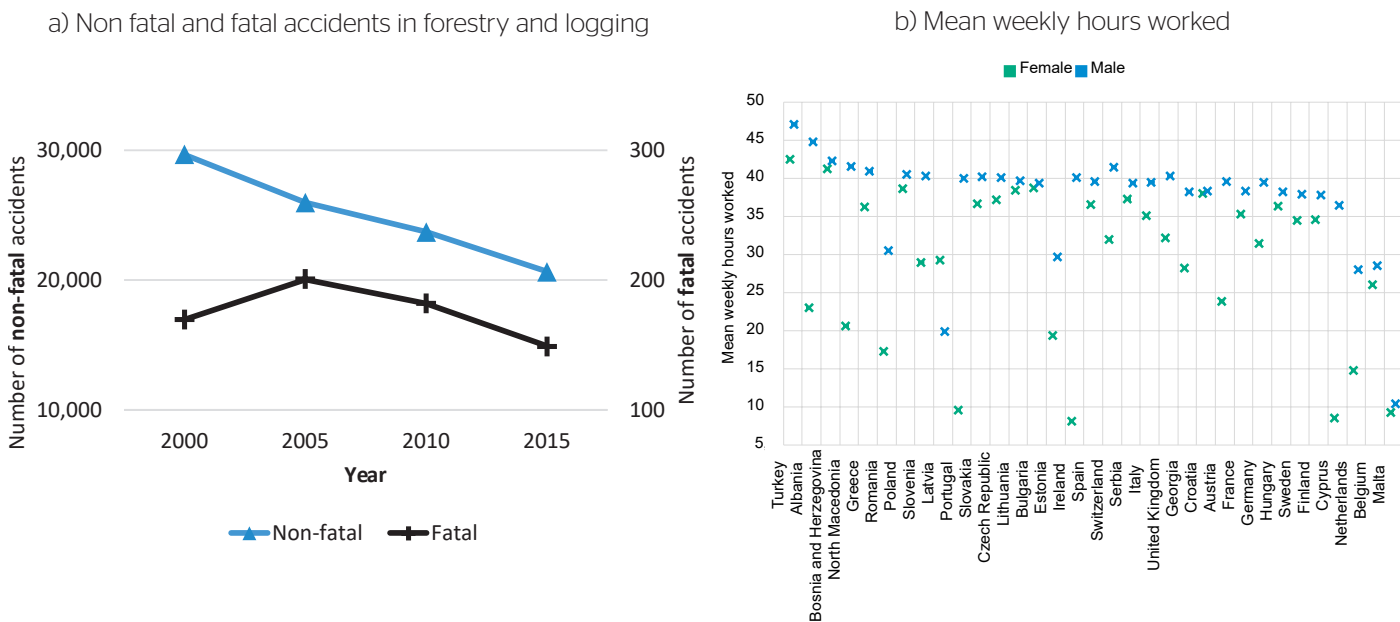
Note: 34 countries in the pan European region reported the age of the traditional forest sector workforce. 36 countries in the pan European region reported the gender balance. The values presented in Figure 4 b) is an average of employment by sex of the years 2017, 2018 and 2019 at ISIC divisions A02, C16, C17, C18 and C31.

Source: The age of the forest sector workforce obtained via European statistics, LSF series - detailed annual survey results <https://ec.europa.eu/eurostat/web/lfs/data/database>; The gender balance was obtained via ILOSTAT Employment by sex and economic activity - ISIC level 2, available in ILOSTAT <https://ilostat.ilo.org/data/>

The number of work accidents has decreased considerably in general as well as in forestry and logging (ISIC division A02) (Figure 5 a). Fatal accidents remained much more frequent in forestry and logging than in other economic activities, making it one of the most dangerous occupations in many countries.

The average number of hours worked in the forest sector varies according to the economic activity and country. Considering the entire traditional forest sector (Figure 5 b), the average of working hours per week indicates that women work to a greater extent in part time positions.

Figure 5 - Accidents in forestry and mean weekly hours worked in the traditional forest sector



Note: 28 countries in the pan European region reported the number of non fatal and fatal accidents in the economic activity of 'forestry and logging' (ISIC division A02). 36 countries in the pan European region reported the mean weekly hours worked in the traditional forest sector workforce at ISIC divisions A02, C16, C17, C18 and C31. Source: Accidents number obtained via Joint pan European dataset by FAO, UNECE and FOREST EUROPE <https://fra-data.fao.org/FE/panEuropean/home/>; Mean weekly hours actually worked per employed person by sex and economic activity obtained via ILOSTAT <https://ilostat.ilo.org/data/>

As shown in Figure 6, women in general earn less than men in almost all occupations in 2018. The largest discrepancies are observed for professionals and managers. These occupations also exist in the forest sector; however, the exact wage gap is so far not quantifiable at this aggregate level.

Occupations called 'skilled agricultural, forestry and fishery workers', which are obviously part of the forestry workforce, received lower remuneration when compared to other occupations. However, the majority of these workers are employed in agriculture and based on the information available it is impossible to specify the average wage for skilled forestry workers in more detail.

Alike the total workforce, since 1990 the number of degrees in forestry in many pan European countries is also decreasing (FAO 2015). In contrast, the number of degrees in engineering studies related to the

manufacture and processing of wood and paper increased in the same period. Some countries such as Germany and Estonia showed a significant drop in technical level graduations on forest related education (EUROSTAT 2020a; FAO 2015). The share of female students in forestry related courses remained mainly below 30 % between 2000 and 2018.

Undoubtedly, the transition to a greener economy requires skills and abilities beyond only the requirements of the traditional forest sector. Increasing demand for degrees in technology and engineering is expected in the future. This increase will assist the forest sector with professionals as well. New established jobs related to technological development to preserve or restore forest quality or reduce energy, material and water consumption in the forestry and wood based industry are the Green Jobs to be pursued. Therefore, training and education are essential to ensure competitiveness of the new forest based sector.

While the information on the workforce size in the traditional forest sector is satisfactory in many countries, little is known about their job quality and whether they could be considered Green Jobs. It is currently unknown how many new forest based Green

Jobs exist. However, only data collection and statistical analysis of job quality and job decency will precisely inform how many Green Jobs the forest sector provides.

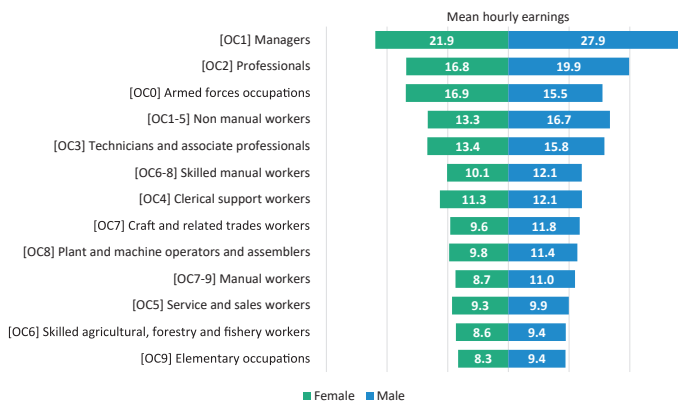


Figure 6 - Mean hourly earnings by sex and occupation (ISCO) in Euro in 2018

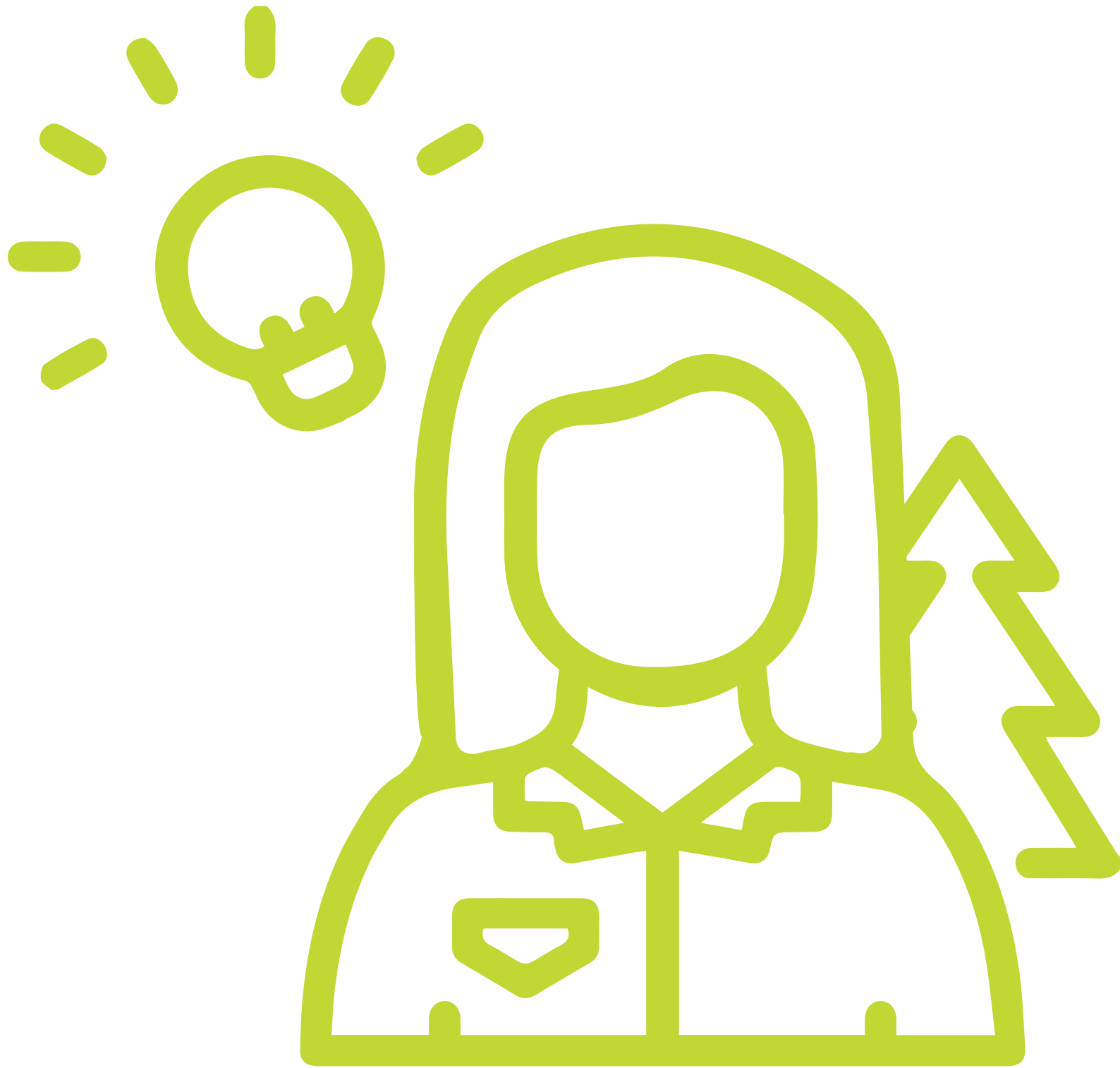
Note: 27 countries in the pan European region reported mean hourly earnings, according to the International Standard Classification of Occupations (ISCO)
Source: European statistics, Structure of earnings survey <https://ec.europa.eu/eurostat/web/labour-market/earnings/database>

TRENDS, CHALLENGES & OPPORTUNITIES OF GREEN FOREST JOBS

Many are the reasons why formal forest-based employment decreased in the past decades. In part it is due to increased mechanization in logging and harvesting (Owuor et al. 2021). Mechanization and automation also declined employment in wood and paper manufacturing (ECE/FAO 2020). Furthermore, increased labour regulation impacted formal employment in some countries and contributed to the growth of informal employment in the forest sector (Cui et al. 2022; Karabchuk and Zabirova 2018).

There is a high probability that the forest sector will lack skilled workers in a relatively near future. The traditional forest sector will be mostly impacted by this trend. Many existing forest jobs will be redefined in terms of occupational qualifications. Only with a well-trained, highly skilled workforce the pan European forest sector will be able to manage the future challenges. In view of the aging and decreasing workforce, further automation and improved productivity is a challenge. Nevertheless, there is significant potential to grow Green Forest Jobs, especially in areas such as education, tourism, nature conservation, health, green chemistry, and new wood based materials (UNECE/FAO/Forest Europe 2020; ECE/FAO 2018).

Data clearly indicate that the forest sector must act now to attract young professionals and prepare the current workforce for the future. A common understanding of what are Green Forest Jobs is required. In addition, countries must join forces and set up a monitoring of Green Jobs based on comparable data at a disaggregated level. Information about job quality must be recorded with qualitative information about status of employment by economic activity, sex, age, level of educational attainment, etc. (ECE 2010; ILO 2017). The awareness of the many societal benefits provided by the forest sector must be raised. This is also to address the interest of young professionals to choose occupations with positive social and environmental impact. Action to increase female employment and improve diversity in the forest sector must be taken. These actions must provide productive jobs with equal pay and social protection. The gender wage gap needs to be closed. Since this is a challenge for all economic sectors, the forest sector has the opportunity to be a frontrunner in this regard. Improvement of working conditions, requalification of the aging workforce, equal opportunity and flexible working hours are key for a successful adaptation (Eurofound 2017; Eurofound and ILO 2019). More Green Forest Jobs are a good opportunity for the forest sector to improve its reputation and be attractive to young job seekers.



INTRODUCTION

SCOPE & OBJECTIVES

This publication is the result of a cooperative effort from the Thuenen Institute of Forestry and the FOREST EUROPE Liaison Unit Bonn. The aim of this report is to clarify what Green Forest Jobs are and to explain why this topic is relevant for the forest sector. The overview of the state of the art of Green Forest Jobs focus on the signatories and observers' countries represented by FOREST EUROPE. Terminologies and definitions pertinent to the topic are presented in this report. The terms 'Green Job', 'forest sector' and 'workforce' are clarified. Economic activities within forestry and forest based industries are introduced and examples of forest based Green Jobs inside the FOREST EUROPE region are shown. Additionally, the synonyms 'job quality' and 'quality of employment' are explained and its relation with Green Jobs is demonstrated. Besides, measures to assess job quality are presented in this report.

Furthermore, this publication introduces facts and figures relative to the current forest sector workforce. The dimension of the pan European forest sector workforce and its gender balance are presented. Information about forest-related education and the gender balance between graduated students is shown as well. Besides gender balance figures, information regarding working conditions are presented for countries reporting data. Given the lack of information, the question of how many Green Forest Jobs the pan European region provides remains unsolved. However, this publication shows why the forest sector is a

potential Green Job provider. The current limitations to assessing the number of Green Jobs is discussed and indicators to characterize a job as 'green' are introduced.

Finally, this document comments on trends and opportunities associated with the development of Green Forest Jobs and recommendations to well adapt the forest sector to the just transition. International good practice examples related to the forest education and Green Job growth are mentioned here.

GREEN JOBS

Before the emergence of the term Green Job, there was already a broader debate about how economies and societies could become 'greener'. The concept of Green Economy dated from 1989 (Pearce et al. 1989). As emphasized by the UN Rio+20 Conference in 2012 (United Nations 2012) it is a low carbon, resource efficient and socially inclusive economy (UNEP 2011). In that respect, more rigorous policies aiming at environmental protection that also impacted employment levels have been introduced. To correctly interpret the impact on employment, it is necessary to clarify some terms. A glossary of statistical terms by International Labour Organization (ILO) is listed in Table 1.

TERMINOLOGIES & DEFINITIONS

Table 1 - Glossary of statistical terms

TERMS	DEFINITION
Employment	Persons in employment are defined as all those of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit. They comprise employed persons “at work”, i.e. who worked in a job for at least one hour; and employed persons “not at work” due to temporary absence from a job, or to working-time arrangements (such as shift work, flextime and compensatory leave for overtime).
Employees	Employees are all those workers who hold paid employment jobs, which are those where the incumbents hold employment contracts, which give them a basic remuneration not directly dependent upon the revenue of the unit for which they work.
Full time equivalent (FTE)	A full-time equivalent, sometimes abbreviated as FTE, is a unit to measure employed persons in a way that makes them comparable although they may work a different number of hours per week. The unit is obtained by comparing an employee’s average number of hours worked to the average number of hours of a full-time worker. A full-time worker is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours he or she works.
Job	A job or work activity is defined as a set of tasks and duties performed, or meant to be performed, by one person for a single economic unit. The term job is used in reference to employment. Persons may have one or several jobs. Those in self-employment will have as many jobs as the economic units they own or co-own, irrespective of the number of clients served. In cases of multiple job-holding, the main job is that with the most hours usually worked, as defined in the international statistical standards on working time.
Work	Work comprises any activity performed by persons of any sex and age to produce goods or to provide services for use by others or for own use.

Source: Glossary of statistical terms by ILO <https://ilostat.ilo.org/resources/concepts-and-definitions/glossary/#all>

The transition to a green economy requires an effective approach towards sustainability, which motivated the United Nations' Sustainable Development Goals (SDGs). The SDGs are a set of strategies to, among others, stimulate economic growth, aligned with environmental and societal benefits (Figure 7). Aligned with the SDGs, in 2015 emerged the concept of just transition (ILO 2015). Just transition is “about achieving decent work for all and eradicating poverty through growing inclusive economies that can meet the needs of the world’s growing population while also

protecting the environment and natural resources on which life on earth depends” (ILO 2015). For this reason, initiatives with regard to low carbon agriculture, renewable energy, restoration of natural resources and reforestation activities are highly recommended to create jobs during this transition.

Figure 7 - Sustainable Development Goals agreed with all United Nation Member States (2015)



Source: Sustainable Development Goals (SDGs) <https://sdgs.un.org/goals>

At the international level, the first publication to introduce the term ‘environmental related employment’ and ‘Green Jobs’ was released in 2008 (UNEP et al. 2008). This publication defined a Green Job as “work in agricultural, manufacturing, research and development (R&D), administrative and service activities that contributes substantially to preserving or restoring environmental quality” (UNEP et al. 2008). “Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity, reduce

energy, material and water consumption through high efficiency strategies, de carbonize the economy and minimize or altogether avoid generation of all forms of waste pollution” (UNEP et al. 2008). Green Jobs must be ‘decent jobs’ (ILO 2013b) and must be productive, provide adequate incomes and social protection, respect the rights of workers and give them a say in decision that will affect their lives. The indicators to classify a job as decent are listed in Table 2.

Table 2 – List of Decent Work Indicators

MEASUREMENT OF DECENT WORK	
Employment opportunities	Adequate earnings and productive work
Decent working time	Combining work, family and personal life
Work that should be abolished	Stability and security of work
Equal opportunity and treatment in employment	Safe work environment
Social security	Social dialogue, workers' and employers' representation
Economic and social context for decent work	

Source: Decent work indicators: guidelines for producers and users of statistical and legal framework indicators by ILO (ILO 2013a)

For statistical purposes, Green Jobs are those placed in the environmental goods and service industries, as mentioned in the System of Environmental and Economic Accounting (SEEA). The SEEA recommends collecting data on employment according to the International Standard Industrial Classification (ISIC) to facilitate comparison of statistics (United Nations 2008). The equivalent Statistical Classification of Economic Activities in the European Community is NACE (or the French language *Nomenclature statistique des Activités économiques dans la Communauté Européenne*).

A good practice example of the just transition inside the forest sector is the adoption of the sustainable forest management (SFM) criteria. In Europe, SFM was defined in 1993 by FOREST EUROPE as “the stewardship and use of forest lands in a way and at a rate that maintains their productivity, biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil now and in the future relevant ecological, economic and social functions at local, national and global levels and that does not cause damage to other ecosystems” (Forest Europe 1993).

However, SFM does not address sustainability of the forest-based industries. Therefore, to ensure sustainability in the industrial processing of forest resources, other solutions as ‘resource efficiency’ and ‘circular bioeconomy’ emerged. The circular bioeconomy (CBE) is the resource efficient valorization of biological resources in integrated production chains with the utilization of residues and wastes (e.g. via reuse, recycling and cascading) to optimize the value of these resources over the time (Stegmann et al. 2020).

According to the FAO, the forest sector is represented by all economic activities that mostly depend on the production of goods and services from forests (FAO 2014). Obviously, it includes forestry, but also processing of forest resources. Besides ‘forestry and logging’, other economic activities depend on forests to exist. The European Commission refers to the ‘forest based industries’ as woodworking, furniture, pulp and paper manufacturing and converting, and printing as part of the forest sector as well (European Commission). The economic activities listed in Table 3 refer to the traditional forest sector analyzed in this report. The employment in the forest sector is regarded as the ‘forest sector workforce’.

Table 3 – Economic activities within traditional forestry and forest based industries

INTERNATIONAL STANDARD INDUSTRIAL CLASSIFICATION	
Division	Description
A02	Forestry and logging
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
C17	Manufacture of paper and paper products
C18	Printing and reproduction of recorded media
C31	Manufacture of furniture

Source: International Standard Industrial Classification (ISIC) <https://unstats.un.org/unsd/classifications/Econ/isic>

There is no doubt that a significant part of the forest sector workforce holds a Green Job. However, there is no concrete evidence that all these jobs are 'green'. Figure 8 shows a schematic relationship between forest sector workforce and Green Jobs.

Besides the traditional forest sector, other economic activities depend on forests. These related areas compose the 'new forest based sector' and include e.g. "Education and Research" and "Health and

Recreation" (Figure 9). The new forest based sector is often overlooked and the jobs it provides are rarely considered part of the forest sector workforce. Nevertheless, the new forest based sector has great potential to generate jobs and mitigate the impacts on employment while the just transition. Consequently, both traditional and new forest-based sectors are providers of Green Jobs.

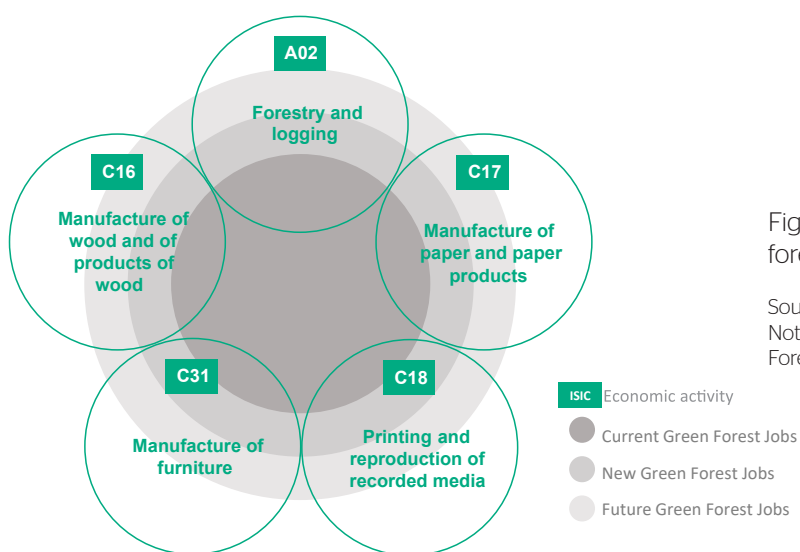


Figure 8 Schematic relationships between traditional forest sector workforce and Green Forest Jobs

Source: Developed by the authors
Notes: ISIC: International Standard Industrial Classification; GFJ: Green Forest Jobs

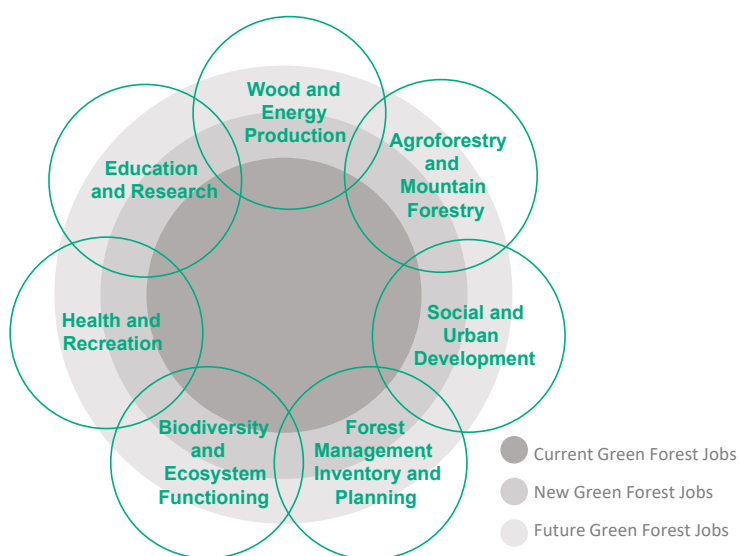


Figure 9 The seven thematic areas within the forest sector

Notes: Source: Green Jobs in the Forest Sector (ECE/FAO 2018)

Only decent jobs can truly be considered as ‘green’. The criterion of job quality is also a path to classify a job as decent. A great part of our life is spent at workplaces. Consequently, the job quality impacts our well being as an employed person. Job quality integrates the strategies of the SDG 8, which incentivize collection of data about earnings, working time, social security coverage, job security, access to paid leave, parental leave and sick leave, career opportunities,

etc. (SDG-Tracker 2018). At the European level, job quality is analyzed by the Organization for Economic Cooperation and Development (OECD) and by the United Nations Economic Commission for Europe (ECE or UNECE). The OECD framework for measuring job quality is listed in Table 4. The ECE prefers the term ‘quality of employment’ and also provides a set of indicators for assessing how good jobs are, as listed Table 5.

Table 4 – Measures to assess job quality according to OECD framework

MEASURING AND ASSESSING JOB QUALITY	
Measure	Description
Earnings quality	Captures the extent to which earnings contribute to workers' well-being in terms of average earnings and their distribution across the workforce.
Labour market security	Captures those aspects of economic security related to the risks of job loss and its economic cost for workers. It is defined by the risks of unemployment and benefits received in case of unemployment.
Quality of work	Captures non-economic aspects of jobs including the nature and content of the work performed, working-time arrangements and workplace relationships. These are measured as incidence of job strain characterized as high job demands with low job resources.

Source: Job quality framework <https://www.oecd.org/employment/job-quality.htm>

Table 5 – Statistical framework for measuring quality of employment according to ECE framework

MEASUREMENTS FOR QUALITY OF EMPLOYMENT	
Safety and ethic of employment	Income and benefits from employment
Working time and work life balance	Security of employment and social protection
Social dialogue	Skills development and training
Employment related relationships and work motivation	

Source: Handbook on Measuring Quality of Employment (ECE 2015, 2010)

A previous mention of the term Green Jobs in the forest sector explains it as work that “complies with the principles of sustainable forest management (SFM), contributes to the green economy, and are involved in the manufacture of forest products and/ or in the performance of forest services” (ECE/FAO 2018). Based on these terminologies and definitions, a more specific definition of Green Jobs for the forest sector was prepared by the Expert Group on Green Jobs of FOREST EUROPE. The proposed definition was approved at the Expert Level Meeting of FOREST EUROPE held in Bonn in August 2022 and clarifies that **“Green Forest Jobs provide forest-related goods and services while meeting the requirements of sustainable forest management and decent work”**.

A common understanding of what Green Forest Jobs are must encompass jobs in the traditional forest sector and include jobs in the new forest-based sector along

all their value chains. To address this understanding in the definition, the phrase “provide forest-related goods and services” has been added to include all forest-related work that meets SFM requirements. The addition of the term “decent work” is intended to make it clear that this condition is a prerequisite to consider any job as “green”. To avoid misunderstandings, other conceptual terms such as “green” or “bio” were avoided.

All these terminologies and definition can be interpreted in many different ways. Besides, countries may engage on the development of national definitions to cover exceptions. Therefore, an intensive discussion on this topic is essential for a common understanding. The next chapter elucidates the relevance of definitions while assessing facts and figures about the Green Forest Jobs.

FACTS & FIGURES ABOUT THE FOREST SECTOR WORKFORCE

An estimation from 2013 reported that inside the European Union (EU-28) an average of 2 % 3 % of the total employment was represented by Green Jobs, with Germany being the largest green employer (4.5 %) (Deschenes 2013). This relatively small share of Green Jobs was estimated for countries where the data is available. However, due to missing data the accurate number of Green Jobs is unknown yet. This chapter presents qualitative characteristics of the traditional forest sector workforce in the pan European region, following established job quality indicators.

At the global level, a recent estimation of traditional forest sector workforce (ISIC divisions A02, C16, C17, C18 and C31), accounted 28 million persons in full time equivalent (FTE Table 1) representing 0.9 % of the global labour force in 2015 (Lippe et al. 2021). This corresponds to around 13.5 million persons employed in the traditional forest sector worldwide. Employment data are usually collected through labour force surveys (LFS). It is recommended that the LFS contain detailed information about the workforce, e.g., the economic activity in which the job is performed, classification of occupation, level of education, gender and age of workers, etc. Unfortunately, many countries face difficulties in carrying out a detailed LFS and do not provide comparable employment statistics, which restricts the assessment of job quality.

This report evaluates employment statistics compiled by the ILO (ILO 2021). Additionally, employment statistics were collected on the Eurostat data browser (EUROSTAT 2021) and with the Food and Agriculture Organization of the United Nation (FAO), via the Global Forest Resource Assessment (FRA) (FAO 2015). Table 6 lists the databases utilized in this report.

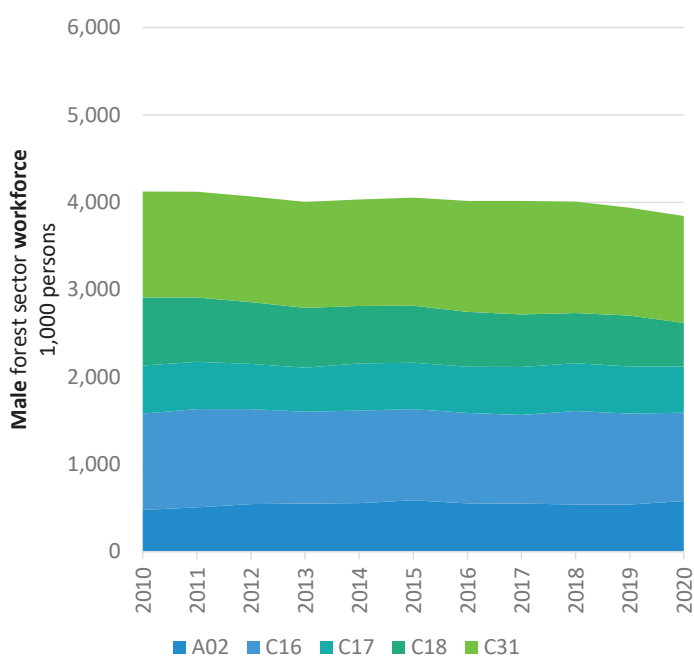
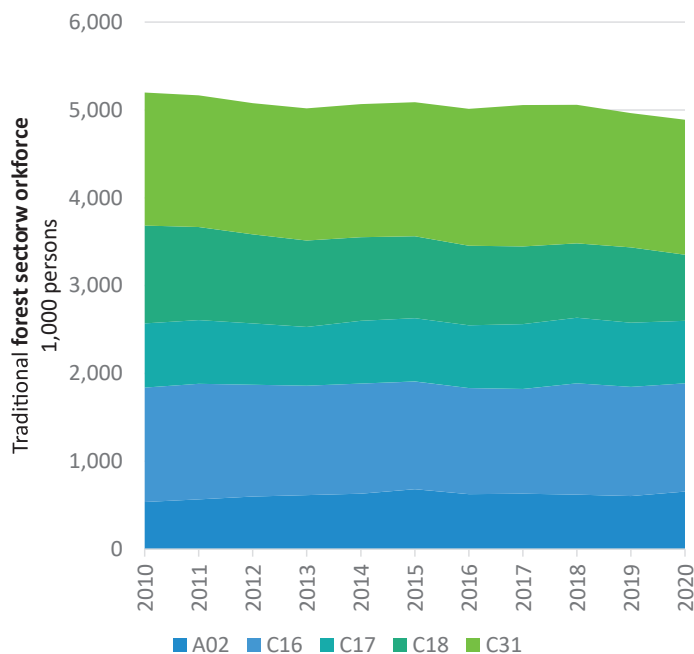
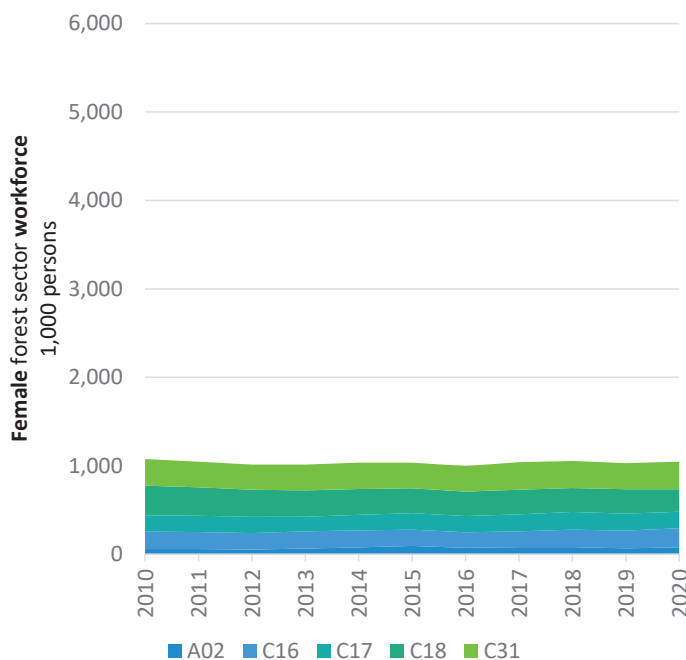
Table 6 - Source of employment statistics relevant to this report

SOURCES	DATABASE
ILOSTAT by ILO (Annual update) https://ilostat.ilo.org/topics/employment/	At 2 digit level of ISIC <ul style="list-style-type: none"> • Employment by sex, age and economic activity • Employees by sex, age and economic activity • Mean weekly hours per employed and employee by age and economic activity
Eurostat by European Commission (Annual update) https://ec.europa.eu/eurostat/web/main/data/statistics-a-z	At 2 digit level of ISIC <ul style="list-style-type: none"> • Employment by sex, age and economic activity • Fatal and non fatal accidents at work At 2-digit level of ISCO <ul style="list-style-type: none"> • Mean hourly earnings by sex, age and occupation At 2-digit level of ISCED <ul style="list-style-type: none"> • Graduation of students in forest related education
Global Forest Resources Assessment by FAO (Latest update in 2015) https://fra-data.fao.org/EU/fra2020/employment/	Only for division A02 of ISIC <ul style="list-style-type: none"> • Employment in forestry and logging • Graduation of students in forest related education

Note: Data at 2 digit level means that information is available for ISIC divisions with two digits, e.g. A02, C16, C17, C18, C31, etc.

Data about the forest sector workforce in the pan European region was available for 36 countries. To assess the workforce size, an average was calculated based on employment data from 2017, 2018 and 2019. The economic activities of forestry and logging, manufacture of wood products and manufacture of paper products (ISIC divisions A02, C16 and C17) provided jobs for at least 2.6 million persons in these countries (ILO 2021). Another 2.4 million jobs were reported for manufacture of furniture and printing (ISIC divisions C18 and C31) by these 36 countries in the same period (ILO 2021). Together, these economic activities provided jobs for at least 5 million persons in the pan European region (ILO 2021). Figure 10 shows the evolution of the employment in the traditional forest sector by economic activity and sex. The traditional forest sector workforce in the pan European region decreased by 7 % between 2010 and 2020 (ILO 2021).

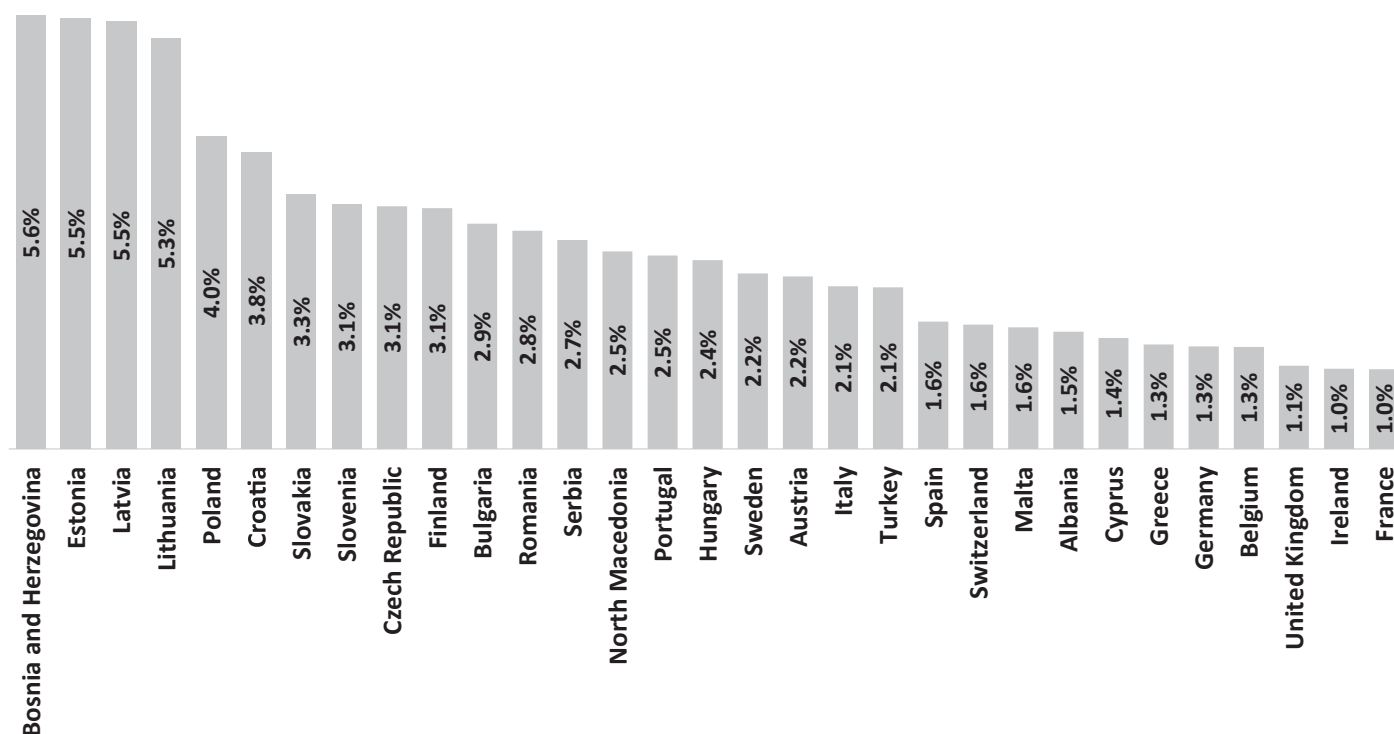
Figure 10 - Evolution of the employment in the traditional forest sector by economic activity and sex



Note: 36 countries in the pan European region reported employment statistics. The values presented in this figure are an average of employment of the years 2017, 2018 and 2019 ISIC divisions A02, C16, C17, C18 and C31.
Sources: ILOSTAT by ILO <https://ilostat.ilo.org/topics/employment/>

The importance of the workforce within an economic sector varies substantially from country to country. Figure 11 shows the share of employment in the traditional forest sector in relation to total employment in the pan-European region.

Figure 11 – Share of employment in the traditional forest sector in relation to total employment (same as Figure 2)



Note: 36 countries in the pan European region reported employment statistics. The values presented in this figure are an average of employment of the years 2017, 2018 and 2019 at ISIC divisions A02, C16, C17, C18 and C31.
Sources: ILOSTAT by ILO <https://ilostat.io.org/topics/employment/>

Considering that not all countries report employment statistics, the size of the forest sector workforce is likely to be underestimated. Figure 12 shows the traditional forest sector workforce in the pan European region by economic activity and sex, utilizing an average of employment between 2017, 2018 and 2019.

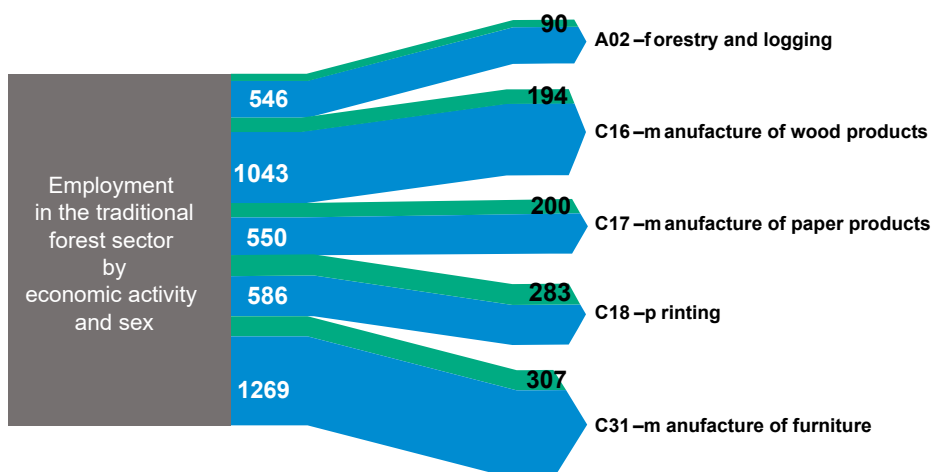


Figure 12 – Employment in the traditional forest sector by economic activity and sex (same as Figure 3)

Note: 36 countries in the pan European region reported employment statistics. Values in 1,000 persons. Green arrows with black numbers indicate female workers. Blue arrows with white numbers indicate male workers. The values are an average of employment in 2017, 2018 and 2019 according to the ISIC divisions A02, C16, C17, C18 and C31.
Sources: ILOSTAT by ILO <https://ilostat.io.org/topics/employment/>

Even though there is an estimation of the size of the forest sector workforce in the pan European region, there is no indication whether this workforce actually held a Green Job. To assess how green the jobs in the forest sector are, an analysis on the job quality would be essential. Job quality is a relevant topic to ensure decent work for all while the just transition. However, information on job quality is lacking.

Efforts to collect and report indicators of job quality is an urgent and critical task to support a Green Jobs growth across all sectors of the economy. To some degree, employment statistics follow international recommendations and collect data according to indicators of decent work (Table 2) and job quality (Table 4 and Table 5). Unfortunately, many of these

statistical series currently available do not report job quality by economic activities. Although data is collected according to the ISIC framework, it is reported only at the aggregated level of ISIC sections, which are identified by a letter, e.g. 'A' for 'agriculture forestry, and fishing', 'C' for 'manufacturing', 'F' for 'construction', etc. However, for more conclusive analysis, employment statistics must be collected and reported at the level of ISIC divisions (2 digit level).

This report is based on available employment statistics reporting decent work and job quality indicators for the traditional forest sector workforce in the pan European region.

FOREST-RELATED EDUCATION & TRAINING

The forest sector workforce is expected to have specific skills and abilities to perform well in their occupations. These specific skills and abilities are offered by various educational institutions all over the world. However, not all persons completing a forest related education will be employed in the forest sector. Nevertheless, tracing the number of graduates in forest related education and training is highly recommended in order to secure the future workforce. This is feasible if the number of graduates is reported as recommended by the International Standard Classification of

Education (ISCED). The ISCED framework informs the broad, narrow and detailed fields of education of each completed degree and enables cross country comparison. Table 7 lists three main fields of education and training which may provide skills and abilities required by the forest sector. Unfortunately, not all pan European countries report the number of graduated persons according to the ISCED, even though they collect information about enrolled students and graduated persons.

Table 7 - Fields of education and training related to forest goods and services

BROAD FIELD	NARROW FIELD	DETAILED FIELD
05 Natural sciences, mathematics and statistics	052 Environment	0521 Environmental sciences 0522 Natural environments and wildlife
07 Engineering, manufacturing and construction	072 Manufacturing and processing	0722 Materials (glass, paper, plastic and wood)
08 Agriculture, forestry, fisheries and veterinary	082 Forestry	0821 Forestry

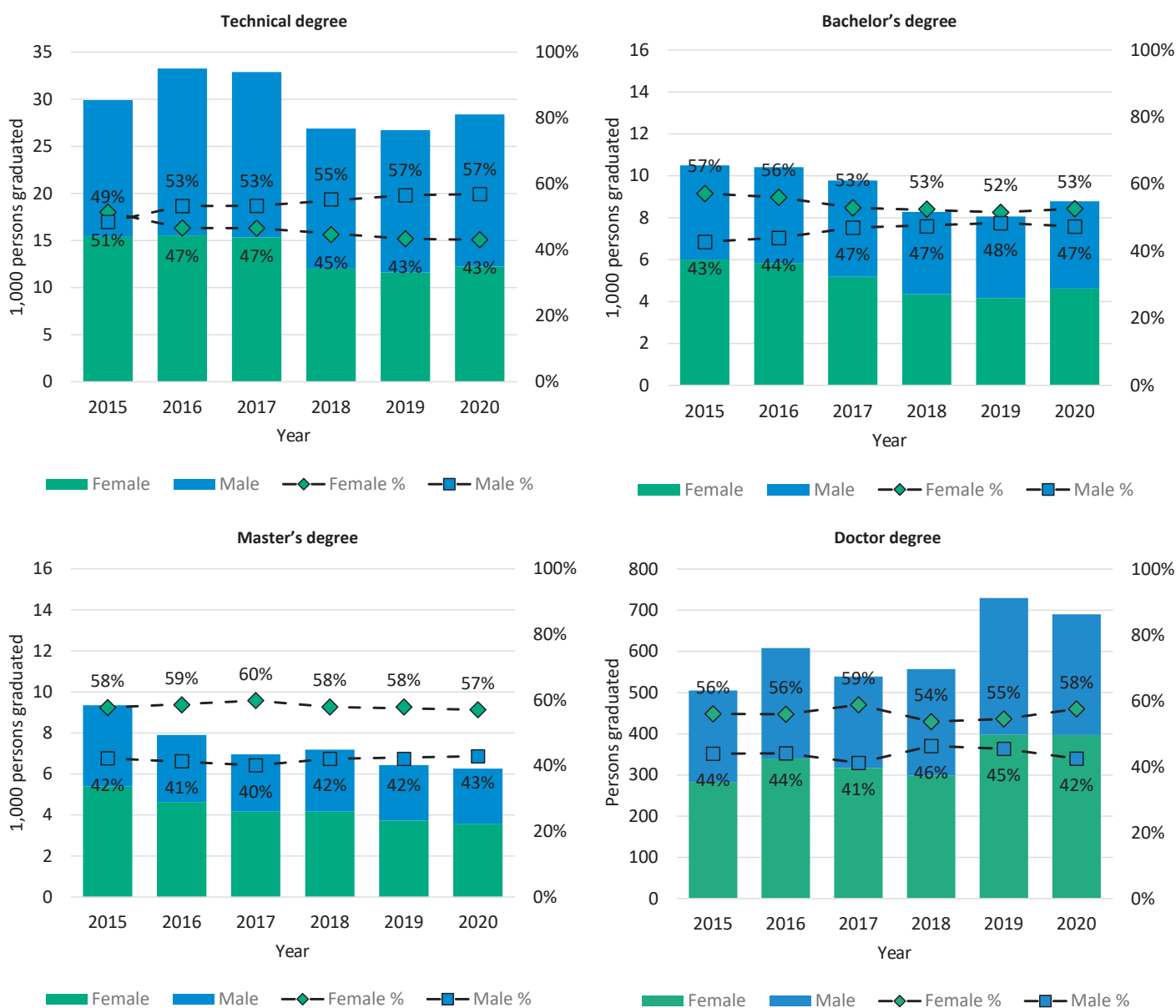
Source: International Standard Classification of Education (ISCED-F-2013) by United Nations Educational, Scientific and Cultural Organization

Undoubtedly, the just transition will require different skills and abilities of the future forest sector workforce. It is expected that graduates who have not obtained a forest related degree will join the sector, especially in the new forest based activities. An overview about the traditional forest related education and training outcomes is presented in Figure 13, Figure 14 and Figure 15.

As showed in Figure 13, between 2015 and 2020, the number of technical, bachelor's and master's degrees in environment related studies decreased. At the same time, the number of doctoral degrees in this field of education increased. In 2020, more than 50 % of bachelor's, master's and doctoral degrees completed in environmental related studies were achieved by women.

Figure 13 - Graduates by education level, programme orientation by sex on environmental degrees

052 Environment



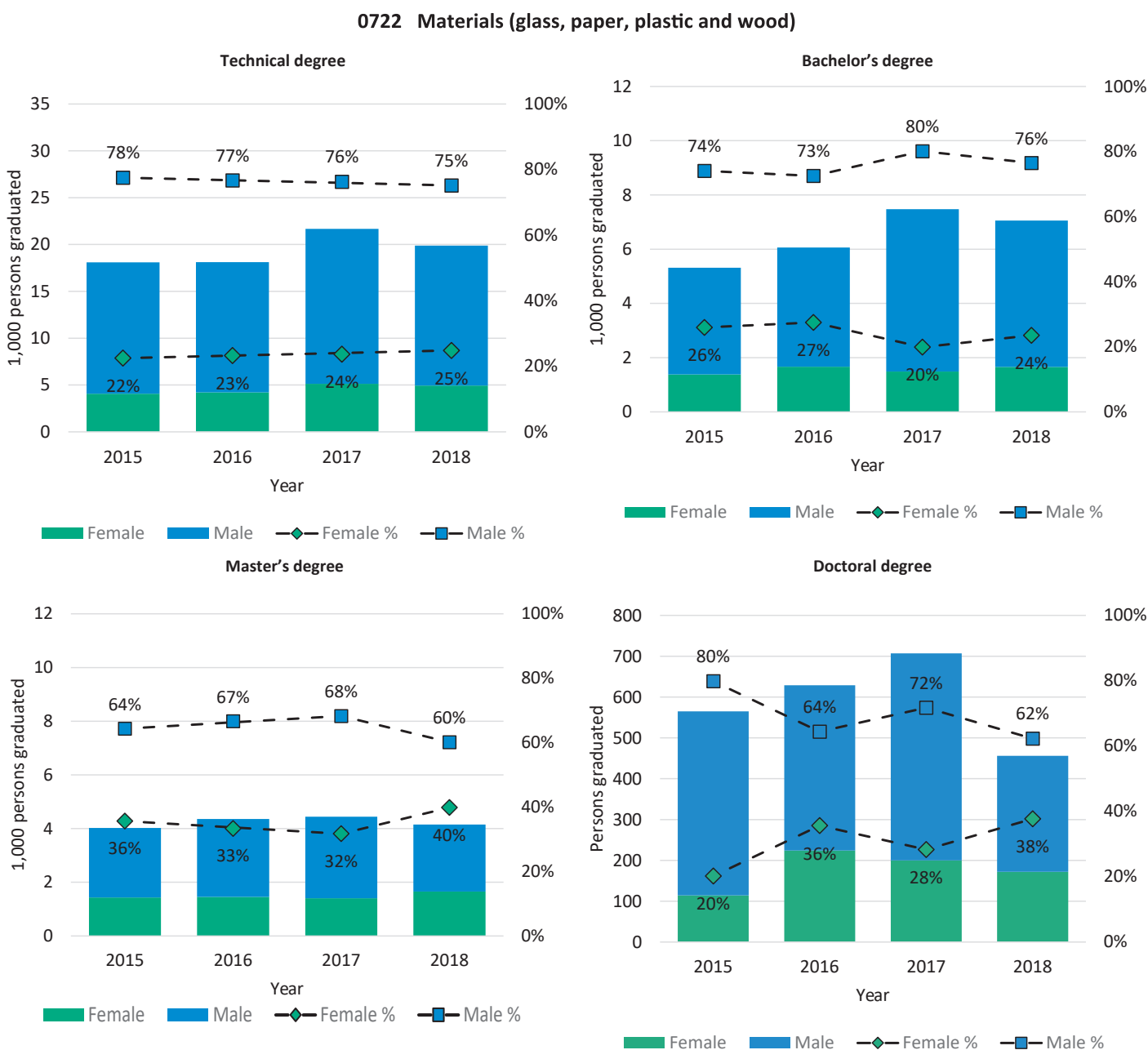
Note: 32 countries in the pan European reported education and training outcomes on the narrow field of education ISCED - 052

Source: Eurostat - Graduates by education level, programme orientation, sex and field of education <https://ec.europa.eu/eurostat/web/education-and-training/data/database>

The top five countries chosen by students to complete an environmental related degree were France, Poland, Spain, Romania and Italy. The decrease in the number of graduates in this field of education requires action. Furthermore, this development could result in a possible shortage of skilled workers in agriculture, forestry or nature conservation.

Knowledge on wood processing and paper manufacturing are skills in demand for the current and future forest sector workforce. Figure 14 shows the number of technical, bachelor's, master's and doctoral degrees in material processing studies between 2015 and 2018. This field of education covers not only training in wood and paper processing, but also glass and plastic. The top five countries chosen by students to complete a degree on processing of materials were Germany, France, Poland, Austria and Turkey.

Figure 14 - Graduates by education level, programme orientation by sex processing of materials



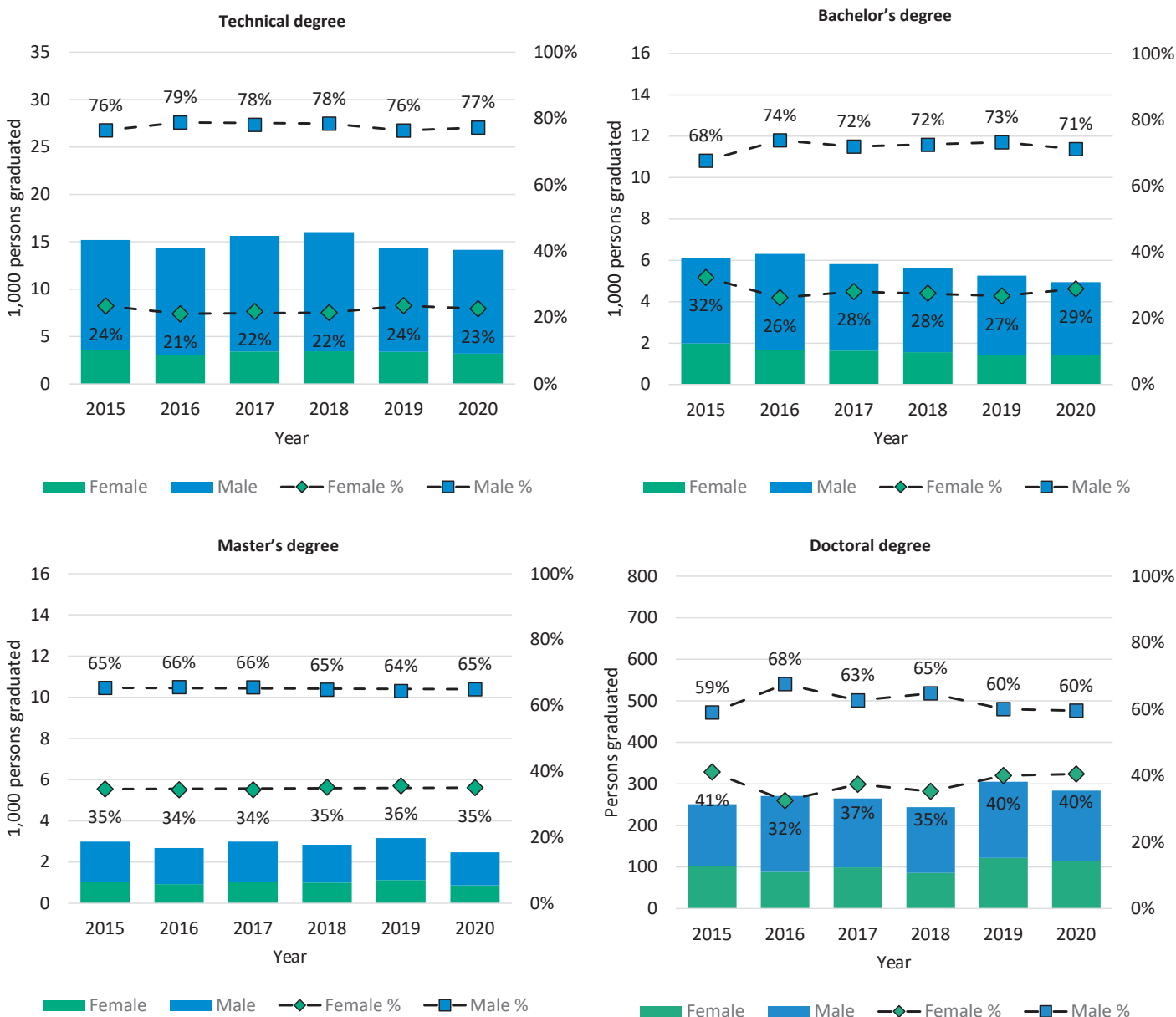
Note: 31 countries in the pan European reported education and training outcomes on the detailed field of education ISCED - 0722
 Source: Eurostat - Graduates by education level, programme orientation, sex and field of education <https://ec.europa.eu/eurostat/web/education-and-training/data/database>

The number of graduates in material processing studies increased between 2015 and 2018, especially for technical and bachelor's degrees. Meanwhile, the number of master's degrees remained stable. The slight increase in completed degrees in this field of education is beneficial for the wood based industry. Unfortunately, female participation in material processing studies remained below 30 % for technical and bachelor's degrees. The gender balance was better for completed degrees at the master's and doctoral levels, but women's participation remained below 40 %.

The same gender imbalance situation is observed for completed degrees in forestry. As shown in Figure 15, most students who graduated in a forestry study between 2015 and 2020 were men. The number of graduates in forestry decreased during the analyzed period, except for doctoral degrees. This development indicates a possible shortage of skilled persons to manage forests in the future. The top five countries chosen by students to complete a degree in forestry were Turkey, Poland, Germany, Spain and Romania.

Figure 15 Graduates by education level, programme orientation by sex on forestry degrees

082 – Forestry



Note: 32 countries in the pan European reported education and training outcomes on the narrow field of education ISCED - O82
 Source: Eurostat - Graduates by education level, programme orientation, sex and field of education. <https://ec.europa.eu/eurostat/web/education-and-training/data/database>

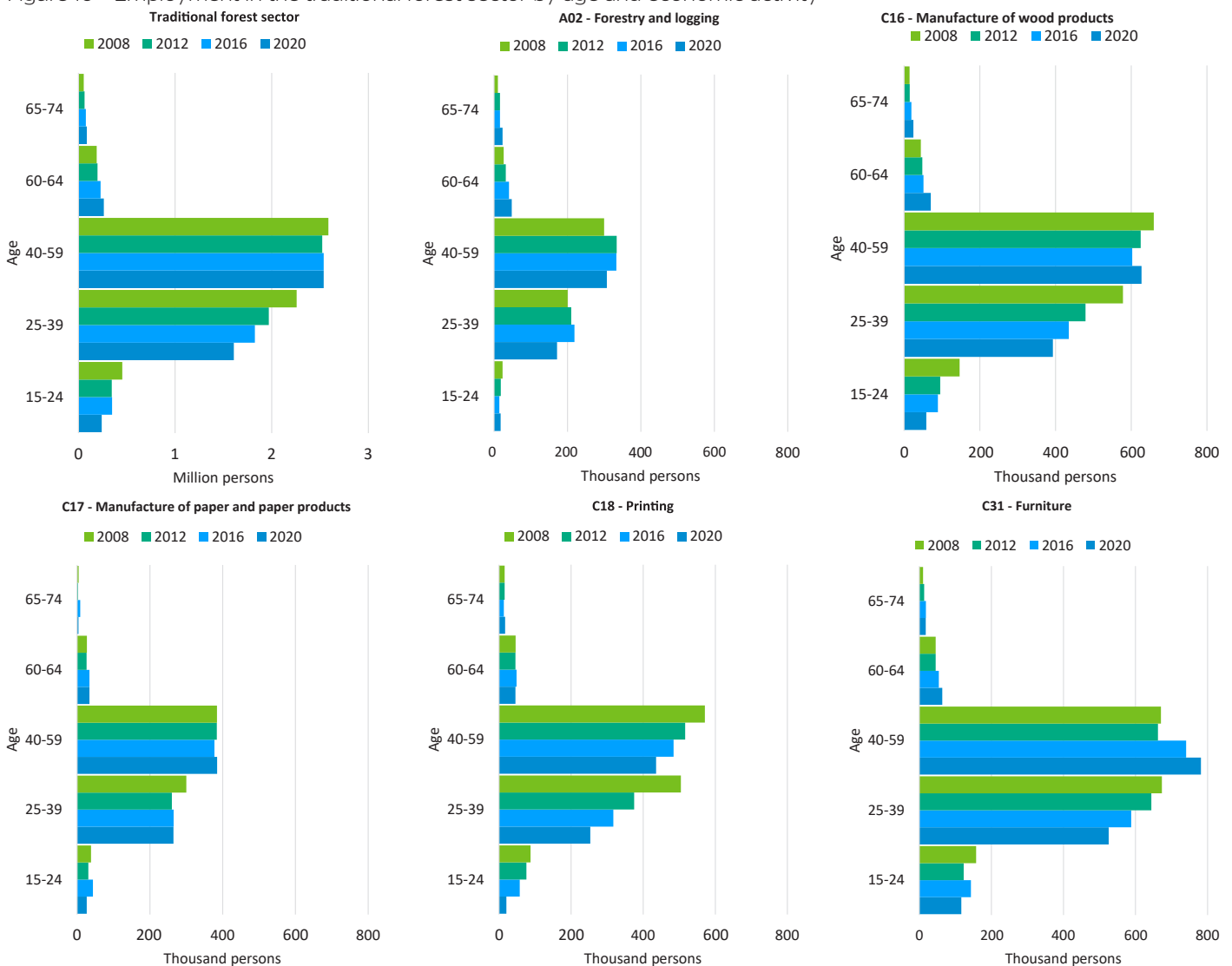
To develop a gender balance in the forest sector workforce in the future, incentives for women to engage in a forest related education should be given at the time of choosing a field of education and training, after primary and secondary school.

THE AGE OF THE FOREST SECTOR WORKFORCE

The proportion of workers aged 50 + over in total employment in Europe increased from 2005 to 2015 (Eurofound 2017). At the same time, the number of workers aged 35 and under has continuously

decreased. An analysis of the age development in the forest sector workforce, according to the economic activity, is shown in Figure 16.

Figure 16 – Employment in the traditional forest sector by age and economic activity



Note: 34 countries in the pan European reported employment by age
Source: Eurostat - LSF series - detailed annual survey <https://ec.europa.eu/eurostat/web/lfs/data/database>

Figure 16 presents the forest sector workforce distributed in five different age groups for the years 2008, 2012, 2016 and 2020. An analysis of the age structure of the entire traditional forest sector workforce reveals that the number of workers aged between 15 and 39 decreased between 2008 and 2020. In contrast, the number of workers aged 60 + increased slightly in the same period and indicates the aging of the current forest sector workforce. Nevertheless, each economic activity related to the traditional forest sector presents individual aging profiles over the years. However, fewer young workers (aged between 15 and 39) were entering all subsectors in 2020 compared to 2008. Also, the number of workers aged 60 + increased in all individual economic activities covered by the traditional forest sector.

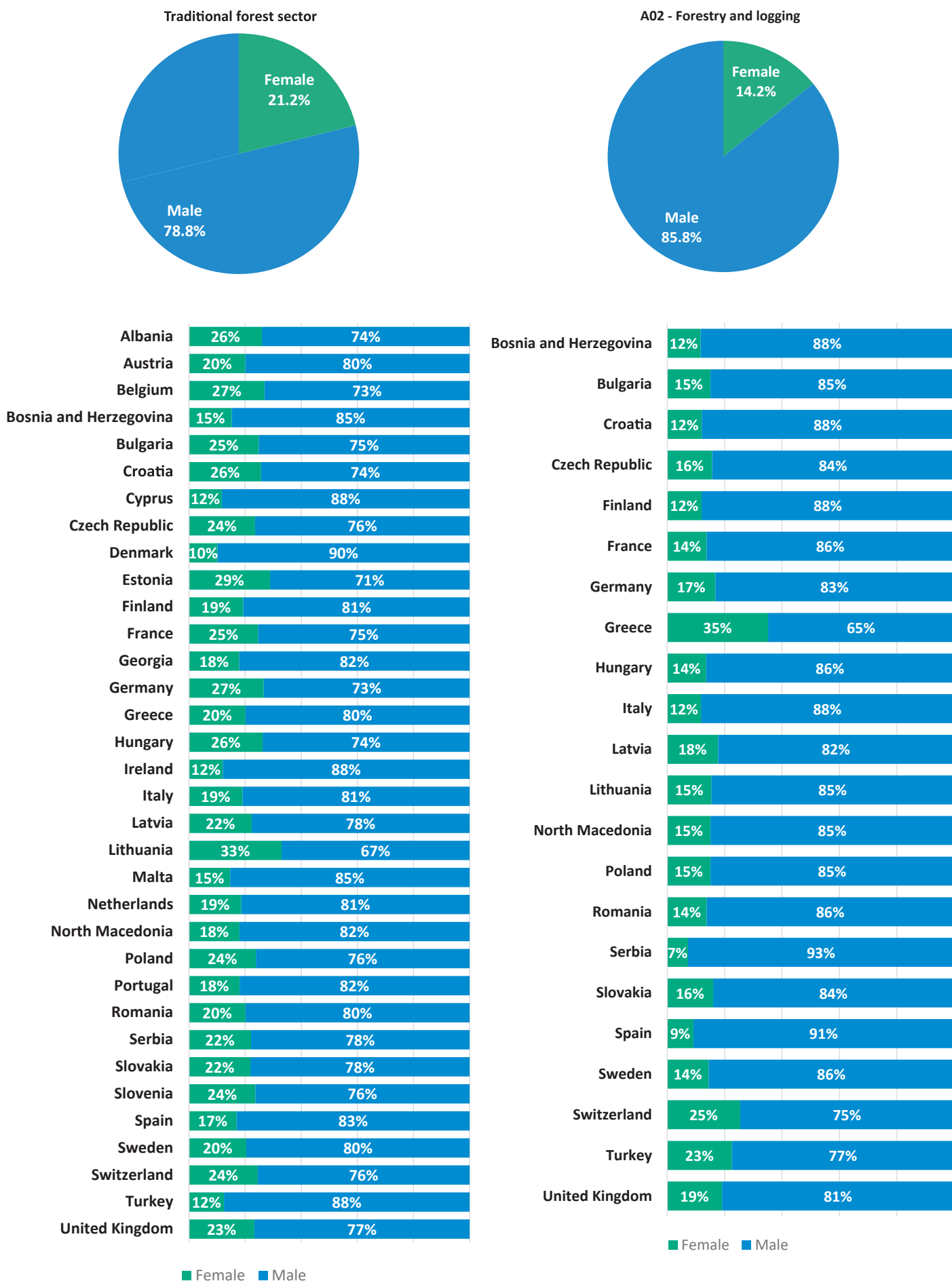
For workers aged between 40- and 59-years development is different. The workforce with this age distribution involved in forestry and logging, manufacture of wood products and manufacture of paper products between 2008 and 2020 remained unchanged. However, the number of workers with the same age distribution involved in printing considerably decreased. The opposite trend was observed for workers aged between 40 and 59 years involved in the manufacture of furniture, which substantially increased in the analyzed period of 12 years. The aging of the forest sector workforce and fewer younger workers is a stable trend. If this trend is not reversed, the forest sector will suffer from a shortage of workers in the future. Therefore, now is the time to establish strategies to attract and retain young workers.

GENDER BALANCE IN THE FOREST SECTOR

The gender balance of workers is an indicator of how inclusive an economic sector is. The share of male and female workers by country is presented in Figure 17, Figure 18 and Figure 19. To analyze gender balance in the forest sector, an average was calculated for the years 2017, 2018 and 2019. At least 36 countries collected and shared information about gender balance within the traditional forest sector. Considering the entire traditional forest sector workforce, women occupy only 21.2 % of the jobs (ILO 2021). Nevertheless, each economic activity related to the traditional forest sector has a different gender balance. However, when gender is analyzed for the entire pan European region, all forest-based economic activities had a gender imbalance. In general, the number of women working in the forest sector is lower than that of men in all pan European countries with available data. Considering the gender balance of graduates of forest related studies, this imbalance is to be expected (FAO 2015).

The lowest female participation is observed in forestry and logging activities, with only 14.2 %. This gender imbalance is partially explained by the working conditions related to forestry and logging, since working in the forest often requires physical strength and is dangerous. The largest female participation is observed in printing (32.6 %), followed by the manufacture of paper products (26.6 %) and by the manufacture of furniture (19.5 %). New forest based activities have a great potential to increase female participation in the forest sector, especially in the areas of research and development, social and health (e.g., ecotherapy, ecotourism). However, to improve gender balance in the traditional forest sector, strategies should be discussed, especially regarding family friendly and safer working environment, where women do not feel intimidated because of their gender.

Figure 17 - Employment in the entire traditional forest sector and forestry and logging by sex in the pan European region

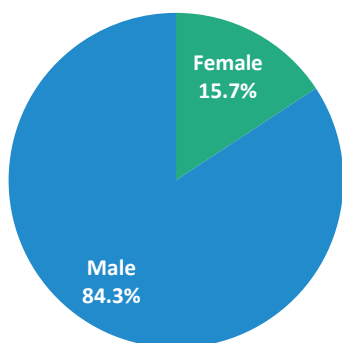


Note: 36 countries in the pan European reported employment by sex. The values presented in these figures are an average of employment of the years 2017, 2018 and 2019 ISIC divisions A02, C16, C17, C18 and C31.

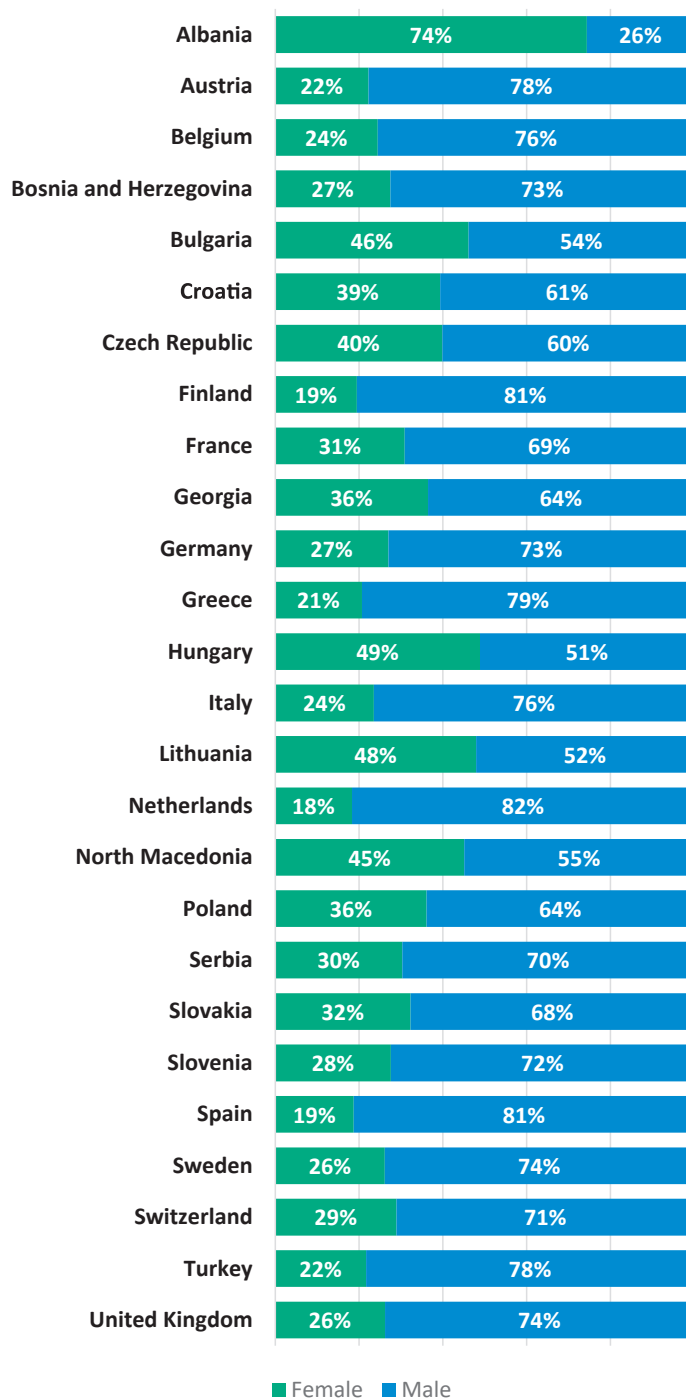
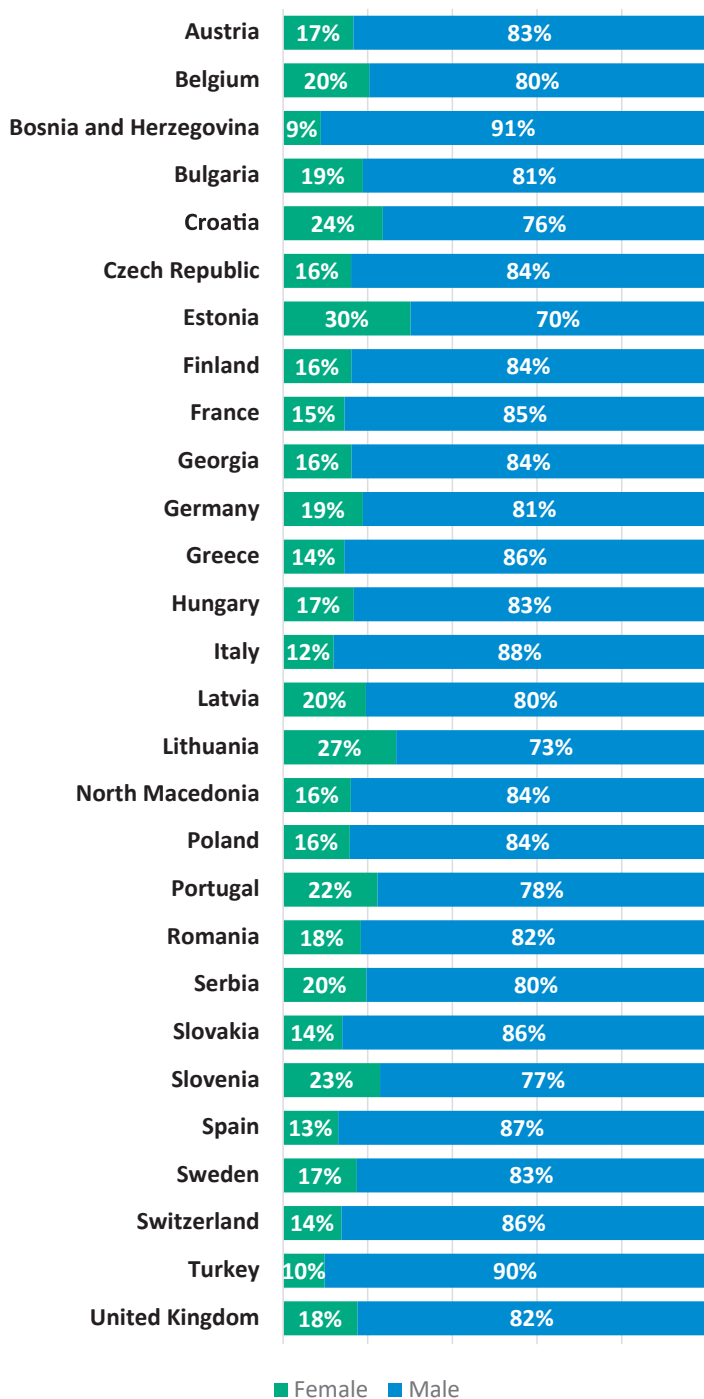
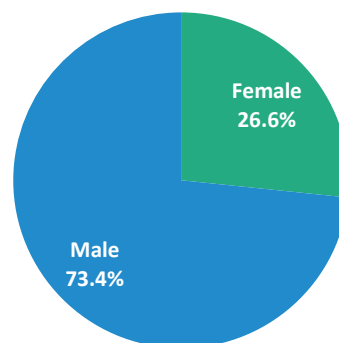
Source: Employment by sex and economic activity - ISIC level 2, available in ILOSTAT <https://ilostat ilo.org/data/>

Figure 18 – Employment in the manufacture of wood and paper products by sex in the pan European region

C16 - Manufacture of wood products



C17 - Manufacture of paper products

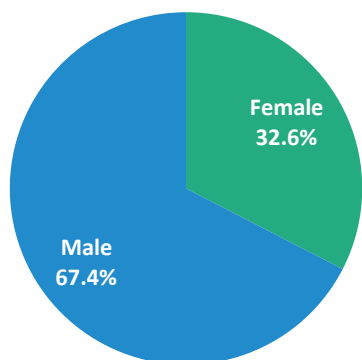


Note: 36 countries in the pan European reported employment by sex. The values presented in these figures are an average of employment of the years 2017, 2018 and 2019 ISIC divisions A02, C16, C17, C18 and C31.

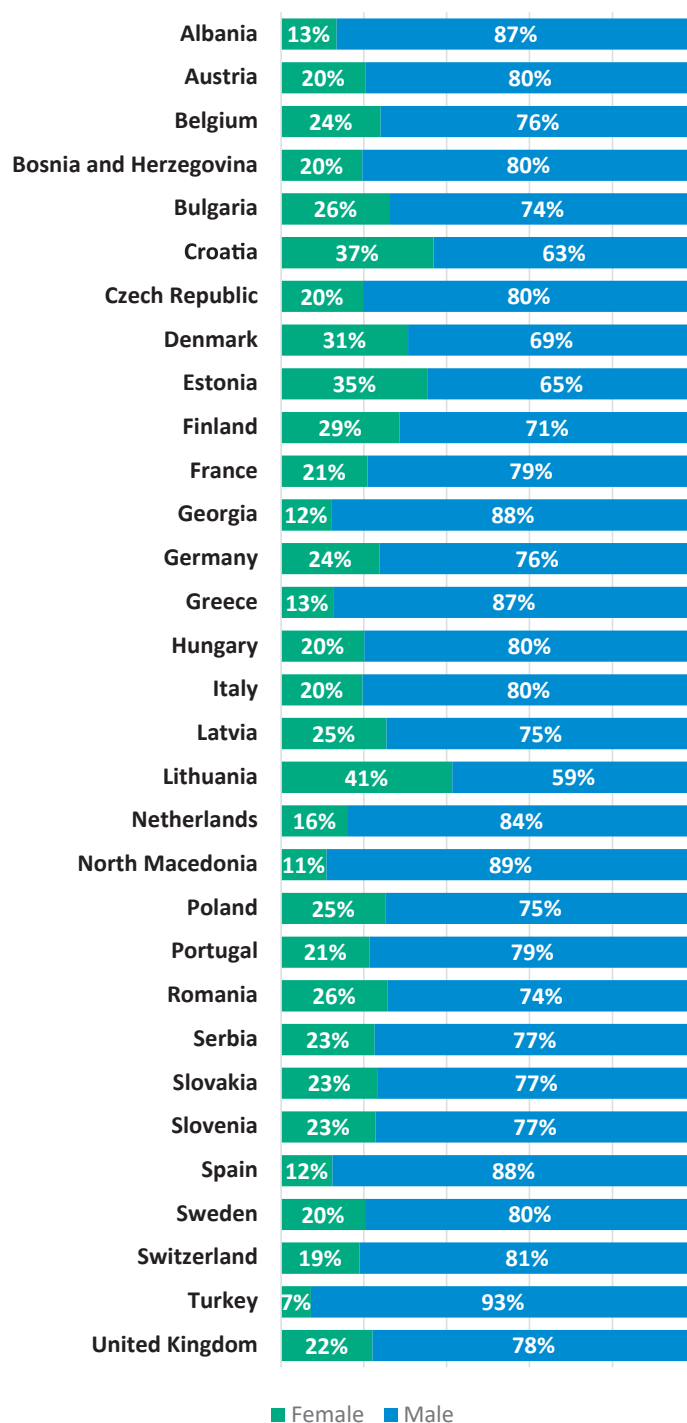
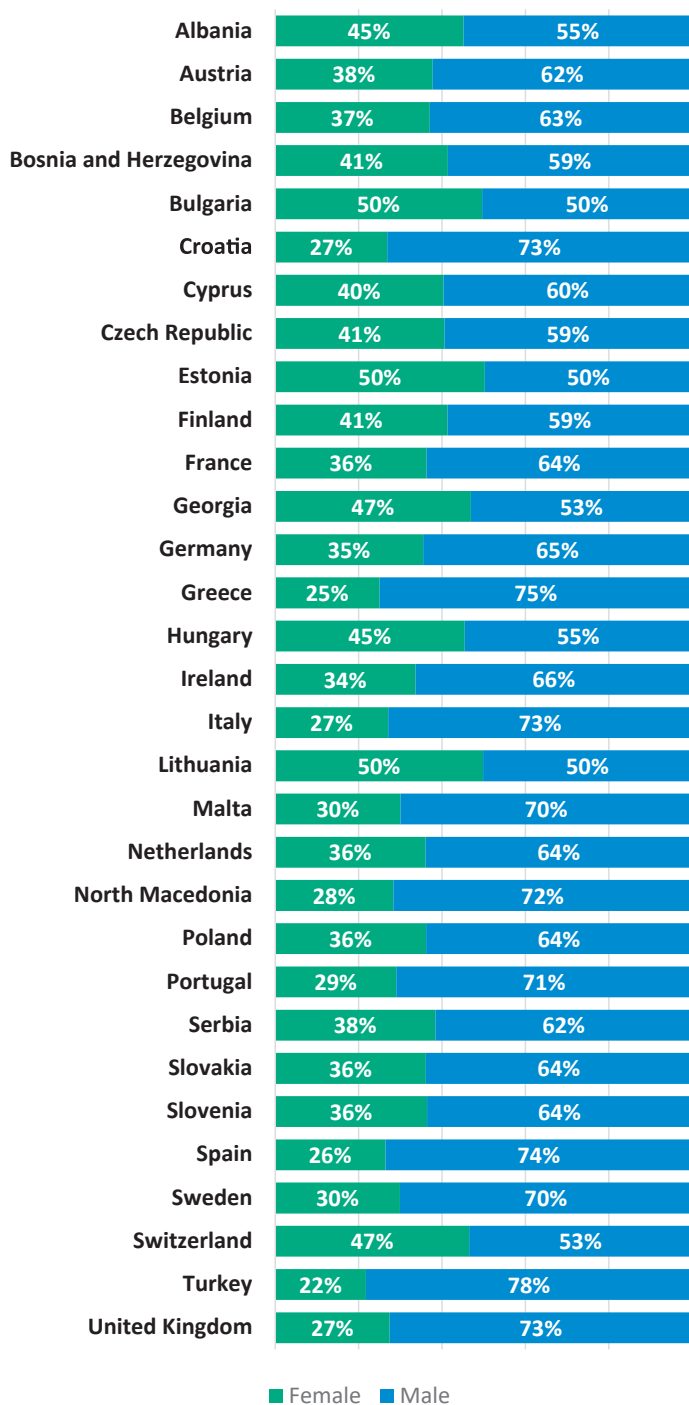
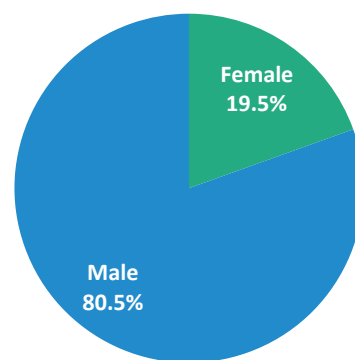
Source: Employment by sex and economic activity - ISIC level 2, available in ILOSTAT <https://ilostat ilo.org/data/>

Figure 19 Employment in the printing and manufacture of furniture by sex in the pan European region

C18 - Printing



C31 - Manufacture of furniture



Note: 36 countries in the pan European reported employment by sex. The values presented in these figures are an average of employment of the years 2017, 2018 and 2019 ISIC divisions A02, C16, C17, C18 and C31.

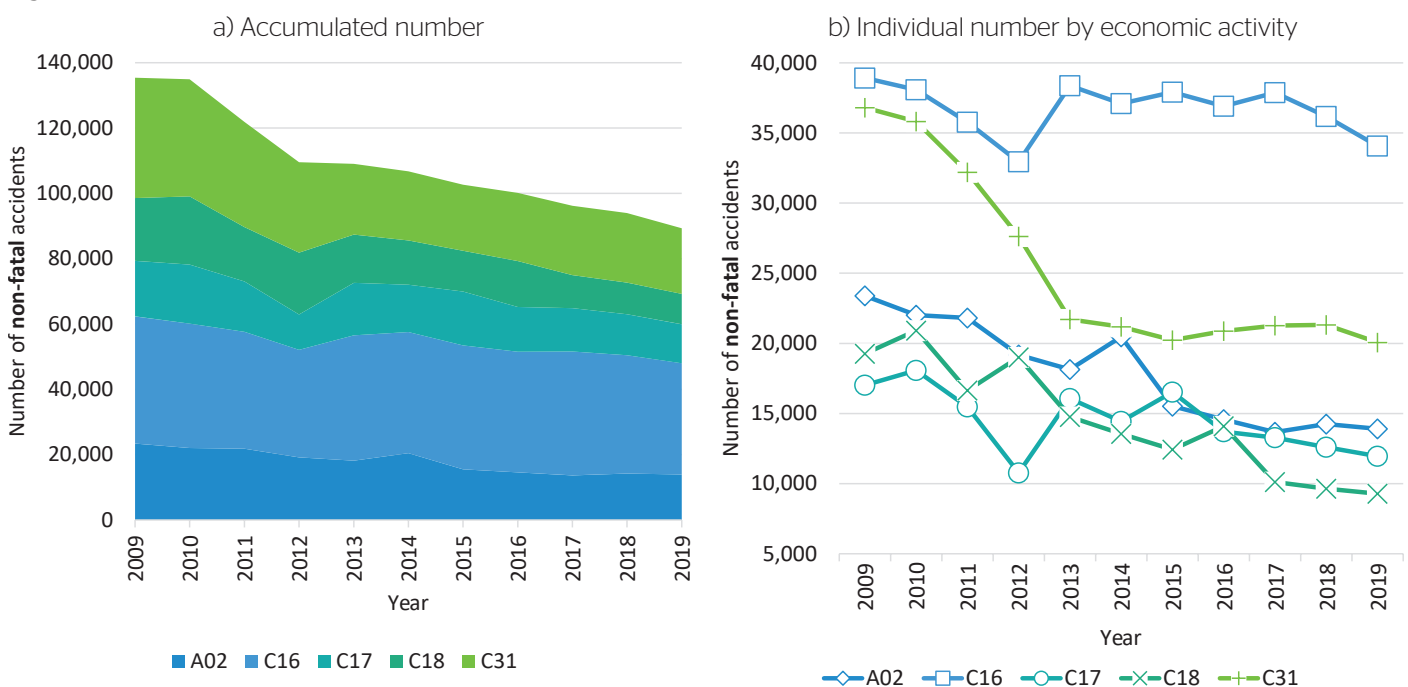
Source: Employment by sex and economic activity - ISIC level 2, available in ILOSTAT <https://ilostat ilo.org/data/>

WORKING CONDITIONS: THE OCCUPATIONAL HEALTH & SAFETY AT WORK

Occupational health and safety at work is an indicator of decent work (Table 2) and therefore must be met in order to provide Green Jobs. Much effort has been made to ensure forestry workers safety (ILO 1998, 2005, 2019b, 2019a). However, forestry activities belong to the most dangerous occupations in the world (Klun and Medved 2007; Garland 2018). An accident at work is “a discrete occurrence in the course of work which leads to physical or mental harm” (EUROSTAT 2022a). Non fatal accidents are reported when the injured

worker stays more than 3 calendar days absence from work. Accidents that lead to the death are called ‘fatal’ (EUROSTAT 2022a). Figure 20 a presents the accumulated number of non fatal accidents at work in the traditional forest sector and Figure 20 b presents the individual number of non fatal accidents by economic activity.

Figure 20 - Non fatal accidents at work in the traditional forest sector



Note: 30 countries in the pan European region reported non fatal occupational accidents
 Source: European statistics, Health and safety at work (ESAW) <https://ec.europa.eu/eurostat/web/health/data/database>

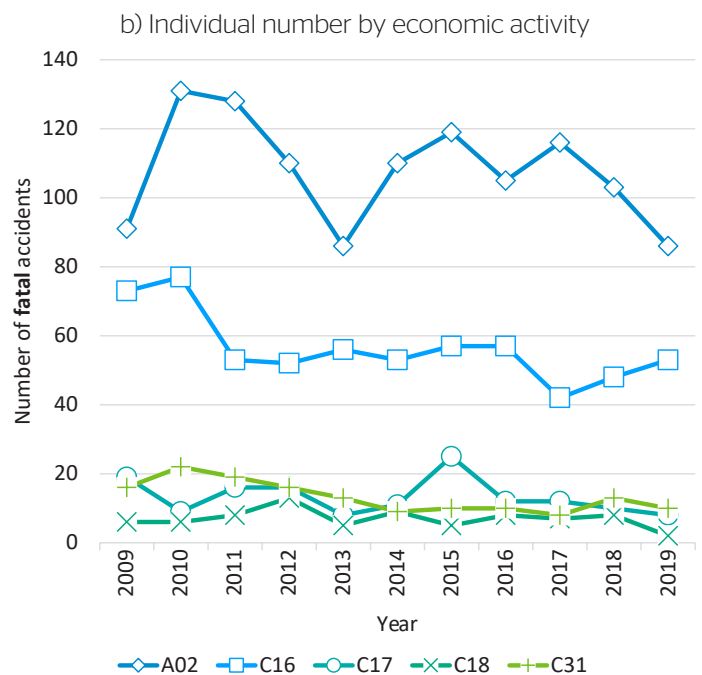
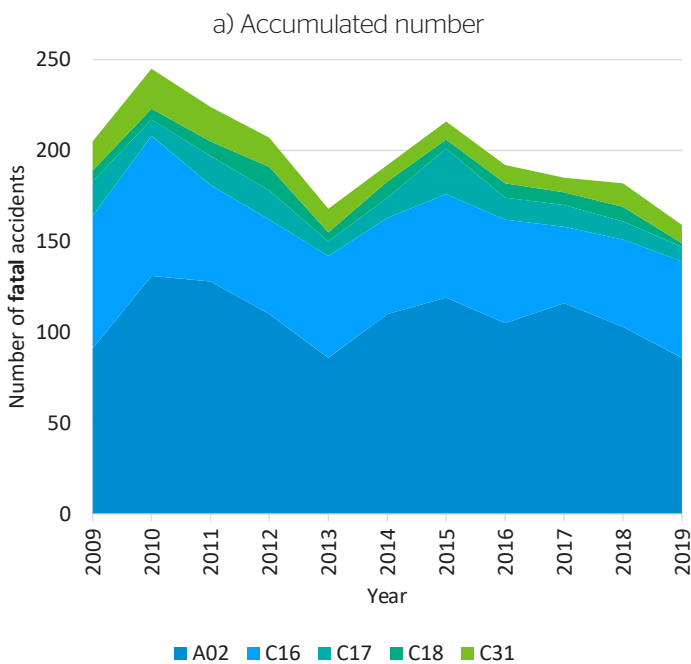
As can be observed in Figure 20 a) the accumulated number of non fatal accidents considerably decreased in the analyzed period. While a total of 135,404 non fatal accidents were reported in 2009, 10 years later this number dropped by 34 % to 89,285. The economic activities that contributed most to this decrease were printing (C18), manufacture of furniture (C31) and forestry and logging (A02). Nevertheless, the number of forest jobs also decreased in the same period (ILO 2021).

Technological development had helped to reduce accidents inside the forestry and forest based industry (ECE/FAO 2020). For instance, the increasing forestry mechanization for harvesting and silvicultural operation was a key factor to diminish accidents at work (Garland 2018). Besides, researches emphasize the need for change in forest worker’ behavior to keep improving occupational health and safety at work (Garland et al. 2020; Forest Europe 2020). The recommendation that employers need to take responsibility and guarantee adequate training and supervision for their workers have a huge influence on the reduction of accidents (Garland 2018; ILO 2019b).

Even though all efforts made to improve occupational health and safety at work, fatal accidents remain a reality in the forest sector. Figure 21 a) shows the accumulated number of fatal accidents in the entire forest sector. Figure 21 b) presents the individual number of fatal accidents in each economic activity

covered by the forest sector. The number of fatalities occurring in the forest sector between 2009 and 2019 decreased. If a total of 205 fatal accidents were reported in 2009, 10 years later this number dropped by 22 % to 159.

Figure 21 - Fatal accidents at work in the traditional forest sector



Note: 24 countries in the pan European region reported non fatal occupational accidents
 Source: European statistics, Health and safety at work (ESAW) <https://ec.europa.eu/eurostat/web/health/data/database>



The economic activities that contributed most to decrease fatal accidents were respectively printing (C18), manufacture of paper products (C17) and manufacture of furniture (C31). The economic activity which contributed least to the decrease of fatal accidents in the analyzed period was forestry and logging (A02). It is important to mention again that at the same time period the forest sector workforce decreased, too. Table 8 shows the rate of accidents per 100,000 employed persons in the forest sector. The major rate of fatalities occurred in the forestry and logging activities, followed by manufacturing of wood and paper products.

The forest sector wants to attract the future generations, so safety records and reputation must be improved (Garland et al. 2020). If job attributes are risky and hazardous, it means that there is room for technological and mechanization improvements. Ensuring occupational health and safety for the future forest sector workforce through technological development potentially creates Green Jobs. In addition, periodic training for more safety at work also creates Green Jobs.

Table 8 - Rate of accidents per 100,000 employed persons in the traditional forest sector

ISIC DIVISION	NON-FATAL ACCIDENTS	FATAL ACCIDENTS
Economic activity	Per 100,000 workers	
A02 - Forestry and logging	2,190	15.97
C16 - Manufacture of wood products	2,911	3.85
C17 - Manufacture paper products	1,679	1.33
C18 - Printing	1,113	0.65
C31 - Manufacture of furniture	1,324	0.66

Note: The values presented in this table are an average of employment and accidents of the years 2017, 2018 and 2019 ISIC divisions A02, C16, C17, C18 and C31.

Source: Employment by sex and economic activity - ISIC level 2, available in ILOSTAT <https://ilostat.ilo.org/data/>, European statistics, Health and safety at work (ESAW) <https://ec.europa.eu/eurostat/web/health/data/database>

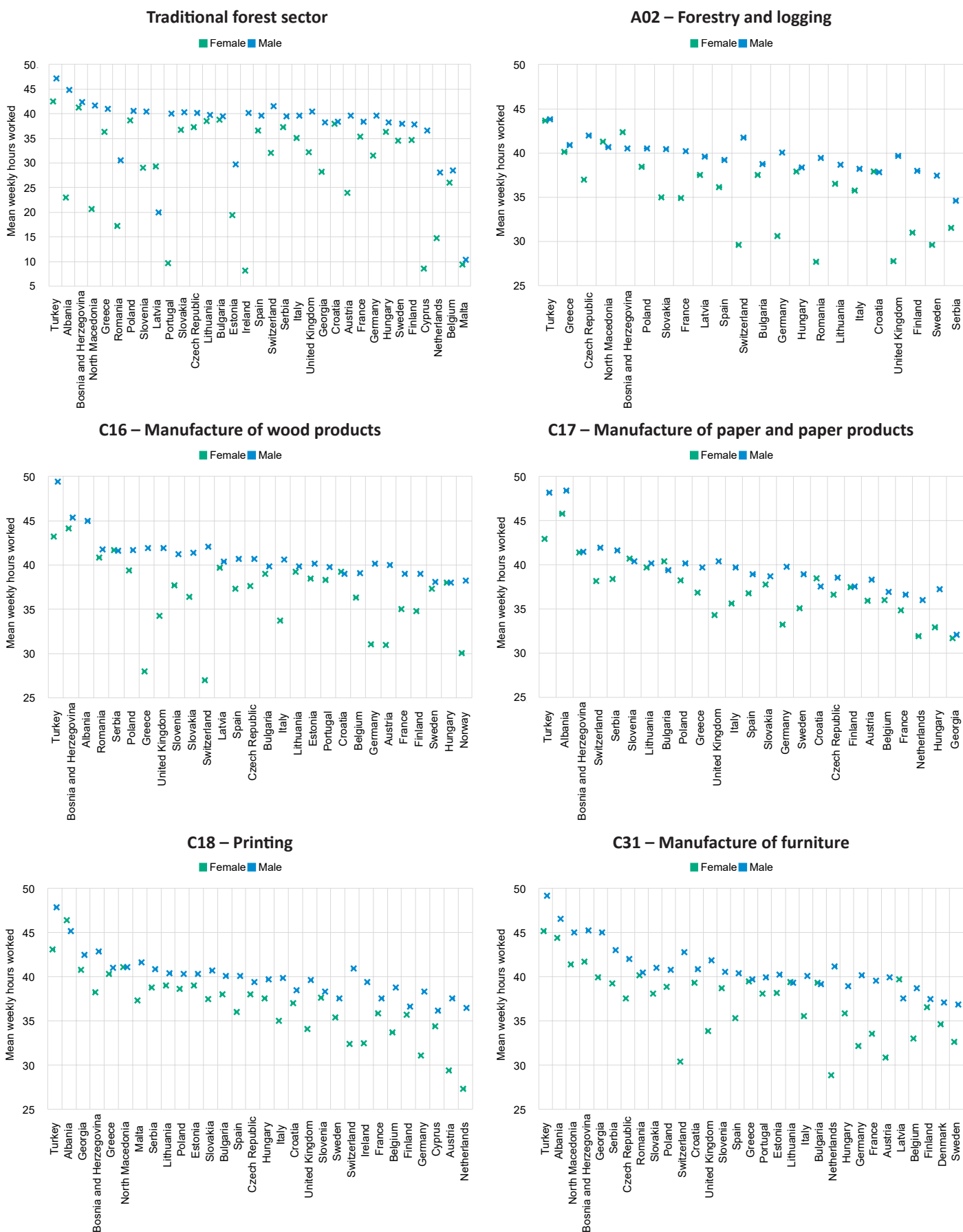
MEAN WEEKLY HOURS WORKED

The decent work agenda recommends that decent working times are a goal to be achieved in the world of employment (ILO 2013a). According to this agenda, excessive working time is considered to be more than 48 hours per week. Figure 22 provides an overview of the mean weekly hours worked in the traditional forest sector. To analyze working time in the forest sector, an average for the years 2017, 2018 and 2019 has been calculated. The average number of weekly hours worked varies according to the economic activity and country.

In general, the female workers worked fewer working hours than men in all pan European countries with available data. This indicates a higher degree of part time employment by women. This fact usually results in a wage gap between men and women (Dieckhoff

et al. 2016). The pan European forest sector workforce mostly did not exceed a maximum of 48 hours worked per week (Figure 22). However, whenever possible, more flexible working hours are increasingly desired by workers. New working models, as for example the hybrid work, are gaining attention of employers and employees. The era of remote work was intensified due to the pandemic experienced in the beginning of 2020. When it comes to the traditional forest sector, the activities are mostly executed on site. Nevertheless, the traditional forest sector has potential to make working time more flexible through technological development, mechanization and digitalization. While part time jobs are becoming more popular, they represent an opportunity for employers to offer education and training for workers, with benefits for both parts.

Figure 22 - Average mean weekly hours worked by sex in the forest sector



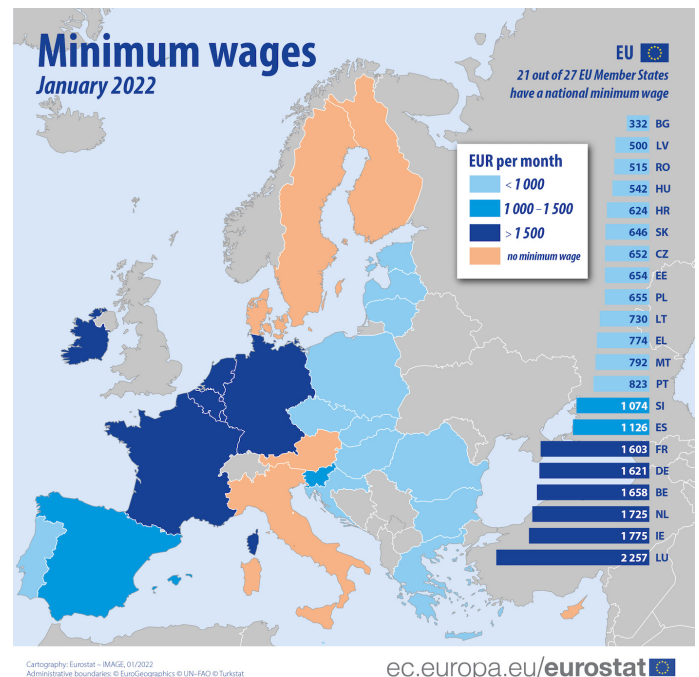
Note: 36 countries in the pan European reported mean weekly hours worked by sex. The values presented in these figures are an average of employment of the years 2017, 2018 and 2019 at ISIC divisions A02, C16, C17, C18 and C31
 Source: Mean weekly hours actually worked per employed person by sex and economic activity - ISIC level 2, available in ILOSTAT <https://ilostat.ilo.org/data/>

INCOME OPPORTUNITIES & JOB SECURITY

Adequate earning is a substantial element of the ILO's decent work agenda (ILO 2013a). Decent and Green Jobs must offer opportunities to move workers out of poverty, but for this to happen, fair wages must be met (Jaeger et al. 2021). According to the European Parliament, the minimum wage is a goal to be achieved in several countries in the region. The establishment of a minimum wage is important to guarantee a decent standard of living for workers and their dependents. Figure 23 shows the EU Member states with a national minimum wage.

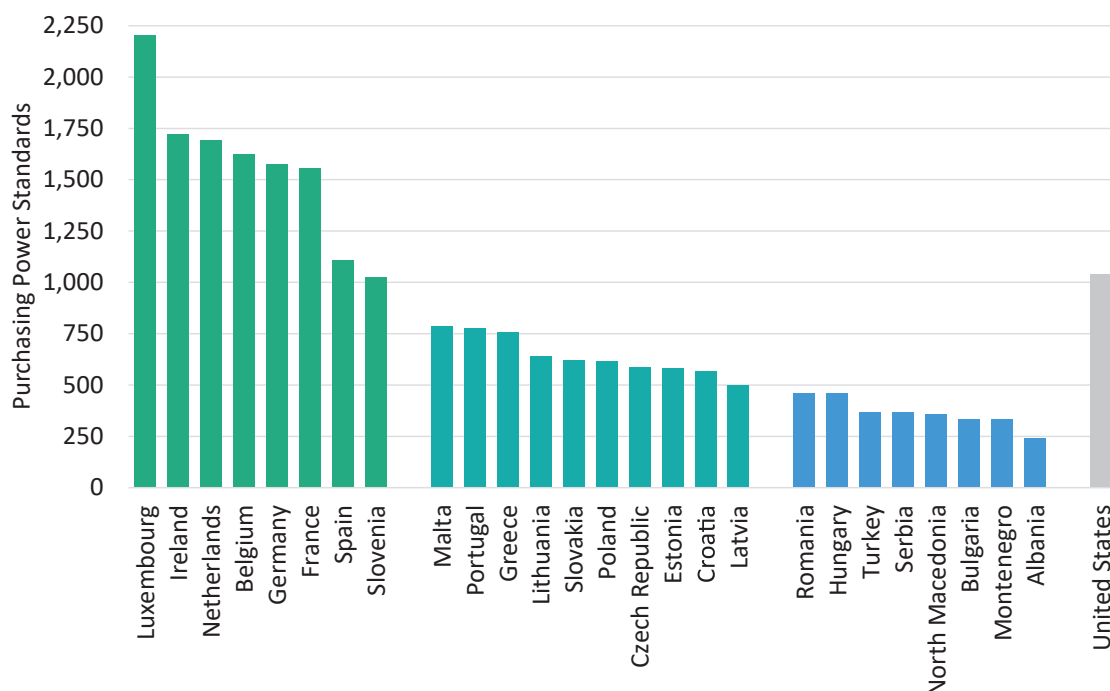
Since costs of living vary significantly in the pan-European region, a coherent analysis of minimum wages between countries should be expressed in purchasing power parities (PPP). The PPP is a conversion factor to estimate the purchasing power standards (PPS). The PPS is an artificial currency unit to compare the purchase of a same amount of goods and services in different countries. PPS is the technical term utilized by Eurostat and reduces the differences between countries when comparing minimum wages (EUROSTAT 2022b). Figure 24 shows EU Member States with a national minimum wage in 2021, grouped into three levels of PPS.

Figure 23 - Minimum wages in 21 out of 27 EU Member states with a national minimum wage in 2022



Source: Eurostat <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220128-2>

Figure 24 - Minimum wages expressed in purchasing power standards (PPS) in 2021



Note: The minimum wage according the PPS is 2021 is presented into three wage groups, differentiated by colors
Source: Monthly minimum wages by Eurostat <https://ec.europa.eu/eurostat/web/labour-market/earnings/database>

Countries represented by the green colour have a national minimum wage above 1,000 PPS. The second level of PPS in green blue represents a national minimum wage between 1,000 PPS and 500 PPS. Countries indicated by the light blue colour present the lowest national minimum wage in PPS terms, below 500. For comparison purposes, the PPS minimum wage in the United States is shown in light gray.

The assessment of wages in the forest sector is challenging because data on disaggregated level of economic activity is lacking. While comparable

information on wages are available following the International Standard Classification of Occupations (ISCO), ISCO doesn't provide information about earnings specifically in the forest sector. Figure 25 shows the mean hourly earnings, according to ISCO between 2010 and 2018. For most occupations a wage gap between male and female workers is reported. The largest gaps are observed between managers, professionals, non manual workers, technicians and associated professionals. While between 2010 and 2014 the wage gap between men and women decreased for various occupations, in 2018 this trend didn't continue.

Figure 25 - Mean hourly earnings by sex and occupation (ISCO) in Euro per year



Note: 27 countries in the pan European region reported mean hourly earnings
 Source: European statistics, Structure of earnings survey <https://ec.europa.eu/eurostat/web/labour-market/earnings/database>

It is important to mention that the low mean hourly earnings paid for skilled agricultural, forestry and fishery workers, is determined by agricultural workers dominating this occupation group (Figure 25). There is currently no information available what the mean hourly earnings of forest workers is.

Unions and their collective bargaining power play an important role to ensure minimum wage (Eurofound 2017) and equal pay for all women and men (DGB 2020; SDG-Tracker 2018). A good practice example from state companies in Germany is the wage agreement (in German language "Tarifvertrag") between employer and employees. This agreement determines rights and obligations between employees

and employers like wage, weekly working time, maximum daily working time, different wage levels for different work attributes, payment of allowance (e.g., for overtime), possibility to reduce working time, right to continued payment of wages in the event of illness, etc. According to the German Trade Union Confederation (DGB) wage agreements apply to any employment relationship if employer and employees agree so. Therefore, wage agreements are also applicable if employees are not member of a union or employers are not member of an employer association (DGB 2020). In addition to establishing a minimum wage and wage agreements, governments and the private sector can provide other benefits for their workforce such as family support wages and parental leave.

TRENDS, CHALLENGES & OPPORTUNITIES

The forest sector is dynamic and constantly adapting to changing framework conditions. For instance, the traditional forest sector has expanded beyond the forest based industry. Forests provide essential ecosystem services to society related to conservation and restoration (Schirpke et al. 2018). Currently, society seeks to reconnect with the forest in different ways and the number of people who resort to this environment to learn how to heal modern diseases is increasing (ECE/FAO 2018). It is expected that several new forest based activities will emerge with the just transition. Therefore, the forest sector workforce needs to constantly adapt their skills and abilities to keep up to date with the sectors' demands.

Some facts and figures presented in this report indicates that the forest sector must act now to alleviate future labour shortage. The number of graduates in environment and forest related studies has decreased over the last 10 years and female participation has remained below 40 %. This gender gap is also seen in the traditional forest sector workforce. Furthermore, this workforce is aging and the forest sector has the urgent task of attracting more youth and women to engage in forest related activities. Stimulating

forest based Green Jobs is a way to avoid potential labour shortages. Providing a more gender balanced workplace, improving occupational health and safety at work, making working time more flexible and offering fair wages are ways to improve the reputation of the forest sector and attract women and youth. However, additional strategies must be met to retain the forest sector workforce.

This chapter presents the trends on employment in the forest sector during the just transition and gives some recommendations for achieving more Green Jobs in the future. The challenges of job creation, job losses, and job transformation (requalification) are addressed. Last but not least, this chapter presents the opportunities that Green Forest Jobs represent for the traditional and new forest based sector.

GREEN JOBS MASTER PLAN IN AUSTRIA

Austria's Green Jobs Master Plan was initiated in 2010 with the main objective of creating Green Jobs focused on agriculture, forestry, environmental technology (e.g., renewable energy), tourism and leisure industries. The Master Plan, established by the Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology, aims to provide high level training and education for employees, stimulate research and development to ensure the constant improvement and innovation, promote networking

and cooperation in the environmental management sector, stimulate demand for environmentally friendly products, advertise technologies and services and actively raise public awareness about the importance of achieving more sustainable growth and Green Jobs. The Master Plan goal is to create Green Jobs related to renewable energies e. g., wood biomass and ecotourism, which are clearly forest related. For more information: <https://www.bmk.gv.at/en>

GREEN FOREST JOB STIMULUS

Since the 2015 Paris Agreement efforts have been made to decarbonized and greener economies around the world. The circular economy concept is one of the efforts to stimulate a green economy (Stegmann et al. 2020). Although a green economy should increase the demand for Green Jobs (Dordmond et al. 2021), the question whether it does remains.

Environmental policies are often appointed as a stimulus to greening the economy (UNEP 2011; ILO 2012). Nevertheless, some researchers contest that the green economy alone is not capable of growing

Green Jobs (Unay-Gailhard and Bojnec 2019). Therefore, additional stimulus for Green Jobs promotion might be needed. Funding of research and development related to green economy (Elliott et al. 2021) is one incentive to grow Green Jobs. This section presents, in tables and information boxes, examples of strategies applied by countries to stimulate a green economy and the growth of Green Jobs. The European Commission developed strategies to stimulate sustainability and growth of jobs within agriculture and forestry economies in rural areas, as listed in Table 9.

Table 9 - Strategies to stimulate employment in rural areas by the European Commission

RELEVANT STRATEGIES	AIMS RELATED TO THE FOREST SECTOR WORKFORCE
CAP, the Common agricultural policy Source: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy_en	<ul style="list-style-type: none"> keep the rural economy alive by promoting jobs in farming, agri-food industries and associated sectors
EU Forest Strategy 2030 Source: https://ec.europa.eu/environment/strategy/forest-strategy_en	<ul style="list-style-type: none"> create job opportunities through the promotion of NWFP and services, such as tourism and ecosystem services
ESF +, the European Social Fund Plus Source: https://ec.europa.eu/european-social-fund-plus/en/what-esf	<ul style="list-style-type: none"> fair and inclusive recovery with focus on social inclusion, education and skills and employment

As shown in Table 9, the ESF + is a great opportunity for forestry stakeholders to join forces and agree on a 'Pact for Skills' in order to increase the number of upskilling and reskilling opportunities in forestry. The ESF + aims to support the recovery from the COVID-19 crisis and focuses on the reduction of unemployment, ensuring quality and equal opportunities in education and training and improving social inclusion and integration. Besides that, the European Commission presented

strategies to promote sustainability and circularity inside all sectors and systems that rely on biological resources (European Commission 2018), as listed in Table 10. It is estimated that at least one million jobs could be created by 2030, particularly in rural areas, stimulated by fast growing startup ecosystem and biotechnology (European Commission 2018). Hence, fostering the forest bioeconomy has a huge potential to create Green Jobs (Wolfslehner et al. 2016).

Table 10 - List of communication policies with aim to stimulate sustainability by the European Commission

STRATEGIES RELEVANT TO THE FOREST BIOECONOMY	
A new EU Forest Strategy: for forests and the forest-based sector	European Commission, 2013
A blueprint for the EU forest based industries	European Commission, 2013
Multi-annual Implementation Plan of the new EU Forest Strategy	European Commission, 2015
CASCADES: Study on the optimized cascading use of wood	European Commission, 2016

Source: Forest bioeconomy - a new scope for sustainability indicators (Wolfslehner et al. 2016)

In order to assist the forest sector to successfully navigate the just transition, UNECE, FAO and FOREST EUROPE jointly developed the Guidelines on the Promotion of Green Jobs in Forestry. To promote Green Jobs, these guidelines include specific recommendations among others identifying and seizing new opportunities emerging from a shift to green economies and measures to attract the workforce of the future (UNECE/FAO/Forest Europe 2020). Green Forest Job stimulus are addressed by many pan European countries. The National Forest Programme (NFP) from the Czech Republic aims to increase employment and improve the social situation

of forest workers in the country (Krejzar 2014). A more audacious plan was established by the government of Ireland. In its 'Climate Action Plan', Ireland included the task to afforest at least 8,000 hectare every year until 2030. The afforestation incentives scheme provided financial support to encourage the planting of trees on land not previously under forest (DECC 2021). This initiative aims to tackle climate change, and at the same time creating Green Jobs in rural areas. Finland has reported the National Bioeconomy Strategy with the aim to create 100,000 jobs by 2025 through new bio based businesses, while securing ecosystem services provided by forests (Finnish Government 2020).

INCENTIVE FOR GREEN JOBS IN SPAIN: PROGRAMA EMPLEAVERDE

Stimulating youth employment in rural areas is a challenge in developed and lesser developed countries. On this regard, initiatives to encourage training, education and entrepreneurship in rural communities are of high priority. Actions as the Programa Empleaverde are relevant solutions to create opportunities and keep youth in rural areas. Empleaverde is a Spanish initiative, designed in 2014 by the Ministry for the Ecological Transition and the Demographic Challenge in cooperation with the Fundación Biodiversidad. This initiative is supported by the European Social Fund and focuses on promoting and improving employment and environmental entrepreneurship in the green and blue economies.

Fundación Biodiversidad plays an important role in coordinating the publication of calls. Project ideas related to sustainability, which aim to promote social and environmental benefits, including job creation, are encouraged to participate in the calls for subsidies. The Programa Empleaverde is expected to create 4,800 jobs, support over 3,000 entrepreneurship to

start their business, support education and training for 24,000 persons and improve job quality for at least 6,000 workers. Additionally, Fundación Biodiversidad has created the Red Empleaverde network to connect persons from entrepreneurs, investors and professionals who want to boost a fairer transition to the green economy. This online network reaches more than 10,500 official members and allows them to access up-to-date education and training, expert advisory and mentoring for entrepreneurs and stimulate the Green Jobs growth.

Empleaverde supports several forests related projects, including forest fires prevention, better job quality for natural parks workers, agroforestry and a NWFP stimulus, provision of training and education for forestry workers, sustainable use of wood products, support for youth entrepreneurs, promotion of ecotourism, etc.

For more information access <https://www.empleaverde.es/>

In addition to policies and funding tools, forest certification also stimulates the improvement of employment conditions and therefore plays a role in the growth of Green Jobs. Established in 1993, the Forest Stewardship Council (FSC) is an international organization that presents a system for voluntary forest certification in accordance to sustainability criteria (FSC 2015). To obtain an FSC certification, the interested parties must undergo an auditing process to check

if certificate holders follow principles and criteria of sustainable forest management. One criteria addresses job quality and the specific issue of workers' right and employment conditions (FSC 2015, 2018), and this is an important milestone to grow decent work in forestry. This criteria is based on the social and economic wellbeing of workers (FSC 2015) and focus on the topics listed in Table 11.

Table 11 – The FSC principle 2 on workers rights and employment conditions

PRINCIPLE 2: WORKERS RIGHTS AND EMPLOYMENT CONDITIONS	
2.1	Uphold the principles and rights at work as defined in the ILO Declaration on Fundamental Principles and Rights at Work (1998) based on the eight ILO Core Labour Conventions
2.2	Promote gender equality in employment practices, training opportunities, awarding of contracts, processes of engagement and management activities
2.3	Implement health and safety practices to protect workers from occupational safety and health hazards. These practices shall, proportionate to scale, intensity and risk of management activities, meet or exceed the recommendations of the ILO Code of Practice on Safety and Health in Forestry Work
2.4	Pay wages that meet or exceed minimum forest industry standards or other recognized forest industry wage agreements or living wages, where these are higher than the legal minimum wages. When none of these exist, the certificate holder shall through engagement with workers develop mechanisms for determining living wages
2.5	Demonstrate that workers have job specific training and supervision to safely and effectively implement the management plan and all management activities
2.6	Through engagement with workers shall have mechanisms for resolving grievances and for providing fair compensation to workers for loss or damage to property, occupational diseases, for occupational injuries sustained while working

Source: Forest Stewardship Council (FSC 2015, 2018)

Later, in 1999, emerged the PEFC, the Forest Certification Endorsement Program. The PEFC, which also aims to promote sustainable forest management through forest certification and labeling of forest-based products, follows similar criteria and principles to the FSC and thus requires that workers' rights be respected within certified enterprises (PEFC 2020). Therefore, forest certification plays an important role in promoting Green Forest Jobs.

Workers' rights must be respected in order to qualify a job as 'green'. A well-recognized mechanism to ensure workers' rights is the social dialogue. Social dialogue includes "all types of negotiation, consultation or information sharing among representatives of

governments, employers and workers or between those of employers and workers on issues of common interest relating to economic and social policy" (ILO 2013b). Social dialogue gives workers a voice to transform and improve job quality and is a substantial element of the decent work agenda by ILO (ILO 2013a). Unions play an important role to secure the social dialogue and decent jobs. The establishment of corporate social responsibility (CSR) within public and private companies is also a path to grow Green Jobs. CSR is a concept whereby companies voluntarily integrate social and environmental concerns to their operations and interactions with aim to achieve more safer working places (European Parliament 2001; Matilainen 2013).

PROJECT LEARNING TREE CANADA

The concern about the aging forestry workforce in Canada called for actions and motivated the development of solutions to attract youth to this sector. Therefore in 2018 the Project Learning Tree Canada was initiated. This project is an initiative by the Sustainable Forestry Initiative and Canadian Parks Council, to grow Green Jobs through environmental education and professional development services. The Learning Tree initiative is offering training and education for youth on environmental topics such as forests, ecosystems, wildlife, water resources and human health from early childhood, elementary and middle school until the high school levels. Additionally, the Project Learning Tree offers courses and workshops for professionals involved in environmental education, to maintain trainers up-to-date with the challenges related to the green transition.

Also, this initiative promotes a wide network between employers and students and already placed over 3,500 persons between 15 and 30 years old in Green Jobs within the environmental and forestry activities

in the country. Furthermore, the Project Learning Tree offers mentorship for youth interested on forests and conservation with the aim to achieve mutual benefits also for the mentees and provide the skills that the next generation of leader will demand in the future.

Additionally, this initiative offers funding for employers hiring youth into Green Jobs that support nature based solutions, forest sector, parks, conservation, natural resource management, environmental education, sustainable food systems, climate change, carbon sequestration, species maintenance and recovery, water quality and other related activities. It is expected that with this financial support, organizations feel motivated to hire more youth than normal and participate in a wide education and training program enabling young people to keep informed about the current demands of the green transition in the forest sector.

For more information assess <https://forests.org/plt-canada/>

The next section will present the challenges and opportunities that Green Jobs growth implies to the traditional and new forest-based sector. In addition, good practices examples are addressed to inspire action to improve job quality and decent work in the pan European region.

JOB CREATION

Green Forest Jobs creation requires more than good practices of SFM and circularity in production processes inside the traditional forest sector. To effectively create Green Forest Jobs, education and training are essential. While skills development poses a challenge for the forest sector, it also represents an opportunity to create jobs, for instance related to environmental and forest education. Forest related knowledge based services will be needed to provide training and education for current and future forest sector workforce, from forest kindergarten (Lesní Pedagogika 1998) to vocational training.

In addition to job creation in the forest related education, the just transition in the forest sector will

create jobs in other areas of the bioeconomy, especially on wood based construction (Jonsson et al. 2021), biorefinery and biochemicals (Jonsson et al. 2021; European Commission 2018; Ronzon and M'Barek 2018), wood based textiles (Kallio 2021), urban forestry (ECE/FAO 2020), ecosystem services (Schirpke et al. 2018; Valatin et al. 2017), ecotourism (Castañeda et al. 2014), ecotherapy (Hinde et al. 2021), forest aesthetics, forest amenity and recreation (ECE/FAO 2018).

Opportunities to grow Green Forest Job are also increasing in the area of providing technology and/or services to the forest sector with the aim of improving sustainability and resource efficiency for the wood based industry. It covers the production, installation

and repair of machinery and equipment utilized by the forest and wood based sector. Therefore, mechanization and technological development are indeed opportunities to grow Green Jobs. Green Forest Jobs are expected to grow in new forest based sector as provision of supporting services related to membership organizations, non governmental organizations, advertising agencies and other consulting activities (e.g. market research and technical analysis).

The utilization of the forest for social services and to improve human health is already growing and provides opportunities for forest based Green Jobs. Some environmental services provided by forests, such

as recreation (e.g. adventure parks, hunting), spiritual support (e.g. woodland/forest cemetery (FriedWald 2001)) and religious ceremonies (Triulzi et al. 2017) not only improve human well being, but also bring benefits to the environment, nature conservation and rises awareness of the importance of forests. Finally, creating Green Forest Jobs supports rural areas. An increase of Green Jobs in rural areas is connected with business decentralization, in which the transformation of goods and the provision of services takes place as close as possible to the communities that originate them (European Commission 2018). This creates opportunities, reinvigorating local economies through the creation of 'green' skills in loco. Also, it mitigates job migration, as it promotes opportunities in rural areas.

JOB LOSSES

The main causes of job loss are increased automation and rising labour productivity (ILO 2017). Even though it poses challenges for the current forest sector workforce, this trend creates job opportunities in other forest related economic sectors as mentioned before. Additionally, mechanization and technological development improves the working conditions and therefore are important to promote Green Forest Jobs growth. However, research and development to automatize the forest sector demands skilled workforce. A requalification program to keep the forest sector workforce employed while automation raises is feasible and needed. Workers without access to training may lose their long term employment opportunities during the just transition (ECE/FAO 2020). Upskilling workers means to provide opportunities for education and training, and are an opportunity for Green Forest Jobs growth. Even though increased productive may

impact employment level, it also provides better job quality for workers. Green Jobs must be productive and mechanization is one way to achieve this goal. In addition, it is important to minimize jobs that not offer perspectives for workers. Therefore, investment in forest related education is crucial to providing 'green' skills to future workers and alleviating job loss.

The aging workforce is an additional concern to the shortage of skilled workforce (ECE/FAO 2018). However, this aging workforce has very important tacit knowledge. To avoid job losses, the well experienced workforce can provide training to the future forest sector workforce. Summarizing, to minimize loss of jobs action should be taken to re skill and up skill workers. Programs to encourage job transformation and requalification are crucial.



JOB TRANSFORMATION & JUST TRANSITION

The forest sector and its workforce must adapt to constant transition. New skills will be required by the new forest-based sector and many existing jobs will be redefined in terms of occupational qualification. Therefore, forestry education and lifelong learning play an essential role in preparing for the just transition. For instance, 'on the job' training allows workers to develop skills and gain experience in everyday work situations while still undergoing training (Basariya and Vasanthi 2019). Training and education are tools to provide the necessary skills demanded by Green Jobs, but also to develop employment security and employability for workers.

Digitalization plays an essential role in providing the 'green' skill of the future. Several initiatives are focused on providing skills and training for students and the forest sector workforce. Table 12 lists some digital offers to gain knowledge and acquire green skills, as well as websites with Green Job offers.

Table 12 - Example for online tools for gaining green skills and searching for Green Jobs

SKILLS	SEARCH FOR A GREEN JOB
Learning and teaching tools about a wide variety of forestry topics https://www.waldwissen.net/en/	Job offers within the green economy https://www.karriere.at/jobs/green-job
Skills provision for forestry students to fill the gaps left by their formal education https://ifsa.net/tree-learning/	Green Job offers and employer support to find workers with green skills https://pltcanada.org/en/
Training and learning materials on innovative European forestry sector to consolidate the digital transformation of the wood value chain https://rosewood-network.eu/	Job positions related to green economy sustainability https://www.greenjobs.co.uk/

Other transformations will occur in relation to new working models, such as more hybrid and remote work, part time positions combined with part time training, more family friendly jobs, inclusive work environments and increased gender diversity.

FINAL REMARKS

There is still a lack of common understanding of what exactly forest based Green Jobs are. Therefore, identification and qualification of Green Forest Jobs in the forest sector is still a challenge. To overcome this challenge, a well-accepted definition of Green Forest Jobs as well as criteria that allow to classify Green Jobs regarding decency and quality requirements are needed. However, there is currently little information available about job quality and how decent the jobs in the forest sector are. To address this lack of information, countries need to join forces and collect comparable data at a disaggregated level. Respective additions to the Forest Europe criteria and indicators might be a solution here.

Policies and measures to increase women's participation in the forest sector workforce are needed to level the gender imbalance. Improving occupational health and safety at work are measures that will make the forest sector also more attractive for female and youth. New working models and more flexible working hours are another important step to be achieved by the forest sector. Wages in the forest sector must become more competitive and the gender wage gap needs to be closed. Wage agreements, that guarantee women

and men an equal pay are needed to reach gender equality. By achieving these goals, the forest sector could become a frontrunner ensuring decent work and equal pay for all to improve its reputation and attracting new workers.

For the just transition to a greener forest sector, education and training are essential. Education, training and (re)qualification programs will prepare the current forest sector workforce for the future needs and give workers opportunities and employability especially in rural areas. Education, training, research and development are key for providing Green Forest Jobs, sustainable forest management and provision of forests' ecosystem services. Green Jobs in the new forest-based sector are an opportunity for the development of rural areas in all pan-European countries by providing employment, income and reducing job migration of the rural population.

BIBLIOGRAPHY

- Basariya, Rabiya; Vasanthi, Sree (2019): Pros and Cons of On the Job training versus Off the Job Training. In International Journal of Scientific & Technology Research (8 (10)), pp. 671-674.
- Castañeda, Ignacio Demaria; Pastor, M^a Pilar Tinoco; Pérez, Rosalía Moreno (2014): Los montes como generadores de empleo. In Revista de Ciencia, Tecnología y Medio Ambiente (XII), Article 22p.
- Cui, Shannon; Lippe, Rattiya Suddeephong; Schweinle, Jörg (2022): Informal Employment in the Forest Sector: A Scoping Review. In Forests 13 (3), p. 460. DOI: 10.3390/f13030460.
- DECC (2021): Climate Action Plan 2021. Department of the Environment, Climate and Communications. Available online at <https://www.gov.ie/en/campaigns/2f87c-climate-action-plan-2021/?referrer=http://www.gov.ie/climateaction/>.
- Deschenes, Oliver (2013): Green Jobs. Policy Paper Series. 62nd ed. Edited by IZA. Forschungsinstitut zur Zukunft der Arbeit. Bonn (Policy Paper).
- DGB (2020): Was ist ein Tarifvertrag? Tarifpolitik und Tarifautonomie. Available online at <https://www.dgb.de/themen/++co++8441ae46-fef1-11df-463e-00188b4dc422>.
- Dieckhoff, Martina; Gash, Vanessa; Mertens, Antje; Romeu Gordo, Laura (2016): A stalled revolution? What can we learn from women's drop-out to part-time jobs: A comparative analysis of Germany and the UK. In Research in Social Stratification and Mobility 46, pp. 129-140. DOI: 10.1016/j.rssm.2016.09.001.
- Dordmond, Gertjan; Oliveira, Heder Carlos de; Silva, Ivair Ramos; Swart, Julia (2021): The complexity of green job creation: An analysis of green job development in Brazil. In Environ Dev Sustain 23 (1), pp. 723-746. DOI: 10.1007/s10668-020-00605-4.
- ECE (2010): Measuring Quality of Employment. Country pilot reports. With assistance of Prepared by UNECE Task Force on the Measurement of Quality of Employment. Geneva (ECE/CES/5). Available online at <https://unece.org/statistics/publications/measuring-quality-employment>.
- ECE (2015): Handbook on Measuring Quality of Employment. A Statistical Framework. With assistance of Prepared by the Expert Group on Measuring Quality of Employment. New York, Geneva (ECE/CES/40). Available online at <https://unece.org/statistics/publications/handbook-measuring-quality-employment>.
- ECE/FAO (2018): Green jobs in the Forest Sector. With assistance of Andreas Bernasconi, Josef Herkendell, Diarmuid McAree, Hakan Nystand, Christian Salvignol. FAO; UNECE. New York, Geneva (Geneva timber and forest discussion paper, 71).
- ECE/FAO (2020): Forest sector workforce in the UNECE region. Overview of the social and economic trends with impact on the forest sector (Geneva timber and forest discussion paper, 76). Available online at <https://unece.org/forests/publications/forest-sector-workforce-unece-region>.
- Elliott, Robert J.R.; Maddison, David; Ozgen, Ceren (2021): Eco-Innovation and Employment: A Task-Based Analysis (IZA DP No. 14028), 69p.
- Eurofound (2017): Sixth European Working Conditions Survey - Overview report (2017 update). Edited by Publications Office of the European Union. Luxembourg.
- Eurofound; ILO (2019): Working conditions in a global perspective. With assistance of Mariya Aleksandrova, Janine Berg, David Foden, Hannah Johnston, Agnès Parent-Thirion, Julie Vanderleyden. Edited by Publications Office of the European Union. Luxembourg, Geneva. Available online at https://www.ilo.org/global/publications/books/WCMS_696174/lang-en/index.htm.
- European Commission (2018): A sustainable Bioeconomy for Europe: strengthening the connection between economy, society and the environment. Updated Bioeconomy Strategy. European Union. Brussels, Belgium (ISBN 978-92-79-94144-3).
- European Parliament (2001): Promoting a European Framework for Corporate Social Responsibility. Edited by Commission of the European Communities. Brussels, Belgium (Green Paper, COM(2001)).

- EUROSTAT (2020a): Education and training. Education and training outcomes. Graduates. Available online at <https://ec.europa.eu/eurostat/web/education-and-training/data/database>.
- EUROSTAT (2020b): Employment and unemployment (Labour force survey). Employment by sex, age and detailed economic activity (from 2008 onwards, NACE Rev. 2 two digit level) - 1 000. Available online at <https://ec.europa.eu/eurostat/web/lfs/data/database>.
- EUROSTAT (2021): Employment. Edited by European statistics. Available online at <https://ec.europa.eu/eurostat/web/forestry/data/database>.
- EUROSTAT (2022a): Accidents at work (ESAW, 2008 onwards) (hsw_acc_work). Eurostat metadata & National metadata. European statistics. Available online at https://ec.europa.eu/eurostat/cache/metadata/en/hsw_acc_work_esms.htm.
- EUROSTAT (2022b): Out now: First 2022 data on minimum wages in the EU. European statistics. Available online at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Minimum_wage_statistics.
- FAO (2015): Global Forest Resources Assessment. Employment, education and NWFP. Edited by Food and Agriculture Organization of the United Nations. Available online at <https://fra-data.fao.org/EU/fra2020/employment/>.
- Finnish Government (2020): The Finnish Bioeconomy Strategy. Sustainably towards higher value added. Edited by Finnish Government. Ministry of Economic Affairs and Employment. Helsinki. Available online at <https://julkaisut.valtioneuvosto.fi/handle/10024/163969>.
- Forest Europe (1993): Sustainable forest management. Edited by Ministerial Conference on the Protection of Forests in Europe (MCPFE). Available online at https://ec.europa.eu/growth/sectors/raw-materials/related-industries/forest-based-industries/sustainable-forest-management_hr.
- Forest Europe (2020): State of Europe's Forests 2020. Ministerial Conference on the Protection of Forests in Europe.
- FriedWald (2001): Die Bestattung in der Natur. Available online at <https://www.friedwald.de/>.
- FSC (2015): Principles and Criteria for Forest Stewardship. Forest Stewardship Council. Bonn, Germany (FSC-STD-01-001 V5-2 EN).
- FSC (2018): International Generic Indicators. Forest Stewardship Council. Bonn, Germany (FSC-STD-60-004 V2-0 EN).
- Garland, J.; Cedergren, J.; Eliasson, L.; van Hensbergen, H.; McEwan, A.; Wästerlund, D. (2020): Occupational safety and health in forest harvesting and silviculture. A compendium for practitioners and instructors: FAO (Forestry Working Paper, No. 14).
- Garland, J. J. (2018): Accident reporting and analysis in forestry. Guidance on increasing the safety of forest work. Food and Agriculture Organization of the United Nations. Rome, Italy (Forestry Working Paper, No. 2). Available online at <https://www.fao.org/3/I9180EN/i9180en.pdf>.
- Harris, Leah (2021): The challenges of defining a "green job". Office for National Statistics. Available online at <https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/thechallengesofdefiningagreenjob>, updated on 4/7/2021, checked on 2/14/2022.
- Hinde, Sebastian; Bojke, Laura; Coventry, Peter (2021): The Cost Effectiveness of Ecotherapy as a Healthcare Intervention, Separating the Wood from the Trees. In International journal of environmental research and public health 18 (21). DOI: 10.3390/ijerph182111599.
- ILO (1998): Safety and health in forestry work: An ILO code of practice. International Labour Office. Geneva. Available online at https://www.ilo.org/safework/info/standards-and-instruments/codes/WCMS_107793/lang-en/index.htm.
- ILO (2005): Guidelines for labour inspection in forestry. International Labour Organization. Geneva. Available online at https://www.ilo.org/safework/info/standards-and-instruments/WCMS_107610/lang-en/index.htm.

- ILO (2012): Working towards sustainable development. Opportunities for decent work and social inclusion in a green economy. International Labour Organization. Geneva. Available online at https://www.ilo.org/global/publications/ilo-bookstore/order-online/books/WCMS_181836/lang-en/index.htm.
- ILO (2013a): Decent work indicators: guidelines for producers and users of statistical and legal framework indicators. ILO manual: second version. International Labour Office. Geneva. Available online at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_229374.pdf.
- ILO (2013b): Sustainable development, decent work and green jobs. Fifth item on the agenda. Edited by International Labour Office. International Labour Organization. Available online at https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---relconf/documents/meetingdocument/wcms_207370.pdf.
- ILO (2017): How to measure and model social and employment outcomes of climate and sustainable development policies. GAIN Training Guidebook. Edited by Green Jobs Assessment Institutions Network. International Labour Organization. Geneva.
- ILO (2019a): Decent Work in Forestry. Portfolio of Policy Guidance Notes on the Promotion of Decent Work in the Rural Economy. International Labour Office. Available online at https://www.ilo.org/global/topics/economic-and-social-development/rural-development/WCMS_437197/lang-en/index.htm.
- ILO (2019b): Promoting decent work and safety and health in forestry. Report for discussion at the Sectoral Meeting on Promoting Decent Work and Safety and Health in Forestry. International Labour Office; Sectoral Policies Department. Geneva. Available online at https://www.ilo.org/global/topics/economic-and-social-development/rural-development/WCMS_437197/lang-en/index.htm.
- ILO (2021): Employment statistics. Data. International Labour Organization. Available online at <https://ilostat.ilo.org/topics/employment/>.
- Jaeger, Joel; Walls, Ginette; Clarke, Ella; Altamirano, J. Carlos; Harsono, Arya; Mountford, Helen et al. (2021): The green jobs advantage: how climate-friendly investments are better job creators. Working Paper.
- Jonsson, Ragnar; Rinaldi, Francesca; Pilli, Roberto; Fiorese, Giulia; Hurmekoski, Elias; Cazzaniga, Noemi et al. (2021): Boosting the EU forest-based bioeconomy: Market, climate, and employment impacts. In *Technological Forecasting and Social Change* 163, p. 120478. DOI: 10.1016/j.techfore.2020.120478.
- Kallio, A. Maarit I. (2021): Wood-based textile fibre market as part of the global forest-based bioeconomy. In *Forest Policy and Economics* 123, p. 102364. DOI: 10.1016/j.forpol.2020.102364.
- Karabchuk, Tatiana; Zabirowa, Aigul (2018): Informal employment in service industries: estimations from nationally representative Labour Force Survey data of Russian Federation. In *The Service Industries Journal* 38 (11-12), pp. 742-771. DOI: 10.1080/02642069.2018.1477131.
- Klun, Jaka; Medved, Mirko (2007): Fatal accidents in forestry in some European countries. In *Croatian Journal of Forest Engineering* (28(1)), pp. 55-62.
- Krejzar, Tomáš (2014): Current trends in the state forest policy of the Czech Republic. Department of Forest Policy and Economics, 2014. Available online at https://unece.org/fileadmin/DAM/timber/Forest_Policy/ToS/Current_trends_in_the_CZ_state_forest_policy.pdf.
- Lesní Pedagogika (1998): Forest Pedagogy in the Czech Republic. Available online at <https://www.lesnipedagogika.cz/home>.
- Lippe, Rattiya Suddeephong; Cui, Shannon; Schweinle, Jörg (2021): Estimating Global Forest-Based Employment. In *Forests* 12 (9), p. 1219. DOI: 10.3390/f12091219.
- Matilainen, Anna-Maija (2013): Forest companies, corporate social responsibility, and company stakeholders in the Russian forest sector. In *Forest Policy and Economics* 31, pp. 44-49. DOI: 10.1016/j.forpol.2011.12.006.

- Owuor, J. A.; Giessen, L.; Prior L.C.; Cilio, D.; Bal, T. L.; Bernasconi, A. et al. (2021): Trends in forest-related employment and tertiary education: insights from key countries around the globe. Knowledge to Action (K2A), Publication Series. Edited by European Forest Institute, International Forestry Students' Association, International Union of Forest Research Organizations. Bonn (ISBN: 978-952-7426-17-3).
- Pearce, David W.; Markandya, Anil; Barbier, Edward (1989): For a Green economy. A report. London: Earthscan Publications (Blueprint Series). Available online at <https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=1520896>.
- PEFC (2020): Chain of Custody of Forest and Tree Based Products – Requirements. PEFC International Standards. Programme for the Endorsement of Forest Certification. Geneva, Switzerland (PEFC/O1-00-01; PEFC ST 2002:2020).
- Ronzon, Tévécia; M'Barek, Robert (2018): Socioeconomic Indicators to Monitor the EU's Bioeconomy in Transition. In Sustainability 10 (6), p. 1745. DOI: 10.3390/su10061745.
- Schirpke, Uta; Marino, Davide; Marucci, Angelo; Palmieri, Margherita (2018): Positive effects of payments for ecosystem services on biodiversity and socio-economic development: Examples from Natura 2000 sites in Italy. In Ecosystem Services 34, pp. 96-105. DOI: 10.1016/j.ecoser.2018.10.006.
- SDG-Tracker (2018): Measuring progress towards the Sustainable Development Goals. With assistance of Ritchie, Roser, Mispy, Ortiz-Ospina.
- Stegmann, Paul; Londo, Marc; Junginger, Martin (2020): The circular bioeconomy: Its elements and role in European bioeconomy clusters. In Resources, Conservation & Recycling: X 6, p. 100029. DOI: 10.1016/j.rcrx.2019.100029.
- Triulzi, I.; Politi, M.; Mendive, F.; Palla, I.; Turchetti, G. (2017): Economic Evaluation Of Ayahuasca Treatment For Substance Use Disorder (SUD) Patients In A Peruvian Centre. In Value in Health 20 (9), A885. DOI: 10.1016/j.jval.2017.08.2641.
- Unay-Gailhard, Ilkay; Bojnec, Štefan (2019): The impact of green economy measures on rural employment: Green jobs in farms. In Journal of Cleaner Production 208, pp. 541-551. DOI: 10.1016/j.jclepro.2018.10.160.
- UNECE/FAO/Forest Europe (2020): Guidelines on the Promotion of Green Jobs in Forestry. Geneva (Geneva timber and forest discussion paper, 77).
- UNEP (2011): Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication. A Synthesis for Policy Makers. Available online at www.unep.org/greeneconomy.
- UNEP; ILO; IOE; ITUC (2008): Green jobs: Towards Decent Work in a Sustainable, Low-Carbon World. With assistance of Michael Renner, Sean Sweeney, Jill Kubit. Nairobi, Kenya: UNEP.
- United Nations (2008): International Standard Industrial Classification of All Economic Activities (ISIC). 4th ed. Statistical papers (Series M No. 4/Rev.4), Article ISBN 9211615186.
- United Nations (2012): Future We Want - Outcome document. Resolution adopted by the General Assembly on 27 July 2012. Available online at <https://sustainabledevelopment.un.org/futurewewant.html>.
- Valatin, Gregory; Abildtrup, Jens; Accastello, Cristian; Al-Tawaha, Abdel Rahman; Andreucci, Maria-Beatrice; Atanasova, Silvia et al. (2017): PESFOR-W: Improving the design and environmental effectiveness of woodlands for water Payments for Ecosystem Services. In RIO 3, Article e13828. DOI: 10.3897/rio.3.e13828.
- Wolfslehner, Bernhard; Linser, Stefanie; Puelzl, Helga; Bastrup-Birk, Annemarie; Camia, Andrea; Marchetti, Marco (2016): Forest bioeconomy - a new scope for sustainability indicators. From Science to Policy 4. Edited by European Forest Institute.