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Forest sector workforce in the UNECE region

Overview of the social and economic trends with impact on the forest sector



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Geneva, 2020

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ABSTRACT

This study provides a comprehensive overview of the current state of the forest sector workforce in the UNECE region. It analyzes working conditions and occupational safety and health as well as the economic and social contexts that have led to structural changes in the sector, to the extent possible, through statistical data available at the regional level. It links the statistics to wider research, conducted in a range of disciplines and contexts, which shed light on the causes of, and experiences with the changes in the sector and possible ways to make the forest sector more future-proof.

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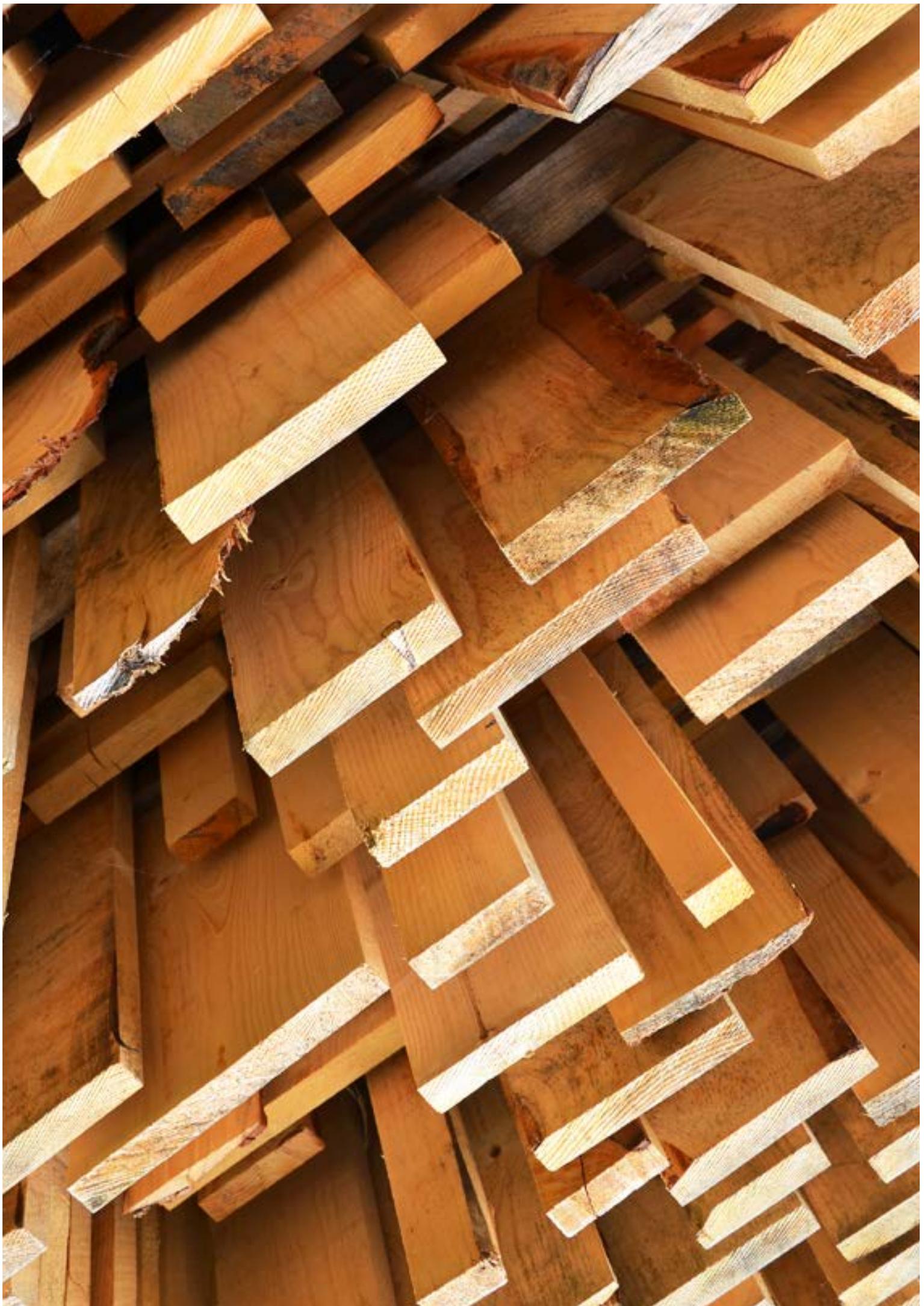
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DEFINITIONS

In this study the following terms were defined as:

Europe: the 28 countries of the European Union (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, UK), plus Switzerland and Norway.

Eastern Europe: Belarus, the Republic of Moldova, Ukraine. In principle, the Russian Federation is part of this subregion, however the country is often presented separately to highlight the weight of this country in the statistics of the subregion.

Balkan countries: Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia. Turkey is part of this subregion, but the country is often presented separately to highlight its weight in the statistics of the subregion.

Caucasus and Central Asia: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan

Scandinavia: subregion including Denmark, Norway, and Sweden

Forest sector: According to the International Standard Industrial Classification of All Economic Activities (ISIC) of the United Nations statistics division, the forest sector consists of the subsectors: forestry and logging (ISIC Re.4 Division 02); wood manufacture (ISIC Rev.4 Division 16); and paper manufacture (ISIC Rev.4 Division 17)

Forestry: Forestry and logging (ISIC Re.4 Division 02)

Wood manufacture: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (ISIC Rev.4 Division 16)

Paper manufacture: Manufacture of paper and paper products (ISIC Rev.4 Division 17)

Total workforce: The total workforce corresponds to the active population from 15 to 64 years old. The 15-year threshold was chosen, because forest workers can be hired as apprentices below the age of 18 in some countries, such as Switzerland, for example.

Employment: Is counted in full-time equivalents (FTE) - one full-time employee counts as one FTE, and two half-time employees also count as one FTE. It is assumed that all sources have followed this definition, but this cannot be guaranteed.

Primary education: Includes the early childhood education, the primary or basic education and the lower secondary education according to the International Standard Classification of Education (ISCED) 0-2

Secondary education: Includes the upper secondary and post-secondary non-tertiary education (ISCED 3-4)

Tertiary education: Includes the academic education (ISCED 5-8)

SUMMARY

This study gives an overview of the forest sector workforce in the UNECE region, based on existing scientific literature and the views of forest experts. It quantifies, to the extent possible, employment trends in the forest sector, through statistical data available at the regional level.

Chapter 1 identifies and describes the variables relevant to the forest sector, documented by statistical data in available literature. Statistics, trends and research show an ageing workforce employing few women. Social research highlights poor representation of ethnic minorities in the securely employed workforce (particularly public forestry) and their over-representation in unstable and poorly-paid informal employment. Forest education is briefly presented through case studies from the UNECE member States and subregions.

Chapter 2 addresses topics related to occupational safety and health (OSH) of forest workers. Forest work is a hazardous occupation, with high rates of injury and fatality, particularly for those working in harvesting. Although this situation still applies across a wide range of UNECE member States, a growing number of countries are improving occupational safety, particularly those with higher levels of mechanization.

While machines and personal protective equipment innovations make the work safer, some research points to the need for workers to change their practices. Organizational safety cultures and systems that support good practices seem to be key to safer working conditions.

Health problems vary widely between different types of forest workers. In some regions, forest work is mostly done by migrant or temporary workers who may lack employment papers, social and health insurance, and may work long hours for employers who are not strongly committed to their welfare. Those working in highly mechanized jobs may develop repetitive physical strain and muscular tension.

Workers' wellbeing can be related to perceptions and experiences of health, safety and security, but also to status of the work, promotion prospects, experiences of working in solitary and remote places, and working in situations of conflict e.g. with landowners or members of the public over environmental issues.

Chapter 3 describes trends in the nature and organization of forest work. Forest employment is becoming less secure. With increased mechanization, productivity per worker has increased significantly resulting in fewer jobs with higher pay as the tasks require more skills. However, workers without access to the necessary training may lose their chances for long term employment in this transitioning environment.

The organization of forest enterprises is also changing. Large companies have merged, downsized, relocated, restructured or closed, sometimes with drastic consequences for workers and communities. Unions neither have the power nor offer the security that they once did. Much of the work formerly performed by corporations, particularly in harvesting, has been outsourced to a rapidly growing number of contractors who have different work management and communication cultures.

In some places, forest work is done by workers in informal employment. This includes migrant, student and seasonal workers. Informality is largely invisible to labour statisticians but has been a topic of study of social research and is well documented in some cases. Workers in informal jobs are much more vulnerable to poor working conditions, and risks to health and safety.

In addition, changing attitudes towards the role of forests in society, from largely production focused to providing ecosystem services mean that public forest services and forest management professionals need to be prepared for work in a multi-disciplinary, multi-functional forest sector, and engage with a wide range of stakeholders.

In general, the evidence portrays a more fragmented but also more diverse forest sector with possibilities for innovation, for adapting to new niches of economic activity, such as biofuel, as well as different ownership structures and forms of worker organizations, like community-owned or worker-owned businesses, and contractor associations.

Chapter 4 provides an outlook on the future of the forest sector workforce with a focus on opportunities that green jobs can create in the forest sector. It builds on the work of the UNECE/FAO Team of Specialists on Green Jobs in the Forest Sector. Many new fields of activity identified will contribute to rural development and help to retain jobs in small- and medium-sized enterprises. They can also create new employment for professional groups that may incur job losses in the process of the transition to a green economy and support the integration into the labour market of under-represented groups, such as young people and women.

In view of the identified opportunities, it is important to look ahead to what the future of forest work will be and where new developments may originate. This chapter considers two specific issues: the attractiveness of forest jobs to the future workforce, and the adaptability of the current workforce to changing job requirements, in particular those resulting from the transition towards a green economy and sustainable development.

The final section offers conclusions about the main trends affecting the forest sector workforce in the UNECE region and reflections on its future outlook.



INTRODUCTION

Forest workforce in the context of the forest sector's contribution to the economy in the UNECE region

Between 2000 and 2011, the forest sector's contribution to GDP in the UNECE region fell in absolute terms, and its share in the region's economy declined from 1.2 % to 0.8 %. Forest sector employment too has fallen, primarily because of higher labour productivity. The recession, caused by the financial crisis of 2008, increased unemployment and economic hardship in forest-dependent communities and regions (United Nations, 2015). Since 1990, government incentives and investments into producing primary and secondary wood and paper products have grown, and Europe has become a net exporter. However, since the economic crisis (2008 – 2009), reorganizations in wood and paper production companies have led to investments outside Europe, both in know-how and in processing facilities (Forest Europe et al., 2011).

The FAO report, "Contribution of the Forestry Sector to National Economies, 1990-2011" examined temperate-climate countries globally, (FAO, 2014b), and showed that the value added by the forest sector had not changed, though exports had increased by 10 %. The share of total labour force (contribution to employment), however, has declined by 0.2 % to 0.5 %.

Canada, the US, western Europe and the Asia-Pacific region are all important producers and consumers of forest products. Together, they account for 23 % of global forest sector employment, half the added-value and 60 % of forest product exports. This reflects the high levels of value-added by their forest processing sectors. Few countries have focused on developing their forestry sectors, preferring to promote development in other sectors (FAO, 2014b).

The 2008-2009 economic crisis hit Canada, the US and western Europe particularly hard and all experienced a substantial fall in employment, added-value and exports. The forestry sector in some countries experienced wide-scale and prolonged shutdowns, cuts in production, consolidations and closures. Many workers in the sector left to find other jobs and value-added has still not returned to its pre-crisis level. Canada's forestry sector was among the hardest-hit. Many of its forest products industries are export-oriented and its largest trading partner is the US (FAO, 2014b).

The overall decline in the size of the forest sector workforce is not simply a result of greater efficiency but reflects a sector that is losing ground in terms of its significance in the overall economy. The fall in employment is taking place against a background of wider change, including a shift from timber-focused forest management to multi-purpose forest management, changing patterns of forest ownership, mechanization and the increasing adoption of information technology (Sorice et al., 2014; Živojinović et al., 2015; Blombäck et al., 2003).

Although these trends are not the same everywhere, they indicate a potential for a revitalized sector. This potential has also been identified in the research reviewed in this study.

A broad interpretation of the "workforce"

This study focuses on the intersection between forest sector activities and work. A broad approach to the analysis was needed because of the large social and economic variations of forest work relations as the sector is characterized by shifting balances between state and private sector, the changing nature of forest work and forest enterprises, and consequently employment relations.

For the study, workforce was defined as, "people engaged in or available for work, either in a country or area or in a particular firm or industry." This definition combines several definitions. It implies employment, but the word work also allows the inclusion of self-employment and management.

Within this broad definition there are different types of workforce and different areas of employment. Headline employment figures are noted to be underestimates as, "many countries fail to account for seasonal workers or self-employed such as contractors" (Blombäck et al., 2003). It is clear that different factors are affecting at least the following categories:

- Forest workers (legal and illegal, formal and informal, long term and seasonal).
- Foresters, forest managers, forestry professionals.

- State forest organizations.
- Other public organizations, including municipal forest structures.
- Private forest management organizations.
- Forest contractors, including machinery operators.
- Sawmill employees.
- Other manufacturing sector employees.
- Forestry consultants, advisers and extension workers.

The list is not exhaustive. Some categories overlap, and the ways in which they are defined are sometimes specific only to some countries and local contexts.

The informal economy, as defined by the International Labour Organization (ILO) is, “all economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements. Their activities are not included in the law, which means that they are operating outside the formal reach of the law; or they are not covered in practice, which means that – although they are operating within the formal reach of the law, the law is not applied or not enforced; or the law discourages compliance because it is inappropriate, burdensome, or imposes excessive costs” (ILO, 2002a).

The ILO defines informal employment as “a job-based concept and encompasses those persons whose main jobs lack basic social or legal protections or employment benefits and may be found in the formal sector, informal sector or households” (ILO, 2012). An estimated 75 % of forest work worldwide takes place in the informal economy (FAO, 2014a).

Self-employed workers are “own-account workers, who hold self-employment jobs and do not engage ‘employees’ on a continuous basis” which may constitute a vast, loosely-connected and heterogeneous group (ILO, 2019a). In Sweden, for example, where it accounts for a significant part of the workforce, the National Board of Forestry defines the self-employed forest workforce as forest owners as well as family members, relatives, employees, neighbours and friends (Lindroos and Burstrom, 2010).

Objective of the study

This study provides a comprehensive overview of the current state of the forest sector workforce in the UNECE region. It analyzes working conditions and occupational safety and health as well as the economic and social contexts that have led to structural changes in the sector. It links the statistics to wider research, conducted in a range of disciplines and contexts, which shed light on the causes of, and experiences with the changes in the sector and possible ways to make the forest sector more future-proof.

Data sources and methodology

Evidence and research reviewed in this study come from three sources. The scientific literature review is the main contribution of this paper, which is used to complement trends identified in international statistics. Occasionally, information has arisen from individual communication with forest sector experts.

National and international statistics are mainly from Eurostat and the FAO Forest Resource Assessments, also analyzed in UNECE, FAO and Forest Europe reports (UNECE/FAO, 2015; UNECE/FAO, 2007; Forest Europe, 2015; Forest Europe et al., 2011; MCPFE et al., 2008; MCPFE Liaison Unit Warsaw et al., 2007; UNECE, 2011). In some cases, where national statistics came directly from national statistical offices, this is clearly indicated.

In addition, a wide-ranging scientific literature search was conducted using standard evidence review techniques, starting with searches in scientific bibliographic databases including Web of Science and Google Scholar using suitable search term sets, for example:

- Forest* AND (workforce OR labour OR labour).
- Forest* AND safety.
- Forest* AND employment.
- Workplace AND safety AND gender.

Relevant scientific papers and reports provided the starting point for upwards and sideways searches (of, respectively, citations and related papers). Authors of key papers were contacted for further information and additional links and papers.

Scope and limitations of the study

The study gives a comprehensive overview of the forest workforce in the UNECE region and identifies main trends in. A more extensive examination of some of the topics addressed is outside the scope of this study. For example, topics like forest education and forest management skills, occupational safety and health, and forest governance structures in relation to employment are fields of research on their own. Separate studies addressing more detailed data and information on the topic would do them, and related national contexts, more justice. Therefore, view this study as an introduction to the multiplicity of options for follow-up research into the trends and areas identified.

In addition, the study focuses primarily on the conventional forest sector as defined by the International Standard Industrial Classification of All Economic Activities (ISIC) of the United Nations Statistics Division, consisting of the three subsectors: forestry and logging (ISIC Rev.4 Division 02); wood manufacture (ISIC Rev.4 Division 16); and paper manufacture (ISIC Rev.4 Division 17). While this does help with the comparability of available data, it leaves out the furniture industry, which in 2011 employed about 1.6 million workers in the UNECE region, some of whom were engaged in wooden furniture production (FAO, 2014b). Chapter 4 introduces emerging occupations and potential new fields of forest-related employment in, introducing the potential the sector beyond its conventional occupations.

This study describes trends in a rapidly changing sector. Data may often be out of date by the time they are published, as research is often published several years after interviews or surveys were conducted.

This study has been unable to present a comprehensive overview of the main forest workforce characteristics for all subregions, due to limited study resources and limited availability of statistical data in English from some. This study therefore shows a bias towards countries that are more extensively documented in English scientific literature. The balance of in-depth social research seems to be weighted towards Canada and the US, perhaps reflecting also easier access to research funding. In addition, the study has not been able to ensure statistical compatibility, as countries may define statistical units in different ways.

Nevertheless, the overview that this study provides, even with recognition of possible gaps, is one of the first attempts to present a regional perspective on several important features of the forest sector workforce in the UNECE region.

Link to the 2030 Agenda for Sustainable Development and gender mainstreaming

The study analyzes topics relevant to employment and job creation in the forest sector, which contribute to the implementation of the 2030 Agenda for Sustainable Development and support the achievement of a number of Sustainable Development Goals (SDGs). Forest-related jobs are of particular relevance to SDG 1 “No poverty”, SDG 3 “Good health and well-being”, SDG 5 “Gender equality”, SDG 8 “Decent work and economic growth”, SDG 13 “Climate change” and SDG 15 “Life on Land”.

Several chapters refer directly to gender-specific topics and analyse the role of gender in different aspects of forest work. One chapter specifically reviews women’s participation in forest work, and organizational structures of forest companies and wood-manufacturing industries.

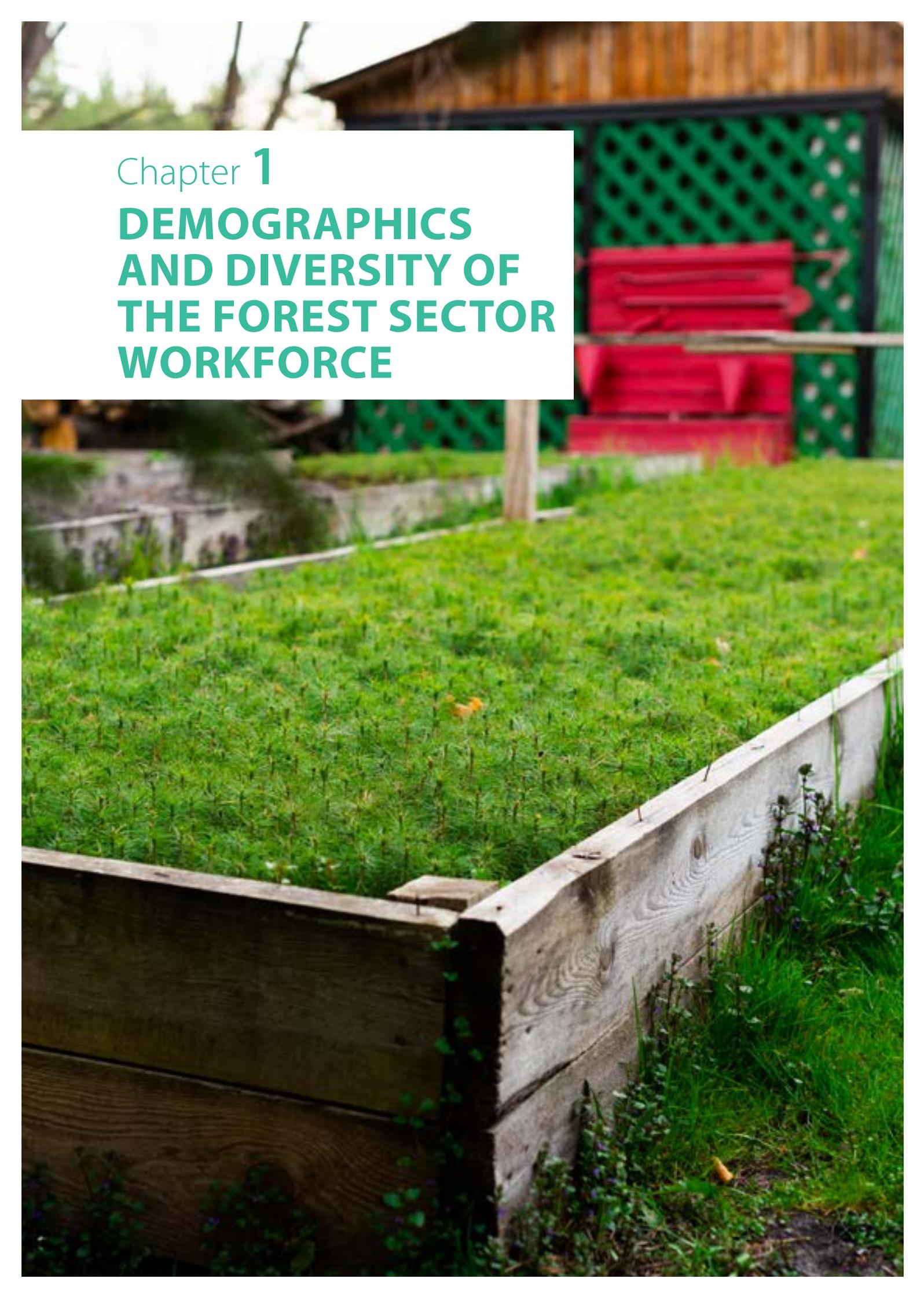
Link to the Joint UNECE/FAO Forestry and Timber Section work

During the International Timber Conference in 1947, UNECE and FAO member States indicated the need to address forest sector workforce related questions. A concept of joint work between UNECE, FAO and the International Labour Organization (ILO) commenced a few years later in Geneva, with the foundation of the Joint Committee on Forest Working Techniques and Training of Forest Workers under the joint auspices of UNECE, FAO and ILO in 1954.

Between 1955 and 1978, study groups focused on the importance of job security, competitive wage rates, adequate living conditions, technical training facilities and better safety measures for forest workers. Along with changes in the economic context and the transformation of the forest sector itself, the forest workforce experienced several structural changes. Accordingly, the topics of UNECE and FAO work related to forest workers have broadened and today they include environmental and social cross-cutting topics, such as ecosystem management in forestry, climate change mitigation and adaptation, green economy, gender equity, ageing workforce and adaptation of skills to technological developments.

Consideration of these topics in the context of forest sector workforce has been the focus of the Joint UNECE/FAO Forestry and Timber Section which from 2014 has been anchored in the “Rovaniemi Action Plan for the Forest Sector in a Green Economy”. This study paper is the result of the work commissioned by the Section to “review and compile existing studies, data and information in order to analyse the recent trends and current situation of the forest sector workforce, identify drivers, challenges and opportunities of the forest sector workforce, and possible needs for data collection”. It is also linked to the recommendations from the UNECE/FAO workshop, “Threats to Sustainability of the Forest Sector Workforce”, held on 17 March 2015 in Geneva and the UNECE-FAO workshop, “Forest Products Markets and Forest Sector Workforce” held in Podgorica, Montenegro, from 8-10 December 2015.



A photograph of a garden bed with young plants, a green lattice fence, and a red bench in the background. The garden bed is made of wooden planks and is filled with small, green, needle-like plants. The green lattice fence is in the background, and a red bench is visible behind it. The scene is outdoors, and the lighting is natural.

Chapter 1

DEMOGRAPHICS AND DIVERSITY OF THE FOREST SECTOR WORKFORCE

1.1 Introduction

The UNECE region contains 43 % of the world's forests and provides roughly 60 % of global wood supply. Nearly 4.3 million people work in the forest sector in the UNECE region. Of these, almost 51 % are in Europe, around 29 % in Canada and the US, 14 % in the Russian Federation, 5 % in Turkey and the remaining 1 % is spread across other countries of the region (source: own calculation based on data from this study).

The number of forest workers, including in wood manufacturing and paper industries, is falling, primarily due to increasing mechanization. The global economic crisis of 2008 reinforced this falling trend, especially in Canada, Europe, and the US, where a slump in the housing sector had a substantial impact on the wood manufacturing industry and its suppliers.

Most countries in Eastern Europe and the Balkans experienced a similar decline in employment, though for different reasons. The origins go back to the 1990s with the collapse of the political systems in both subregions and the transition to a market economy. The forest sector in these subregions experienced heavy structural change, which resulted in a significant decrease in the forest sector workforce. The reforms of the public sector led to the collapse of many large state-owned companies, compensated only in small measure by the setting up of smaller, private entities.

In parallel, countries in Central Asia underwent structural changes after the collapse of the Soviet Union, which also resulted in a significant decrease in the forest sector workforce.

Overall, the forest workforce in the UNECE region is shrinking in number and getting older, reflecting a general trend in the general working population. Statistical data and literature present a number of reasons for this.

Gender diversity in the forest sector has come increasingly under the spotlight in recent decades. Despite this, women are still heavily under-represented in the forest sector, particularly at senior levels. Those women who do work in the forest sector tend to be employed in administrative roles. In family companies, women often do not appear on the official list of workers and may not even be paid for their work.

Information about ethnic or other minority groups in the forest sector workforce is scarce. In some countries, such as France, the law prohibits institutional surveys from collecting data on ethnicity. It is difficult to identify industry sector data disaggregated by these criteria, except for

the US, where such data are collected in support of anti-discrimination policies.

Several UNECE countries identify forest sector education as a priority. It is challenging to get a good overview, as statistical data on training and education are scarce, and scientific studies mostly present good practices and case studies on educational programmes, rather than aggregated data.

1.2 Employment trends

1.2.1 Canada and the US

In 2016, the forestry subsector workforce in the US and Canada was 159,000 and 49,000 workers, respectively (Graph 1).

Following the 2008 global financial crisis, the subsequent slump in the housing market led to a sharp decline in wood demand and reduced employment in the forest sector. Canada and the US are estimated to have lost about 600,000 jobs (a fall of 39 %) between 2000 and 2011 (FAO, 2014b). The shift from paper to electronic formats led to a decline in demand for paper products, leading to several mill closures and job losses in the Canadian and US paper manufacturing industry (UNECE/FAO, 2016).

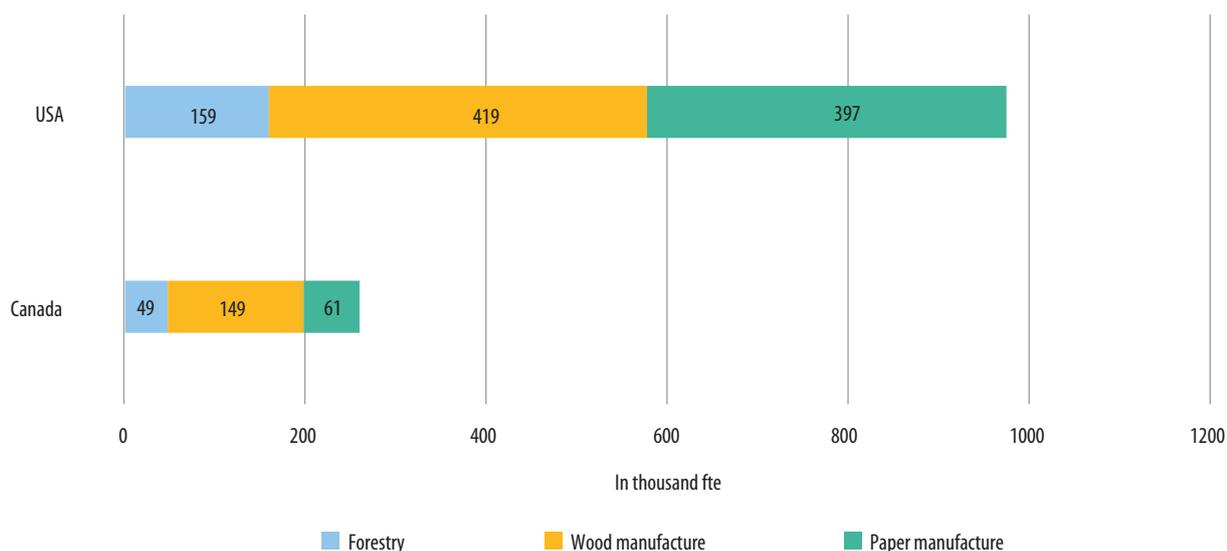
The ongoing mechanization of forest work is another factor affecting employment. Automation has replaced manual operations in the forest and in manufacturing. Harvesting is less reliant on the chainsaw and more on sophisticated machines. In manufacturing facilities, scanners and robotics are taking the place of workers. For example, sawnwood and veneer grading are now operated with scanners, rather than relying on human decisions and formerly labour-intensive jobs, such as patch lines and layup processes in veneer/plywood mills use scanners, working in tandem with robots.

Despite striking increases in productivity rates per worker in Canada and the US, employers face difficulties finding workers to replace older workers who are leaving the workforce. This is a key factor pushing efficiency innovation in the sector. Many current jobs require skillsets aimed at the automated, mechanized and intelligent systems being put in place and this trend is almost certain to continue.

The role that national forests will play in supplying raw-material (sawlogs) for conversion to forest products remains a key issue for future employment. National forest lands account for the clear majority of timber holdings in Canada and a significant portion in the US (approximately 50 % of standing softwood in the US). From 1955-1990, the volume harvested from

GRAPH 1

Size of the forest sector workforce in Canada and the US in 2016 (in thousand fte)



Source: U.S. Bureau of labour statistics, 2016; Statistics Canada, Labour Force Survey 2015.

Note: According to the ISIC (Rev.4) Section A Division 02 the Forestry and logging sub-sector, support activities are included in the statistical definition. In this figure, however, the Canada forestry sector includes support activities for forestry industry, while the US forestry sector does not include them.

United States Forest Service forests averaged roughly 63 million m³/year. This volume fell sharply from 1991 - 2016 to only 17 million m³, a reduction of more than 73 % (based on a conversion factor of 5.9m³ per thousand board feet) (USDA Forest Service, 2018a). A significant shift in policy on the management of government-owned forest in the US, particularly if it allowed harvest levels closer to their sustained yield, could lead to greater demand for forest workers and reduced demand for imported forest products. Canada has faced a different set of issues. Government-owned forests have experienced a serious pine beetle epidemic in western Canada, reducing their ability to sustain current harvest levels in the west of the country for many years to come. This will undoubtedly affect forest sector employment in Canada, particularly in the west.

1.2.2 Europe

In 2016, the forest sector in Europe employed 540,700 workers in the forestry subsector, 1,061,300 workers in the wood manufacturing subsector and 629,800 workers in the paper manufacturing industry (Table 1).

TABLE 1

Forest sector employment in Europe in 2016 (in thousand fte)

Forestry	540.7
Wood	1 061.3
Paper	629.8
TOTAL	2 231.8

Source: Eurostat, 2016.

In Europe, the forest sector workforce accounts for between 0.025 % and 1.53 % of the total workforce (Graph 2.). Latvia, Estonia, Bulgaria, Croatia and Lithuania are the countries with the highest share of forest sector workers relative to the total workforce, in descending order.

In these countries, forestry and logging played an important role before the economic transition to market economies in the 1990s. Forestry still employs a large proportion of the total workforce thanks to the low labour costs compared with other parts of Europe. Many wood manufacturing facilities are located there, including sub-

1. Demographics and diversity of the forest sector workforce

contractor units for multinational companies, which produce construction elements, furniture and other wooden products.

Estonia, Latvia and Lithuania, are among the leading European exporters of logs and sawnwood. In Croatia, Hungary, Latvia, and Poland, the numbers of forest workers as a proportion of the total workforce increased from 2008-2016, the result of improved economics in the sector after the 2008 economic crisis and competitive prices for logs and sawnwood exports.

Finland and Sweden have a high proportion of forest sector workforce relative to the total workforce compared to the rest of Europe. This is explained by the fact that the forest sector has traditionally played an important role in the national economies of these highly-forested countries.

Running counter to the trend in some of the newer EU countries and in Scandinavia, forest sector employment in the EU-15 (e.g. Belgium, the Netherlands, and the UK) is marginal and dropping.

Europe's wood manufacturing sector employs about twice as many people as the forestry sector and the paper manufacturing sector employs 20 % more than

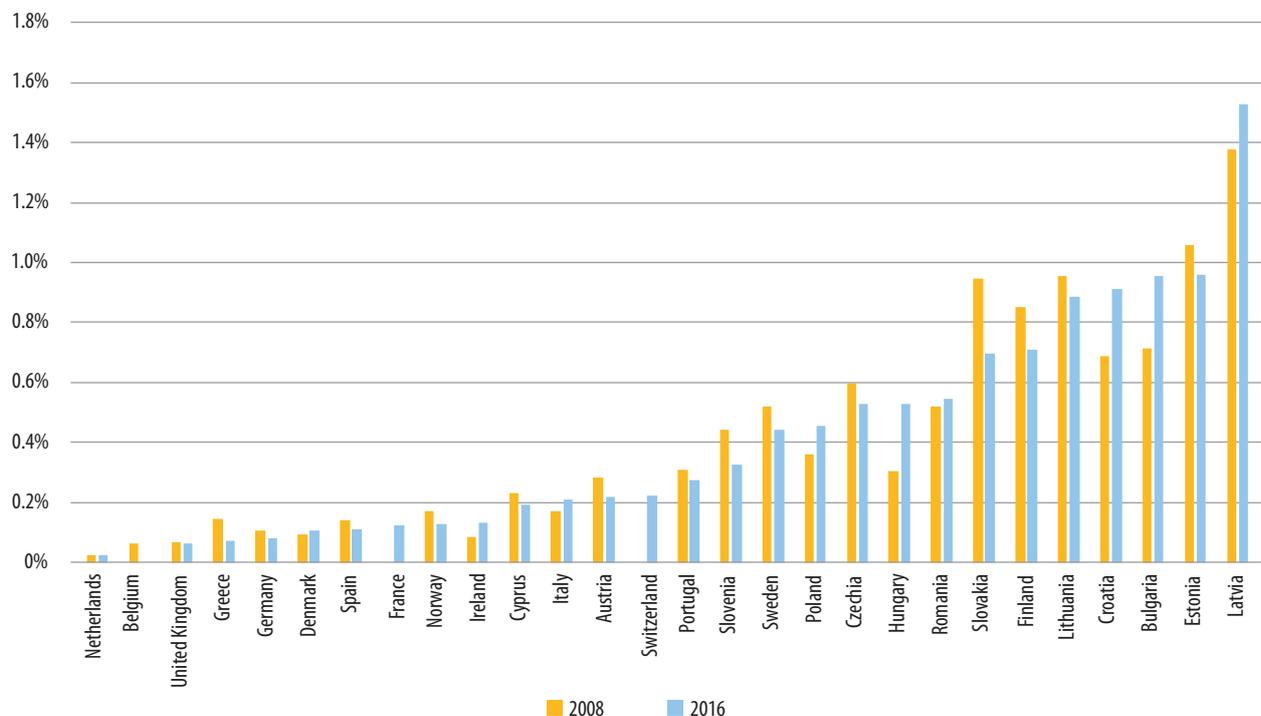
the forestry sector (Table 1). These numbers do not include "the unknown number of people in informal employment who are not covered by the reported data" such as private forest owners, members of their families and communities (Forest Europe, 2015). This unrecorded work is likely to be mostly in the forestry subsector, along with some small-scale wood processing.

Poland is estimated to have the largest workforce in absolute numbers, at 311,000 workers, followed by Germany and Italy (Graph 3).

Over the period 2008 – 2016, the number of forest workers in Europe decreased by 18 % (Graph 4). This trend is particularly visible in the wood manufacturing sector, where the workforce decreased by 26 %. The global economic crisis of 2008, which impacted the housing market, had a substantial impact on the wood market. Employment has not recovered yet from this crisis (FAO, 2014b). Europe's forestry sector is going through an important mechanization process, as a result of growing capital investment, reducing the workforce needed. Lower production costs in Eastern Europe, compared to the rest of Europe, have led many wood processing companies to relocate production there (FAO, 2014b).

GRAPH 2

European forest sector employment as a proportion of the total workforce, by country

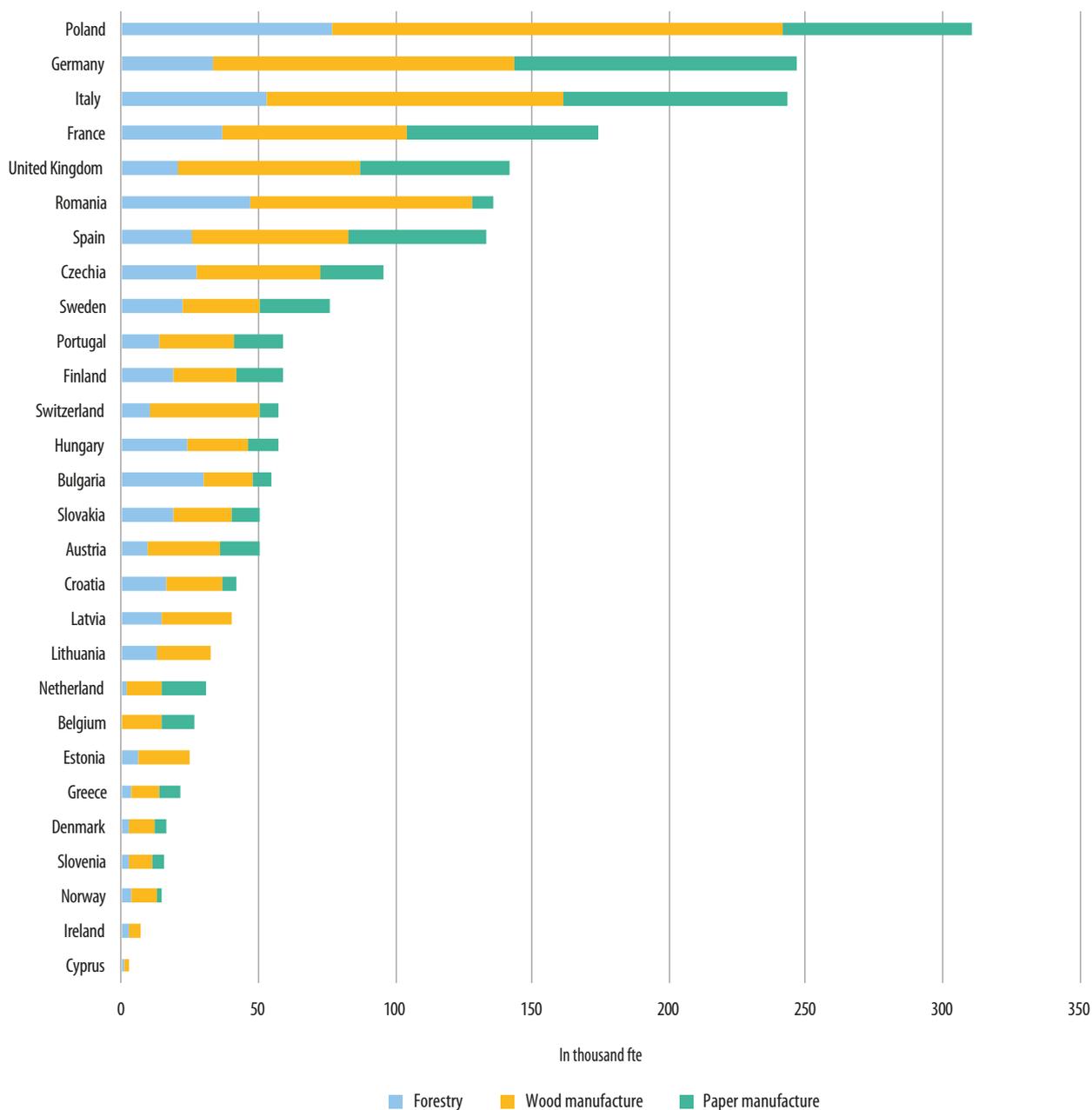


Source: Eurostat, 2016.

Note: Data for Luxembourg and Malta were missing, Data for Belgium, France and Switzerland were incomplete, therefore their inclusion was not possible.

GRAPH 3

Workforce in the forest sectors in Europe in 2016 (in thousand fte)



Source: Eurostat, 2016.

Note: Data for Luxembourg and Malta missing, Paper manufacturing data for Cyprus, Estonia, Ireland, Latvia, and Lithuania unavailable.

Box 1.1: The largest European forest workforce: Poland

There were 53,400 workers in the forestry subsector registered in Poland in 2016, of which 8,560 were women (17 %). Since 2010, forestry employment increased by 5,000 (8 %), including an increase (12 %) of 900 women.

Approximately half were employed in companies owned by the public sector; 282 large firms (more than 50 workers) employed 17,551 in total and 160 small public firms (less than 50 workers) employed 6,912 workers. The Polish private forestry sector includes 436 small companies and 12 large companies.

In 2015, the forestry sector employed 805 new workers, mostly with tertiary education. The public sector employed about 90 % of the new workforce.

The exploitation of the forestry and wood manufacturing industry in Poland has traditionally been integrated in the past. Many companies had manufacturing capacities and their own forests to supply raw material. This integration between forestry and wood manufacturing arose between World War I and World War II.

During the 1930s, state forests were one of the important financial assets of the government. State-owned forests began to do their own harvesting, sawmills were reacquired from leaseholders. Sawmill and plywood production were modernized and expanded. A special agency was created to handle the storage and transport of logs and sawn timber for export, which, over time played a major role for the domestic market.

Thus, an integrated forest-industry system developed under the direction of the state-owned forest sector and resulted in increased revenue and exports as well as improved management of state forests.

During World War II, forests were exploited by the occupying powers and a large part of the wood industry was destroyed.

After 1945, an integrated system to manage forestry and manufacturing industries was created. Circumstances for the application of this approach were favourable, because of the socio-political context in Poland at that time. The state took over forests previously held by large landowners, as well as a large part of the forest industry. These newly integrated operations of the forest product supply chain gradually expanded to encompass the current structure of forests, state forest sawmills, the wood-based panels industry, the furniture industry, the pulp and paper industry, the chemical processing of wood, and the industrial processing of non-wood forest products such as wild fruit, mushrooms and wildlife products, such as venison.

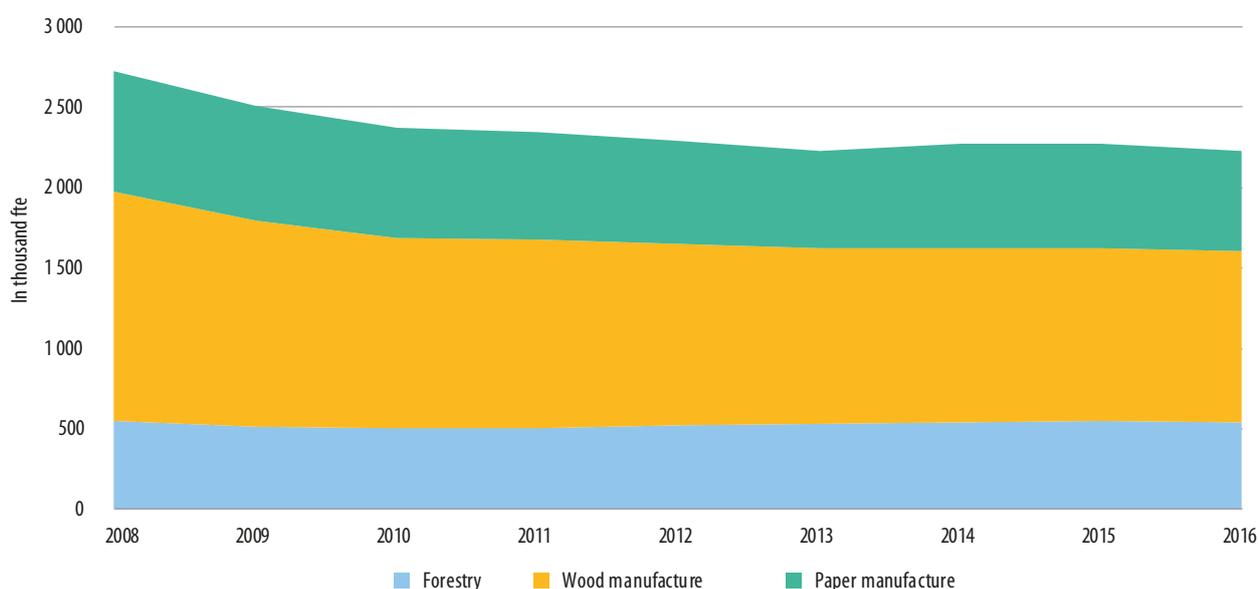
The corporations involved in the forest product supply chain also coordinate a network of vocational and secondary forestry schools and training centres.

Source: Central Statistical Office, 2017¹; Knothe, 1980.

¹ Figures may differ from Eurostat data due to difference in definitions.

GRAPH 4

Evolution of forest workforce in Europe 2008-2016 (in thousand fte)



Source: Eurostat, 2016.

Box 1.2: Case study: Encouraging employment in the forest sector, Slovakia

Slovakia's high forest cover at 40 %, makes forestry an important sector in its national economy. The sector is focused on primary production and is highly dependent on regular timber supply. However, outdated infrastructure, which requires substantial investment, creates an obstacle to the smooth distribution of harvested wood.

Unemployment in rural areas is 17 % but exceeds 20 % in several districts, much higher than the EU average of 9.4 % in 2015 (EUROSTAT, 2019).

To address this situation, Slovakia developed the Rural Development Programme (RDP), which was formally adopted by the European Commission on 13 February 2015. The Programme outlines Slovakia's priorities for using EUR 2.1 billion of public funds that are available for the 7-year period 2014-2020. The EU provided three-quarters of the funds and the remaining quarter came from national sources.

The RDP includes support to the forestry sector through:

- Building and/or modernizing 250 km of forest roads.
- Investing in modern technologies for 230 forestry holdings.
- Increasing the resilience of forests against natural disasters by preventive and restorative actions that address fire, biotic diseases and weather events.
- Focusing on the use of renewable energy resources, mainly by processing the byproducts and biomass production from agriculture and forestry.

The impact of the project on employment in rural areas was not evaluated at the time of writing of this study, as the project was still ongoing.

Source: O. Kiyko, Ukrainian National Forestry University, personal communication, 2016.

1.2.3 Eastern Europe

In 2011, the forest sector employed 2.5 % of the workforce in Belarus, and between 0.5 % to 0.8 % in the Republic of Moldova, the Russian Federation and Ukraine. From 1990 - 2011, the

forest sector workforce in Eastern Europe decreased by more than 1.1 million employees, a fall of 58 %. By contrast, Belarus saw an increase of 33 %, though the actual numbers employed are small (Graph 5).

1. Demographics and diversity of the forest sector workforce

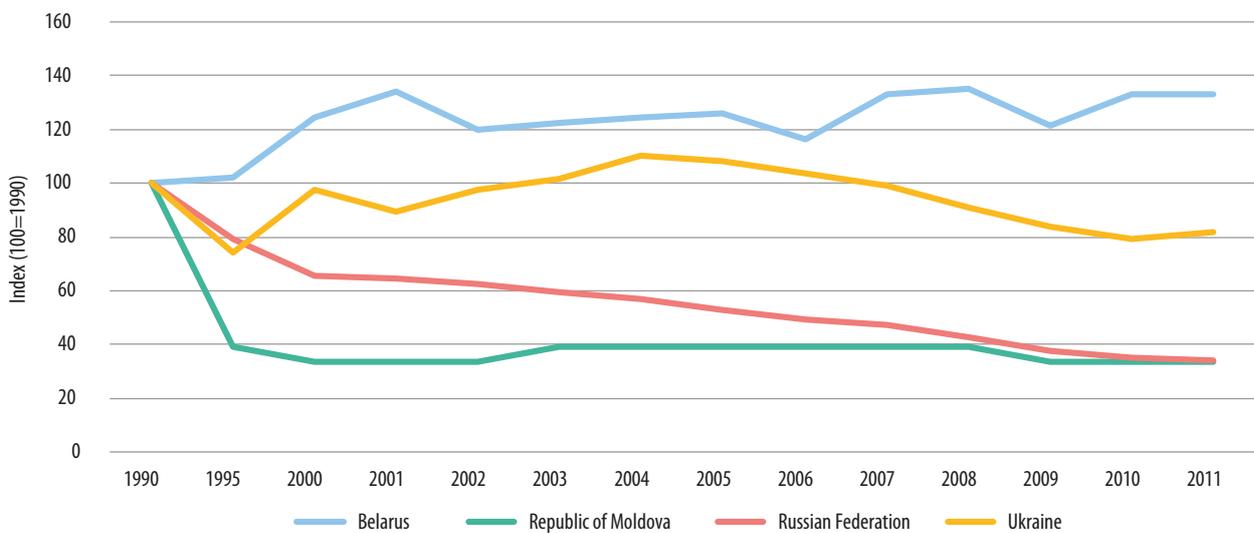
In the Republic of Moldova, wood manufacturing almost disappeared between 1990 and 1995. This is reflected in the loss of about two-thirds of the workforce between 1990 and 2011. The wood manufacturing subsectors of the Russian Federation and Ukraine experienced decreases of 65 % and 21 % respectively. Transitioning to a market economy and the collapse of administrative systems have

had negative consequences for the wood manufacturing subsector in these countries (FAO, 2014b).

In Eastern Europe, the forest workforce is predominantly employed in wood manufacturing (Graph 6). In the Russian Federation, the wood manufacturing sector employs 44 % of the forest workforce, with a similar share in Belarus.

GRAPH 5

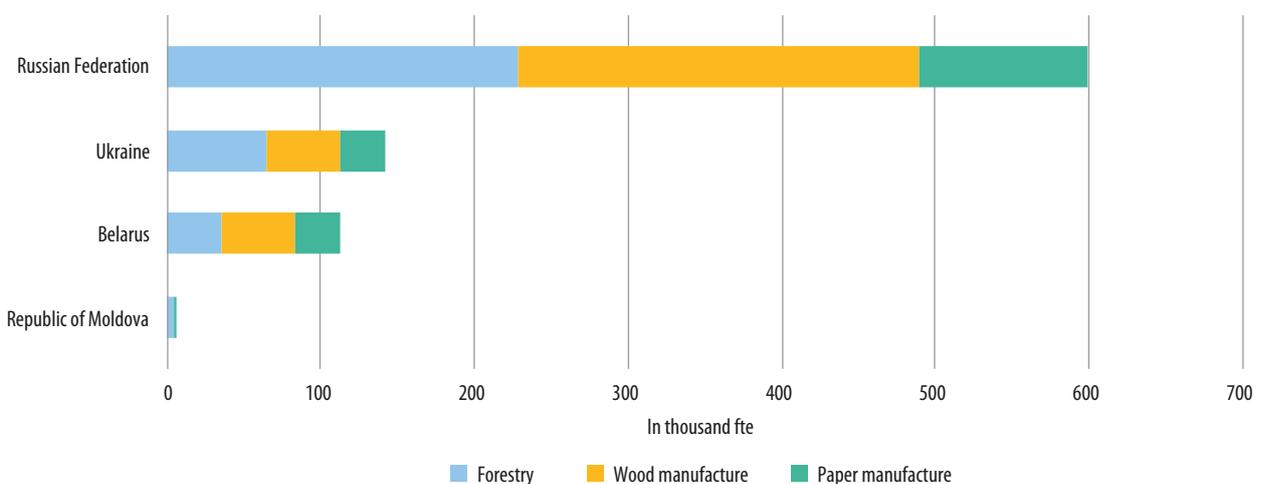
Percentage change in numbers of workers employed in the forest sector in Eastern Europe relative to benchmark year 1990 (1990=100%)



Source: O. Kiyko, Ukrainian National Forestry University, personal communication, 2016.

GRAPH 6

Forest sector employment in Eastern Europe in 2011 (in thousand fte)



Source: O. Kiyko, Ukrainian National Forestry University, personal communication, 2016.

1.2.4 Balkan countries

In the 1990s, the forest sector in the Balkan region experienced heavy structural changes, which resulted in a 46 % decrease in the forest sector workforce, from 194,000 to 104,000. The economic transition and reforms of the public sector caused the collapse of several wood and paper manufacturing companies. Large companies were replaced by smaller ones, usually employing 5-50 workers.

Montenegro introduced the concession model, transferring the responsibility for timber harvesting and haulage from the forest owner to the buyer. Private companies were created to obtain concession rights. However, the transition was difficult for the workforce in these new private companies, because of a lack of training. This problem was exacerbated by the development of new technologies and innovation, for which the workforce was not trained. These and other changes led to a 94 % decrease in the forestry workforce between 1990 and 2015.

Albania, Bosnia and Herzegovina and Serbia introduced new organizational structures for publicly-owned forests. In Albania, some activities in public forests were delegated to private sector workers with limited skills. However, training of the workforce and consolidation of companies has improved the private sector and has limited workforce losses.

Bosnia and Herzegovina had the greatest reduction in the number of employees in the forest sector at 64 %. By 2015, the sector employed only 32,400, compared with 90,800 employees in 1990. The paper manufacturing industry has fallen to a very low level, with only 2,500 employed at the end of 2015, 74 % fewer than in 1990 (Graph 7).

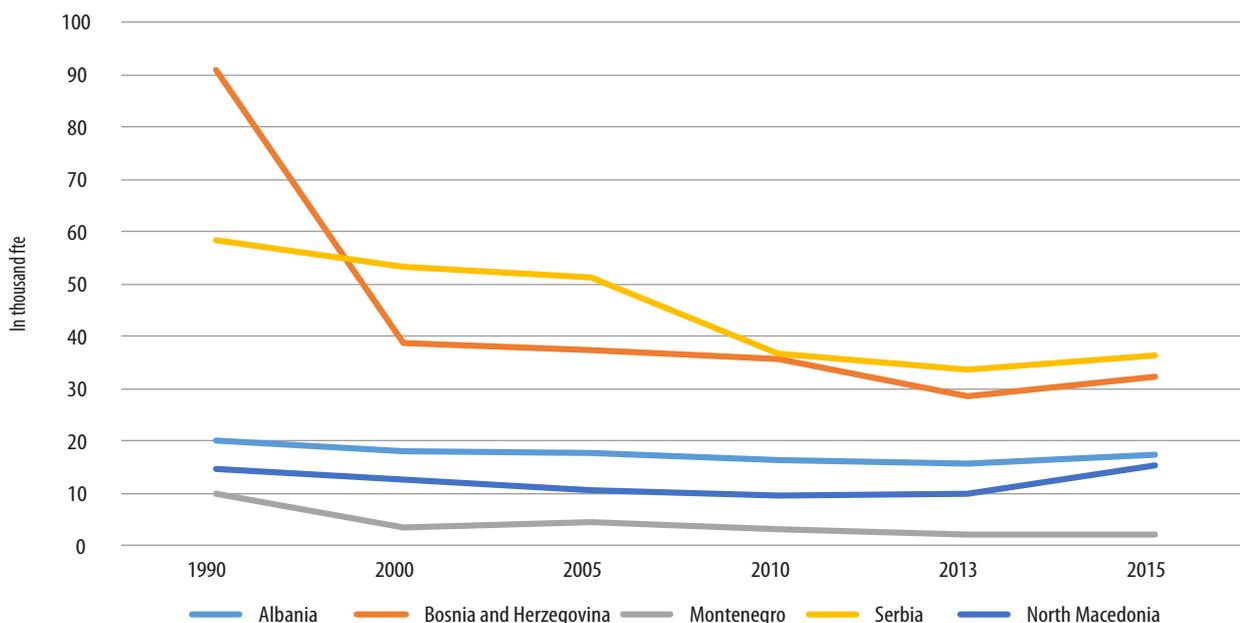
Serbia experienced a drop of 38 % in its forest workforce, mainly because the pulp industry halved in size. During the period 1990-2015, Albania's workforce size decreased by 13 % (3,000 fte), Montenegro's fell by 77 % (7,800 fte) while North Macedonia's workforce remained constant (Graph 7).

Wood manufacturing is the dominant employer of the forest sector in the Balkan countries, particularly so in Montenegro (B. Glavonjić, Belgrade State University, personal communication, 2016).

Despite falling employment, the forest sector, primarily the forestry and wood industry subsectors, remains an important source of employment for the Balkan countries (particularly in rural areas). In Serbia, for instance, the forest sector accounts for 2.2 % of all employment, and the wood and paper manufacturing subsectors employ 10 % of the industry workforce. The forest sector could generate considerable additional jobs between now and 2030 if it could focus less on exporting unprocessed timber and more on promoting domestic processing of wood into final products.

GRAPH 7

Number of forest sector workers in the Balkan countries 1990 – 2015 (in thousand fte)



Source: B. Glavonjić, Belgrade State University, personal communication, 2016.

Research conducted in the 2009-2011 FAO project, "Wood Energy as a Driver for Sustainable Rural Economic Development in Serbia" showed that about 4,000 workers were employed in wood fuel production in Serbia, 70 % in rural areas. When indirect work was added to these data, wood fuel production in Serbia accounted for 6,700 jobs.

The forest sector in the Balkan countries has a significant potential in terms of self-employment in wood production and collecting and processing non-wood forest products, especially in rural areas. Research in Serbia showed that 12,300 self-employed workers in rural areas were engaged in firewood production in private forests. This is important, as these workers are not reflected in national employment statistics (Vasiljević, 2015).

Box 1.3: Turkey

In 2016, Turkey's forest sector employed 0.17 % of the total workforce, corresponding to 225,000 workers. Turkish forest law requires that village residents are given employment priority in the local forest sector. This approach had enabled 140,000 out of a total of about 7 million village residents to be employed in the forestry sector (Ü. Örnek, Central Union of Turkish Forestry Cooperatives, personal communication, 2017).

1.2.5 Caucasus and Central Asia

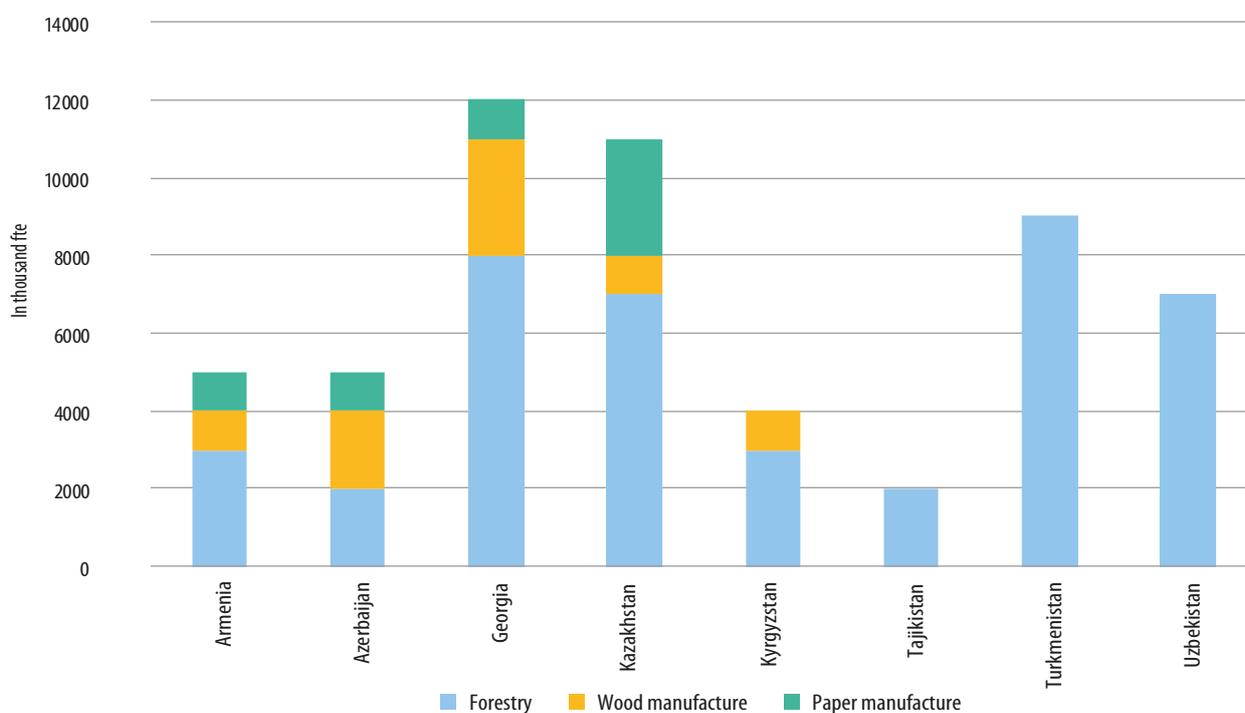
The collapse of the Soviet Union affected all countries in the Caucasus and Central Asia. While there are limited data, it is clear that the transition from centrally planned to market economies affected all three forest subsectors, and there were drastic falls in employment in several countries.

Employment in the three subsectors responded roughly the same across all Caucasian and Central Asian countries. All subsectors experienced falls in employment from 1990 - 1995, after which the forestry subsector gradually and moderately recovered, while the wood manufacturing subsector showed almost no recovery in the period up to 2011. By 2011, the wood manufacturing subsector had collapsed and by then employed only 1,000. During the same period, Tajikistan's wood harvest also fell and, by 2008, the country's wood manufacturing industry had ceased to exist (Graph 8).

The paper manufacturing subsector disappeared from several countries after 1995, to reappear in 2008. Although of considerable size in Uzbekistan, paper manufacturing did not return in the country in the period up to 2011 (Graph 8).

GRAPH 8

Employment in the three forest sector subsectors in Central Asia in 2011



Source: FAO, 2014b.

During the Soviet period, Armenia and Uzbekistan relied on the import of timber and other forest products from other Soviet republics. After the end of the Soviet era, the Central Asian countries went through a crisis. Uzbek economic relations were destroyed, and Armenian transport, energy and trade was blocked, also due to the conflict with neighboring Azerbaijan and the aftermath of a devastating earthquake in 1988. This deprived the countries of imports needed to sustain their manufacturing industries and increased the pressure on domestic forests (Sayadyan & Moreno-Sanchez, 2006; UNECE/FAO, 2006).

In Kyrgyzstan, the organizational structure became more horizontal and decentralized, with the transfer of decision-making power to local state-owned forests (leshozes). When subsidies from Moscow stopped, the Kyrgyz government could not sustain the high level of financial support to the sector, which led to its reorganization and created the necessity for the sector to enter the market economy to become more financially self-sufficient (FAO, 2004). These changes had a major impact on employment in the sector.

1.3 Age

During the period 2015 - 2060, ageing will have the largest impact on countries' demographics worldwide (Economist Intelligence Unit, 2015). The same report identifies that the workforce in Europe is both shrinking, and ageing, slightly.

Data for Europe show the proportions of forest workers aged 50 years and older for the years 2000 and 2010 (Graph 9). Over that period, the number of workers aged 50 years or more increased by 6 % in forestry and, on average, accounted for about 30 % of the forestry subsector workforce in 2010. In Sweden, by 2010, more than half of all workers were aged 50 years or more. In four other countries, France, Germany, Ireland and Norway, the workforce aged 50 years and over increased by more than 15 % to reach between 37 % and 46 % of the forestry workforce.

The trend was similar in the wood and paper manufacturing subsectors, with an average 8 % increase in the proportion of workers aged 50 years or more.

Box 1.4: Forest sector workforce in Georgia.

Forests cover about 40 % of the national territory of Georgia. As in other countries in the Caucasus and Central Asian subregion, the forest sector is small. In May 2019, an estimated 7,000 people worked in wood manufacturing and an estimated 2,076 people in forestry and logging. Georgia has a population of 3.73 million people (excluding the municipalities of Abkhazia and South Ossetia) The forest sector accounts for only 0.27 % of total employment (based on own calculations) (National Statistics Office of Georgia, 2018).

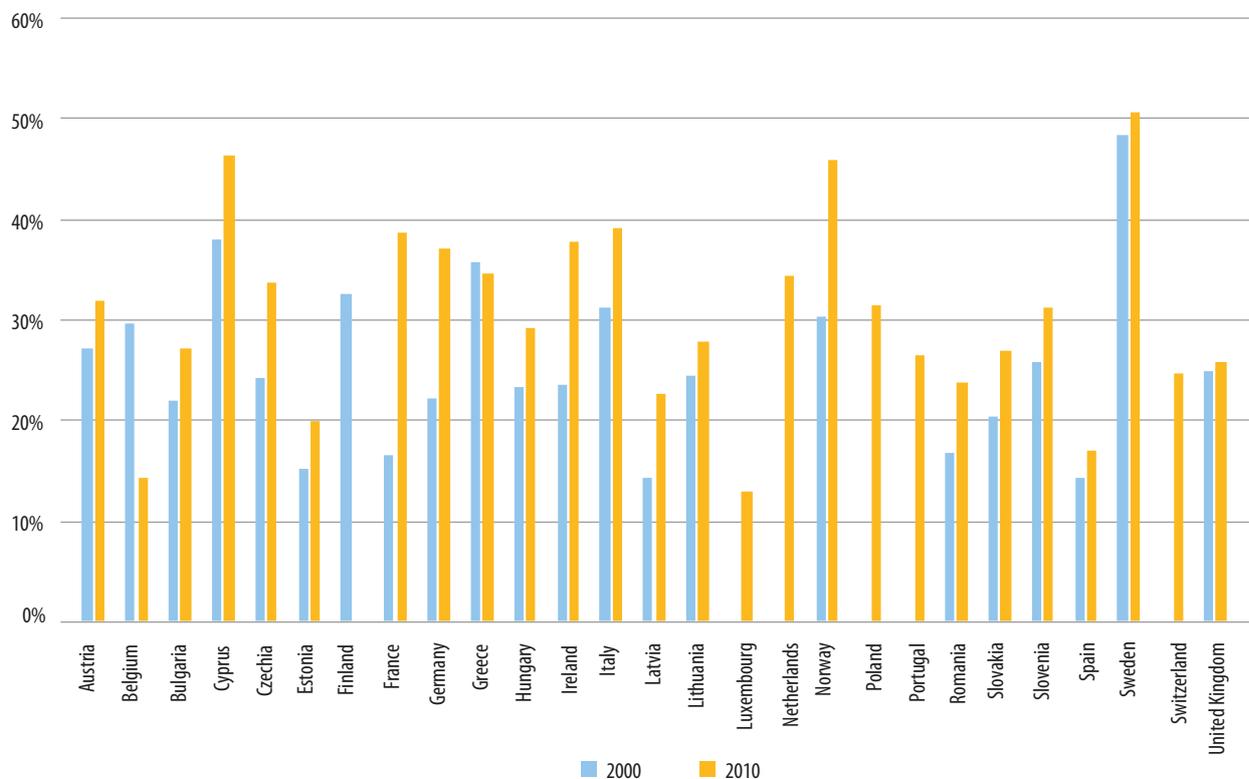
The figure for the forestry and logging subsector includes;

- 7 employees of the Forest Policy Division of the Ministry of Environmental Protection and Agriculture;
- 475 employees of the National Forest Agency (NFA);
- 524 employees of the Agency of Protected Areas (APA);
- 470 employees of the Department of Environmental Supervision (DES) (with an ambition to add another 400 people to the team before 2020);
- and around 600 people are employed in private logging companies sub-contracted by the NFA, and "wood processing license" (timber concessions) holder companies, which manage specially allocated forest areas for wood utilization. As there is no institution conducting special surveys among private sector forest-related companies, the number is an estimate and based on the companies contracted and existing timber concessions. For the same reason, it is not possible to provide a more exact number of the people working in the private sector.
- Of the 1,476 people working for public agencies, 8 % are women.

Source: G. Aleksidze, Ministry of Environmental Protection and Agriculture of Georgia, personal communication, 2019.

GRAPH 9

Proportion of workers aged 50 and older in the European forestry workforce in 2000 and 2010



Source: UNECE statistical database.

In Eastern Europe, there was a 12 % reduction in the age group of 15-49 in the forestry workforce; 26 % in wood manufacture; and 5 % in paper manufacture. During this same period, the share of employees aged 50 and older in forestry increased by 42 %, with wood manufacture increasing by 3 % and paper manufacture by 5 % (O. Kiyko, Ukrainian National Forestry University, personal communication, 2016).

The Balkan forest sector also faces the challenge of an ageing workforce. In North Macedonia, for example, the proportion of workers in forestry of 50 years and older increased by 13 % between 2005 and 2010, making up 39 % of the workforce. This development can be related to the low profitability of this industry in the Balkan countries and the associated low wages, which have reduced the attractiveness of this sector (B. Glavonjić, Belgrade State University, personal communication, 2016).

In Turkey, 17 % of the total forestry workforce in 2005 were over the age of 50 and this ratio increased to 20 % in 2010. This percentage was stable in the wood and paper manufacturing industries, with 12 % and 5 % respectively (UNECE, Statistical Database 2016).

In 2015 in the US, the average age of the employed population in the forest sector, with a tertiary degree in natural resources & conservation, was 41 with just over a quarter aged 50 or older (Data US, 2019a).

Box 1.5: Implications of an ageing workforce

Research into accidents and fatality rates related to age suggest that rates increase with an ageing workforce (Briere et al., 2010). Specific characteristics and vulnerabilities of older workers require employers and authorities to develop new, appropriate injury prevention strategies (Jones et al., 2013).

One study from Finland found that in industries not experiencing major technological shocks, such as the forest industry, both productivity and wages increase as age and 'seniority' increase (Daveri and Maliranta, 2007). By contrast, skills decline after a certain threshold age, but this decline does not appear to increase the costs of labour. The authors of the study recommended retraining workers to ease their reallocation into new jobs.

1.4 Gender

Promoting gender equality has become a major policy drive globally. Gender diversity in the forest sector has received increasing attention in recent decades. Women are significantly under-represented among the forest sector workforce and there is a desire to achieve a better gender balance, supported also by the inclusion of gender in sustainable forest management certification schemes.² Attracting women into the forest sector could help mitigate some of the negative trends such as ageing of the forest sector workforce.

1.4.1 Data overview

Canada and the US

In Canada in 2018, women represented 16.5 % of the workers in forestry and logging and support activities for forestry (Statistics Canada, 2019). This compares with 16.4 % in 2001, employed in the forestry and logging,

² Participation in forest management certification schemes is voluntary and the schemes are market-based. In the absence of an internationally binding forest convention they set guidelines for sustainable and legal forest management (Rayner et al., 2010). Two of the most widely adopted global schemes are the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These certification schemes set standards for environmentally- and socially-responsible managed forests and provide forest owners and managers independent validation of their sustainable management practices (PEFC, 2019a; FSC, 2019). Both schemes adhere to the ILO core conventions, as well as several others relevant for the forest sector (PEFC, 2019b; FSC, 2002)

support services for forestry, wood manufacturing, pulp and paper manufacturing and furniture manufacturing industries combined (FAO, 2006).

In the US, the paper manufacturing industry employs 23 % of women, against 14 % in wood manufacturing and 10 % in forestry and logging (Graph 10). In all forest industries, women are paid significantly less than their male counterparts, with a pay gap of about 25 % in both paper and wood manufacture and about 11 % in logging in 2016 (Data USA, 2019b/c/d).

Europe

The proportion of women in the forest sector workforce remained fairly constant between 2008 and 2016 at around 13 % in forestry, 16 % in wood manufacture and 28 % in paper manufacture (Graph 11).

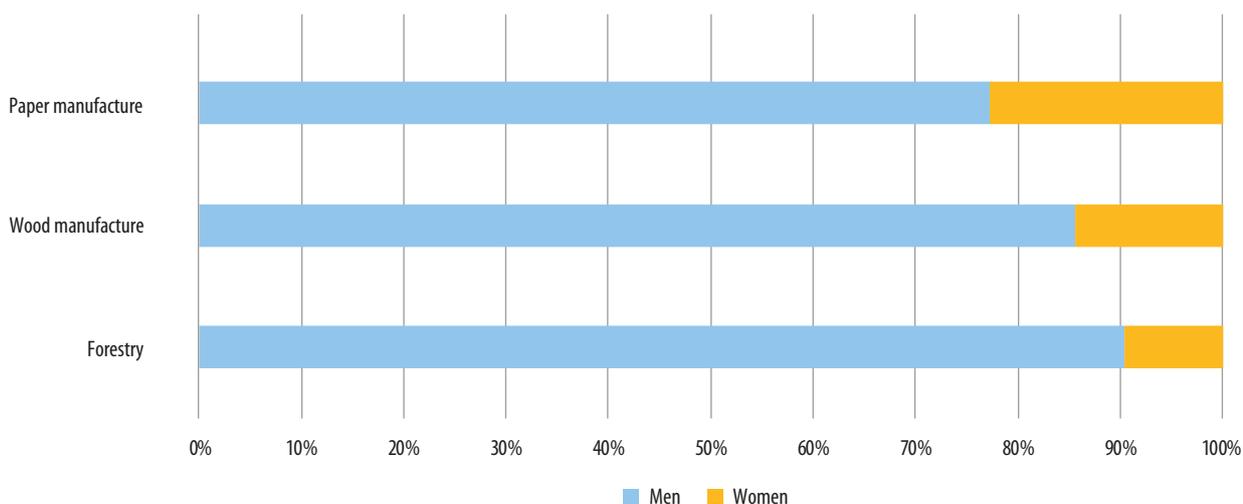
In 2016 in Switzerland’s forestry subsector, women represented 32 % of the workforce, the highest in Europe for this subsector (Graph 12). Lithuania employed the highest share of women (27%) in the wood manufacturing industry. Hungary had the highest rate of women employed (55%) in the paper manufacturing subsector.

Balkan countries

Across the Balkan countries, employment of women in the forest sector developed differently between 1990 and 2013. In Albania, Montenegro and North Macedonia, the proportion of women increased substantially: from 20 % to 30 %

GRAPH 10

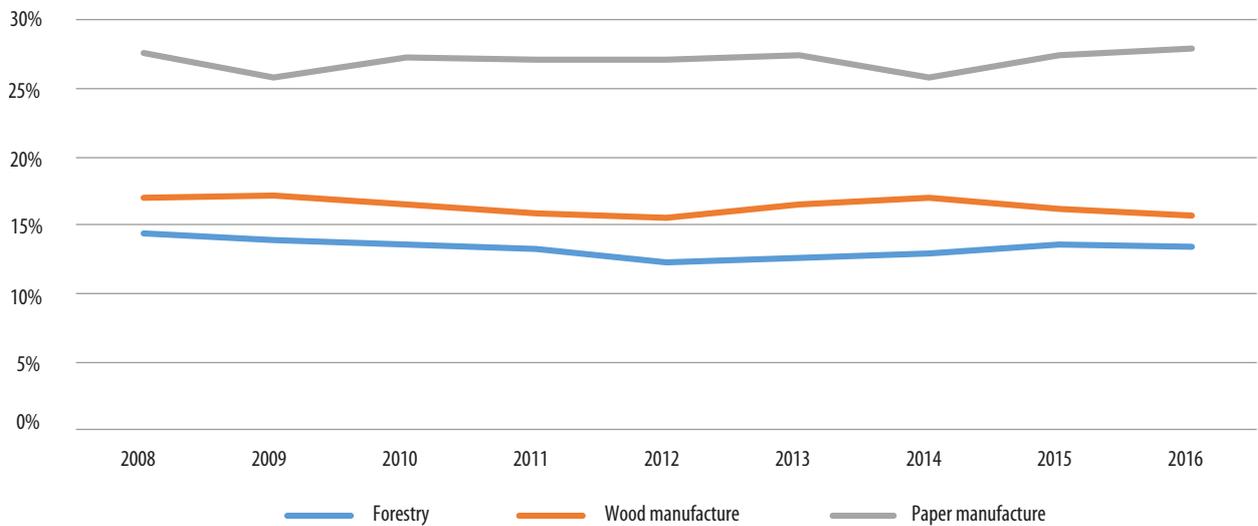
Forest workforce by gender in the US in 2015



Source: U.S. Bureau of Labour Statistics, 2016.

GRAPH 11

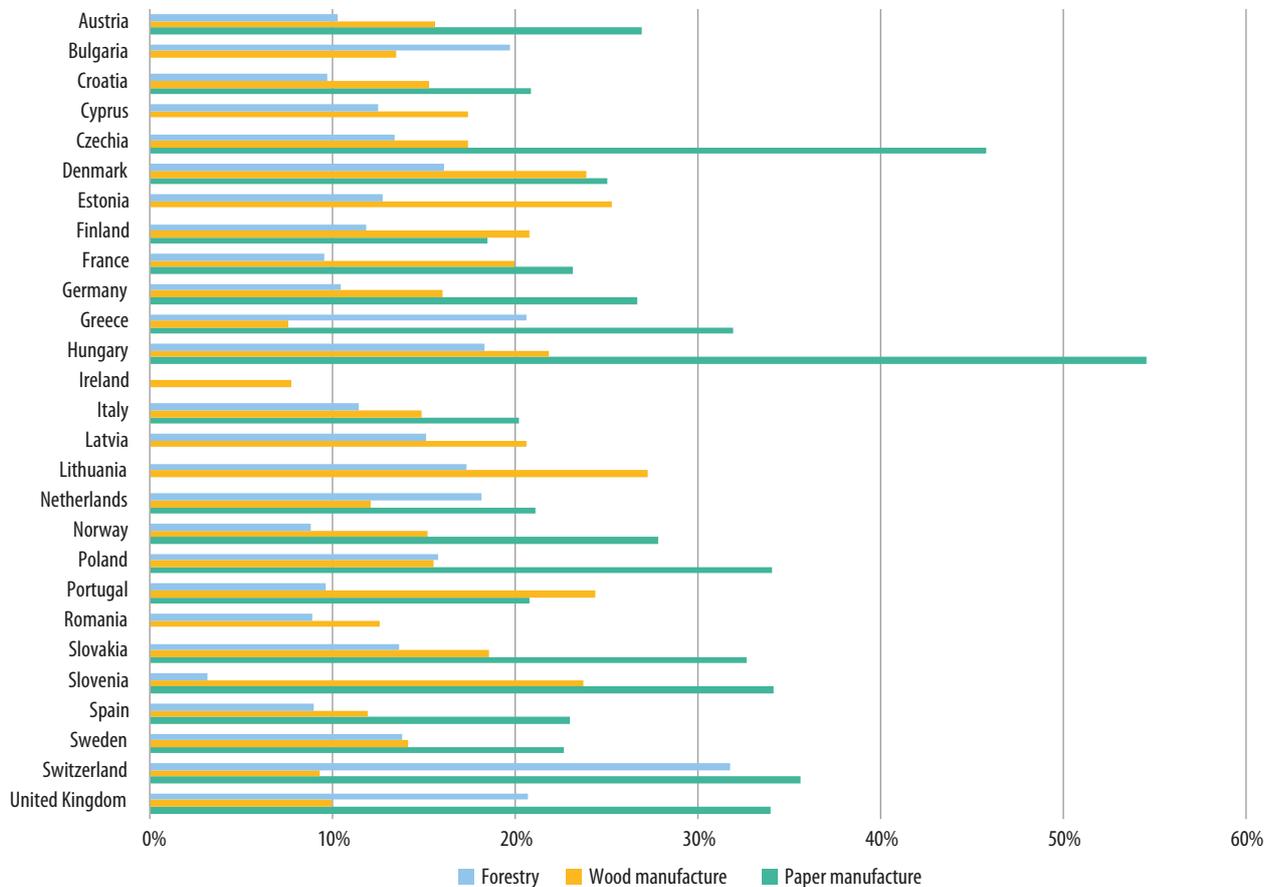
Proportion of women employed in the forest sector compared to the total forest sector workforce in Europe



Source: Eurostat, 2016.

GRAPH 12

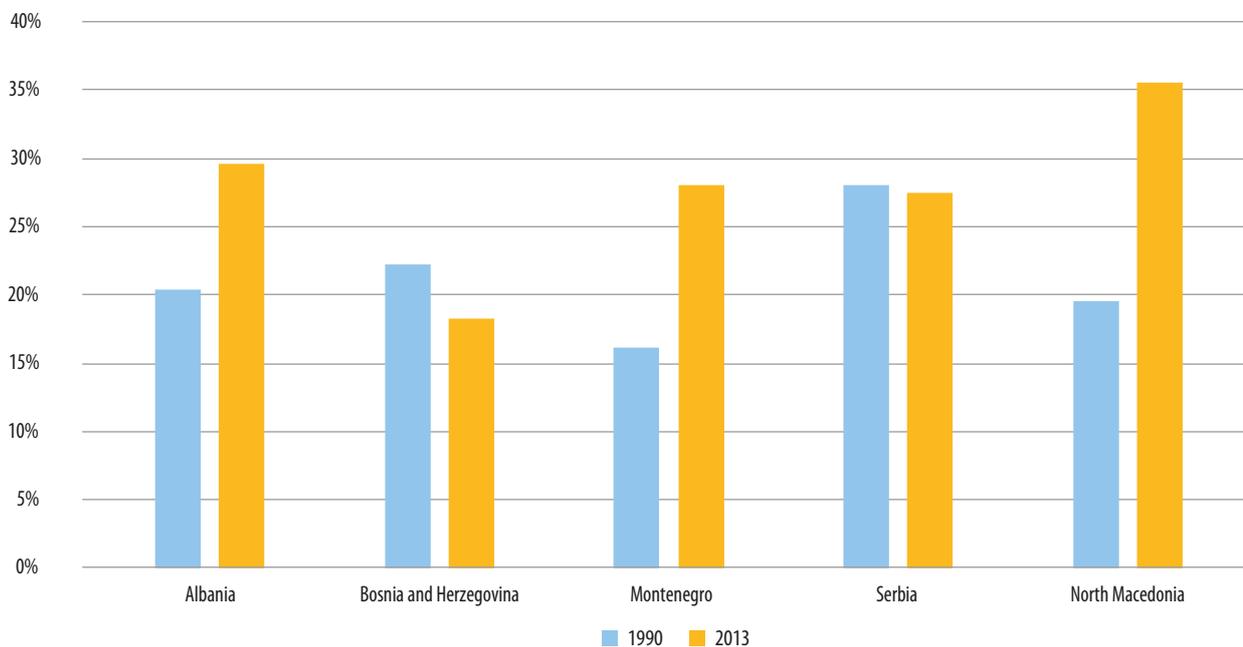
Percentage of women employed in the forest sector, compared to the total forest sector workforce in Europe in 2016



Source: Eurostat, 2016.

GRAPH 13

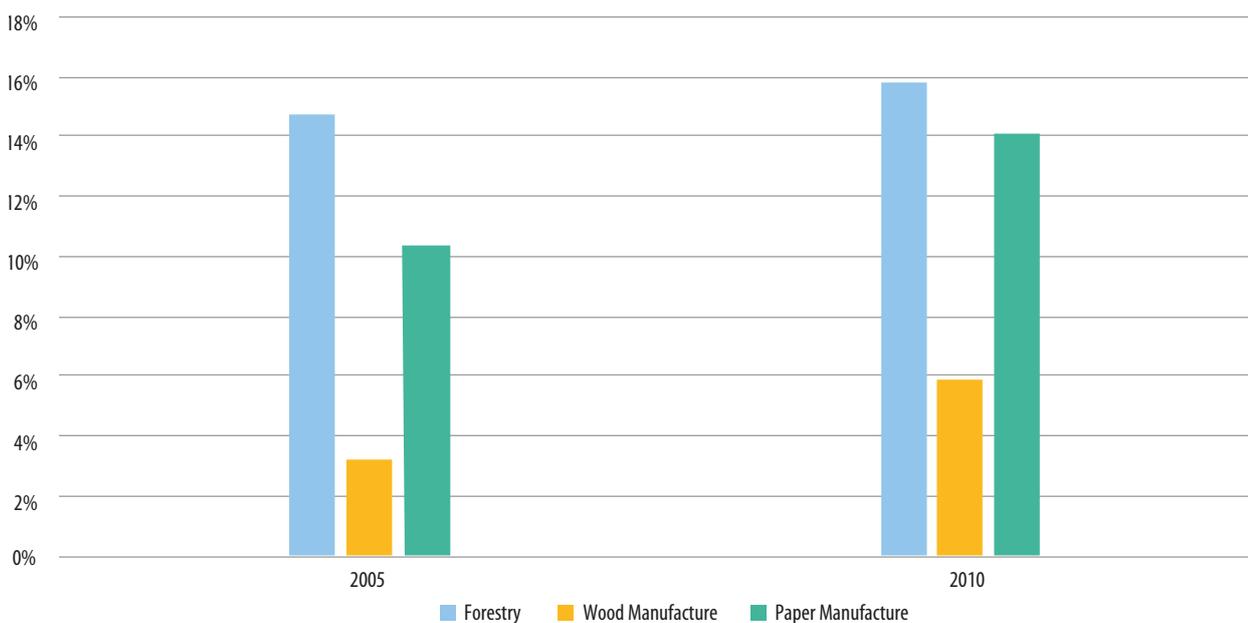
Percentage of women employed in the forest sector, compared to the total forest sector workforce in the Balkan countries in 1990 and 2013



Source: B. Glavonjić, Belgrade State University, personal communication, 2016.

GRAPH 14

Proportion of women employed within the forest sector workforce in Turkey in 2005 and 2010



Source: UNECE, statistical database.

in Albania, 16 % to 28 % in Montenegro and from 20 % to 36 % in North Macedonia. Employment of women decreased in Bosnia and Herzegovina from 22 % to 18 %, and marginally in Serbia, from 28 % to 27 % (Graph 13).

Across the Balkans, paper manufacturing employed the highest share of women within the forest sector in 2013, averaging 37 % though, in Albania, the proportion of women was 65 %. Forestry has the lowest representation of women within the forest sector, in large part due to the nature of the work. Overall, only 26 % of the total forestry workforce across all the Balkan countries were women, though this share is increasing. North Macedonia stands out among Balkan countries with women accounting for 46 % of the forestry workforce in 2013.

In Turkey, in 2010, women made up 16 % of the forestry workforce, 6 % in wood manufacturing and 14 % in paper manufacturing (Graph 14). These proportions increased compared to 2005.

1.4.2 Gender and ownership

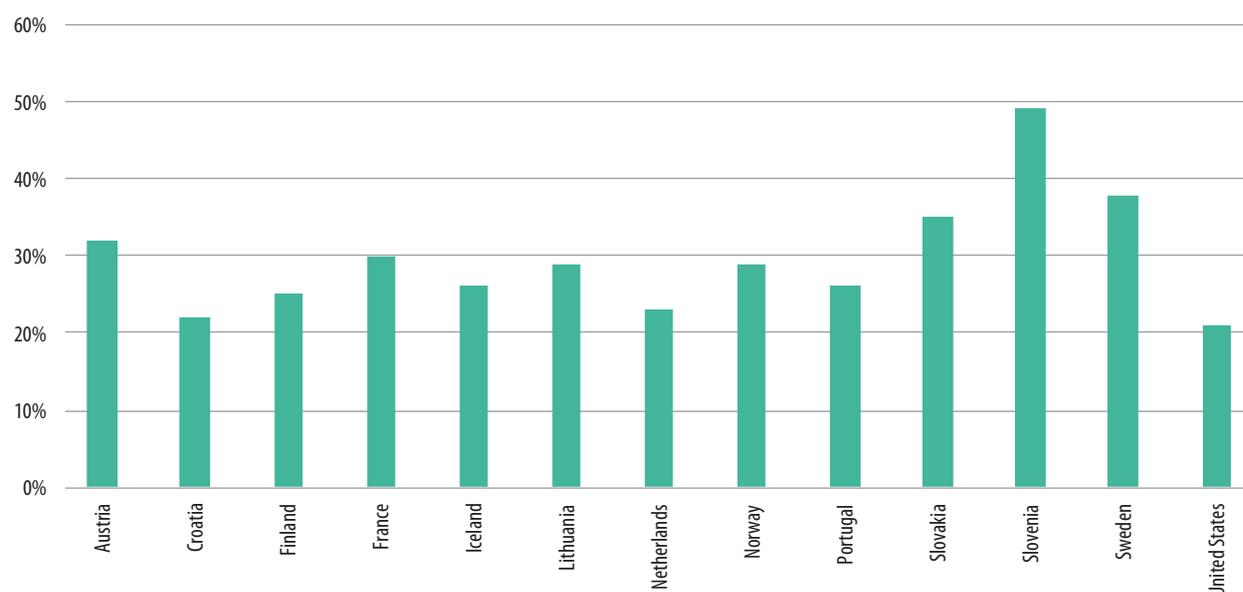
In several UNECE countries, according to the UNECE Statistical Database (2019), female, individual private ownership in 2015 was considerable (Graph 15).

In most European countries, private forest ownership structures were based on family ownership of forest land, often connected to agricultural practices and farmland. The head of the household, as recognized in predominantly patriarchal norms, was a man and custom dictated that the land be passed on to the eldest son in the family. Due to modernization, individualization and mainstreaming of gender equality, in recent times private forest land has been divided between multiple siblings, causing fragmentation of the land but also a higher number of female primary owners (Lidestav, n.d.).

A study on attitudes, silvicultural activities and business activities connected with forest ownership of individual forest owners in Sweden indicated differences between female and male forest owners' silvicultural activities as well as between their inclination to derive value from industrial roundwood production and other forest-related products/activities. The study showed that both male and female forest owners were almost equally interested in roundwood production. More than male forest owners, female owners were also interested in ecological, social or recreational values, and were "more inclined to see business opportunities in less traditional forest activities in fields as tourism and health/rehabilitation" (Umaerus et al, 2019).

GRAPH 15

Share of female primary owners relative to total ownership by private individuals in selected countries in the UNECE region in 2015



Source: UNECE Statistical Database, 2019.

1.4.3 Gender in international forest certification schemes

The Forest Stewardship Council (FSC) was established in 1994 to, “promote environmentally appropriate, socially beneficial and economically viable management of the world’s forest” (FSC, 2019). It aims to promote the long-term social and economic wellbeing of forest workers and local communities. It has established rules about gender diversity in the forest sector. For instance, it requires that women receive adequate training and that health and safety measures are the same as those applicable to men. The scheme also has requirements about maternity leave and reporting cases of gender-based discrimination and sexual harassment through a confidentiality mechanism.

The Programme for the Endorsement of Forest Certification (PEFC) promotes all aspects of sustainable forest management: environmental appropriateness, social benefits and economic viability for present and future generations. PEFC-endorsed standards require compliance with the International Labour Organization (ILO) Convention No. 100, on Equal Remuneration Convention, 1951, as well as with ILO Convention No. 111, on Discrimination (Employment and Occupation), 1958, among others. Moreover, PEFC’s requirements for the development of national standards recognize the nine major groups defined in Agenda 21, of which women are identified as one, as the stakeholder groups having concern for sustainable forest management (PEFC standard 1001).

Box 1.6: Women in informal forest work

Women may be more represented in informal forest work, which is much less visible to governments and researchers alike. Some case studies give some further insight into this issue. In Turkey, a study of seasonal forest workers found that 70 % of the women interviewed worked with their spouses in the forest, but 46 % of these women stated that they did not contribute to their family’s budget (Özden et al., 2011).

In Belgium and Germany, forest operations have been more and more outsourced to small and micro enterprises. Traditionally, in these companies the vast majority of contractors are men. Information received directly from forest professionals revealed that many women are employed in many small family companies (1 to 5 workers) (P. Hermans, *Sylva Nova*, personal communication, 2017; E. Kastenholz, KWF, personal communication, 2017). They do not appear on the official list of workers of the enterprise nor on the payroll. Consequently, they often do not have pension rights nor personal health insurance.

When asked about the headcount in the enterprise, company owners might count only the men working in the forest operations. Only when asked specifically about who does the office work, is it found that in most enterprises there is a woman doing the job, often the wife of the entrepreneur or a family member (usually part-time). Women often take the lead in the administrative work, accounting, and sometimes logistical organization. In an enterprise with an average 3-4 workers (according to official headcount), there is generally 0.5 to 1 fte woman working time dedicated to office tasks.

As there are thousands of small contractor enterprises in Europe, there may be thousands of women employed in them, who are not reflected in official studies and statistics. They do highly qualified jobs in many enterprises.

1.4.4 Overview of literature

The data on gender in the forest sector are not comprehensive, making it difficult to draw conclusions on general trends. Overall it can be concluded that women are under-represented in the forest sector workforce. This is particularly the case for senior positions in private companies (FAO, 2006). Women tend to be primarily employed in administrative roles, such as accounting.

There have been past exceptions to this general trend, when the percentage of women employed in the forest sector was higher. For instance, in the 1960s and 1970s, working class women were employed as tree planters by the British Columbia government (Ekers, 2014). A study

from this period showed how women were a valued part of the tree planting teams and seen to enhance the work (Sweeney, 2009b).

Three surveys, in 1995, 2001 and 2010, highlighted changing attitudes towards the role of women in the US Forest Service (USFS). The 1995 study found that the USFS had been dominated by white, male foresters, particularly in more senior professional and management levels, despite the fact that from the mid-1970s, civil rights legislation and lawsuits impelled the agency to begin diversifying. The numbers of women in the agency increased considerably during that period, but largely in administrative support positions rather than in jobs with potential for career advancement (Thomas and Mohai, 1995).

1. Demographics and diversity of the forest sector workforce

A study on paper, pulp and packaging companies in Europe, Canada and the US found initial evidence that increasing gender diversity in higher management is positive for the industry but pointed out that the pool of women qualified for leadership positions in the sector is small. The strategies suggested to improve this are, “recruiting young employees and promoting from within, attracting outside talent into traditional positions, and utilizing talent that is increasingly operating in a non-traditional manner through project work” (Hansen et al, 2016). In the US, a study found that the organizational structure affects the diversity of the scientific workforce, and a lower representation of women present in senior roles in forestry research (Kern et al., 2015). Canadian studies concluded that the low participation of women in forest management decision making may have over-represented the industrial values of forestry, and given them preference over other community and ecological values (Reed and Varghese,

2007; Richardson et al., 2011). A study from Norway also found that, “women are grossly under-represented in all sectors of forestry industry, and recruiting women has been difficult” but the study concluded that gender attitudes were not a barrier to recruitment (Follo, 2002).

1.5 Ethnic diversity of the forest sector workforce

Statistical data and other information about ethnic groups in the forest sector workforce in Europe are scarce. France, for example, prohibits by law the collection of ethnic origin data by institutional surveys. In other European countries, data are very limited. Therefore, in general, it is challenging to identify industry sector data disaggregated by ethnic or other minority groups.

Box 1.7: ILO Convention No.111 and No.169 on diversity in the workforce

One of the eight fundamental conventions of the International Labour Organization (ILO) is the Discrimination (Employment and Occupation) Convention, 1958 (No. 111). As per the ILO Declaration on Fundamental Principles and Rights at Work, 1998, all member states of the ILO are committed to respect and promote these principles and rights of which the elimination of discrimination in respect to employment and occupation is recognized as one. Discrimination in this context is understood to be “any distinction, exclusion or preference made on the basis of race, colour, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation” (ILO, 1958). Special reference in this context is also made to migrant workers and unemployed people.

In addition, and very relevant for the forest sector specifically, Convention No. 169, on Indigenous and Tribal Peoples, 1989, addresses the rights of these minorities at work. In particular, the convention fosters the respect of human rights and urges governments to establish means by which these people can participate at all levels of decision-making. This includes equal remuneration and access to training as well as the prevention of any discrimination.

Further ILO Conventions and accompanying Recommendations concerning elimination of discrimination are:

- Equal Remuneration Convention, 1951 (No. 100).
- Equal Remuneration Recommendation, 1951 (No. 90).
- Discrimination (Employment and Occupation) Recommendation, 1958 (No. 111).
- Workers with Family Responsibilities Convention, 1981 (No. 156).
- Workers with Family Responsibilities Recommendation, 1981 (No. 165).

The UNECE and FAO statistics do not record the ethnic diversity of the workforce, but the topic is receiving increasing attention, particularly in Canada and the US.

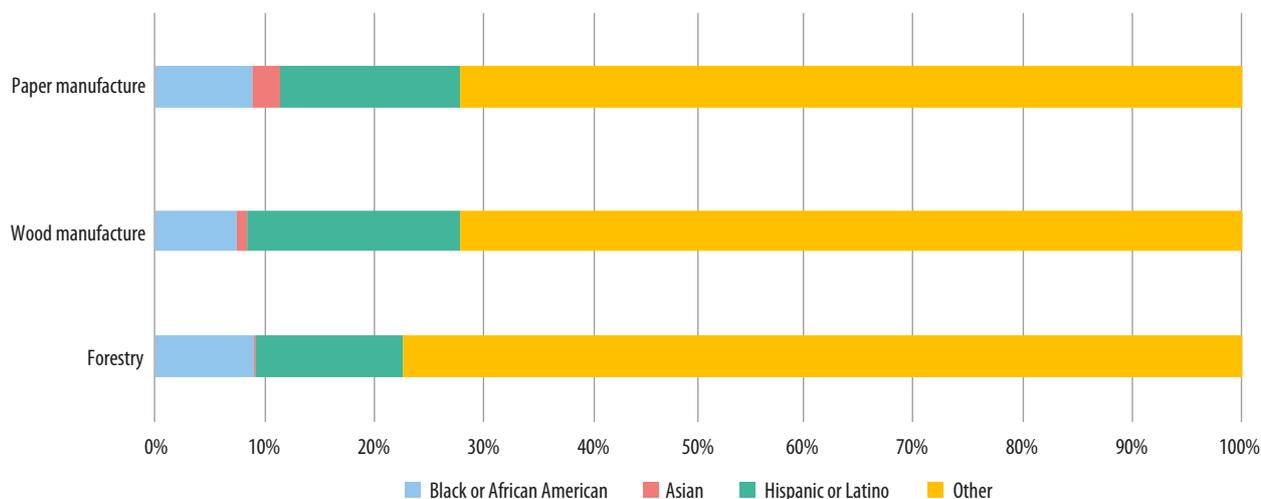
One US review summarizes, “There is a need for greater attention to race and ethnicity by all in the natural resource field, and for greater diversity among professionals in the field itself. A broader and more inclusive view of natural resource values, use, and management will both better serve a diverse US population and attract more diversity to the natural resource professions” (Schelhas, 2002).

The United States Forest Service (USFS) has been trying to improve the representation of different ethnic groups³. Almost all relevant research on this subject comes from the US, where the census data on workers’ origins exists by industry.

³ The terminology used for different ethnic groups in this report has been based on the terminology used by the United States Department of Commerce (2018). Without meaning to ignore the richness of ethnic backgrounds that underly these terms, for readability purposes the terminology has been further simplified to: Indigenous, for all reference to American Indian, Native American, Aboriginal and First Nation peoples; Black, also meaning people of African American descent; Hispanic, also meaning people of Latino descent; White, also meaning Caucasian..

GRAPH 16

Proportion of ethnic minorities in the US forest sector



Source: US bureau of labour statistics, 2016.

For the last few decades, US policy has been to diversify the workforce and provide better working conditions. Research shows that in parts of the US, forest sector ethnic minorities are over-represented. For instance, a study discovered that Hispanics form a disproportionately large part of the labour-intensive workforce (Moseley, 2006). They often worked seasonally, away from home and for companies that did not offer health insurance.

Hispanics represent about 13 % to 19 % of the workforce in the US forest sector (Graph 16), which corresponds to the 17 % of Hispanics in the general population and the total workforce.

Diversifying the workforce is challenging. Some authors have suggested that a cultural shift is needed to explicitly value diversity, rather than policies imposing specific behaviours (Koontz, 2007).

Minority enrolment in forest degrees, in most disciplines, is dominated by Hispanic people, with notable exceptions being wood science/products (Asian) and recreation (Black). The representation of Hispanic people is growing in the forest products industry in south eastern states of the US, where they work in logging and millwork and provide a majority of the tree-planting and herbicide-application labour (Casanova and McDaniel, 2005). In the US Pacific Northwest, Spanish has become the dominant language among reforestation crews and Christmas tree workers (Emery et al., 2006).

Historically, in Canada and the US, indigenous peoples were usually among the first to be impacted by declining

work opportunities. However, since the early 2000s, initiatives have taken place, for instance in British Columbia, to involve indigenous peoples more fully in forest industry decision-making. In the Great Bear Rainforest Agreement of 2001, indigenous peoples won tentative timber rights and assurances that mid-coast watersheds would have a protected status and henceforth would be subject to ecosystem management practices (Robbins, 2008).

In Canada, in 2006, indigenous people represented 3.5 % of the forest sector labour force. The median age of indigenous workers (27 years) was lower than non-indigenous workers (40 years). Also, the participation of indigenous youth (age 15 – 24) in the forest sector was higher than non-indigenous youth (NRCAN, 2010). This proportion was higher in some specific provinces. For instance, in New Brunswick 48 % of the workers in logging were indigenous (FPSC, 2011). Through the ‘Indigenous Forestry Initiative’, the Canadian Government, “provides funding to support indigenous-led economic development in Canada’s forest sector. The funding aims to increase indigenous participation in forestry-related opportunities, businesses, careers and governance” (NRCAN, 2019).

Indigenous communities, however, still face challenges to their integration into the forestry labour market because many jobs in forestry need a more advanced level of education (FPSC, 2011). Although education attainment has increased amongst indigenous people, there is still a disparity with the rest of the population. While 23 % of the

non-indigenous population have a first university degree, the figure within the indigenous population is only 8 %. Among the non-indigenous population, only 15 % do not achieve a high school diploma. Within the indigenous population, the figure is more than double at 34 % (FPSC, 2011).

1.6 Education

Globalization, technological development (including mechanization and the digital revolution) as well as an ageing workforce require an assessment of the needs for new competencies and skills in the forest sector and its different branches. A comprehensive analysis of forest education trends is beyond the scope of this study, but this section gives some elementary information about the key issues raised in the scientific literature on the topic.

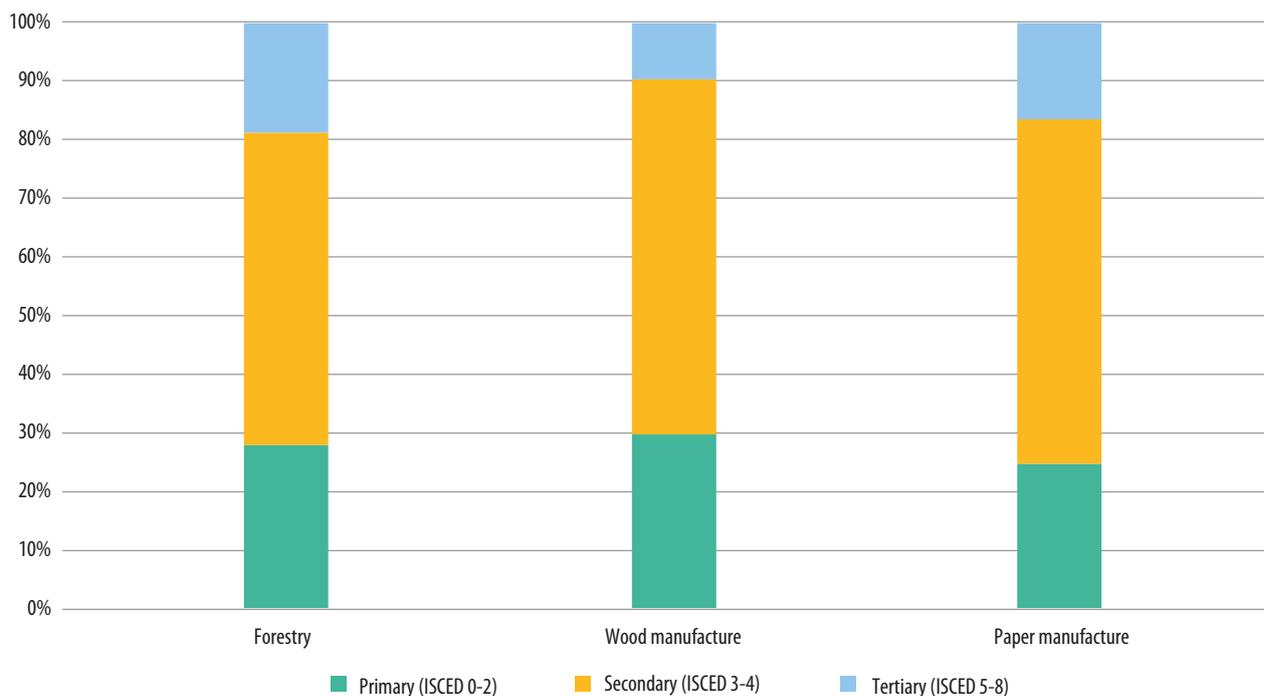
Education can be categorized as basic (primary), vocational (secondary), and professional (tertiary). In general, the forestry workforce in Europe is well educated with nearly three-quarters achieving vocational or professional qualification (Forest Europe, 2015). There is interest in

strategies that create life-long learning and re-training opportunities to address the major changes that are ongoing in the forest sector, as well as those anticipated in the transition to a green economy (ILO/OECD, 2012; Hetemäki, 2014). Some research has found widespread use of on-the-job training and in-house classrooms by employers that are seeking to prepare workers for green jobs (Brite et al., 2010). These capacities can be developed in partnership with universities and other traditional educators. There is broad recognition of the need to develop skills in science, technology, engineering and mathematics (STEM) to support green economic growth (OECD, 2012).

In Europe, the forest sector workforce with primary education represents a higher proportion in the forestry workforce (28 %) than in the paper industry (24 %) and in the wood manufacturing sector (22 %). The wood manufacturing sector workforce has the lowest rate of tertiary education (12 %), compared with 19 % for forestry and 18 % for paper manufacture. The differences in educational attainment between the subsectors are small. For all subsectors, workers with secondary education level form the largest group (Graph 17).

GRAPH 17

Education attainment in the forest sector in Europe in 2016



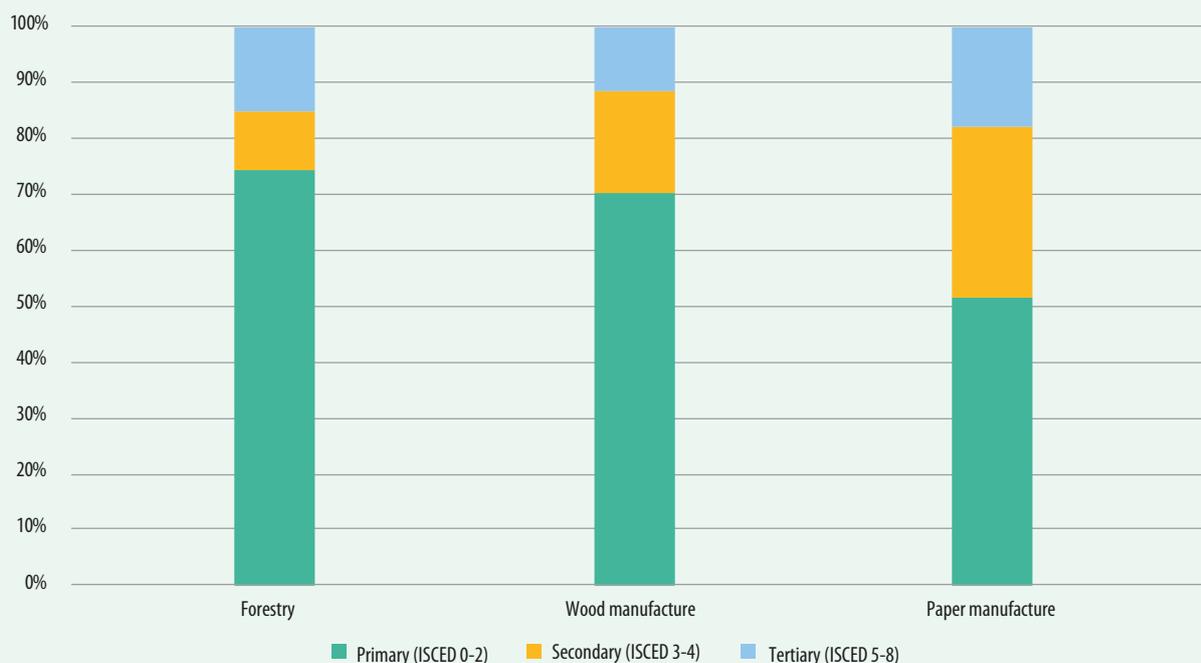
Source: Eurostat, 2016.

Box 1.8: Education level of forest workers in Turkey

Turkish data show a higher number of workers with primary education than in Europe. About 74 % of the Turkish workforce in forestry, 70 % in wood manufacturing and 52 % in the paper industry have primary education (Graph 18) The rate of workers with tertiary education is comparable with Europe, in all three subsectors (Graph 17).

GRAPH 18

Education attainment in the forest sector in Turkey, by subsector, in 2016



Source: Eurostat, 2016.

Studies in the Balkan and Central European regions suggest that the forestry profession is seen as unattractive because of hazardous working conditions and low salaries (B. Glavonjić, Belgrade State University, personal communication, 2016; O. Kiyko, Ukrainian National Forestry University, personal communication 2016). In Serbia, 200 new workers with secondary school qualifications enter the wood manufacture workforce annually but this number does not cover those who retire annually from the 2,540 companies in this subsector. In 2014, in the entire Balkan region, 2,052 students concluded secondary school education in the field of forestry and wood processing; only a fraction of the need.

Data from the US show that student numbers nationally have shifted from traditional fields such as forestry to more interdisciplinary and ecosystem-based programmes. The share of female enrolments in natural resource degrees has steadily increased but has fallen in forestry. Similarly, while there has been an increase in minority group enrolment,

forestry's share of those enrolments is below the average (Sharik et al., 2015).

The authors attribute this 'dramatic decline' in forestry enrolments from 1980 to 2012, to the following factors:

- Changing public opinion about forests and forestry.
- Diversification of natural resource degrees.
- Inflexible, science-based curricula associated with accreditation, certification, and Federal Office of Personnel Management standards.
- Perceived lack of jobs and concern about low wages.
- Little attraction to forestry for women and minorities, two student cohorts that have grown significantly in recent decades.

Boxes 1.10 - 1.13 below, present specific regional and national case studies, which highlight several other aspects characterizing forest sector education.

Box 1.9: Minority professionals in forestry: reflections on 10 years of higher education in the US

In 1992, the Florida Agricultural and Mechanical University and the University of Florida launched a degree in Forestry and Natural Resources Conservation, largely funded through the US Forest Service (USFS). The year 2002 marked the tenth anniversary of what has become one of the most successful national initiatives of the USFS.

The degree was established to increase the number of ethnic minority professionals trained in forestry and related fields. Student financial assistance, work and travel experience, opportunity for future employment, and the personal support of advisors were identified as strengths of this initiative. Recruitment and retention have been critical to educating minorities in natural resources and forestry (NRF).

Among the recruitment efforts made were, annual summer programmes for targeted high school students; a one-week "Forestry 2000" summer programme organized by the university and public and private agencies; annual career fairs; invitation letters, and phone calls to incoming freshmen with good grades, to encourage them to consider NRF careers. Professional clubs, student chapters of the Society of American Foresters (SAF), and the Wildlife Society (WS), and advising and mentoring services have been instrumental in the successful completion of academic programmes by minorities.

Source: Onokpise et al., 2008a.

Box 1.10: Forestry education in Eastern Europe

Forestry education in Eastern Europe is provided by a well-structured system which includes vocational training schools and institutions of higher education. The large research centers and higher education institutions have been reintegrated and reformed to be able to adapt to the political and economic transformation in the region. The Bologna Process, which ensures the comparability in the standards and quality of higher education qualifications in participating countries, has levelled the playing field between universities of applied sciences and classical universities. By introducing a three-cycle system of bachelor, master, and doctorate, and easier recognition of qualifications received from different higher education institutions, the Bologna Process has helped better exchange between institutions.

Challenges still include the decrease in number of students due to competition between forestry education and other specialties and study curriculums; discrepancy between modern requirements and quality of instruction; and low levels of available funding.

Source: O. Kiyko, Ukrainian National Forestry University, personal communication, 2016.

Box 1.11: Some features of forestry education in the Balkan countries

There are secondary vocational schools for forestry and wood processing in all the countries except in Montenegro. In all secondary vocational schools, curricula are updated regularly to take account of new technology trends and needs of the companies. However, although jobs for graduates from secondary vocational forestry school are easily available, enrolment levels are low, particularly for three-year courses (e.g. carpentry, upholstery and wood coating and treatment).

At the tertiary level, structural changes in the forest sector have led to changes in curricula to address the need for combining professional practice and practical work during. For instance, the first pilot project for the so called "dual system" in which students work and study at the same time was initiated in Serbia, following models in Germany and Austria. The first pilot class started on 1 September 2016. Companies agreed to participate in the project by hosting professional practice and training students in their production plants. It is planned that after completing three years of education all the students will get jobs in these companies.

In most faculties in the region, joint study programmes exist in cooperation with universities from the EU countries. Between 2004 and 2010, all faculties in the region worked together to establish a master's programme on "Forest Policy and Economics".

Source: B. Glavonjić, Belgrade State University, personal communication, 2016.

The case studies above highlight some specific challenges that existing education programmes are facing. The “Scottish FOREST AND TIMBER TECHNOLOGIES SECTOR: SKILLS & TRAINING SCOPING STUDY” on forestry education in Scotland, the UK, highlights the difficulty of assessing future skill needs of the forest sector, because it cuts across different education sectors (Ambrose-Oji et al., 2015). Education programmes required in the sector also include skill development for CEOs of contractor companies and a pilot programme in Sweden involved the participation of six CEOs (Sääf et al., 2014b). There were two parts to the programme, a theoretical and practical component where the participants implement acquired skills within their own firm. The project addressed development areas including sales skills, developing business with new clients and recruitment.

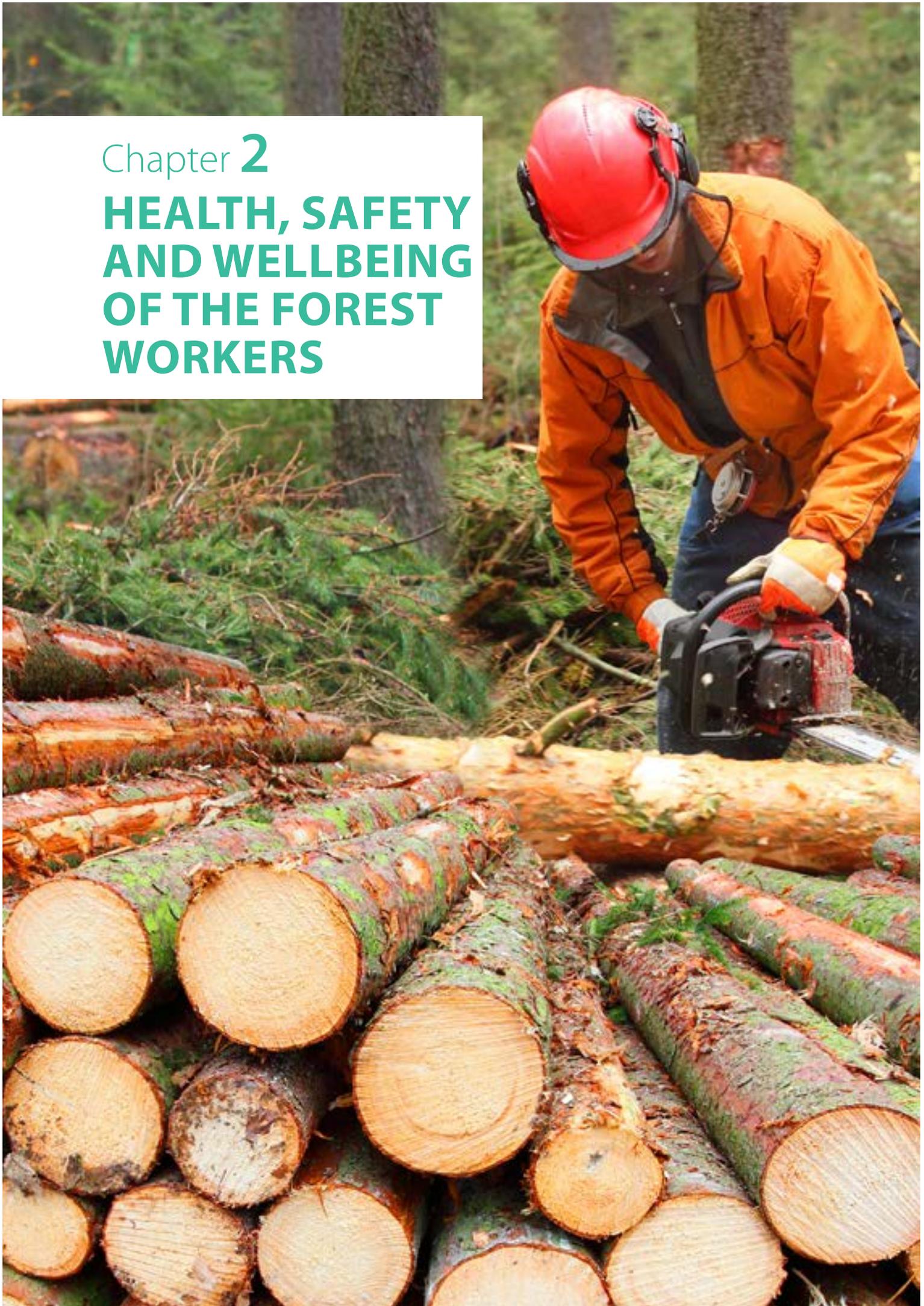
The information in this section does not allow for formulating conclusions about trends in forest education, but some general observations about the current needs in

the UNECE region can be drawn. The following points are relevant to addressing some of the challenges for forest education in the UNECE region:

- Identify and update required skills frequently to address developments in the sector.
- Exchange regularly knowledge and experience at the international level (including mobility of students through international exchange programmes).
- Adopt an interdisciplinary approach to education programmes (combine wood technology, design, architecture, art, ecology, IT tools,).
- Implement a dual system training in education programmes.
- Include the development of social and management skills in education programmes.
- Provide all social groups with access to education opportunities.



Chapter 2
**HEALTH, SAFETY
AND WELLBEING
OF THE FOREST
WORKERS**



2.1 Introduction

Forest workers face a number of occupational health and safety risks. Most forest work is physically demanding, and mechanization does not reduce the physical load of every task. Hand-held tools and machines can be heavy and moving or lifting timber is strenuous. Some machine work may involve repetitive movements, which may result in neck, shoulder or back pain or other ergonomic issues. Workers may experience negative effects on their physical and mental health if the demands of work (e.g. skills, experience) and the work environment (e.g. isolation, instability of employment) exceed the worker's ability to deal with them. In addition, many organizational aspects, such as relationships and atmosphere at work, responsibility for work and safety of others or unclear roles, can influence a worker's health, safety and wellbeing.

Data for occupational accidents are the most common measure of the state of occupational safety in the forest sector. Other health problems may arise from long-term physical stress caused by whole body and hand-arm vibrations, acoustic and infrasonic noises, biohazards and musculoskeletal loads. Continuous exposure to risk factors may cause several occupational diseases such as noise-induced hearing loss, hand-arm vibration syndrome, infectious and parasitic diseases, allergic diseases, photo dermatoses, toxic reactions, spine pain syndrome and peripheral nervous system diseases.

Occupational accidents and diseases are a source of suffering and, as such, affect physical and psychological health and integrity of forest workers. In addition to the general health of the worker, improving safety at work also makes economic sense. Apart from the substantial direct costs associated with accidents, such as compensation, medical treatment and wages, there are indirect costs related to interruption of work, which might be several times higher than direct costs.

2.2 Risks

The forestry operation with the highest exposure to occupational risks and accident rates is harvesting work (logging). Most literature and data analyze cases from forestry work.

2.2.1 Risks related to natural conditions and forestry operations

Forestry work is generally exposed to a combination of risks related to natural conditions and risks directly related to the way forestry operations are performed.

Risks related to natural conditions are associated with steep and broken terrain, dense crops and adverse working conditions, including extremes of both weather conditions (rain, snow, fires) and temperatures - hot and cold. These risks can be increased by forestry operations risks, related to human behaviour and attitudes to risk, such as the inadequacy or absence of protective measures, of proper work-site facilities, appropriate equipment or protective clothing.

Several country-specific studies (Box 2.1) analyzed natural conditions and particular forestry task risks which may lead to accidents and fatalities, providing a better understanding of forest work risks.

A study in Kentucky, USA, focused on the risks of fatal accidents due to logs rolling off trucks at sawmills, led to recommendations for interventions to include limiting load height on trucks, installing unloading cages at sawmills and prohibiting overloaded trucks on public roadways (Struttman and Scheerer, 2001).

Many studies have confirmed that chainsaw (motor-manual) operation is the most dangerous forestry work. Such work is often undertaken by small companies, local contractors and self-employed people, who have fewer systems in place to control safety. A European study (Robb and Cocking, 2014) into chainsaw accident fatalities found the main reasons were:

- Being struck by falling trees, branches and items from trees – primarily whilst working on hung-up, storm- and fire-damaged trees: 63 %.
- Bleeding to death from chainsaw cuts – primarily due to saw kickback and lack of adequate first-aid provision: 13 %.
- Slipping, tripping or falling on hazardous ground conditions – e.g. falling onto a running chainsaw on steep wet ground: 11 %.

It is not possible from this overview to draw general conclusions about risks and risk prevention. Several studies mention the importance of context, and variations in conditions can be highly specific. For example, winter hazards such as tree icicles, tree wells and snow traps were noted in Slovakia, where steep terrain causes injuries due to rolling stems and loss of balance is common (Robb and Cocking, 2014). In Turkey, the terrain in most forests is too steep for mechanical harvesters and so most forestry operations use manual labour (Melemez, 2015). Risk assessment for the specific working conditions is essential to develop appropriate safety recommendations.

Box 2.1: National studies on risks

In Austria, extracting by cable yarder (skyline winch) had an accident rate of 36 incidents per million m³. On average, an accident needed 17.9 days for recovery, compared to 25.6 days for manual extraction and 29.7 days for extraction by tractor or skidder. An analysis of slip, trip and fall accidents found 19.9 incidents per million m³ or 28.3 incidents per million work hours (Tsioras et al., 2014b).

In Germany, felling and de-branching (snedding) were the most dangerous activities in chainsaw operations (Robb and Cocking, 2014).

In north-west Russia, felling, cross-cutting, extraction and skidding operations led to most fatal forestry accidents. The risk associated with each harvesting method was found to depend on local conditions, technology used, and the share of manual operations in the overall process (Gerasimov and Sokolov, 2014).

In Slovakia, a review of chainsaw accidents showed that most occurred during de-limbing of branches (snedding), and all fatalities occurred during felling (Robb and Cocking, 2014).

In Slovenian state forests, of 846 accidents occurring between 1990 and 2005, most occurred during felling (68 % and 20 lost days), skidding (24 % and 19 lost days), and chainsaw operations (6 % and 17 lost days) (Potocnik et al., 2009).

In Sweden, accidents among self-employed small-scale forestry workers were most likely to occur during felling, thinning and transport (Neely and Wilhelmson, 2006). A different study based on hospital registry data, of self-employed small-scale forest workers, found that accidents occurred most commonly during firewood processing (54% of the timber harvest related accidents) (Lindroos and Burstrom, 2010).

In the US, between 1992 and 2000, there were 780 logger fatalities of which 63 % were tree fellers (Scott, 2004). Earlier data (1980 - 1988) found regional differences in fatality rates, with the highest rates in those regions where hardwood timber was primarily harvested (Myers and Fosbroke, 1994). In West Virginia, a mail survey among loggers found that 9 % of those directly involved in logging operations reported injuries. The leading cause of injury was being struck by a falling tree or a limb at 29 % (Helmkamp and Derk, 1999).

2.2.1.1 Role of technology in reducing forestry operations risks

Some authors see technology as one of the solutions to reducing risks related to forestry operations, while some emphasize the need for change in workers' behaviour.

In West Virginia, companies using feller-bunchers to harvest trees had a significantly lower injury claim rate than companies not using them, at least part of the time (Bell and Grushecky, 2006). The study pointed out that other strategies are needed to reduce injuries in areas of very steep terrain where it is not technically possible to use such machines, (Bell, 2002).

Preliminary testing of a new tool for felling trees in the US, showed that the use of the "wood duck" (a version of scissor jack that uses a ball screw to separate the jaws) increased the rate of safe tree-felling (where the tree did not begin to fall before the wood duck was actuated) from 78 % to 91 % (Lyons and Ewart, 2012).

An international technical review concluded that mechanization of operations brings "proven improvements in both safety and cost-effectiveness" (Visser and Stampfer, 2015).

Some authors emphasize how workers' practices affect safety. A study of self-employed private forest owners in Sweden found accidents arose because of unsafe working methods, more than equipment (e.g., a chainsaw), and it recommended improving workers' skills (Lindroos and Burstrom, 2010). Another Swedish study noted that injuries from accidents involving chainsaw work were rarely due to the chainsaw itself, as a result of advancements in chainsaw design and improvements in personal protective clothing (Larsson and Björnstig, 1990).

Most existing studies conclude that both technology and behaviour change are necessary to improve worker safety. Behaviour change is also needed to adopt new, safer technologies. Research on the way in which new technologies are best adopted then becomes important.

A survey of logging contractors in northern Italy found that they were aware of the potential of mechanized cut-to-length technology and its safety benefits, and that cost, rather than lack of awareness, reduced the adoption of this technology. The study concluded that younger contractors, who are more familiar with computer technology, would be more likely to adopt this technology (Ferrari et al., 2012).

2.2.2 Risks associated with social factors

Risks can also be associated with social factors, such as gender, age and cultural background. This chapter presents general studies across sectors, which can be applied to the forest sector, as well as some that are specific to the forest sector.

2.2.2.1 Gender

A review of high-risk occupations in different sectors highlighted that in many countries (e.g. Canada, the UK and the US), men accounted for more than 90 % of work-related fatalities (Stergiou-Kita et al., 2015). That study explained that more men worked in physical, higher-risk occupations and were less likely to pay attention to pain and health issues. The study noted that masculine cultures tend to encourage competitive behaviour, displays of confidence and emotional toughness, and challenge authority. These characteristics made men more likely to take risks, accept injuries, and less likely to report problems or health issues. The study was considered particularly valuable because it was conducted by a large team of health, safety, and gender experts. It pointed to the importance of understanding that gender concepts are socially constructed and shaped by organizational cultures, practices, workplace pressures and job insecurity, as this should give a better understanding of how ideas of masculinity may vary between cultures, classes, age groups, and places.

The conclusions of this study have not been tested in the forest sector specifically, and findings are likely to vary with occupation and economic sector.

2.2.2.2 Age

Evidence of how age affects injury rate is inconclusive, as studies are scarce. If the ageing forest workforce is symptomatic of a more general ageing among the working population, it may be more important to focus on the consequences. While older workers may be subject to health and safety risks, they also bring more experience and skill.

Some studies have indicated that older workers are more likely to be injured (Pompei et al., 2015; Steege et al., 2014). Other studies indicate that younger workers are more likely to be injured. For example, in Slovakia workers between the ages of 18 and 49 were found to have the poorest safety record (Robb and Cocking, 2014).

Older workers are more affected by strain. A study in Italy found that fit, young operators in winching crews experienced a lower physical workload than older ones and recommended that, "when the task is assigned to older workers, it is necessary to allow longer rest breaks, accepting a lower productivity" (Aalmo et al., 2016).

Another study in northern Wisconsin, USA, found that younger individuals attributed their accidents to human errors, whereas older individuals felt their injuries were unavoidable (Fischer et al., 2005). Though not specific to the forest sector, one study found that young male workers might have been especially vulnerable to workplace risks and fatal accidents due to their limited work experience and lower inclination to question occupational cultures (Stergiou-Kita et al., 2015).

Employers and authorities will need a better understanding of characteristics and vulnerabilities of older-workers to enable appropriate injury prevention strategy implementation (Jones et al., 2013).

2.2.2.3 Social and cultural factors

A US study examining occupational health and safety disparities across professions, found that employment in high risk occupations was independently associated with being male, Black, having at most secondary education, foreign-birth, and low wages (Steege et al., 2014).

A different review of trends in occupational fatalities across all jobs involving machines in the US, 1992 - 2010, found that groups that continued to be at high risk included older workers; self-employed; and workers in agriculture / forestry / fishing, construction, and mining (Marsh and Fosbroke, 2015).

Finally, a small number of studies highlight drug and alcohol use in some natural resource communities. A study of accidents in British Columbia, Canada highlighted a, "need to address the culture of marijuana use in the logging industry" (Holizki et al., 2015). Another study in that province noted high drug use in logging communities (Ekers and Sweeney, 2010). In an analysis of the agriculture, hunting and forestry sector accidents in the Russian Federation, 39 % of victims had a higher than allowed blood alcohol content (Varakina et al., 2010).

In Iowa, USA, fatally-injured workers were rarely tested for drugs and alcohol (and even less so in the agricultural, forestry and fisheries sectors). Where testing did take place, older workers tended to test positive more often. The authors suggested that substance abuse interventions for workers should be targeting the use of drug and alcohol and may help to reduce fatalities (Ramirez et al., 2013).

2.2.3 Risks associated with employment status

Various studies suggest that logging contractors are more prone to accidents than employees in secure employment. However, an analysis of 780 logger fatalities in the US over the period 1992 - 2000 found that the size of the employing organization was not statistically significant (Scott, 2004).

In a different study in the Italian Alps, logging crews from public companies showed a significantly lower level of risk-taking behaviour, and the best safety performance was from the only (public) crew that had received formal safety training (Borz et al., 2014).

Also, in Italy, the fatal injury rate for direct employees was 14 %, less than half the rate for temporary workers. Reasons can be traced to the lack of experience in the activity, insufficient knowledge (formal and informal) about how to use specific equipment and an inadequate training period (Fabiano et al., 2008).

Accidents tend to be more frequent and severe among the workers with less experience also in Spain (Albizu Urionabarrenetxea et al., 2013) and Turkey (Melemez, 2015) and. Temporary and seasonal workers are particularly vulnerable (Melemez, 2015).

In West Virginia, US, worker turnover was significantly related to injury compensation claim rates; companies with higher turnover of employees had higher claim rates (Bell and Grushecky, 2006).

In Switzerland, the risk of injury in forestry was estimated at 123 in 1,000 in companies employing more than 80 workers. This risk tripled in smaller companies (SUVA, 2016).

An international review of wider research on the effect of results-based payment systems, e.g. per number of trees planted or volume firewood cut, supported the hypothesis that in most situations there is a negative effect on health and safety (Johansson et al., 2010).

Studies available indicate that accident rates are particularly high among self-employed or occasional workers. For example, a study in Sweden showed high accident rates among self-employed small-scale forestry workers (Neely and Wilhelmson, 2006). In that study, about 40 % of respondents reported an accident or incident during the previous 24 months. The study found that 50 % of these cases happened when not fully using safety equipment, and that this was 10 % higher than in earlier studies.

In the northern part of the state of Wisconsin US, occasional wood cutters' experienced three times more injuries than professional loggers, who were more likely to wear personal protective equipment (Fischer et al., 2005).

2.3 Safety

Achieving good health and safety standards at work depends on complying with laws and regulations, establishing relevant policies and training schemes as well as promoting a safety culture and providing appropriate equipment at worksites. This section addresses different aspects of health and safety in forestry work identified in

the literature, presents challenges related to data collection and a few national case studies.

2.3.1 Health and safety in ILO conventions and international forest certification schemes

Occupational health and safety topics are covered by several international labour conventions of ILO, the most important of which are the Occupational Safety and Health Convention, 1981 (No. 155), and its accompanying Recommendation No. 164, and the Occupational Health Services Convention, 1985 (No. 161), and its accompanying Recommendation No. 171.

Convention No. 155 requires ILO member States to develop a national policy on health and safety and to enforce regulations through a system of inspection. Convention No. 161 calls for ILO member States to develop occupational health services for all workers. The objective of both Conventions is to prevent occupational accidents and injuries by minimizing the causes of hazards inherent in the working environment (Guidelines for Labour Inspection in Forestry, ILO, 2005).

Specific issues related to health and safety in forestry work are covered by the ILO code of practice on Safety and Health in Forestry Work (1998). The code covers all types of forestry workers, including contractors, the self-employed and forest farmers. It outlines a safety management system for enterprises that integrates safety into overall enterprise management and offers detailed technical guidance on logging and on some high-risk operations like tree climbing, harvesting of windfalls and forest fire-fighting. The code is intended to help countries and companies that have no forestry specific regulations to achieve health and safety of employees engaged in the forestry work.

Social, health and safety requirements are also part of major international forest management certification schemes promoting sustainable forest management, like the major schemes FSC and PEFC. These are voluntary, market-based schemes, providing forest owners independent validation for their environmentally and socially responsibly management practices. According to the FSC, an organisation, "shall commit to occupational health and safety (OHAS). At a minimum, the organisation shall appoint an OHAS representative, establish and implement procedures adequate to its size and complexity, and train its staff on OHAS" (FSC, 2016). OHAS should meet or exceed the recommendations of the ILO Code of Practice on Safety and Health in Forestry Work. Workers should have specific trainings and supervisions and be appropriately equipped for their assigned tasks (Hontelez, 2017). Statistics on accidents also need to be collected.

2. Health, safety and wellbeing of the forest workers

PEFC (PEFC, 2015) requires that an organization, “shall demonstrate its commitment to comply with the social, health and safety requirements defined in this [its] standard.

- Workers are not prevented from associating freely, choosing their representatives, and bargaining collectively with their employer.
- Forced labour is not used.
- Workers, who are under the minimum legal age, the age of 15, or the compulsory school attendance age, whichever is higher, are not used.
- Workers are not denied equal employment opportunities and treatment.
- Working conditions do not endanger safety or health.”

Box 2.2: Poland: forest certification and the perception of responsibility for health and safety

In 2015, the Regional Directorate of the State Forests National Forest Holding in Warsaw contracted entrepreneurs, micro-companies, who employ forest workers for forestry operations work. In a relatively short period (approx. 6 months), several work accidents occurred, some of which were fatal.

Under the national law, the State Forests have no obligation to take responsibility for workers, who are not the employees of the company. According to FSC/PEFC standards, however, the auditors need to verify the safety conditions at working sites and check what has been done to avoid accidents. Consequently, the State Forests could be held accountable for not providing proper health and safety conditions at their working sites.

With that in mind, the State Forests proposed training for forest workers, which would refresh their knowledge of health and safety measures to be taken while cutting a tree. A group of certified trainers was hired, and contractors were informed via e-mail of the possibility of participating in the training. Of 700 forest workers who worked as contractors for the State Forests, more than 500 were interested in training, even though most had worked for 20 to 30 years in forestry.

Training was provided for 25 groups in two parts. First, participants were shown pictures of real accidents and discussed the causes and after, trainers showed how to cut a tree safely. Then, every participant had to cut a tree under the supervision of a trainer. Some participants needed to cut several trees before they did it in line with health and safety standards. A survey after the training, showed that participants valued the training and would like to have it every year.

The example shows that forest certification requirements of give a useful framework for action in the field of health and safety of forest operations. They provide forest managers with an incentive to take responsibility for every person working in the forest, even if the law does not impose an obligation on them.

Source: J. Sienkiewicz, State Forests, personal communication 2017.

2.3.2 Overview of safety trends

Despite the fact that health and safety in forest work is often reported on statistically, only a few studies distinguish between health and safety in the forestry, wood manufacturing and paper manufacturing industries.

In Europe, Eastern Europe, the Balkans and Central Asia⁴, the safety and health in manufacturing industries improved compared to 1980s but continued to be a major concern in forestry in many countries. In some regions and for some groups the situation deteriorated, most notably for self-employed workers and private forest owners in Central and Eastern Europe (Blombäck et al., 2003).

One Russian Federation study found that in 1996 - 2007, the highest proportions of injuries in the forest sector were

in timber processing (40%) and paper manufacture (25%) (Varakina et al., 2010).

Between 2000 and 2005, “The State of Europe’s Forests 2015” noted that the number of accidents fell, though over the years 2005 to 2010 accidents remained at the 2005 level and even increased in some countries in the last five years of the reporting period (Forest Europe, 2015).

According to the same report, about one in ten workers suffers an accident annually. In 2005, 193 fatal accidents were reported across Europe, Eastern Europe and the Balkans and in 2010 this number was 178. This figure does not include the Russian Federation where over 321 fatalities were reported for 2005 alone.

2.3.3 Costs of occupational injuries

Injuries and fatalities cause distress and costs to individuals, families and businesses. A few studies quantify these costs using direct or indirect indicators.

⁴ In Blombäck et al., 2003 these regions are referred to as Europe, Russia and the Commonwealth of Independent States (CIS)

In West Virginia US, several studies used Workers' Compensation⁵ claims data to assess the economic burden of logging injuries reported in the state. The average cost of a worker's compensation claim in the forestry industry during the time of the study was about \$10,400 (Bell, 2002). The total cost of injuries in West Virginia was over \$14 million (Mujuru et al., 2006). The most severe injuries, including traumatic brain and back injuries, resulted in the highest medical and indemnity costs.

In Sweden, accidents among self-employed forest workers resulted in long sick leave and a high proportion of permanent disability (Lindroos and Burstrom, 2010). On average, each injury led to 13 days of sick leave and 24 hours of institutional care (Wilhelmson et al., 2005).

Another study, looking at four crews working under the same conditions, in close-to-nature alpine forestry in Italy, analyzed the relationship between risk-taking behaviour and productivity. It found that taking more risks did not increase productivity (Montorselli et al., 2010).

2.3.4 Challenges related to data collection

There are many challenges around data on injuries at work. Several analysts concluded that fatal accident statistics are generally the most accurate of all accident statistics, and that they are often more readily available than other accident data because the law requires their publication in official records (Thelin, 2002). For that reason, they provide an important indicator which allows comparisons between countries, sectors, and across time (Melemez, 2015). Nevertheless, even the indicator "fatalities at work" presents "a serious problem of lack of comparability of data" (Forest Europe et al., 2011). There are several reasons for this lack of comparability:

- Different methods for collecting indicator data.
- Different levels of transparency and reliability of data collection.
- Little incentive for some sectors to report on accidents e.g. self-employed.
- High level of data aggregation (data for agriculture, forestry and fisheries are often combined in reporting) (e.g. Toivanen et al., 2015; Frank et al., 2013; Gorucu et al., 2015; Ramirez et al., 2013; Varakina et al., 2010; Kitching et al., 2014; Briere et al., 2010; Kogler et al., 2016).

There is no international consensus about how to report data on accidents and injuries, nor the time lost due to them and transparency varies widely (Ackerknecht, 2010). Ackerknecht concludes that, "the number of fatal accidents per million cubic metres of harvested wood is perhaps the

only category for which figures can be compared", and quotes data ranging from 0.11 fatalities per million m³ wood harvested in Sweden, to 4.9 fatalities per million m³ wood harvested in Slovenia. Where such data were available, the fatality rate for small-scale operations was 2 to 7 times higher than for all operations. Myers et al. (1998) advocated using the concept of worker's lifetime risk of dying of a stated illness based on exposure to a hazard in a specific job. The concept, however, has not been widely applied to occupational injury deaths.

Individual study papers provide more detail than national statistics. For instance, one US study concluded that although safety and health of forest sector workers has improved substantially, "injury, illness and fatality rates have declined by half since 1990. Fatality rates in the forest sector have not improved and logging is still the most dangerous civilian profession in the USA" (Prestemon, 2015).

In Spain, the accident rate in forestry was reported as nine times higher than other industries making forestry (including arboriculture) the most dangerous occupation. This accident rate was increasing and at the time of analysis a forestry worker was three or four times more likely to suffer an accident than an agricultural worker (Gorgues and Guiu, 2010).

Researchers often seek alternative and more detailed data sources for injury. In Austria, the analysis of accident reports found that the reports alone are insufficiently detailed to allow the development of preventive measures, and additional injury surveys and evaluations of accidents and new machines were necessary (Robert et al., 2015).

In France, an attempt was made to use existing data from social insurance compensation funds, with some success, although forestry was aggregated there with other occupations (Briere et al., 2010). In Italy, data on occupational injuries from the National Organization for Labour Injury Insurance together with data directly obtained through a field survey in three large manufacturing firms were analyzed to highlight the interaction between injury frequency index and the characteristics of the labour force (Fabiano et al., 2008). In examples from Slovenia, Sweden and the US, the analysis included not only the number of accidents but the number of days lost from work (Potocnik et al., 2009) and the cost of compensation (Eriksson et al., 2011; Bell, 2002). Another study in Sweden noted that for self-employed workers, the absence of an effective accident-registration system largely excluded this group from accurate representation in official statistics (Wilhelmson et al., 2005).

A different study in Sweden concluded that the legal requirement to report occupational accidents to the

⁵ Type of insurance providing wage replacement and medical benefits to employees injured.

authorities was probably frequently violated in this field of work, deliberately or unconsciously, because in cases where the injury would not result in financial compensation, there was no incentive to report it to insurance companies (Lindroos and Burstrom, 2010). The same study explored the use of different data to better understand fatalities related to self-employed foresters, gathered from the registries of the Swedish Work Environment Authority, the Labour Insurance Organization and the University Hospital in Umeå, Sweden. Data in these registries overlapped to a certain extent but also had “large discrepancies” in the areas and types of injuries they covered.

A French study used social insurance worker compensation funds to provide information about injuries to self-employed forest workers (Briere et al., 2010).

Data from observations in emergency rooms were used to identify risk factors for professional and occasional woodcutters in Wisconsin, US (Fischer et al., 2005).

These experiences in seeking better data also concluded the need for improved injury monitoring (Bentley et al., 2005). In New Hampshire, US a ‘non-fatal injury surveillance system’ is considered a top priority in the National Occupational Research Agenda⁶. It uses data sources including patient care reports and hospitalization records on electronic databases. Researchers tested the use of these data and found that it was possible to identify agricultural and logging injury events, and that multiple data sources increased accuracy although underestimates were still likely (Scott et al., 2015).

⁶ The National Occupational Research Agenda (NORA) is a partnership programme developed by the National Institute for Occupational Safety and Health (NIOSH), US. The programme was founded in 1996 to provide a framework for research collaborations in the field of workplace safety and health that require immediate attention based on the number of workers affected, the seriousness of the hazard, and the likelihood that new safety information and approaches can effect a change. Source: <https://www.cdc.gov/nora/about.html>

Box 2.3: Statistical data on forestry occupational health and safety in Poland

The Central Statistical Office in Poland publishes extensive data annually on the status of health and safety conditions in forest work.

Data include information about number of employees working in hazardous conditions, as well as threats connected with their working environment (chemical substances, hazardous industrial dusts, noise, vibrations, hot and cold microclimates, influence of electromagnetic field and other) and threats connected with strenuous conditions (caused by physical overburden, workplace lighting and the use of dangerous machinery).

Statistics measure the incidence of occupational diseases by type (hearing loss, infectious and parasitic diseases, pneumoconiosis, and vibration syndrome) and the number of employees injured in accidents at work.

The analysis of occupational accidents also provides information about:

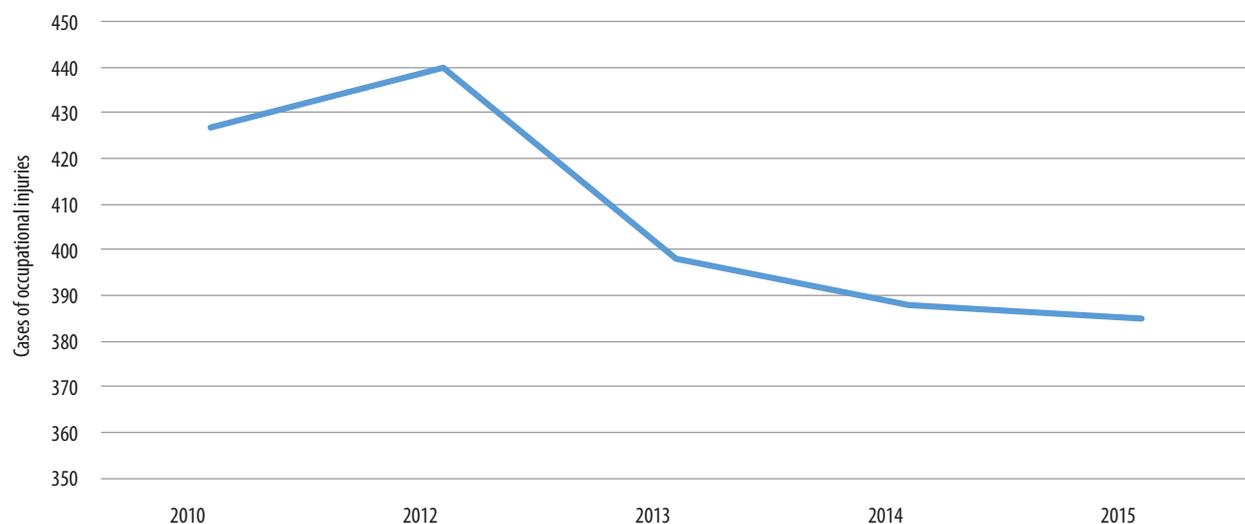
- Causes of accidents at work (by variables such as inappropriate conditions, incorrect technical or ergonomic solution, improper operation of equipment; inappropriate organization of work; inappropriate use of equipment; use of protective equipment; inappropriate wilful employee action; inappropriate mental-physical condition of employee and, incorrect employee action).
- Number of employees injured in accidents by group of age; work seniority in forestry; the number of hours worked till the time of accident; the part of body injured.
- Number of employees injured in accidents by types of events causing accidents (e.g. breaking of equipment, loss of control of a tool or means of transport, slipping or stumbling of a person).

According to the Central Statistical Office, the rate of occupational injuries decreased from 440 cases in 2012 to 385 cases in 2015 (Graph 19). The data show that in 2015 there were 8.4 injuries per 1,000 male workers and 4.0 per 1,000 female workers.

Source: Central Statistical Office, 2017.

GRAPH 19

Cases of occupational injuries in forestry in Poland 2010 - 2015



Source: GUS, 2016.

Box 2.4: Occupational diseases in Switzerland

In Switzerland, all workers must be insured against occupational diseases. The largest professional accident insurance company (SUVA) publishes yearly statistics about health and accidents in the forest sector. On average, in the forestry subsector, 20 cases of occupational diseases happen each year, versus 16 in wood manufacture and 9 in paper manufacture. The general trend was downwards, though 2016 showed a marked peak (Graph 20).

SUVA also publishes statistics about professional injuries. The injury risk is two times higher in the forestry subsector (323 cases annually on average) than in wood manufacture (167 cases), and four times higher than in paper manufacture (78 cases) (Graph 21). The fatality rate caused by injuries was 4 per year in the forestry subsector, against 0.4 in the wood manufacture and 0.1 in paper manufacture.

In forestry, 25 % of injuries occur to the head (eyes, face, skull), about 30 % to the arms (fingers, hands, shoulders) and about 30 % to the legs (knees, ankles, feet).

Source: SUVA, 2016.

2.3.5 Organizational safety culture and workers' behaviour

Section 2.2 described the risks facing forest workers associated with natural conditions and particular tasks and roles. Some of the research ascribes risk in forestry work

mainly to the failure to follow recommended safe working practice and many studies point to a combination of failures, both in personal responsibility and organizational supervision.

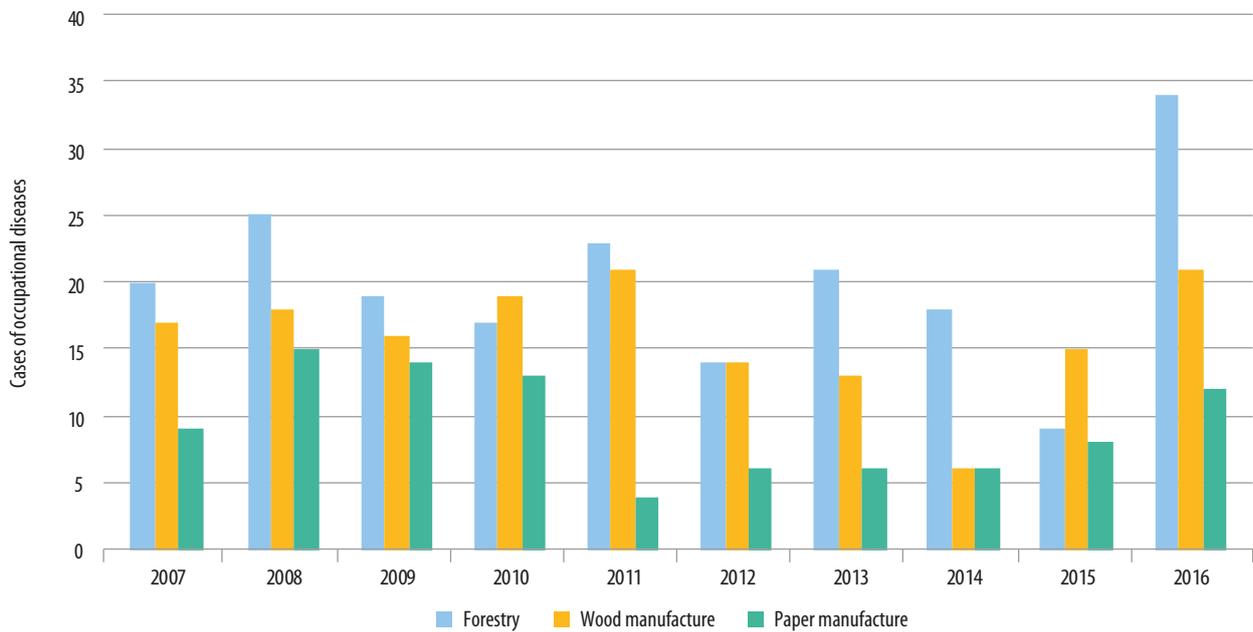
In Turkey, personal factors (32%) and organizational factors (22%) were ranked as the two most important causes of fatal accidents in forest harvesting. Factors included positioning in dangerous zones, carelessness, disorderly behaviour, and unsuitable selection of workers (Melemez, 2015).

In Spain, research on occupational health and safety in forest harvesting and thinning analyzed the use of protective equipment by chainsaw operators and found protective chaps, helmets and visors were hardly used. The researchers attributed this behaviour to poor training, lack of experience of many operators, too much emphasis on productivity at the expense of safety measures, and the lack of supervision (Ambrosio Torrijos et al., 2001). Similar results were found by other studies in Spain (Albizu Urionabarrenetxea et al., 2010). Poor use of protective clothing was also reported in the Czech Republic, where serious injuries to professionals were often exacerbated by late arrival of first aid (Robb and Cocking, 2014).

Safety failures may not be as widespread as these studies indicate. An ILO qualitative study with data from more than 30 countries worldwide, concluded that personal protective equipment, though uncomfortable to wear in hot weather, was generally well accepted by forest workers (Strehlke, 2003).

GRAPH 20

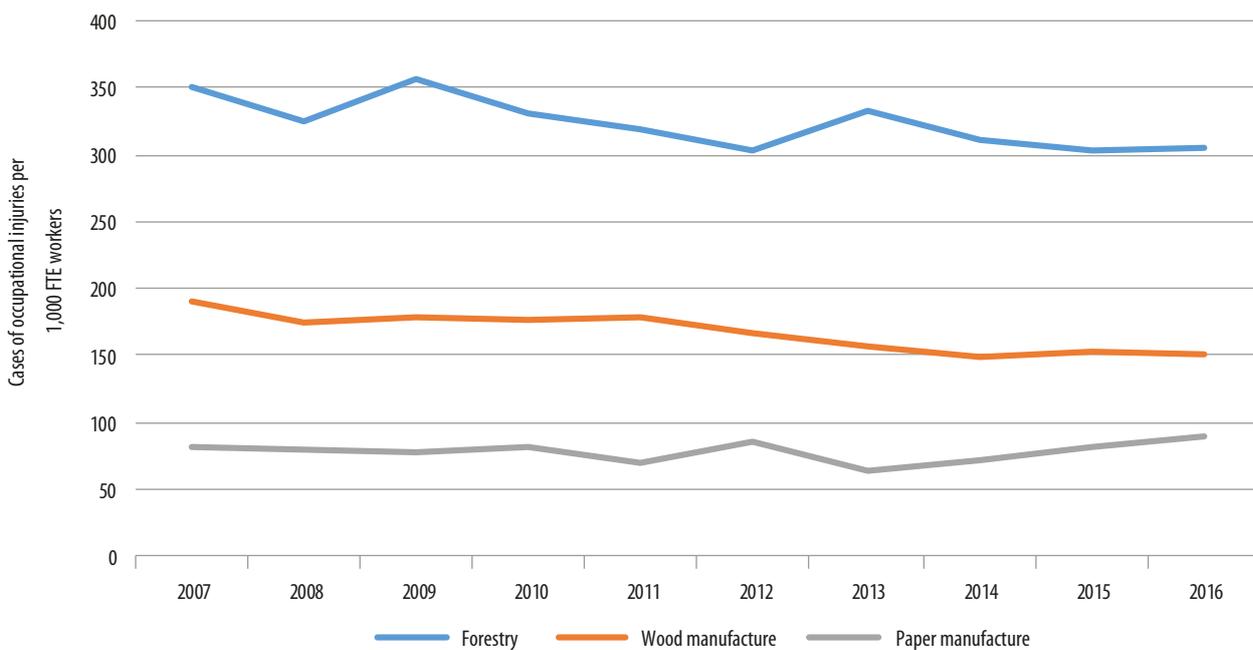
Number of annual cases of occupational diseases in the forest sector in Switzerland 2007 - 2016



Source: SUVA, 2016.

GRAPH 21

Number of annual numbers of occupational injuries per thousand fte in the forest sector in Switzerland 2007 - 2016



Source: SUVA, 2016.

Box 2.5: Workers' behaviour

One meta-analysis on workplace safety, using data from the United States found that there were differences in the factors affecting workers' behaviour, and in the rate of accidents. Workers' behaviour depended most on their knowledge of safety and motivation; whereas accident rates depended most on the "group safety climate" (Christian et al., 2009). In other words, the risks are lower in a work culture which believes accidents can be avoided.

The safety climate, supported by several decades of research, is an important predictor of safe behaviour and safe outcomes to avoid accidents and injury. It is based on the idea that, "safety climate is a collective value derived from shared individual perceptions of the various ways that safety is valued in the workplace" (Griffin and Curcuruto, 2016). Studies suggest that some forestry organizations, both public and private, lack a safety climate. For example, in the state of West Virginia US, staff of the state Division of Forestry indicated that accidents were seen as part of the job and half of the workers had experienced a "near miss" in their work (Helmkamp et al., 2004). Another study in British Columbia, Canada, highlighted the view of logging contractors who, "accepted the risk of physical harm rather than facing almost certain economic loss" (Patterson, 2007). Both examples go completely against promoting a culture of prevention, as is prioritized by the ILO (2003).

2.3.6 Work ergonomics and organization systems

Ergonomics can contribute to work organization and lead to a reduction in accidents. Risk assessment is a key part of this process.

There are three components of risk assessment: 1) identifying potential dangers at the workplace, in the structure of the work or possible external dangers; 2) calculating risk by determining the frequency of accident occurrence and severity of dangers; and 3) determining preventive measures (Melemez, 2015). The routine assessment of risk is a critical component helping regulators and researchers to develop viable prevention strategies to reduce the incidence and severity of logging-related injuries (Bell and Helmkamp, 2003).

Ergonomic studies play an important part in selecting appropriate machinery or equipment and examining work systems (processes and activities) through which employees and machines perform their work.

Another important part of forest work ergonomics and organization systems relates to the necessity of adequate rest breaks. In Turkey, fatigue was the main reason given for accidents by women and seasonal workers, and the second highest (after "lack of attention") for men (Özden et al., 2011).

Lack of sleep or poor-quality sleep impact work performance. A systematic review across various sectors confirmed the correlation between sleep problems and work injuries and, for the first time, quantified its magnitude (Uehli et al., 2014). Another review of the impact of the rest breaks on accident risk in industrial, transport and non-transport settings found that regular rest breaks can be an effective way to address fatigue, maintain performance and manage risks during long shifts. There is evidence that even if workers are allowed to take rest breaks to counter intense fatigue, they sometimes do not take enough breaks or fail to take them when they are needed (Tucker, 2003).

Shift patterns of working are a particular issue for the forest sector. Multiple and extended work shifts are used widely

Box 2.6: Development of safety measures through participatory ergonomics

"Participatory ergonomics" programmes identify and correct factors that negatively impact the physical health of workers by involving them to identify the solutions that are best adapted to their needs. This approach benefits from the workers' active involvement in implementing ergonomic knowledge, procedures and changes with the intention of improving working conditions, safety, productivity, quality, morale and/or comfort.

A multidisciplinary team of researchers (not specific to the forest sector) in New England, US tested two innovations introduced together: (1) integrating traditional workplace health protection (e.g. ergonomics, industrial hygiene) with health promotion (e.g. assisting workers in improving healthy behaviour) and (2) a bottom-up participatory model for engaging employees in innovative design efforts to enhance both components of this integrated programme (Henning et al., 2009).

Safety improved when workers took part in risk assessment, not only because they learned from the results, but because the very process of risk assessment raised their awareness of what they were doing and the risks involved. (Oliveira et al., 2013).

in the forest sector in Canada, the Scandinavian countries and the US, where there may have been heavy capital investment in forest machinery and equipment could become quickly outdated (LeBel et al., 2010). Rotating shifts and long working hours have detrimental effects on worker wellbeing, both physically and psychologically.

A survey amongst entrepreneurs in eastern Canada showed that many different work regimes were used, even within the same company, with 46 work schedules reported (Golsse, 1992 as cited in LeBel et al., 2010). In Quebec, Canada, cutting shift length from 12 hours to 10 hours reduced operator fatigue. Even greater benefits could result from postponing the start of the morning shift and by reviewing the timing and length of breaks during the working day (LeBel et al., 2010).

2.3.7 Safety training

Available research on evaluation of safety training in the forest sector does not present a clear picture. Amongst initiatives which have been evaluated, few report a sustained positive impact. In the US an evaluation of the West Virginia Loggers' Safety Initiative (LSI), found that in most companies which participated, the number of insurance claims did not decline as a result of participation in the initiative and did not differ from those companies that did not participate (Bell and Grushecky, 2006).

By contrast, Italian workers who attended a training programme behaved unsafely less frequently than those who had not. This change in behaviour could be attributed to a change in attitude as much as any change in knowledge (Cavazza and Serpe, 2010). Two other studies indicated the importance of being able to relate to the training material. Loggers trained through the West Virginia Division of Forestry said that they related to the real-life victim stories portrayed in the video (Helmkamp et al., 2004). Italian workers reported that liking the training programme motivated them to adopt safe practice (Cavazza and Serpe, 2010). In New England, USA, most loggers, preferred on-the-job training to formal training programmes (Egan, 2005).

An Oregon State University study tested the feasibility of using helmet cameras to observe work directly in a remote environment. The study found notable differences between individual fellers as well as among fellers with different skills. The helmet camera worked well for observing work behaviour and could be used to assess student loggers and training programmes (Hammond et al., 2011).

In Sweden, a voluntary education programme described as a "chainsaw driver's licence" was initiated in 2004

(SäkerSkog, 2009). This type of collaboration between forestry and government is thought to be one of the most promising intervention measures to improve safety for forest workers. Other Swedish initiatives supported self-employed foresters. "Forest days" targeted on forest owners in the Stockholm area, focused on safe chainsaw use. A 'before and after' test assessed the immediate learning effect. Those who tended to know less, female forest owners and non-chainsaw users, learned the most from these days. The study showed that safety equipment use was limited among absentee forest owners and that "forest days" and other courses were important for the participants' understanding of safety (Haggqvist et al., 2010).

2.3.8 Role of legislation and control measures

Some studies attribute reductions in injury rates to legislation development. For example, a Russian Federation law of 1999 aimed at decreasing the level of occupational injuries led to the formation of the "Regional Coordination Council on Occupational Safety" in the Arkhangelsk region. This development might account for a fall in fatal injuries, though poor occupational safety practice was still common in small- and medium-sized enterprises (Varakina et al, 2010).

The European Forestry and Environmental Skills Council has developed standards for chainsaw use (EFESC, 2017). These include chainsaw maintenance and tree felling under various conditions and are expected to improve safety in forestry and logging.

In the US, companies in West Virginia that had a higher level of safety inspections per year also had lower claim rates (Bell and Grushecky, 2006).

In Sweden, there is lack of monitoring of the self-employed work force, a group that accounts for 7 % of work-related fatalities. A call for an intervention scheme to improve workplace safety has been made (Lindroos and Burstrom, 2010).

According to ILO (2005), "public inspection is one of the fundamental ways of enhancing safety and health and general working conditions in the forestry sector. The technical development of forestry tools, operational procedures and the mechanization of high-risk operations can improve occupational safety and health and productivity. Also, other organizations, such as government agencies and employers' and workers associations can provide useful input to health and safety management."

Studies on this topic are scarce and do not allow broad conclusions to be drawn on the impacts of legislation and control measures on workers' safety trends.

2.4 Health and wellbeing

“State of Europe’s Forests 2011” noted that, “health and safety is more than just prevention of accidents. It is about maintaining the physical and mental wellbeing of people in their workplaces. Non-accidental injuries and work-related diseases can be as debilitating for people’s health as accidents can be” (Forest Europe et al., 2011). These aspects are, however, not covered by Eurostat data nor by most national statistics.

In most countries, labour codes prescribe measures to be taken at the workplace to protect the health of workers and provide basic equipment installations such as rest and meal facilities, organized transport or housing at the worksite, for the use of workers, as a means to ensure their wellbeing during working hours. Forest workers’ wellbeing is usually analyzed together with health issues in regulatory and management frameworks, however psychosocial issues affecting foresters’ perception of their welfare warrant coverage as a separate topic.

2.4.1 Impact of forestry work on health

Most workplace health literature on forestry focuses on the impacts of using forestry tools and machines. Frequently-observed conditions affecting forest workers attributable to forestry operations include:

- Hearing loss, resulting from noise, related to chipping (Poje et al., 2015), or use of chainsaws (Rottensteiner et al., 2012).
- Whole body vibration (WBV) syndrome caused by repetitive hand and arm movements, and distorted body postures. A study of the contributions of crane work elements and potential effects of the use of three grapple and brake-link combinations to vibration exposure levels in a small forwarder in northern Sweden found that exposure to shock-type vibrations while loading appears to be due to driving rather than crane work (Haggstrom et al., 2016).
- Traumatic Vasospastic Disease affecting workers exposed to repeated percussion who develop circulatory disturbances in the hands. The condition is most frequently associated with chainsaw vibration (Gorgues and Guiu, 2010). Synonyms for this condition are dead fingers, white fingers, traumatic vasospastic syndrome, vasospastic disease of the hands and Raynaud’s phenomenon.
- Musculoskeletal symptoms: while some note that vibration-induced disorders have declined as chainsaws have improved, new risks have emerged with mechanization, such as musculoskeletal complaints and

injuries to neck and shoulders among logging-machine operators (Axelsson, 1995). A study of 353 professional loggers in Poland found that the majority suffered from musculoskeletal symptoms, including 66 % who suffered from lower back pain (Grzywinski et al., 2016). Nearly 90 % of seasonal forest workers in Turkey suffered from back pain, and 40 % from numbness in arms and legs (Özden et al., 2011). Other studies note muscle fatigue from long-term operation of mobile machines (Kuruganti et al., 2011).

- Lyme disease is a common disease caused by bacteria transmitted by tick bites in the temperate northern hemisphere. The disease imposes increasing global public health challenges. With an estimated 300,000 cases per year it is the fifth most commonly reported notifiable⁷ disease in the US, against an estimated 200,000 cases in Europe, with a particularly high incidence in the south of Scandinavia and Central and Eastern Europe. Reported cases in Canada have so far been low but the northward spread of tick vectors from the US is already a major issue for public health promotion and protection. This wider spread of tick vectors is predicted to persist and accelerate with climate change (Lou and Wu, 2017). Due to the nature of their work, forest workers have a high occupational exposure to Lyme disease (Piacentino & Schwartz, 2002).

Health risks and impacts affect different socio-economic groups differently. Impacts may be linked to age, lack of experience, and previous health problems (Grzywinski et al., 2016). In the US, migrant workers are often poor, more likely to experience bad health conditions, often uninsured, ineligible to benefits, and unable to afford health services (Frank et al., 2013).

Compared with safety conditions in forestry, there are few studies which analyze forestry health risks, and even fewer which propose methods to address them (Gorgues and Guiu, 2010).

2.4.2 Benefits of a forest work environment

The numbers of studies about “restorative experiences” of visits to forests and other green spaces have been growing (Karmanov and Hamel, 2008; Korpela et al., 2008; Takayama et al., 2014). There is relatively little research about the health benefits of forests as a workplace and what little research has been done suggests that the benefits of a forest workplace are not felt by the workforce. A study of woodland workers in north west England found that woodland work environments involve many ‘counter-restorative factors’ that

⁷ A notifiable disease is any disease that is required by law to be reported to government authorities. The collation of information allows the authorities to monitor the disease and provides early warning of possible outbreaks.

can have a negative impact on health and wellbeing of forest workers, including stress, dangerous and tiring tasks. The study states that older workers have skilful strategies to mitigate some of these adverse effects and gain benefit from the restorative qualities in the woodland environment based on imaginative elements of the work, enabling them to maintain enthusiasm and resilience (Bingley, 2013).

A survey of 1,678 individuals in Switzerland, who occasionally visit forests during their leisure time, raised questions about the benefits of working in a forest environment. The study concluded that those who work in forestry professionally experience less restorative quality of forest visits compared with non-forest professionals, because there is less sense of getting a break from everyday life (Von Lindern et al., 2013).

2.4.3 Wellbeing and happiness

Increasing attention has been paid to the wellbeing or general condition of workers' and their state of contentment at work. Discussions about wellbeing often focus on mental health and on emotional state. The forest sector has some specific related issues, including perceptions of risk, job security, isolation and conflict probability.

Some studies of wellbeing in the forest sector are related to the effects of structural changes in the industry. Some found that restructuring and cutbacks negatively affect employee morale (Brown et al., 2010b). Others found more mixed results. In Finland, restructuring was found to affect employees who continued working in the organization:

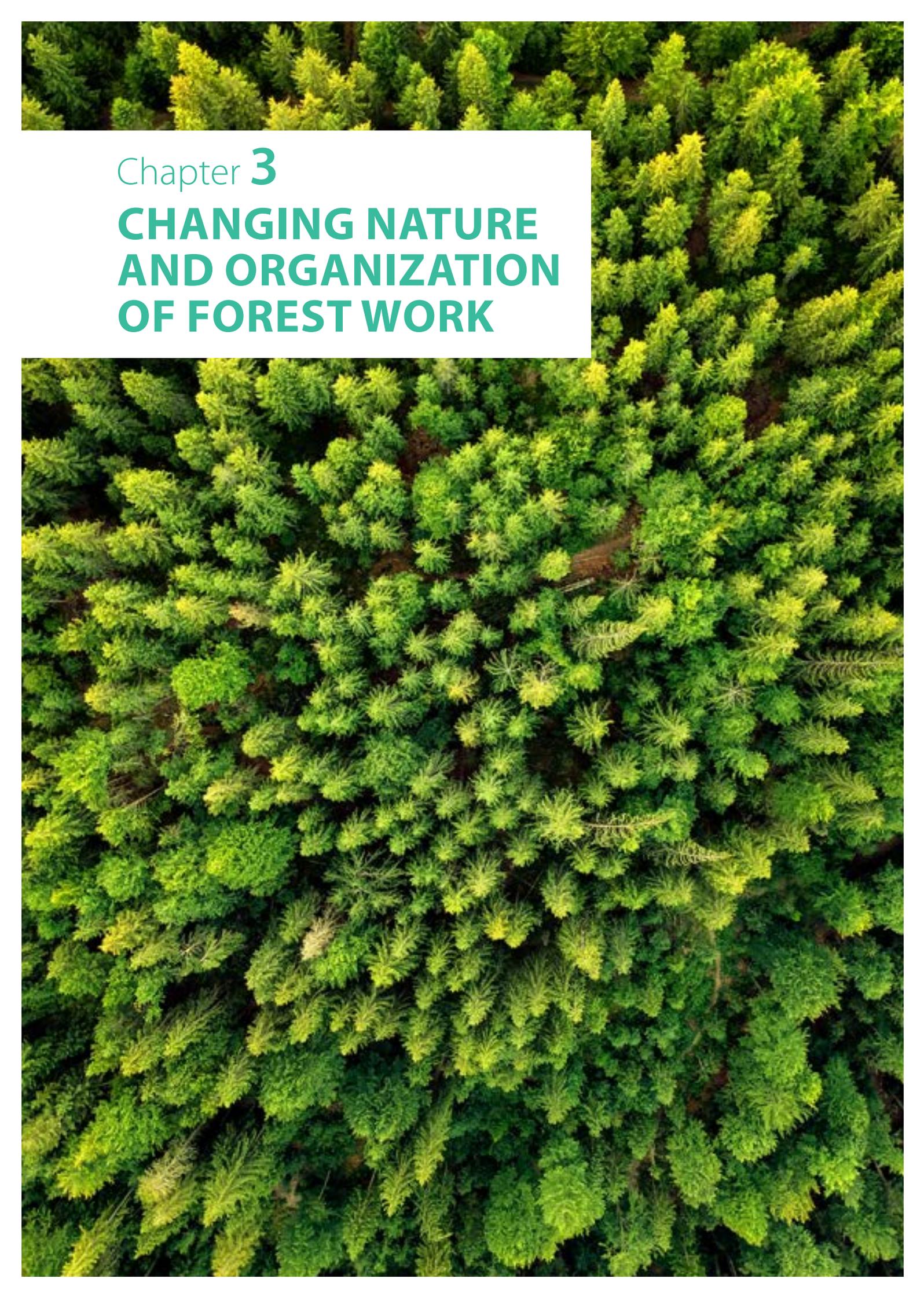
their functional wellbeing (i.e. work capacity) improved but their psychological wellbeing decreased (Pahkin et al., 2013).

Other factors affecting morale include the decline of the sector in general and the change in public perception of the status of forestry professionals, such as that following the transition in the post-socialist countries in Europe (Lawrence, 2009). In Greece, a study of 115 experts and 106 forest workers reflected their low morale: participants believed that government shows a lack of interest in forest sector issues, and lack of support for income, leading to continued decline of the sector (Tsiaras, 2012).

Isolation, due to extended consecutive periods of work in remote areas, may also affect mental health. There has been little research on this issue in forestry.

One extreme measure of workers' wellbeing at work is the suicide rate. Forestry is mentioned in several academic papers on suicide, but data are usually combined with those in agriculture, making it impossible to draw precise conclusions for the forest sector alone. A US study found that workplace suicide rates were highest for men (2.7 per million); workers aged 65-74 years (2.4 per million); those in protective service occupations (5.3 per million); and those in farming, fishing, and forestry (5.1 per million) (Tiesman et al., 2015). A systematic review which covered a range of occupations, including forestry, concluded that the risk of suicide is greater among the lowest skilled occupations than in the highest skill-level group (Milner et al., 2013).



An aerial photograph of a dense forest of evergreen trees, likely spruce or fir, showing a rich green canopy with some yellowish-green highlights. The trees are packed closely together, creating a textured, repetitive pattern of green. The lighting is bright, suggesting a sunny day, and the overall tone is vibrant and natural.

Chapter 3

**CHANGING NATURE
AND ORGANIZATION
OF FOREST WORK**

3.1 Introduction

To stay competitive, all sectors of the economy continuously adapt their activities to the latest global developments, such as those resulting from globalization or technology development. This process impacts the workforce, especially in terms of developing new skills. It also requires the establishment of flexible organizational structures, labour reorganization and adaptability of employment forms.

As well as meeting the challenges of the transforming economy, the forest sector needs to respond to the structural changes facing resource-based sectors, such as globalization of commodity markets, rural depopulation and an ageing workforce. Technological development and evolving priorities in forest management (from timber production to ecosystem management) are also changing the nature of forest work.

Work structures too have been changing. Large companies have merged, downsized, relocated or closed, with substantial impacts on workers and communities. Trade unions do not have the same influence they once did. Forest work, particularly harvesting has been outsourced to a growing number of contractors who have different work, management and communication cultures (UNECE/FAO, 2018).

3.2 Mechanization

Mechanization of forest work, particularly in harvesting and thinning, has profoundly affected not only the economics of forestry but also the quality of forest work

and social relations, including changes in the division of work, and the appreciation and remuneration of labour (MacDonald and Clow, 1999). There is a significant scientific literature on the development and testing of new tools and machines, but there has been less attention given to how mechanization impacts forest work (apart from the health and safety implications for workers).

A literature review has revealed some examples that consider the social consequences of mechanization in the forest sector. One Canadian study showed that successful mechanization of forest work had been accompanied by fragmentation of the workforce and the evolution of more detailed divisions of labour (MacDonald and Clow, 1999).

Other authors highlight a decline in forest jobs as a result of mechanization. A German study tested the assumption that increased wood harvesting would support a growth in forest jobs. In fact, it found the opposite and that, “despite the obvious increase of annually cut timber, a significant decrease in employment was observed, due to mechanization in all four federal states studied” (Hagemann et al., 2009).

Several studies show that mechanization is not well suited to all situations. In some countries, mountainous conditions or small-scale land ownership mean that only low levels of mechanization are possible. For instance, motor-manual working methods (chainsaw felling) are still prevalent in the Italian Alps, despite the growing popularity of mechanical processors (Montorselli et al., 2010). Winching (line-skidding) is also common on steep slopes in small-scale operations (Aalmo et al., 2016).

Box 3.1: Impact of political changes on industry reorganization in Central and Eastern Europe

The political and economic transformation which took place in Central and Eastern Europe after the collapse of the Soviet Union is a specific case of an industrial reorganization which had a significant impact on the forest sector across the region. In many cases, under the supervision of international development agencies, such as the World Bank, existing forest sector structures were profoundly reorganized. Forest ownership, management and administrative roles were separated and some roles transferred to the private sector, while much national forest land was re-privatized or given back to former owners.

Reorganization of the sector in former Soviet republics and former socialist states has been a far-reaching process. For instance, reforms in the Czechia after 1990 included separation of supervision of the state forests from operations and led to the transfer of economic activities to entrepreneurial units or contractors in the forestry industry (Kupčák, 2005). In Romania, joining the European Union and changes in forest ownership resulted in a separation of the regulatory, control and forest management functions. Changes included the setting up of more than 110 private forest districts, privatizing the wood harvesting and processing sectors, supporting foreign investment and establishing large protected areas (Abrudan et al., 2009).

In Ukraine, forest reform slowed after only a few years. No institutional division of policy, control and management took place, and the development of private initiatives in the sector was slow (Nordberg, 2007).

In France, mechanization was identified as the main means of increasing productivity and wood mobilization, in the context of a diminishing workforce. One study that looked ahead to 2020, identified that increasing mechanization would be essential to make up for the continuing loss of chainsaw operators (registered operators had fallen from 11,000 in 2004 to only 7,000 in 2013) (Cacot et al., 2015). Without this it would not be possible to expand, or even maintain harvesting levels.

3.3 Industrial reorganization

Many studies report profound changes in the structure of the forest industry throughout the 1980s and 1990s, continuing into the 2000s. Formerly large secure workforces with lifelong jobs, have either been made redundant, moved to new locations, or reorganized and restructured. This trend has been evident in traditional logging activities in Canada, Finland and the US.

A recent study of blue-collar workers in six factories in the Finnish forest industry that were restructured in a period of extensive transition (2008-2009), found that, “negative change appraisal increased the risk of experiencing more stress and less work enjoyment” (Pahkin et al., 2014). An earlier study from Finland, concluded that, during reorganization, it is strategically more desirable to retrain existing and ageing workers to improve their employability, rather than continue to support existing jobs (Daveri and Maliranta, 2007).

A Canadian study highlighted the consequences of job instability for forest-dependent communities. Companies sought flexibility on their terms, which would have led to loss of jobs in the local community, reduced support for community organizations, fewer part-time and summer jobs for university students, and reduced municipal taxes. Communities responded by reducing regulation and taxation and offering land to make themselves attractive places for investment. Competing in this way only resulted in economic loss to the community. Furthermore, skilled workers were the first to leave and the hardest to attract back when timber prices recovered (Martin, 2014).

Another Canadian study found that even long-term employees were exposed to sustained job insecurity, cyclical unemployment, adverse physical work conditions and related psychosocial issues (Ostry et al., 2001).

These examples disclosed that changes in industrial organization are not only about the economy, but also affect the social wellbeing of workers.

3.4 Multi-functional and multi-stakeholder forest management

A separate trend affecting forest sector industrial organization has been the shift to multi-functional forest management. Objectives of forest management have responded to changing political and social expectations since the 1990s. Forestry has evolved from focusing primarily on natural resources to embrace a much wider range of forest functions (ecosystem services). This has been reflected in multiple shifts of management approach, through multi-purpose management, adaptive management and, more recently, a wider focus on the green economy and bioeconomy (Kennedy and Koch, 2004; Marald and Westholm, 2016; Lawrence, 2016a; Winkel, 2017).

This shift requires new skills in the forest sector, particularly within public forest management (Pugliese et al., 2015; Cheng and Mattor, 2006). For example, the US provides extension services to advise small landowners on managing forests. The increased population in forested areas, combined with an increasing focus on urban forests, mean that the Extension Service is working with non-traditional landowners, including ethnic minorities and citizens with limited resources. If the Extension Service is to reach these “non-traditional and under-served” clientele groups, it will need to employ more people from minority groups (Hubbard and Jackson, 2008). The successful forest manager of the future must be able to work effectively with people, including those who use national forests, adjacent landowners, non-traditional landowners, and people of differing ethnicities (Turner, 2008).

The increasing competition between the different users of the forest with their differing expectations will impact forest governance and existing models for land use (Eckerberg and Sandström, 2013; Leys and Vanclay, 2010). The development of more inclusive and participatory forest management approaches, addressing concerns of various stakeholders, can be challenging for forest managers and workers, who often may not have received specific training in such skills and techniques.

Foresters can find themselves working in situations characterized by conflict (Rossiter, 2004; Mylek and Schirmer, 2015). This can have a negative impact on their work motivation and wellbeing (Loxton et al., 2012). Drawing on examples from the Netherlands, the UK and the US, researchers highlighted the need to acknowledge the role of emotions and conflict management skills in forest work, in contrast to the conventional tendency for forest professionals to seek ‘rationalized’ solutions in every aspect of their work (Buijs and Lawrence, 2013).

For public sector forestry, the pressures can be especially acute. For instance, researchers describe the case of the US Forest Service (USFS) as, “the agency in transition from a timber-dominated organization to an agency struggling to cope with its post-timber reality” (Brown et al., 2010b). This is not just about a move to multiple objectives management, but also to balancing public, political and expert input into decision-making, because community and stakeholder engagement is increasingly required from forest agencies and private companies.

As forestry has moved to be more focused on stakeholder engagement and ecosystem services, it has increasingly incorporated the role of trees in urban and rural development (Kennedy et al., 2001; Sarvašová et al., 2010; Slee, 2006; Elands and Wiersum, 2003; Wiersum and Elands, 2002). These changes demand new skills of foresters. There is little research into the effect of these changing demands. Work focuses on the challenges for foresters, not on the effect of training in new skills. For example, in the UK, research challenged the prevailing state forestry culture, and called for it to be more sensitive to community involvement (Kitchen et al., 2002; Milbourne et al., 2008).

Foresters in the UK also face challenges presented by new structures and politics, reduced budgets and staff, and several high impact tree health disasters (Lawrence, 2016). Important parts of the adaptive process lie with practice and innovation in the forest, rather than hierarchical, science-led approaches. There is a need to support these developments taking place in the forest, as they can be blocked by top-down decision-making structures.

Changes in the forest management objectives are reflected in the mainstreaming of forest certification, particularly in temperate forest regions. Forest certification places additional demands on the forest sector about maintaining forest ecosystem biodiversity, productivity, regeneration capacity, vitality and the potential of forests to serve ecological, economic and social functions (Keskitalo and Liljenfeldt, 2014).

Finally, it is important to note that forest ecosystem management approaches, combined with increasing uncertainty related to climate change and policy, require a shift towards more adaptive and resilient forestry. These add to the demands made on forest agencies, staff, contractors and processors to be flexible and innovative – skills and approaches that will become more important (Keenan, 2015). Yet, the context in which the organizations function seems to exacerbate the challenge.

3.5 Labour organization

In general, the organization of labour is closely connected with industry organization. Structural changes that have taken place in forest sector industries in recent decades have implied changes in the forest sector workforce.

Historical descriptions of the forest sector highlight times of strong corporate loyalty and lifetime job continuity. For example, a case study covering Canada and the US found that respondents who had worked for vertically-integrated firms in the 1950s - 1970s often entered as a logger, hoping eventually to move on to work in a sawmill, pulp or paper mill. These accounts help in understanding the impact of changes in the 1980s and 1990s, when the dominant system of employment relations changed dramatically, with numerous job losses and corporate sell-offs. Former workers felt that these changes undermined the trust that had previously existed between workers, managers, executives, owners and unions (Sweeney, 2010).

Corporations and their structures had a dominant influence on timber harvest economies in the mid- to late-20th century, but unions played a role as well (Hayter, 2000). Today the role of trade unions has become weaker as the number of workers in the sector has diminished and forest workers have become a marginal group among unionized workers in many UNECE countries.

A rich seam of research focuses specifically on the history and development of trade unions, showing implications for the sustainability of forest jobs. In the past, when industries were profitable, workers were able to ‘extract a modest living for themselves’ but often struggled to gain a fair share of the wealth they produced (Robbins, 2008). Trade unions played a key role in raising the status of forest workers.

In Canada and the US, forest labour unions had long been powerful and had a mixed influence in terms of the ‘greenness’ of their jobs. From 1937 to 1948, the International Woodworkers of America challenged the timber industry’s forestry practices, attempting to reshape the Pacific Northwest’s timber industry to work for the sustainability of logging communities and the forests, instead of corporate profits. Their activities demonstrate a long history of unions pressing for the environmental agenda of their members (Loomis, 2015).

In the 1970s, Canadian unions and industry worked together to block policy change and forest sector reform by promoting a focused message that moving towards more sustainable forest management would mean loss of employment and government revenue (Rayner et al., 2001). The unions were seen as sharing the vested interests of the corporations that owned the forest harvesting rights, and therefore being part of the large-company bureaucracy (Marchak, 2011). The province of British Columbia’s largest woodworkers’ union led strong protests against environmentalists (Prudham, 2007). The involvement of unions with nature conservation NGOs in Canada in developing environmental agreements was celebrated by some workers but criticized by others, for instance for bypassing First Nation (indigenous) groups (Kittmer, 2013).

Prudham (2007) pointed how environmental and labour politics were rarely addressed in relation to each other, but that this schism needed to be addressed, to be able to better understand the dynamics between the two in British Columbia's recent forest sector history.

The examples above represent the prevailing story of forest labour unions, for instance in large-scale corporations in Finland, Canada and the US. Elsewhere, more diverse and context-specific conditions exist, only a few of which feature in academic research.

In Turkey, for example, members of the forestry workers' trade union consist largely of forest villagers, including forest cooperatives (Özden et al., 2011). More than 70 % of forestry work in Turkey is undertaken by forestry cooperatives and partners. Cooperatives play an important role in education and training (Örnek, 2017).

According to a study of mill closure in Kemijärvi, Finland, moving from unionized labour towards contractors reflects a wider trend of governance strategies, including privatization, change of governance from a state-led to a market-based structure, outsourcing, and seeking a more responsible corporate image (Sarkki and Rönkä, 2012). New collective agreements have linked employee pay to mill performance. These trends as well as the computerization of the production process have come

at the expense of high-paying union jobs (Martin, 2014). As the number of contractor businesses has grown, contractor associations and other organizations representing their interests have emerged.

For instance, in the US, harvesting non-wood forest products such as foliage is often done by poor, low-skilled workers from ethnic minorities. Many lack legal work documents and occupy a highly insecure position in the labour market. Instead of unions, they have been helped by smaller buyer companies who have worked with social justice organizations to pressure the Washington State Department of Labour to enforce regulations on employer-contractor relations (Lynch and McLain, 2003).

Closure of mills and the need for workers to commute has also had an impact on labour organization. It created a shift from traditional logging camps (Strehlke, 2003). An example from British Columbia, Canada, described the ups and downs of an operation which closed in 2008, only to re-open in 2011. Many forestry workers had to commute long distances to retain their jobs. The benefits of the new arrangements included financial support, employment benefits, education and training, and work experience in other sectors, but these were offset by disadvantages such as logistics, financial

Box 3.2: Historical role of unions in Canada and the US

A case study of Cascadia, Pacific North West, US and British Columbia, Canada, highlighted differences between the two countries in corporate-labour relations in the late 1990s, (Hayter, 2000). Nearly half of the Pacific Northwest's solid wood processing workforce was unionized at the time and worked for large or medium-sized well-established companies. Unions helped to create stability in employment relations and to ensure good pay and secure jobs. However, some medium-sized firms generated competitive pressure by undertaking cost-saving at the expense of their workers (Sweeney, 2010).

In British Columbia, wages and working conditions in unionized and non-union mills were similar. The competition between mills for labour together with the likelihood that non-unionized workers would organize and receive union certification if working conditions and wages were threatened, underpinned this situation. Consequently, even in non-union mills, workers were well supported by the employers (Sweeney, 2010).

A 1990s study analyzed attempts to unionize tree planters in Canada and found that unions and grassroots organizations had different approaches to sustainability (Ekers and Sweeney, 2010). While the industrial union was concerned primarily with employment relations and material gain, the grassroots body saw that the organization of labour was intimately tied in with the ecology of the forested landscape, and that the security of future work for tree planters depended on a commitment to reforestation and sustainable forest management. The union succeeded in unionizing workers in Ontario but failed in British Columbia because of its hostility to the environmental movement. The grassroots body failed in unionizing workers because of the remoteness of the planting camps and successful attempts by some contractors to prevent access.

Since the study, the introduction of the internet and Wi-Fi, giving access to social media have radically changed the social access of tree planters. The authors see potential for renewed participation in the labour movement through on-line communication between seasonal and geographically-dispersed workers. They concluded that future attempts to organize tree planters may succeed if they have financial and institutional support.

impacts, and safety (Ryser et al., 2016). The authors of the study recommended flexible shift schedules, improved communication, conflict resolution, and problem-solving skills for workers, fatigue management training, and better connection with support networks. Overall, the study suggested that addressing labour organization change needed to be based on good employer/employee relations, with employers working to resolve issues with their workers.

3.6 Contractors and enterprises

The biggest shift in forestry employment structure has been from public to private sector, and from large multi-purpose organizations to a multiplicity of contractors. Since the 1970s, this change has been characterized by outsourcing forest work in Europe, Canada and the US, leading to the emergence of contractor companies, especially in logging operations (Blombäck et al., 2003). To an extent, this reflects changing ownership patterns, such as in forests of the eastern US, where ownership has become fragmented into smaller parcels. This has been accompanied by an increase in small-scale contractor companies, characterized by few workers and low capital investment, who can harvest timber economically and carry out silvicultural operations (Moss and Hedderick, 2012).

To save costs and gain flexibility, several companies released workers from direct employment and took them on as contractors. This move frequently resulted in poorer working conditions, such as excessive working hours alternating with slack periods when not enough work was available, or insufficient insurance against accidents, sickness and invalidity (Strehlke, 2003). Employers in both the Pacific Northwest, and British Columbia have outsourced most logging operations to reduce risk and uncertainty (Sweeney, 2010). The contractor companies often found it difficult to pay back loans taken out to invest in machinery, especially during periods of low demand, ending up in a cycle of debt. This led to companies submitting low bids to secure contracts and maintain cash flow. In turn, this reduced workers' earnings, making it difficult to recruit and keep experienced and competent workers (Sweeney, 2010).

Since 2000, employment in the public forest sector across Europe has declined by approximately 60 % whilst employment in the private forest sector has almost tripled (Robb and Cocking, 2014). "The State of Europe's Forests 2015" describes forestry and wood manufacturing as, "micro-enterprise environments where at least 1 in 5 workers is self-employed or an entrepreneur" (Forest Europe, 2015).

The words 'contractors' and 'entrepreneurs' both generally refer to small to medium businesses. Some official reports treat the two as equivalent (Forest Europe, 2015). Others highlight a need for more entrepreneurial skills, implicitly linking entrepreneurs and innovation (United Nations, 2015; Rametsteiner and Weiss, 2006a). Still others suggest that entrepreneurship is linked to profit maximisation and the rapacious use of resources (Schelhas, 2002).

These changes in labour organization have made contractor companies an important stakeholder group in the future of the forest workforce. Their structures and way of operating have had a significant impact on the forest workforce and the conditions of their work. For instance, in Germany, forestry contractors collectively own about two-thirds of harvesting capacity. There are about 2,700 companies with 9,000 employees and nearly half are family businesses, often combining agriculture with forestry.

In Norway, in 2014 there were about 250 forest contractors, mostly family enterprises, averaging 2 - 5 employees. These firms are characterized by great practical and technical skills, but less so on administrative and financial competence. This has been a challenge, since such knowledge would improve their negotiation position with large business partners. In Sweden, the majority of silvicultural activities in large-scale forestry have gradually been outsourced to small contractor firms, resulting in a corresponding increase of contractor firms during the last 15 to 20 years (Skagestad, 2014).

Contractors can be highly mobile and respond to differences in contract rates between countries, especially where that difference is related to market factors rather than technical aspects of extraction. This makes cross-border activities a good business for loggers based where labour cost is lowest (Spinelli et al., 2015b). In Italy, temporary work, supplied by temporary-help agencies, became popular owing to its flexibility and cost effectiveness (Fabiano et al., 2008).



Box 3.3: Contractor work characteristics in the US

A 2005 survey of the logging contractors' sector in Idaho, Montana, and Washington concluded that, other than timber sales, the constraint that most adversely affected their business in 2004 was the quality of employees (Allen et al., 2008).

In Ohio, a study of the logging industry identified three clusters of contractors: local mill suppliers, product merchandizers, and volume-dependent producers. The clusters differed in terms of haul distance and equipment, highlighting the diverse contexts in which contractors, entrepreneurs and private sector employees work (McConnell, 2013).

In Virginia, where the forest products industry was described as 'a vital component' of the economy, a survey of logging businesses found that contracting companies operated with an average of 1.2 crews and 3.3 workers per crew. Size and type of harvesting system varied between regions (mountains, piedmont, coastal) as did the products harvested, production levels, use of technology, and time spent planning harvests and implementing best management practices (Bolding et al., 2010).

Another study from West Virginia, found that independent loggers averaged 47.8 years old with 17.8 years of experience, and the business size varied between 1 and 80 employees, averaging 8 (Milauskas and Wang, 2006).

A study in Georgia, drawing on surveys conducted every five years (1987-2007), indicated that average weekly production of logging contractor firms increased by 83 % between 1987 and 2007. During that period, moderate investment in mechanization and crews was accompanied by declining marginal returns on investment but an increase of 50 % in production per man hour. Implementing best management practice increased steadily to over 95 % and lost-time due to accidents fell by 90 %. The key problems listed by respondents were financial concerns, ageing firm owners, and finding suitable employees (Baker and Greene, 2008).

Another study of 19 logging contractor companies and 140 of their employees in Georgia, analyzed the workers' education and training and found that fewer than half had finished secondary school and almost none had received formal training in how to perform their job. They were satisfied with logging as a line of work and with their wages but felt the lack of health insurance and pensions (Greene et al., 1998).

In southern New England, logging business owners cited several challenges to maintaining or expanding their businesses, including: costs, reduced availability of forest to harvest, harvest regulations, as well as a general perception that the public did not understand and respect their work (Egan, 2011).

Two other projects in Norway and Sweden, analyzed training needs of contractors and highlighted the importance of communication skills. Approximately 90 % of all forest work in Sweden is done by contractors. A survey of perceived development needs for strengthening logging contractor firms identified the need for improved leadership and managerial skills, better business finance skills and improved practical workmanship of employees. The contractors also identified untimely and unclear communication from their clients as a common obstacle to improving precision and efficiency of their operations (Sääf et al., 2014a). As a country with similarly high cost levels, experience from Norway confirms these gaps and experiences. Well-organized and effective communication, documentation and quality assurance are required to succeed, and dialogue and cooperation between entrepreneurs, their customers, research and education institutions and industry in general are

important to be prepared to meet future demands and challenges (Skagestad, 2014).

There is little literature available on contractors, but several general characteristics of contractor companies can be identified. They tend to be small, are increasing in number, and lack management skills. Forest contractor associations may be improving matters, but little research is available. In more than 20 European countries, forestry contractor associations provide a platform for a better bargaining position with larger forestry companies and/or forest owners and for influencing forest policy making (Blombäck et al., 2003).

A review of factors contributing to innovation and entrepreneurial skills of contractors is beyond the scope of this study, but the characteristics of the contractor sector suggest a need to give attention to such skills. Further reviews are available (Buttoud et al., 2011; Rametsteiner and Weiss, 2006b).

Box 3.4: Example of an association representing contractors in front of the European Union

The European Confederation of Agricultural, Rural and Forestry Contractors (CEETTAR), established in 1961, represents about 150,000 companies and nearly 600,000 workers. It aims to represent the interests of land-based contractors in Europe. In 2014, the European Network of Forestry Entrepreneurs decided to merge with CEETTAR, resulting in a stronger organization representing land-based contractors at EU level.

CEETTAR aims to benefit forestry contractors by:

- Representing the national federations and defending their professional interests with the institutions of the EU. This way, CEETTAR is recognized as the representative organization for forestry contractors with European Institutions,
- Representing national federations and defending their professional interests towards other private organizations, which are active at European Union level and beyond
- Helping organizations in the new member states to fulfil their national objectives as rapidly as possible.

CEETTAR takes positions in the process of shaping EU legal and strategic documents. For instance, it pleaded to add a workforce dimension to the European Forest Strategy. CEETTAR proposed to consider three priorities with the aim of improving forest sector sustainability in the European Union member states:

- Improve databases on forestry actors to identify windows of opportunities for the sector.
- Set goals and targets to attract new skilled workers to forestry (which includes extending Common Agricultural Policy provisions for rural business start-ups to forestry contractors).
- Provide financial support to improve the image of the sector.

Source: J. Roche, CEETTAR, personal communication, 2018.

3.7 The informal economy

The informal economy plays an important role in the total labour supply available for formal employment but is not so visible (Economist Intelligence Unit, 2015). When the formal market fails to satisfy the demand for jobs and unemployment rises, the informal economy can become

the best available option for people who experience barriers to entering the labour market (e.g. lack of qualifications, education or legal status) (ILO, 2014; ILO, 2002b). The informal economy includes, “all economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements”, but it does not cover illegal activities (ILO, 2015).

Box 3.5: Case study: seasonal forestry workers in Turkey

In Cankiri municipality in northern Turkey, 102 workers were included in a study analyzing the work conditions of seasonal forest workers.

Seasonal forestry workers accounted for 76 % of those who responded to the survey. Among these 80 % were not educated beyond primary school, 57 % were married and 35.3% were families of seven or more members. Whole families migrated for the seasonal work.

Almost all workers had to wait for their pay with 91 % stating that they were to be paid at the end of the work. There were 81 who said that they did not receive their payments regularly and 85 indicated that income was inadequate and 24 % did not have social security or health insurance. More than half did not like the job and had no pride in their jobs but felt they had no choice.

During the work season, 77 % of respondents lived in tents in camping areas, which lacked adequate toilets, bathrooms, the provision of drinking and utility water and 84 % did not have access to sanitary facilities. Most workers had multiple health problems, back pain and numbness in limbs. Those working in charcoal production suffered from bronchitis due to high levels of dust and toxic gases.

Source: Özden et al. (2011).

In the forest sector, most informal workers are not enrolled in unemployment, injury or old-age insurance schemes. They find it difficult to access proper medical services, especially in remote locations. Informality and the remoteness of worksites make labour inspections more difficult (ILO, 2011). The situation of migrant workers gives cause for concern. They are generally more vulnerable, less protected and more exposed to exploitation and dangerous working conditions than locally-based workers (Blombäck and Poschen, 2003).

In Turkey, for example, a large proportion of the workforce is seasonal unorganized labour (Melemez, 2015). Workers who lack sufficient farmland for subsistence migrate seasonally with their families to forest areas and often

endure difficult work and life conditions. (Özden et al., 2011).

Informal work is often characterized by poor working conditions, low pay, lack of job security, health and safety protection (Ackerknecht, 2010). In some parts of the US, where plantation forestry predominates, migrant labour is significant and may not have the protection of employment law. Agriculture, forestry and fisheries are among the most hazardous industry sectors in the US, yet worker legal protection in these sectors is limited (Liebman et al., 2013). Both regulation and enforcement were weak, and the vulnerability of the workforce was exacerbated by the fact that they were immigrants. (Box 3.6).

Box 3.6: Migrant forest labour in the US

At the beginning of 2000s, in the southern US, government incentives and investment initiated a transformation of land use from exhausted agricultural fields to forests and pine plantations. At that time, these plantations produced one-third of all timber in the US and 77 % of the pulpwood (Casanova and McDaniel, 2005).

Every winter, thousands of workers from Mexico and Central America were employed on temporary visas for planting and herbicide spraying. They travelled around the region and were accommodated in trailers and hotels. The lack of interest among US residents in this same work, despite high rates of unemployment, was attributed to a decline in employment based on unionized labour, and assembly-line, mass production work, and the seasonal, low-paid and dangerous nature of the planting work (Casanova and McDaniel (2005). This shift has been accompanied by the rise of numbers of contractors, and the decline of work and wages for former forest managers.

Mexican migrants earned 10 times what they would earn at home and Guatemalans and Hondurans, up to 25 times. Workers stated that the work was hard but worth it and showed pride in their planting rates. The reliance on migrant labour succeeded because they valued the money more than their status; and because, according to contractors, local resident labourers found the work unattractive. However, the consequences of that situation also included risks, such as exploitation of migrant workers and undercutting of wages and work opportunities for local populations.

A second study built on these results, through comparisons of migrant workers with forest workers in the Pacific Northwest, using United States Department of Labour data and qualitative fieldwork in Alabama and Oregon (Sarathy and Casanova, 2008). While the new, privately-owned forest plantations in Alabama were largely worked by seasonal legal migrant labour, the study found that numerous workers on federal lands in Oregon were undocumented. The legal status did not affect the working conditions and, whether undocumented immigrants or guest workers, both groups experienced isolation, fear of job insecurity, and lack awareness of their basic rights. The legal guest workers who lacked access to social networks in the United States faced more problems of isolation and insecurity. Social networks were stronger among the undocumented migrants in Oregon, but workers were vulnerable to exploitation because of the fear of deportation.

Sources: Liebman et al. (2013); Casanova and McDaniel (2005); Sarathy and Casanova (2008).

Tree planters form another group of workers in insecure employment. This group has been well studied in Ontario, Canada, where they have been marginalized and stigmatized since the mid-1940s (Sweeney, 2009). At one level, tree planters belong to an extensive network of practice and

have a shared sense of identity, but at a more detailed level, it depends on which contractor employs them. The most important factor accounting for these differences relates to the role of worker turnover and retention (Sweeney and Holmes, 2008).

Box 3.7: Non-local tree planters in Ontario, Canada

In the tight labour markets of the 1960s, governments sought to provide employment for the less represented workers, including women, students and First Nation people. Both industry and state continued to prioritize harvesting and processing over reforestation, with the result that tree planting used quasi-legal labour, adding to the stigma of tree planters. Gradually, the responsibility for reforestation shifted to the logging companies, who hired private contractors for reasons of time and cost-efficiency.

Residents were unwilling to take on tree planting work, because of its negative image. Contractor companies recruited students who were willing to work long hours and competitively, and to tolerate living in bush camps. Contractors, foresters, and student tree planters all supported payment by piece rates, which increased wages and raised production rates. Labour unions, which opposed piece rates and supported local employment, became side-lined. Further recessions in the 1990s led to resources being concentrated in a few large contractor companies, to more reliance on student labour, and increasing female labour until these two accounted for almost half the labour force. This was due in part to employers' efforts to attract women to make the camps more attractive workplaces. After 2001, tree planting again declined in Ontario and workers moved west.

Despite the negative image, tree planters differ from the migrant workers described in more exploitative situations. They rely heavily on their own experience and acquired knowledge, are willingly remunerated on an incentive basis, and their interests are often more closely aligned with management and clients than with other forestry workers.

The author of the study concluded that, "a stable and docile labour force willing to sacrifice freedom in exchange for relatively high remuneration is required. (...) in an uncertain future, contractors in the reforestation sector may turn to guest workers to resolve the problem of labour recruitment" (Sweeney, 2009).

Source: Sweeney (2009).

The seven cases above all support the need to raise awareness among forest stakeholders of the importance of decent working conditions for all workers for the future productivity and sustainability of the sector. Vulnerable groups, such as migrants, ethnic minorities, older people, women, to whom the informal economy is central to their

economic subsistence should be informed about their rights.

Improving working conditions, guaranteeing access to social protection for formal and informal forest workers, adopting safe working practices, and providing secure and stable contracts all have the potential to increase forest sector productivity.



Chapter 4

**GREEN JOBS –
TOWARDS AN
ATTRACTIVE AND
ADAPTIVE FOREST
SECTOR**



4.1 Introduction

Attracting young people to the sector is a recognized challenge to maintain the sustainability of the forest workforce. An important means of achieving this is communication directed at improving the sector's public image (Arndt, 2015).

Forest work offers considerable potential for employment. The workforce is highly diverse, ranging from the organized industrial workforces of the mid-20th century through disorganised, insecure and sometimes exploited seasonal and migrant labourers, to self-employed forest owners and entrepreneurs.

Many people view forest work as unattractive. In some areas, vacancies are likely to be filled mainly by migrant and informal workers. Regional study papers point to low wages as another factor that makes forest work unappealing (B. Glavonjić, Belgrade State University, personal communication, 2016; O. Kiyko, Ukrainian National Forestry University, personal communication, 2016). In countries in transition from planned to market economies, a sharp rise in fraud has tarnished the image of forestry as a profession. Some detailed social studies have found links between foresters and organized crime (Bouriaud and Marzano, 2014; Wallace and Latcheva, 2006; Vandergert and Newell, 2003; Eikeland et al., 2004). The traditional status of forester as an expert and government official has been challenged by political change in post-socialist Europe and the Russian Federation (Lawrence, 2009; Eikeland et al., 2004).

The evidence in this study and literature in general show the types of challenges that workers face. There are positive developments, but these do not feature strongly in the research, which has tended to focus on the issues that create challenges and require attention and are more likely to attract funding. There is less chance of securing funding for a major study into 'reasons why forest workers love their work'. It is necessary to keep this in mind and to avoid jumping too easily to the conclusion that forest work is all about danger, isolation, low status, poor pay and sore backs.

Contractors, self-employed people and migrant workers alike express more contentment where there is strong social capital in the form of networks or associations. A strong safety culture and employers who care about the workforce all contribute to workers being able to take pride in their work.

Some studies report that workers who are able to find meaning in their work display a positive attitude to forest work. In the UK, for example, traditional woodland workers tell stories that are constructed around a sense of 'mastery' and pride in their local woodlands as well as a newer generation who 'tend toward greater idealism', and the chance to get away from office-based work (Bingley, 2013).

Based on workers' own stories, Strehlke (2003) conveys a sense of contentment and pride in forest work, across many jobs and cultures. Most logging business owners in the state of New York, cited positive aspects of their work as reasons for becoming loggers, although they sensed both a lack of occupational prestige associated with logging and a lack of understanding among the general public of the logging profession and its contribution to the economy (Egan, 2009; Egan, 2011).

The forest sector has struggled to attract students with an interest in the fields in forestry that require high qualifications such as machine operators, forest management and business management. Data from the few countries where studies have been published, show that student numbers in forestry have been falling. In Eastern Europe and the Balkans, measures to address this have been based on innovative course design, including work placements with guaranteed jobs on graduation.

Elsewhere, courses with a strong environmental/wider natural resource element and that include a focus on approaches to public engagement, have attracted growing numbers of students. Given that forestry professionals also need these skills, placing an emphasis on these topics in forestry courses might help to attract more students.

The UNECE/FAO workshop, "Green Forest Jobs: Exploring Opportunities and Increasing the Capacity of UNECE member States," held in Geneva, Switzerland in September 2018 concluded that management of forest ecosystem services is a founding pillar to create new jobs in the forest sector. Until recently, forest jobs were mostly associated with traditional silvicultural and timber harvesting operations. Looking ahead, managing forest to enhance the provision of ecosystem services is likely to result in new job opportunities.

The recent UNECE/FAO publication, "Green Jobs in the Forest Sector", which builds on the work of the UNECE/FAO Team of Specialists on Green Jobs in the Forest Sector includes many examples of these forest jobs, along with emerging tasks and functions that could lead to new employment opportunities (UNECE/FAO, 2018).

4.2 Major transformation drivers for green job creation in the forest sector

(Source: UNECE/FAO, 2019)

The green jobs development has been initiated and supported by several major transformation drivers, including social, environmental, and economic conditions. Globalization, digitalization, changing requirements of

society, and changing labour markets influence the forest sector (FAO, 2017). The forest sector is highly vulnerable to risks associated with environmental degradation as currently as many as 16.7 million jobs in forestry worldwide are dependent upon the provision of ecosystem services (ILO, 2018a). With rising concern about climate change, there is an urgency to develop environmental skills and diversify sectors of the economy, including the forest sector, that offer potential solutions to reduce and mitigate atmospheric pollution and other environmental risks (Forest Europe, 2017; Prins, 2016).

There are several characteristics of the forest sector that support effective employment generation, including low capital requirements, a multiplier effect between direct and indirect jobs, and job diversity and flexibility that ranges from tasks that require high levels of technology to labour-dependent occupations (Nair & Rutt, 2009). There are important opportunities for green forest jobs to create economic development and employment that address social concerns and objectives for greater equality. Many 'quality of life' considerations can be addressed through employment in the forestry subsector, including improvements to food security and nutrition, non-timber benefits, human health, and recreation (Estruch & Rapone, 2013; Herkendell, 2016). The global distribution of forests offers the potential to create green jobs in many regions, both urban and rural.

Green jobs are key to supporting the sustainable economic development that is essential for a green economy, in which the responsible use of natural resources helps to prevent or minimize environmental degradation.

Forestry especially is well positioned to provide economic benefits in rural areas with many small- or medium-sized companies, family-owned businesses, and connections to the local community (Confor, 2012). Forest sector green jobs support local, community-based needs as well as broader international or global objectives, including the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs).

Achieving the Paris Agreement goal of limiting the global temperature rise to 1.5°C will require the development of carbon sinks through reforestation, potentially creating employment and growth opportunities for the forestry sector (ILO, 2018a). Many countries provide examples of using investments in forestry as a key component of economic development, such as Canada, Chile, China, India, and the US (Nair & Rutt, 2009). These country experiences can provide valuable lessons that support the importance of the forest sector as a component of green jobs creation and sustainable development.

The "Rovaniemi Action Plan for the Forest Sector in the Green Economy" identified five pillars supporting the transition of the forest sector to a green economy (Table 2), the third one addressing green jobs in the forest sector (UNECE/FAO, 2014).

Within each pillar, there are a number of objectives and proposed actions. To address green jobs in the forest sector there are objectives for job creation, skills development, reduction of risk and injury, monitoring impacts and trends, and addressing education needs (Brizay, 2014).

TABLE 2

The five pillars of the Rovaniemi Action Plan (RAP) for the Forest Sector in a Green Economy

Pillar	Objective
1. Sustainable wood consumption and production	Patterns of consumption and production of forest products are truly sustainable.
2. The low-carbon forest sector	The forest sector makes the best possible contribution to mitigation of, and adaptation to, climate change.
3. Decent green jobs in the forest sector	The workforce is able to implement sustainable forest management and the forest sector contributes to achieving social goals of the green economy by providing decent jobs.
4. Valuation of and payment for forest ecosystem services	Forest functions are valued and payments for ecosystem services are established.
5. Policy development and monitoring of the forest sector	Policies and institutions promote sustainable forest management, policy making is evidence-based, and policy instruments are effective, efficient, and equitable.

Source: UNECE/FAO, 2014.

4.3 Existing and emerging green jobs in the forest sector

As defined in the UNECE/FAO publication, “Green Jobs in the Forest Sector”, green jobs are jobs that “minimize the adverse environmental impacts of enterprises and economic sectors by preserving or restoring the quality of the environment”.

Following on this definition, the UNECE/FAO Team of Specialists on Green Jobs in the Forest Sector defined a green job in the forest sector as one which:

- Complies with the principles of sustainable forest management.
- Contributes to the green economy, and
- Is involved in the value chain of forest products and/or in the performance of forest services. (UNECE/FAO, 2018).

With these definitions in mind, the publication identified 7 thematic areas and 19 related fields of activity associated with green jobs in the forest sector (Table 3).

For a variety of reasons, including policy and programmatic purposes, green jobs in the forest sector may be defined more broadly or narrowly in different situations. However, across the many approaches to identifying green jobs in the forest sector, there is a consistent trend of recognizing the inter-connectedness of different kinds of jobs and skillsets that are necessary to support green job creation and growth in the sector, from the forest to finished product. For example, there is a need for collaboration between people working in education and knowledge transfer with those in wood and energy production to ensure that training programmes develop the skills and capabilities that employers need. There are similar linkages across many other categories of forest sector green jobs.

TABLE 3

The seven thematic areas and 19 fields of activity for green jobs in the forest sector

7 Thematic Areas	19 Fields of Activity
1. Wood & Energy Production	1. Wood Production 2. Energy Production
2. Regional and Land Use Development	3. Agroforestry 4. Mountain Forestry and Soil Bioengineering
3. Social & Urban Development	5. Urban Forestry and Arboriculture 6. Culture and Forests
4. Forest Management, Inventory and Planning	7. Forest Inventory and Forest Monitoring 8. Planning, Governance, Sustainable Forest Management 9. Pests, Diseases and Forest Fires 10. Risk Management and Contingency Planning
5. Biodiversity & Ecosystem Functioning	11. Biodiversity Conservation and Nature Protection 12. Climate Change 13. Forests and Water 14. Mycoforestry
6. Health & Recreation	15. Forest Ecotherapy 16. Recreation, Leisure and Sports
7. Education & Research	17. Education, Further Training and Knowledge Transfer 18. Forest Research
	19. Other New Fields of Activity

Source: UNECE/FAO, 2018.

There remains potential to add more detail to the categories of green jobs and entirely new areas of job opportunity. For example, the following areas of emerging and potential green job opportunities within the forest sector are not fully incorporated in most existing literature:

- Nanotechnology applications, including modification of lignocellulosic materials to increase durability and provide additional environmental benefits.
- Wood recycling and reuse, including pre- and post-consumer recovery of materials from new and existing construction and redevelopment activities, as well as urban wood utilization to reduce environmental impacts associated with disposal.
- Life Cycle Assessment research and policy development to support improved understanding of environmental impacts and the benefits of renewable wood-based materials.
- Research and product development to replace fossil-fuel-based materials with wood-based materials, including work in adhesives, plastics, batteries, computer chips, and other wood and fibre-based products.
- Wildfire risk management, mitigation, and emergency response, as a dimension of biodiversity and forest protection, are growing areas of need, opportunity, expertise, and educational awareness.
- Plant breeding, genetics, and gene-therapy technologies to adapt tree species to climate change and other health and productivity threats.

These areas of work offer job opportunities in research, education, production, and marketing. The success of many forest sector green jobs will require working relationships between foresters and other forest workers as well as the scientists, engineers, economists, and other professional groups who will bring emerging research concepts to operational scale and support implementation.

4.4 Regional, social, and economic trends with impact on green jobs in the forest sector

The number of potential green forest sector jobs is significant across the various categories. For example, it has been estimated that the development and growth of the wood fuel resource could lead to the creation and support of more than 7,000 jobs in the UK economy through direct and indirect effects (Confor, 2012). Jobs will be created by increased timber harvesting, processing capacities and manufacturing, tree planting for reforestation and afforestation, tree nursery growth and supporting services. The forest sector in Canada is expected to fill

60,000 positions across these different disciplines between 2010 and 2020 (The Greenest Workforce, 2018).

The forest sector recognizes the need for a larger workforce. Chapter 1 showed that the current forestry workforce is getting older, which poses a significant threat to the future of the forestry sector in many regions. Several areas in the UNECE region show a decline in the forest sector workforce, largely due to reforms of public enterprises and the collapse of former state-owned companies (UNECE/FAO, 2016b). Employment in the forest sector in the Balkans declined by 45 % over the period from 1990 to 2015 and in Eastern Europe it declined by 49 % in the period from 1990 to 2011 (UNECE/FAO, 2016a; UNECE/FAO, 2016b).

Within the UNECE region there are some forest areas that are not currently managed and expanding the workforce may help to improve forest stewardship. For example, Forestry Commission England (FCE) reported that 52 % of woodland is actively managed, leaving more than 600,000ha of woodland unmanaged (Confor, 2012). Several European countries report that less than half their forest area is under management plans (or equivalent), including Cyprus, Denmark, France, Norway, Portugal, Spain, and the UK (Forest Europe, 2015). Expanding management should create job opportunities as well as the capacity to address forest health threats, wildfire risks, invasive species, and other concerns that diminish the potential for forests to provide environmental, economic, and social services and benefits.

Additional workforce-related concerns for the forest sector include the lack of young entrants, insufficient training and education, high accident rates and health risks, gender imbalance and the low profitability of forestry (Kastenholz, 2014). For these and other reasons, developing green jobs in the forest sector also includes ensuring decent work. Decent work as defined by the ILO includes fair income, security in the workplace, social protection for families, personal development and social integration, freedom to express concerns and organize, to participate in decision-making, and equal opportunities and treatment (ILO, 2019b).

At the international policy level, these and other concerns are being integrated into environmental instruments, such as the International Tropical Timber Agreement (2006), which mentions the need to improve working conditions within the forest sector, taking into account standards established by ILO instruments. There is an observable trend at the national level to include occupational safety and health standards in laws and policies focusing on agriculture and forestry. Increasingly, legislation relevant to greening the forestry sector includes green job concerns (ILO, 2018a). Diverse organizations, such as cooperatives can assist in developing green jobs while also addressing

training needs and working conditions (Örnek 2017). There is evidence of good practice instruments that combine environmental objectives for forests, with social objectives, such as policies pursuing unemployment protection; cash transfer programmes; public employment programmes with environmental components and, payment for ecosystem services with social components (ILO, 2018b).

The drivers and limitations to green job development in the forest sector include impacts from outside the sector. For example, the demographic, environmental, economic, and social trends impacting forestry are widely felt throughout economies. Additionally, other land use activities and urban development impact forest resources, associated economic opportunities for individuals and organizations and green job creation opportunities. Green jobs and green job opportunities are not unique to the forest sector. In fact, green jobs are represented in most of the major industrial sectors. This trend is likely to further expand. It is estimated that the adoption of sustainable practices in the energy sector, for example, will lead to a net increase of approximately 18 million jobs across the world by 2030. Advancing towards circular economy will create additional 6 million new employment opportunities (ILO, 2018a).

A US review found green jobs identified within utilities, construction, manufacturing, trade, transportation and warehousing, services, and industry (including crop production, animal production, and forestry and logging). Green employment was highest in the forestry and logging sector at 19.8 % (Deschenes, 2013). There are green initiatives within many sectors, including energy, construction, and agriculture. The forest sector needs to identify opportunities to engage with these efforts in a way that maximizes the environmental benefit and minimizes any negative impacts to forest resources and green jobs in the forest sector.

The forest sector is closely linked to intra-regional trade, including trade between Canada and the US, and between northern and Central Europe, and these connections continue to evolve with changing global trade patterns (ILO, 2001). These trade flow patterns present challenges to the global workforce, such as the ability to move workers and materials between countries, immigration patterns, and education and training needs.

4.5 Skills requirements for green jobs in the forest sector

The "Rovaniemi Action Plan" has prioritized the development of the necessary skills to support green forest jobs through strategic actions that include monitoring and analysis, policy reviews, entrepreneurship, tripartite approaches, investments in education and training, and encouraging the role of associations.

The forest sector employs people across a wide range of job types and working conditions. It is estimated that in 2010 the forestry sector in Europe provided direct jobs and income for at least three million people: 1.4 million in wood manufacturing sector, 790,000 in the paper industry, and 620,000 jobs in forestry. It is estimated that a quarter of the forest sector workforce is self-employed or a business owner (Forest Europe, 2015). A US survey identified nearly 50,000 workers employed in forestry and logging in 2011 (Hamilton, 2013). Global employment is difficult to assess. In 2014, FAO estimate that 54.2 million FTE were employed globally in the forest sector, with 13.2 million FTE in the formal forest sector and 41 million FTE in the informal sector (FAO, 2014a; FAO, 2014b).

While millions of people are formally employed in forestry globally, there are millions more that are employed informally, including in fuelwood harvesting and subsistence activities. The majority of people that have direct contact and impact on the forest have limited training opportunities. For instance, more than 70 % of forestry work in Turkey is undertaken by forestry cooperatives and partners, rather than professionals. However, cooperatives play an important role in education and training (Örnek, 2017). Gender inequality and concerns about forced labour and child labour are challenges for the sector. Women account for only about 20 % of the European forest sector workforce (Forest Europe, 2015). Globally, it is estimated that 25 % of the formal forest sector workforce are women (FAO, 2014c). The numbers of women employed vary between countries and sectors. The paper industry employs the highest proportion of women, with the lowest proportion in direct forestry operations (Lawrence, 2016b).

The forestry workforce is highly productive. Many parts of Europe have a high level of mechanization, though the picture is not uniform across Europe (Forest Europe, 2015). Forest sector jobs provide high quality career opportunities and competitive income levels, though not all jobs do. Research in the US found that most occupations in forestry and logging had median annual wages that were near or above the national median annual wage (Hamilton, 2013). Annual income tends to be higher in Canada, Europe and the US, and, not surprisingly, lower in much of Eastern Europe (ILO, 2001).

Current evidence and trends suggest that, in future, the forest sector will be dominated by diversification and new technologies. The biggest challenge for green jobs in the forest sector is a shortage of workers with the necessary skillsets. Skills mismatch is one of the major hurdles in greening the economy (ILO, 2018). Addressing this will need building education and training capacities and actively motivating and recruiting the next generation of forest sector workers.

4.6 Major adaptation needs for forest education and training in support of green jobs development

Several areas will need to be adapted to meet the education and training needs of green jobs in the forest sector. They include innovation, rural and urban connections, monitoring and research, gender diversity and recruitment strategies. All provide opportunities for greater development and creativity and are discussed below.

4.6.1 Innovation

Developing green jobs and giving full expression to the role of forests in the green economy will need innovation and the promotion of innovative uses of forest products (Brizay, 2014). The skills needed to secure the full impact from innovation include research, promotion, marketing, and communications. Those individuals with the required skills to ensure that innovation moves from the research lab and testing facility to the market and ultimately to businesses and consumers, will need to operate throughout both the product development process and the supply chain. Training and education will need to address wood product information and complement business, marketing, and communications expertise. Developing innovation within the forest sector relies upon enabling legislation and policy as well as supporting investment in research and combatting harmful practices, such as illegal logging. The forest sector must engage policy makers in developing a shared understanding of the sector and the opportunities it can provide to create green jobs. It is also strategic to support forest sector experts in direct engagement in policy discussion. Developing all the diverse skillsets that are necessary to support innovation in the forest sector requires recognizing that the education and training needed for a thriving, green forest sector extend beyond university forestry departments. The education and training needs for green jobs in the forest sector will require collaboration with many other professions and ongoing learning opportunities.

4.6.2 Rural and urban connections

It is commonly recognized that forest sector jobs are highly relevant in rural areas (Brizay, 2014). As the role of green jobs in the forest sector expands, it is increasingly important to recognize the linkages between rural and urban communities and the green job opportunities that exist across the landscape. These trends are apparent from a growing interest in urban forestry and in manufacturing of products from urban trees. Job opportunities in urban forestry include land management and planning with service providers from the public and the private sector. There are also jobs in tree care, tree removal and planting. Many of

the necessary skills, education and training parallel those of rural forestry and there are opportunities for collaboration. A more robust engagement with urban forest opportunities can contribute to achieving several SDGs, including SDG11 "Sustainable Cities and Communities" where the green infrastructure of a well-managed urban forest can have an impact on quality of life (Herkendell, 2016). Connections are being made between rural forests and urban communities through the development of innovation in building design and construction, and the development of urban planning initiatives aiming to integrate sustainable development objectives and reduce the carbon footprint of the urban environment (referred to as 'ecoquartier', ecodistrict, green building projects, among others) (EcoDistricts, 2019; Ministry of Housing and Territorial Equality of France, 2016; Wikipedia, 2019). The expanded use of mass-timber and tall-wood buildings links rural forest resources to urban planning and sustainable community design goals. Addressing these opportunities requires education and training capacities, including using online and digital technologies to deliver information.

4.6.3 Monitoring and research

Many forest sector jobs are already recognized as green but green jobs are still only a small proportion of overall forest sector jobs. Data on green jobs from 11 countries⁸ showed that green jobs as a proportion of total employment varied between 0.2 % and 4.5 % (Deschenes, 2013). Over the period 2002-2011, employment in the environmental goods and services sectors in the EU-28 increased by 40 %, including growth of 20 % during the years of recession (McAree, 2017). The beneficial potential for green jobs across many sectors, including forestry, continues to be widely expected (Renner et al., 2010).

The drivers for green job growth include government policy, individual company values and choices and market demands (UNEP, 2008). For example, in countries such as Estonia and Spain, skill development as a priority for the transition to a green economy has a strong focus on forestry (ILO, 2018a). A recent US survey of the forest sector in Louisiana, found that 63 % of responding companies were unwilling to incur incremental costs to increase green jobs, even though general attitudes and behaviours toward green activities were positive (Olson, 2011).

Developing better approaches to monitoring, reporting, and researching green job trends will be needed to influence the drivers for green job growth. There is also the opportunity to develop metrics and methodologies

⁸ Countries included in the review and their reported green jobs as a % of total jobs: Austria (3.99%), Finland (0.24%), France (1.60%), Germany (4.50%), Hungary (4.18%), Japan (2.19%), South Korea (2.56%), Portugal (0.40%), Spain (2.62%), Switzerland (4.50%), and the US (2.43%).

to measure the environmental benefits from the growth of green jobs, including reduced carbon emissions and improved human health and worker safety.

The "Rovaniemi Action Plan" includes objectives for monitoring trends in forest sector green jobs, including social aspects of sustainable forest management and employment conditions. Continuing to monitor the forest sector, based on the numbers of companies, employment trends, promotional activities, investment, use of technology, and other key indicators will be important in assessing the overall position. To ensure that monitoring enhances green job opportunities, it will be important to measure benefits that are specific to the forest sector. These benefits may be key indicators for the importance of green jobs in the forest sector, including environmental benefits unique to the forest sector, such as conserving biodiversity, water benefits, and carbon storage. Forest sector green jobs may contribute to human health and wellbeing in unique ways. These metrics may support additional objectives within the RAP. Applying consistent definitions and measures of forest sector jobs and green jobs is key to understanding conditions and trends (ILO/OECD, 2012; Kastenzholz, 2014). A better understanding of green job trends and challenges will allow forest educators to adapt training programmes so that they fit the emerging needs and opportunities.

4.6.4 Gender diversity

Gender inequality in the forest sector persists in all countries (FAO, 2006). The RAP includes integrating national gender strategies into relevant forest policy strategies and emphasizes the importance of gender mainstreaming for providing decent green jobs in the forest sector. This strategic approach should aid recruitment and retention of a workforce that will support green jobs and sustainable forest management.

Establishing gender equality is an essential element in providing decent work opportunities (Kastenzholz, 2014). Address gender inequality and, more broadly, forest workforce diversity needs will take several forms, from formal policy to the creation of informal networks. A starting point will be to establish consistent mechanisms to measure workplace diversity and to develop communication strategies to increase awareness of the needs and benefits that follow more shared empowerment and engagement (FAO, 2006). A variety of programmes and organizations support the success of women in the forest sector; the Association of Women Foresters in Slovakia, for instance and Women in Wood in Canada. Education and training can actively address gender diversity and inequality in their programmes and curricula.



4.6.5 Recruitment strategies

The forest sector is just one sector of the economy that is competing to recruit and retain workers. To aid in recruitment, forest sector specific job listing resources have been developed. For example, Forestry Jobs in Canada is a website featuring career opportunities in all fields of Canada's forestry and forest products' sector (Canadian Forests, 2018). The website is a useful resource for current and potential employees and employers in understanding the opportunities and needs that exist in the sector. Similar websites exist in Portugal (Green Career, 2018), the US (Forestry USA, 2018; USDA Forest Service, 2018b), and the UK (Green Jobs, 2018). Listings at the website www.ecojobs.com include a wide range of environmental jobs (Environmental Career Opportunities, 2018), O-Net, addressing diverse green economy sectors (O-Net Online, 2018), and a book, "Green Careers for Dummies" that looks at green jobs in forest resource management (McClelland, 2010).

Another Canadian website goes beyond simple job listings. It provides tools for employers and employees to better understand the full range of opportunities for forest sector green jobs and careers and provides career resources, job insights, and labour market information, focusing on the environmental benefits of working in the forest sector. The site supports students and new workers as well as life-long learning and career advancement opportunities (The Greenest Workforce, 2018).

There is a need to raise awareness of career opportunities and educational programmes that provide the training and knowledge skillsets that are necessary for getting a green job in the forest sector. Several online resources

provide listings of aggregated information about classroom and online opportunities, for example, the agriculture and forestry career programme listings by Environmental Science (Environmental Science, 2018). As training and education programmes are developed, it will be important to evaluate them, to aid in improving their design and delivery.

Improving green job opportunities in the forest sector will involve meeting specific workforce development needs that are closely related to education and professional development. In addition, the sector will need to address economic conditions that enhance business competitiveness, investment opportunities, and greater use of technology and innovation. These strategies will strengthen the sector and should make it easier to recruit new workers.

4.7 The way forward

The further development of green jobs in the forest sector will strongly depend on the revision of existing curricula to address existing skill gaps and adapt to new career paths. This could also change public perception of the forest sector to an innovative sector that attracts qualified workers and offers modern careers in a green economy. This will require looking across the current and future employment needs to support new workers as well as developing life-long learning opportunities for the forest sector workforce.

Continued work will be needed to raise awareness of existing and emerging green job opportunities within the forest sector. It will require continuous adaptation to changing trends to ensure resilience and flexibility in the workforce and to enhance the economic, social and environmental benefits that forests bring to a green economy.





CONCLUSIONS

Since 1990, there has been a significant reduction in the size of the forest sector workforce in the UNECE region. Rural depopulation, political transformation in Central and Eastern Europe, structural changes resulting in the collapse of several large companies, privatization, fragmentation of the supply market, and outsourcing work to contractors have all played a part. The trend has affected all subsectors, but was most marked in wood manufacturing, which is heavily dependent on construction and was particularly hard hit by the global economic crisis of 2008.

The forest workforce in the UNECE region is reducing in number and becoming older, reflecting the trend in the working population generally. Forest sector employment figures include only those working in forestry, wood manufacturing and paper industries. They do not include the increasing numbers of people employed in areas such as biodiversity conservation, education, tourism, forest monitoring and certification, all of which depend on forests. Estimating the number of these jobs is not currently possible, but they may be significant.

Long-term and structural unemployment patterns have been deepening due to a mismatch of skills and market demand. If the forest sector workforce is to remain resilient in meeting the requirements of a green economy, it will need continuous reassessment of training and education needs and adaptation of existing curricula. In all forest enterprises, but particularly in small- and medium-sized businesses, adapting the workforce to meet the requirements of new jobs will need training and retraining.

The numbers of women employed in the sector have changed little between 2008 and 2016. Women account for around 15 % of the workforce in forestry and wood manufacturing and between 25 % and 30 % in pulp and paper manufacturing. Though promoting women and other under-represented groups in the forest sector has risen in importance, few occupy senior positions still.

Forest work is changing, and the forest sector will need to respond continuously to trends in global markets, demographics and technological development if it is to remain competitive. The pace of change creates pressure on productivity as well as on health, safety and wellbeing of forest workers.

Occupational health and safety in the manufacturing segment of the forest sector has been improving continuously in past decades generally. There is still cause for concern in many countries where the situation has deteriorated in some regions and within some groups.

This applies particularly to self-employed and private forest owners and in Central and Eastern Europe.

The common measure of occupational risk is data on accidents, but forest workers may also face health problems from continuous physical and mental stress. Addressing these problems will need a shift to reinforcing solutions that focus on behaviour and cultural change in the sector, including more safety training, more effective regulation and control measures.

Health and safety at work go beyond preventing accidents and include maintaining the physical and mental wellbeing of workers. Little research is available on these latter aspects, related mainly to the fact that the perception of forest workers' welfare is highly subjective. Factors that influence this perception include occupational risk, job security, isolation, and the potential for conflict with a public that tends to give greater priority to conserving forest resources. Other factors affecting morale are structural changes of the sector in general and the change in the public perception of the status of forestry professionals. In most UNECE countries, labour codes prescribe workplace measures to protect the health of workers. Labour legislation also shows an increasing recognition of the advantages to both employees and employers that stem from providing mental health and emotional support services.

The nature of forest work is changing due to the technological development and evolving priorities in forest management with increasing emphasis on ecosystem management and not just timber extraction. Work-structures have been changing too. Large companies have merged, downsized, relocated or closed with substantial changes for workers and communities. Trade unions may have less influence than they once did. Many former corporations have outsourced work, especially harvesting, to a growing number of contractors, who may have different work, management and communication cultures.

Standing up to the challenges of a changing economy, such as globalization of commodity markets, ageing and relocation of rural populations, has perhaps made the forest sector less appealing as a workplace. Also, public perception of forest jobs does not always reflect the full merits of the forest sector.

Making forest jobs safer, better paid and more attractive for future workers is the first step to ensure that the forest workforce is fit for purpose and the sector can play its due role in a green economy. The challenge of developing a sustainable workforce in the future includes becoming more innovative in attracting a qualified workforce to fill new jobs. One element, appealing perhaps to millennials, is to emphasize natural resources management and public service within forestry jobs.

The following outlook for the forest sector workforce emerges from the findings of this study:

- Future workers in the forest sector will operate with higher awareness of environmental and social consequences of economic activities in the forest, and have the willingness to apply sustainable development values at the workplace.
- The future jobs in the forest sector are decent, green jobs enhancing all forest ecosystem functions and supporting an inclusive transition of the sector to a green economy.

Conclusions on the implementation of the Rovaniemi Action Plan for the Forest Sector in a Green Economy

Consideration of forest workforce topics has been a focus of the Joint UNECE/FAO Forestry and Timber Section and a key issue of the Rovaniemi Action Plan for the Forest Sector in a Green Economy (RAP). The Rovaniemi Action Plan proposed that by 2020, the forest sector will be applying eight principles, including one specifically dedicated to the forest sector workforce that the forest sector, “cares for and builds up its workforce, developing necessary skills and significantly improving the occupational safety and health of workers and giving due consideration to gender equality”.

Therefore, evidence gathered in previous chapters has been used to evaluate the implementation of the RAP pillar: “Decent Green Jobs in the Forest Sector” namely the RAP actions, which are relevant to the content of this study:

1. C.0.1 Review forest sector workforce issues in order to recommend priorities and communicate their importance including through wide stakeholder consultation.
2. C.1.2 Review and discuss at policy level the main threats to sustainability of the workforce, and possible countermeasures. The review should also include gender aspects.
3. C.1.3 Review and discuss the developments of the new forest jobs and rural entrepreneurship in the green economy.

This study identified the following issues which are key for the development and communication of strategies supporting the expansion of decent green jobs in the forest sector (RAP Action C.0.1):

- Demographic (age, gender, ethnic diversity):
 - Age – research indicates that the ageing workforce echoes wider global patterns. Much forest work is not suitable for older workers, but wider evidence is not available (e.g. on whether broader scope of forest work provides more options for an older workforce).

- Gender – women’s employment in forestry is low across all countries. Women’s employment needs and conditions are not well studied. Proactive attempts to diversify the workforce suggest women bring different values and are part of the transition to more ecosystem-based management, but this is not always an easy transition. Women may be better represented among scientists but are still under-represented in managerial and leadership roles.
- Ethnic diversity – challenges have been experienced, in attempting to diversify the ethnicity of forestry in the US, but proactive educational programmes report some success.
- Changing work types (mechanization and move from timber and biomass production to a wider range of forest ecosystem management objectives):
 - Existing information on wage rates does not reflect the effect of changing work types, which may be leading to a widening gap between well-paid and poorly-paid forest work.
 - The shift to fully mechanized cut-to-length harvesting is not universal, but depends on terrain, and to some extent on economy.
 - The effects of the shift to multi-functional forestry can be challenging for forest managers, but also highly rewarding. The need for more people skills is widely acknowledged. The pressures resulting from the competition among different forest functions can be acute particularly for public sector forest managers, and organizational culture often lags behind the demands made on staff.
 - Work conditions are shifting from remote long-term camps to more long-distance commuting. Social media and better communication tools may alleviate the challenges of remote working, but the effects are little-researched.
- Changing employment structures (from ‘jobs-for-life’ to entrepreneurial and self-employment):
 - The decline of unions and globalization of corporations reflect global patterns, but there are examples of forest-dependent communities that have developed innovative models to address the insecurity which results from these changes.
 - Contractors are a significant emerging segment of the workforce and are characterized by small- to medium-sized businesses which are increasing in numbers. They benefit from associations, both in terms of accessing training and information, and wellbeing. Their particular challenges include lack of skills in business management, as well as poor cash flow and cycles of debt.

- Workers in the informal economy often suffer from insecure work and working condition deficits. Examples of specific visa schemes for Hispanic workers in the south-east US provide models for some aspects of success.
- Safety, health and wellbeing.
 - The issue related to the improvement of the safety and health of the workforce appears to be one that goes beyond 'political will' and reflects differences in terrain, organization, and cultural attitudes to safety. Real improvements have been made but these are specific to particular organizations and are not generally reflected in statistics.
 - The key factor is that change needs to be systemic; it is not enough to deliver safety equipment or even training but monitoring systems must be in place to ensure that behaviour changes. Successful outcomes are supported by team-work on safety culture; risk assessment procedures and monitoring; and organization cultures of risk reduction. Associations may be good ways to reach contractors, and self-employed or forest owners.
- Attracting and training the future forest workforce:
 - This subject is not extensively treated in the scientific literature and a wider range of examples is needed. In Eastern Europe and the Balkans, active measures to address this issue are based on innovative course design, including work placements on graduation. In other countries, it appears that students are more attracted to other natural resource management degrees with a wider ecosystem and public engagement approach.

The evidence gathered in this study suggests that maintaining a sustainable workforce (RAP Action C.1.2) will benefit from providing attractive working conditions for the current workforce, and attracting and inspiring competent, well-educated and trained workers for the future. Given the changing nature of forest work, and the developing field of application (including multi-functional, community and urban forestry), a sustainable workforce must involve a diverse workforce, with capacity for innovation and leadership.

Improvements to working conditions have received little attention in the international literature. Several researchers recommend that it would be valuable to know the impact of monitoring safety practices in organizations and in the field. Given that job security and continuity, and the build-up of experience, confidence and knowledge, are important contributions to livelihood, wellbeing and safety, further research work is needed on conditions of job security.

Although education was not a focus of this study, the evidence reviewed suggests that forestry education needs include: the general challenge of attracting students

from a wide range of socio-economic groups, into forestry education; addressing required skills resulting from mechanization, computerisation and advanced technology; multipurpose forest management; embedding safety and health cultures and practices; communication, and organizational structures and management.

Conclusions from these findings are that:

- More work is needed to assess the impact of measures to improve safety, and to enhance work conditions more generally in the forest sector.
- More research is needed about the experiences of women, ethnic groups and older people to integrate them more fully into the forest workforce.
- The greatest threat to work continuity lies in difficulties in attracting future members of the workforce. Students are attracted to natural resource management degrees with a wider ecosystem and public engagement approach. Forestry professionals also need these skills and it may be important to emphasize this aspect to attract more students.
- More research is needed on the effect of safety culture change, and its dissemination between organizations. Conclusions from existing studies suggest that the focus needs to be on behaviour change as much as on training. Good practice needs to be promoted, including good organizational systems and monitoring.
- Contractors, self-employed workers, and the informal economy need particular attention and support. The need for political will is particularly strong within the informal economy, where government may need to focus on ways to enforce labour legislation and improve communication among government departments.

Developing new forest jobs and rural entrepreneurship in the green economy (RAP action C.1.3) has already started and is supported by several major transformation drivers, including social, environmental and economic conditions. Transition to a green economy offers new prospects to the forest sector and the creation of new jobs. While the forest sector has a long history of providing green jobs within the economy, it is recognized that many current environmental and social considerations can be addressed through forests and forestry and therefore offer new opportunities to grow the forest sector workforce.

The Rovaniemi Action Plan provides a foundation and a roadmap for continuing to advance these green job opportunities in the forest sector and for the development of skills needed for them. It is meant to inspire action and provide the basis for concrete actions, so that the forest workforce is able to implement sustainable forest management and achieve social goals of the green economy by providing decent jobs.



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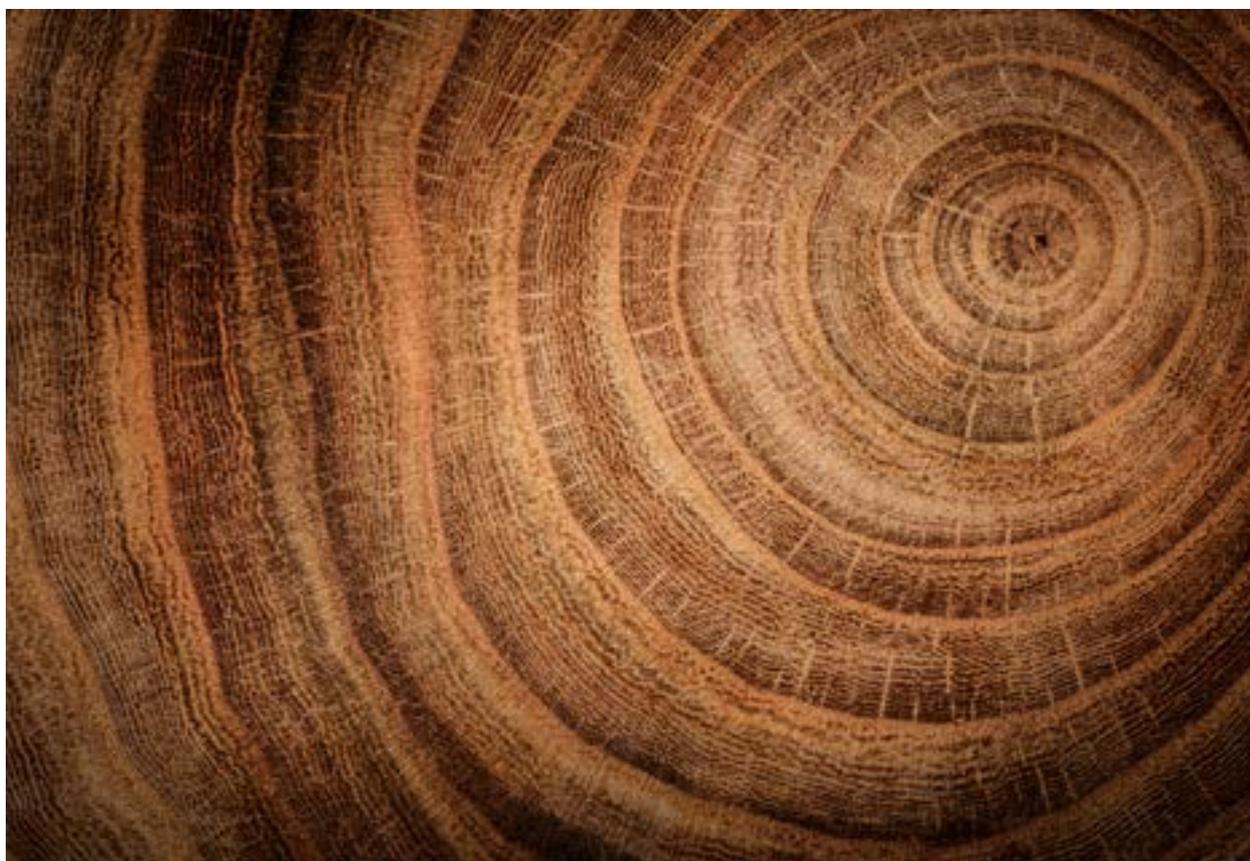
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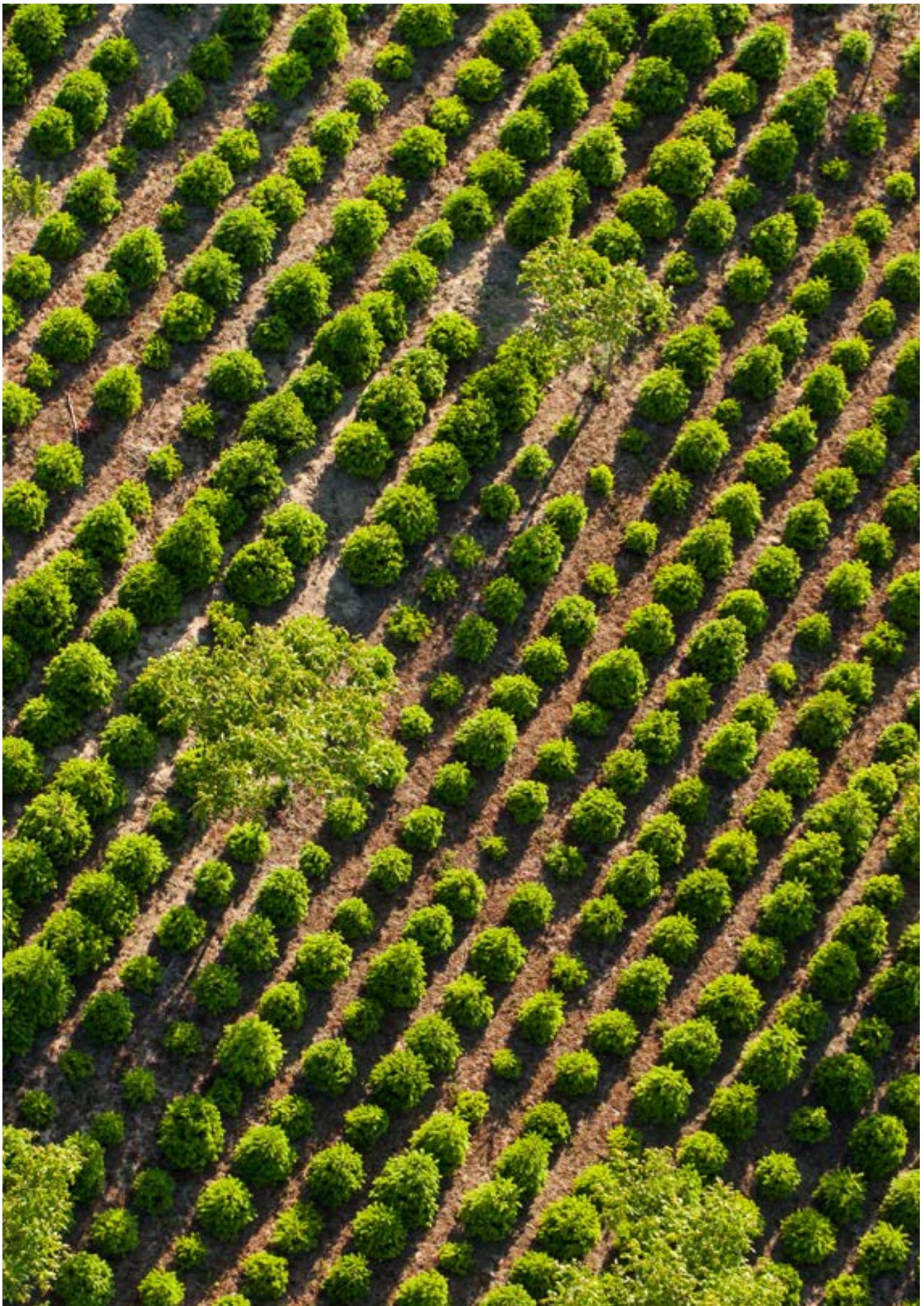
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Overview of the social and economic trends with impact on the forest sector

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