REGIONAL ASSESSMENT OF FOREST EDUCATION IN ASIA AND THE PACIFIC

Creation of a Global Forest Education Platform and Launch of a Joint Initiative under the Aegis of the Collaborative Partnership on Forests
REGIONAL ASSESSMENT OF FOREST EDUCATION IN ASIA AND THE PACIFIC

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RECOFTC

The Food and Agriculture Organization of the United Nations
Rome 2021
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Foreword

At RECOFTC, we believe in a future in which people live equitably and sustainably in and beside healthy, resilient forests. Forest education has a huge part to ensure that happens.

That is why the results of this study of forestry education are crucially important to us, to the 450 million people in Asia and the Pacific who depend on forests to survive and to the environments we aim to protect.

Through advances in forest education, we can build the resilience and the capacity to respond to challenges, not only among the foresters of tomorrow but in everyone as they grow to understand how all humans (rural and urban) and the vast majority of other species depend on healthy forest environments.

The assessment shows that forest education requires considerable investments, reforms and revitalization to achieve this. The recommendations will help shape responses not only to the challenges of achieving the Sustainable Development Goals of the United Nations 2030 Agenda and the Paris Agreement on climate change – but also to challenges that future generations will face that we cannot today foresee.

I want to extend RECOFTC’s gratitude to the hundreds of people who took part in the regional survey and in the expert consultation workshop, generously giving their time and their insights. I also want to thank the Food and Agriculture Organization (FAO) of the United Nations and the International Tropical Timber Organization for leading this important initiative and for asking RECOFTC to conduct the study in the Asia and Pacific region.

I hope the findings in this report and the global assessment to which they contribute will usher in a new era for forest education. So much depends on it.

David Ganz
Executive Director, RECOFTC
Acknowledgements

This report is based on the results of the 2020 Global Forest Education Survey, which aims to lay a new path forward for forest education around the world.

The survey was led by the Food and Agriculture Organization of the United Nations (FAO), the International Tropical Timber Organization (ITTO) and the International Union of Forest Research Organizations (IUFRO). It was funded by the Government of Germany.

RECOFTC was the lead agency for the survey in the Asia–Pacific region and for preparing this report. Mike Shanahan wrote the report. Sirichai Saengcharnchai, Julian Atkinson and David Ganz from RECOFTC, and Susan Braatz, Khalil Walji and Emma Gibbs from FAO provided technical support and guidance.

RECOFTC acknowledges the contributions made by the 435 respondents to the regional survey and the 62 experts who provided information, data and support during a regional consultation on 4–5 February 2021. RECOFTC used the consultation to validate the survey data and shape the recommendations presented in this report.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>APEC</td>
<td>Asia-Pacific Economic Cooperation</td>
</tr>
<tr>
<td>APFNet</td>
<td>Asia-Pacific Network for Sustainable Forest Management and Rehabilitation</td>
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<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<tr>
<td>FLEGT</td>
<td>forest law enforcement, governance and trade (of the European Union’s FLEGT Action Plan)</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<tr>
<td>GIS</td>
<td>geographic information system</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>ITTO</td>
<td>International Tropical Timber Organization</td>
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<tr>
<td>IUFRO</td>
<td>International Union of Forest Research Organizations</td>
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<tr>
<td>NGO</td>
<td>non-governmental organization</td>
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<tr>
<td>REDD+</td>
<td>Reducing Emissions from Deforestation and Forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks</td>
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<td>SDGs</td>
<td>Sustainable Development Goals</td>
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<td>TVET</td>
<td>technical and vocational education and training</td>
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Executive Summary

The Food and Agriculture Organization (FAO) of the United Nations, the International Tropical Timber Organization (ITTO) and the International Union of Forest Research Organizations (IUFRO) are the lead partners in the Global Forest Education Project, which aims to catalyse, accelerate and enhance broad efforts in forest education, from local to global levels, and to counteract the considerable deficiencies in forest education in many parts of the world.

The project is designed to prepare the foundation for a longer-term effort in forest education, envisaged as a joint initiative of the Collaborative Partnership on Forests. As part of the preparations, the project conducted surveys, literature reviews and expert consultations to assess the status of forest education globally and in six regions. This report presents the findings of the regional assessment for Asia and the Pacific.

The region’s forests make vital contributions to societies and economies and have important roles in the efforts to achieve the United Nations Sustainable Development Goals and tackle the climate and ecological emergencies. For the region’s forests to fulfil their potential, countries will need workforces trained in forestry and a broad range of other forest-related disciplines. However, recent literature highlights that many gaps exist, raising concerns that forest education is often not meeting the fast-changing needs of the labour market.

This assessment therefore set out to understand the status and needs of forest education at the levels of primary, secondary and technical and vocational education and training (TVET) schools as well as colleges and universities. This assessment is based on a global forest education survey undertaken by the project between July and October 2020. The survey targeted three groups of respondents: professionals doing forest-related work in organizations, government agencies and the private sector; teachers and school administrators; and students and recent graduates of TVET, college and university programmes. Overall, 435 people in 35 of the Asia–Pacific region’s 44 countries responded. The assessment also drew on scientific and grey literature and on expert contributions made during a regional consultation on the findings.

The region’s size and diversity of contexts are reflected in the variability of survey responses. Some people said, for example, that tertiary-level forest education is modernizing and diversifying to encompass a broader range of subjects and disciplines. Others said forest education is stagnating or in decline. Despite this variability, the assessment identified some broad patterns. Selected findings follow.

**Topic coverage is often inadequate:** The survey revealed widespread perceptions of insufficient coverage of forest-related topics. This was particularly evident at the primary and secondary school levels and among teachers commenting at the TVET level. Many respondents also criticized university curricula and suggested they modernize to encompass a broad range of topics and skills that go far beyond the narrow scope of classical forestry courses. This included increasing coverage of non-timber forest products, socio-economic issues relating to forests and interdisciplinary approaches as well as boosting skills relevant to engaging with communities, managing projects and working collaboratively.
Students often lack exposure to forests: A common theme in the survey responses was the limited experience students had of forests, despite the widespread recognition that exposure to forests increases interest and learning. This gap was particularly acute for the youngest students for whom time spent in forests was rare. But at higher levels of education, too, the survey respondents repeatedly indicated that students had limited exposure to forests through field trips or practical work.

Resource gaps are widespread: Respondents reported significant gaps in the availability of teaching resources. These gaps were particularly evident at the primary, secondary and TVET levels but also present at the bachelor’s, master’s and doctoral levels.

Graduates often lack workplace readiness: While many survey respondents said that TVET and university education produce graduates who are ready for the workplace either moderately or very much ready, there was also a large number of respondents who disagreed. Many people commented that graduates are ill-equipped for work because they are unfamiliar with modern approaches and lack relevant knowledge and skills. In particular, respondents cited a lack of experience in forests, gaps in knowledge of tools and practical skills, gaps in “soft skills” such as facilitation and communication and a limited understanding of social issues such as gender, social inclusion and forest governance.

Students need internships and part-time forest jobs: One way to fill the knowledge and skills gaps is through internships or relevant part-time jobs. But while most respondents recognized the potential of such experiences to increase students’ learning, they indicated that such opportunities are rare.

Digital tools are valued more than they are used: Respondents were generally positive about digital learning tools but less likely to report frequent use of them. And many respondents raised concerns. Some warned that digital tools cannot replace practical experience in forests. Others said that digital learning is limited by Internet accessibility, low levels of digital literacy, inadequate equipment or unskilled teachers.

Gender affects job prospects: Many respondents said that a graduate’s gender is moderately or very much a factor in their ability to find a job and, more so, a factor in the types of jobs graduates are offered. Women were more likely to say this than men.

Forest jobs have an image problem: Several respondents said that forestry as a subject and forest-related jobs in general suffer from a negative image. Efforts to improve forest education should therefore go hand in hand with wider efforts to informally educate society on the crucial importance of forests and the opportunities that forests provide for fulfilling jobs and careers.

This assessment report includes recommendations for academic institutions, national governments, international donors and regional bodies, and organizations, companies and government agencies active in the forestry sector. These recommendations focus on: improving curricula; training teachers; increasing student exposure to forests and forest careers; strengthening the links between educational institutions and employers; increasing the availability of internships and part-time jobs; addressing gender and social inequalities; improving access to digital learning tools; and improving the image of forest-sector careers.
The assessment conclusion emphasizes the need for locally relevant, appropriate and inclusive solutions that take account of digital divides, language barriers and gender inequalities. And it highlights the need for efforts to improve formal forest education to be accompanied by efforts to boost non-formal and informal forest education.
1. BACKGROUND

1.1. Need to strengthen forest education and adapt it to a changing context

Forest education is the primary means of building the knowledge, skills and shared values that underpin sustainable forest management and the contributions of forests and trees to the achievement of environmental, social and economic development goals, from local to global levels.

Over the past several years, however, various international fora have raised concerns that, in many places, forest-related education is insufficient, deteriorating or outdated, leading to a lack of awareness and understanding of forests and to forest graduates who are insufficiently prepared to meet the changing demands of the workplace.

Various reports indicate that countries around the world have experienced variations in student enrolment across forest education programmes and have faced challenges to the inclusion of forest-relevant topics within curricula (Jegatheswaran et al., 2018; Rekola et al., 2017; Temu and Kiwa, 2008; van Lierop, 2003).

The Food and Agriculture Organization of the United Nations’ (FAO) Global Forest Resources Assessment1 (FRA) 2020 (FAO, 2020) includes information on forest enrolment trends in the post-secondary levels of education between 2000 and 2015, gathered from 119 countries and territories. In the countries that provided information across all education levels2 and complete time-series data3 (representing approximately half of the global forest area), there has been a general increase in forestry graduates and marked advancement towards gender parity. Although FRA 2020 warns that these trends should be treated with caution because the data are incomplete, the findings appear optimistic.

Forest education had been largely missing from the global forest policy agenda for nearly 20 years, marked by reduced efforts of the FAO on the topic. Recently, however, attention on forest education has picked up due to activities of various research organizations and non-governmental organizations (NGOs) and, notably, the inclusion of forest education on the agenda of the 14th session of the United Nations Forum on Forests, in May 2019. This signals a growing realization that forest education can and must be part of the solution to many pressing needs, such as reducing the rate of deforestation and forest degradation, protecting ecosystems, enhancing livelihoods and safeguarding human health and well-being, conserving biodiversity and mitigating and adapting to climate change. There is greater awareness that forest education must adapt to the many challenges facing the forestry sector. These challenges include:

- changes in societal expectations related to the goods and services that forests provide to communities and in how forests are perceived;

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1 See pages 103–106.
2 Aggregated numbers are underestimated at regional and global areas (most countries only provided data for several education levels).
3 The trend is accurate for those who provided a complete time series of data disaggregated by gender.
● changes in employment trends and thus the need for further training and education within the forestry sector to maintain a strong cadre of skilled foresters and environmental professionals;
● a lack of interest in the forestry sector, which needs to be revamped and rebranded to attract the most talented and interested students to study and manage the world’s forests and interdependent ecosystems;
● an ageing workforce in many countries; and
● a curriculum that is often outdated, too narrowly focused and in need of broadening to integrate emerging topics.

There is an urgent need to reinvigorate interest in forest education, strengthen and expand existing programmes and tap into emerging opportunities, including those offered by modern digital communication and information technologies, and new types of jobs in the growing green economy.

Without a resurgence in forest education, it will be difficult to achieve sustainable forest management, to secure widespread recognition of the full value of forest goods and services and to overcome the growing disconnect between people, nature and forests. Without robust and suitable forest education, it is unlikely that forests and trees will fulfil their potential contributions to the achievement of global development goals and targets, including the Sustainable Development Goals (SDGs), the targets of the United Nations Framework Convention on Climate Change, the post-2020 Global Biodiversity Framework of the United Nations Convention on Biological Diversity, the United Nations Strategic Plan for Forests and other global goals.

The SDG 4 Target 7 underlines the need for improved education on sustainable development:

“By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development.”

1.2. A global initiative on forest education

The Global Forest Education Project, formally titled Creation of a Global Forest Education Platform and Launch of a Joint Initiative under the Aegis of the Collaborative Partnership on Forests, was carried out between November 2019 and September 2021. It was generously funded by Germany’s Federal Ministry for Food and Agriculture. The project was implemented by three lead project partners: FAO, the International Tropical Timber Organization (ITTO) and the International Union of Forest Research Organizations (IUFRO), with collaboration from other members of the Collaborative Partnership on Forests and of regional lead partners that carried out regional-level project activities.

The regional lead partners by region were:
● Africa: African Network for Agriculture, Agroforestry and Natural Resources Education
● Asia and the Pacific: RECOFTC and ITTO
● Europe and Central Asia: University of Helsinki, Forum4Edu and IUFRO
- Latin America and the Caribbean: IUFRO
- Near East and North Africa: Arab Organization for Agricultural Development

Within the scope of the project, forest education was defined as education related to forests, other wooded land and trees outside forests, including natural forests, forest plantations, woodlands, agroforestry and urban forests. The project focus was on formal education. Even though informal, non-formal and continuing forest education and training as well as indigenous and traditional forest-related knowledge were beyond the scope of the project, the partners consider these sources of education and knowledge to be critical to overall forest-related learning. Several questions that refer to informal and non-formal education and traditional forest-related knowledge were included in the survey questionnaire with the expectation that they might be included in an eventual initiative of the Joint Collaborative Partnership on Forests on forest education and other initiatives to strengthen forest education, training and knowledge.

The project consisted of several interrelated activities aimed at taking stock of the current status of forest education (see Figure 1). A global survey on forest education was carried out between 15 July and 31 October 2020. The survey results, supplemented with information from other sources, informed six regional assessment reports and a global synthesis report on forest education. Each regional report assessed the status of forest education in the region and provided recommendations to strengthen it. The reports served as background material for regional consultations on forest education, which were convened in February 2021. The regional reports and findings of the regional consultations were used to prepare a global assessment of the status of forest education. In June 2021, a virtual International Conference on Forest Education was conducted, in which the findings of the global assessment and recommendations for action to strengthen forest education globally were discussed.

FIGURE 1
Milestones of the Global Forest Education Project

<table>
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<tr>
<th>Reports &amp; Deliverables</th>
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<tr>
<td>Global survey on Forest Education carried out</td>
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<tr>
<td>Regional Assessment Reports on Forest Education completed</td>
</tr>
<tr>
<td>International Conference on Forest Education held</td>
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<td>Call to Action on Forest Education launched</td>
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Note: LSSC = Legal and Sustainable Supply Chains for Tropical Wood and Tropical Wood Products.

The project carried out two pilot activities to develop online resources aimed at enhancing forest education. Under the leadership of IUFRO, the prototype of Forestra®, an enhanced online platform for
consolidating and making forest education resources accessible globally, was developed. As a pilot effort to explore new approaches and technologies for training and education, ITTO developed an online course on Legal and Sustainable Supply Chains for Tropical Wood and Tropical Wood Products.

The culmination of the project was the preparation of a global framework for action on forest education. It would form the basis for a multiyear, multipartner initiative of the Collaborative Partnership on Forests. That proposed joint initiative would address contemporary and emerging challenges facing forest education, and its scope could encompass formal forest education, informal and continuing forest education, and indigenous and traditional forest-related knowledge.
2. INTRODUCTION TO THE REGIONAL ASSESSMENT

2.1. Objective and description of the regional assessment

The aim of the regional assessment was to appraise the current status of formal forest education at all educational levels, identify gaps and areas that need strengthening, provide information on initiatives and actors working to evaluate or enhance forest education and present recommendations for action that could be taken to strengthen forest education in the region.

The levels of education analysed were:
- primary education (in most countries, from age 5 or 6 to age 12 or 13);
- secondary education (in most countries, from age 12 or 13 to age 17 or 18);
- technical and vocational education and training (TVET); and
- tertiary education in universities and colleges.

The regional assessment draws upon the following sources of information: the global survey on forest education, carried out from July to October 2020; scientific and grey literature; and a regional consultation on forest education, virtually conducted on 4–5 February 2021 with 62 experts and stakeholders.

The objectives of the consultation were to validate the findings of the regional assessment report and to finetune the recommendations for strengthening forest-related education in the region. Section 5 of the report includes unattributed quotations from many of the consultation’s participants. These comments have been lightly edited for clarity and style.

The assessment covers education content and competencies, teaching approaches, educational resources and policy, workplace readiness and employability, digital readiness and general developments and trends in forest education. These topics reflect the frame of reference that represents the conceptual framework for the assessment.

2.2. Frame of reference

A frame of reference was adopted as the conceptual framework for the global forest assessment of forest education. It also was instrumental in defining the questions posed in the global survey on forest education. The frame of reference consists of four main components of forest education and their relationships (see Figure 2 below).

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4 The reports of all six regional consultations are available on the project website (www.fao.org/forestry/forest-education/en/).
Needs and demand describe objectives for education. Needs are defined as general socially desirable objectives, for instance, the SDGs. Demand refers to more narrowly defined (economic) requirements for how much and which kinds of skills and competencies are called for in labour markets.

Supply and resources are inputs needed to organize and implement educational programmes. There are direct and indirect links between needs and demand and supply and resources.

Teaching and learning are the essential and central components of education. They are mutually interacting activities, like two sides of the same coin.

Learning outcomes (or achievements) are the competencies of students upon graduation, including their knowledge, skills, attitudes and values. Competences can be subject-specific – related to forest-based knowledge and skills, such as related to the ecological, technological and economical aspects of forests and forestry. They also can be generic – related to such skills as literacy, numeracy, communication, teamwork and leadership.

2.3. Forest education in Asia and the Pacific

2.3.1. Overview of forests and trees in the region

2.3.1.1. Importance of forests for societies and economies
The forests of Asia and the Pacific are important to societies and economies as sources of timber and non-timber forest products, repositories of biodiversity, regulators of water and climate, mitigators of greenhouse gas emissions, generators of tourism revenue and as homes and resources for millions of people who depend on forests for their livelihoods and well-being. The region’s forests are therefore crucial to national and global efforts to achieve the United Nations Sustainable Development Goals and to tackle the climate and ecological emergencies, including through commitments under the Paris Agreement on climate change and the forthcoming Post-2020 Global Biodiversity Framework.

The region comprises 44 countries, and its forests vary greatly in type, status and use. In much of Asia and the Pacific, large areas of forest have been heavily logged and/or converted to agriculture and other land uses. About 64 percent of the region’s forests are now secondary, with varying levels of degradation (FAO, 2019).

In 2015, the forestry sector employed more than 1.4 million people in Indonesia, the Lao People’s Democratic Republic, Malaysia, the Philippines, Thailand and Viet Nam and generated tens of billions of dollars (FAO, 2016). Many millions more people derive incomes and livelihoods from forests in other ways. In recent decades, the focus of forest management has generally shifted over time from timber production to sustainable forest management to forest and biodiversity conservation and then to exploring multiple uses of forests (Jegatheswaran et al., 2018; FAO, 2010). There is also a growing interest in evidence-based, participatory landscape approaches that transcend traditional agricultural, forestry and other land-use governance mechanisms (FAO, 2019).

Increasingly, countries in the region are turning to community or social forestry. In 2010, only 6.7 million hectares were managed by local communities under social forestry practices in the country members of the Association of Southeast Asian Nations (ASEAN). In just one decade, this area doubled to 13.8 million hectares (RECOFTC, 2020). Today, ASEAN countries are committed to achieving targets that will total 30 million hectares by 2030. If they succeed, they will have increased the area of forest managed by communities by almost 500 percent in only 20 years.

Demographic trends are also affecting the use and management of forests and landscapes in the region. Using China as an example, millions of rural people have migrated to towns and cities, with significant impacts on the viability of small-scale forestry.

Overall, the total forest area in Asia and the Pacific increased from 2010 to 2020, but much of this growth was due to afforestation with commercial plantations in China and other countries (FAO, 2020). These gains mask declines in forest cover elsewhere in the region. An indicator of societal pressure on forests is the average forest area per person. In the Asia–Pacific region, this area is 0.18 hectares per person, just one-third of the global average (FAO, 2019).

2.3.1.2. Forest governance

Forest governance varies greatly across Asia and the Pacific. Many of the region’s countries are former colonies of European nations, and they inherited forest governance systems that overlooked customary norms and focused on control and management of commercial extraction of timber and other resources.
from forest lands. Efforts to improve forest governance are under way in many of the region’s countries. These efforts are driven by such factors as national and international goals related to economic development, sustainability and climate change; advocacy by civil society organizations (RECOFTC, 2018); and the demands of consumer markets for legal and sustainable forest products and agricultural commodities.

For example, several countries are engaged in forest law enforcement, governance and trade (FLEGT) processes with the European Union to improve forest governance and promote trade in legal timber products, and/or they are developing REDD+ monitoring and safeguards. These processes are increasing transparency, accountability and public participation in forestry sector policy processes. At the same time, many countries are working to address long-standing tenure issues and increase community control over forest resources (RECOFTC, 2020). Regional initiatives that support these efforts include the Asia–Pacific Economic Cooperation (APEC) Expert Group on Illegal Logging and Associated Trade and the ASEAN Working Group on Social Forestry.

A recent survey of 120 forestry experts from China, Indonesia, Malaysia, Nepal and Viet Nam found that national forest programmes tended to be aligned with wider objectives, such as those related to climate change, conservation and community-based development (Putzel et al., 2019). However, it also identified forest governance challenges, including inadequate integration and communication among sectors and between local and national scales. It also highlighted social issues related to weaknesses in forest governance.

2.3.2. Needs and demands of the labour market

Surveys of forest-sector employers in Malaysia (Kammesheidt et al., 2007) highlighted the demand for state-of-the-art knowledge in technical fields such as forest management and geographic information system (GIS) and remote sensing as well as basic computer skills, soft skills and adequate practical training programmes.

While these needs must be fulfilled across the region, new needs of the labour market are emerging because of technological developments and changes in the way societies view and value forests. Automation, robotics and biotechnology could, for example, make many existing forest-sector jobs obsolete and create new jobs that require specialized knowledge and skills (FAO, 2019). Meanwhile, growing commitments of countries to climate action, including more ambitious Nationally Determined Contributions under the Paris Agreement, create a growing need for graduates who are knowledgeable about climate change mitigation, including voluntary carbon markets, assessment of carbon stocks, auditing and verification as well as climate change adaptation measures in the forestry sector.

And as forestry shifts focus from traditional approaches to social forestry, agroforestry, conservation, climate change and green economy goals, foresters will need greater understanding of social issues and

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5 FLEGT refers to the European Union’s Forest Law Enforcement, Governance and Trade Action Plan; REDD+ refers to reducing emissions from deforestation and forest degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks.
the ability to use multidisciplinary and participatory approaches that require effective stakeholder engagement (Brack, 2019; Jegatheswaran et al., 2018).

Reflecting such changes, a recent study in Lao PDR examined how to change forestry curricula so they can produce graduates with expertise needed for new roles (Park et al., 2019). It identified four areas of competency: (1) comprehensive forest management considering multiple forest services and global negotiations; (2) forest management planning technology; (3) field skills and teamwork; and (4) problem solving and social relations.

2.3.3. A brief history of forest education in the region

There is too little space to describe the origins and evolution of forest education across such a broad and diverse region. It is notable, however, that in many countries in the region, formal post-school forest education has its roots in colonial forest management and research (Jegatheswaran et al., 2018; Bennett, 2011; Abdul Razak, Norini and Krishnapillay, 2005). As such, the initial focus was often on research, development and practical training of foresters and field assistants.

Jegatheswaran et al. (2018) noted that traditional models of forestry education persist in many Asian countries but are “ill-equipped to produce the human capital needed to cope with the challenges arising from emerging global trends sweeping through the forestry sector”. Gaps between the knowledge and skills that forest education provides and what the job market needs have also been documented in, for example, Australia (Brack, 2019) and India (Bhat, 2005). The general conclusion is that, to stay relevant, forest education must change.

Some change is under way. A 2016 survey of forestry programmes in Southeast Asia identified five trends: (1) consolidation of traditional forestry programmes with other disciplines or termination of forestry programmes; (2) increasing use of multidisciplinary approaches; (3) increasing demand for generic skills and social aspects of forestry; (4) e-learning and blended learning; and (5) internationalization (Li and Yuan, 2017). The growing demand for social forestry is reflected in a survey by RECOFTC and the ASEAN Working Group on Social Forestry. It found that this subject was either taught as a specific course or integrated into other programmes at all 11 bachelor’s, master’s and doctoral degree programmes the study examined in seven Southeast Asian countries (RECOFTC and AWG-SF, 2020).

A review by APFNet (2018) reported that forest education in the region was evolving from a resource-centred approach to a more integrated multidisciplinary approach, with stronger links to environmental science and international policy agendas, such as sustainability development. APFNet noted that 190 universities in the region were offering more than 510 forestry-related programmes, with new programmes having been developed in such areas as urban forestry, ecotourism, environmental services, parks, recreation and tourism and geomatics for environmental management. The APFNet report proposed cooperation and standardization as solutions to pressures from changes in labour markets, economies and policies that are changing the demands for forest education. Gabay and Rekola (2019) explained that this would encompass “exchange programmes, standardization of course materials and common online courses”.

9
Technology is another area in which forest education must stay current. An FAO survey of 262 young women and men from 32 Asia–Pacific countries (half of whom had a forestry background) revealed that young people want opportunities. They called for training and other learning to acquire new technology-based skills relevant to forestry and foresters (FAO, 2019). Two-fifths (41 percent) said they were already studying new technologies or using them at work, including remote sensing, lidar, drones, artificial intelligence-based spatial models for ecosystem services, tree genetics and precision forestry.

FAO reported, however, that there are many obstacles to the greater study and use of technologies in forestry in the region. They include a lack of funding, scholarships, access to education, awareness of the availability of education programmes and promotion of such training in forestry institutions and universities.

While forest education obviously varies greatly across the Asia–Pacific region, a few snapshots are illustrative of the situation today:

- Arunachalam and Pandey (2019) reported that India produces nearly 1,500 graduates in BSc programmes (forestry) each year, but that jobs for them are lacking, particularly in the national and state-level forest services.
- In Australia, Brack (2019) reported that there are now only one bachelor’s and two master’s degree programmes with the words “forestry” or “forest science” in their name, yet there are many other bachelor’s and master’s programmes in which forestry can feature. Brack added that forestry graduates are in short supply, and most are quickly employed at relatively high starting salaries.
- By contrast, Jegatheswaran et al. (2018) discussed dwindling interest in forestry among young people in Southeast Asia and falling enrolment rates in forestry education institutes due to a perceived lack of jobs.
- In China, student enrolment in forestry education grew from 12,630 in 1998 to 56,656 in 2008 (Zhang, 2010). During this period, forestry education also internationalized through joint programmes with foreign universities and increased job placements.
- From 2000 to 2015, enrolment in forestry-related programmes was stagnant or declined slightly in Malaysia, the Philippines and Thailand but increased in Indonesia, Lao PDR and Viet Nam (Jegatheswaran et al., 2018).

2.3.4. Governance of forest education within overall educational structures in the region

2.3.4.1. Educational institutional arrangements

Each of the 44 countries in Asia and the Pacific has its own education system, and any attempt to summarize their diversity in the space here would be inadequate.

2.3.4.2. Regional and national policies, regulations and strategic plans around forest education
The Asia Pacific Forestry Education Coordination Mechanism\textsuperscript{6} was formally launched in 2011 “to develop concrete activities in support of the reform and improvement of forestry education in the region”. Among other things, it produces online courses and organizes biennial conferences to promote information and experience exchange among its members and other institutions.

\textsuperscript{6} Formerly known as the Forestry College Deans Meeting Mechanism in the Asia–Pacific Region.
3. SURVEY METHODS AND SURVEY RESPONDENTS

3.1. Survey methodology and regional data analysis and reporting

Data were collected from three target groups using different questionnaires developed by the project team, as follows:

- forest professionals working in government organizations, business organizations (the private sector), labour unions, forest owners’ associations and environmental and other non-governmental organizations (Questionnaire 1);
- teachers and administrators in primary and secondary schools and TVET institutions, universities and colleges (Questionnaire 2); and
- enrolled or recently graduated students of forestry and forest-related programmes in TVET schools and in universities and colleges (Questionnaire 3).

For the sake of brevity, these groups are referred to hereafter as professionals, teachers and students.

The questions asked in the survey covered a range of topics, including education content and competencies, teaching approaches, educational resources and policy, workplace readiness and employability (of TVET, university and college students and recent graduates), digital readiness (for secondary, TVET and university and college students), and general development and trends in TVET and university and college education. Most of the questions used a Likert scale in which several response options were provided to choose from. Some questions were open-ended, permitting the respondent to write in a response.

Sampling of the target groups consisted of statistical sampling and snowball sampling. For the statistical sample, a subset of countries in the region was selected, and individuals, organizations and institutions in the three target groups in these countries were identified and sent survey invitations. Snowball sampling was achieved by sending an open invitation to take the survey through social media channels, such as Twitter; promoting the survey through the use of the Global Forest Education hashtag (#globalforesteducation) and through web stories prepared by the partners; sending survey announcements to project partners’ membership or contact lists; and encouraging survey respondents to forward the survey invitation to their contacts, networks and colleagues. The regional data analysis was based on the total responses received, combining the statistical and snowball survey responses.

Webropol, an online survey and reporting tool, was used to dispatch the surveys and manage the data received (Webropol.com). The survey questionnaires were translated by the project team and made available on Webropol in 14 languages.

In some cases, responses to open-ended questions were subjected to content analysis. This is a method for making numerical comparisons among written data. The approach used for this report involved scoring each answer for the presence of terms or concepts, before grouping related answers into categories of content. Although subjective to a degree, this method can identify broad patterns from responses.

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3.2. Respondent’s socio-demographic background

Overall, 435 people in the Asia and Pacific region responded to the survey – 180 professionals, 143 teachers and 111 students. Table 1 shows the number of people in each group who responded to questions about each level of education. Table 2 shows the gender balance in each group of respondents. Overall, a majority (58.2 percent) of respondents were men. The gender balance of respondents was particularly male-skewed among professionals and teachers, but among students, the reverse was true: 58 percent were women.

Table 3 summarizes the geographic spread of each group of respondents. The survey received responses from 35 of the region’s 44 countries. This included responses from every Asian country except Bhutan and Brunei Darussalam. The other countries with no responses were all in the Pacific: Fiji, Samoa, the Solomon Islands and some of the smaller island nations. However, nearly half (47.6 percent) of all respondents were from six countries: China, India, Indonesia, the Philippines, Thailand and Viet Nam. Among teachers, the proportion from those countries rose to 58.7 percent. For more details of the numbers of respondents per group and per country, see Table 6 in the Appendix.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Numbers of survey respondents for each level of education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary school</td>
</tr>
<tr>
<td>Professionals</td>
<td>77</td>
</tr>
<tr>
<td>Teachers</td>
<td>17</td>
</tr>
<tr>
<td>Students</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Gender balance of survey respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
</tr>
<tr>
<td>Professionals</td>
<td>57 (31.7%)</td>
</tr>
<tr>
<td>Teachers</td>
<td>41 (28.7%)</td>
</tr>
<tr>
<td>Students</td>
<td>65 (58%)</td>
</tr>
<tr>
<td>Total</td>
<td>163 (37.5%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>Summary of geographic spread of survey respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Professionals</td>
</tr>
<tr>
<td>Total respondents</td>
<td>180</td>
</tr>
<tr>
<td>Category</td>
<td>34</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Countries represented (out of 44)</td>
<td>34</td>
</tr>
<tr>
<td>Countries represented by five or more people</td>
<td>16</td>
</tr>
<tr>
<td>Countries represented by ten or more people</td>
<td>5</td>
</tr>
<tr>
<td>Countries not represented</td>
<td>10</td>
</tr>
<tr>
<td>Proportion of respondents from China, India, Indonesia, Philippines, Thailand or Viet Nam (%)</td>
<td>46.1</td>
</tr>
</tbody>
</table>
4. SURVEY RESULTS

All charts to which this section of the report refer are located in the Appendix.

There are some caveats to consider before reading the survey results:

- The data presented here are pooled from across Asia and the Pacific and thus represent many diverse contexts. For any given question, answers from different countries in the region can be very different. The pooled data do not therefore represent any objective reality but rather a collection of often-divergent viewpoints. Of the 35 countries from which survey responses were provided, only three had more than 30 respondents: India (61), Thailand (30) and Viet Nam (38). As each country’s respondents are further broken down into professionals, teachers and students, the numbers become too small for statistically reliable analysis of intercountry differences and similarities.

- It is clear from the answers to the open-ended questions that respondents often interpreted questions in different ways. This was especially the case in terms of how they interpreted “digital tools”, “out of school”, “topics” and “subjects”. The effect of these interpretations renders some results less reliable than the data and the charts might suggest.

4.1. Primary school education

The following results are based on responses from 77 professionals and 17 teachers (see section 8.1 of the Appendix for the relevant charts).

4.1.1. Education content and competencies

4.1.1.1. Forest topics as individual subjects

Both groups of respondents want to see forest-related topics taught as individual subjects far more than they currently were. Nearly a quarter of teachers and professionals said primary school curricula currently include forest-related topics as individual subjects “moderately” or “very much”, with only 5 percent of professionals and none of the teachers characterizing it as very much. Among professionals, 74 percent thought that forest-related topics should be moderately or very much included in the curriculum as individual subjects, while 59 percent of teachers replied very much (see Figure 3 [See Appendix Figures and Tables]).

When asked which topics should be individual subjects, most respondents (68 percent of them) misinterpreted the question. Many conflated “topics” with “subjects” and so described which forest-related topics they thought a curriculum should cover (rather than as individual subjects). However, these answers were still useful because they provided insight into which forest-related topics that respondents think the primary school curriculum should cover. Content analysis of these responses clustered them into the following groups: the importance of forests, including benefits to society (58 percent of answers); forest ecology, ecosystems and biodiversity (31 percent); threats to forests, including deforestation (31 percent); forestry and forest management (18 percent); and forests and climate change (11 percent).
4.1.1.2. Forest topics in other subjects

Teachers and professionals said forest-related topics should be included in other subjects in the curriculum more than they currently were (see Figure 4). Only 24 percent of teachers and 34 percent of professionals said that forest-related topics were included in other subjects either moderately or very much, with only 7 percent of professionals and 6 percent of teachers saying very much. Among professionals, 82 percent thought that forest-related topics should be moderately or very much included in other subjects, while 69 percent of teachers agreed (see Figure 4). Indeed, 56 percent of teachers replied very much.

The survey asked which subjects currently or should cover forest-related topics. The most frequent answers were: science (44 percent of respondents); environment and environmental science (34 percent); social science (22 percent) and geography (16 percent). Between 6 percent and 9 percent of respondents said art, health, chemistry, mathematics or literature. Respondents suggested several other subjects at lower frequencies.

4.1.1.3. Coverage of specific topics

Figures 5–7 show the extent to which primary schools cover each of 13 topics, according to the survey respondents. A majority of teachers and professionals thought coverage was inadequate for all topics, apart from professionals’ view of the forest role in providing clean water and air, for which 49 percent still replied it was inadequate. Among these two groups of survey respondents, seven topics emerged for which at least two-thirds of them said coverage was inadequate (see Table 4). Among both groups, the topics for which the smallest proportion of respondents said coverage was inadequate were plants and animals that live in or around forests and the forest role in providing clean water and air. But for these topics, between 49 percent and 56 percent of respondents said coverage was inadequate.

| Plants and animals that live in or around forests | 52.7 | 56.3 |
| Products that come from forests and trees | 62.2 | 70.6 |
| The contribution of forests and trees to local people | 68.5 | 75.0 |
| The value of forests and trees to the well-being of society | 66.7 | 53.3 |
| The risks and threats to forests and trees | 65.2 | 52.9 |
| The importance of conservation and sound management of forests and trees | 67.6 | 60.0 |
| Forests and climate change | 71.0 | 73.3 |
| Forests as a recreational space | 68.1 | 75.0 |
### 4.1.1.4. Additional topics and skills to cover

A separate question asked professionals to name additional forest-related topics and skills the primary schools should teach. Content analysis of the 50 answers clustered them into the following main categories: benefits that forests provide (36 percent of respondents); threats to forests, and forest conservation (30 percent); forest ecology and biodiversity (16 percent); environmental awareness and active care for nature (16 percent); experience of forests and tree planting (14 percent); working in forests and with trees and wood (14 percent); and sustainable use of natural resources (14 percent).

### 4.1.1.5. Forests as teaching environments

Only a minority of respondents (12 percent of teachers and 18 percent of professionals) said that forests were either very much or moderately used as a teaching environment, and in each case, less than 6 percent said very much (see Figure 8). More than a third of respondents said forests were not used at all as a teaching environment.

Several respondents highlighted that field trips and practical work do not count towards grades and so were less of a priority for teachers and students. “Many Thai schools focus too much on standardized test results due to the Ministry of Education criteria for evaluating schools. Forest education should be part of those criteria,” explained one respondent.

Other respondents cited other barriers:

> “From the growing risk-management consciousness, there is a tendency to refrain from outdoor activities where there is a possibility of personal injury. Rather than management's side of the school to avoid the risk, if you do not advertise the significance of the activity, activity is rapidly reduced.”

> “It’s very hard to get kids outside. Many schools have few tree areas [where] they can study. Successful programmes are usually down to a single teacher with a passion for sustainability. There is often not much support from school leadership.”
4.1.6. Interest in learning more about forests

A minority of the teachers and professionals said primary school increased students’ interest in pursuing further learning about forests or related subjects moderately or very much (see Figure 9). Teachers were less positive than professionals about the impact of primary education. Only 12 percent of teachers answered very much (compared with 34 percent of professionals), while 29 percent of teachers said not at all (compared with 10 percent of professionals).

4.1.2. Teaching approaches

4.1.2.1. Teaching methods

The dominant teaching methods reported by teachers were lectures (88 percent of respondents), outdoor learning (47 percent) and individual writing and reading assignments (41 percent) (see Figure 10).

4.1.2.2. Improving learning and interest

The survey asked teachers to choose three of eight options to use to improve primary schoolchildren’s learning and interest in forest-related topics. They most often chose outdoor learning (71 percent of responses), project-based learning or problem-based learning and guest speakers (see Figure 11).

4.1.2.3. Teacher competence

The survey asked primary school teachers to rate the extent to which they felt sufficiently knowledgeable in each of five teaching areas: Forest ecosystems and forest flora and fauna; forest roles in global sustainability issues (biodiversity, climate change, renewable energy, food security and water resources); effective teaching approaches to guide students’ thinking and learning; digital technology in teaching; and forest and tree management.

The results were similar across the five categories (see Figure 12). In each case, more than half of all teachers answered moderately or very much. The proportions answering in this way ranged from 56 percent for forest ecosystems to 71 percent for digital technology. The only subject for which no teacher answered not at all was forest ecosystems. For the remaining four subjects, 12–19 percent of teachers said not at all. Overall, these answers were more positive than for secondary schools (see section 4.2).

4.1.2.4. Out-of-school activities

Respondents thought strongly that when students engage in forest-related activities outside of school, it increases their knowledge and appreciation of forests – 75 percent of teachers said this was moderately or very much true (see Figure 13). However, only 12 percent of teachers said students actually took part in such activities to more than a limited extent, but none said that students did this very much (see Figure 14). The most common types of activities that respondents mentioned were: school field trips (36 percent of answers), camping (21 percent), litter picking (14 percent) and tree planting (14 percent).
4.1.3. Educational resources and policy

4.1.3.1. Educational resources

Figure 15 shows the extent to which the survey respondents thought that four classes of resources were available for forest education in primary schools. The four classes of resources were: educational environment; practical opportunities; teachers; and learning materials. In all four cases, no more than half of all teachers and nearly a quarter of the professionals thought that the resources were moderately or very much available. In all cases, considerably more teachers than professionals said resources were moderately or very much available. Some 31 percent of teachers and 38 percent of professionals said the educational environment was not at all available. Nearly a third (31.6 percent) of professionals also said this about practical opportunities. Only 16.8 percent of professionals said that teachers were moderately or very much available. Only 22.1 percent of professionals and only 35.3 percent of teachers said learning materials were moderately or very much available.

4.1.3.2. Supportive policies and strategies

Most respondents (70.6 percent of teachers and 85.7 percent of professionals) said that there were government policies or strategies that could improve forest education (see Figure 16). School or school board policies or strategies were much less common, with only 32.1–52.9 percent of respondents saying they existed. In each case, teachers were more likely than professionals to say that government or school policies or strategies could improve forest education.

4.1.3.3. Actions to improve forest education

The survey asked what three actions would have the greatest impact on improving primary school students’ knowledge and appreciation of forest and forest-related subjects. Content analysis of the responses clustered them into five main groups.

- **Activities (73 percent of respondents):** Many respondents (77 percent of this cluster) highlighted the need for field trips, particularly to forests but also to other sites, such as wood-processing industries. A quarter of this cluster’s responses mentioned tree planting.

- **A better curriculum (29 percent):** Many respondents (39 percent of this cluster) stressed the need for the curriculum to emphasize the importance and values of forests.

- **Better teaching resources (22 percent):** The cluster encompassed a range of responses, including better trained and motivated teachers; and better teaching materials, laboratory facilities and more use of online resources and guest speakers.

- **Policies and strategies (18 percent):** Respondents said governments and schools needed to introduce policies and strategies to drive the changes needed to curricula, teaching methods and resources.

- **Awareness-raising activities (10 percent):** Respondents’ suggestions included forest art and photography contests and the creation of forest and nature clubs.

Finally, respondents were asked to add any other comments. Most responses highlighted need for: students to visit forests (28 percent); a better curriculum (26 percent); better trained and more experienced
teachers (23 percent); policies to promote forest education (15 percent); and better teaching resources (13 percent).

4.2. Secondary school education

The following results are based on responses from 74 professionals and 24 teachers. The relevant charts are in section 8.2 of the Appendix.

4.2.1. Education content and competencies

4.2.1.1. Forest topics as individual subjects

Both groups of survey respondents wanted to see forest-related topics as individual subjects far more than they currently were. A minority of teachers (39 percent) and professionals (29 percent) said the secondary school curriculum moderately or very much includes forest-related topics as individual subjects, with 13 percent of teachers and 7 percent of professionals saying it was very much so, and 26 percent of each group saying not at all (see Figure 17). Among both groups of respondents, a majority (73–74 percent) thought that forest-related topics should be moderately or very much included in the curriculum as individual subjects (see Figure 17).

The survey asked which topics should be individual subjects. Content analysis of the responses clustered them into the following groups:

- a stand-alone “forests” subject (39 percent of these responses);
- forest ecology, forest biodiversity and forest conservation (37 percent);
- forestry, forest management, silviculture, GIS and natural resources management (24 percent);
- climate change (24 percent);
- forests, livelihoods and forest products (20 percent); and
- the environment (19.6 percent).

Overall, 78 percent of these respondents said there should be some kind of course subject with “forest” in its name.

4.2.1.2. Forest topics in other subjects

Teachers and professionals both said forest-related topics should be included in other subjects in the curriculum more than they currently were (see Figure 18). Only 26 percent of teachers and 34 percent of professionals said that forest-related topics were either moderately or very much included in other subjects, with only 9 percent of professionals and 3 percent of teachers saying very much. Among professionals, 72 percent thought that forest-related topics should be moderately or very much included in other subjects, while 59 percent of teachers agreed (see Figure 18).

The survey asked which subjects currently or should cover forest-related topics. The most frequent answers were: biology (38 percent of respondents), environmental science (32 percent), science (30 percent), social studies and science (24 percent), geography (22 percent) and society and civics
Other subjects that respondents suggested included economics (14 percent), history (11 percent), physics (11 percent), mathematics (8 percent), chemistry (8 percent) and art (5 percent).

4.2.1.3. Forests as teaching environments

Only a minority of respondents (26 percent of teachers and 13.5 percent of professionals) said that forests were either very much or moderately used as a teaching environment, and in each case, less than 9 percent said very much (see Figure 19). The following responses to ensuing open-ended questions shed light on these results.

“People and all kids are usually scared of going to forests. We need to remove the fear of forests being bad and lonely places to go.”

“Our students live in the city and have little engagement with the outdoors. As a school, we should do a better job of connecting with organizations that would take students out for this opportunity to engage more. It becomes a last priority though in the face of everything else.”

4.2.1.4. Coverage of specific topics

Figures 20–22 show the extent to which secondary schools cover each of 15 topics, according to the survey respondents. For all topics, a majority of professionals thought coverage was inadequate. This proportion ranged from 57 percent (for forest biodiversity) to 87 percent (for rights to forest use and products). Teachers had a more positive view of coverage. For five topics, a majority of respondents said coverage was at least sufficient (forest ecology; forest biodiversity; forests and water supply and quality, forests and climate change; and deforestation and forest degradation). For each of the other ten topics, a smaller proportion of teachers than professionals said coverage was inadequate. Overall, there was only one topic (forests and climate change) for which more than 60 percent of teachers said coverage was not inadequate.

4.2.1.5. Additional topics and skills to cover

A separate question asked professionals what additional forest-related topics and skills should secondary schools teach. The respondents provided dozens of answers that clustered into the following categories: forest conservation (24 percent); values of forests, including ecosystem services (22 percent); forest ecology (20 percent); forest products and value chains (20 percent); forestry and timber harvesting knowledge and skills (18 percent); and forests and climate change (11 percent).

4.2.1.6. Teacher competence

The survey asked secondary school teachers to rate the extent to which they felt sufficiently knowledgeable in each of these teaching areas:

- forest ecosystems and forest flora and fauna;
- forests’ roles in global sustainability issues (biodiversity, climate change, renewable energy, food security, water resources, etc.);
● effective teaching approaches to guide students’ thinking and learning;
● digital technology in teaching; and
● forest and tree management.

The results were similar across the first four categories. In each case, a sizeable minority (39–48 percent) of respondents said not at all or to a limited extent, while 52–61 percent said moderately or very much (see Figure 23). For the last category, a majority of respondents (62.5 percent) said not at all or to a limited extent. However, this was also the category for which the greatest proportion of teachers (29 percent) said very much. These differences likely reflect the heterogeneity of the sample population.

4.2.2. Teaching approaches

4.2.2.1. Teaching methods

The dominant teaching methods reported by teachers were lectures (83 percent of respondents), individual writing and reading assignments (54 percent) and guest speakers (50 percent) (see Figure 24).

4.2.2.2. Improving learning and interest

The survey asked teachers to choose three of eight options to use to improve secondary school children’s learning and interest in forest-related topics. They most often chose problem-based learning (62.5 percent of respondents), lectures (50 percent) and outdoor learning (46 percent) (see Figure 25).

4.2.2.3. Out-of-school activities

Respondents thought strongly that when students engage in forest-related activities outside of school, their knowledge and appreciation of forests increases; 64 percent of teachers and 58 percent of professionals said this was moderately or very much true (see Figure 26). However, both groups of respondents were much less likely to report that students actually took part in such activities (see Figure 26). Only 39 percent of teachers and 18 percent of professionals said this was moderately or very much true. The activities that respondents mentioned most often were school trips (41 percent of answers), camping (27 percent), hiking and nature trails (13 percent) and tourism and recreation (9.5 percent).

4.2.3. Educational resources and policy

4.2.3.1. Resource availability

Figure 27 shows the extent to which survey respondents thought that four classes of resources were available for forest education in secondary schools. The four classes of resources were: educational environment; practical opportunities; teachers; and learning materials. Fewer than half of all respondents said that any of the resources were moderately or very much available, except in the case of teacher resources, as viewed by teachers. But even in this case, the proportion answering moderately or very
much was only just more than half. In all cases, a greater proportion of teachers than professionals was positive about the availability of resources.

### 4.2.3.2. Supportive policies and strategies

Most respondents (79.2 percent of teachers and 63.2 percent of professionals) said that there are government policies or strategies that could improve forest education (see Figure 28). School or school board policies or strategies were much less common, with only 28.9–54.2 percent of respondents saying they existed. In each case, teachers were more likely than professionals to say that government or school policies or strategies could improve forest education.

### 4.2.4. Readiness

#### 4.2.4.1. Interest in learning more about forests

Among both teachers and professionals, roughly half of respondents said secondary school moderately or very much increased students’ interest in pursuing further learning about forests or related subjects. About half said not at all or to a limited extent (see Figure 29). Teachers were generally less confident in this than professionals.

When asked to elaborate, 35 percent of respondents highlighted the potential of secondary education to inspire young minds, but others (44 percent) said that the likelihood of inspiring young people was limited. Reasons for this included a focus on “more academic” subjects, a lack of experienced teachers and a lack of forest-related subjects in the curriculum.

Awareness and perceptions of career and further-education opportunities also appear to be important factors, with 28 percent of respondents mentioning them. Some highlighted job opportunities as helping to build students’ interest, while others highlighted a lack of awareness of career opportunities, competition from other sectors or a negative image of forestry. As one respondent explained, “It's just not something that most students will be attracted to, especially if the news mostly shows forest rangers being killed.”

#### 4.2.4.2. Motivation to enter a tertiary-level forest programme

As Figure 30 shows, only one-third of teachers said that secondary school students were moderately or very much motivated to enter a forest programme at a technical or vocational training school or at a college or university. The proportion of professionals who said this was even smaller.

#### 4.2.4.3. Awareness of the importance of forests

Only 29 percent of teachers said it was moderately or very much true that graduates from their school had sufficient understanding of the contribution of forests and trees to global targets, such as the SDGs (see Figure 31). And 17 percent of teachers replied not at all.
4.2.4.4. Actions to improve forest education

The survey asked what three actions would have the greatest impact on improving secondary school students’ knowledge and appreciation of forest and forest-related subjects. Content analysis of the responses clustered them into four groups.

- **Activities in nature (57 percent of respondents)**: Many respondents (49 percent) highlighted the need for field trips and practical work in forests. Others suggested promoting interest in forests through nature clubs, volunteering, tree planting and camps.

- **A better curriculum (43 percent)**: Some suggested having a stand-alone “forest” subject. Others said forests should be mainstreamed into subjects across the curriculum. Many (17 percent) stressed the need for the curriculum to emphasize the importance and different values of forests.

- **A focus on future careers (29 percent)**: Respondents said it was important to educate students about the existence of forest-related further education and fulfilling forest-related jobs. To foster this, they suggested school-to-industry partnerships, field trips to forest industries and visits and guest lectures by role models who had successful careers in forestry, forest science or forest conservation. Respondents also wanted to see more internships, job openings and educational scholarships.

- **Better teaching resources (20 percent)**: The cluster encompassed a range of responses, including better trained and motivated teachers, better teaching materials and more use of online resources, such as YouTube and massive open online courses.

4.3. Technical and vocational education and training

The following is based on responses from 67 professionals, 14 teachers and 3 students. Given the small number of students, their responses are not analysed here, but they can be seen on relevant charts in section 8.3 of the Appendix.

4.3.1. Education content and competencies

4.3.1.1. Coverage of specific topics

Figures 32–41 show the extent to which TVET programmes cover 41 topics, according to the survey respondents. For all topics, a large proportion of respondents thought coverage is “inadequate”. This proportion ranged from 32 percent to 73 percent of the professionals and between 31 percent and 93 percent of the teachers (there were too few student responses to analyse). For only two of the 41 topics – forest ecology and forest planning – did more than two-thirds of teachers consider coverage to be adequate. There was no topic for which two-thirds of professionals considered coverage to be adequate. Overall, teachers were much more likely than professionals to rate coverage as inadequate. For example, for each of 17 topics, more than 70 percent of teachers said coverage is inadequate (see Table 5), whereas for only one topic – traditional and indigenous forest knowledge – did such a large proportion of professionals say this.
TABLE 5
The 17 topics for which at least 70 percent of teachers said coverage was inadequate

<table>
<thead>
<tr>
<th>Topic</th>
<th>% that said coverage was inadequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable harvesting systems</td>
<td>92.9</td>
</tr>
<tr>
<td>Forests and human health</td>
<td>85.7</td>
</tr>
<tr>
<td>Forests, trees and gender issues</td>
<td>85.7</td>
</tr>
<tr>
<td>Range management</td>
<td>85.7</td>
</tr>
<tr>
<td>Wood as renewable energy</td>
<td>85.7</td>
</tr>
<tr>
<td>Professional ethics</td>
<td>84.6</td>
</tr>
<tr>
<td>Forest genetic resources</td>
<td>83.3</td>
</tr>
<tr>
<td>Forest industry, marketing and management</td>
<td>78.6</td>
</tr>
<tr>
<td>Forest landscape restoration</td>
<td>78.6</td>
</tr>
<tr>
<td>Forest-based recreation</td>
<td>78.6</td>
</tr>
<tr>
<td>Other mechanized work, e.g. site preparation</td>
<td>78.6</td>
</tr>
<tr>
<td>Forest, trees and race or ethnicity issues</td>
<td>76.9</td>
</tr>
<tr>
<td>Urban forestry</td>
<td>75.0</td>
</tr>
<tr>
<td>Cultural values of forests and trees</td>
<td>71.4</td>
</tr>
<tr>
<td>Forest and agroforestry extension</td>
<td>71.4</td>
</tr>
<tr>
<td>Watershed management</td>
<td>71.4</td>
</tr>
<tr>
<td>Wildlife management</td>
<td>71.4</td>
</tr>
</tbody>
</table>

4.3.1.2. Curriculum revisions

Only one-third (14) of teachers said that their TVET had been revised in the past five years. The four teachers who elaborated on this said it was to modernize the curriculum and include climate change and global issues or to incorporate training and market demands.

4.3.1.3. Additional skills and topics to cover

An open-ended question asked what additional forest-related topics and skills TVET forest programmes should cover. Only 13 percent of respondents used the word “forestry” in their answers. Content analysis of the answers from 10 teachers, 2 students and 27 professionals clustered them into the following groups:

- **Topics beyond a strict focus on timber (47 percent of 40 respondents):** such as non-timber forest product harvest and development, climate change, ecosystem services (and payments for ecosystem services), total economic valuation, poverty reduction, disaster risk reduction, agroforestry and forest landscape restoration.
• **Practical skills (29 percent of respondents):** such as forest surveying, carbon stock assessment, carpentry, tree felling and biodiversity monitoring.

• **Business skills (18 percent of respondents):** such as business development, marketing and wood product design.

• **Working with communities (16 percent of respondents):** such as community forestry, skills for engaging with local communities and conflict resolution.

• **Core competencies (13 percent of respondents):** such as computing, networking, presentation, project management and communication skills.

### 4.3.2. Educational resources and policy

#### 4.3.2.1. Resource availability

Figure 42 shows the extent to which the survey respondents said that four classes of resources were available for forest education at the TVET level. The four classes of resources were: educational environment; practical opportunities; teachers; and learning materials. At least half of all teachers and professionals said that the following resources were available only to a limited extent or not at all: learning materials, educational environment and practical opportunities. While 55 percent of professionals also said that this was true of the quality and quantity of teacher resources, only 29 percent of teachers agreed. In no case did more than 30 percent of respondents consider any of these four classes of resources to be very much available.

#### 4.3.2.2. Supportive policies and strategies

Half of the teachers and 71.6 percent of professionals said that there were government policies or strategies that could improve forest education (see Figure 43). School or school board policies or strategies were much less common, with only 7.1–35.7 percent of respondents saying they existed.

#### 4.3.2.3. Forest-related activities and work experience

Respondents thought strongly that when students engage in forest-related activities outside of school, their knowledge and appreciation of forests increases: 61.5 percent of teachers and 61.8 percent of professionals said this was moderately or very much true (see Figure 44). Among teachers, 46 percent replied it was very true, while 32 percent of professionals said this. However, both groups of respondents were much less likely to report that students actually took part in such activities. Only 42.9 percent of teachers and 30 percent of professionals said this was moderately or very much true (see Figure 44).

The more common types of activities that respondents mentioned were:

- environmentalism (volunteering, activism, tree planting, clean-ups): 46 percent;
- field trips (including research and practical work): 39 percent; and
- outdoor recreation (hiking, bird watching, ecotourism): 22 percent.

Few respondents mentioned internships (4.3 percent), part-time jobs (2.2 percent) or visits to organizations that work in the forestry sector, such as NGOs or forest management authorities.
Reflecting on this, only 7.1 percent of teachers and 10.1 percent of professionals said that forest-related jobs or internships were very much available (see Figure 44). Only a fifth of teachers (21.4 percent) and a quarter of professionals (25.4 percent) said such work experience was even moderately to very much available. And 75 percent of teachers and 55.9 percent of professionals thought such opportunities increased students’ learning moderately to very much, with at least a third of each group of respondents saying they did so very much.

4.3.2.4. Teacher competence

The survey asked TVET teachers to rate the extent to which they felt sufficiently knowledgeable in each of these teaching areas:

- multipurpose forest management;
- social and cultural issues in forest management;
- new technologies useful for forest management (such as GPS) and for forest industries (such as wood-processing machinery);
- forests and global sustainability issues (biodiversity, climate change, renewable energy, food security, water resources, etc.);
- effective teaching approaches to guide students’ thinking and learning; and
- digital learning tools.

Results were similar across these categories. In each case, 23–38 percent of respondents said they felt very much knowledgeable in each teaching area, while 32–52 percent felt moderately knowledgeable. However, 14–35 percent said they competent to a limited extent, while 3–8 percent said not at all (see Figure 45). The greatest deficit was for new technologies for forest management, for which only 57 percent answered they felt moderately or very much knowledgeable. The strongest area was effective teaching methods, for which 81 percent answered moderately or very much.

4.3.3. Workplace readiness and employability

4.3.3.1. Preparedness to enter the workforce

Half of the professionals and 53.8 percent of the teachers said TVET programmes moderately or very much prepared students to enter the workforce (see Figure 46). When asked if employment was available for their students upon graduation at a level compatible with their skills, 64 percent of teachers said not at all or to a limited extent.

4.3.3.2. Gaps in learning

In open-ended answers, 43 respondents highlighted the following reasons for gaps in learning between TVET programmes and workplace needs:

- 32.6 percent highlighted the lack of practical training and experience working in forests during TVET courses;
- 23.3 percent said TVET courses were not aligned with the needs of the private sector or government employers;
In terms of specific knowledge and skills, gaps mentioned included forest management, administrative skills, entrepreneurship and workplace professionalism.

4.3.3.3. Impacts of gender, race and ethnicity on job prospects

Most teachers (64 percent) said that a student’s gender was moderately or very much a factor in a graduate’s ability to find a job. Most teachers (73 percent) said that gender either moderately or very much influenced the kinds of jobs graduates were considered for (see Figure 47). Fewer professionals (40 percent) said that a student’s gender was moderately or very much a factor in their ability to find a job or that gender either moderately or very much influenced the kinds of jobs graduates were considered for (57 percent). Teachers and professionals were both far less likely to think that race or ethnicity affected job prospects and the types of jobs than gender (see Figure 47).

Women were more likely than men to say that a student’s gender was moderately or very much a factor in a graduate’s ability to find a job; 57.9 percent of women said this, compared with 43.6 percent of men. Women and men were equally likely to say that a student’s gender either moderately or very much influenced the kinds of jobs they were considered for; 60 percent of women said this, compared with 58.9 percent of men.

4.3.3.4. Availability of affordable professional training

Most teachers (57 percent) and professionals (56.5 percent) said that affordable continuing education or training to update forest professionals’ skills were only available to a limited extent or not at all (see Figure 48). A fifth of teachers replied not at all. Large minorities of each group also said that such training was available, with another fifth of teachers saying it was very much available. In response to an open-ended follow-up question, one respondent in Sri Lanka highlighted barriers to participation in such training: “Women do not have access to adequate information and prospects. Most of the time, this information is available in English language, and therefore women and youth in rural areas will not get these opportunities.”

4.3.3.5. Awareness of the importance of forests

Only 29 percent of TVET teachers said it was moderately or very much true that graduates from their school had sufficient understanding of the relevance of forests to emerging global trends and to the SDGs (see Figure 49). And 14 percent of teachers replied not at all.

4.3.4. Digital readiness

Respondents believed strongly that digital tools can be a valuable supplement to forest education at the TVET level, with 71.2 percent of professionals and 69.2 percent of teachers saying this was moderately or
very much true (see Figure 50). However, little more than a third of respondents in each group said digital learning tools were either moderately or very much used.

Of the 47 respondents who elaborated in open-ended answers, 64 percent were generally positive about digital learning tools. The tools they highlighted included: Internet-based teaching and learning, simulators, digital maps, GIS, GPS and data loggers. And 23 percent of respondents emphasized that practical experience in forests is as important or more important than use of digital learning tools. A quarter of respondents highlighted limitations to digital learning. These included limited Internet accessibility, low levels of digital literacy, inadequate equipment and unskilled teachers.

4.3.5. General developments and trends in TVET

4.3.5.1. Enrolment trends

More than one-third of teachers (36 percent) and professionals (34 percent) said enrolment in TVET forest programmes was declining (see Figure 51). Only 14 percent of teachers and 28 percent of professionals said enrolment was increasing.

4.3.5.2. Developments, initiatives or policies

The survey asked respondents to list any developments, initiatives or policy decisions that were improving or reducing the quality of forest TVET education. The responses were evenly divided between improvements and reductions.

Some respondents cited improvements in infrastructure, equipment, machinery, information technology, human capacity and curriculum content. Others mentioned reforms in the education sector. According to one respondent who ticked off examples, “For example, combining departments, employing young professionals as lecturers at universities, improving the practice of making presentations and mutual discussions, student exchange programmes, more scholarship programmes offered by the international universities and better cooperation.”

Other positive examples specific to education and training included: a mandatory requirement for certified skills; quotas for people from forest communities to study forestry; forestry jobs being reserved for forestry graduates; training improvement strategies (“available in many states in India”); job opportunity strategies; and an annual internship programme targeted to forestry students in TVET and supported by the Government of the Republic of Korea.

Wider policies that respondents cited included: increased spending on research and development; new policies, laws and strategies in areas such as wildlife protection, forest certification and green growth; stricter enforcement of forest laws; and promotion of ecotourism as an industry.

Factors reducing the quality of TVET education included a lack of supportive policies for and investment in forest education and forests and natural resources more broadly. Some respondents spoke of TVET education being left behind. “University moves towards graduate-level learning, and the TVET education
is the least priority,” said one person. According to another person, “Obsession with academia has resulted in a downgrading of vocational and technical training in Asia, the Pacific and Australasia. Professional foresters must be backed by field-level supervisors and managers [wearing boots] who can implement plans and tasks.”

4.4. University and college education levels

The survey allowed respondents to answer questions in the context of one or more of the following degree categories: associate’s, bachelor’s, master’s and doctoral. A fourth option was “all levels”. Only six respondents answered about the associate’s level and only 26 responded at all levels (see Table 1, section 3.2). This compares with 196 respondents at the bachelor’s level and 139 at the master’s or doctoral level. The following analysis therefore considers only the results for the bachelor’s and the master’s or doctoral level, for which the sample sizes are considerably larger.

4.4.1. Bachelor’s degree level

The following is based on responses from 71 professionals, 65 teachers and 60 students. The relevant charts are in section 8.4 of the Appendix.

4.4.1.1. Education content and competencies

4.4.1.1.1. Coverage of forest topics

Figures 52–59 show the extent to which respondents believed tertiary courses covered each of 30 forest-related topics at the bachelor’s degree level. The proportion of all topics for which a majority of each group of respondents rated coverage as inadequate varied from 17.6 percent of topics among the students to 20 percent of topics among the teachers, and 27.3 percent of topics for professionals. Overall, 39.8 percent of all ratings by professionals across all 30 topics were characterized as inadequate. This compares with 38.2 percent of teachers and 35.9 percent of students.

A majority of teachers said coverage of the following topics was inadequate: forest, trees and race or ethnicity issues (62.7 percent); entrepreneurship (56.3 percent); range management (53.1 percent); forests, trees and gender issues (52.3 percent); wood as renewable energy (51.4 percent); and forests and human health (50.7 percent).

A majority of students said coverage of the following topics was inadequate: forests, trees and gender issues (66.7 percent); forest, trees and race or ethnicity issues (60.4 percent); small-scale forest enterprise (58 percent); forests and human health (53.7 percent); entrepreneurship (52 percent); and small-scale forestry (51.1 percent).

A majority of professionals said coverage of the following topics was inadequate: forests, trees and gender issues (63.9 percent); forest, trees and ethnicity issues (62.5 percent); forests and human health 61.6 percent); urban forestry (61.4 percent); traditional and/or indigenous forest-related knowledge
(60.6 percent); entrepreneurship (58.6 percent); cultural values of forests and trees (55.6 percent); small-scale forest enterprise (55.1 percent); and forest landscape restoration (51.4 percent).

The topics that two-thirds or more of the teachers said were sufficiently covered were: forest ecology (81.9 percent); forest biodiversity (81.1 percent); forest soils (75.7 percent); silviculture (69.6 percent); and agroforestry (68.6 percent). The topics that two-thirds or more of students said were sufficiently covered were: forest conservation (73.2 percent); agroforestry 70.9 percent; forest biodiversity (66.1 percent); forest health (66 percent); and wildlife management (66 percent). The only topic that two-thirds or more of the professionals said was sufficiently covered was forest ecology (66.2 percent).

Topics that more than 15 percent of students thought were excessively covered were: forest ecology (23.7 percent); wood and non-wood forest products (19.3 percent); silviculture (18.5 percent); forest biology (17.9 percent); forest planning (16.4 percent); wood technology (16 percent); forest soils (15.8 percent); forests and climate change (15.5 percent); and forest-based recreation (15.1 percent). Topics that more than 15 percent of non-teaching professionals thought were excessively covered were: silviculture (19.7 percent); forest ecology (17.6 percent); and forest conservation (15.3 percent). There was no topic for which more than 15 percent of teachers said coverage was excessive.

4.4.1.1.2. Additional topics and skills

Each group of respondents suggested many additional skills and topics that universities and colleges should teach. Content analysis clustered 163 responses into three broad categories: topics (59 percent of respondents); soft skills (31 percent); and practical skills (21 percent). Within each category, most responses clustered as follows:

- **Topics:** forest conservation and restoration (13.5 percent of all respondents who suggested topics, and 17 percent among teachers); forestry, silviculture and forest management (13 percent of all and 15 percent among students); social issues (22 percent among professionals); forest governance, policy and law (14 percent of teachers and 19 percent among professionals); economics and forest economics (11 percent of professionals); and community and social forestry (10 percent of teachers).

- **Soft skills:** communication skills (20 percent of all respondents who suggested soft skills; 45 percent of teachers who did); entrepreneurship (12 percent overall and 21 percent of students); and collaboration and teamwork (16 percent overall and 36 percent of teachers).

- **Practical skills:** Mapping, GIS and remote sensing (29 percent of respondents who suggested practical skills and 36 percent of students); and field skills (26 percent overall in this category).

(The data provided were not disaggregated by degree level, so this text is repeated in section 4.4.2 on master’s and doctoral degrees.)

4.4.1.1.3. External forest-related activities

Fewer than half of the teachers (41.9 percent) and professionals (42.9) said that bachelor’s students were either moderately or a lot engaged in forest-related activities outside of their degree programme (see Figure 60). However, among students, the reverse was true, with slightly more than half of the
respondents (54.4 percent) saying that they engaged in such activities moderately or a lot. In fact, slightly less than a quarter (22.8 percent) of the students said they did this a lot.

4.4.1.2. Educational resources and policy

4.4.1.2.1. Availability of resources

Figure 61 shows the extent to which survey respondents thought that four classes of resources were available in forest degree programmes. The four classes of resources were: educational environment; practical opportunities; teachers; and learning materials. A majority of each group of respondents said that each class of resources was moderately or very much available. These overall positive assessments ranged from 59.5 to 79.3 percent of each group of survey respondents, meaning that across all surveys and resource classes, 20.7–40.5 percent of respondents replied not at all or to a limited extent.

Across all assessments for all classes of resources, 22–41 percent of the respondents replied that resources were very much available, with the highest rating being that made by students of teacher resources. For no resource class did more than 5.1 percent of respondents say not at all. Overall, there were no notable differences among the responses from the different groups of survey respondents other than that students never replied “not at all”.

4.4.1.2.2. Supportive policies and strategies

Most teachers (92 percent) and professionals (79 percent) said that there were government policies or strategies that could improve forest education at the bachelor’s degree level (see Figure 62). More than half of each group (60 percent of teachers and 56 percent of professionals) said school policies or strategies existed, while slightly less than half of each group said there were school board policies or strategies.

4.4.1.3. Workplace readiness and employability

4.4.1.3.1. Part-time forest-related employment and internships

Only minorities of professionals (25.7 percent), teachers (43.7 percent) and the students (46.2 percent) said that part-time work or internships were moderately or very much available (see Figure 63). A quarter of students (25 percent) said such opportunities were not at all available. However, a majority of teachers (73.5 percent), students (71.4 percent) and professionals (60.3 percent) said such jobs and internships were moderately to very much beneficial to students’ learning, with 45.6 percent of teachers, 45.2 percent of students and 32.9 percent of professionals saying they were very much so.

4.4.1.3.2. Preparing students to enter the workforce

Most teachers (72.9 percent) said that bachelor’s forest programmes moderately or very much prepared students to enter the workforce (see Figure 64). A third of teachers (32.4 percent) said that this was very much true. Among students, however, only 15.7 percent said they were very much prepared to enter the
workforce, a third (35.3 percent) said they were moderately prepared and nearly half (47 percent) said they were prepared only to a limited extent or not at all. Professionals were similarly less convinced than teachers of the ability of bachelor’s programmes to produce graduates who were ready for the workforce. Just 12.4 percent thought graduates were very much prepared, while 45.8 percent of them thought graduates were prepared only to a limited extent or not at all. As one responded pointed out, “Most graduates now entering forestry come with an environmental management background, as opposed to practical forestry training, and often lack practical skills.”

4.4.1.3.3. Job prospects upon graduation

Only a third (32.5 percent) of the professionals said jobs were moderately or very much available to graduates of forest programmes at the bachelor’s degree level, and only 3.9 percent said very much available (see Figure 65). Teachers were more positive, with a small majority (54.1 percent) saying that jobs were moderately or very much available to graduates of their programmes. While some students were very positive, with 17.5 percent saying jobs were very much available, and 29.8 percent said they were moderately available, a slim majority (51 percent) said jobs were available only to a limited extent.

4.4.1.3.4. Impacts of gender and race or ethnicity on job prospects

A majority of the teachers (65.7 percent) and professionals (54.2 percent) said that a student’s gender was a factor in their ability to find a job only to a limited extent or not at all, with just over a quarter of each group saying not at all (see Figure 66). However, a fifth (19.4 percent) of the professionals said gender was very much a factor. Students were even more likely to say gender was a factor: 28.8 percent said moderately so and 26.9 percent said very much. Students were also the group most likely to say that gender influenced the kinds of jobs graduates were considered for: 30.2 percent said this was moderately the case, while 26.4 percent said it was very much the case. Professionals broadly agreed with the students’ assessment. Teachers, however, were more likely to say gender was an important factor (only 9.9 percent replied it was very much the case). Teachers, students and professionals were all far less likely to say that race or ethnicity affected job prospects and types of jobs than gender (see Figure 67).

Women were more likely than men to say that a student’s gender was moderately or very much a factor in a graduate’s ability to find a job; 56.2 percent of women said this, compared with 34.7 percent of men. The proportions of women and men who answered in this way was similar in all three groups of respondents.

Women were also more likely than men to say that a student’s gender influenced the kinds of jobs they were considered for either moderately or very much; 56.6 percent of women said this, compared with 39.1 percent of men. This disparity between the views of women and men was greatest among teachers, with 88 percent of the female respondents replying moderately or very much, compared with 37.3 percent of the male respondents in this group.

4.4.1.3.5. Availability of affordable professional training
Teachers and professionals were split between those who said affordable continuing education or training to update forest professionals’ skills was only available to a limited extent or not at all and those who said it was moderately or very much available (see Figure 68).

4.4.1.3.6. Gaps to fill

The survey asked an open-ended question about perceived gaps in education at the bachelor’s degree level. Respondents were most likely to mention gaps in practical knowledge and experience (33 percent of teachers, 49 percent of professionals and 59 percent of students). They generally spoke about a lack of relevant experience that left graduates unfamiliar with modern techniques and technologies and of a lack of field experience. Many respondents also specifically highlighted gaps in soft skills (32 percent of teachers, 21 percent of professionals and 16 percent of students), such as communication, project management, information technology, report writing, teamwork and language skills. A significant number of professionals (34 percent) spoke about gaps related to employment, such as lack of internships or work placements, weak links between universities and potential employers, a mismatch between what students learn and what the job market needs and a general lack of job opportunities. A final group of answers referred to gaps in the quality and quantity of teaching (14 percent of teachers, 11 percent of professionals and 16 percent of students), including outdated or otherwise inadequate curriculum (60 percent of this group of respondents) and a lack of quality teachers, teaching methods, software and equipment.

4.4.1.4. Digital readiness

4.4.1.4.1. Use and perceived value of digital tools

Digital tools were valued to a greater extent than they were used (see Figure 69). A majority of the students (51.8 percent) and teachers (66.2 percent) and half of the professionals (50.7 percent) said digital tools were used moderately or very much. About one quarter of students and teachers replied very much, compared with just 14.5 percent of professionals. Large majorities of students (77.8 percent), teachers (75 percent) and professionals (71.4 percent) said that digital learning tools can be moderately or very much a valuable supplement to forest education. Large proportions of students (50 percent), teachers (36 percent) and professionals (42.9 percent) replied they are very much valuable. Across all groups of respondents, more people said digital tools were very much valuable than said they were used very much.

When asked to explain their views on digital tools, respondents provided a range of responses that reflects the diversity of contexts across the region. Content analysis identified two main themes:

- **Examples of tools used (36 percent of respondents):** Respondents interpreted digital tools in widely divergent ways, with some focusing on Internet-based teaching and learning (87 percent of answers that mentioned uses), and others considering more practical applications of technology to aid research and analysis (24 percent), including GIS specifically (16 percent).

- **Concerns about digital tools (39 percent):** Two-fifths of respondents commented on limitations to the uptake and value of digital tools. Of them, 35 percent expressed doubts about the relevance of digital tools as opposed to practical experience of fieldwork; 32 percent cited a lack of resources needed to buy, maintain and use modern tools; and 12 percent mentioned challenges in Internet connectivity.
Figure 70 shows the digital tools that students and teachers said were in use and which tools professionals said were of use in the job market. The main finding is that professionals identified a job market need for experience with geospatial tools and digital tools for mill and field operations to a greater degree than either students or teachers said such tools were in use.

Students and teachers were asked which tools they would like to use more (see Figure 71). The most popular choices among teachers were online learning platforms (56.9 percent of responses), enhanced media, such as virtual reality (45.8 percent), and geospatial tools (40.3 percent). Among the students, the top choices were geospatial tools (72.4 percent), digital tools for mill and field operations (58.6 percent) and net-based research tools (58.6 percent).

4.4.1.4.2. Familiarity with digital learning environments

Respondents were asked to identify forest-related digital learning environments that they were familiar with. Results were broadly similar across all groups of respondents, with the most familiar options being the Global Forest Information System, the FAO elearning Academy and Forest Learning (see Figure 72). There was no digital learning environment for which more than 55 percent of any group of respondents reported familiarity.

4.4.1.5. General developments and trends in university- and college-level forest education

4.4.1.5.1. Enrolment trends

Nearly half of all teachers (46.3 percent) and more than a third (37.3 percent) of the professionals said enrolment in forest degree programmes had declined over the past decade (see Figure 73). Only 17.4 percent of teachers and 26.9 percent of professionals said enrolment had increased.

4.4.1.5.2. Understanding of the relevance of forests

Three-quarters (75.1 percent) of teachers said that bachelor’s programme graduates moderately or very much had sufficient understanding of the relevance of forests to emerging global trends and to the SDGs. A fifth (19.4 percent) of teachers replied it was very much the case. A much smaller majority (55.6 percent) of the professionals said this was moderately or very much true for bachelor’s programme graduates, and only 9.7 percent said it was very much so (see Figure 74).

When professionals were asked to elaborate, their replies included the following:

“Malaysia still focuses on traditional core forestry education, such as mensuration, growth and yield, wood technology, etc. Global policy trends are limited.”

“SDGs are simply not a huge topic in applied forestry.”

“Very limited implementation of the SDGs in New Zealand. Not mainstreamed.”
“When the education system and government management are inefficient, then personal interests take the place of national interests, and this is what happens in [the Islamic Republic of] Iran. Therefore, in such circumstances, sustainable development and its definitions will not have a place.”

4.4.1.5.3. Developments, initiatives or policies

The survey asked respondents to list any developments, initiatives or policy decisions that are improving or reducing the quality of forest education in universities and colleges. The responses of those who chose to comment on the bachelor’s programme education were evenly divided between improvements and reductions.

Several respondents highlighted a growing realization among governments and the wider society about the importance of forests, as reflected in national forest-related policies aligning social, ecological and economic goals.

Other trends reported:
- a few respondents mentioned mergers of forestry schools or faculties into schools or faculties of science or environmental science;
- some respondents said that universities, in their efforts to increase student enrolment, had compromised on the quality of teaching;
- some respondents said wider sectoral trends, such as a declining forest industry or government restrictions on logging, had diminished the need for forestry graduates; and
- several respondents said that reduced or inadequate budgets and a lack of qualified teachers were reducing the quality of education.

Other comments included:

“Institute of Forestry at the National University of Mongolia tries international networking and Asia–Pacific forestry network scholarships increased abroad [for] graduate studies.”

“Continuous acquisition of scientific equipment; improvement in Internet connectivity; certification of programme compliance implemented by the government; accreditation programmes; and support from local government units.”

“On paper, the implementation of the outcome-based education system and the Malaysian Quality Framework should lead to an improvement in the quality of forestry education; however, the focus seems to be more on the systems and documentation rather than delivery.”

“Delegation of management decisions to universities; financial self-reliance mechanism; close collaboration between universities and the forestry and relevant industry, potential employers.”

“Increased investment from government sector on R&D activities.”
“The main development is the number of webinars were very supportive and improving education; the initiative is also done by holding online apprenticeships in various forest management units spread [across] Indonesia so that the student insight is expanded.”

“The trend of forestry training globally is swayed towards social forestry, whilst many technical aspects of forestry training are becoming very expensive to undertake. Many timber and forestry training companies in the region are closing or are unsustainable, as fewer students are able to meet the cost of training.”

4.4.1.5.4. Negative perceptions of forestry

Several respondents said that forestry had a negative public image and that this affected forest education. Examples from responses to open-ended questions include:

“Forestry needs to raise its profile as a well-regarded occupation to attract high quality students.”

“Bad publicity on forestry.”

“Forestry related courses have not been popular.”

“Forestry is not popular in Malaysia, and is deemed an 'unwanted course' most of the time… Forestry is not [seen to be] professional like lawyer, doctor, engineer, etc.”

4.4.1.5.5. Numbers of women graduates

A majority of the teachers (64 percent) and professionals (66 percent) said that the number of women graduates from bachelor’s programmes was increasing, while just 11 percent of teachers and 13 percent of professionals said the rate was decreasing.

4.4.2. Master’s and doctoral degree levels

The following is based on responses from 55 professionals, 43 teachers and 41 students. The relevant charts are in section 8.5 of the Appendix.

4.4.2.1. Education content and competencies

4.4.2.1.1. Coverage of forest topics

Figures 75–82 show the extent to which respondents said tertiary courses covered each of 30 forest-related topics at the master’s and doctoral degree levels. The proportion of all topics for which a majority of each group rated coverage as inadequate varied from 22.5 percent of topics for students to 41 percent of topics for teachers and 40 percent for the professionals. Overall, 46 percent of all ratings by the professionals across 27 categories were “inadequate”. This compares with 46.2 percent of ratings by teachers and 40.2 percent of ratings by students.
A majority of teachers said coverage of the following topics was inadequate: entrepreneurship (77.8 percent of respondents); forest, trees and race or ethnicity issues (72.1 percent); small-scale forest enterprise (wood and non-wood) (66 percent); range management (62.5 percent); forests, trees and gender issues (61.9 percent); forest fire management (59.5 percent); forest industry, marketing and management (55.6 percent); forests and human health (52.2 percent); forest genetic resources (51.2 percent); and wildlife management (51.1 percent).

A majority of the students said coverage of the following topics was inadequate: entrepreneurship (65.7 percent of respondents); forests, trees and gender issues (61.8 percent); forest, trees and race or ethnicity issues (61.8 percent); urban forestry (54.1 percent); and wood as renewable energy (51.4 percent).

A majority of the professionals said coverage of the following topics was inadequate at the master’s and doctoral degree level: forests, trees and gender issues (73.6 percent); urban forestry 72.7 percent); forest, trees and ethnicity issues (71.7 percent); entrepreneurship (67.3 percent); small-scale forest enterprise (wood and non-wood) (66.1 percent); forests and human health (64.9 percent); traditional and/or indigenous forest-related knowledge (64.3 percent); cultural values of forests and trees (62.5 percent); forest landscape restoration (57.1 percent); wood as renewable energy (52.7 percent); forest-based recreation (51.8 percent); and forest industry, marketing and management (50.9 percent).

The topics that two-thirds or more of teachers said were sufficiently covered were: forest ecology (76.6 percent); forest biodiversity (73.5 percent); silviculture (68.2 percent); and forest conservation (67.4 percent).

The topics that two-thirds or more of the students said were sufficiently covered were: forest conservation (78.4 percent) and forests and climate change (68.4 percent). The topics that two-thirds or more of the professionals said were sufficiently covered were: forest soils (70.2 percent); watershed management (67.9 percent); forest biodiversity (67.8 percent); and forest conservation (66.1 percent).

Topics that more than 15 percent of students thought were excessively covered were: silviculture (21.6 percent); forest conservation (20.5 percent); and forests and climate change (15.8 percent). Topics that more than 15 percent of teachers thought were excessively covered were: forest conservation (19.6 percent) and silviculture (15.9 percent). Topics that more than 15 percent of professionals thought were excessively covered were: wildlife management (16.3 percent) and silviculture (15.2 percent).

4.4.2.1.2. Additional topics and skills to cover

In response to an open-ended question, each group of respondents suggested many additional skills and topics that universities and colleges should teach. Content analysis clustered 163 responses into three broad categories: topics (59 percent of respondents); soft skills (31 percent); and practical skills (21 percent). Within each category, most responses clustered as follows:

- **Topics**: forest conservation and restoration (13.5 percent of all respondents who suggested topics and 17 percent among teachers); forestry, silviculture and forest management (13 percent of all and 15 percent among students); social issues (22 percent among the professionals); forest
governance, policy and law (14 percent of teachers and 19 percent among professionals); economics and forest economics (11 percent of professionals); and community and social forestry (10 percent of teachers).

- **Soft skills**: communication skills (20 percent of all respondents who suggested soft skills and 45 percent of teachers who did); entrepreneurship (12 percent overall and 21 percent of students); and collaboration and teamwork (16 percent overall and 36 percent of teachers).
- **Practical skills**: mapping, GIS and remote sensing (29 percent of respondents who suggested practical skills and 36 percent of students) and field skills (26 percent overall in this category).

(The data provided were not disaggregated by degree level so this text is repeated from section 4.4.1 on bachelor’s degrees.)

### 4.4.2.1.3. Forest-related activities outside of school

Fewer than half of the teachers (45.7 percent) and slightly less than a third of the professionals (29.6 percent) said that master’s or doctoral students were either moderately or a lot engaged in forest-related activities outside of their degree programme (see Figure 83). However, among students, the reverse was true, with slightly more than half of respondents (56 percent) saying that they engaged in such activities moderately or a lot. In fact, just less than a quarter (24.4 percent) of the students said they did this a lot.

### 4.4.2.2. Educational resources and policy

#### 4.4.2.2.1. Availability of resources

Figure 84 shows the extent to which the survey respondents said that four classes of resources were available in master’s and doctoral forest degree programmes. The four classes of resources were: educational environment; practical opportunities; teachers; and learning materials. A majority of each group of respondents said that each class of resources was moderately or very much available. These overall positive assessments ranged from 61.1 percent to 80.5 percent of each group of survey respondents, meaning that across all surveys and resource classes, 19.5–37.9 percent of respondents replied not at all or to a limited extent.

Across all assessments for all classes of resources, 17.2–53.7 percent of respondents replied that resources were very much available, with the highest rating by students in reference to teacher resources. For all four classes of resources, a considerably smaller proportion of professionals (average 22 percent) replied that resources were very much available, compared with teachers (average 39.5 percent) or students (average 46.3 percent). For no resource class did more than 6.1 percent of respondents say not at all.

#### 4.4.2.2.2. Supportive policies and strategies

Most teachers (74 percent) and professionals (75.9 percent) said that there were government policies or strategies that could improve forest education at the master’s and doctoral degree levels (see Figure 85). Two-fifths of teachers (40 percent) and 44.8 percent of professionals said school policies or strategies
existed, while just around a third of professionals (34.5 percent) and a quarter of teachers (24 percent) said there were school board policies or strategies.

4.4.2.3. Workplace readiness and employability

4.4.2.3.1. Part-time forest-related employment and internships

Only a minority of professionals (19.2 percent), teachers (31.9 percent) and students (27.8 percent) said that part-time work or internships were moderately or very much available (see Figure 86). A large portion of the students (30.1 percent) and professionals (26.3 percent) said such opportunities were not at all available. However, a majority of the teachers (68.2 percent), students (66.7 percent) and professionals (53.6 percent) said such jobs and internships were moderately to very much beneficial to students’ learning, with 52.2 percent of teachers, 46.7 percent of students and 30.4 percent of professionals saying they were very much so.

4.4.2.3.2. Availability of affordable professional training

Teachers and professionals were both split between those who said affordable continuing education or training to update forest professionals’ skills was only available to a limited extent or not at all, and those who said it was moderately or very much available (see Figure 87).

4.4.2.3.3. Preparing students to enter the workforce

Most teachers (69.4 percent) thought that master’s and doctoral forest programmes moderately or very much prepared students to enter the workforce (see Figure 88). A third of the teachers (32.7 percent) said that this was very much true. Among the students, 44.7 percent said they were very much prepared to enter the workforce, while a third (34.2 percent) said they were moderately prepared, and a fifth of them (21.1 percent) said they were prepared only to a limited extent or not at all. Professionals were generally less convinced of the ability of master’s and doctoral programmes to produce graduates ready for the workforce. Just 15.8 percent thought graduates were very much prepared, while half of the professionals (50.9 percent) thought graduates were prepared only to a limited extent or not at all.

4.4.2.3.4. Job prospects upon graduation

Nearly a third (27.3 percent) of the professionals said jobs were moderately or very much available to graduates of forest programmes at the master’s and doctoral degree levels, and only 1.8 percent said jobs were very much available (see Figure 89). Teachers were more positive, with a majority of them (57.4 percent) saying that jobs were moderately or very much available to graduates of their programmes. Close to a quarter of teachers (23.4 percent) replied that jobs were very much. Among the students, however, 60.5 percent said jobs were available only to a limited extent or not at all.
4.4.2.3.5. Impacts of gender and race or ethnicity on job prospects

Among the teachers, professionals and students, respondents were divided in their views of whether a student’s gender was a factor in their ability to find a job. In each case, however, a small majority replied that it was only to a limited extent or not at all (see Figure 90). A small majority (56.1 percent) of teachers said that gender either moderately or very much influenced the kinds of jobs graduates were considered for. Far fewer professionals (37 percent) and students (34.2 percent) agreed, with half of the students saying gender was not a factor at all. Teachers, students and professionals were all far less likely to think that race or ethnicity affected job prospects and types of jobs than gender (see Figure 91).

Women (at 56.2 percent) were more likely than men (at 34.7 percent) to say that a student’s gender was moderately or very much a factor in a graduate’s ability to find a job. The proportions of women and men who answered in this way were similar in all three groups of respondents.

Women (at 56.6 percent) were also more likely than men (at 39.1 percent) to say that a student’s gender either moderately or very much influenced the kinds of jobs they were considered for. This disparity between the views of women and men was greatest among teachers: 88 percent of the women replied moderately or very much, compared with 37.3 percent of the men.

4.4.2.3.6. Gaps to fill

The survey asked an open-ended question about perceived gaps in education at the master’s or doctoral degree levels. Respondents mostly mentioned gaps in practical knowledge and experience (39 percent of teachers, 47 percent of professionals and 52 percent of students). Many respondents also highlighted gaps in soft skills (24 percent of teachers, 14 percent of professionals and 13 percent of students), such as communication, leadership, management and language skills. A significant number of professionals (44 percent) spoke about gaps related to employment, with two-thirds of them saying that students were not acquiring the knowledge and skills that employers need. Students and teachers also made this point, and students in particular pointed out the lack of internships or other opportunities to gain workplace experience.

4.4.2.4. Digital readiness

4.4.2.4.1. Use and perceived value of digital tools

Digital tools were valued to a greater extent than they were used (see Figure 92). A majority of the students (61 percent) and teachers (70 percent) but slightly less than half of the professionals (48 percent) said digital tools were used moderately or very much. Nearly half of all the students (46.3 percent) and a fifth of the teachers (22 percent) said they were very much used, compared with just 14.8 percent of the professionals. A large majority of the students (83 percent), teachers (80 percent) and professionals (76 percent) said that digital learning tools can be moderately or very much a valuable supplement to forest education. A large proportion of students (58 percent), teachers (48 percent) and professionals (51 percent) replied that they are very much valuable. Across the three groups of respondents, more people said digital tools were very much valuable than said they were used very much.
4.4.2.4.2. Further views of digital tools

When asked to explain their views on digital tools, respondents provided a range of responses that reflects the diversity of contexts across the region. Content analysis identified two main themes:

- **Examples of tools used (51 percent of respondents):** Respondents interpreted “digital tools” in widely divergent ways, with some of them focusing on Internet-based teaching and learning (48 percent of answers mentioned uses) and others considering more practical applications of technology to aid research and analysis (36 percent), including GIS specifically (21 percent).

- **Concerns about digital tools (29 percent):** Two-fifths of the respondents commented on limitations to the uptake and value of digital tools. Of them, 47 percent expressed doubts about the relevance of digital tools as opposed to practical experience of fieldwork; and 26 percent cited a lack of resources needed to buy, maintain and use modern tools, while 11 percent mentioned challenges in Internet connectivity.

Figure 93 shows the digital tools that students and teachers said were in use and which tools professionals said were of use in the job market. The main finding is that the professionals identified a job market need for experience with geospatial tools, enhanced media (such as virtual reality) and digital tools for mill and field operations to a greater degree than students said such tools were in use. Contradicting this, the proportion of teachers who said that the latter two tools were in use was greater than the proportion of professionals who said experience of such tools had value in the job market.

Students and teachers were asked which tools they would like to use more (see Figure 94). The most popular choices among teachers were geospatial tools (19 percent), online learning platforms (16 percent of responses) and net-based research tools (13 percent). Among the students, the top choices were net-based research tools (18.5 percent), geospatial tools (14 percent) and enhanced media (14 percent).

Respondents were asked to identify forest-related digital learning environments that they were familiar with. Results were broadly similar across all groups of respondents, with the most familiar options being the Global Forest Information System, the FAO elearning Academy and Forest Learning (see Figure 95).

4.4.2.5. General developments and trends in university- and college-level forest education

4.4.2.5.1. Enrolment trends

The proportion of teachers who said enrolment in forest degree programmes had declined over the past decade (29.8 percent) was the same as those who said enrolment had increased (see Figure 96). Among the professionals, similar proportions also said enrolment had declined (35.8 percent) or had increased (34 percent).

4.4.2.5.2. Understanding of the relevance of forests

A majority of teachers (68 percent) said that master’s and doctoral graduates had a moderate or very much sufficient understanding of the relevance of forests to emerging global trends and to the SDGs (see Figure 97). A quarter (24 percent) of the teachers said it was very much sufficient. By contrast, only half
of the professionals said this was moderately or very much true for these graduates, and only 1.8 percent said it was very much so. See section 4.4.1.5.2. for some responses that professionals gave when asked to elaborate.

### 4.4.2.5.3. Developments, initiatives or policies

The survey asked respondents to list any developments, initiatives or policy decisions that are improving or reducing the quality of forest education in universities and colleges. The responses of those who chose to comment on the education situation at the master’s or doctoral degree level were evenly divided between improvements and reductions, and they were largely similar to those in section 4.4.1.5.3 (on the situation for bachelor’s degree programmes).

### 4.4.2.5.4. Negative perceptions of forestry

Several respondents said that forestry had a negative public image and that this affects forest education, such as:

- “Forestry is becoming more unpopular to prospective students. Generally, people seem to think that forestry is not a rewarding career.”

- “Due to the mainly negative perception of forestry within Australian society, forestry education suffers from the lack of funding and popularity.”

### 4.4.2.5.5. Numbers of women graduates

A majority of teachers (52 percent) and professionals (63 percent) said that the number of women graduates from master’s and doctoral programmes was increasing, while 6.5 percent of teachers and 13 percent of professionals said the rate was decreasing.
5. DISCUSSION

5.1. Primary and secondary school levels

The survey revealed a widespread perception that forests do not feature enough in primary and secondary school education. A large majority of teachers and professionals want this gap to be filled either by introducing stand-alone forest subjects or by mainstreaming forest-related topics into a broad range of subjects across the curriculum.

The topics that respondents most often said primary and secondary schools should cover more included: the importance and values of forests, forest ecology and biodiversity, threats to forests and forest conservation, forests and climate change, forestry and forest management, and forest livelihoods, products and value chains.

The survey also revealed a lack of resources needed to support effective forest education. Although most teachers felt confident in their abilities to teach about forests, many teachers and professionals highlighted a need to improve teaching resources, including with teacher training and use of online materials.

The survey findings indicate that the use of forests as teaching environments remains limited in Asia and the Pacific. For example, 75 percent of teachers said that exposure to forests moderately or very much increases primary schoolchildren’s learning, but only 12 percent of teachers said that forests are either moderately or very much used as a teaching environment at the primary school level. At the secondary school level, respondents said the situation was only marginally better.

The survey findings also show that most primary school students engaged in forest-related activities through out-of-school activities to a limited degree. While secondary school students were reportedly more likely than primary school students to engage in such activities, this was still infrequent. Some respondents highlighted challenges to increasing the exposure of students to forests, such as a lack of visitor centres in forests or that field trips and other outdoor activities do not contribute to grades and so they provide little incentive for participants.

The missed opportunities to foster interest in forests from an early age were well recognized by the survey respondents. The survey asked them to name three actions that would have the greatest impact on improving students’ knowledge and appreciation of forest and forest-related subjects. For both primary and secondary schools, the most common responses were about increased activities in forests and nature. Among other things, they suggested outdoor teaching, running forest camps and field trips, setting up nature clubs and tree-planting activities.

One respondent from India called for the “rejuvenation” of the National Green Corps.8 This scheme, managed by the Ministry of Environment and Forests, led to 120 000 schools forming nature clubs and undertaking activities relating to the environment. Another respondent, in Australia, highlighted a new

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initiative called Millennium Kids Green Lab, which is “a project-based youth-led citizen science and urban forest stewardship initiative”.9

The benefits of outdoor learning and forest-school approaches for children’s development and learning are increasingly well documented; see Kim and Choi (2018) for a recent example from the Republic of Korea. However, there can be big differences among outdoor learning models and outcomes. Inoue et al. (2019) found, for example, that Japan’s national guidelines on nature-based activities to promote child development “fall short on matters of global sustainability, environmental issues, environmental education or education for sustainability”. Inoue et al. also noted limitations to Australian guidelines in these areas and concluded that “forest kindergartens” and Swedish skogsmulle outdoor programmes offer more potential.

In the context of the previous findings, it is not surprising that the survey respondents indicated fairly low levels of interest among primary school students in learning more about forests. The respondents were divided in their views about the extent to which secondary school education increased student interest in learning more about forests. While some were positive, others highlighted structural barriers, such as a lack of adequate teachers, an inadequate curriculum and a lack of positive images of forest-related career opportunities.

Several survey respondents highlighted the importance of educating primary and secondary schoolchildren about the value of forests to generate interest about potential future careers in forest-related jobs. For example, to open-ended questions respondents replied:

“Inculcate a strategy of ‘catch them young’ and ‘greening of mindsets’ at the very early stages of child development.”

“Showcasing success stories and on-ground project activities on the importance of forests will greatly motivate and enhance the sense of responsibility for forest conservation and career development.”

“[We] need to inject the topic ‘forestry’ into the minds of the students because they have not heard about it. They might know some basic functions of trees, but they might not know they could make forestry a profession.”

5.2. TVET level

The survey revealed widespread perceptions of insufficient coverage of forest-related topics in TVET programmes, with teachers generally more likely than professionals to say coverage of a given topic was inadequate.

Respondents reported a widespread lack of resources needed to support effective forest education in TVET programmes. While most professionals said that the quality and quantity of teachers was lacking, only a minority of teachers agreed. Most teachers were confident in their ability to teach about forests.

The survey findings show that most TVET students do not engage often in forest-related activities through out-of-school activities. There was, however, broad recognition among teachers and professionals of the value of such experiences to a student’s knowledge of forests. Internships or part-time jobs related to forests are also rare, but their potential to increase students’ learning is widely recognized.

The same can be said of digital learning tools. While respondents generally valued such tools, most reported only limited use of them. Many respondents highlighted barriers to the use of digital tools. Many of them also viewed such tools as having limited potential for teaching and learning about practical aspects of forest-related subjects.

Respondents were divided in their views of the extent to which TVET programmes prepared students to enter the workforce. A notably small proportion of teachers indicated that TVET graduates were familiar with the relevance of forests to global issues and the SDGs. Affordable professional training or continuing education was only patchily available, and most teachers said there were few jobs available for TVET graduates. Teachers and professionals were both more likely to say that gender affected a graduate’s job prospects than say that race or ethnicity did.

The topics that respondents most often said TVET programmes should cover related to uses and values of forest beyond the supply of timber. Other areas of focus were business skills, practical skills, soft skills and training on working with communities living in or near forests.

Asked to identify gaps to fill in TVET education, respondents were more likely to suggest a lack of practical training and field experience, weak alignment of TVET courses with the needs of the job market, outdated curricula, a lack of teaching resources and a lack of career development opportunities such as internships.

These results generally conform with the descriptions of TVET forest education made by Gabay and Rekola (2019), who included a useful case study of the situation in Viet Nam.

5.3. University and college levels

The survey respondents identified many of the patterns and trends discussed in more detail by RECOFTC and the ASEAN Working Group on Social Forestry (2020), Brack (2019), Gabay and Rekola (2019), Jegatheswaran et al. (2018), Bhat (2005) and others. It is notable, however, that the study by RECOFTC and the ASEAN Working Group, which focused on social forestry education in seven countries in Southeast Asia, was generally much more positive than this study. This may reflect the growing government support for social forestry and resulting job opportunities in those countries. That study found, for example, that most social forestry graduates find work and that employers rate them highly.
The present survey revealed divergent views on how well bachelor’s programmes cover forest-related topics, with professionals generally more likely than teachers to say coverage of a given topic was inadequate. Three topics for which all three groups of respondents said coverage was inadequate – when presented with a list from which to choose – were gender and forests, race or ethnicity and forests, and entrepreneurship.

Participants in the regional consultation elaborated on some of these topics. For example, in relation to gender, one person said: “The first step is to focus on increasing the number of women studying and teaching in forestry education. But we need to go beyond this, too. We need men [who are leaders in the field] to understand that gender is not just about women and increasing their numbers but that gender is a system of power [and it is] about shifting paradigms and patriarchy issues. Gender should not just be a subfield of a curriculum; it has to be mainstreamed as a core part of every course.”

In relation to entrepreneurship, survey respondents and consultation participants highlighted a role for forest education in producing graduates capable of developing forest-based enterprises. This included developing entrepreneurial mindsets and business skills, such as negotiation, marketing, product development, supply chain analysis and management. This would require capacity-building to change the mindsets of teachers as well as new linkages with other disciplines (such as vocational schools or university business departments) and with private companies.

The survey also asked respondents to suggest other topics that bachelor’s degree programmes should cover. Common answers included forest conservation and restoration; forestry, silviculture and forest management; social issues; forest governance, policy and law; economics and forest economics; and community and social forestry. There was also high demand for more training in GIS, remote sensing and more practical fieldwork. Among soft skills, priorities included communication, entrepreneurship and collaborative working.

As one participant in the consultation noted, “Formal forest education only focuses on the key technical skills, while in a working environment the practical skills [facilitation and communication] and understanding of social issues [gender, social inclusion and forest governance] are also necessary.”

At the master’s and doctoral degree levels, the teacher, professionals and (to a lesser extent) student respondents considered coverage of several specific forest-related topics to be inadequate, often by large a majority. For a small number of topics, the survey respondents thought that coverage was sufficient or even excessive. The topics that respondents most often said master’s and doctoral degree programmes should cover more thoroughly included forest conservation and restoration; forestry, silviculture and forest management; social issues; forest governance, policy and law; economics and forest economics; and community and social forestry. As at the bachelor’s degree level, there was high demand for more training in soft skills and in GIS and remote sensing as well as for more practical fieldwork.

Participants in the regional consultation highlighted reasons for inadequate experience of forests and of practical work in forests among university graduates. One, from the Philippines, said students are deterred from doing fieldwork in forests due to a complicated and time-consuming process required for security reasons. Another, from Myanmar, said that the main issue is that their university had increased forestry
student numbers. “Thirty years ago, there were probably 50 students in each intake studying forestry, and they were able to spend up to three months per year in the field,” the person explained. “Nowadays, there are up to 200 students in each intake. Many of them only get to do two weeks of fieldwork per year.”

One approach to boosting forest exposure is the university forest model used in China (Liu, 2018) and Japan (Owari et al., 2018). Beijing Forestry University, for example, manages a forest of 795 hectares that students from 30 different courses at the university use for fieldwork (Liu, 2018). Several other universities in Beijing make use of this resource, with 3,600 of their students using the forest for fieldwork in 2015. More than 2,000 primary and secondary school students also visit the forest each year, as do 200,000 members of the public, who use the forest for recreation. Through recreation activities, the forest generates US$ 360,000 each year for the university. The ability of university forests to generate finance that could be used to support forest education indicates that this model deserves attention elsewhere in the region.

Respondents were generally positive about the availability of resources needed to support effective forest education at the university or college level, but a sizable minority of each group of respondents indicated that there were big resource gaps. “A challenge to overcome is to increase funding and resources to forestry education, which includes funding to train students on using new technologies,” said one participant in the consultation. Another explained, “Universities lack the resources to purchase modern technology [such as GIS and drones], and students need practical skills using this technology in the field.” These views echo those of Jegatheswaran et al. (2018), who warned that “without funding to improve facilities, changes in the curricula will be meaningless, as potential forestry graduates will lack the necessary hands-on skills required in the job marketplace.”

While many respondents reported the use of digital learning tools, large proportions of them said they valued such tools, indicating a gap between desire and actual use. As at the TVET level, many respondents voiced concern about the uptake and value of digital tools, including a lack of resources needed to use such tools and inadequate Internet connectivity.

Although the survey asked about the situation before the COVID-19 pandemic, many respondents referred to ways in which the pandemic had led to increased use of digital tools and to the challenges that had arisen. One participant in the regional consultation said a university in Myanmar had launched a new online course on environmental science to enable learning to continue. Problems arose, however, because of the high-speed Internet needed to run the course and the lack of available funding or government support.

Overall, professionals were far less likely than teachers or students to say that digital learning tools were in use at the master’s or doctoral degree level. This may appear to indicate that the professionals are out of touch with current practices in universities. However, it may indicate instead that the professionals were more likely than the other respondents to interpret digital tools as meaning practical tools, such as geospatial tools, rather than online teaching tools.

This is supported by the finding that professionals identified a job market need for experience with geospatial tools, enhanced media tools and other digital tools for mill and field operations to a greater
degree than what students (and teachers at the bachelor’s degree level) said such tools were used in their educational settings. These tools were among those that students and teachers at the bachelor’s degree level said they wanted to use more.

Most respondents indicated that there are few available internships or part-time jobs related to forests, but they widely recognized the potential of such opportunities to increase students’ learning. The survey findings also show that out-of-school forest-related activities are popular among students at the bachelor’s, master’s and doctoral degree levels. Teachers and professionals were less likely to perceive this than students were to say it.

In contrast to the findings at the secondary school and TVET levels, most teachers indicated that graduates of bachelor’s, master’s and doctoral programmes were familiar with the relevance of forests to global issues and to the SDGs.

Most teachers also said that graduates of these programmes were prepared to enter the workforce. Students (at the bachelor’s degree level) and professionals (referring to bachelor’s, master’s and doctoral degree levels) were less confident in this. Given that this latter group of respondents is the best proxy for the job market, this is a notable difference. Professionals also had the greater proportion of responses (to an open-ended question) indicating that university programmes were not matched to workplace needs.

In the regional consultation, for example, an employer from a large international forestry company noted that employers struggle to recruit qualified foresters and so must look for international candidates or provide employees with additional training. A representative from an international non-profit organization said that two major skills lacking among job candidates in Viet Nam are English and practical experience.

Asked to identify gaps in bachelor’s, master’s and doctoral programmes, survey respondents were most likely to suggest a lack of practical training and field experience, weak alignment of degree courses with the needs of the job market, gaps in soft skills essential in professional settings, outdated curricula, a lack of teaching resources and a lack of internships or other opportunities to gain workplace experience.

Most professionals also indicated that there were few jobs available for graduates. Again, teachers had a different view, with most saying that jobs were available.

5.4. Interdisciplinarity and formal forest education

5.4.1. Alternative visions of forest education

A large part of the regional assessment focused on the scope and content of forest education. Many survey respondents and consultation participants spoke of the need to strengthen technical skills as well as business knowledge and soft skills. Many of them also highlighted a desire for forest education to broaden its scope and encourage interdisciplinary thinking, particularly at the landscape scale.

Some comments from the consultation are illustrative:
“There is a need to integrate climate change, biodiversity into forest education and broaden the curriculum beyond forests and trees into the landscape.”

“It is necessary for the universities to look holistically beyond the forest and link forest education with global initiatives [such as REDD+ and FLEGT voluntary partnership agreements], social issues [gender, social inclusion and forest governance], bioeconomy and enterprise, and community forestry. This will help broaden the forest student job opportunity into wider sectors.”

“There is a need for a paradigm shift from conventional perception that forestry is about trees and forests with no people to be more inclusive with the interaction of people and forests together.”

“The connections of forests with other sectors inside the landscape are too vast to ignore.”

“Forestry education needs to be more holistic and interdisciplinary. Different educational systems should communicate more and collaborate with the forestry sector to update forestry and environmental curricula.”

“The teachers and curriculum developers and reviewers should change their mindset of forest education from ‘conservative’ and ‘technical-knowledge based’ to ‘co-managed’ and ‘technical, practical and soft skills-based’.”

But others questioned whether broadening curricula in this way would produce only generalists rather than specialist graduates. There were some concerns that forestry, in the traditional sense, risks being left behind as forest education develops.

As one participant commented, “[We] need to find a balance in the incorporation of social components with forestry. While training of foresters in social dimensions is essential, the technical spine on which forestry hangs should not be lost. The social side is only half of the equation. We must ensure that technical forestry and forest management knowledge is retained and strengthened. This then needs to be expanded to the landscape level, where both the social and technical elements come together.”

The survey did not ask any question on whether “forestry” should continue in its own right and/or in its own faculty or whether it should be integrated into faculties and disciplines that are more broadly interdisciplinary. Several survey respondents mentioned, however, that such mergers had taken place or were under way, as has been reported elsewhere (Brack, 2019). The findings here highlight a need for continuous exchange among employers and educational institutions to ensure that forest education can stay abreast of trends and produce the kind of graduates that employers need.

5.4.2. Women in forest education and forest jobs

The survey asked teachers and professionals whether the number of women graduating from TVET, bachelor’s, master’s and doctoral programmes was increasing, decreasing or remaining stable. In each case, a majority of respondents said the number of women graduating was increasing. And in each case, no more than 13 percent of respondents said that the number was decreasing.
But as one participant in the regional consultation pointed out, while the numbers of women students and faculty are increasing, “leadership roles are still male-dominated. Social norms [favouring male power relations and women’s traditional roles] are still prevalent.”

The survey also asked how much a graduate’s gender was a factor in their ability to find a job. Respondents were divided in their views, but in most cases, a concerningly large proportion of respondents said gender was moderately or very much a factor. In the case of teachers responding about the TVET level and students responding about the bachelor’s degree level, a majority agreed.

In most cases, an even larger proportion of respondents said that gender was a factor in the types of jobs graduates were offered. These views were particularly evident at the TVET level and somewhat less so at master’s or doctoral programme level. These results are open to interpretation, but they become more interesting when the answers given by women and men are disaggregated.

Commenting on both TVET and university levels, a majority of women said that a graduate’s gender either moderately or very much affected both their chances of getting a job and the types of jobs they were offered. In each case, a greater proportion of women than men said this. And in three of the four cases, only a minority of men said this. These findings indicate very different experiences and perceptions among women and men and highlights the need for all actions recommended in this report to consider gender.

### 5.4.3. Negative perceptions of forest jobs

Many survey respondents and consultation participants indicated that forest jobs suffer from a bad image, which some blamed for declining enrolment in forest education or interest in forest careers, as reported previously by Brack (2019) and van Lierop (2003), among others.

“In Indonesia, the image of forestry is that it is not an important job,” said one consultation participant. “Most forestry graduates don’t work in the forestry sector but diversify to other jobs, such as banking.” Others in the survey and consultation said forest jobs were often perceived to be poorly paid, dangerous – especially for women, or less professional than work in other sectors.

Suggestions for improving the image of forest jobs made during the consultation included increasing job opportunities in the forestry sector. Building links between universities and employers and community forestry groups “increase student interest and pride to work in the forestry sector”.

### 5.4.4. Integration of traditional knowledge into forest education

Answers to open-ended survey questions and contributions made in the regional consultation highlight a need to integrate traditional knowledge into formal forest education. Respondents and consultation participants spoke of the potential contributions of ancient knowledge to modern science in sustainable resource management, adaptation to climate change, food and agriculture, and medicine.
“Myths regarding traditional knowledge cause marginalization of traditional practices,” said one participant in the consultation. “The general public needs to become more aware of what traditional knowledge can offer to advance forestry, and [traditional knowledge should] be elevated to the same level as scientific knowledge.”

“Our curricula remain very much Western-centric and retain some of the logic-based reductionist philosophies that have led to many of the existing problems,” said another participant. “The curriculum should be revised in such a way that it draws upon the wellspring of locally relevant indigenous knowledge and experience.”

“It’s important for traditional knowledge to be documented so that it is not lost or forgotten,” said another person. “Knowledge is slowly being lost, forgotten, as it is orally transmitted and this causes it to be less accessible and also deemed less important. There is a need to regain experts and knowledge holders in the community to help transfer the knowledge to younger generations.”

5.5. Informal, non-formal and continuing education

5.5.1. Informal and non-formal forest education

Non-formal education is structured learning that takes place outside of a formal educational structure. Examples of non-formal forest education include webinars, podcast series and the massively open online courses, which may involve university input but do not necessarily meet International Standard Classification of Education standards (Brack, 2019). Informal education is that which people acquire through everyday life. It could include seeing a television documentary or newspaper article about forests, hearing traditional tales in childhood homes, visiting a museum exhibition or being in a forest in the company of a knowledgeable guide.

Although no survey respondent mentioned the terms “informal” or “non-formal” education, many of them referred in general terms to the benefits of online courses, webinars and YouTube videos. Non-formal forest education is relevant to students who are also engaged in formal forest education. For example, it may be particularly important to people who are participating in community forestry and want to learn about forest management, forest product development and marketing and related issues.

Given the concerns that some respondents raised about the viability of digital learning tools in their context and about language barriers, it is clear that access to such resources is uneven. This highlights the need to have locally appropriate solutions, to address digital divides and to consider alternatives to Internet-based informal learning, such as community radio stations.

This can include formal educational institutions directly participating in informal education through media outreach and other forms of public communication. A participant at the regional consultation cited the example of Ateneo de Manila University in the Philippines, which encourages field trips through nature walks and focusing on folklore stories about trees and forests. “It’s a good starting point for appreciation for forests, for urban communities (school kids) and also the faculty,” the participant added. “Informal learning can increase awareness and appreciation among the general community.”

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As Brack (2019) pointed out, informal and non-formal education “now forms the majority of the ‘education’ that people receive on forestry and the environment”. This is a reminder that any efforts to reform or revitalize formal forest education in Asia and the Pacific should be accompanied by efforts to boost informal and non-formal education. One benefit of such an approach is that along with reaching future holders of forest-related jobs, it would also help to build broader societal appreciation of the values of forests and of those jobs.

But as Brack also pointed out, “non-formal and informal education cannot easily be monitored, and even truth-checking is limited”. This highlights a need for quality controls and for curation of information and resources by knowledgeable educators and forest experts.

5.5.2. Continuing education

Many respondents indicated that affordable professional training was in short supply. However, many others were more positive about the availability and affordability of such training. Some of the responses to an open-ended question about the accessibility of continuing education made brief references to affordable schemes administered by government agencies and other organizations. This suggests there are important lessons and experiences to share among countries in the region. However, this is beyond the scope of the present study.
6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

At the XII World Forestry Congress in Quebec City in 2003, several experts spoke about the state of forest education (IISD, 2003). Jeannette Gurung, then with the International Centre for Tropical Agriculture, called for the institutionalization of gender equity in the forestry sector. Juan Pulhin, with the College of Forestry and Natural Resources in the Philippines, said a shift towards participatory forest management requires an academic forestry curriculum that incorporates social dimensions. And Pieter van Lierop of FAO (2003) noted, “While some forestry training or education institutes are struggling to survive and others will stop to exist, others seem to be able to survive by adapting to new demands.”

Eighteen years later, the picture remains remarkably similar – at least in Asia and the Pacific, according to the surveys and consultations reported here. What is different now, as forests rapidly ascend political agendas, is that there is a perhaps greater opportunity than ever before to ensure that forest education gets the attention it needs.

What happens to forests in this decade to 2030 will significantly influence global progress in tackling the climate and ecological emergencies and in achieving the SDGs. For forests to fulfil their potential, it will be essential to have workforces that can effectively manage, use, protect, study, monitor and communicate about forests, as well as having societies that understand and value forests and respect the work of people in forest-related jobs.

Forest education, as defined in this study, will be central to achieving both of those goals. Echoing van Lierop, the survey findings reported here show that, in some places in Asia and the Pacific, forest education is changing while in other places it is being left behind. Indeed, many respondents painted a picture of forest education that is under-resourced, outdated and disconnected from the changing needs of the job market. Overall, participants in the regional consultation said this report accurately represented the realities of forest education in Asia and the Pacific.

Despite many positive responses about the state of forest education, the assessment revealed widespread perceptions of insufficient coverage of forest-related topics at all educational levels. At primary and secondary schools, respondents noted limited exposure to forests and to forest-related teaching, including exposure to the kinds of jobs that people can do in forests.

The survey findings also show that many forest-related programmes at the TVET and tertiary levels often produce graduates who are ill-equipped to enter the workforce because they are unfamiliar with modern approaches and lack relevant knowledge and skills. In particular, the survey identified a pressing need to increase the amount of practical experience that students gain, in terms of fieldwork in forests and the use of digital tools for mapping and analysis. A widespread lack of work placement opportunities compounds this gap. Many formal educational institutions should require internships to give students the real-world experience that they need and perhaps even give them academic credit for it.
Many respondents criticized university curricula and suggested they modernize to encompass a broad range of topics and skills that go far beyond the narrow scope of classical forestry courses. This included increasing coverage of non-timber forest products, socio-economic issues relating to forests, interdisciplinary approaches and boosting skills relevant to engaging with communities, managing projects and working collaboratively.

The survey findings reveal a high demand for digital tools for teaching and learning over the Internet and for practical work and analysis, including GIS, simulators and drones. However, a significant minority of respondents raised concerns about the applicability of such tools, the lack of resources needed to use them and Internet connectivity issues.

While the survey findings suggest that in many countries forest education appears to have an identity crisis, they also show that forest jobs often have an image problem. Efforts to improve forest education should therefore go hand in hand with wider efforts to informally educate society about the crucial importance of forests and the opportunities that forests provide for fulfilling jobs and careers.

6.2. Recommendations

The following recommendations are based on comments made in the survey and the regional consultation as well as in relevant publications cited in this report. Implementation of these recommendations should be done in a way that addresses gender and social inequalities and digital divides and that takes account of the region’s diversity of national and subnational contexts.

National governments should:

- recognize the vital contributions of forests to livelihoods, environmental security and sustainable development and the need to ensure that forest education provides the personnel needed to work in a broad variety of forest-related jobs;
- develop cross-sector and multistakeholder groups to inform national policy development in relation to forest education;
- increase the roles of forests in Nationally Determined Contributions under the Paris Agreement on climate change, thereby incentivizing forest education programmes to train students for jobs in the forest carbon market that international consultants currently perform;
- develop policies and strategies to improve and promote forest education at all levels of teaching, focused on developing preschool-to-job educational pathways to multiple career options in forest-related work;
- review forest education curricula to identify and fill gaps in knowledge, skills and experiences that the job market requires;
- increase funding to the forestry sector and, in particular, increase support to forest education, research and extension;
- include forest education among the criteria against which educational authorities evaluate schools;
- identify and address the barriers that prevent schools from taking children into forests;
- promote outdoor forest education of schoolchildren, such as through forest school initiatives and through the development of evidence-based policies and guidelines;
● develop environmental awareness programmes and activities for schoolchildren – an example is India’s (now-defunct) National Green Corps and School Eco Clubs;
● incentivize the private sector to offer work placements and internships to students in TVET or tertiary education;
● require national and subnational forest departments to:
  o facilitate forest visits by schoolchildren
  o offer work placements or internships to students in TVET or tertiary education and
  o reserve jobs for graduates of forest programmes;
● provide scholarships to encourage students to pursue further learning about forests at the TVET or tertiary levels;
● give land grants to universities and colleges that provide forest education to enable them to increase students’ opportunities to visit, work and learn in university forests;
● develop initiatives to support informal and non-formal forest education, including:
  o continuing education and training for teachers and people working in forest jobs
  o training for members of community forests and
  o training for journalists to report on forest issues; and
● align efforts to improve informal forest education with existing initiatives aimed at increasing public awareness of climate change (under Article 6 of the United Nations Framework Convention on Climate Change) and biodiversity (under new targets to be agreed in 2021 in the post-2020 Global Biodiversity Framework of the United Nations Convention on Biological Diversity).

At the primary and secondary school levels, educational authorities and institutions should:
● update teaching curricula to reflect the modern understanding of the values and uses of forests, new technologies used in the forestry sector and the changing demands of the job market;
● mainstream forest topics throughout the curriculum at the primary and secondary school levels, and consider introducing forest-related subjects at the secondary school level;
● ensure that teaching covers issues of gender and social inclusion in relation to forests;
● develop and promote school policies for promoting outdoor learning, care for nature and awareness of the importance of forests;
● establish professional networks to improve school-based and nature-based forest education;
● support and incentivize professional training to equip teachers to provide quality forest education;
● increase students’ direct exposure to forests and trees through visits, practical work, tree-planting and forest school activities;
● increase teaching that highlights the range of potential forest-related careers; and
● develop relationships with the forest administration, private sector and NGOs that can facilitate access to forest sites and expose students to potential careers through visits by guest speakers and internships and work placements for older students.

At the TVET, college and university levels, educational authorities and institutions should:
● update teaching curricula to reflect the modern understanding of the values and uses of forests, new technologies used in the forestry sector and the changing demands of the job market;
● increase the focus on issues this study has found to be lacking, such as:
  o social issues (forest livelihoods, forests and gender, community forestry)
entrepreneurship and business skills
- non-timber forest product development and marketing
- multidisciplinary approaches
- international dimensions of forests and forestry, at global and regional scales and
economic valuation of forests, carbon stock assessment and payments for ecosystem services;
- develop internships and other work-experience programmes with employers active in the forestry sector, and include in such programmes monitoring systems to ensure that students benefit and gain real practical workplace experience;
- promote international exchanges among faculty and students of university and college forest programmes (noting the recommendations made by Kanowski, 2015);
- establish partnerships with other educational institutions to share resources and give students access to facilities in partner colleges and universities;
- actively engage with alternative forms of education (including formal and informal, extended study, short courses and vocational education) to save costs and help students fill gaps in their formal learning; and
- support and incentivize professional training to equip teachers to provide high-quality forest education.

Organizations, companies and government agencies active in the forestry sector should:
- support educational institutions and educational authorities in reviewing and revising curricula for forest education at all levels;
- help educational institutions and educational authorities to make generic information about forests locally relevant; and
- develop and/or engage in initiatives to increase exposure of students at all levels of education to forests and potential careers in forest-related jobs by:
  - providing small grants, and facilitating access to forest sites to enable students to do research projects there
  - sending ambassadors to speak to students
  - providing internships or work placements and
  - providing more on-the-job training or supporting continuing education programmes.

International donors and regional cooperation bodies, such as ASEAN and APEC, should:
- increase forest-sector spending and investment in forest education in particular; and
- support scholarships, exchanges and other activities that promote learning across institutions and settings, thus contributing to the internationalization of forest education.

International organizations, individually or collaboratively through the Collaborative Partnership on Forests, should:
- develop a ten-year vision, strategy and action plan to reshape forest education so that it is fit to meet the needs of the job market and emerging challenges;
- build a coalition of partners – donors, international organizations, research organizations, tech companies – able to support and implement this work;
● implement a communication strategy to improve the image of forest-sector jobs and of forests as places in which to work and make a difference to the world, with special attention to jobs for women;
● create a platform or network for dialogue in Asia and the Pacific to support learning and experience-sharing among university students, teachers and employers and to enable these groups to discuss competencies required from students and teachers to produce graduates who meet the needs of the job market and ensure such a platform is visible and accessible to all stakeholders;
● collaborate with universities in the region and with APFNet to strengthen forest education through activities related to research, knowledge-sharing, student exchanges and so on;
● develop resources to facilitate the mainstreaming of forest topics into a broad range of subjects in both primary and secondary school education;
● demonstrate to governments the contributions that investments in forests and forest education can make to progress towards national development objectives and targets on climate change, biodiversity and sustainable development;
● encourage national governments to increase support to forest education and to improve Internet infrastructure, educational facilities and the capacity of teachers;
● develop low-cost, accredited online training for teachers (a model to consider is the One UN Climate Change Learning Partnership, also known as UN CC:Learn\textsuperscript{10});
● disseminate this report – including translations into national languages – to relevant educational institutions, government agencies, private sector bodies and NGOs in the region;
● raise the profile of traditional knowledge related to forests in sustainable management, traditional fire control, shifting cultivation and customary forest governance, among others;
● facilitate efforts to document relevant traditional knowledge and integrate it into formal forest education, with the free, prior informed consent of knowledge holders;
● identify and promote best-practice approaches to forest education at all levels;
● gather and curate a collection of online resources that can support forest education;
● support the development of nationally relevant equivalents of Australia’s ForestLearning\textsuperscript{11} and its ForestVR virtual reality tool for use in other countries in the region;
● promote and support countries’ efforts to create or strengthen systems of school-based nature clubs at primary and secondary schools;
● develop and widely promote a global “forest teacher of the year” scheme to promote and recognize effective forest education;
● consider developing (in relevant languages) Wikipedia pages about each country’s forests, covering their status, uses, biodiversity, governance and related topics, so that schoolchildren in every country have an authoritative “go-to reference” on forests that is free to access and can be continuously updated; and
● create a Global Fund for Forest Education, with high-profile patrons to support the efforts outlined here.

\textsuperscript{10} See https://www.uncclearn.org/about/.
\textsuperscript{11} See www.forestlearning.edu.au.
REFERENCES AND ADDITIONAL RESOURCES


**Additional resources**

Asia-Pacific Forestry Education Coordination Mechanism  
www.apfecm.forestry.ubc.ca

Collaborative Partnership on Forests  
wwwcpfweb.org

FAO-ITTO-IUFRO Global Forest Education Project  
www.fao.org/forestry/forestry-education

Forest business incubation: Towards sustainable forest and farm producer organization businesses that ensure climate resilient landscapes  
https://pubs.iied.org/13595IIED/

International Forestry Students’ Association  
https://iflsa.net/

Securing forest business: A risk management toolkit for locally controlled forest businesses  
https://pubs.iied.org/13583IIED/
APPENDIX FIGURES AND TABLES

The charts that follow display the numbers of respondents in each group alongside their questionnaire number:

- Questionnaire 1 (Q1) targeted individuals working in organizations, government agencies and the private sector who are knowledgeable about or are engaged in education related to forests and trees or who hire recent graduates from forest-related programmes (the report refers to this groups as “professionals”);

- Questionnaire 2 (Q2) targeted teachers and educational administrators who are knowledgeable about and involved in education related to forests and trees (the report refers to this groups as “teachers”);

- Questionnaire 3 (Q3) targeted students or recent graduates at/from either (a) technical and vocational education and training (TVET), (b) university or college, including associate’s, bachelor’s, master’s or doctoral degree programmes (the report refers to this group as “students”).

TABLE 6
Countries of three groups of survey respondents

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<th>Students</th>
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<th>% of total</th>
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### 8.1. Primary education

**FIGURE 3**
Inclusion of forest-related curriculum as individual subjects in primary education (A1) (Q1q11-Q2q3)
FIGURE 4
Inclusion of forest-related curriculum in other subjects in primary education (A3) (Q1q13-Q2q5)

FIGURE 5
Coverage of forest-related topics and skills in primary education (A2.1) Q1q15-Q2q7
FIGURE 6
Coverage of forest-related topics and skills in primary education (A2.2) (Q1q15-Q2q7)

FIGURE 7
Coverage of forest-related topics and skills in primary education (A2.3) (Q1q15-Q2q7)
FIGURE 8
Forests used as a teaching environment or classroom (A6) (Q1q17_Q2q8)

To what extent are forests used as a teaching environment or classroom?

- very much
- moderately
- to a limited extent
- not at all

Q2 n = 17
Q1 n = 77

FIGURE 9
Impact of forest education at the primary school level to increase student interest in nature and natural resources (A8) (Q1q19-Q2q8)

To what extent is primary education in your school increasing children's interest in nature and natural resources?

- unable to answer
- very much
- moderately
- to a limited extent
- not at all

Q2 n = 20
Q1 n = 97
FIGURE 10
Common teaching and learning approaches (A9) (Q2q9)

Select the most common teaching and learning approaches used in your school to teach forest-related concepts (check all that apply).

FIGURE 11
Recommended improvements to learning and increased student interest in forest-related concepts (A10) (Q2q10)

Please select a maximum of 3 options you would like your school to use to improve learning and to increase student interest in forest-related concepts.
FIGURE 12
Forest-education teaching knowledge and skills (A5) (Q2q14)

To what extent do you feel sufficiently knowledgeable about the following in order to effectively teach forest-related concepts and skills in your classroom?

- forest ecosystems and forest flora and fauna
- forest and tree management
- forests’ roles in global sustainability issues (biodiversity, climate change, renewable energy, food security, water resources, etc.)
- effective teaching approaches to guide students’ thinking and learning about forests and related subjects
- digital technology in teaching
- other forest related topics and skills

Q2 n = 17
FIGURE 13
Ability of out-of-school activities to increase forest knowledge and appreciation (A12) (Q2q13)

To what extent do the out-of-school activities listed above increase your students’ knowledge and appreciation of forests?

- very much: 6%
- moderately: 35%
- to a limited extent: 29%
- not at all: 30%

Q2 n = 17
To what extent do your students learn about forests through out-of-school activities (e.g., clubs, after-school programmes, field trips)

- not at all: 33%
- to a limited extent: 55%
- moderately: 5%
- very much: 6%

Q2 n = 18
FIGURE 15
Availability of forest education resources in primary schools (A7) (Q1q18-Q2q15)
8.2. Secondary education

FIGURE 17
Inclusion of forest-related curriculum as individual subjects in secondary education (A13) (Q1q24-Q2q20)
FIGURE 18
Inclusion of forest-related curriculum in other subjects in secondary education (A14) (Q1q26-Q2q22)

FIGURE 19
Forests used as a teaching environment or classroom (A18) (Q1q28-Q2q24)
FIGURE 20
Coverage of forest-related topics and skills in secondary education (A21.1) (Q1q29-Q2q25)

FIGURE 21
Coverage of forest-related topics and skills in secondary education (A2.2) (Q1q29-Q2q25)
FIGURE 22
Coverage of forest-related topics and skills in secondary education (A2.3) (Q1q29-Q2q25)

FIGURE 23
Forest-education teaching knowledge and skills (A17) (Q2q33)
FIGURE 24
Common teaching and learning approaches (TBC1) (Q2q28)

Select the most common teaching methods used in your school to teach forest-related concepts (check all that apply)

FIGURE 25
Recommended improvements to learning and increased student interest in forest-related concepts (TBC2) (Q2q29)

Please select a maximum of three options you would like your school to use to improve learning and to increase student learning in forest-related concepts
FIGURE 26
Students’ exposure to forests through out-of-school activities and impact on forest knowledge and appreciation (A19) (Q1q31q33-Q2q30q32)

FIGURE 27
Availability of forest education resources in secondary schools (A15) (Q1q34-Q2q34)
FIGURE 28
Policies or strategies leading to improved forest-related curriculum in secondary schools (A16) (Q1q35-Q2q35)

Is there any educational policy or strategy that could lead to improved forest-related education? (check all that apply)

Q1 n = 67
Q2 n = 20
FIGURE 29
Impact of forest education in secondary school to increase student interest in nature and natural resources (A20) (Q1q36-Q2q36)

FIGURE 30
Student motivation to enter forest-related programmes in tertiary education (A22) (Q1q38-Q2q38)
FIGURE 31
Level of awareness among secondary school graduates of the contribution of forests to global targets, such as the Sustainable Development Goals (TBC3) (Q2q27)
8.3. Technical and vocational education and training (TVET)

FIGURE 32
Coverage of forest-related topics in TVET forest programmes (forest resources and forest ecology (A28) (Q1q42-Q2q43-Q3q17)
FIGURE 33
Coverage of forest-related topics in TVET forest programmes (forest and tree planning and management) (A29.1) (Q1q43-Q2q43-Q3q18)

FIGURE 34
Coverage of forest-related topics in TVET forest programmes (forest and tree planning and management) (A29.2) (Q1q43-Q2q43-Q3q18)
FIGURE 35
Coverage of forest-related topics in TVET forest programmes (forest and tree planning and management) (A29.3) (Q1q43-Q2q43-Q3q18)
FIGURE 36
Coverage of forest-related topics in TVET forest programmes (forest services and socio-cultural issues) (A30.1) (Q1q44-Q2q44-Q3q19)

FIGURE 37
Coverage of forest-related topics in TVET forest programmes (forest services and socio-cultural issues) (A30.2) (Q1q44-Q2q44-Q3q19)
FIGURE 38
Coverage of forest-related topics in TVET forest programmes (forest enterprise) (A31) (Q1q45-Q2q45-Q3q20)

FIGURE 39
Coverage of forest-related topics in TVET forest programmes (forest policy and economics) (A32) (Q1q46-Q2q46-Q3q21)
FIGURE 40
Coverage of forest-related topics in TVET forest programmes (A33.1) (Q1q47-Q2q47-Q3q22)

FIGURE 41
Coverage of forest-related topics in TVET forest programmes (A33.2) (Q1q47-Q2q47-Q3q22)
FIGURE 42
Availability of resources in TVET forest programmes (A23) (Q1q49-Q2q54)

FIGURE 43
Policies or strategies leading to improved forest-related education in TVET programmes (A24) (Q1q50-Q2q55)
FIGURE 44
Student engagement in forest-related out-of-school activities and wider educational and professional impacts (A26) (Q1q51q53-Q2q59q61-Q3q30q32)

To what extent ...

- are students engaged in forest-related activities outside of school (e.g., societies, networks, clubs)?
- do the activities you have listed in the previous question increase students’ learning?
- are part-time forest-related employment or internships available for students?
- do part-time forest-related employment or internships increase students’ learning?

Q1 n = 35
Q2 n = 36
Q3 n = 5

FIGURE 45
Teacher self-assessment of knowledge needed to teach forest-related concepts and skills (TBC4) (Q2q58)

To what extent do you feel sufficiently knowledgeable about the following to effectively teach in your TVET forest programme?

- digital learning tools
- effective teaching approaches
- forests and global sustainability issues
- new technologies for forest management / industries
- social and cultural issues in forest management
- multi-purpose forest management

Q2 n = 64
FIGURE 46
Workforce preparation within TVET forest programmes (A34) (Q1q54-Q2q62-Q3q34)

FIGURE 47
Gender, race and ethnicity as factors influencing job prospects (A35) (Q1q56-Q2q64-Q3q36)
FIGURE 48
Availability of affordable continuing forest education (A25) (Q1q59-Q2q66-Q3q38)

FIGURE 49
Levels of awareness among TVET graduates of the relevance of forests to global trends and the Sustainable Development Goals (TBC5) (Q2q50)
FIGURE 50
Use and benefit of digital learning tools within TVET forest programmes (A27) (Q1q60-Q2q68-Q3q40)

FIGURE 51
Overall trend in student enrolment in TVET forest programmes over the past decade (2010–2020) (A36) (Q1q64-Q2q72)
8.4. Bachelor’s degree programme level

FIGURE 52
Coverage of forest-related topics in degree programme (A55) (Q1q73-Q2q87-Q3q67)
FIGURE 53
Coverage of forest-related topics in degree programme (A58) (Q1q74-Q2q88-Q3q68)

FIGURE 54
Coverage of forest-related topics in degree programme (A61) (Q1q74-Q2q88-Q3q68)
FIGURE 55
Coverage of forest-related topics in degree programme (A63) (Q1q74-Q2q88-Q3q68)

FIGURE 56
Coverage of forest-related topics in degree programme (A65) (Q1q75-Q2q89-Q3q69)
FIGURE 57
Coverage of forest-related topics in degree programme (A68) (Q1q75-Q2q89-Q3q69)

FIGURE 58
Coverage of forest-related topics in degree programme (A70) (Q1q76-Q2q90-Q3q70)
FIGURE 59
Coverage of forest-related topics in degree programme (A73) (Q1q77-Q2q91-Q3q71)

FIGURE 60
Student engagement in forest-related out-of-school activities (A41) (Q1q83-Q2q102-Q3q80)
FIGURE 61
Availability of resources in forest degree programme (A37) (Q1q81-Q2q99-Q3q64)

FIGURE 62
Policies or strategies leading to improved forest-related education at university and college level (A40)
FIGURE 63
Availability of forest-related internships or part-time employment and effect on learning (A76) (Q1q83q85-Q2q105-Q3q82)

FIGURE 64
Workforce readiness within degree programme (A78) (Q1q86-Q2q106-Q3q83)
FIGURE 65
Availability of suitable jobs for graduates of forest programmes (TBC6) (Q1q88-Q2q108-Q3q85)

FIGURE 66
Gender as a factor and influence in forest-related employment at the bachelor’s degree programme level (A81) (Q1q89-Q2q109-Q3q85)
FIGURE 67
Race or ethnicity as a factor and influence in forest-related employment (A84) (Q1q89-Q2q110-Q3q85)

FIGURE 68
Availability of affordable continuing non-formal forest education (A87) (Q1q91-Q2q66-Q3q38)
FIGURE 69
Use of digital learning tools at the university and college level (A44) (Q1q92-Q2q114-Q3q89)
FIGURE 70
Use of digital learning tools in degree programme (A47) (Q1q94-Q2q116-Q3q91)
FIGURE 71
Desired digital learning tools for use in degree programme (A50) (Q2q117-Q3q92)

Select the three digital learning tools you would like to use more in your forest degree programme(s).
Bachelor’s

- Online learning platform and study tools
- Communication and publication tools (e.g., layout, design and presentation)
- Tools for managing, editing, and sharing documents (e.g., cloud-based services)
- Enhanced media (augmented reality, virtual, multimedia)
- Digital tools for field and mill operations
- Geospatial tools
- Conference meeting tools
- Net-based research tools (e.g., reference and literature databases, statistical software)
- Other, please list

Q2 n = 72
Q3 n = 49
FIGURE 72
Familiarity with digital learning environments (A52) (Q1q109-Q2q129-Q3q93)

FIGURE 73
Overall trend in student enrolment in forest-related programmes (10-year period) (A90) (Q1q96-Q2q118-Q3q85)
FIGURE 74
Graduates’ understanding of forests’ relevance to emerging trends and Sustainable Development Goals (A93) (Q1q99-Q2q95)

To what extent do graduates at university and college level have sufficient understanding of the relevance of forests and their sustainable management to emerging global trends and to the Sustainable Development Goals?

Q1 n = 72
Q2 n = 72
8.5. Master’s and doctoral degree programme level

FIGURE 75
Coverage of forest-related topics in degree programme (A56) (Q1q73-Q2q87-Q3q67)
FIGURE 76
Coverage of forest-related topics in degree programme (A59) (Q1q74-Q2q88-Q3q68)

FIGURE 77
Coverage of forest-related topics in degree programme (A62) (Q1q74-Q2q88-Q3q68)
FIGURE 78
Coverage of forest-related topics in degree programme (A64) (Q1q74-Q2q88-Q3q68)

FIGURE 79
Coverage of forest-related topics in degree programme (A66) (Q1q75-Q2q89-Q3q69)
FIGURE 80
Coverage of forest-related topics in degree programme (A69) (Q1q75-Q2q89-Q3q69)
FIGURE 81
Coverage of forest-related topics in degree programme (A71) (Q1q76-Q2q90-Q3q70)

FIGURE 82
Coverage of forest-related topics in degree programme (A74) (Q1q77-Q2q91-Q3q71)
FIGURE 83
Student engagement in forest-related out-of-school activities (A42) (Q1q83-Q2q102-Q3q80)

To what extent are students engaged in forest-related activities outside of school (e.g. societies, networks, clubs, community outreach)?

Master’s + Doctor’s

Q1
Q2
Q3

Q1 master’s and doctors n = 54
Q2 master’s and doctors n = 46
Q3 master’s and doctors n = 41

not at all  to a limited extent  moderately  very much

FIGURE 84
Availability of resources in forest degree programme (A38) (Q1q81-Q2q99-Q3q64)

Availability of resources in forest degree programme
Master’s + Doctor’s

Teachers (quality and quantity of educators)
Q1
Q2
Q3

Learning materials (e.g. textbooks, online learning materials, tools or applications)
Q1
Q2
Q3

Educational environment (e.g. laboratory access, class sizes)
Q1
Q2
Q3

Practical opportunities (e.g. experiential learning, practical training, field visits)
Q1
Q2
Q3

Q1 masters and doctors n = 58
Q2 masters and doctors n = 48
Q3 masters and doctors n = 41
FIGURE 85
Policies or strategies leading to improved forest-related education at the university and college level (A40) (Q1q82-Q2q100)

FIGURE 86
Availability of forest-related internships or part-time employment and effect on learning (A77) (Q1q83q85-Q2q105-Q3q82)
FIGURE 87
Availability of affordable continuing non-formal forest education (A88) (Q1q91-Q2q66-Q3q38)

FIGURE 88
Workforce readiness within degree programme (A79) (Q1q86-Q2q106-Q3q83)
FIGURE 89
Availability of suitable jobs for graduates of forest programmes (TBC7) (Q1q88-Q2q108-Q3q85)

FIGURE 90
Gender as a factor and influence in forest-related employment (A82) (Q1q89-Q2q109-Q3q85)
FIGURE 91
Race or ethnicity as a factor and influence in forest-related employment (A85) (Q1q89-Q2q110-Q3q85)

FIGURE 92
Use of digital learning tools at the university and college level (A45) (Q1q92-Q2q114-Q3q89)
FIGURE 93
Use of digital learning tools in degree programme (A48) (Q1q94-Q2q116-Q3q91)

[Bar chart showing use of digital learning tools in degree programme for Master's and Doctor's degrees.]

Q1 n = 58
Q2 n = 49
Q3 n = 40
FIGURE 94
Desired digital learning tools for use in degree programme (A51) (Q2q117-Q3q92)

Select the three digital learning tools you would like to use more in your forest degree programme(s).
Master’s + Doctor’s

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Q2 (n=50)</th>
<th>Q3 (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online learning platform and study tools</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>Communication and publication tools (e.g. layout, design and presentation)</td>
<td>35%</td>
<td>40%</td>
</tr>
<tr>
<td>Tools for managing, editing and sharing documents (e.g. cloud-based services)</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Enhanced media (augmented reality, virtual, multimedia)</td>
<td>50%</td>
<td>55%</td>
</tr>
<tr>
<td>Digital tools for field and mill operations</td>
<td>45%</td>
<td>50%</td>
</tr>
<tr>
<td>Geospatial tools and technology</td>
<td>55%</td>
<td>60%</td>
</tr>
<tr>
<td>Conference meeting tools</td>
<td>25%</td>
<td>30%</td>
</tr>
<tr>
<td>Net-based research tools (e.g. reference and literature databases, statistical software)</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Other, please list</td>
<td>5%</td>
<td>10%</td>
</tr>
</tbody>
</table>
FIGURE 95
Familiarity with digital learning environments (A53) (Q1q109-Q2q129-Q3q93)
FIGURE 96
Overall trend in student enrolment in forest-related programmes (10-year period) (A91) (Q1q96-Q2q118-Q3q85)

FIGURE 97
Graduates’ understanding of forests’ relevance to emerging trends and Sustainable Development Goals (A94) (Q1q99-Q2q95)