Chapter 8

Legal, policy and institutional framework

OVERVIEW

The national legal, policy and institutional framework related to forests constitutes the fundamental basis for sustainable forest management. National forest programmes provide an internationally agreed framework which many countries use for the development and implementation of national forest-related policies and international commitments. The effective development and implementation of forest policy depends on the institutional capacity of national and subnational forest agencies. These include, among others, forest administrations, agencies responsible for the enforcement of forest laws and regulations and forest research and education institutions. For FRA 2010 countries were asked for the first time to report on these key aspects, with the aim of addressing a critical information gap on the governance of the world's forests.

More specifically, for FRA 2010 countries were asked to provide information on the following variables:

- the existence of a national and/or subnational forest law, date of enactment and date of latest amendment;
- the existence of a national and/or subnational forest policy and date of endorsement;
- the existence of a national forest programme, date of commencement and its current status;
- the institutional structure related to forests and forestry;
- human resources in public forestry institutions;
- the number of graduates in forest-related education;
- the number of professional staff in publicly funded forest research centres.

In addition, information was compiled on international conventions and agreements related to forests and the extent to which countries have ratified or adopted these.

KEY FINDINGS

Significant progress has been made in developing forest policies, laws and national forest programmes. Of the 143 countries that reported the existence of a forest policy statement, 76 have issued or updated their statements since 2000. Of the 156 countries that have a specific forest law, 69 countries – primarily in Europe and Africa – reported that their current forest law was enacted or amended since 2005. Close to 75 percent of the world's forests are covered by national forest programmes, most of which were started since 2000 and are currently in implementation.

Staff numbers in public forest institutions are decreasing

Around 1.3 million people were reported to work in public forest institutions, 22 percent of whom were female. At the global level, the number of staff has declined by 1.2 percent annually since 2000. More than 20 000 professionals work in public forest research institutions. Forest policy is mostly within the purview of the ministry of agriculture, but only about one-third of heads of forestry agencies report directly to the minister. The others report to lower levels in the ministry.

The number of university students graduating in forestry is increasing

More than 60 000 university students graduate in forestry annually. This is about 1 per 86 000 inhabitants, or around 200 per 10 million hectares of forests. One-third of graduating students are female, and this proportion is increasing.

KEY CONCLUSIONS

The high response rate on this theme, particularly from developing countries, in this first reporting within the FAO Global Forest Resources Assessments provides important global reference data. The findings show that countries have been very active in developing and updating their forest policies, programmes and legislation in the years since 2000, often using national forest programmes as a comprehensive forest policy framework.

The status of, and trends in, human resource capacity in public forest administrations provide an indication of a country's ability to govern its forests. While existing data indicate that the number of staff is decreasing, little is known about trends in staff quality. It is also noteworthy that only 63 percent of countries provided information on human resources.

In many countries national capacities in forest education and research seem to be inadequate to support the sustainable development of the forestry sector and respond to new issues. While the data indicate growing numbers of university level graduates, it remains unclear how well this education enables them – including graduates working in forest research institutions – to face up to the challenges of a globalized world.

POLICY AND LEGAL FRAMEWORK

Introduction

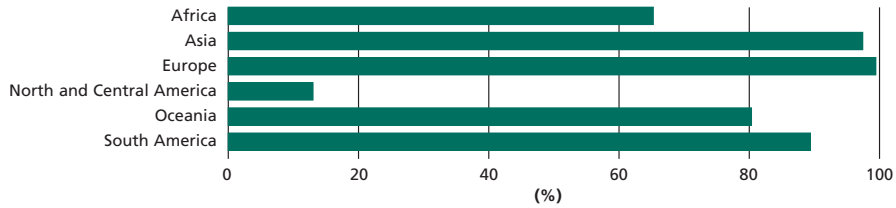
The national or subnational policy framework on forests and their management aims to guide decision-making and provide a clear sense of direction over time. In the context of international commitments many countries have agreed to use 'national forest programmes' (NFPs) as a comprehensive framework in order to develop and implement their forest policies. The legal framework provides a key instrument in support of the national forest policy. Together the national policy and the legal framework related to forests constitute the basis for sustainable forest management.

Status

Globally, 181 countries and areas reported on forest policies. Of these, 143 countries (more than 80 percent), accounting for more than 70 percent of the total forest area, responded that they had a forest policy statement. The large majority of countries reported that they had a national level policy statement; only eight countries – among them Brazil – reported that they had subnational statements but no national forest policy statement. Thirty-eight countries and areas reported that they did not have a forest policy statement. Countries without a forest policy statement were mainly found in Western and Central Asia, Europe and Africa. Fifty-two countries and areas did not report on this variable.

A total of 178 countries and areas reported on NFPs. Almost three-quarters of these (74 percent, 131 countries) stated that they had an NFP as of 2008. Together, these countries account for around 75 percent of the global forest area (Figure 8.1). Only a few countries had a forest policy statement but no NFP, and even fewer reported that they had an NFP but no policy statement. Around two-thirds of the responding countries (66 percent) reported that their NFP was in the implementation stage. In close to one-third of the remaining countries, NFPs were either in development or under revision. In a few countries the NFP process was stalled at the time of reporting. Forty-seven countries stated that they had no NFP, while 55 did not provide data. Overall, more NFPs were reported in Africa and Europe compared with

FIGURE 8.1
Percentage of forest area covered by national forest programmes by region and subregion, 2008



other regions, while North America had the lowest proportion of countries reporting an NFP.

Of the 233 countries and areas included in FRA 2010, 182 (covering 99.4 percent of the world's forests) reported on forest legislation. The remaining 51 countries and areas, with a combined forest area of 24.7 million hectares (0.6 percent of the world's forests), did not report. Forest management is regulated through a specific forest law in 156 countries, or 86 percent of those reporting. In the vast majority of these (150 countries) a specific forest law exists at the national level, while in six countries forests are regulated through subnational but not national legislation. Seventeen countries reported that forests are not covered through specific laws but are incorporated under other legislation. Nine countries, mostly small island states, reported that forests are not covered under legislation at all. Eight of these nine also reported no forest policy statement or NFP. Six countries govern their forests through national forest legislation only, without a forest policy statement or NFP. Two countries reported the existence of a forest policy statement but did not have specific forest legislation.

Table 8.1 summarizes the information on forest policies, NFPs and forest laws by region and subregion. Box 8.1 lists the main international conventions and agreements related to forests and the extent to which countries have ratified or adopted these. For country-level information, see Table 16 and Table 20 in Annex 3.

Trends

A large majority of national forest policy statements were issued comparatively recently: more than a quarter (28 percent) of statements with known issue dates are from the last five years, and more than half of the statements date from the last decade (see Figure 8.2). In a number of countries processes to develop a forest policy are ongoing or have recently concluded. Almost twice as many countries issued forest policy statements in the 2000s compared with the 1990s. Over the last five years, on average more than ten countries have issued a national forest policy statement each year.

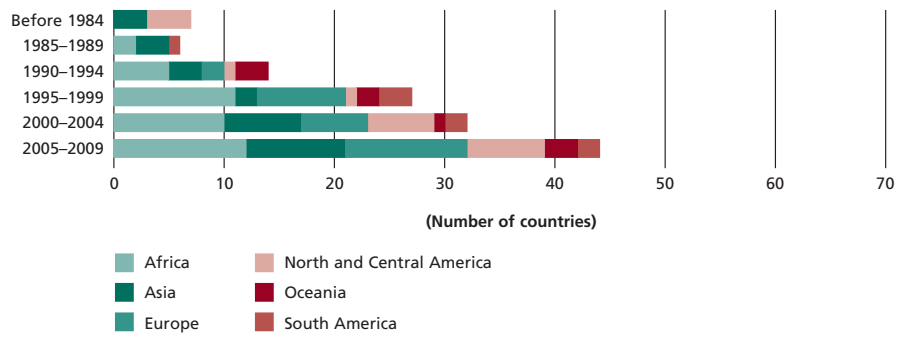
Following the international commitments made by countries in the context of the Intergovernmental Panel on Forests/Intergovernmental Forum on Forests (IPF/IFF) and later the United Nations Forum on Forests (UNFF), it appears that countries have widely adopted them in one form or another across the globe. Almost three-quarters (85 of the 115 NFPs whose starting year was reported in FRA 2010) began since 2000, and one-third began comparatively recently, since 2006. Only around one-fifth of the countries (25) reported that they started their NFP in 1999 or earlier. This indicates that an increasing number of countries have made efforts more recently to use NFPs as an approach to forest policy development and implementation.

The year of enactment of forest legislation currently in force varied widely between countries. The forest law in some countries dates back to the 1970s or earlier and changes in forest legislation in many of these countries are made through amendments

TABLE 8.1
Number of countries with a national forest policy, NFP and national forest law by region and subregion, 2008

Region/subregion	National forest policy			National forest programme			National forest law			
	Exists	Does not exist	No data	Exists	Does not exist	No data	Specific forest law	Incor-porated in other law	No law	No data
Eastern and Southern Africa	15	5	3	15	5	3	17	1	2	3
Northern Africa	4	2	2	3	2	3	5	1	0	2
Western and Central Africa	21	3	2	21	1	4	21	1	1	3
Total Africa	**40**	**10**	**7**	**39**	**8**	**10**	**43**	**3**	**3**	**8**
East Asia	3	1	1	4	0	1	4	0	0	1
South and Southeast Asia	16	2	0	15	3	0	15	2	1	0
Western and Central Asia	11	8	6	11	9	5	17	1	2	5
Total Asia	**30**	**11**	**7**	**30**	**12**	**6**	**36**	**3**	**3**	**6**
Total Europe	**27**	**11**	**12**	**31**	**6**	**13**	**33**	**2**	**3**	**12**
Caribbean	10	4	13	8	6	13	10	3	2	12
Central America	6	0	1	6	0	1	6	0	0	1
North America	4	0	1	1	3	1	2	1	1	1
Total North and Central America	**20**	**4**	**15**	**15**	**9**	**15**	**18**	**4**	**3**	**14**
Total Oceania	**10**	**4**	**11**	**6**	**8**	**11**	**8**	**4**	**2**	**11**
Total South America	**8**	**6**	**0**	**10**	**4**	**0**	**12**	**1**	**1**	**0**
World	**135**	**46**	**52**	**131**	**47**	**55**	**150**	**17**	**15**	**51**

FIGURE 8.2
Date of endorsement of forest policy statement



rather than by enacting a new law. Most existing forest laws are a decade old or less. In fact, the number of countries enacting new forest legislation each year has considerably increased over the last decades. In the mid-1970s, only around two countries enacted a new forest law each year, rising to about four per year in the 1980s. Since the mid-1990s, however, every year six to eight countries have enacted new forest legislation and even more countries have amended their forest laws. Around 63 percent of countries (100 out of the 159 countries that provided data) reported that their latest amendment took place in, or after, the year 2000. For a few others, however, the latest amendment occurred in the mid-1970s. In around half of all 159 reporting countries the currently valid forest law – either enacted or amended – is from 2004 or later (see Figure 8.3). On a regional scale, on average, forest legislation is most recent in European countries, followed by Africa. In comparison, in countries of North and Central America and in Oceania current legislation averages more than a decade in age.

BOX 8.1

International conventions and agreements related to forests

A number of binding and non-binding international conventions and agreements relate to forests and their management. Among the non-binding agreements, the Non-Legally Binding Instrument on All Types of Forests, adopted by the UN General Assembly in 2007, is particularly important. Prior agreements are the Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests, also known as the 'Forest Principles', and 'Chapter 11 of Agenda 21: Combating Deforestation'. These both resulted from the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil in 1992.

There are several legally-binding international conventions and agreements related to the sustainable management and conservation of forests. These international conventions and agreements rely for their impact on ratification by individual countries. Once ratified, the agreements are incorporated into the signatory countries' national legal frameworks, through which they take effect.

For the purposes of FRA 2010, the ratification status of international conventions and agreements related to forests were compiled based on information provided on their official web sites. The detailed ratification status is shown in Table 20 in Annex 3 and summarized below. The total number of countries refer to those countries that have either ratified, acceded to, approved, accepted or adopted a convention or an agreement.

Convention or agreement	Number of countries as of 1 January 2010
Non-Legally Binding Instrument on All Types of Forests	192
Convention on Biological Diversity (CBD)	192
United Nations Framework Convention on Climate Change (UNFCCC)	193
Kyoto Protocol	191
United Nations Convention on Combating Desertification (UNCCD)	192
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	175
Convention on Wetlands of International Importance (Ramsar)	160
World Heritage Convention	187
International Tropical Timber Agreement (ITTA)	60

Sources:

NLBI: http://www.un.org/en/members/

CBD: http://www.cbd.int/convention/parties/list/

UNFCCC: http://unfccc.int/parties_and_observers/parties/items/2352.php

Kyoto Protocol: http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php

UNCCD: http://www.unccd.int/convention/ratif/doeif.php

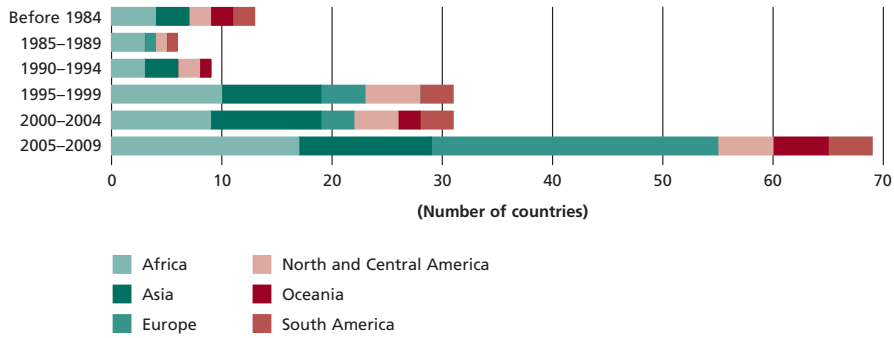
CITES: http://www.cites.org/eng/disc/parties/alphabet.shtml

Ramsar: http://www.ramsar.org/cda/en/ramsar-about-parties-contracting-parties-to-23808/main/ramsar/1-36-123%5E23808_4000_0__

World Heritage Convention: http://whc.unesco.org/en/statesparties/

ITTA: http://whc.unesco.org/en/statesparties/

FIGURE 8.3
Date of enactment of forest legislation



Conclusions

The results of FRA 2010 indicate that developing and issuing forest policy statements has become considerably more widespread over the last decade – almost equally across the countries around the globe. This is an indication that more attention is being given to developing and updating formal policies and, often, to communicating them. If properly developed and implemented, for example in the context of an NFP process, such policies provide effective strategic guidance towards sustainable forest management.

Following the commitments made in the context of the IPF/IFF, and later UNFF, countries reported that NFPs have indeed been widely taken up as a comprehensive approach to forest policy development. However, in many countries an NFP still tends to be understood as a programming document, rather than an ongoing forest policy process. Several of the NFP elements are comparatively new in forest policy processes: in particular, the strong emphasis on broad stakeholder participation and the focus on cross-sectoral coordination. Given the often major differences from traditional approaches, the progress made in adopting and integrating new elements over a short period of time varies across countries. The real added value of the NFP approach, however, accrues over time and with experience of iterative NFP cycles.

Most countries reported that they have enacted or amended their forest legislation relatively recently, enabling them to take into account the multitude of changes over the last decades and to recognize better the broad concept of sustainable forest management. If the legislation is sound and enforced this should provide a solid basis for the sustainable management of forests.

INSTITUTIONAL FRAMEWORK

Introduction

The importance of institutional structure and capacity in achieving national goals for forest management is increasingly being recognized. For the first time, in FRA 2010, countries were invited to submit information regarding their forest institutional structure, including: main responsibility for forest policy formulation; the ministry to which the national forestry agency reports; the level of subordination to the minister and human resource levels, disaggregated by gender and level of education.

Status

Countries were asked to report which ministry held the main responsibility for forest policy formulation in 2008. A total of 168 countries and areas, together accounting for

98 percent of the world's forests, replied. As can be seen in Figure 8.4, forest policy formulation was most commonly within the purview of the Ministry of Agriculture (43 percent of reporting countries). In about 33 percent of reporting countries, it was a responsibility of the Ministry of the Environment and, in about 20 percent of countries, forest policy was the responsibility of multiple ministries, the prime minister, president, or other ministries that feature neither 'agriculture' nor 'environment' in their title. This category includes countries where forest policy formulation has been entirely regionalized, with regional forestry agencies reporting to regional ministries or their equivalent (e.g. Belgium). It also includes countries where the public forestry agency is autonomous and reports directly to the president, prime minister or a board of directors (e.g. Paraguay). In 55 of the reporting countries (about one out of three) the word 'forestry' featured in the title of the ministry.

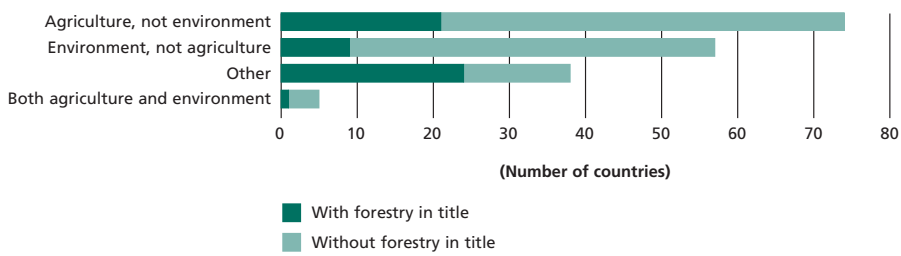
International negotiations to address climate change through a reduction in emissions from deforestation and forest degradation (REDD) pose a potential challenge to countries where interministerial coordination is not effective, since these negotiations are typically carried out by representatives of the ministry of environment, despite the fact that responsibility for taking action may fall within the ministry of agriculture and forestry. As can be seen in Figure 8.4, this is a potential risk for a significant number of countries.

A related question enquired about the level of subordination of the head of the forestry agency to the ministry. A total of 168 countries (72 percent of the total) responded to this question, representing 98 percent of the global forest area. In about a third of these countries (57) the head of the forestry agency reported directly (first level of subordination) to the minister or held a ministerial level position (as in China). These countries account for 52 percent of the total forest area. Direct reporting to the minister, however, varied greatly among regions (see Table 8.2).

Thirty-eight percent of countries (35 percent of forest area) reported at the second level of subordination (e.g. a vice-minister); 21 percent of countries (7 percent of area) reported at the third level; and 7 percent of countries (6 percent of area) reported at the fourth level of subordination. Overall, in 71 percent of responding countries (covering about 87 percent of forest area) the head of forestry reported either directly to a minister or to the next level of subordination.

Countries were also asked to report on the level of human resources within public forest institutions in 2008 (Table 8.3). This question was answered by 146 countries, representing 60 percent of the global forest area. Some large, forest-rich countries like Australia, Canada, the Democratic Republic of the Congo and the Russian Federation did not report on staff levels.

FIGURE 8.4
Ministry with main responsibility for forest policy, 2008



Most countries reported staff numbers at the national and subnational levels. However, some countries only reported a figure for national level staff (e.g. Brazil only reported staff levels for federal institutions), only for forestry officers (e.g. Thailand) or only for selected institutions (e.g. United States of America and Mexico). With the above caveats, the human resources within public forest institutions amounted to

TABLE 8.2
First level of subordination of the head of forestry to minister

Region/subregion	Information availability		Number of countries with 1st level of subordination	% of forest area with 1st level of subordination
	Number of countries	% of total forest area		
Eastern and Southern Africa	20	100.0	2	n.s.
Northern Africa	6	98.8	4	98.5
Western and Central Africa	23	96.8	6	10.6
Total Africa	**49**	**98.3**	**12**	**16.4**
East Asia	4	97.4	3	95.2
South and Southeast Asia	13	87.7	3	58.0
Western and Central Asia	18	71.5	3	20.8
Total Asia	**35**	**90.5**	**9**	**72.4**
Total Europe	**36**	**99.3**	**20**	**91.7**
Caribbean	14	83.6	5	8.9
Central America	6	93.1	4	81.3
North America	3	100.0	1	9.7
Total North and Central America	**23**	**99.6**	**10**	**11.6**
Total Oceania	**12**	**99.6**	**1**	**4.2**
Total South America	**13**	**100.0**	**5**	**65.0**
World	**168**	**98.1**	**57**	**52.0**

TABLE 8.3
Human resource levels per unit of forest area 2008 and changes between 2000 and 2008

Region/subregion	Information availability		Number of staff 2008		% of total staff with university degree (2008)	Annual change rate 2000–2008 (%)
	Number of countries	% of total forest area	Total	per 100 000 ha		
Eastern and Southern Africa	18	96.2	22 819	9	3.8	-2.6
Northern Africa	6	98.8	24 587	32	13.4	-0.1
Western and Central Africa	20	41.7	25 782	18	33.4	2.3
Total Africa	**44**	**70.0**	**73 188**	**15**	**17.0**	**n.s.**
East Asia	4	97.4	746 300	317	35.7	-1.6
South and Southeast Asia	14	89.6	306 600	114	20.1	-0.3
Western and Central Asia	13	48.1	33 498	163	33.8	-0.7
Total Asia	**31**	**89.8**	**1 086 398**	**207**	**21.8**	**-1.3**
Total Europe	**29**	**16.0**	**81 120**	**51**	**18.7**	**-1.0**
Caribbean	11	53.6	4 146	115	12.5	2.1
Central America	6	53.6	1 167	6	61.4	n.s.
North America	2	54.2	32 577	9	55.1	–
Total North and Central America	**19**	**55.4**	**37 890**	**10**	**50.6**	**1.9**
Total Oceania	**11**	**21.6**	**2 732**	**6**	**49.1**	**2.8**
Total South America	**12**	**93.1**	**5 215**	**1**	**47.4**	**2.2**
World	**146**	**59.7**	**1 286 543**	**53**	**23.2**	**-1.2**

about 1.3 million people, mostly concentrated in Asia (1.1 million), Europe (81 000) and Africa (78 000). Only about 5 000 were reportedly employed in South America.

Levels of human resources can be used to estimate the number of staff per 100 000 ha, a partial indicator of the institutional capacity to promote forest objectives. Regions exhibited large differences. Staffing levels per 100 000 ha ranged from higher than 100 in Asia and the Caribbean to lower than 10 in Central, North and South America and Oceania, with figures somewhere in the middle in Africa and Europe. This variability appears to correlate with population density, so densely populated countries have higher personnel levels per unit of forest area. When staffing levels per unit area are plotted against total forest area, there appears to be a positive correlation between the two variables meaning that more forested countries have lower human resource levels per unit area, as would be expected. The country with the highest number of staff per 100 000 ha was Egypt (9 700 or almost one staff member per 10 ha) while Venezuela had the lowest number of staff per 100 000 ha (0.17 or almost one member of staff per half a million hectares).

Fewer countries responded to the question on the number of staff in public forest institutions with a university degree. Only 119 countries (or 51 percent of the total) reported on this question for 2008, representing 35 percent of the global forest area, and information was missing for several of the larger countries. A total of about 104 000 professionals were employed in the reporting countries. On average, about one in five members of staff (23 percent) in public forest institutions had a university degree. This percentage varied from 17 percent in Africa to over 50 percent in North and Central America.

The percentage of female staff in 2008 was reported by 124 countries (or 53 percent of the total, representing 40 percent of the global forest area). Globally, countries reported that about one in five (22 percent) of total staff members were female. This percentage varied from less than 18 percent in Africa and Europe to over 30 percent in North and Central America (see Figure 8.5).

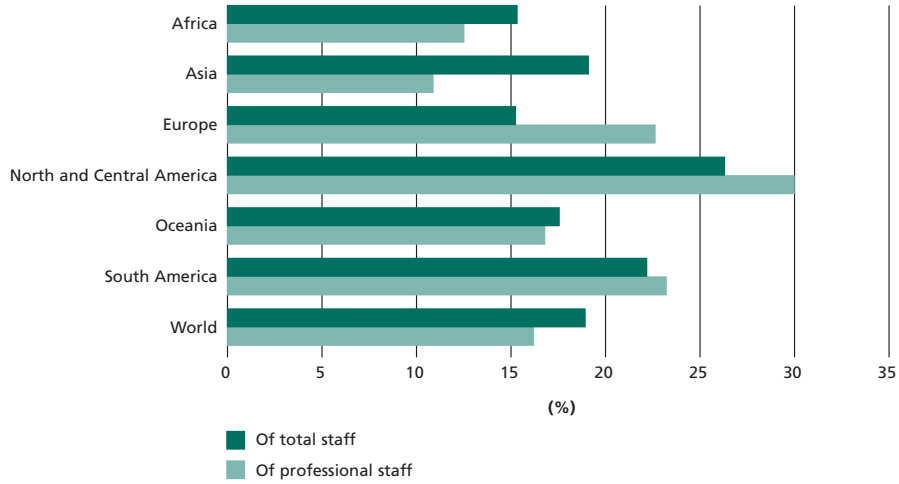
The percentage of female professional staff in 2008 was reported by 109 countries (or 47 percent of the total, representing 33 percent of the global forest area). In 2008, 19 percent of professional staff members were female. The proportion of female staff was highest among professionals in the reporting countries of North and Central America and lowest in Asia.

Trends

Staff of public forest institutions decreased globally between 2000 and 2008 by 9.1 percent, or 1.2 percent annually. These decreases were mostly concentrated in Asia and Europe. On the other hand, North, Central and South America and Oceania experienced an increase while numbers in Africa remained basically unchanged. Reported decreases may reflect a reduction in staffing levels but also a redefinition of jurisdiction, a distribution of assets to other agencies (e.g. South Africa and Mozambique), privatization of functions previously performed by public forest agencies, or structural changes (e.g. Georgia). The number of professional staff grew at an annual rate of 0.4 percent between 2000 and 2008, suggesting an increasing professionalization of public forest agencies.

Between 2000 and 2008, the proportion of female staff diminished slightly, from 23.5 percent to 22.1 percent. Indeed, this global decrease is mostly a result of reductions in the Eastern and Southern Africa and the East Asia subregions, as all other regions experienced an increase or no change in the proportion of female staff. Only 66 countries (representing 21 percent of the global forest area) reported figures that could be used to compare the percentage of professional female staff between 2000 and 2008. Globally, the percentage of women among professional staff remained basically unchanged.

FIGURE 8.5
Percentage of female staff in public forest institutions by region, 2008



Conclusions

As the role of forests in climate change mitigation becomes increasingly recognized, so does the need for improved interministerial coordination, in particular among ministries of environment and ministries of agriculture and/or forestry. This is particularly important where forest policy formulation and climate change policy are within the purview of separate ministries.

It is noteworthy that only 63 percent of countries reported figures on total human resources working in public forest institutions. Many large countries (e.g. Australia, Canada, Democratic Republic of the Congo and the Russian Federation) did not report on this variable, presumably because their decentralized institutional structures made compiling this level of information very difficult. Since this is the first time that countries have reported on such data, full comparability among them cannot be expected.

Are current staffing levels in public forest institutions appropriate to promote sustainable forest management? Unfortunately, this question cannot be easily answered because many factors contribute to overall institutional capacity including financial resources, knowledge, technology, infrastructure and equipment, partnerships and overall institutional context (e.g. policies, legal framework and other institutions). Furthermore, the appropriateness of staffing levels also depends on society's demands on forests which, in turn, are driven by demographic, geographic, environmental and climatic factors, as well as the level of economic development and national priorities.

EDUCATION AND RESEARCH

Introduction

Information about education and research provides a useful indication of a country's managerial, technical and administrative capacity for sustainable forest management and its ability to adapt the forestry sector to complex challenges such as climate change.

The number of students completing a master's degree is one indicator of the future national ability to develop and implement policies and strategies for sustainable forest management; the number of bachelor's degrees can provide an indicator of the ability to manage programmes and implement policies; and technical certificates or diplomas indicate the ability to implement operational plans. The total number

of university students who graduate with master's and bachelor's degrees may also indicate the importance society accords to forests and their management. The number of professionals working in publicly funded forest research is an indication of the national interest in, and capacity to solve, forestry sector issues, while the percentage of female students points to possible future changes in the gender balance in forestry.

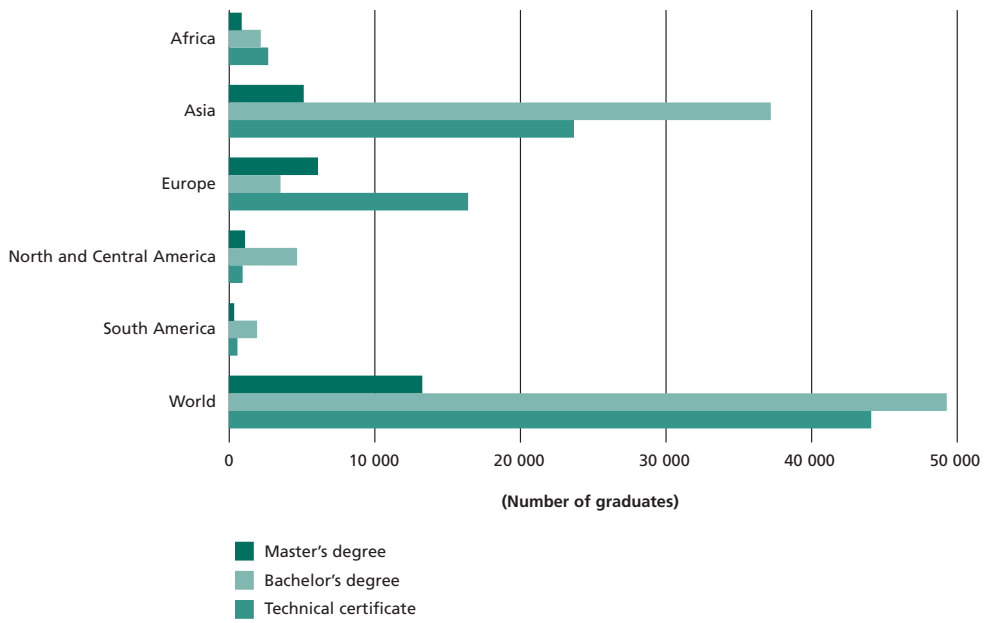
Status

In 2008, 125 countries representing more than 70 percent of the total forest cover, reported that a total of 106 800 students completed an education in forest sciences. Of these, 62 600 were university students (13 200 completing a master's degree and 49 400 a bachelor's degree) and 44 200 obtained a forest technician's certificate (see Figure 8.6).

Globally, the ratio of master's to bachelor's degrees was about one to four, but the pattern varied considerably between and within regions. For example, the low number of bachelor's degrees in Europe is partly due to the fact that the education system in many countries provides a combination of bachelor's and master's degrees in forestry, but is also a result of the lack of data for several large countries, including the Russian Federation. The lower number of technical certificates compared with bachelor's degrees is surprising. It highlights the particular difficulty of compiling data at the global level about technical certificate students focusing on forestry. Technicians often receive a broad technical education which includes forestry, agriculture and environment, and the forestry part is not necessarily mentioned in the title. The information related to master's and bachelor's degrees appears to be more coherent as it is gathered mainly from universities and faculties of forestry.

It may be assumed that a society that educates more students in forest sciences would be better prepared for future challenges related to forest conservation and

FIGURE 8.6
Graduation of students in forest-related education, 2008



Note: Oceania is not included as Australia and New Zealand did not report.

management. The readiness of the forestry sector to respond to such challenges can therefore be assessed by calculating the ratio of university educated students in forest sciences to the total population or forest area. In 2008, globally one university student graduated per 86 300 people, or one per 44 200 ha of forest. Figure 8.7 shows the number of university graduates for every 10 million people and every 10 million hectares by region. The number of graduates per 10 million hectares of forest in Asia was very high in comparison with other regions as a result of the large number of university students graduating in China.

Female students made up about 31 percent of total master's students, 36 percent of bachelor's students and 16 percent of technicians. However, some significant forest countries did not provide gender disaggregated information. Asia, North and Central America and Oceania had the highest proportions of female students in 2008, while Europe and Africa had the lowest (see Figure 8.8).

A total of 124 countries, representing 53 percent of the total forest area, reported that about 21 000 professionals were working in publicly funded research centres in 2008. Information was missing from many countries with large forest areas including Australia, Canada and the Russian Federation. About 25 percent of the total forest research workforce held a Ph.D. degree. When related to the total forest area of the reporting countries, this is equivalent to one Ph.D. per 417 000 ha of forest. Europe had by far the highest number of Ph.D. level researchers per unit of forest area (see Figure 8.9).

Trends

Between 2000 and 2008 the trend in numbers of students graduating in forest sciences was generally positive. Countries that reported on master's and bachelor's degrees represent about 50 percent of world forest area, and indicated that the number of master's students increased by about 8 percent annually and bachelor's students by 13 percent per year over the period. This increase varied between regions and subregions. Asia accounted for the largest change with an annual increase of 17 percent in master's and 16 percent in bachelor's graduates; Africa and America saw rises of between 4 and 8 percent per year in the number of master's and bachelor's students graduating in

FIGURE 8.7
Ratio of university graduates to population and forest area, 2008

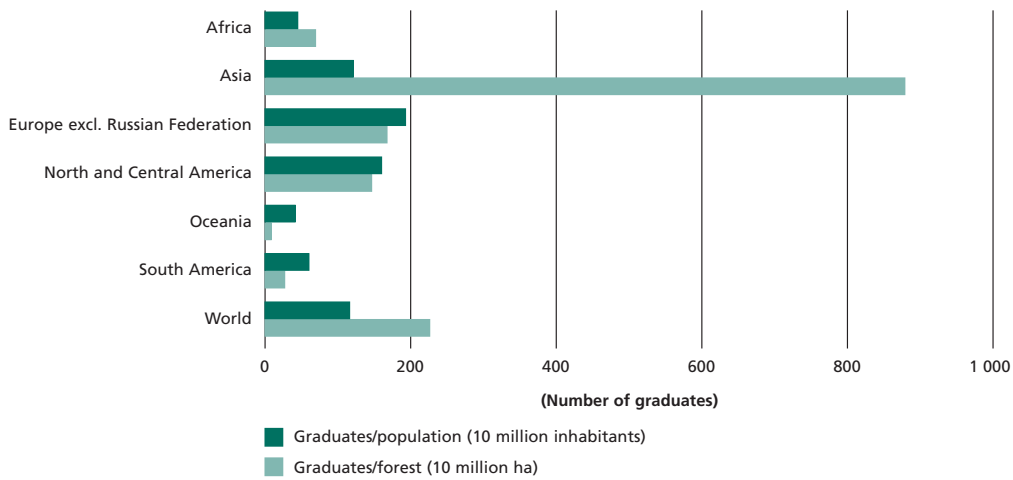


FIGURE 8.8
Percentage of female graduates in forest-related education, 2008

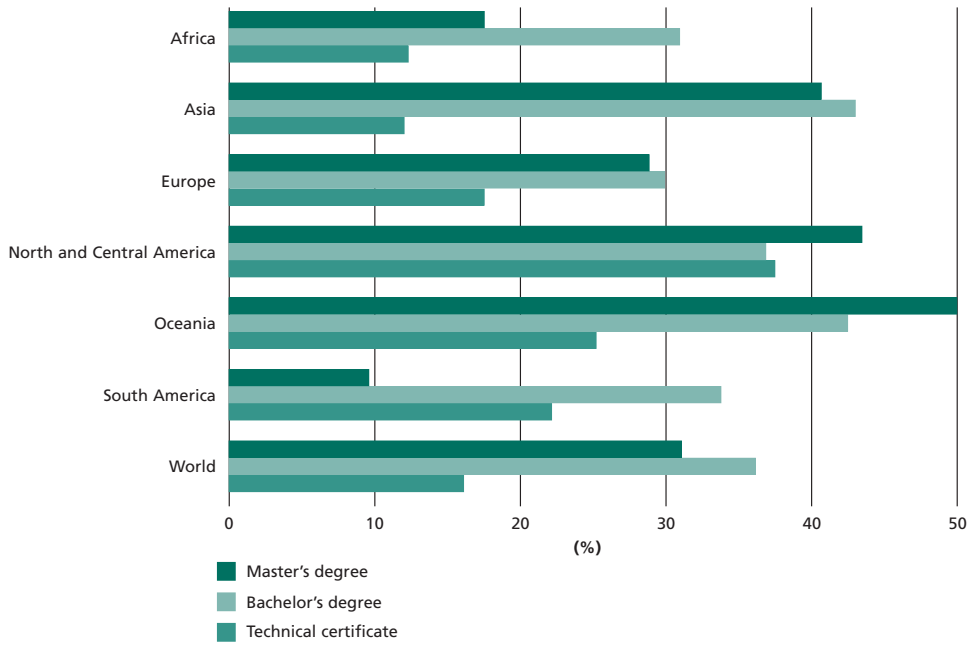
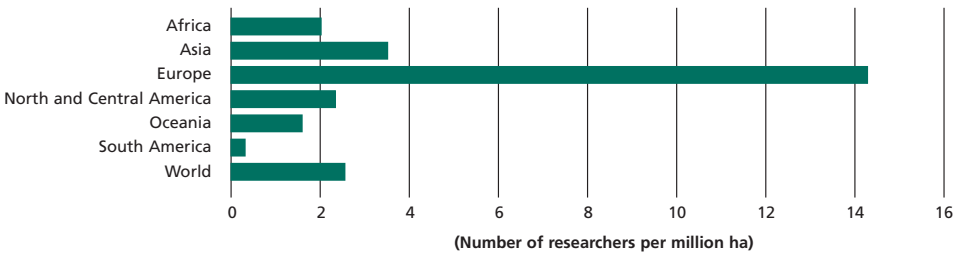


FIGURE 8.9
Number of Ph.D. researchers in public forest research institutions per million hectares of forest, 2008



Note: Several large countries, including Australia, Canada and the Russian Federation, did not report on this variable

forest sciences. Europe showed an annual increase of only 1 percent for master's and 4 percent for bachelor's degrees.

Fewer countries, representing only 33 percent of total forest area, reported on technicians and the trend was less positive at this level of education. Africa and South America showed a negative trend (-0.5 percent and -6.0 percent per annum respectively), while the United States of America showed the greatest increase with 16 percent annually.

Changing numbers of university students (master's plus bachelor's degrees) may translate into a changed potential for influencing society on current and future forest-related issues. Between 2000 and 2008, the total number of the foresters who graduated from university steadily increased for most regions by 2 to 8 percent per

year, and globally by 11.7 percent per year on average. This trend is strongly influenced by China which significantly increased the number of university students in forest sciences between 2000 and 2008.

Data from the few countries (68) that reported on the proportion of female graduates confirmed the progressive increase in the proportion of women studying forest sciences at university between 2000 and 2008. At the global level this change was about 2.1 percent annually, taking the proportion of female forestry students at university level from 30 percent in 2000 to about 34 percent in 2008.

In countries where a time series was reported the total number of Ph.D. and master's degrees held by the publicly-funded forest research workforce increased by about 2 percent per year between 2000 and 2008, while the number of research staff with bachelor's degrees increased by 1 percent annually.

Conclusions

Adequate national forest education and research capacity is essential for providing the information and knowledge needed to manage, conserve and enhance forest resources. General trends in education numbers do not suggest an imminent collapse in the profession. However, the magnitude and diversity of demands on forests and the related threats and opportunities have grown significantly in recent decades in many countries. To address these new challenges, education and research systems need to provide appropriate skills and knowledge. An assessment of whether existing capacities are appropriate is not feasible on the basis of the data reported and must be carried out at country level.