Global trends in forest ownership, public income and expenditure on forestry and forestry employment

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Abstract
This paper presents results of analyses of data from the 2015 Global Forest Resources Assessment on changes in forest ownership, public income and expenditure on forestry and forestry employment. Forest ownership continued to show less state control and ownership of forests. This was due to private-sector investment and, in some countries, the transfer of public forests to the private-sector (including local communities). This contrasts somewhat with results on public income and expenditure, which indicate that public expenditure on forestry has increased dramatically over the last decade, while income has increased by very little. Global employment in forestry has not changed much over the last two decades and has remained at about 12.7 million people, with the majority of these employed in informal activities, particularly in Asia. While production of many if not most forest goods and services has increased, labour productivity has improved at the same time, leading to this result. Comparing the results for groups of countries at different income levels, it appears that higher income countries tend to have a relatively high proportion of private forest ownership, high levels of labour productivity and high levels of public spending (per hectare) on forestry. However, apart from these very general differences in outcomes related to income levels, there does not appear to be strong correlation between these socioeconomic variables and other forest-related variables collected in the FRA.

1. Introduction

The structure of forest ownership and public sector income and expenditure on forestry are two major institutional variables that affect the way that forests are managed. Changes in ownership can occur as a result of transfers of forest from the state to the private sector or they can reflect different levels of investment in forest land management. Employment in forestry is one indicator of the socioeconomic benefits that are derived from forest management. It is important to note that for the purposes of this paper, employment in forestry is only that which occurs in the forest – up to the forest gate. Employment in transportation, processing, manufacturing and retailling of forest products is not included.

Ownership, management rights, income, expenditure and employment may be linked to wood production, forest area change, the designated purpose of forest management and other forest variables, although many of these factors are heavily influenced by macroeconomic dynamics outside the forestry sector (Contreras, 2000; Cañares, 2009).

1.1. Forest ownership

Forest ownership is a very rough indicator of the distribution of costs and benefits from forest management across different stakeholders in the public and private sectors (including different types of owner in the private-sector). Changes in forest ownership often follow large-scale political change – for example, the privatisation of land ownership in former Communist states or decentralization of government responsibilities for land management (Krott, 2008; Tomter, 2011). Shifts to decentralization of forest control have resulted in more control at more local levels over the past 25 years (Phels et al., 2010). In each of these cases (privatisation and decentralization) it may be difficult to detect significant impacts, negative or positive, in forest management. For example, Ribot et al. (2006) note that decentralization initiatives have been launched in the majority of developing countries, but these rarely lay the foundations necessary to reach decentralization’s purported efficiency and equity benefits.
1.2. Public sector income and expenditure on forestry

Public sector expenditure on forestry is a simple indicator of political commitment to sustainable forest management. It is also not an easy indicator to understand as differences in forest management costs and in income levels between countries are likely to have a major impact on this variable. Public sector income from forestry also provides useful information about the returns to the state from its support for forestry activities and comparing the two can show whether government involvement in the sector results in a net cost or net income to the government (Indufor, 2013). Income and expenditure data are difficult to find in part because in today’s world government revenue and expenditure related to forests and forestry occur in multiple agencies. Production, recreation and conservation for example may all be funded through different departments with complex taxation and fee collection schemes.

1.3. Employment in forestry

Employment in forestry is an indicator of the social benefits derived from forests. Having a job brings many important benefits, including: providing a source of income, improving social inclusion, fulfilling one’s own aspirations, building self-esteem and developing skills and competences (OECD, 2014). In addition, employment in forestry has always been and continues to be an important contributor to rural economies and to the livelihoods of people living in rural areas (Kastenholz, 2011).

Official statistics on forestry employment are often weak – largely due to informal and part-time activities. This informal employment includes people working in small-scale timber harvesting, wood fuel and charcoal production or collection of non-timber forest products. Despite the lack of data to produce a reliable global estimate of the informal employment, some country studies have shown that informal employment, especially in developing countries, is large and plays a crucial role in the livelihoods of rural areas (Cerutti and Tacconi, 2006; Forest Europe, 2014). Agrawal et al. (2013) mentioned that about 40–60 million people are employed in the informal forestry sector, while the findings of the recent State of the World’s Forests report estimated this figure to be at least 41 million people (FAO, 2014).

2. Materials and methods

FRA 2015 was organized around 21 key questions grouped into eight topical categories for the years 1990, 2000, 2010 and 2015. FRA 2015 definitions, analytical categories, methods and applications are described in MacDicken (2015). For this paper, a listwise deletion method was used to select data for analysing trends, excluding all countries that did not provide data for one or more reporting year.1 In addition, using the data to calculate the proportion of private forest ownership in countries, Pearson’s correlation coefficients (r) were estimated to see if this was related to a number of other forest variables, such as the proportion of the total forest area used for production or under forest plantations or changes in the total forest area. Table 1 describes the reporting for each of the variables covered in this paper.

2.1. Forest ownership

A forest owner is defined in the FRA 2015 as an entity that has the legal rights to freely and exclusively use, control, transfer or otherwise benefit from a forest (FAO, 2010, 2012). This includes ownership of trees growing on land classified as forest, regardless of whether or not the owner of those trees also owns the land on which they grow. The FRA 2015 then divides forest ownership into the following three categories:

- **Public ownership** – forests owned by the state or lower-levels of government.
- **Private ownership** – forests owned by individuals and families, business entities and other private institutions, communities, or other types of private owner; and
- **Unknown ownership** – areas where ownership is unclear, unknown or disputed.

The public and private ownership categories are also further sub-divided into different types of owners (as listed above).

Information about the area of forests in each of the ownership categories was collected for four periods: 1990, 2000, 2005 and 2010 (Table 1). It is important to note that reporting was excluded for two significant forest area countries (Australia and Brazil) due to missing data.

2.2. Public sector income and expenditure on forestry

In the FRA 2015, public expenditure on forestry is defined as expenditure on forest activities of all government institutions (including at sub-national levels), but excluding publicly owned business entities (nationalised industries or state enterprises). It includes the total budget allocated to forestry and spent by all concerned institutions, including expenditures for administrative functions, reforestation funds, direct support to the sector (e.g. grants and subsidies) and support to other forest-related institutions (e.g. training and research centres).

Public sector income is defined to include all charges collected specifically from individuals and enterprises engaged in the production of forest products and services (e.g. concession fees and royalties, stumpage payments, public timber sales revenue, etc.), but excluding taxes and charges generally collected from all

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1 Other FRA reporting for a single year may include data from all countries, which will result in some differences in reported values with those reported in this paper.
individuals and enterprises (e.g. corporate, payroll or income taxes, land and property taxes, sales or value-added taxes), import taxes or duties levied on forest products and income from publicly owned business entities.

Income and expenditure data were reported for 2000, 2005 and 2010 (Table 1). For the countries providing information about only income or expenditure, it was much more common for countries to report expenditure, although it is quite likely that the missing values (about income) are either zero or very low. Thus, the comparison of income and expenditure is not likely to be biased significantly by the absence of paired observations, although this remains a source of uncertainty in this analysis.

2.3. Employment in forestry

It is vital to note that FRA 2015 defined employment in forestry as "employment in activities related to production of goods derived from forests", which corresponds to the International Standard Industrial Classification (ISIC, 2008) Activity A02 (forestry and logging) and is referred to as the forestry sub-sector in the remainder of this text.

The ISIC does not distinguish between formal and informal or between legal and illegal production. According to ISIC Rev. 4, Activity A02, forestry and logging include the following Groups: 021 – silviculture and other forestry activities; 022 – logging; 023 – gathering of non-wood forest products; and 024 – support services to forestry. This means that forest sector employment in other than these activities is not included in this analysis.

Employment data were reported for 1990, 2000, 2005 and 2010 and were expressed in thousand Full Time Equivalents (1000 FTE) (see Table 1).

For the year 1990 in FRA 2015, information about employment was collected from 105 countries representing 32% of the global forest area (Table 1). Several large forest area countries did not report (Democratic Republic of Congo, Mexico, Colombia, Angola, Papua New Guinea and the Republic of Congo).

Ninety-one countries reported employment for all four years, with these countries representing approximately 30% of the global forest area. The low response rate is because some countries with large forest areas (Russian Federation, Brazil, USA, the Democratic Republic of Congo, Australia and Indonesia) did not provide information for the entire time series. Thus, due to the low number of countries reporting the whole time series, the trend analysis from 1990 to 2010 is likely to be very imprecise. The same is true for female employment, where only 29 countries reported for the whole time series, representing approximately 16% of the total forest area. This shows clearly the challenge to collect sex-disaggregated data (SDD).

3. Results and discussion

3.1. Forest ownership

Forest ownership in 2010 was divided as follows: 2,964 million ha in public ownership (76%); 772 million ha in private ownership (20%); and 141 million ha of unknown or unclear ownership (4%).

Fig. 1 shows that most forests are owned by the state in all categories. In many cases, public ownership accounts for the greatest share of all forest by far, but this dominance is lower in the temperate and subtropical domains, where public ownership accounts for only 52% of all forest area in both cases.

With respect to income, the dominance of public ownership generally declines at higher levels of income. For example, the proportion of forest that is publicly owned is lower in upper-middle income countries than in lower-middle income countries (86% compared to 77%) and it is highest of all in low income countries (at 96%). The result for high income countries largely reflects the presence of the Russian Federation in this country group, which accounts for over half of the total forest area in this domain and almost all of this forest is owned by the state. Excluding this country, the other high income countries would also follow this pattern with a proportion of forests in public ownership of 62%, slightly lower than in upper-middle income countries.

The area where forest ownership is unclear or unknown is relatively small at the global level and the figures presented above largely reflect the situation in two of the 21 countries that reported any areas of unknown ownership (Brazil and Mexico\(^2\)). Given that it is commonly believed that land and forest ownership and tenure is quite uncertain in many countries (especially tropical countries), it would appear that the data reported to the FRA 2015 may not be capturing the complexity of the situation with respect to forest ownership.

For example, land tenure and ownership is very clear in almost all high income countries. The legal framework for land and forest ownership has been established for many decades and record-keeping is effective in many of these countries, so there are relatively few areas of forest where ownership is uncertain, unknown or contested. In contrast, in many low income countries privately owned land is clearly identified and recorded, but most other land is owned by the state as a default position in the absence of any other legally defined or recognised types of land ownership. In reality, while technically owned by the state, many of these areas are likely to be used by local people for lots of different purposes, meaning that the state does not always have exclusive control and use rights (as stated in the definition of ownership given above) (Banerjee, 1997).

Countries that report some areas of unknown ownership are likely to be those that recognise that state ownership without real control over such areas is untenable in the long-run and many of these countries have reached a level of development where they are willing and able to address such issues. It is also worth noting that many of the countries with areas of unknown ownership are in Latin America, where socio-economic and historical factors have not led to state ownership as the default position for much of the land area in these countries.

Globally, the forest area owned by the state has fallen from 2.6 billion ha to 2.5 billion ha over the period and the area of privately owned forest has increased by about 100 million ha, from 430 million ha to 530 million ha (Table 2). This means that the proportion of forest owned by the state has fallen slightly from 85% in 1990 to 82% in 2010\(^3\) and privately owned forests have increased in importance from 14% to 18% of the total forest area over the same period (Fig. 2). However, while these two trends at first appear to be “equal and opposite” at the global level, the regional pattern of changes in forest ownership are much more complicated and the trends at this level have been driven in different places by several different factors.

For example, looking at the different ecological domains, almost all of the change in the structure of forest ownership has occurred in the temperate zone, where the proportion of forests owned by the state has declined from 63% to 52% over the period. The structure of ownership in the tropical and boreal domains is the same in 2010 as it was in 1990 with only a 1% change in the subtropical domain (see Fig. 2).

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\(^2\) Brazil (Tropical) and Mexico (Subtropical) are upper-middle income countries.

\(^3\) Note – the figure for 2010 is slightly different to that presented earlier because the calculation only includes the countries that provided data for all of the four years: 1990; 2000; 2005 and 2010. The area of forest of unknown ownership is not mentioned here because, in the absence of trend data for Brazil and Mexico, the figures for the remaining countries are insignificant.
More importantly, it should be noted that the change in ownership structure in the temperate zone has been due to two different mechanisms: the transfer of public forest to private owners and an expansion of privately owned forest through afforestation. Thus, for example, the area of privately owned forest increased by 95 million ha from 1990 to 2010 in the temperate domain. About 40 million ha of this increase came from a net transfer of forests from the state to private sector. The remaining 55 million ha came from private sector investment in afforestation (i.e. an expansion in forest area).

Similar trends appear if the data is examined by income levels, although in this case it is upper-middle income countries where the most significant changes have occurred and very little has changed elsewhere. Upper-middle income countries include some countries in Eastern Europe where the transfer of state owned forests to the private sector (restitution) occurred in the 1990s. In addition, several countries with significant expansion of planted forests appear in this group (e.g. Brazil). So, this change in ownership structure is again due to a mixture of transfer of forests from the public to private sectors and private investment in afforestation.

Given that private forest owners may have different management objectives and sources of finance, it might be expected that the structure of forest ownership would be related to a number of other forest characteristics. However, more detailed examination of the data did not arrive at any significant correlations.

For example, there is no correlation between the proportion of forest that is privately owned and the share of forest plantations in total forest area (r = 0.016) or between private ownership and the proportion of forests managed for production (r = 0.015). There is a very slight correlation between private ownership and the average annual change in forest area (r = 0.082), but this may be spurious because both of these variables are higher in high income countries and it is likely that income is driving both of these variables rather than one driving the other.

Thus, while it might be expected that a greater level of private sector involvement in forestry could be associated with more forest plantations, more forests used for production and possibly even an expansion of forest areas, the results of the FRA 2015 do not reveal such a relationship.

3.2. Public sector income and expenditure

In 2010, governments spent approximately USD 38 billion on forest-related activities and received income amounting to USD 15 billion, suggesting that public expenditure was about 2.5 times the level of income that governments received. However,
the Fig. 3 below shows that there are some significant differences between public sector income and expenditure in countries, largely related to income levels in countries.

Looking at the climatic domains, expenditure in boreal and tropical forests was relatively low at USD 1.5 billion and USD 2.9 billion respectively and income in each of these domains was just under USD 6 billion. In these countries, forestry activities result in significant net income for the state, although these figures largely reflect the results in a small number of countries (Sweden, Finland, the Russian Federation, Canada, Brazil, Malaysia, Gabon, India and Papua New Guinea) and while the results for the boreal region are comprehensive, many tropical countries did not provide any data.

For the subtropical and temperate zones, public sector expenditure is far higher than income, at USD 8.3 billion and USD 25.2 billion respectively and with corresponding public sector income figures of USD 0.5 and USD 2.8 billion. The figures for these two domains included the results for many countries in Europe, plus China, so they are likely to be quite representative of public sector income and expenditure in these two domains (although a figure for income in 2010 was not available for the United States of America, which reported income of USD 1.3 billion in 2000).

The figure for income and expenditure by income category clearly shows how public expenditure is much higher in higher income countries and is significantly higher than income in those countries. At low and lower-middle incomes, both public expenditure and income are much lower, although they do also appear to be approximately the same, suggesting that forestry in these countries is not a net cost to the government. The data for these countries is very partial, especially with the absence of any figures for many tropical countries. However, it is suspected that income and expenditure is probably also very low for many of the missing countries (and may also be in balance).

What is perhaps the most interesting result of this analysis is that expenditure on forest management per hectare is significantly higher in higher income countries; at about USD 12 per hectare in high and upper middle income countries compared to USD 2 per hectare in low and lower middle income countries.

Fig. 2. The proportion of forest owned by the state by climatic domain and income category (1990–2010).

Fig. 3. Public sector income and expenditure on forestry by climatic domain and income category in 2010.
Expenditure increased by USD 15.7 billion over the decade between 2000 and 2010, while income increased by only about USD 6.1 billion, although there are clearly differences between climatic domains (Table 3).

Looking at the apparent trends by climatic domain, most of the increase in public expenditure on forestry occurred in the temperate zone, with China accounting for by far the greatest share of this increase. Expenditure increased very little in the other climatic domains and even declined slightly in the subtropical domain.

In terms of income, there have been small increases in all of the domains over the decade, but the biggest increase in public sector income from forestry occurred in the tropical domain. The trend in this domain is dominated by the results from Brazil (also an upper-middle income country), but most of the other countries in this domain also experienced an increase in income over the period.

Public expenditure on forestry and revenue from the sector are correlated to some extent ($r = 0.273$), but the relatively low degree of correlation suggests that many other factors probably affect the amount of money that governments are willing to spend on forest management. Similarly, other correlations between public expenditure per hectare and forest change ($r = 0.294$) and expenditure per hectare and the proportion of forest plantations ($r = 0.577$) are likely to be capturing underlying income effects rather than a strong relationship between public spending in the sector and outcomes in terms of the areas and types of forests present in countries. All that can really be concluded from the public expenditure and income data collected in the FRA is that the former is much greater than the latter in most countries and at the global level.

### 3.3. Employment in forestry

In 2010, employment in the forestry sub-sector reached 12.7 million employees or about 0.4% of the global workforce. The countries with the highest numbers of employees were India, with 6 million, Bangladesh with 1.5 million and China with 1.1 million. These three countries accounted for 70% of global forestry employment in 2010, as reported to the FRA 2015.

The high number for India can be explained because India included some estimates of informal or unpaid employment in activities such as collection of fuelwood and fodder. Similarly, in Bangladesh, part time labour was included, but this was not translated into FTE. In other cases, it was noted that, due to a lack of proper statistics, many countries reported figures based on expert estimations or the results of small ad-hoc studies, so there are considerable uncertainties about the validity of some of these figures. It should also be noted that, with the inclusion of informal employment in some countries, these figures overestimate formal employment at the global level, but under estimate total (i.e. formal and informal) employment in the sub-sector.

Figs. 4 illustrate the state of employment in the forestry sub-sector in 2010. Low middle income countries represent more than half of the employment in 2010; upper middle and low income countries have almost the same share, while high income countries have the smallest percentage. Regarding domain, the tropical domain accounts for 81% of all employment, followed by the temperate domain with 14%. These results are strongly influenced by India, because India is a low middle income tropical country.

Fig. 5 shows the relationship between employment in 2010, total wood removals (industrial roundwood production and woodfuel production) and forest area designated for production, here defined as the addition of two variables; “forest area designated for production” and “multiple use forest (MUF)”. With the exception of high income countries, the proportion of the total workforce engaged in forestry is correlated with the proportion of forest area designated for production or multiple uses. As might be expected, this suggests that more employment is generated in forestry in countries where more forests are used for production or multiple uses.

In the case of high income countries, industrial roundwood production (rather than woodfuel production) accounts for the majority of total wood production, as is shown by the relative size of the bubbles in the two different halves of the figure. This partly explains why employment in these countries is so low (despite the high area of forest designated for production and multiple uses), because industrial roundwood production in many of these countries is highly mechanised, leading to very high labour productivity. Conversely, the figure also shows the importance of employment in woodfuel production, which is strongly negatively correlated with income and, thus, particularly important for low income countries.

Because of the limited availability of data, trends in employment were analysed from 2000 onwards including 110 countries (representing 82% of the total forest area) that provided data for the period 2000–2010.  

### Table 3

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boreal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Revenue</td>
<td>3.9</td>
<td>5.9</td>
<td>5.3</td>
</tr>
<tr>
<td>– Expenditure</td>
<td>0.4</td>
<td>1.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Temperate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Revenue</td>
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<td>1.7</td>
<td>2.7</td>
</tr>
<tr>
<td>– Expenditure</td>
<td>9.4</td>
<td>15.6</td>
<td>25.0</td>
</tr>
<tr>
<td>Subtropical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Revenue</td>
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<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>– Expenditure</td>
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<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Tropical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Revenue</td>
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<td>3.3</td>
<td>5.5</td>
</tr>
<tr>
<td>– Expenditure</td>
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<td>1.1</td>
</tr>
<tr>
<td>Global</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Revenue</td>
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<td>11.2</td>
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<tr>
<td>– Expenditure</td>
<td>17.8</td>
<td>24.0</td>
<td>33.5</td>
</tr>
</tbody>
</table>

Fig. 4. Distribution of global forestry employment by income category and by climatic domain in 2010.
Generally, from Fig. 6 above it can be observed that global employment in forestry and logging has decreased very slightly over the decade towards 2010, with very little difference in these trends between income or climatic domain categories. However, there are differences between selected sub-regions (Fig. 7).

Although these trends in sub regions have been strongly influenced by a few countries in each case, two main trends can be observed. The first is that there is a group of sub regions where employment has declined in the last decade (including: Europe; North America; Oceania\(^5\); East Asia; and Western and Central Asia), although the reasons behind these declines differ somewhat between the sub regions.

In the case of Europe and North America (generally high income countries), employment has been drastically affected by the global economic downturn of 2008–2009, when the construction industry (a major consumer of forest products) entered a period of deep and prolonged recession (Ma et al., 2009). China accounts for most of the trends in East Asia\(^6\) and employment there has also reduced by 21% from 2000 to 2010, due to a decline in export markets for processed forest products (such as furniture) and a decline in house building (UNECE/FAO, 2009). In contrast, employment also decreased in Australia and New Zealand at the same time that production increased, showing that declining employment in the sub sector can also be due to rising productivity (in terms of production per employee).

An opposite trend (of increasing employment) can be observed in some other regions, such as: South America, Western and Central Africa and South and Southeast Asia. Some countries in these regions have considerably increased employment in forestry (and also wood removals in many cases) with, for example an increase of 200% in Uruguay, 136% in Peru, 96% in Suriname and 26% in Brazil from 2000 to 2010. According to the Forest Producer’s Society of Uruguay (2011), forestry there has been growing due to increasing exports of forest products, afforestation and reforestation, as well as industrial development. In Brazil, afforestation has consistently increased the forest plantation area since the mid-1960s and these resources now support a major pulp and paper industry, as well as the development of furniture and other value added industries (Biani et al., 2009). Both of these countries are good examples of where legislation to promote development of the forestry sector has led to significant long-term employment benefits.

In contrast, employment growth in South and Southeast Asia and West and Central Africa has been strongly influenced by increases in the numbers of people involved in the collection of wood fuel and NWFPs in places such as India, Togo and Mali.

3.3.1. Female employment in 2010

In 2010, female employment reached 1.40 million employees. The countries with the highest female employment were Bangladesh with 600 thousand, China, with 300 thousand, Mali with 180 thousand and Brazil with 90 thousand.

Sixty-nine countries provided information on female employment in 2010 (of which nine reported this as zero) and the share

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\(^5\) Oceania is represented in this analysis by 3 countries; Tonga, Australia and New Zealand.

\(^6\) In this analysis, there are 3 East Asian countries reporting for the 3 years: China, Japan and Mongolia.
of female employment in total forestry employment was calculated and is shown in Fig. 8. The countries with the highest share of female employment are Mali with 90%, Mongolia and Namibia with 45% and Bangladesh with 40%.

The countries that did report female employment included countries from a mixture of the different climatic domains and levels of development and if these are considered to be globally representative, they suggest that females may account for about 30% of employment in the sub-sector. This figure is similar to the level reported in FAO (2014), which estimated that women accounted for about 25% of all employment in formal forestry and logging activities. The analysis of the additional information in the country reports suggested that, because of a lack of options, women are more involved in non-paid and subsistence activities (e.g., collection of fuelwood and NWFPs) rather than in salaried jobs, so the slight difference between these two figures could be explained by the inclusion of informal activities in some countries in the FRA 2015 data.

The high proportion of women employed in forestry in some countries could also be partly explained by progress in policy and legislation in places like in Bangladesh, which has updated its forest policy and legislation to enhance women’s participation in social forestry development.7

3.3.2. Productivity

The data on employment can also be used to analyse trends in productivity (i.e., the amount of output per employee) (Fig. 9). In general, productivity has increased over the last 10 years, by 23% at the global level from 2000 to 2005 and 20% from 2005 to 2010. As this figure shows, boreal countries have the highest levels of productivity and it has also increased in these countries more than

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greater amount at the same time as wood removals have increased. In contrast, the Russian Federation (which accounts for most of the boreal region) has reduced employment by an even greater amount at the same time as wood removals have increased. In the tropical domain, the productivity trend is strongly influenced by India, Brazil and Indonesia. While India shows a level of productivity far below the global average (47 and 67 m\(^3\) per employee in 2000 and 2010 respectively), Brazil and Indonesia are nearer the global average. Productivity in Indonesia has drastically increased in the last 10 years from 25 to 522 m\(^3\) per employee, although this may be due to inaccurate information about wood removals.

Subtropical countries show relatively stable productivity, with a slight decreased from 2005 to 2010. This is the result of gains in some countries and losses in others. For instance, Australia has reduced employment by almost 50%, resulting in a productivity increase of 84%, although the sector is of growing importance to Australia and has received intensive policy focus since the early 1990s (Low and Sinniah, 2010).

The analysis presented here has used fairly simple techniques to try to identify relationships between different variables by examining changes over time or differences between countries, but the results have been fairly inconclusive. Given the complexity of situations in different countries it may be more useful in the future to explore similarities rather than differences between countries, using techniques such as cluster analysis. While less useful for examining causal relationships in forestry development, such techniques could provide insights in other areas such as the forest transition hypothesis and may make better use of the many different dimensions of the data collected in the FRA.

4. Conclusions

The FRA data on forest ownership, public income and expenditure and employment in forestry show huge variations between countries that cannot be easily explained. Apart from the general observation that some of these variables appear to vary according to income levels, they are not strongly related to other forest variables where some degree of correlation might have been expected. This suggests that factors outside the sector may have more of an influence on the way that forests develop over time and in different places.

It is also worth noting that, for many of these variables, often only a small number of countries account for a huge proportion of the global total and tend to have a major impact on results at the global level (e.g. China and the USA in the case of public expenditure, Russia, Canada and the USA in the case of ownership structures and India in terms of employment). A similar issue was noted in the previous FRA. Despite some improvements in the dataset, there still remain a number of significant gaps and uncertainties in the data, particularly related to public expenditure and income in the sector and, to a lesser extent, employment.

The analysis presented here has used fairly simple techniques to try to improve information about the roles that they play, as the few figures that are available suggest that they are largely involved in subsistence activities, especially in developing countries. With this apparent lack of employment opportunities presented to women, this suggests that further action is needed to promote more equal opportunities for women to access training and paid employment.

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References


Laskar Muqsudar Rahman, 2012. ICIMOD. Gender-positive changes in benefits-sharing in social forestry projects in Bangladesh. National Forest Policy- 1994 “Women will be encouraged to participate in homestead and farm forestry, and participatory afforestation programs”.


