Alternative Futures for Fibre Supply

DEFINING THE FUTURE

One of the main objectives in collecting, compiling and analysing forest resource statistics is to provide a better foundation for predicting or simulating possible future events. A difficult step is establishing a starting point or baseline – a rough indicator of immediate supply levels based on current growing stock, forest increments, harvesting intensity and forest losses. In the GFSM, the baseline was established by making a separate calculation for each major source of fibre (forest disturbed and undisturbed by man, industrial plantations, non-wood and recovered fibres) and then combining them. Details on the methodology and assumptions to carry out this task were reviewed in Section 2 – *Constructing alternative futures*.

There are significant limitations to keep in mind when reviewing the preliminary forecasts reported in this section and these are described at the end of this section. The emphasis of the work in the GFSM thus far is to create a "starting point" from a statistical point of view and to provide some modelling tools to help structure the discussion. The project does not attempt to find the right answer but to provide a vehicle to assist in exploring alternatives, in other words, a planning tool.

A set of preliminary futures for the Asia/Oceania, South America and Africa regions is described in Section 6. These will be adjusted as policy makers and analysts provide greater clarity as to what the future might hold. For South America and Asia/Oceania only one possible future is described; for Africa, three futures are presented to demonstrate the flexibility of the GFSM model to work with different assumptions.

For Europe, United States, Canada and Russia the forecasts were developed using a different methodology by the government agency, the research institute or the agency responsible for "official" forecasting; therefore, it is not possible to aggregate the forecasts for these regions merely by adding them together. Details of the reference materials used in compiling these forecasts are highlighted in the respective sections. Until there is a consensus on an appropriate and consistent methodology to be employed across all countries for global analysis it is not possible to give a definitive global picture.

ASIA/OCEANIA

Figure 18 describes one possible supply future for the Asian region. In this example, the increase in supply is primarily driven by assumptions made with respect to the role of plantations. The example simulates a future in which all undisturbed forest available for wood supply is transformed into disturbed forest by the year 2030. The deforestation rate is set sufficiently high that for many Asian countries the portion of the wood supply to come from natural forests continues to decline. Recovered fibre and non-wood fibre partially offset these declines. Since the role of trees outside of forests is quantitatively unknown in industrial fibre supply, estimates of the impact of this variable have not been made.

Figure 19 provides a brief summary of potential fibre availability for Oceania. The stability of the future described here is due to the continued significant role of plantations and the management of disturbed forests to provide a stable, even increasing, fibre supply. The undisturbed forests available for wood supply are assumed to be unlikely to play a significant production role beyond 2040.

SOUTH AMERICA

Figure 20 describes a possible future for the South American region. In this figure, the future role of plantations and forests disturbed by man is shown to be approximately equal. The supply significance of forests undisturbed by man is expected to decrease significantly under current market conditions. In

Figure 18
Potential fibre availability 1996 - 2050 for Asia
Future 1 ***(million m³)***

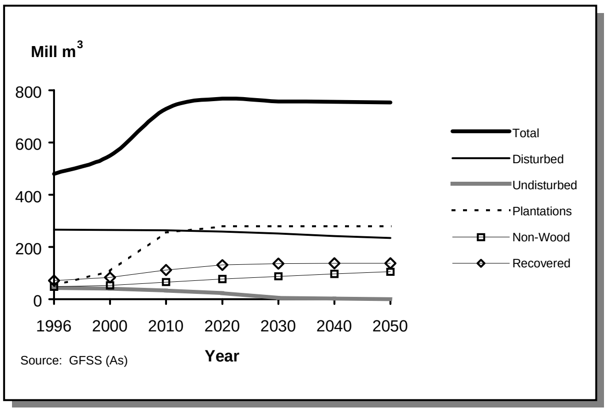


Figure 19
Potential fibre availability 1996 - 2050 for Oceania
Future 1 ***(million m³)***

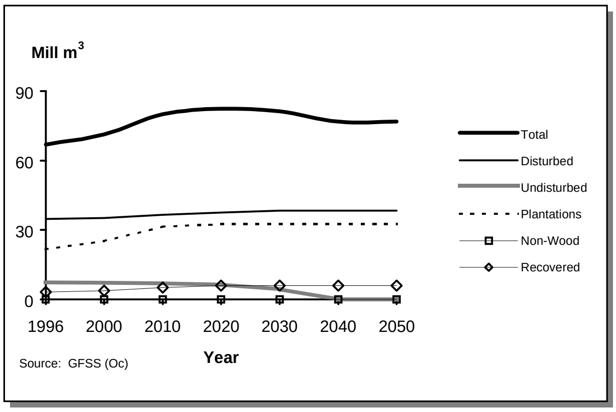
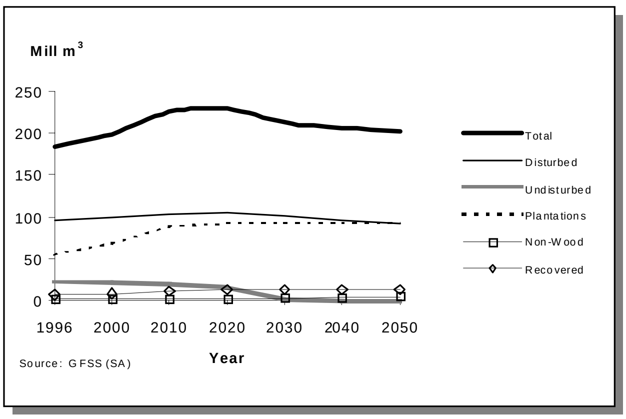


Figure 20
Potential fibre availability 1996 - 2050 for South America Future 1 ***(million m³)***



addition, changes in government policy in the important producer countries are also likely to change the future in South America and consequently the shape of the curves presented here. The GFSM model offers a capability to model the fibre supply impacts of some of these potential policy changes.

AFRICA

Table 18 lists the major factors identified in the GFSM futures for Africa. The list of factors is not an exhaustive set but rather a subset of a larger set of variables that have been raised in various studies within the last decade. The factors included in the GFSM modelling capability were selected based on their relative importance and the feasibility of obtaining information for each. In the future a wider range of factors could be added to the modelling framework.

Table 18 also indicates the variations introduced in order to produce three potential futures that are displayed graphically. The modelling in this example uses equation IV, as described in Section 2 – *Constructing alternative futures*.

Table 18
Selected major factors influencing fibre supply in Africa

	Future 1	Future 2	Future 3
Forests disturbed/undisturbed by man			
Sustainable management (as expressed by cutting cycle – periodic or annual)	0	-10	10
Land use – deforestation	0	20	-20
Land use – legally protected area change	0	-10	10
Industrial Plantations			
Afforestation rate	0	20	-90
Development gains	0	50	10
Non-wood Fibres			
Non-wood fibre pulping capacity	0	-20	20
Recovered Fibres			
Wastepaper recovery rate	0	-10	10

Note: percentage increases are applied in the model only to 2010

The graphic representations shown in Figure 21, Figure 22 and Figure 23 are, of course, only summary data. The more detailed forecasts are generated by country forest type.

Figure 21 describes a future where all factors are held constant (set to zero) with the deforestation rate being that which is reported in the Forest Resources Assessment 1990. The figure suggests that if fibre supply is to remain stable it will be necessary to increase the role of plantations in order to supplement the losses with the conversion from undisturbed forest to disturbed forest.

Figure 22 (Future 2) explores the impact of increasing the deforestation by 20 percent from the current level, placing less land in protected area status, and introducing shorter cutting cycles in the natural forests. For industrial plantations it is assumed that development gains increase by 50 percent and the afforestation rate increases by 20 percent which is seen to be an offsetting strategy for a projected downfall in supply from the natural forest. The non-wood fibre capacity is decreased by 20 percent and the recovered fibres potential is decreased by 10 percent.

Finally, Figure 23 (Future 3) explores an alternative future where the emphasis is placed on the natural forest in terms of management strategy. The forest harvesting cutting cycle is lengthened by 20 years and this is combined with a decrease of 20 percent in the deforestation rate, and a 10 percent increase in the areas placed under protected status. Industrial plantation afforestation rates are dramatically reduced – by 90 percent. The non-wood fibre capacity is increased by 20 percent and the recovered fibre by 10 percent.

In summary, and as illustrated using Africa, the model can be used to predict futures based on dramatic departures from the static supply situation for a region, but the most practical use is based on possible or achievable variations, determined on a country-by-country basis. The analysis at the country level allows greater sensitivity to the particular forest policies within a country. It particularly enables a rapid and

Figure 21
Potential fibre availability 1996 - 2050 for Africa,
Future 1 ***(million m³)***

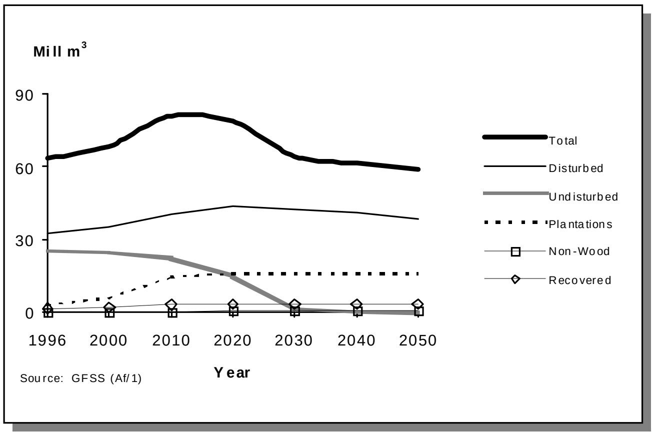


Figure 22
Potential fibre availability 1996 - 2050 for Africa,
Future 2 ***(million m³)***

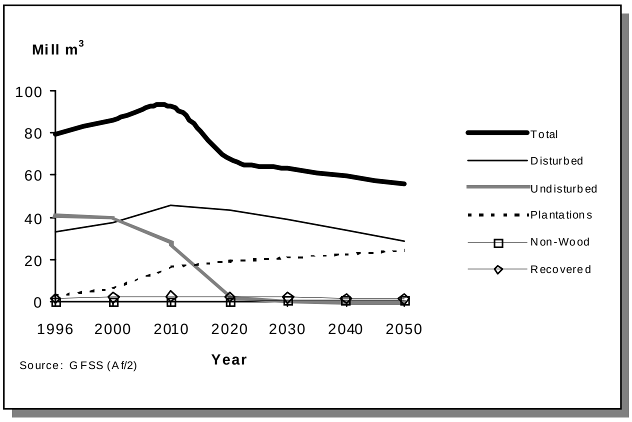
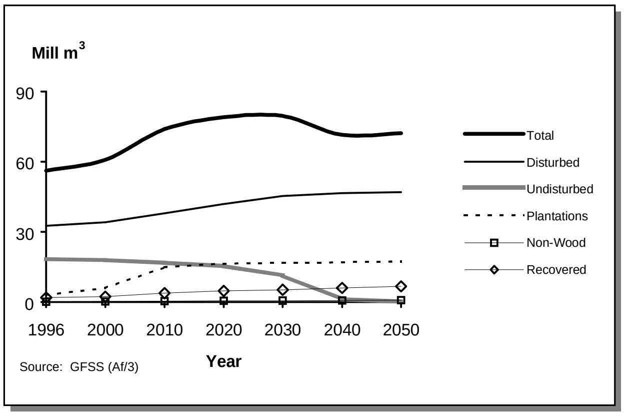


Figure 23
Potential fibre availability 1996 - 2050 for Africa,
Future 3 ***(million m³)***



comprehensible articulation of some fibre supply aspects of sustainable forest management policies suitable for presentation to decision-makers.

RUSSIA

Table 19 shows estimates based on an even and an increasing harvesting level in Russia during the next 200 years. Because large areas of the Russian forests comprise mature and overmature forests, a different (but still sustainable) harvesting profile (to those employed elsewhere) could be undertaken. These overmature forests have a high risk of being affected by large-scale disturbances such as fires, insects and diseases; they have a low productivity, and are subject to significant degeneration in the form of wood rot. Thus, much could be gained by a more rapid liquidation of fibre volume. The model results presented in Table 19 applies an accelerated harvest during the next 40-50 years in the regions with overmature forests. The model calculations indicate that Russian wood supply capacity could be significantly enhanced by applying an uneven harvesting profile in overmature forests. Although not indicated in Table 19, for European Russia, this would result in an additional 40 million m^3 per year of roundwood during the next 40 years (28 million m^3 of industrial roundwood). For Asian Russia, the result would be an additional 100 million m^3 per year of roundwood (65 million m^3 per year of industrial wood) for this period.

It should be noted that this scenario does not require the liquidation of all overmature forests. Up to 80 percent of Russia's overmature forests have uneven-age structures and, as such, a forest management regime that works towards a more balanced profile is one of the crucial components of a sustainable landscape.

Table 19
Estimated long-term sustainable economic industrial wood supply and commercial wood supply (industrial wood + fuelwood), respectively, in million m^3 per year

	European Russia	Asian Russia	Total
Official Russian AAC	133 (187)	219 (325)	352 (512)
Base Scenario Economic Supply (with existing infrastructure and relative prices)	90 (135)	70 (100)	160 (235)
With 10% increase in relative prices in forest products	105 (160)	100 (145)	205 (305)
Investments in infrastructure	110 (165)	105 (160)	225 (325)
With relative price increase of 10% + investment in infrastructure	130 (195)	160 (240)	290 (435)

Source: Nilsson, S. and Shvidenko, A. 1998.

EUROPE

The European Timber Trends Study (ETTS V) developed 14 scenarios of timber supply. Table 20 is a summary of the base low scenario statistics, considered by the Secretariat as the most likely scenario. The removals statistics are based on the official forecasts of individual countries in Europe. The domestic supply, residues and wastepaper forecasts were derived through complex model projections with many assumptions regarding GDP growth, competitiveness of products and suppliers, trade patterns, policies, recovery rates, etc. These assumptions are presented and discussed in the source documents cited below. The recovered fibre data below is converted from the ETTS V scenarios (which are in metric tons for this parameter) with the assumption that each ton of recovered fibre replaces pulp (including fillers, etc.) that would have required the consumption of 2.5 m³ of industrial roundwood. Fuelwood is subtracted from the ETTS V removal scenarios to reflect the industrial roundwood supply forecasts. This makes the statistics presented more comparable with those for the other regions presented in this report. The net total estimates the potential availability of industrial fibre supply from domestic markets under the assumptions described. A more detailed description of ETTS V is provided in the source document:

Table 20
European forecast of removals, residues & recovered fibre net of fuelwood consumption in million m³

	2000	2010	2020
Total roundwood removals	422 222	452 288	479 896
Residues	54 582	64 441	74 051
Recovered fibre	33 672	45 628	59 376
Less fuelwood	**-83 514**	**-89 519**	**-94 861**
Net	477 470	541 280	607 526

Source: ECE/FAO 1996c

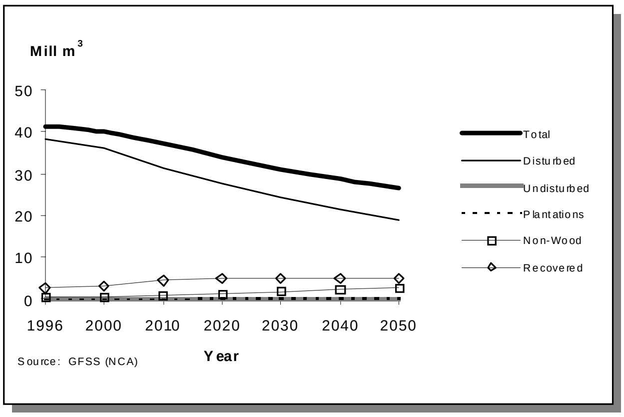
UN Economic Commission for Europe and FAO. 1996*. European forests and timber: into the 21st century*. Geneva Timber and Forest Discussion Papers. ECE/TIM/SP/11. Geneva.

NORTH AND CENTRAL AMERICA

Excluding USA and Canada

GFSM modelling for North and Central America (excluding United States and Canada) is presented in Figure 24 and indicates a continual decline in fibre availability due to continuation of current deforestation trends and no significant role for industrial

Figure 24
Potential fibre availability 1996 - 2050 for North and Central America excluding USA and Canada, Future 1 ***(million m³)***



plantations in this future. The disturbed forest decline is partly offset by the fibre supply from non-wood and recovered fibre.

United States of America and Canada

USA

Table 21 presents the most recent published information available on projected roundwood harvests from USA timberlands. From the base year 1995 to 2040 roundwood harvests are projected to increase by some 41 percent. The USA South is expected to supply 56 percent of the total required supply by the year 2000 and will be the major source of supply for the next 50 years. The roundwood harvest includes industrial roundwood and fuelwood.

Table 21
USA Projections of roundwood harvest on forestland in the United States 2000-2040, by species group in million m³

Species Group	2000	2010	2020	2030	2040
Softwoods	314.13	322.62	353.75	384.88	413.18
Hardwoods	237.72	263.19	280.17	288.66	302.81
All species	**551.85**	**585.81**	**633.92**	**673.54**	**715.99**

Conversion factor used: 1 cubic foot = 0.0283 cubic meters
Roundwood harvest equals production
Source: Haynes *et al* 1995

Canada

Industrial roundwood projection for Canada

Canadian wood supply data and descriptive text for the GFSM were provided by the Canadian Forest Service:

The forecast shown in Table 22 is a projection of industrial roundwood production. It embeds assumptions about future demand, prices and changes in technology over time. In particular, it assumes that increased demands will result in increased product prices, which will result in some expansion of the economically accessible forest land base in Canada. It also assumes that there will be improved wood utilization as a result of adoption of new and existing technologies. This means that forest products production will increase proportionately more than industrial roundwood production, as more product is produced from the same volume of roundwood.

Table 22
Canadian industrial roundwood production, actual and projected, and estimates of allowable annual cut (AACs) in million m³

Year	1970	1980	1990	1995	2000	2005	2010	2015
Industrial Roundwood Production	**117**	**151**	**156**	**183**	**194**	**202**	**213**	**227**
Allowable annual cut	228	228	253	233	na	na	na	na

na = not available
Sources: ECE/FAO 1996b and CCFM 1997.

The forecast is for coniferous and deciduous species combined. The increased use of deciduous species is already apparent. Deciduous roundwood production (i.e. both industrial roundwood and fuelwood) has more than doubled in the last ten years, increasing from 14 million m^3 in 1985 to over 30 million m^3 in 1990. This trend is expected to continue, reflecting both the relative availability and cost of hardwoods compared to softwoods, as well as the development of new products using hardwood such as oriented strand board that provide good structural performance.

Table 22 also shows the historical allowable annual cuts in Canada; but a forecast is not available at this time. The provinces own the majority of forest lands, and control the rate of timber harvesting on them; the harvest rate on provincial Crown land is regulated through an Allowable Annual Cut (AAC). AACs are a measure of how much timber volume forest companies are permitted to harvest annually, for a specified area over a certain time period (Pers. Comm. Dr. Darcie Booth, Canadian Forest Service, March 1998).

COMPARATIVE ANALYSIS (SELECTED REGIONS)

Table 23 provides the most optimistic assumptions of future commercial fibre availability for five regions. The remaining regions have not been assessed using the model developed for the Global Fibre Supply Model. There is a need to view these upper limits with a great deal of caution. The estimates should be viewed as starting points for a discussion of how to bring the fibre availability to more realistic levels.

Table 23
Total potential fibre availability (all sources) by selected region 1996, 2010, 2050 in 000 000 m^3

	1996	2010			2050		
		Future 1	Future 2	Future 3	Future 1	Future 2	Future 3
Africa	62.95	79.38	94.38	92.87	58.22	55.62	71.83
Asia	482.65	675.65	702.42	716.36	690.87	714.89	844.92
Oceania	66.81	78.18	86.26	82.03	76.18	88.98	82.78
Central America	41.92	36.02	34.44	37.65	25.01	14.13	38.00
South America	182.76	220.01	247.18	234.78	201.35	217.67	242.99
Total	**837.09**	**1 089.24**	**1 164.68**	**1 163.69**	**1 051.62**	**1 091.29**	**1 280.52**

Changes to the factors need to be applied to these calculations based on an assessment and quantification of at least the following:

- Harvesting residues losses are significant, often between 20 to 30 percent in tropical countries.
- Afforestation rate can be significantly lower than the officially reported statistics in some countries.

- ❑ Unreported forest harvesting is often significant in many developing countries and this could mean much more of the forest is already disturbed than the GFSM model records. This would lead to significantly lower yields in the future.
- ❑ Recovered fibre will almost certainly increase as a supply source in the future.
- ❑ Industrial plantation investment in genetics and silvicultural programmes leads to significant (but difficult to quantify) gains in fibre supply.
- ❑ Trees outside of forests are important fibre sources in some regions and they are frequently not taken into account in wood supply forecasts.
- ❑ Non-wood usage could significantly increase in developed and developing countries.
- ❑ Improvement in technology has allowed engineered wood products to be produced using much lower quality wood fibre.
- ❑ Sustainable forest management could lead to increasing fibre availability in all regions over the longer term.

It should be restated that it was only possible in this project to quantify some of these factors. Others are not yet integrated into the simulation tool developed for the GFSM. Future upgrades of the model can incorporate these capabilities.

It should also be reiterated that, given the incompatibility of methodology used in the different regional analyses of Europe, North America and Russia, it is not possible to present a forecast or global picture at this time. Hopefully this problem can be rectified in the future.