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Forests in Focus

Proceedings Forum

Forests as Source of Raw Materials

7 – 10 May 1999

EXPO2000
HANNOVER

Registriertes Projekt
der Weltausstellung

Niedersachsen

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Responsible for the contents of each contribution is the respective author.
Editorial Remark:
The forum was open to various kinds of contributions by participants. Contributions were made in form of statements, abstracts of papers, scientific papers and posters. This publication includes all these various kinds of contributions without attempt to create a unified format. Some texts were slightly modified by the editors, mainly in order to overcome language problems, and the text was not revised again by the author. It was not meant to change the contents, but if the modification resulted in a different meaning, it is solely the responsibility of the editors.

Editors: Dr. Jutta Poker, Inge Stein

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Forstwirtschaft
in Niedersachsen

Alfred Toepfer Akademie
für Naturschutz

Landkreis
Soltau-Fallingbostel

Schutzgemeinschaft
Deutscher Wald

NNA-Reports

Volume 12, Special Issue 3, 1999

Contents

FORESTS IN FOCUS

within the framework of 'WELTFORUM WALD', official project of the World Exposition 2000

A series of fora focusing on global forests issues aims at achieving consensus among relevant interest parties on tools and concepts to sustainably develop the world's forests. The project 'Forests in Focus' adds operative recommendations for solving environmental problems concerning forests to current political negotiations and scientific meetings in the field of forestry. The fora act as an agent between politics, economics, science and public and provide condensed up-to-date knowledge as well as agreed upon proposals for action adequate to target groups. Thus, 'Forests in Focus' supports the local implementation of guidelines on forest management and enforces the forest related parts of the Agenda 21 process.

Background

The World Exposition 'EXPO 2000 Hannover' presents the concept of sustainable development as agreed upon in the Agenda 21 at the UNCED 1992 in Rio de Janeiro. EXPO 2000 includes various worldwide decentralised projects. One of these, 'WELTFORUM WALD' (World Forum on Forests) has been initiated by authorities of the district Soltau-Fallingbostel, Northern Germany, the Association for the Protection of Forests and Woodlands (SDW), the Forestry Commission of Lower Saxony and the Alfred Toepfer Academy for Nature Conservation (NNA).

The project includes various activities and exemplary projects demonstrating sustainable management and use of forests to local people and international visitors (reafforestation of degraded heathland, redevelopment of former military areas, environmentally sound wooden buildings, thermal use of wood, use of non-timber products, management of a nature reserve and tourism, etc.).

Within this frame, 'Forests in Focus' forms the professional backbone. The fora address institutions and social parties concerned with forests, particularly those which

- are directly connected to forests,
- play an active role in forest management
- are affected by forest management.

The fora intend to encourage the relevant social parties to participate efficiently in decision making on forest issues, thus promoting the worldwide implementation of the recommendations of the Agenda 21.

Auspices

'Forests in Focus' is performed under the auspices of the Federal Minister of Food, Agriculture, and Forestry, Mr. Karl-Heinz Funke.

Time Schedule

Between 1998 and 2000, five fora take place. With respect to the multiple functions of forests, the fora focus from different perspectives on the worldwide sustainable co-existence of mankind and forest:

Forests and Energy (To what extent can forests contribute to the world's future energy supply?) January, 1998

Biodiversity – Treasures in the World's Forests (Prospects of conservation, use and sustainable development of biodiversity in forests) July, 1998

Forests – Source of Raw Material (Potentials of forest products' use and marketing) May, 1999

Forests and Atmosphere-Water-Soil (Regulation of energy and matter cycles with respect to climate change, water cycles and soil degradation) July, 1999

Forests and Society (Interrelation of cultures and environment, public awareness, public participation; integration of recommendations of the former fora) November, 1999

The final events will be the presentations of the results and recommendations of all fora at the EXPO 2000 in Hannover in Summer 2000 and at the congress **Sustainability in Time and Space** – in cooperation with PRO SILVA (Implementation of forest management guidelines in divergent forest types.) June, 2000.

Forests as Source of Raw Materials – Forum Recommendations

Chairman: Prof. Jeffery Burley, Oxford Forestry Institute, Oxford, UK

Background to the Forum

The Forum was one in a series of five preparatory fora leading up to the PRO SILVA Congress in June 2000, the Global Dialogue of EXPO 2000, also in June, and the Day of Forests in EXPO 2000 during October.

Plenary sessions of the Forum of about 80 participants from 20 countries heard presentations from representatives of international organizations, commercial wholesalers, forest policy-makers, forest managers and timber users. The Forum participants split into two workshops considering (a) growth and supply and (b) production and utilization.

Changes in forestry

The face of forestry has changed since the end of the Second World War. In the 1950s emphasis was placed on industrial wood volume but in the 1960s interest in wood quality began. During the 1970s particular attention was given to the impact of wood raw material on the quality of pulp and paper. During the 1980s and1990s there was increasing concern for the role of trees in support of agriculture, human welfare and the environment, while in the entire post-war period in many countries research and development efforts on non-wood products increased significantly.

The most authoritative source of data on areas and types of forests and on wood production and use is the FAO (1999) report "State of the world's forests"; most figures relate to 1996. The global demand for wood itself in 1996 was 3,358 million m^3; of this 1,860 million m^3 (55%) were used for fuelwood and charcoal while 1,498 million m^3 (46%) were industrial roundwood. Of all the wood used for fuelwood and charcoal, 90% were used in developing countries, mainly domestic heating and cooking.

In the last decade, four major policy and institutional trends have had major impacts on forest management, use and conservation: (a) in many countries, governments have tended to devolve production forestry to the private sector; (b) there has been a trend away from industrial plantation forestry to rural development forestry; (c) where industrial production is still needed there has been a trend to involve farmers and local communities as out-growers for the central processing plant; (d) there has developed a world-wide perception that forests are no longer just a national but a global resource, even though national sovereignty over forests has to be respected.

International initiatives on forestry

In parallel with these trends, a number of international initiatives have focussed on forestry. Since the United Nations Conference on Environment and Development in 1992 the United Nations, through its Commission on Sustainable Development and its Intergovernmental Forum on Forests (IFF), has given great attention to the roles, evaluation, and political institutions in support of, forests and forestry; current IFF activities include the consideration of the need for an international convention or other instrument similar to the conventions on biodiversity, climate, desertification and trade in endangered species.

A number of intergovernmental processes are in train to seek criteria and indicators of sustainable forest management at the global level (e.g. guidelines of the International Tropical Timber Association) or regional level (e.g. Helsinki Process for the Protection of European Forests; Montreal Process for Boreal and Temperate Forests excluding Europe; Lapaterique Process for Central American Forests; Tarapoto Process for Amazonian Forests; and others – see Grayson and Maynard, 1997). In addition, two major international institutes within the Consultative Group for International Agricultural Research (CGIAR) deal with forestry (the Centre for International Forestry Research, CIFOR, in Indonesia) and agroforestry (the International Centre for Research in Agroforestry, ICRAF, in Kenya). In support of these processes, and indeed of all forest policy and management, the International Union of Forestry Research Organizations (IUFRO) has 700 member institutions in 100 countries with some 14,000 working scientists grouped in 276 research units covering virtually all aspects of research into forests, forestry and forest products.

Forest outlook for the new millennium

The Forum identified four key elements of the global outlook as we approach the new millennium:
(a) a rising demand for wood and its products;
(b) a declining area of forests available;
(c) an increasing pressure on wood supply caused by the demands for non-wood benefits – environmental and social; and
(d) an increasing opportunity and need to restore deforested and/or degraded land.

In order to meet these trends, the Forum recognized the need for:
(a) strengthened inter-sectoral decision making on land use;
(b) enhanced forest management and plantation establishment; and
(c) specific attention to local fuelwood shortages.

The Forum recognized four groups of factors as the basis of sustainable forest management:
(a) recognition and valuation of all economic, environmental and social benefits of forests;
(b) balancing ("trading off") the different types of benefits;
(c) integration of production, processing and marketing of forest products; and
(d) recognition of the complementarity between natural, secondary and plantation forests.

Underlying these factors are five key requirements for sustainable forest management:
(a) political will and cooperation with environmental and social non-governmental organizations and industry;
(b) appropriate forest education, research and extension services,
(c) people's participation in planning, managing and benefiting from forests;
(d) appropriate institutional frameworks (law, tenure, tax, etc.); and
(e) improved information on the extent, quality, value, management, use and conservation of forests.

The Forum recognized also that wood itself is a primary need of today and tomorrow. Sustainable forest management includes the production of wood for five key reasons:
(a) inter-generational justice so that future generations have the resources for their own development and decision making;
(b) meeting the needs of growing human populations;
(c) meeting changing and growing cultural demands;
(d) meeting increasing energy demands, including substitution of non-renewable resources; and
(e) substitution of non-renewable construction products such as aluminium and steel. It must be recognized that there are areas of surplus wood production, e.g. parts of northern Europe and Scandinavia but these are often far removed from the areas of deficit.

In order to meet the identified future needs, the Forum considered both intensification and integrated management; this includes improved management of natural forest, secondary forests and plantations together with the creation of new plantations. In addition, it requires the integration of forest management with the production and use of all forest products. There was strong support for close-to-nature silviculture where this could be compatible with meeting all the demands placed on forests.

With specific reference to the harvesting and utilization of forest products, the Forum noted the need to increase the efficiency of logging, transport, conversion, use and preservation of wood; this included the replacement of preservatives by new construction techniques, new designs for wooden structures, enhanced efficiency of energy production and the development of recycling, re-use or closed-cycle conversion systems. The comparative advantage of wood over many competitive products in terms of renewability, energy use, appearance etc. was noted.

Coping with change

As we enter the new millennium foresters, forest industry personnel, researchers, teachers, and the people who depend on forests have to learn to cope with change. Eight fundamental elements include:

(a) the increasing demand for plantation products and the consequent need to improve plantation material and management;
(b) the changing availability from the old trees of natural forests to the young trees of plantations;
(c) the changing size from the large trees of natural forests to the smaller material derived from plantations;
(d) the changing preference from indigenous to exotic species for industrial plantations but the converse for rural development;
(e) the growing pressure to develop mixed forests, even in plantations, as opposed to monocultures;
(f) changing the management of forests to yield multiple benefits including many non-wood products;
(g) increasing pressure to avoid negative environmental impacts; and
(h) the globalization of the forest and forest products industries.

While the economic productive benefits of forests will continue to grow, there will be increasing pressures to evaluate forest policy makers and managers for the environmental and social performance of forests. All technologies will be reviewed from the point of view of saving energy and reducing carbon emissions. Forests will be evaluated specifically for their role in long-term carbon sequestration. Techniques will be required to use planted trees and forests for the restoration of degraded lands, possibly for eventual return to sustainable agriculture. Recent efforts to develop low-impact logging systems will need to be intensified and expanded. All processing will seek to develop clean technologies and optimized waste management. Forest development should play an increasing role in enhancing employment opportunities.

The search for sustainable forest management

While forest managers will continue to seek sustainable forest management, persons and institutions concerned with marketing of forest products will need to adapt to equal changes and issues. Mechanisms must be found to equilibrate global surpluses and deficits. The qualities, properties and processing of wood must be more closely tailored to the purpose for which it is to be used. Flexibility in wood supply, properties and processing must be maintained for future changes in market demand. The marketing opportunities and the image of wood as a raw material must be enhanced in the public eye with a campaign of public relations and advertising. Certification will grow as a market-focussed tool for sustainable forest management (parallel to government criteria and indicators) and there is an urgent demand to harmonize the various certification systems.

In marked contrast to single product agriculture, forests and forestry can offer multiple economic, environmental and social benefits. Typically the production unit is an ecosystem with all its component biodiversity and environmental contributions to the conservation of soil, water, climate etc. It is possible to intensify production without compromising the other benefits. However, there will always be a need to rationalize the decision between financial maximization and social/environmental optimization. It is significant that many governments are now beginning to include the standing capital value of forests in national accounts by giving values to non-market benefits.

Collaboration

While forests and forest products may be fundamental to a country or a company in terms of competitive economic performance, there are still great advantages to collaboration and cooperation in research, development, harvesting and processing of wood and other products. Cooperation may be between:

(a) two or more governments;
(b) between a government, private owners, non-governmental organizations and rural people (i.e. all stakeholders) in a given country;
(c) forest managers, industry and the consumer;
(d) science, information processes, policy makers and educators; and
(e) between advanced and less advanced institutions through technology transfer.

References

FAO (1999). State of the World's Forests 1999. Food and Agriculture Organization of the United Nations, Rome, Italy, 154pp.

Grayson, A.J. and *Maynard, W.B.* (Eds.) (1997). The World's Forests – Rio +5: International Initiatives towards Sustainable Management. Commonwealth Forestry Association, Oxford, UK, 147pp.

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Workshop: Growth and Supply

Chairman: Tim Rollinson, Forestry Commission, Cambridge, UK

Sessions I and II: Production Systems and the Supply of Forest Products

1. The Workshop received presentations from Professor Julian Evans on 'The Sustainability of Forest Plantations' and Dr. Wulf Killmann on 'Long-Term Trends in Wood Supply and Demand'.
2. In discussion of the long-term global outlook it was noted that there was:

- a rising demand for wood and wood products;
- a declining area of forest available for wood production;
- increasing pressure on wood supply as a result of the demands for non-wood products and the demands for environmental protection;
- increasing opportunity to restore deforested and degraded land.

3. The Workshop noted that plantations and planted forests will increasingly be the primary source of forest products. Trials are needed to measure the long-term productivity of forests – this will require better information using inventory data, remote sensing and other resource data. The Workshop recognised also that economic and environmental goals can be compatible to deliver multiple benefits. This could be achieved in plantations and planted forests and the experience of 'close to nature' forestry in Germany was noted.
4. The Workshop considered the basis of sustainable forest management. This will require greater recognition of the complementarity of the roles of natural, secondary and plantation forests. There is a need to value the full range of economic, environmental and social benefits, and this will involve 'trade offs' between benefits. The economic need to produce timber will require improved forest management and silvicultural measures than in the past.
5. The Workshop noted the need for better co-operation between industry, Governments, environmental and social non-governmental organisations, local people and others to provide a more holistic approach to land use decision-making. This will have to take account of recent trends to encourage greater public participation, and for decentralisation and privatisation of forest management and the forest industry.
6. Following discussion by the Workshop participants the following priorities were proposed:

- the need to strengthen decision-making affecting land use between
- the need to support improved forest management and the establishment of plantations, to meet the expanding demand for industrial wood;
- the need to address the problem of local shortages of fuelwood.

Sessions III and IV: Market Instruments and Timber Harvest and Supply

7. The Workshop received presentations from Mr Tim Rollinson on 'Forest Certification' and from Professor Pentti Hakkila on 'Developments in Harvesting Technology'.
8. The Workshop noted the range of intergovernmental initiatives, underway to deliver sustainable forest management. These include work to define criteria and indicators, the main purpose of which is to allow monitoring and reporting of performance by governments. The Workshop noted that environmental management systems such as ISO 14001 also have a role to play.
9. In discussion the Workshop noted that there were a number of eco-labelling and certification schemes that could operate and which forest owners could use. The Workshop considered that mutual recognition and harmonisation of schemes will be important. The Workshop noted also that certification can help in bringing industry, growers, retailers and others together. This could lead to wider economic and environmental benefits. Forest owners, who were concerned at the costs of certification, were now taking a more active role in developing certification schemes.
10. The Workshop noted that the impact of certification on the protection or maintenance of tropical rain forests would be relatively small as only a small proportion of rain forest loss is due to logging. Certification is likely to have a greater impact in those forest areas managed for timber production, notably in northern Europe and North America. The Workshop noted the trend towards natural resource accounting by governments which could lead to greater recognition of the value of forest resources.
11. The Workshop considered a number of global trends in the harvesting operating environment. These include the trend in production from natural forests to plantations; the increasing role of thinnings; the trend from larger to smaller trees; and an increasing emphasis in forest management on ecological sustainability, biodiversity, landscape management, and the multiple use of forests.
12. It was noted that the tending of young stands was a key to improved wood quality. Greater attention was needed on wood quality issues, for example in stand treatment and in raw material use. The Workshop considered measures to improve the efficiency of harvesting, increase the productivity of work, advances in information technology and their impact on timber procurement, and recent improvements in the skills of harvesting contractors.
13. The Workshop recognised that efficiency improvements would lead to increased productivity and reduced pressure on forest resources. There is also scope to integrate energy production with conventional forestry, including harvesting more biomass for energy production. The social implications of increasing mechanisation were considered, including the impact on jobs and improvements in safety.
14. The Workshop noted that there was scope for raising forest productivity through enhanced forest management, and to meet higher demand for wood products from a smaller resource base.

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Workshop: Processing and Utilization

Chairman: Professor Dr. Dr. habil. Dr. h.c. Gerd Wegener,
Institute for Wood Research, Munich, Germany

Scope and programme

The workshop comprised 9 contributions in the course of 4 sessions, ranging from silvicultural challenges and consequences on wood quality, via ecological aspects to now technologies and products. One paper dealt with the role of non-timber forest products, world-wide.

The papers and discussions are to be considered against the background as outlined by Prof. Dr. Gerd Wegener in his introductory speech:

- Motto of EXPO 2000: Man – Nature – Technology
- Globalization, Global Players, Global Consumers
- Sustainable Development
- Impact of Forests, Forestry and Wood Utilization on Greenhouse Effect, Energy Balances, Standard of Living, Social Benefits etc.
- Challenges to Improve and Optimize Forest and Wood Processing
- Challenges to Apply More Environmental Friendly Technologies

Conclusions and Recommendations

1. World-wide, the demand for wood and wood products will increase. Hence, we need as many managed forests as possible based on sustainable and economically successful forestry. Differentiating at regional and local levels, forestry must warrant the efficiency of the greatest possible number of forest functions, apart from wood utilization and the supply of non-timber forest products.

2. Relevant sustainable management approaches will have to be introduced or improved for the productions and supply of wood in the required quantities, qualities, wood species and grades ("optimized supply").

3. New/improved/intelligent/competitive wood products will have to be developed under modern ecological, technical and design aspects.

4. Technologies must be adapted to changes in raw material characteristics of wood from secondary forests, plantations, etc.

5. Processes and product design are to take into account essential requirements such as
   - raw material efficiency
   - technical product properties
   - closed cycles (materials, energy, CO_2 etc.)
   - re-use, recycling etc.

6. Market chances must be improved for all types of wood products and wood uses (from solid wood to engineered products and constructions), including the substitution of wood preservatives by construction techniques.

7. A strengthening is called for of the entire sector forestry and wood utilization in competition with other raw materials and products.

8. There is a strong need for improved discussions, interactions and common strategies in the chain from forestry to wood industries and wood utilization ("from producer to consumer").

9. Education needs to be improved and activities increased between forestry/wood industries and the people involved in decision-making processes, politicians, NGOs, consumer etc. (at national and international levels).

10. Better marketing and PR activities are required to increase public awareness of the environmental/social/cultural benefits of forestry and wood utilization so as to improve the overall image and raise public appreciation.

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Congress Programme

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2nd International Wood Congress, LIGNA plus Hannover '99

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Grußwort des Herrn Staatssekretärs

Werner Greifelt

Meine sehr geehrten Damen und Herren,

es ist mir eine besondere Freude, eine so zahlreiche und internationale Teilnehmerschaft hier in Soltau begrüßen zu können. Den Organisatoren des Weltforums Wald möchte ich zunächst herzlich dafür danken, dass Sie diese Veranstaltung unter ein Thema gestellt haben, welches alle forst- und holzwirtschaftlich Handelnden sehr interessieren wird: „Der Wald als umweltfreundliche, sich selbst regenerierende Rohstoffquelle".

Das EXPO-Motto „Mensch – Natur – Technik" stellt genau das Spannungsfeld dar, in dem sich auch die moderne Forstwirtschaft bewegt. Der Mensch stellt vielfältige Ansprüche an den Wald, in unserem dichtbevölkerten und hochindustrialisierten Land hat sich die Natur noch am ursprünglichsten im Wald erhalten, aber nur mit Hilfe der Technik ist es im Hochlohnland Deutschland überhaupt möglich, den Wald als Rohstoffquelle wirtschaftlich zu nutzen.

Die Waldgeschichte gerade der Lüneburger Heide, die Region in der wir uns heute befinden, ist nach ursprünglicher Bewaldung, Devastation durch Übernutzung und anschließender Regeneration nach Wiederaufforstung ein hervorragendes Beispiel dafür, wie verwüstete Gebiete wieder in nutzbare und ökologisch wertvolle Landschaften verwandelt werden können.

Welches Bild die hiesige Landschaft noch vor rund 200 Jahren bot, kann man ermessen, wenn man die folgende Beschreibung von Joachim Heinrich Campe aus dem Jahre 1785 liest: „Die ganze Strecke zwischen Haarburg und Zelle ... ist eine der ödesten, unfruchtbarsten und unangenehmsten in Deutschland. Der Grund ist entweder trockener und unfruchtbarer Sand oder sumpfiges Moor. Es ist ein gräulicher Anblick, oft meilenweit kein Baum, keine Hütte, kein angebautes Feld, sondern überall nichts als dürres Haidekraut zu sehn, welches dem Boden, den es bedeckt, ein so finsteres, trübseliges Aussehen gibt, dass man die Augen unwillkürlich schließt, und sich freut, wenn man von einer Raste zur anderen schlafen ... kann."

Offensichtlich genoß die Heidelandschaft damals nicht die gleiche touristische Wertschätzung wie ihre heute noch erhaltenen Relikte. Bei der heutigen Diskussion um die Schaffung neuer Heideflächen sollten wir diese geschichtliche Dimension nicht ganz vergessen und ein gesundes Augenmaß bezüglich des Umfangs bewahren. Vielleicht ist es ja auch nur ein Mengenproblem nach dem Gesichtspunkt Übermaß schadet, Raritäten haben dagegen einen hohen Wert.

Aber zurück zum Thema der heutigen Veranstaltung: „Der Wald als Rohstoffquelle"

Die multifunktionale Forstwirtschaft auf ökologischer Grundlage erfüllt heute alle Ansprüche unserer Gesellschaft an den Wald. Viele Menschen, die im Wald zu recht ein natürliches Refugium in einer durch und durch technisierten Welt sehen, tun sich allerdings schwer mit der Einsicht, daß auch die Forstwirtschaft nicht auf die Fortschritte der Technik verzichten kann. Rufen wir uns ins Bewußtsein, daß sich das Spannungsfeld "Mensch, Natur, Technik" mit der Entwicklung der Gesellschaft fortlaufend verändert und folglich auch die Position des Waldes in diesem Spannungsfeld. Sehr deutlich wird dies, wenn wir die Interessensgegensätze betrachten, die zwischen Waldnutzung und Naturschutz auftreten. Ich sehe mit Sorge, daß von Naturschutzseite die Forderung gestellt wird, immer größere Waldflächen ganz aus der Nutzung zu nehmen. Wer unsere Wälder großflächig aus der Nutzung nehmen will, der muß sich auch folgende Fragen stellen lassen:

- Soll heimisches Holz durch importiertes „Holz der weiten Wege" ersetzt werden?
- Kommt solches Importholz nicht oft genug aus unpfleglicher Nutzung, aus Großkahlschlägen oder Plantagen?
- Oder soll heimisches Holz durch Beton, Stahl oder Kunststoffe ersetzt werden?
- Welche Ersatzarbeitsplätze können wir bieten, wenn Holzverarbeitungsbetriebe schließen müssen, weil wir ihnen mit Waldstillegungen die Rohstoffbasis entziehen?

Ich denke, daß sich auf diese Fragen nur eine befriedigende Antworten finden lässt.

Die bei uns auf der ganzen Fläche betriebene nachhaltige, pflegliche, multifunktionale Forstwirtschaft erübrigt den Totalschutz auf großer Fläche. Ein Ausgleich für eine ansonsten rücksichtslose, nur an kurzsichtigen Interessen des Grundeigentümers ausgerichtete Waldnutzung ist nicht erforderlich, weil es letztere hier schon lange nicht mehr gibt.

Unsere Waldfläche nimmt zu, der Anteil von Laub- und Mischwald steigt an. Unsere Wälder stehen der Bevölkerung fast auf ganzer Fläche als Erholungsraum zur Verfügung. Sie erfüllen wichtige Naturschutz- und andere Schutzfunktionen. Und sie produzieren gleichzeitig Holz, den einzigen heimischen Rohstoff, über den das Industrieland Deutschland neben der Kohle überhaupt in größerem Umfang verfügt. Damit sind wir wieder beim zentralen Thema dieser Tagung: „Der Wald als Rohstoffquelle".

Der Holzverbrauch liegt in Deutschland bei 90 Mio cbm (Rohholzäquivalenten), das sind 1,1 cbm je Einwohner. Der Selbstversorgungsgrad für Holz liegt bei 82 %. Er nimmt seit Jahren ständig zu. Das ist nur zum Teil auf das steigende Rohholzaufkommen aus heimischen Wäldern zurückzuführen, vor allem wichtig ist die steigende Recyclingquote. Längst ist Altpapier zum wichtigsten Rohstoff unserer Papierindustrie geworden. Die Rohstoffquelle Wald ist Versorgungsbasis für eine leistungsfähige Holzindustrie. Die Sägeindustrie, die Holzwerkstoffindustrie, die Zellstoff- und Papierindustrie sowie die Furnierindustrie Deutschlands rangieren sowohl nach dem Umfang ihrer Produktion als auch nach ihrem technologischen Stand in der Spitzengruppe Europas.

Sie alle greifen auf „Holz der kurzen Wege" zurück. Die Umweltfreundlichkeit von Holz gründet sich ja nicht nur darauf, daß es als nachwachsender Rohstoff nachhaltig zur Verfügung steht, sondern auch darauf, daß die Produktionsstätte Wald in unmittelbarer Nähe der Verarbeitungs- und Verbrauchszentren liegt, so daß die umweltbelastenden Transporte minimiert werden können.

Es soll aber nicht verschwiegen werden, daß es in der deutschen Holzbilanz ein großes Defizit gibt:

Unsere Zellstoffproduktion ist zu gering, weil wir kein großes Sulfatwerk haben. Der hohe Zellstoffbedarf unserer Papierindustrie muß zu über 80 % durch Importe gedeckt werden, obwohl wir über beträchtliche Schwachholzreserven in unseren Wäldern verfügen, die für einen Ausbau der deutschen Zellstoffkapazitäten zur Verfügung gestellt werden könnten.

Auch wenn sich unsere Holzindustrie dem allgemeinen Trend zur Konzentration nicht entziehen kann, bleibt sie doch eine überwiegend mittelständisch ausgerichtete Branche, die vor allem im ländlichen Raum verankert ist.

Rechnet man noch verwandte Branchen wie die Möbelindustrie und das Holzhandwerk hinzu, so wird verständlich, daß die Rohstoffquelle Wald Grundlage für eine große Zahl von Arbeitsplätzen in unserer Volkswirtschaft ist.

Diese Tagung ist eine internationale. Die von mir aus mitteleuropäischer Sicht aufgeworfenen Fragen stellen sich in anderen Teilen der Welt sicher ganz anders. Während in unseren Breiten die Wälder unter strengem Schutz stehen und die Waldfläche sogar zunimmt, hat die fortschreitende Waldzerstörung vor allem in den Tropen ein alarmierendes Ausmaß angenommen.

Unsere Sorge um das einmalige Ökosystem Tropenwald ist mehr als berechtigt: Über 13 Millionen Hektar Waldfläche werden jährlich allein in der tropischen Region entwaldet. Das ist mehr als die gesamte Waldfläche Deutschlands! Die Ursachen dafür werden in der Öffentlichkeit oft verkannt. Nicht die Ausplünderung des Urwaldes wegen seines wertvollen Holzes ist hauptverantwortlich für seine fortschreitende Vernichtung, vielmehr ist es die Gewinnung von Siedlungsraum mit neuen Weiden, Äckern und Plantagen für die wachsende Bevölkerung. Sicher wird man dieses Problem nicht allein damit lösen können, daß man Teile des Tropenwaldes per Dekret unter Schutz stellt. Daneben wird man den dort lebenden Menschen vor Augen führen müssen, daß der Wald ihnen eine dauerhafte Lebensgrundlage bieten kann, wenn sie ihn nachhaltig und pfleglich nutzen. Die Nutzung des Waldes, wenn sie denn nachhaltig, das heißt unter Berücksichtigung der Interessen auch der nachfolgenden Generationen erfolgt, gefährdet nicht die Existenz des Waldes, sondern sie kann sogar notwendige Voraussetzung für seine dauerhafte Erhaltung sein.

Dieses Fachforum stellt den Wald als Rohstoffquelle in den Mittelpunkt der Vorträge und Diskussionen der nächsten Tage. Namhafte Experten aus verschiedenen Ländern werden über die Produktion und Bereitstellung des Holzes, über seine Verarbeitung und Verwendung bis hin zu seiner Vermarktung sprechen.

Ich danke dem Weltforum Wald als Veranstalter dieser Fachtagung im Vorfeld der EXPO 2000 in Hannover für seine Initiative zu dieser Veranstaltung und wünsche ihr vollen Erfolg.

Als eines der Wahrzeichen der EXPO entsteht jetzt ein riesiges Dach aus 24 m hohen hölzernen Schirmen über einem für vielerlei Veranstaltungen und Begegnungen vorgesehenen Freigelände. Nehmen Sie das Holzdach als Sinnbild dafür, daß der Mensch Natur und Technik in Einklang bringen kann, wenn er verantwortlich handelt.

Allen Teilnehmern dieses Fachforums wünsche ich, daß sie Gewinn daraus ziehen, und rufe ihnen zu;

„Auf Wiedersehen im nächsten Jahr zur EXPO 2000 in Hannover"

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Welcoming Address

Johannes Dengg

This third international meeting of the "World Forum on Forests" is being held under the auspices of the Federal Minister of Food, Agriculture and Forestry. On behalf of Minister Karl-Heinz Funke, I am pleased to have opportunity to welcome you as representatives from different countries here in the beautiful surroundings of heath-land and forests. As during the two last meetings of the World Forum

- "Wood as energy source" and
- "Biodiversity – Treasures in the world's forests"

your participation again should guarantee lively discussions and valuable results within the framework of the general EXPO 2000 exhibition theme "Mankind – Nature – Techniques".

Not only in Germany the forestry sector plays an important role in fulfilling all the expectations society has in relation to intact, multifunctional forests. They provide a range of environmental benefits which are increasingly important, both on a local and global level. The role that forests play in the global carbon cycle has become an important issue in the context of climate change. The protective functions which forests fulfil such as water protection, water cycle regulation, soil protection, combating desertification and prevention of natural hazards are a prerequisite for sound economic development. Some studies which have been conducted on these issues show that the economic value of such environmental services, along with the value of the recreational function of forests, might exceed by far the market value of the timber the same forests produce.

A forest which is left to itself may not be able to meet all the functions demanded by society which a sustainable and properly managed forest can. Regular forest care (e.g. by thinnings) is necessary for the stabilisation of the forest ecosystems and the improvement of their resistance to windthrow, infestation with pests or forest fires. However, in most parts of the world forest owners do not receive any compensation for maintaining these environmental benefits through sustainable management.

Due to the fact in particular that fossil fuels and products based upon them are becoming increasingly scarce and that their negative effects on the environment are open to criticism, the utilisation of economic functions of forests is indispensable. They constantly supply renewable raw materials for manifold purposes. Besides, forestry and forest industry are significant sources of employment especially for the countryside. The sale of timber still makes up 90% of the income of forestry enterprises in Germany, but only few non-wood products, such as game, berries or mushrooms, have become marketable goods.

The current market developments and technological changes reflect the great future challenges forestry will be faced with world-wide. Markets of forest products are increasingly global and large-scale. Developments in one country may influence trade flows and prices on the other side of the world. This was demonstrated by the aftermath of the Asian crisis when slumps in demand, notably in Japan, and severe supply problems in several South-East Asian countries affected European and North American markets. In addition there is an increasingly stiff competition between different raw materials and recovered materials (e.g. waste paper recycling).

The process of concentration within the sector through mergers and acquisitions persists and the average size of production units, even in hitherto small-scale sectors such as saw-milling in Germany, is increasing. Several sectors, including paper industry, saw-milling and board industry, are experiencing surplus capacity. With the development of recycling, legislation, infrastructure and consumer awareness, some more countries will reach the high recycling rates of industrialised regions, especially since the latter countries' recycling rates will reach technological limits.

In a global view, growing populations, incomes and technological developments will generally lead to a growing demand for raw materials and energy. In this context ecological aspects are to be considered in strategy development and decision-making in order to minimize negative ecological impacts and to strengthen market competitiveness of renewable raw materials and energy sources. Special emphasis should be put on life-cycle-analysis, including product design, processing design, raw material and energy consumption and recycling aspects.

Ecological considerations (like resource management, nutrient cycles, CO_2-balance, etc.) could have an influence on decisions of how to efficiently use forest resources, processing residues and recovered wood. Introduction of taxes on fossil fuels has been essential in creating a viable wood fuel market in some countries (e.g. Sweden). Such taxes, harmonised within the European Union, could be decisive to intensify the use of renewable energy sources, especially at a time of low fossil fuel prices. Increasing recycling in many countries results in a loss of market share for forest products. Therefore stronger efforts are necessary to open-up new markets for wood products, taking into account the manifold environmental benefits of sustainably produced wood.

There is an urgent need to make clear to all consumers the benefits of using wood products in correlation with the climate and the environment. It is necessary to put forward the argument of the advantages of sustainable forest management and recycling of wood products as well as the advantages of keeping wood products in a nearly closed cycle from growing trees until the return of used products back to nature (whether by biological decomposition or by burning). There still exists a great need for further exchange of information on the important role of wood in cycle-driven economies, including technology transfer and continuing education, development of policy and legislation.

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Supply and Demand of Forest Products

Wulf Killmann

With great pleasure I convey to you the greetings of Dr. Jacques Diouf, Director-General of the Food and Agriculture Organization of the United Nations (FAO), and of my colleagues in FAO's Forestry Department together with their best wishes for the success of this Conference.

I shall focus on wood and Non-Wood Forest Products. Forests Services are not included. The following topics are addressed:

- Overview of world's forests
- Wood availability
- Demand for forest products
- Policy options related to demand and supply

World's Forests

One of the functions of FAO's Forestry Department is to produce policy relevant statistics on forest resources, products and their trade. In collaboration with other partners, FAO has been conducting global forest resources assessments about every ten years since 1947. The latest FRA 1990 is currently the most comprehensive source of global, regional and national level information on forest state and change available. A partial, interim assessment using modelling was done for forest cover and its change for the reference year 1995, the results of which were published in the State of the World's Forests (SOFO 1999). A comprehensive new report is going to be presented next the year as FRA 2000.

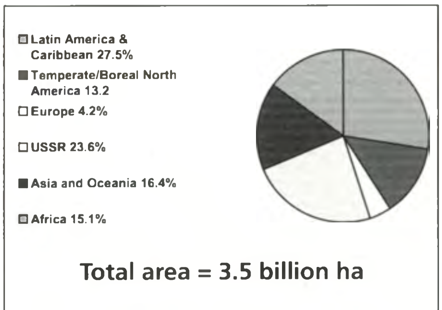

Figure 1. Forest area by main regions

In 1995, the world's forests, including natural forests and forest plantations, were estimated to cover 3.5 billion ha (Fig. 1, FAO, State of the World's Forests 1999), or about one-fourth of the land area of the Earth. The world's forests are almost equally divided between the subtropical/tropical (55 percent) and temperate/boreal (45 percent) regions.

Only about 3 percent are currently forest plantations, the remainder being still in natural or semi-natural conditions.

Another 1.7 billion ha are classified as other woodland, having some tree or woody vegetation on it. While use of this area for wood has increased, it has limited potential for closed forests.

GFSM

Starting with information reported in FRA 1995 on forest area, the Global Fibre Supply Model (GFSM) was developed to focus on the sources of industrial fibre as raw material for future industrial wood processing. The GFSM consists of three components:

- **Analysis of inventory data** on forest area, growth and yield for the largest 110 fibre producers, including recovered and non-wood fibre;
- **A set of models** investigating fibre supply futures;
- **Interface** which allows users to manipulate variables and run the models under different scenarios. Available in hardcopy and as CD-ROM in English, Spanish and French.

GFSM assessed 90 percent of the total forest area.

Wood Availability

Half of the forest is available for commercial utilization (Table 1). The balance faces restrictions such as:

- legal status (ownership, designation as park or reserve);
- physical inaccessibility or economic inoperability;
- unattractive mixture of species or quality.

Time and changes in wood prices and policy influence availability and may thus in- or decrease available supplies.

Table 1. Natural forest availability for wood supply

Natural forest classification under the Global Fibre Supply Model	Area (billion ha)
Area available for wood supply	**156**
Semi-natural	90
Undisturbed by man	67
Area unavailable for wood supply	**166**
Legal restrictions	29
Economic restrictions	
Physical reasons	26
Transport/infrastructure constraints	37
Other	75
Total area of natural forest evaluated	**322[1]**

[1] Small areas of forest in countries with poor information were not evaluated in GFSM. Data presented in the "Interim data of TBFRA 2000 as presented to Lisbon Ministerial Conference on Protection of Forest in Europe, June 1998".

Changes in Forest Area Available for Wood Supply

The area of natural forest currently available for wood production is diminishing due to:

- deforestation or degradation;
- conversion into agricultural plantations and cattle pasture;
- designation as strict conservation areas.

Impacts on the supply might also have the designation of forest lands to indigenous communities, and devolution of forest areas to past owners (Eastern Europe).

Shift to Secondary Forest

Forest utilization is shifting from predominantly natural to:

- semi-natural or secondary forests;
- plantations;
- trees outside forests.

In Europe already 85 percent of the forests are considered semi-natural.

Table 2. Natural forest area (million ha) by region – Global summary

Region	Total	Not Available for Supply	Available for Supply		
			Undisturbed	Disturbed	Total
	Million ha	(%)	(%)	(%)	(%)
Asia	400	44	12	44	56
Oceania	88	70	9	20	30
Africa	400	58	15	27	42
South America	863	82	5	13	18
Central America	78	64	0	36	36
North America	543	40	0	56	56
Europe	139	15	0	85	85
Russia	694	24	74	2	76
Total	3 204	52	21	27	48

Semi-natural forests (Table 2) and bushland on agricultural land are expected to increase, mainly in the developing world.

The area available for timber production varies considerably from region to region. Oceania and South America have with 20-30 percent the least available forest. In Oceania this is (mainly New Zealand) primarily out of policy choice, in South America for reasons of economy and physical access. In Europe, 85 percent of the forest land is available – this is because most of the forest is physically and economically accessible and privately owned, and currently not affected by legal restrictions.

Commercial Growing Stock

Timber supply depends on the volume of standing timber, its location, other factors affecting harvesting costs, market conditions, and the management objectives of the forest owner. The long-term wood supply potential is closely related to the net growth rate.

Methods of estimating growing stock and their accuracy vary substantially from country to country. Consequently, the world-wide volume estimates can only give an indication. FRA 1990 reported the total growing stock in forests and other wooded lands as 384 billion m^3. This included available and unavailable forest. Growing stock on available forest area in 1995 (GFSM 1998) was 182 billion m^3.

Timber supply forecasts

Timber supply forecasts are of critical importance to assessing the pressure on forests, state of the industry, and future price trends. From time to time, these forecasts have led to fears of "timber famine", which have only occurred on a very local basis. One reason for this is that it is difficult to adequately capture dynamics that include managerial adaptation, changes in economically accessible wood supply, and technological enhancements that improve the efficiency of use.

Apart from the GFSM, FAO is preparing a series of outlook studies to forecast regional and global forest development and forest products supply and demand. The Asia Pacific Forestry Outlook Study has been published in January 1999, and the Global Forest Products Outlook Study will be printed later this year.

The forecasts summarized are derived from varied methodologies. For the tropical world they were prepared using GFSM (1998). For Europe, the United States, Canada, and Russia the forecasts are adopted from the respective national forest agencies.

Table 4. Forecasts of timber supply for selected countries and regions (million m^3/a)

Region	2000	2010	2020
Europe	422	452	480
Mexico/ Central America	39	37	35
USA	552	586	634
Canada	194	213	n.a.

Source: GFSM, 1998

Presently, boreal and temperate forests contribute 80 percent to word's production of industrial wood. Main producers are Canada, USA, Europe and CIS (65 percent). Timber supply is expected to rise in Europe, Canada and the United States. Russian wood supplies are estimated to be 160 million m^3/a but no projections are provided. The growth in tropical supply has been moderate since the early 1990s. Major tropical producers such as Malaysia and Indonesia have been reducing harvests of industrial

Table 3. Standardized total and commercial species growing stock in forests available for wood supply, 1995 (million m^3)

Region[1]	Growing stock[2]			Commercial species growing stock[3]		
	Total	Undisturbed forest	Semi-natural forest	Total	Undisturbed forest	Semi-natural forest
Africa(26)[3]	26 796	13 519	13 277	11 927	6 274	5 653
Asia(22)	22 670	7 160	15 510	15 089	2 942	12 147
Oceania (6)	3 013	1 166	1 847	2 226	729	1 496
Europe (28)	17 029	0	17 029	17 029	0	17 029
North America (2)	30 926	0	30 926	30 018	0	30 018
Central America (10)	2 2339	0	2 339	1 845	0	1 845
South America (13)	20 120	5 602	14 518	7 995	2 241	5 753
Total	182005	84 766	97 240	173 499	96 931	76 567

1 Excluding Russia.
2 Volumes pertain to the forest available for supply; the reference diameter is 10 cm.
3 Number of countries currently included in database

wood to a more sustainable level, while production from Brazil and India has remained relatively stable.

Plantation Forest

Many countries are giving increasing attention to plantations, and in some cases to farm- and agroforestry (Table 5). A wide array of incentives are used. Despite these efforts, the increase in plantation area is still generally small, as compared to areas cleared for agriculture or lost to fire. Globally, the present plantation area is estimated at about 120 mill ha.

Table 5. Estimated regional distribution of plantations in 1995

Country or region	Industrial plantation area (million ha)	Non-industrial plantation area (million ha)	Total plantation area (million ha)
North and Central America	**14.2**	**0.3**	**14.5**
United States	*13.7*	*0*	*13.7*
South America	**6.1**	**2.1**	**8.2**
Asia	**41.8**	**15.1**	**56.9**
China	*17.5*	*3.9*	*21.4*
India	*4.1*	*8.3*	*12.4*
Japan	*10.7*	*0*	*10.7*
Oceania	**2.7**	**0.01**	**2.7**
Africa	**3.6**	**2.1**	**5.7**
Europe			**8.7**
Former-USSR			**22.2**
Russian Federation			*17.1*
Total			**119.0**

Sources: FAO, E

Global demand for wood products

Overall, the demand for forest products increased by 40 percent (2.4 to 3.35 billion m^3, FAOSTAT) from 1970 to 1996. However, most of the growth has been in the demand for fuelwood, which is poorly tracked and reported. In addition, some portion of fuelwood is gathered from areas other than forests. Therefore, it is difficult to address fuelwood together with wood and non-wood products. It is assumed that fuelwood accounts for 60 percent of the global wood production, 90 percent of which are consumed in developing countries. The demand for industrial roundwood has actually declined by an average of 2 percent per annum since 1990, reflecting in part:

- reduced consumption of sawnwood;
- more efficient utilization;
- greater use of recycled fibre.

The decline in sawnwood consumption can be largely attributed to growing scarcity of sawlog material, and to its substitution through wood-based panels, engineered wood and non-wood products like plastic and aluminium.

Demand for timber and forest products is largely driven by increases in population and by a general economic development and thus industrialization. Between 1970 and 1994, the world population rose by 50 percent, with increases of 60 and 90 percent in South America and Africa, (UN, World Population 1996). At the same time, the per capita consumption of all wood has changed little since 1950, standing now at roughly 0.6 m^3 per person per year.

Regional Demand for Timber and Wood Products

Until the recent economic recession in Asia and South America, demand in the tropical zone was rising far more rapidly than in temperate regions. Their share of wood-based panels and pulp and paper doubled from 1970 to 1990. However, in absolute terms, the volumes consumed in the temperate countries are much higher than in the developing tropical world (Fig 2).

Future Production Trends

SOFO 1999 projects the demand for industrial roundwood to increase at an annual rate of 1.7 percent up to 2010. Thus, the output will then be about one-quarter higher than today, but only about 10 percent higher than the 1990 peak in production (1.7 billion m^3). Asia and Oceania are expected to exhibit the most rapid growth rates during this period. Production is expected to grow in the Americas, but at a lower rate. However, North America and Europe will continue to dominate world markets.

As in the past, the market for paper and paperboard is expected to grow most rapidly, at an annual rate of 2.4 percent, while that of pulp for paper is expected to grow by only 1.1 percent per year, reflecting an expected in-

Table 6. Global wood and forest products consumption trend

	1970	1980	1990	1996
Wood consumption (in million m^3)				
Industrial roundwood	1 277.4	1 451.5	1 703.0	**1 499.8**
Fuelwood	1 177.0	1 470.0	1 744.0	1 860.0
Total wood	*2 454.4*	*2 921.5*	*3 447.0*	*3 359.8*
Forest product consumption				
Paper and paperboard (million mt)	125.9	168.9	240.1	275.8
Wood-based panels (in million m^3)	69.8	100.5	123.7	148.8
Sawnwood (in million m^3)	413.5	449.3	507.7	426.8

Source: FAOSTAT

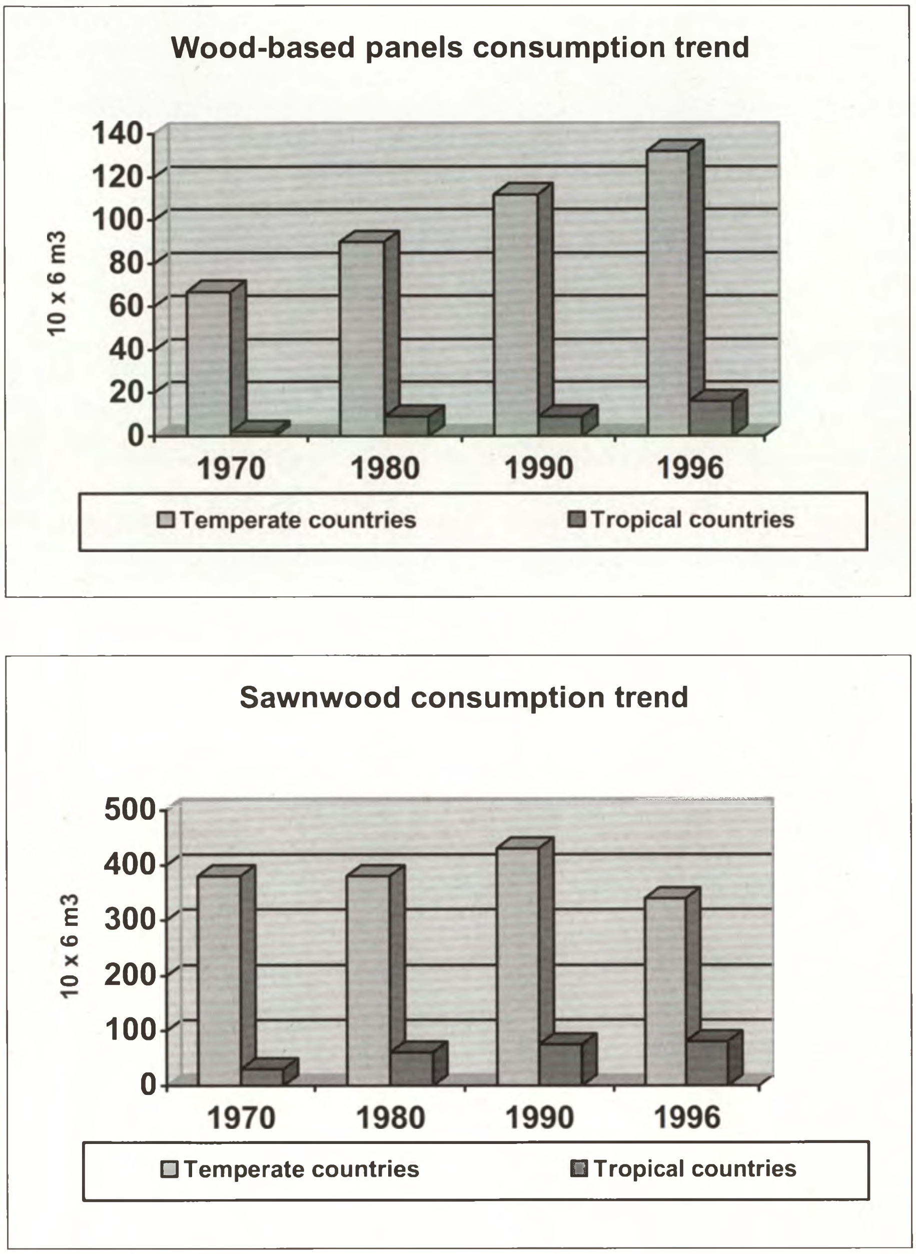

Figure 2. Wood-Based panels and sawnwood consumption in temperate tropical countries

Table 7. Current and forecast global forest production by product class, 1996 and 2010

Product category	Production 1996	Production 2010	Total growth 1996-2010	Annual growth 1996-2010
Industrial Roundwood (million m³)	1 490	1 872	26%	1.6%
Sawnwood (million m³)	430	501	17%	1.1%
Wood-based panels (million m³)	149	180	20%	1.3%
Pulp (million tons)	179	208	16%	1.1%
Paper and paperboard (million tons)	284	394	39%	2.4%

Source: SOFO 1999

creased use of recovered paper in the total fibre furnish. Sawnwood consumption is expected to grow moderately, at annual rates of 1.1 percent, and wood based panels and other reconstituted wood at 1.3 percent.

Demand for Non-Wood Forest Products (NWFPs)

People have innumerable uses for many of the plant and animal resources found in forests. Although several species have been domesticated over the centuries, others, referred to as NWFPs, continue to be gathered from wild sources. In many parts of the world, NWFPs provide food, animal fodder, construction materials, fibres, medicines and other health care products, and goods of religious/spiritual significance. The bulk of these are gathered for household use or for local sales, but about 150 enter national and international trade in significant quantities at an estimated annual value of US$ 11 billion (Abramovitz & Mattoon, 1999).

The Asia-Pacific region is thought to account for up to 40 percent of the world's NWFP exports. Production of NWFPs is not systematically or broadly monitored but policy-makers and others are paying increased attention to the actual and potential economic role of NWFPs. Their importance to household and local economies, particularly among the poor in developing countries, is increasingly recognized, as is the need to consider them in forest management planning and in policy (SOFO 1999).

Among the valuable and important classes of NWFPs are medicinal plants. More than 10 000 plant species (of both forest and non-forest origins) are used for medicinal purposes, mainly as traditional medicines. The World Health Organization has estimated that 80 percent of the population of developing countries rely on traditional medicines, which are mostly plant-derived, for primary health care. Use is by no means restricted to developing countries and traditional medicine, however; at least 25 percent of drugs used in modern pharmacopoeia derive from plants. Many others are synthetic analogues built on prototype compounds isolated from plants.

The COMTRADE database (UN Conference on Trade and Development – UNCTAD) reported the value of medicinal plants exported in 1995 from 100 countries as US$ 880 million. Demand for medicinal plants is increasing in both developing and developed countries.

We can expect the following developments:

- Increasing commercialization of some NWFPs;
- Large scale cultivation of high-potential NWFPs (e.g. rattan);
- Increased synthetization of active ingredients in medicinal plants;
- Declining subsistence use of some NWFPs due to use of industrial substitutes and alternative sources of income;
- Legal conflicts between private enterprise and industry on one hand and countries/indigenous peoples on the other (bioprospection).

Policy options related to supply and demand

The results sum up as follows:

- Natural forest diminishes as resource, production shifts to secondary forests and plantations;
- In spite of strong increase in production and consumption in the tropics, by far main producer and consumer is still the industrial world;
- Demand for forest products continues to increase;
- Apparent demand declines (better utilization etc.);
- Substitution of solid wood through wood based panels, engineered industrial products will increase;
- Non Wood Forest Products will take up larger market share.

Supply and demand of forest products correspond closely to forest management. Here are given some key developments, we might expect, and options to address them.

Key Development	Option to address it
Stronger Consideration of Multiple Forest Functions	
* Move towards SFM	Respect and attend Multiple Forest Functions
* Forest Conservation high on Agendas	
Demands on Forest increase	Intensify/extend forest management
Regional and local shortages	Establish more forest plantations
* Regionally concentrated Deforestation	Utilize more non-wood fibres
* Forest degradation	Increase wood resources from outside forest
	Utilize resources more efficiently
Demands for more social and economic equity	Involve rural poor in benefits from forests
	Strive for gender equity
	Settle land ownership problems
	Strengthen stakeholder negotiations
	Recognize interests of indigenous peoples
	Increase rural employment
Stronger involvement of private sector in forest management	Handle vested interests
	Select appropriate pricing and taxing
	mechanisms and incentives
	Promote private public partnership
	Restructure industry
	Concentrate Government involvement on normative and monitoring functions

Conclusion

Unfortunately, in some countries, there are stumbling blocks in the implementation of the options decision makers might choose:

A country may have an adequate forest policy, but often it is not effectively implemented

The future supply for the industry will very much depend on:

- **choices** made by societies to address the key developments;
- **political will** and **ability** to implement national forest policies;
- willingness of the **private sector to adopt a responsible role** in forest management;
- willingness of societies **to reinvest** some of the income from forests into the resource and the institutions monitoring its management;
- **balance between public and private interest.**

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Promoting Sustainable Forestry within the Home Improvement Market

John Frost

Topics

B&Q:	Who they are What do they sell What are the product environmental impacts
Customer:	Do they care about the environment What do they want to know
Message:	Must be same world-wide standard Must be simple
Marketing:	Packaging Posters Newspaper & TV

B & Q Facts and Figures

The discussion on promoting sustainable forestry within the Home Improvement Market is an area, which may be very alien to a lot of forestry experts. One thing I can assure you at the outset, B&Q is passionate about sustainable forestry. In order to explain how and why within our stores we promote sustainable forestry there is a need to explain something about the background, who B&Q is and what they sell:

- B&Q has 288 stores in the UK with a large amount of timber products
  - 39 of them with a selling area of about 15,000 m², each of them stocks over 40,000 products, has a staff coverage of 250 people
  - 249 stores in the 3,500 to 5,500 m² range with 16,000 to 20,000 products in the store
- B&Q has 4 stores in Taiwan, further stores are opening this year in China
- in Poland, B&Q is market leader with 21 stores, trading as NOMI
- the recent merger with the world-trader Castorama added another 176 stores to the group- not only in France, but also Canada, Belgium, Brazil, Germany, Italy and Poland.

This totals up to almost 500 stores. We are all part of the Kingfisher Group and as such a world player within the Home Improvement Market. Actually, we are No. 3 in the world and No. 1 in Europe.

Timber products

The ranges sold by B&Q which are timber or pulp based actually run up to 10,000 products and all of those products are eligible for independent certification.

All but 6 of B&Q's stores have a garden centre, 282 stores in total which include an enormous number of wooden products such as garden furniture from Bolivia, South Africa or Pacific Rim. There has been a lot of anguish recently as to the sources of some of these products. This year, 32 % of the volume that B&Q sells, has been independently certified under the principles and criteria of the Forest Stewardship Council (FSC). All of the rest are at different stages of the same procedure. Next year there will be 100 %. If we can not get it, we are not going to stock the product.

Other examples of wooden products in the garden centres which are FSC certified:

- Barbecues from the USA and Pacific Rim and charcoal from UK and Brazil. The UK-sources are decentralised: stores are broken down into clusters of 6-8, local to each of those clusters is one man who is the charcoal burner. The whole process ensures that environmental impacts are kept to a minimum.
- Trellises from UK and Poland.

Moving inside the store shows other examples:

- Tool handles mainly from North America
- Cupboard door furniture mainly from various European countries
- Toilet Seats from USA and Pacific Rim. Within the Pacific Rim, the majority of the actual timber is coming from New Zealand and is FSC-certified.
- A lighting range has an enormous amount of timber build into it.
- Plus many more such as kitchens, furniture, conservatories, shelving, lumber, sheet materials, doors, flooring and wall coverings to mention but a few.

Thus, timber is a very important item to B&Q. It represents almost 25% of our sales, in product version not in raw material. It is important to us to have a very simple message for our customers when we are explaining to them where the sources are, how good they are. We have a lot of products in our business and we have to give a lot of environmental messages to meet the customers' needs of understanding.

Certification schemes

At this moment in time it is well known that B&Q supports FSC and will continue to do so. There are numerous other opportunities and deviations from the FSC. The Paneuropean Forest Certification scheme is deep into conversations and coming together at a rapid rate. However, take pity on the poor retailer!

The retailer has to have one label on a product which makes it very clear to the customer who may have limited interest or limited understanding. We cannot have multiple labels, i.e. take a standard kitchen cabinet: the carcase comes from the UK and it will be FSC certified by the end of this year. The door comes from Italy, maybe, it will carry a Paneuropean certificate and label. The oak trim that goes around the cabinet comes from North America, it might be FSC but it could be another different certification scheme. The knob and the handle on the door front come from the Far East, it might have an LEI-label on it. For a customer, much confusion arises when wanting to purchase one product and having hanging off of it four little labels making similar statements with different logos. So, as a retailer, B&Q has a very simple request: <u>one scheme, one label.</u>

The context of the environmental impacts of B&Q's products

All products across our total business have an environmental impact. From the products we have spoken about so far – sustainable forestry is obvious. However, B&Q has many other concerns within its organisation. We have problems in areas such as paint, volatile organic compounds, peat, with sites of scientific special interst, we have problems with dioxins from P.V.C. products.

Paint is a very important commercial part of our business. Paint leaves an unpleasant lingering smell. These are all the evaporating solvents which assist in creating photochemic smog. B&Q has had as much pressure from certain quarters about this subject as we have about forestry and B&Q has addressed it. The way, we actually went about it was to take all of our own brand paint and by using straightforward mathematical assistance we came up with a system whereby a product which has a label on it which says minimal VOC in layman's language will not smell, and the product with a high one will have that lingering smell for 24, 48, 72 hours. By doing this we have given our customers the opportunity of choosing. The label is not overpowering, but it is there. That is an B&Q driven initiative and it is one that we put on all our brand paint since then. ICI adopted it and all of our other paint suppliers have been encouraged to do the same.

The timber sector

There was great awareness of problems with timber 7 years ago. Demonstrations by environmental groups, Friends of the Earth, Greenpeace and others, in a B&Q-store put some of the customers off. At that time, it was an enormous embarrassment to us, today we have to say whole-heartily 'thank you' because this has triggered B&Q to go down the root and become a more responsible retailer.

Back in 1991, B&Q did not know where the timber came from; nor did our competitors. In fact, we soon found out, the majority of our suppliers did not know, either. We set about understanding where, how, what, why, when and it took a while to do so. We had national TV-cameras outside our head-office asking questions which we could not answer. We had no choice in those early days but to be proactive. B&Q set itself targets and by the end of the year 1993 we knew exactly where our timber was coming from. Between 1993 and 1995 we used outside consultancy to discover exactly which of those forest areas, countries, locations were good, bad or indifferent and we took the necessary action. It was an internal scrutiny, which is perhaps not good enough. Customers do expect retailers to be responsible. At that time we decided we would have to go beyond that and we would have to face up to a need for a third party to come in and do the job in a professional manner. At the same time, FSC had been given birth and was raising his head and being a great help in the systems to ourselves. Within that, we set ourselves a target: by the first of January 2000 B&Q will only purchase FSC-certified timber. You may ask 'Tall target, and how are you doing so far?'. There are 10,000 products within B&Q, 2,800 have been FSC-certified. There are some 5,200 which are sourced from the UK. The UK Woodlands Assurance Scheme is currently starting co-operation with the FSC so we expect a great number of these will pour into our stores before the end of this year. At this moment in time, we have 2,000 products left which are a problem which we will solve.

Therefore, with what we have done, questions like this are no longer a concern to us. When we were asked back in 1990, 1991, we did not know the answers. Because we did not know the answers, it was perceived we did not care. That was not good for our business. We now know the answers and we do care.

Product labels

The customer wants one message which is simple, easy to understand and gives them confidence. With regards to sustainable forestry there is currently only one world-wide standard and logo which is available to us, which we consider is working well and is satisfying our most demanding customer. Implicating this customer we exceed the expectations of many of our other customers. In doing so we grow our business most successfully.

FSC-certified sources are available now from almost 30 countries around the world. Our answer is this: in our stores we have an enormous range of doors. We clearly label the product with the FSC-logo always using continuously the same green panton colour-code, the logo is bold, it is easily recognised, it is kept very simple.

There are customers who want to know more than the basic details that are on the packaging. So we have in the stores, wherever there is a group of products which has been certified, at the end of that aisle a 2 m high poster strategically placed. It gives more information, is complete with brochures, pamphlets for customers to take away.

Additionally, we promote our environmental credentials via our own catalogues which B&Q issues every 6 to 7 weeks in an edition of 9 million. We continuously give exposure to certified timber. We go much further than that. We feature our FSC-products by newspaper advertisement and we give the full story. It is commercially advantaged. We all have been winners. As I have said, B&Q is totally passionate about buying and promoting products from sustainable forestry. It cost us a lot of money. If we were to extract all those items that we have advertised over the last 12 months which have carried an FSC-label, and value the costs of that advertising it would have cost just over 2.5 million Pounds. Still, we will continue to support it in that way.

Because we insist on one simple message and one logo, for B&Q it must be FSC. Other possible logos, other labels, should run in harmony with FSC, because the home retailer requires it.

Back in 1990 and 1991 this was a major issue. We are getting very close now to a decade of discussions. Please help us to get it out of the in tray and let us all get on with business.

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Entwicklungen in der Forstpolitik – Das europäische Beispiel

Gerd Janßen

Die Meldungen über weltweite Waldverluste, die jährlich mehr als 11 Mio. ha betragen, haben zunehmend auch die Politik aufgeschreckt und die Einsicht wachsen lassen, daß diese Entwicklung gestoppt werden muß, wenn nicht unwiederbringliche Verluste in der biologischen Vielfalt, unabsehbare Auswirkungen auf das Klima und den Wasserhaushalt und unverantwortliche Verluste in der weltweiten Versorgung mit dem wichtigen nachwachsenden Rohstoff Holz hingenommen werden sollen.

Der von weltweit agierenden Umweltgruppen angestrebte Tropenholzboykott war – so untauglich er als Mittel war – ein wichtiges Signal, das zur Sensibilisierung in den Industriestaaten beigetragen hat.

Auf der Konferenz der Vereinten Nationen von Rio 1992 nahm die Erhaltung der Wälder einen großen Raum ein, die Agenda 21 und die Walderklärung setzten einen Diskussionsprozeß in Gang, der unverändert anhält. Ein wesentlicher Teil dieser Diskussion befaßt sich mit der Zertifizierung von Forstwirtschaften und Holzprodukten.

Die Wälder Europas

Die Situation der Wälder dieser Erde ist hinsichtlich ihrer natürlichen Entwicklung, ihrer Standortgebundenheit, ihrer bisherigen Nutzung und der politischen und wirtschaftlichen Rahmenbedingungen außerordentlich unterschiedlich. Der globale Auftrag zur Sicherung und nachhaltigen Entwicklung der Wälder muß sich deshalb an der Situationsgebundenheit orientieren und entsprechend differenzierte Antworten finden.

Europa verfügt nur über 4,9 % der weltweiten Waldfläche. Die tatsächliche Nutzung übersteigt aber diesen Anteil deutlich, sie dürfte einen relativen Anteil von 6,9 % haben.

Waldfläche Europas im weltweiten Vergleich

Region	Waldfläche (incl. sonst. Holzfläche) (forest and other wooded land)	
	(mio ha)	(%)
Europa (o. Russ. Föd.)	169,8	4,9%
davon		
Nordeuropa	52,5	1,5%
Westeuropa	59,5	1,7%
Osteuropa	57,8	1,7%
Afrika	520,2	15,1%
Nord-/Zentralamerika	536,5	15,5%
Südamerika	870,6	25,2%
Asien (o. Russ. Föd.)	503,0	14,6%
Russ. Föderation	763,5	22,1%
Ozeanien	90,7	2,6%
Gesamt	3454,4	100,0%

Quelle: FAO 1999

Wald und Forstwirtschaft in der EU hier: Waldfläche, Vorrat, Zuwachs, Nutzung

	(Mio ha)
Wald und sonst. Holzfläche (forest and other wooded land)	**127,8**
davon Wald i.e.S. (forest)	**96,7**
davon Wirtschaftswald (exploitable forest)	**87,0**

	Durchschnitt (m^3/ha)	Min. (m^3/ha)		Max. (m^3/ha)	
Vorrat pro ha Wald i.e.S. (forest)	**122**	56	(Spanien)	257	(Österreich)
Zuwachs pro ha Wirtschaftswald (exploitable forest)	**4,7**	1,4	(Griechenland)	8,4	(Irland)
Nutzung pro ha Wirtschaftswald (exploitable forest)	**2,7**	1,1	(Griechenland)	4,8	(Belgien)

UN-ECE/FAO 1990 Forest Resource Assessment

Im Bereich der EU liegt der Einschlag bei 2,7 m^3/ha bezogen auf die produktive Forstfläche, bezogen auf die Gesamtwaldfläche bei 1,9 m^3/ha. Verglichen damit liegt der Einschlag weltweit bei rd. 1 m^3/ha Gesamtwaldfläche.

Daraus wird deutlich, daß die europäischen Wälder sehr produktiv sind und gleichzeitig auch intensiv genutzt werden. Während weltweit alle Stadien von Waldverwüstung über die Übernutzung bis zur völligen Schonung anzutreffen sind, spielen in Europa heute Waldverwüstung und Übernutzung keine Rolle. Umgekehrt sind allein aus der Geschichte heraus unberührte Wälder die Ausnahme. Die europäischen Wälder sind nämlich das Ergebnis jahrhundertelan-

Waldflächenveränderung in Europa im Weltweiten Vergleich

Region	**Waldflächenveränderung 1990-1995** (forest and other wooded land)	
	(1000 ha)	(%)
Europa (o. Russ. Föd.)	2594	1,5%
davon		
Nordeuropa	40	0,1%
Westeuropa	1791	3,0%
Osteuropa	763	1,3%
Afrika	-18741	-3,6%
Nord-/Zentralamerika	-1369	-0,3%
Südamerika	-23872	-2,7%
Asien (o. Russ. Föd.)	-14504	-2,9%
Russ. Föderation	n.a.	n.a.
Ozeanien	-454	-0,5%
Gesamt	-56346	-1,6%

Quelle: FAO 1999

ger menschlicher Nutzung und Steuerung; nach Zeiten vernichtender Übernutzung in großen Regionen setzte eine Wiederaufforstung und Vorratsauffüllung ein, von denen wir heute profitieren. Festzuhalten ist also, daß die europäischen Wälder von Menschen geformte Kulturwälder und nicht von kleineren Resten abgesehen – Urwälder sind.

Der Maßstab zur nachhaltigen Nutzung ist der Zuwachs. Dieser wird jedoch in Europa nicht annähernd ausgeschöpft.

Einem Zuwachs von 4,7 m^3 steht eine Nutzung von 2,7 m^3 gegenüber, also knapp 60%. Hinter diesen Zahlen verbergen sich sowohl nicht realisierte Nutzungsmöglichkeiten, z. B. aus wirtschaftlichen Gründen, als auch die Tatsache, daß in den vergangenen Jahrzehnten erhebliche Flächen aufgeforstet wurden, die noch nicht oder erst zu geringen Anteilen genutzt werden können. Die Wälder Europas sind also eine Rohstoffquelle, die zunehmend sprudeln wird.

Die Waldflächenbilanz ist europaweit positiv. Während die Waldfläche weltweit von 1990 bis 1995 um 56 Mio. ha abnahm, stieg sie in Europa um 1,5 % bzw. 2,6 Mio. ha an.

An dieser Stelle sei darauf hingewiesen, daß sowohl mit der Vorratserhöhung als auch mit der Waldmehrung die europäische Forstwirtschaft einen fühlbaren Beitrag zur Minderung des CO_2-Anstiegs in der Erdatmosphäre leistet. Es ist dies ein Aspekt, der zukünftig stärker als in der Vergangenheit betrachtet werden und Eingang in die Wirtschafts- und Forstpolitik finden muß.

Wald und Forstwirtschaft in der EU hier: Besitzartenverteilung

	(Mio ha)	(%)		
Wald i.e.S. (forest)	96,7	100%		
			Min.	Max.
davon **Privatwald**	64,4	67%	16%	90%
davon **Staatswald**	19,4	20%	2%	84%
davon **sonst. öffentl. Wald**	13,0	13%	0%	36%

Ein weiteres Spezifikum der europäischen Wälder ist die Besitzartenstruktur. Während in den forstwirtschaftlichen Problemregionen nicht zufällig die in Konzessionsbetrieb genutzten Staatswälder, die in der Regel auch keine eigene schlagkräftige Forstverwaltung haben, überwiegen, dominieren in Europa die Privatwälder. Im Bereich der EU nehmen die Privatwälder zwei Drittel der Waldfläche ein, fast die Hälfte der Waldfläche insgesamt befindet sich im bäuerlichen Besitz. In den Privatwäldern verbinden sich forstwirtschaftliche Interessen mit den Grundgedanken der Vermögenserhaltung und -mehrung, ihre Bewirtschaftung wird getragen von einer ausgeprägten Eigentümerverantwortung.

Aber auch die Staatswälder weisen Besonderheiten aus; sie werden von gut ausgebildeten Forstleuten bewirtschaftet, zu deren Grundverständnis es gehört, den Wald wie ihr Eigentum zu behandeln.

So ist es nicht verwunderlich, daß die europäischen Wälder nachhaltig bewirtschaftet werden, ein Prozeß, der in Mitteleuropa vor über 250 Jahren angesichts der damaligen Waldverwüstung seinen Ausgang nahm.

Der Begriff der Nachhaltigkeit hat sich inzwischen zu einem umfassenden Verständnis weiterentwickelt, er umfaßt die Nachhaltigkeit der Nutz-, Schutz- und Erholungsfunktion.

Unübersehbar ist die derzeitige Gefährdung der Vitalität der Wälder regional sehr unterschiedlich durch Luftschadstoffimmissionen, die sowohl die aufstockenden Bestände als auch den Boden beeinträchtigen. Trotz großer Fortschritte in der Luftreinhaltung ist das Problem noch nicht gelöst, wie die Waldzustandsberichte dokumentieren. In dem hier zu diskutierenden Zusammenhang ist aber von Bedeutung, daß die Waldschäden nicht ursächlich der Forstwirtschaft anzulasten sind.

Europäische Forstpolitik

Die Europäische Union hat im forstlichen Bereich keine Rechtssetzungskompetenz. Es gibt im Gegensatz zur Landwirtschaft keine europäische Marktordnung für forstwirtschaftliche Erzeugnisse.

Gleichwohl gehen von verschiedenen Bereichen, in denen die EU Rechtssetzungskompetenz hat, Einflüsse auf die Forstwirtschaft aus. Im wesentlichen sind dies die Bereiche Agrarpolitik, Wettbewerbspolitik, Struktur- und Handelspolitik sowie Umweltpolitik.

Der Forstsektor wird unmittelbar oder mittelbar von forstlichen Förderprogrammen so zum Aufbau eines gemeinschaftlichen Überwachungsnetzes zur Waldzustandsüberwachung oder zur Förderung der Waldbrandbekämpfung sowie von der Förderung der Erstaufforstung landwirtschaftlicher Flächen im Rahmen der EU-Agrarreform u.a.m. betroffen.

Ziel der meisten Mitgliedstaaten ist nicht eine einheitliche, sondern eine koordinierte Forstpolitik. Die im Dezember letzten Jahres vorgelegte „Strategie der Europäischen Union für die Forstwirtschaft" trägt dem Rechnung, das Subsidiaritätsprinzip bleibt gewahrt.

Dieses ist auch der Rahmen, in dem sich die Diskussion um die Zertifizierung von Holz aus nachhaltiger Forstwirtschaft und Lösungsansätze bewegen müssen. Auf dieses Thema werde ich mich im Folgenden wunschgemäß konzentrieren.

Zertifizierung

Die Zertifizierung von Betrieben und Produkten ist ein marktwirtschaftliches Instrument: der Produzent verpflichtet sich zu bestimmten Produktionsmethoden, der Verbraucher weiß durch das Zertifikat, daß er beruhigt die so produzierte Ware erwerben kann.

Die Zertifizierung im Bereich der Forstwirtschaft hat – von ihrer Genese her – zunächst einen Adressaten: nämlich den Waldbesitzer / Konzessionär, der zu einer Forstwirtschaft veranlaßt werden soll, die bestimmten Anforderungen entspricht: Verzicht auf Raubbau und Waldvernichtung, Verpflichtung zu einem naturnahen Waldbau, Verzicht oder Beschränkung beim Einsatz von Pflanzenschutzmitteln u.a.m. Zur Durchsetzung dieser Ziele bedarf es eines Partners, des Holzabnehmers und letztlich des Endverbrauchers. Dieser soll veranlaßt werden, nur Holz zu verwenden, das aus einer nachhaltigen, schonenden Forstwirtschaft stammt. Verhält er sich so, wachsen die Marktchancen dessen, der seine Produktionsmethoden so verändert, daß er ein Zertifikat erhält, tut er es nicht, läuft er Gefahr, Marktanteile zu verlieren.

Strategisch gesehen hat die Zertifizierung auf der Abnehmerseite zwei Adressaten: den Holzabnehmer, der in der Regel nicht Endverbraucher ist und den Endverbraucher selbst.

Es ist ein langwieriger Prozeß, den Endverbraucher so zu informieren und letztlich zu beeinflussen, daß er das Zertifikat als entscheidendes Kaufargument verwendet. Zwar wird er, vor die Frage gestellt, ob er lieber schonend oder rücksichtslos produziertes Holz nimmt, selbstverständlich beteuern, nur schonend produziertes Holz erwerben zu wollen, auch dann, wenn dieses etwas teurer sein sollte, in der Realität sieht das aber anders aus. Bei seinem Holzhändler wird er nach Qualität des Produktes und Preis entscheiden. Selbst bei Nahrungsmitteln, die immerhin das leibliche Wohl betreffen, kann ein solches Kaufverhalten beobachtet werden, wovon sich jeder im Supermarkt überzeugen kann.

Einfacher ist die Nachfrageauslösung bei den Holzverbrauchern als Zwischenstufe und einigen Großverbrauchern in der Endverwendung durchzusetzen. Hier gilt es, nur einige Hundert Käufer zu veranlassen, zertifiziertes Holz zu erwerben, um eine gezielte Nachfrage beim Waldbesitz auszulösen. Als besonders wirksam hat sich erwiesen, Großverbraucher wie die Papierindustrie, die Verpackungsindustrie oder Zeitschriftenverlage mit dem nötigen öffentlichen Nachdruck auf „ihre Verantwortung hinzuweisen", um sie zu einem solchen Kaufverhalten zu veranlassen.

Die Zertifizierungsansätze

Ausgehend von den unbefriedigenden Ergebnissen des Tropenholzboykotts, von den Verweisen der Dritte-Welt-Länder auf ruppige Praktiken in den borealen Wäldern sowie den Waldschäden in Europa und nicht zuletzt von den Anstößen der Umweltkonferenz in Rio setzten weltweite Überlegungen ein, wie die Ziele der Walderhaltung und der nachhaltigen Nutzung auch mittels des Instrumentes der Zertifizierung erreicht werden können.

In den europäischen Forstwirtschaften stießen diese Gedanken zunächst auf wenig Verständnis. Mit Recht wurde darauf hingewiesen, daß die europäischen Wälder in ihrem Bestand nicht gefährdet seien, daß die Waldfläche wachse, die Vorräte stiegen, von Raubbau o. ä. also nicht die Rede sein könne, und daß sich Schritt um Schritt das Gedankengut zu mehr Naturnähe in der Forstwirtschaft durchsetze.

Die einzige Bedrohung der Wälder seien regionale, luftschadstoffbedingte Schäden, die aber nicht dem Waldbesitzer, der selbst Opfer sei, angelastet werden können.

Gleichwohl befaßte man sich in einigen Ländern, insbesondere solchen mit hohen Exportanteilen von Holz und Holzprodukten und solchen mit hoher Umweltsensibilität der Bevölkerung, mit zunehmender Intensität mit dieser Frage. Dieses nicht zuletzt, weil sich abzeichnete, daß sich eine entsprechende Nachfrage etabliert, die nicht zu bedienen Absatzmärkte gefährden könnte.

Dabei wurden verschiedene Wege beschritten, die von

- Herkunftszeichen, so in Deutschland, über
- regionale Zertifizierungsansätze, so. z. B. in Finnland, bis zur
- einzelbetrieblichen Zertifizierung nach
  - nationalen Kriterien, z. B. Naturland in Deutschland
  - nach internationalen Prinzipien, wie FSC oder Umweltmanagementstandards der ISO 14000

reichen.

Regionale und nationale Ansätze einschließlich der Herkunftszeichen haben den Nachteil, daß sie, unabhängig von ihrer fachlichen Qualität, nicht den Anforderungen der Holzwirtschaft in ihrer internationalen Verflechtung gerecht werden. FSC und ISO wiederum berücksichtigen trotz internationalen Anspruchs die europäischen Waldbesitzstrukturen nicht angemessen. Es setzten sich deshalb die Bestrebungen durch, ein europäisches Zertifikat zu entwickeln, das den Forderungen nach internationaler Vergleichbarkeit auf der einen Seite, nach spezieller Anpassung an die europäischen Verhältnisse andererseits gerecht wird.

Anforderung an ein Zertifizierungssystem

Eine Zertifizierung muß allgemein folgenden Ansprüchen genügen

- die Zertifizierung muß freiwillig sein
- sie muß durch unabhängige Dritte kontrolliert werden
- sie muß transparent sein
- sie muß glaubwürdig sein
- sie muß international kompatibel sein
- sie darf nicht handelshemmend sein
- der Aufwand muß im vernünftigen Verhältnis zum Nutzen stehen

Umstritten ist die Frage, wie weit die Partizipation, die Beteiligung sonstiger nichtstaatlicher Gruppen, zu reichen hat.

Das alles klingt zunächst einmal sehr einfach, wird aber komplizierter, wenn man sich in die lästigen Einzelheiten vertieft.

Da ist zunächst die Frage, welche Maßstäbe werden angelegt, um die nachhaltige, schonende Forstwirtschaft nachzuweisen. Um einige Aspekte herauszugreifen: Wie bewertet man kleine, mittlere, große Kahlschläge; wie bewertet man den Einsatz von Harvestern, sind Fremdländeranbauten zulässig, wenn ja, in welchem Umfang usw.

Wie weit können gesetzliche Regelungen, die tatsächlich auch durch eine funktionierende Forstaufsicht durchgesetzt werden, als Erfüllung im Rahmen der Zertifizierung anerkannt werden, das ist eine zweite wichtige Frage. Schließlich kann es nicht zweckmäßig sein, für die Forstwirtschaft einen zweiten Verwaltungszweig aufzubauen, der parallel die gleichen Tatbestände überwacht.

Welche Rolle spielt der Waldbesitzer in dem System, wie weit kann er die Kriterien der Zertifizierung mitbestimmen, wie weit wird er schließlich durch die Zertifizierung in seinen Eigentümerentscheidungen eingeschränkt, dann nämlich, wenn er trotz aller Freiwilligkeit gezwungen ist, sich zertifizieren zu lassen, weil er anders seinen Holzabsatz gefährden würde.

Die Zertifizierung zielt in der ursprünglichen Form auf den einzelnen Betrieb, er soll zu einer schonenden Forstwirtschaft veranlaßt und dementsprechend kontrolliert werden.

Wie organisiert man eine einzelbetriebliche Zertifizierung im überwiegenden Kleinprivatwald mit wenigen Hektar Wald, oder läßt man den kleinen Waldbesitz vor der Tür – was doch wohl einer Diskriminierung gleichkäme?

Um noch einmal auf die Partizipation zurückzukommen: Was versteht man unter Partizipation in einer funktionierenden Demokratie, in der sich der Wille der Bevölkerung durch Wahlen ausdrückt, ist dieses nicht die reinste Form der Partizipation?

Sollte die Partizipation, der Dialog mit den gesellschaftlichen Gruppen über eine Beteiligung am Diskussionsprozeß, über eine Transparenz, die jederzeit die Möglichkeit zum Einblick und auch zu öffentlicher Kritik gibt, hinausgehen?

Vor dem Hintergrund dieser Fragen war zu prüfen, ob man sich in Europa nicht zweckmäßigerweise FSC anschließt, wenn man zu einer übernationalen Zertifizierung kommen will.

Warum nicht FSC?

Es sind im wesentlichen 4 Punkte, mit denen die Skepsis und Distanz zur FSC-Zertifizierung erklärt werden können.

Da ist zunächst die Konstruktion des Drei-Kammer-Systems, in dem die ökologische, die soziale und die ökonomische Kammer gleichberechtigt sind. Diese Form der Organisation hat in Gebieten mit großen Waldungen im Staatsbesitz, wo die Gefahr besteht, daß der Staat nur Interesse an den Konzessionsgebühren hat und der Konzessionär auf schnellen Profit aus ist, durchaus ihre Berechtigung. In Europa werden dagegen die Interessen des Waldes in erster Linie durch den Waldbesitzer (auch den Staat, der seinen Wald selbst bewirtschaftet) wahrgenommen. Sie erhalten und pflegen den Wald aus ihrer Eigentümerverantwortung heraus und befürchten deshalb, in einem solchen Drei-Kammer-System in die Minderheit gedrängt, also fremdbestimmt zu werden. Daran ändert auch nichts, daß zu Änderungen in den FSC-Standards eine Dreiviertelmehrheit erforderlich ist.

Da ist zum Zweiten die Forderung der einzelbetrieblichen Zertifizierung. Diese Forderung ist grundsätzlich nachvollziehbar und im größeren Einzelbesitz auch durchführbar. In Europa mit 12 Millionen Privatwaldbesitzern, deren durchschnittlicher Besitz nur 3,5 ha beträgt aber schlichtweg nicht praktikabel. Und zwar aus zwei Gründen: 1. ist sie verwaltungsmäßig nicht zu bewerkstelligen und zu bezahlen und 2. sind viele der Kriterien im Kleinstbesitz, also in aussetzenden Betrieben, nicht umzusetzen. Die Tatsache, daß FSC nunmehr auch andere Ansätze, so die Gruppenzertifizierung, erprobt, ist ein schönes Zeichen für die befruchtende Wirkung des derzeitigen Diskussionsprozesses und gibt Hoffnung, daß eine Annäherung eines Tages möglich sein wird.

Zum Dritten sind die FSC-Standards zu nennen. Die weltweit geltenden Prinzipien und Kriterien werden durch nationale Gruppen an die jeweils herrschenden spezifischen Verhältnisse angepaßt und konkretisiert. Das ist prinzipiell richtig. Allein die bisher bekanntgewordenen FSC-Standards in Europa geben zu großen Bedenken Anlaß, weil sie weit über die naturalen oder sozialen Unterschiede hinausgehend in durchaus wichtigen Fragen zu ganz unterschiedlichen Festsetzungen kommen. Das bewirkt in der Konsequenz sowohl eine unterschiedliche Entscheidungsfreiheit der Waldbesitzer als auch eine Wettbewerbsverzerrung zwischen in gleicher Weise FSC-zertifizierten Forstwirtschaften. Um einige Beispiele zu nennen (nach Ripken):

Die deutschen FSC-Standards verbieten den Kahlschlag grundsätzlich, in Schweden ist er ohne Größenbegrenzung erlaubt, wenn im Durchschnitt 10 alte Bäume je ha stehenbleiben, die polnischen Standards enthalten überhaupt keine Bestimmungen zum Kahlschlag.

Referenzflächen, also unbewirtschaftete Flächen, müssen in Deutschland alle staatlichen Forstbetriebe und alle Kommunalbetriebe, die größer als 1.000 ha sind, in der Größenordnung von 5 % der Flächen ausweisen, in Schweden gelten diese 5 % für alle über 20 ha großen Betriebe, in Polen fehlt jegliche Angabe von Flächenteilen.

In Deutschland wird die Ausrichtung des Rückegassenabstandes auf den Harvestereinsatz auf Betriebe in der Umstellungsphase beschränkt mit der zusätzlichen Einschränkung, daß gleichzeitig der Anteil pflegebedürftiger Reinbestände in den jüngeren Altersklassen den normalen Flächenanteil erheblich übersteigt.

In Schweden und Polen gibt es dagegen zum Harvestereinsatz keinerlei einschränkenden Bestimmungen.

Die Bedeutung dieser Standards für die Erntekosten und damit für den Betriebserfolg liegt auf der Hand.

Weitere Beispiele, so für den Einsatz von Pflanzenschutzmitteln oder im Bereich der Arbeitsbedingungen ließen sich anführen.

Insgesamt drängt sich der Eindruck auf, daß die nationalen FSC-Arbeitsgruppen versuchen, die Meßlatte jeweils etwas höher zu legen, als im jeweiligen Land ohnehin erreicht, was dazu führt, daß in Ländern mit hohem ökologischen Niveau in der Waldbewirtschaftung schmerzhafte zusätzliche Forderungen gestellt werden, während bei niedrigerem Ausgangsniveau sich die Zusatzforderungen im relativ schmerzfreien Bereich bewegen.

Schließlich sind die mit der Zertifizierung verbundenen Kosten anzuführen. Diese umfassen nicht nur die Kosten des Zertifizierungsverfahrens, sondern auch die der Umstellung und Einschränkung im Forstbetrieb. Die direkten Kosten liegen nach Angaben des FSC zwischen 1 und 3 DM/ha für die Erstzertifizierung, darüber hinaus sind nach Steenbock 0,5 % des Erlöses aus mit FSC-Logo verkauften Holzes zu bezahlen. Schwerwiegender dürften aber die Mindererträge und Mehraufwendungen in Betrieb und Verwaltung sein.

Aus alledem ergab sich das Bestreben vieler europäischer Forstwirtschaften, einen eigenen Weg zu gehen, ein Bestreben, das zur Entwicklung eines europäischen Nachhaltigkeitszertifikates führt.

PEFC Paneuropäisches Nachhaltigkeitszertifikat

Der im Juli 1998 gegründeten Initiative zur Entwicklung eines alternativen regionalen Zertifizierungssystems haben sich mittlerweile 17 Länder mit einer Waldfläche von rd. 100 Mio. ha angeschlossen. Weitere Länder haben bereits ihr Interesse bekundet.

Grundlage für das paneuropäische Nachhaltigkeitszertifikat sind die von 37 europäischen Staaten auf den Forstministerkonferenzen in Helsinki und Lissabon sowie auf den begleitenden Expertentreffen erarbeiteten Kriterien, Indikatoren und operationellen Empfehlungen für eine nachhaltige Waldbewirtschaftung. Diese haben zwar nur empfehlende Charakter, üben also keine unmittelbare Bindungswirkung aus, sie sind aber das einigende Band, das die europäischen Partner bei allen Unterschieden in den nationalen Forstgesetzen in Fragen der Waldbewirtschaftung zusammenhält.

So stand einer raschen grundsätzlichen Einigung auf dieser Grundlage auch nichts im Wege.

Allerdings wird beim genauen Lesen der Helsinki-Kriterien und der operationellen Empfehlungen auch deutlich, daß diese sich nur in begrenztem Umfang zur unmittelbaren Verwendung eignen. Sie bedürfen vielmehr der Beigabe von Maßstäben, an denen die Einhaltung gemessen werden kann, der weiteren Interpretation, der operativen Präzisierung.

Das soll an einzelnen Beispielen verdeutlicht werden.

Das 1. Kriterium, „Erhaltung und Verbesserung der Forstressourcen und ihr Beitrag zu den Kohlenstoffkreisläufen" kann meßbar gemacht werden, über die Erfassung der Waldfläche, der Waldplanung, des Zuwachses, der Nutzung, des Vorrates und des darin gebundenen Kohlenstoffvorrates.

Kriterium 2 „Erhaltung der Gesundheit und Vitalität von Forstökosystemen": Entwicklung der Bodenversauerung, zufällige Nutzungen, Luftschadstoffbelastungen, gekalkte Fläche, Sanierungsprogramme, Regelungen zum Einsatz von Pflanzenschutzmitteln.

Kriterium 3 „Erhaltung und Förderung der Produktionsfunktionen der Wälder": Gesetzliche Grundlagen, Förderrichtlinien, Ergebnisse der Waldbewirtschaftung, Durchforstungsrückstände, Walderschließung und Regelungen zum umweltschonenden Waldwegebau.

Kriterium 4 „Erhaltung und angemessene Verbesserung der biologischen Vielfalt in den Waldökosystemen": Geschützte Biotope, Waldschutzgebiete, Totholzanteil, Waldbauverfahren und ihre Ziele: Naturverjüngung, Anteil Mischbestände, Strukturvielfalt.

Kriterium 5 „Erfassung und angemessene Verbesserung der Schutzfunktionen bei der Waldbewirtschaftung": Waldfunktionenkartierung, Umfang von Wasserschutz- und Bodenschutzwald sowie sonstigem Schutzwald, und – überschneidend mit anderen Kriterien – Regelungen zum Pflanzenschutzmitteleinsatz oder zum Waldwegebau, Wasserbau.

Kriterium 6 „Erhaltung sonstiger sozio-ökonomischer Funktionen und Bedingungen": Zahl der Beschäftigten, Regelungen der Eigentums- und Nutzungsrechte, Betretensrecht, Erhaltung von Standorten mit besonderer historischer, kultureller oder religiöser Bedeutung, Arbeitsbedingungen, Arbeitsschutzbestimmungen für die Arbeit im Wald sowie Schulungsmaßnahmen zur Arbeitssicherheit.

Die konkreten Zielbestimmungen und Methodenbeschreibungen erfolgen in Anpassung an die jeweiligen naturräumlichen, wirtschaftlichen und rechtlichen Verhältnisse in den teilnehmenden Ländern. Sie können nach Regionen weiter differenziert werden. Das ist prinzipiell ähnlich wie beim FSC-Prozeß, wird aber zu nicht so divergierenden Ergebnissen führen.

Auf jeden Fall wird das paneuropäische Zertifikat nicht mit der strittigen Forderung nach Referenzflächen belastet werden. Die Forderung nach nutzungsfreien Flächen ist eine politische Forderung, deren Umsetzung dem Waldeigentümer nicht entschädigungslos abverlangt werden kann. Es ist an dieser Stelle daran zu erinnern, daß die europäischen Wälder fast ausnahmslos mehr oder minder intensiv genutzte Kultur- und nicht Urwälder sind. Abgesehen von den wirtschaftlichen Verlusten, die mit der Ausweisung von Referenzflächen verbunden sind, ist zu diesem Streitpunkt noch folgendes anzuführen:

Aus der Entwicklung auf den Referenzflächen können nicht, wie behauptet, unmittelbare Lehren für die Waldbewirtschaftung gezogen werden. Es bedarf vielmehr einer sehr intensiven und aufwendigen Forschung, um Kausalitäten erkennen und bewerten zu können. Jedes Land, das sich mit diesem Thema befaßt, wird das bestätigen. Voreilige Schlüsse aus Entwicklungen auf Referenzflächen zu ziehen, könnte sich als noch belastender als der Produktionsverlust auf der entzogenen Fläche erweisen. Im übrigen muß für eine seriöse Forschung die Auswahl der Beobachtungsflächen nach systematischen Gesichtspunkten und nicht nach Besitzstruktur oder nach zufällig ohnehin nutzungsfreien Problemzonen erfolgen.

Natürlich steht es den Nachfragern nach Naturschutzleistungen frei, seien es der Staat oder interessierte Gruppen, unabhängig von unmittelbaren oder meßbarem Nutzen, diese Leistungen bei den Waldbesitzern einzukaufen. Das entspricht marktwirtschaftlicher Logik.

An der Spitze der Organisation wird der Pan-Europäische Zertifizierungsrat (PEFCC) mit Sitz in Luxemburg stehen. Zu seinen Aufgaben gehört die Zulassung der nationalen Zertifizierungssysteme, die Vergabe des PEFC-Logos, er vertritt die Europäer als internationaler Ansprechpartner in Fragen der Zertifizierung.

Die nationalen Belange werden von einer nationalen Dachorganisation, einem Zertifizierungsausschuß, wahrgenommen, in dem sowohl die Waldbesitzer als auch die Holzwirtschaft, die Umweltverbände, die Gewerkschaften und die Verbraucher vertreten sein werden. Er beschließt die Systembeschreibung und gibt die Anforderungen vor, die zur Erlangung des Zertifikates erfüllt werden müssen.

Das Verfahren könnte so aussehen – endgültige Beschlüsse stehen noch aus:

Die Vertreter einer Region beantragen bei einer Zertifizierungsstelle die Begutachtung der Region. Mit dem formlosen Antrag müssen die von der Systembeschreibung geforderten Unterlagen, eine ausreichende Dokumentation, eingereicht werden. Das kann z. B. ein erweiterter Landeswaldbericht sein.

Die eingereichten Unterlagen werden durch Gutachter, die von der Zertifizierungsstelle in Einvernehmen mit den Vertretern der Region bestimmt werden, auf die Übereinstimmung mit den Anforderungen dieser Systembeschreibung geprüft. Als Grundlage für die Bewertung der Unterlagen dienen der Zertifizierungsstelle die Begutachtungsrichtlinien, die ebenfalls vom Zertifizierungsausschuß definiert und beschlossen werden.

Bei einem positiven Begutachtungsergebnis können die Forstbetriebe der Region die Ausstellung eines Zertifikates direkt bei der zuständigen Zertifizierungsstelle oder jeweils regional zu definierenden Mittelstellen beantragen. Bestandteil des Antrages ist eine Selbstverpflichtung zur Einhaltung der in dieser Systembeschreibung genannten Anforderungen.

Die Zertifizierung erfolgt in der Regel regional, d. h. für alle Waldbesitzer einer Region – in Deutschland Bundesland – gemeinsam. Die Gründe wurden bereits dargelegt. Sollte das nicht möglich sein, z. B. weil sich eine Reihe von Waldbesitzern für ein anderes Zertifizierungssystem entschlossen hat, so kann der Antrag auch von einer Gruppe von Waldbesitzern oder einzelnen Betrieben gestellt werden.

Als Zeitraum für die Gültigkeit der Zertifikate werden 10 Jahre ins Auge gefaßt. Das entspricht dem Zeitraum für die Forsteinrichtung und ist den langsamen Veränderungen im Walde angemessen. Nach Ablauf dieser Frist erfolgt eine unabhängige Evaluierung der Waldbewirtschaftung in der Region. Im gleichen Turnus wird anhand von Unterlagen der Waldbesitzer die Einhaltung der Selbstverpflichtung kontrolliert. Hinsichtlich Vorortkontrollen in den Forstbetrieben besteht das Problem, daß in Deutschland wegen der geringen Betriebsgrößen eine hinreichende statistische Absicherung eine immense Kontrolldichte und damit Aufwand erfordern würde. Deshalb ist es zweckmäßiger, Prüfungen in der Fläche auf Fälle zu beschränken, in denen der Verdacht besteht, daß die Anforderungen nicht erfüllt werden.

Für Streitfälle bei der Vergabe bzw. der Verlängerung der Zertifikate wird

Organisation und Verfahren

Organisationsaufbau PEFC

eine unabhängige Schlichtungsstelle eingerichtet werden.

Als Regelfall wird also die regionale Zertifizierung angestrebt. Wegen des großflächig zu führenden Nachweises der schonenden, nachhaltigen Forstwirtschaft liegt der damit verbundene Aufwand niedrig. Es ist von Kosten um 0,50 DM/ha für die Erstzertifizierung auszugehen.

Zusammengefaßt läßt sich das paneuropäische Verfahren also wie folgt darstellen:

- Es basiert inhaltlich auf den Helsinki-Kriterien
- der Nachweis der nachhaltigen Forstwirtschaft wird regional und periodisch erbracht
- alle Waldbesitzer, die das Logo führen wollen, müssen sich verpflichten, die Anforderungen zu erfüllen
- die Überprüfung erfolgt durch unabhängige Dritte.

Zeitplan und Ausblick

Voraussichtlich zum 30.06.1999 sollen die Entwicklungen in Europa so weit vorangetrieben worden sein, daß mit der Umsetzung im PEFC in den beteiligten Ländern begonnen werden kann. Derzeit laufen in Deutschland in drei Bundesländern, in Bayern, Baden-Württemberg und Thüringen Pilotverfahren, um die Umsetzung des PEFC auf regionaler Ebene in Deutschland zu erproben.

Mit einem entsprechenden Einführungsbeschluß durch den Deutschen Forstwirtschaftsrat ist zum 01.06.1999 zu rechnen. Der Deutsche Holzwirtschaftsrat unterstützt diese Entwicklung. Bis zur tatsächlichen Umsetzung wird dann ein weiterer Vorlauf von rund einem halben Jahr nötig sein, so daß die Zertifizierung mit Wirkung vom 01.01.2000 greifen könnte.

Dann wird es zwei Zertifizierungen geben: PEFC und FSC. Das ist kein Unglück, zwei miteinander konkurrierende Systeme können durchaus sinnvoll und nützlich sein. Sie werden aber dann negative Auswirkungen auf den Verbrauch von Holzprodukten haben, wenn sie einander bekriegen und in Zweifel ziehen. Im Interesse der Sache, Sicherung der Walderhaltung und der schonenden und nachhaltigen Nutzung von Waldökosystemen sowie Förderung des Holzabsatzes sollten deshalb Rivalitäten nicht auf Kosten der Glaubwürdigkeit ausgetragen werden. Eine gegenseitige Akzeptanz wäre die anzustrebende Lösung. Das sollte um so leichter fallen als dem Vernehmen nach FSC Deutschland das Niveau seiner Anforderungen bei den strittigen Punkten anpassen will und sich damit den PEFC-Vorstellungen weiter annähert.

Letztlich wird der Markt über Richtigkeit und Erfolg des eingeschlagenen Weges entscheiden.

Anschrift des Verfassers:

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Globalisation of Forest Products Markets

Lars Salovius

Summary

Wood as a renewable resource is an excellent raw material for industrial production of goods to satisfy the need for information, packaging, hygienic products and construction. Differences in population density, culture, standard of living, access to managed forests etc. influence the forest product material flows. From a global point of view, however, the main material flows are local or at least within a single continent. The local differences in demand and supply, population and availability of raw materials create an increasing global flow of forest products. Environmental and social aspects are increasingly important in determining the flow of forest products, in addition to economic factors.

The major trade of roundwood products in 1996 was within Europe and from the former USSR to Europe. These flows represented about 40 million m³ altogether (Fig. 1). Roundwood product flows from Latin America in Caribbean as well as from Africa played a certain role in wood supply to Europe.[1]

Pulp products traded in 1996 in Europe, imports from North America to Europe and exports from Latin America represented altogether about 15 million tons (Fig. 2). An increased pulp flow from Asia to Europe can be expected in the future.

About 35 million tons of paper products were traded in Europe in 1996. Exports from Europe to Asia and Pacific amounted to 5 million tons and imports from North America to Europe respectively. At the same time North America imported 1,5 million tons of paper and board from Europe.

[1] *This presentation is partly based on material from WFSE (World Forests and Environment Research Program, c/o METLA, worldforests@metla.fi*

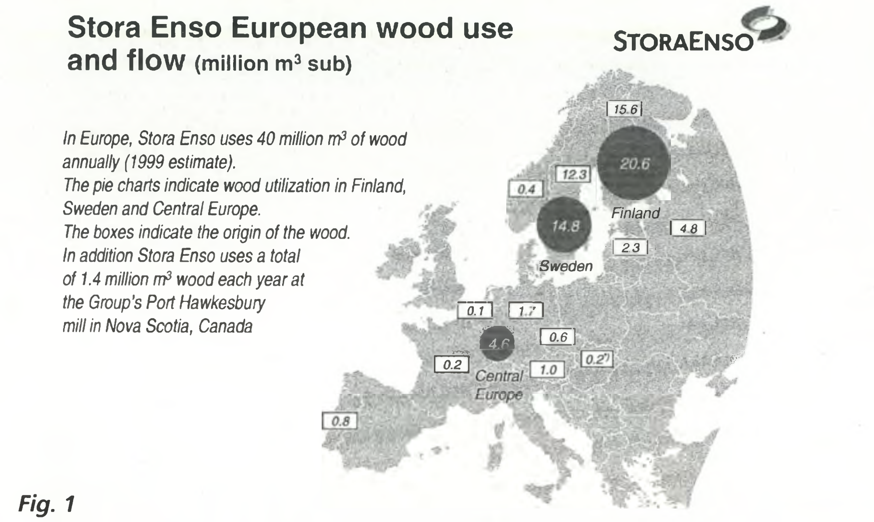


Fig. 1

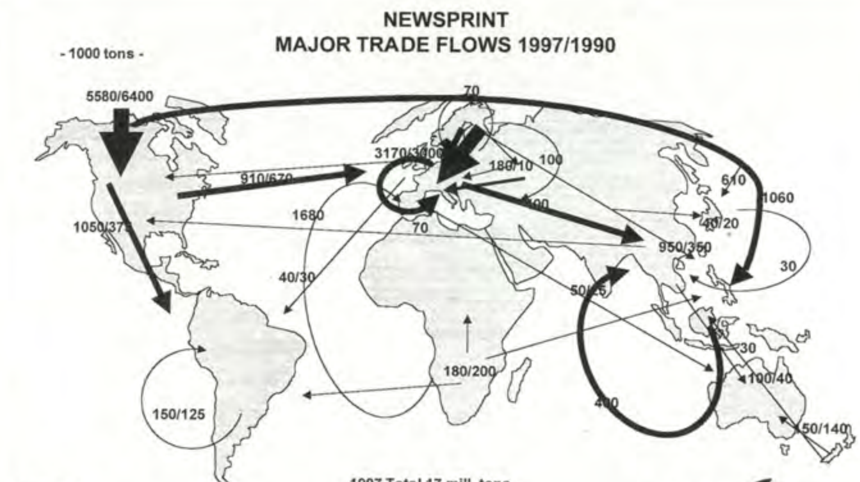


Fig. 2

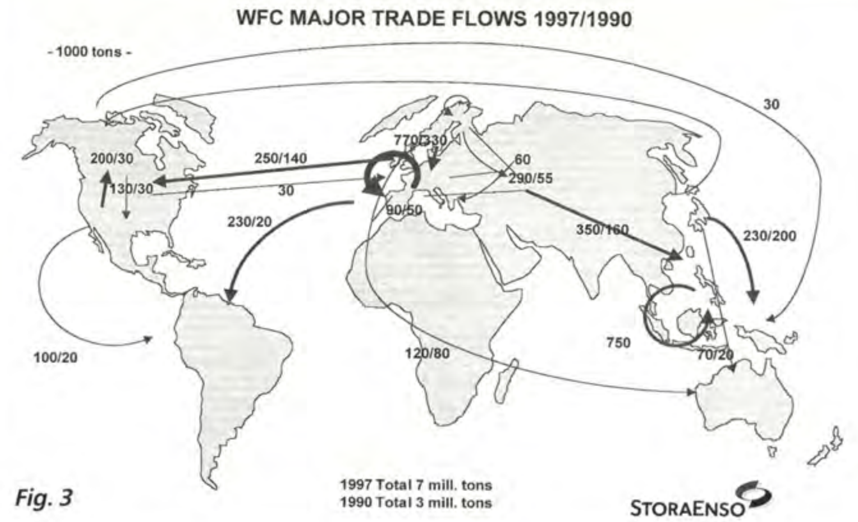
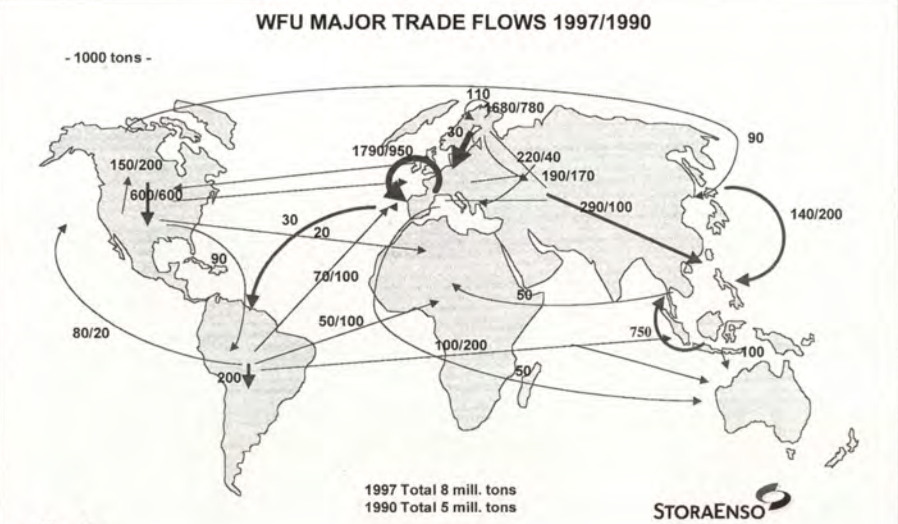


Fig. 3



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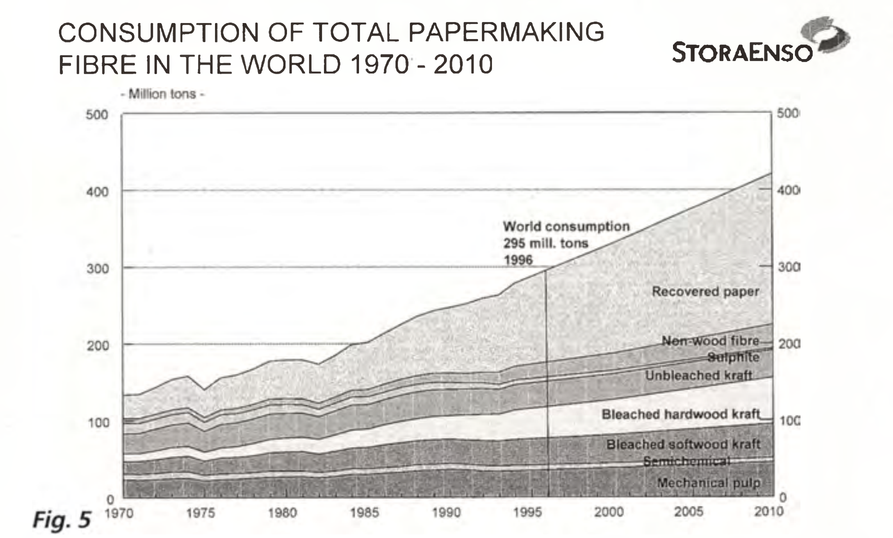

Fig. 5

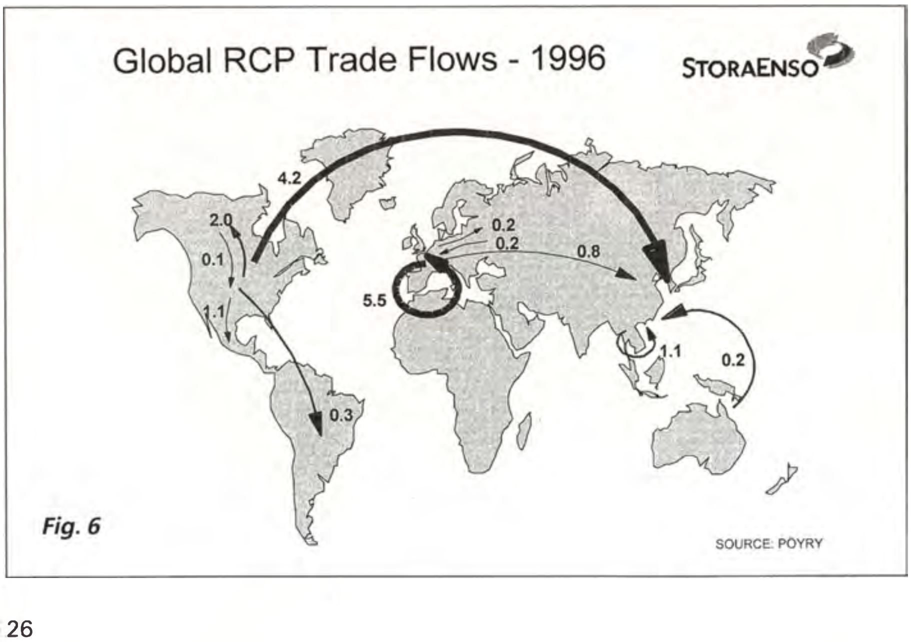

Fig. 6

In 1997 world's biggest newsprint paper flow, 5,6 million tons within a continent, was directed from Canada to the USA (Fig. 2). In Europe, the Nordic countries supplied the main stream of newsprint to mainland Europe. The flow from North America to Japan was also rather large, one million tons.

In 1997 the major woodfree coated paper flows were within Europe and from Europe to Asia (Fig. 3). For woodfree uncoated (copy paper) paper in 1997 the biggest flows were in Europe and in North America (Fig. 4). The Asian flow was also notable. A strong growth in the flows of woodfree uncoated paper to Europe is expected from Indonesia, Thailand and China in the future.

The value of all forest products, excluding recovered paper, traded between continents and internationally in Europe was about 76 billion dollars in 1996.

Recovered paper plays an important role in the forest product raw material trade. It is estimated that in the near future the recovered fiber consumption of paper and board production will cover more that 50% (Fig. 5). The major recovered paper flows are from the USA to Far East and inside Europe from one country to another (Fig. 6).

Inside Europe there is a natural division of labour. The northern parts of Europe are thickly forested so products from that region are basically made from primary fiber. Products produced in mainland Europe are to a large extent produced from secondary fiber as large resources of recovered paper are available in the densely populated areas.

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Quantification of Environmental Performance

An Opportunity or Threat for Forest Products?

Klaus Richter

Introduction

The criteria applied by consumers when deciding what to buy have always puzzled marketing experts. Research carried out specifically in this area over the last few decades has indicated that there are no generally applicable criteria, but rather the response to such issues is highly differentiated depending, for example, on product type and group (consumer goods versus capital goods), category of purchaser (educational level, income level, age etc.) and the fundamental psychological and emotional characteristics of the individual. Alongside the paper and pulp industry, the furniture and building sectors are the most important areas of use for forest and wood products. Experience gained over the last few years has shown that, when it comes to the use/selection of certain products or groups of materials, potential purchasers or decision-makers apply a wide range of criteria. While the majority of these relate, as always, to product profile and thus basically to the image of a product or a material, a new and (perhaps) increasingly important emphasis is being placed on environmental and health aspects (Figure1).

So the question now is: where do wood and wood products stand in relation to alternative products in the eyes of the most important decision-makers?

Criteria for product selection

The question of materials assessment has been investigated relatively thoroughly. A survey carried out among architects, engineers and construction industry clients in Switzerland at the end of the 70s relating to assessment of the most important building materials (steel, aluminium, plastics, wood, brick, concrete) on the basis of the individual aspects of price, processing, durability, maintenance, comfort, aesthetics and ecology was repeated in 1998. The results were very similar with only slight differences (Table 1).

Table 1: Results of a survey of architects relating to the assessment of the most important building materials (Source SAH 1999) (weighted average rating) 1=bad; 2=poor, 3=moderate, 4=good, 5=very good)

	Material (weighted average rating) 1=bad, 5=very good					
Aspect	Steel	Alu	Plastics	Wood	Brick	Concrete
Price	3.5	2.8	3.8	3.6	3.9	3.6
Processing	4.0	3.6	3.6	**4.5**	4.1	3.9
Durability	4.0	4.3	3.4	3.7	4.4	4.1
Maintenance	3.2	4.1	3.5	*3.1*	4.2	3.7
Comfort	3.3	3.6	3.2	**4.4**	4.1	3.3
Aesthetics	3.8	3.7	3.6	**4.5**	4.1	3.7
Ecology	3.2	2.2	2,2	**4.5**	3.9	3.0
Average	**3.6**	**3.5**	**3.2**	**4.0**	**4.1**	**3.6**

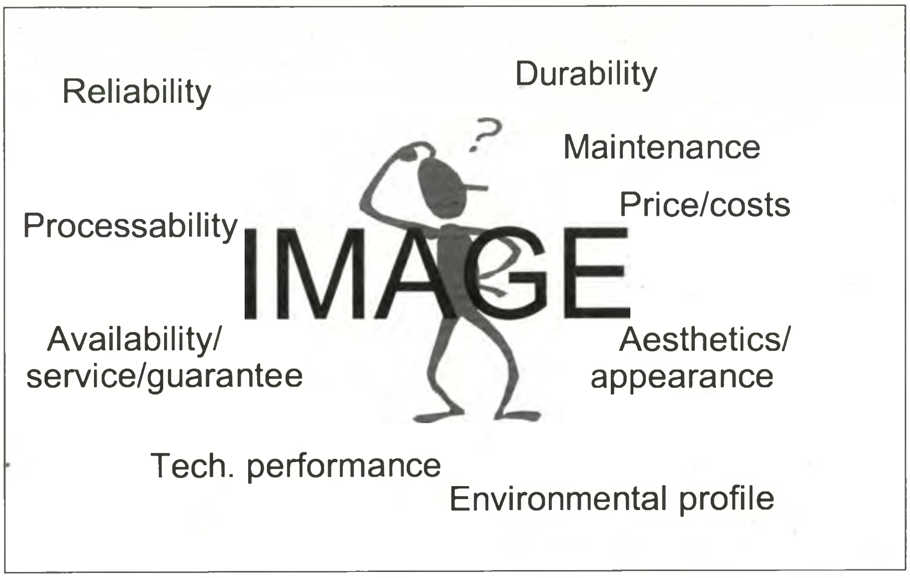

Figure 1. Criteria for product selection

Overall, wood lies in second place just behind brick, but still clearly ahead of steel and concrete. Looking at the criteria individually, wood stands out as the best in the environmental and aesthetic areas, but is the worst from the point of view of maintenance. One could conclude on this basis, with regard to the subject matter of this paper, that further quantification of the environmental position would be of no benefit, it being sufficient to rely on emotional motives based on gut feeling. However, the apparent great liking for wood in general has virtually no effect on actual behaviour: the construction industry relies predominantly on solid structures, wood playing as ever only a small role in Central European house building, with, for instance, far more PVC than wooden windows being installed in Germany in recent years. There are many reasons for this (Quettling et al 1999).

1) The liking for wood is most marked among one-off or occasional clients of the construction industry.
2) Professional or institutional construction industry clients view wood much more rationally and merely as a possible alternative to other building materials.
3) In some cases, criteria such as durability carry a higher weighting than aesthetics or the environment.
4) The basic image of the material cannot be transferred directly to the image of the individual product. A conflict of aims thus arises, especially for professional decision-makers, between the desire to achieve a natural look and the need to improve durability by impregnation and coatings.
5) Alternative industries have recognised the deficiencies in their environmental image and continually provide general and product-specific information about the improvements they make, using any tools possible.

The forest and wood industry needs to face up to this situation. Is it sufficient to continue to rely on the emotion-based environmental merits of wood as a raw material, which, as the above-mentioned investigations have shown, are largely familiar to the people of Central Europe (attitudes in the countries round the Mediterranean, for example, may well be very different from those of the Swiss)? Or, alternatively, should the forest and wood industry place much greater emphasis on developing and communicating its environmental performance?

In discussing certification of forestry methods, the forestry sector is reacting to the pressure from environmental associations, even though no system acceptable to all interest groups has yet been designed. This is clearly illustrated by the ongoing discussions about the FSC approach or the PEFC initiative. Where a 'chain of custody' is concerned, it is not sufficient merely to provide evidence of the environmental compatibility or sustainability of wood production; all the processing stages involved, from felling through intermediate and finished products to disposal and recycling, have to be portrayed and communicated in a transparent manner, so that the professional decision-maker has a better basis for assessment, comparison and decision-making.

Tools for environmental information

Today, our lives are dominated more than ever before by the communication and information media. Nothing seems more important these days than the right information at the right place at the right time, but, at the same time, information is ever more short-lived. There is a real risk of information overload and it is important to see the possibilities and limits of product information in this light. A brief presentation follows of the tools available and the options for applying them to wood products. The tools are

- quality seals
- certification of origin
- product declarations
- ecolabels
- life cycle assessment (LCA).

Reflecting the apparent need for more information, there is at present an abundance of certificates, labels and marks which are intended to clarify specific (environmental) characteristics of products or aspects connected with the product. This is in addition to the legally binding standards and classifications (standards/permits pursuant to building products legislation), which are excluded from the following discussion. We should all know from our own experience that reality frequently falls short of the intended aim of clarifying these characteristics, because on the one hand we as consumers do not know the precise background of the marks or the manufacturers deliberately include imprecise or misleading information in their marketing strategies. The intention behind all these tools of clarifying the situation and building confidence, which is in itself to be welcomed, has suffered greatly in the past.

Quality seals, as strictly defined, provide information about a very precisely specified product property and are as a rule verified and awarded by accredited organisations in accordance with established standards. Wood boards, for example, are classified according to their formaldehyde emission potential (Classification E1 in Europe & CH10 in Switzerland). In this case, therefore, environmental performance is quantified over only a very narrow range and may be used to choose between similar products on a simple yes/no basis.

Certification of origin has a relatively large role to play in the area of forestry and agricultural products; it states the region or production or cultivation (in Germany: Wood from sustainable forestry. Grown in Germany. In Austria: O.K. – Wood from Austria. Natural. Inspected. In Switzerland: Certification of Origin Swiss Wood. In Belgium: Walloon Region). The list could be continued, but mention should also be made of the negative aspects of such marks. Environmental performance is not quantified, and it ought to be clear that wood is not the same as wine. Where wine is concerned, the region of production has been clearly accepted as an definitive indication of quality. However, there are many reasons why this should not be expected for wood as an industrial product and such certification would have only a very marginal influence on sales figures.

Product declarations are of increasing significance in relation both to important properties of the materials themselves and to properties of environmental relevance. In Switzerland, the professional association of architects and engineers (SIA) has responded to the increasing need of its members for environmental information and developed a grid which manufacturers or retailers may use to declare their products and which may be requested by construction industry clients and architects and used for production selection (SIA 1997).

Uniformly structured information is requested for a total of 14 product groups, relating to physical, health and environmental aspects of the products and organised in accordance with the lifecycle stages of production, processing, use and disposal. The grid has been available since last year and is being very widely used. It does not itself make any assessment, since that is the job of the planner – the grid merely provides important information, supplemented by an interpretation aid. The grid aims to provide very precise quantification of certain important environmental aspects, e.g. primary energy consumption, while grouping and classifying others, e.g. solvent contents, R phrases. The grid is clearly a tool directed at specialists, requiring a certain level of sophistication in evaluating information. A separate grid has been developed for derived timber products.

Tools for environmental management according to ISO 14000ff

Since launching its standards series for improving quality management (ISO 9000), the ISO, which is accepted and recognised particularly in industrial circles, has begun to develop standards and directives for environmental management of companies and products (ISO 14000). These tools may be divided into families relating to companies/organisational structures and those relating to products or services (Figure 2).

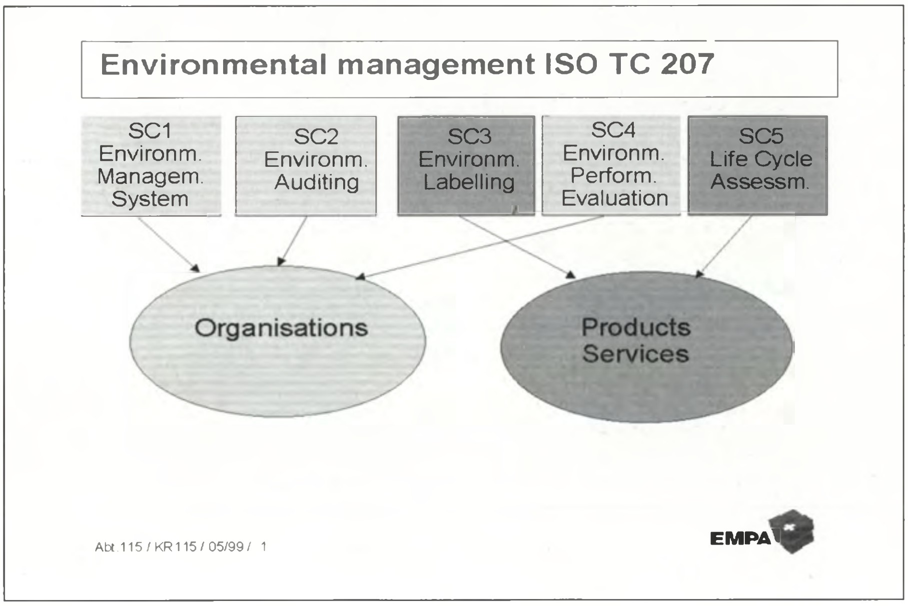

Figure 2: Overview of the structure of ISO TC 207

While, for instance, the provisions of SC1 (EMS), SC2 (Auditing) and SC4 (Performance Evaluation) may play a decisive role in forest certification, when supplemented by a specific criteria grid, the environmental aspects of products or services may be clarified using the standards packages covering Environmental Labelling (Ecolabels, SC3) or Life Cycle Assessment (SC5).

Ecolabels provide information about the overall or selected environmental properties of a product or service. Ecolabels are intended to promote the demand for and the provision of products which involve less damage to the environment than the average products of any one group. This is intended to encourage competition and thus contribute to a reduction in environmental impact. The best known environmental labels are: Nordischer Schwan (Nordic Swan), Blauer Engel (Blue Angel) and the EU-Eco Label. Too many symbols on packaging can sometimes create great confusion amongst the target groups, i.e. the end consumers, about the content and purpose of the labels. Misinterpretation has been found to arise if the label relates to the packaging, for example, but not its contents. To remedy this, the ISO has adopted certain basic principles and instructions governing the issuing of labels. Standards series ISO 14020 lists 3 types of optional labels:

Type 1: Label issued by independent private or public groups to demonstrate that a product is one of the most environmentally friendly products in a product category. Criteria to be assessed using the life cycle approach;

Type 2: Self-declaration by manufacturer, identifying the environmentally relevant properties of its products (recyclability, reusability, refillability etc.);

Type 3: This label is issued by independent organisations and is the ecolabel entailing the most comprehensive level of quantification. It comprises a report giving detailed information about the possible environmental impact of the product in question, which have again to be established using the life cycle approach. Ultimately, the information content of the label should correspond to that given in foodstuffs declarations, which requires the target audience to be correspondingly aware of the criteria used.

In practice, these ecolabel types have not yet become widely accepted, in part because the standards series are still at the development stage. In principle, the basic standard (ISO/DIS 14020) sets out a series of 9 principles which are to be taken into consideration when assessing criteria; only once these principles are actually applied can the labels achieve their intended purpose and generate the desired benefits.

It is striking that, in the case both of the more complex forms of label (Types I and III) and of the exacting product declaration, reference is made to the lifecycle of the product, providing a degree of overlap with the most exacting, but also the most expensive and complex form of environmental analysis, life cycle assessment.

Life cycle assessment or analysis is set out in standards series ISO 14040ff and is designed to enable an integral assessment and evaluation of the environmental impact of a product over its life cycle. LCA involves drawing up a very precise record of all the energy and material flows relating to the product or functional unit in the form of inputs and outputs (emissions) and subsequent evaluation of the potential environmental impact which may arise from these material flows.

The information obtained from life cycle analyses may be used for weak point analysis and optimisation, for communication and environmental information and, provided that important methodological requirements are fulfilled, also for comparing products of differing material compositions.

The basic idea behind LCAs, together with their content and aims, will now be discussed with reference to a few examples (Richter 1998). Further examples of their application to wood products will be presented in the second session of the workshop.

Acceptance of LCA in industry

Of importance to the theme of this presentation is the question of the extent to which this expensive method, which is naturally not uncontroversial where product comparisons are concerned, is accepted and used by industry. Although LCA has only a brief period of development behind it, the chemical industry has shown considerable interest in its development from the outset. Because LCA involves comprehensive product evaluation and makes reference to product benefits, the chemicals industry recognised it as an opportunity to develop new approaches to environmental improvement and more purposeful environmental information through an active examination of the environmental problems associated with the bulk and speciality chemicals industry. The automotive, metals, detergents, paper, electronics and foodstuffs industries are today also making intensive use of this method for internal and also external purposes. One important finding was that good, representative fundamental data relating to the sector-specific material and energy flows had to be compiled so that the data did not have to be recreated from scratch every time a new product was modelled, but were instead ready for use. Considerable investments in joint, often international projects, were made in order to compile data inventories, covering all the most important semi-finished products (example: plastics, aluminium, cement, steel). Large publishers have also recently conducted a comprehensive life cycle analysis of their product groups and required all the companies in the supply and production chain to join in and support the study.

In contrast, the response of the wood industry to life cycle analysis has been relatively hesitant for various reasons, including:

- hardly any public pressure had been applied (except in relation to the type of forestry, wood preservation, formaldehyde emissions);
- the production chain is heterogeneous (forestry, 1st-3rd processing stages);
- the differences in geography and ownership structures in forestry are considerable (Nordic countries vs. Central Europe);
- the wood industry, being based on small- and medium-sized enterprises, is not amenable to large-scale analyses;
- there is considerable variation in the level of development, technology and manufacturing in the various sectors.

Nevertheless, it is astonishing that there are as yet no uniform, averaged inventory data acceptable across Europe even for the mass-produced semi-finished products of the wood industry. Thus, the applications of LCAs in the wood sector have so far been restricted to publicly financed studies, which, although able to demonstrate the potential for use of this assessment method, have also pointed out its limitations.

Findings from currently available LCAs relating to wood products

Comparative life cycle analyses carried out so far have generally produced positive assessments as far as products made from native, sustainable wood sources are concerned. Firstly, the regenerative capacity and CO_2 neutrality of the resources themselves may be documented for all wood products. Expressed in figures, i.e. quantitatively, there is generally lower consumption of fossil primary energy sources during harvesting and processing of the wood and a commensurately slight contribution to the greenhouse effect. In addition, wood structures generally make less intensive use of materials than do structures built from alternative products and wood structures generate only small quantities of waste requiring disposal after thermal energy recovery when material use is complete (as a rule dust and ashes).

In addition, LCAs have produced a series of further findings:

- Carbon dioxide uptake and the twin functions of wood as a raw material and renewable energy source are useful, substantial arguments;
- Most wood products are composed of a large number of materials, which has a distinct impact on the overall assessment;
- LCA results relating to finished wood products are essentially determined by the auxiliary substances used;
- LCAs open up possibilities for improvement for wood products too;
- Optimisation (e.g. by material economies) frequently also provide opportunities for financial savings;
- The environmental advantages demonstrated using LCAs contribute to increased use in the building industry (examples: NL, CH);
- The contribution of forestry and long-term wood product utilisation to the CO_2 balance in individual countries is increasingly being acknowledged;
- The role of wood and other forms of biomass as energy sources is assuming a greater significance.

However, these fundamentally advantageous findings are accompanied by some problems relating to the application of LCA to wood products:

- Recording and assessment of land use and types of forestry (biodiversity, sustainability);
- Allocation of remaining forest exploitation to wood products;
- Varying quality of data relating to basic processes and products;
- Activities barely coordinated internationally before 1995;
- Lack of commitment from the industries concerned;
- Competing industries are making intensive use of LCA to outline their future potential (e.g. through recycling). The wood industry is too passive in this respect.

It may however be noted that certain improvements have been made in recent years, initially at a scientific level, arising from an EU research project and a COST action aimed at improving cooperation in the field of life cycle assessment of forestry and wood products.

Quantified environmental performance – advantage or disadvantage for wood products?

There certainly are some arguments against increasing the level of detail when addressing the environmental aspects or life cycle of wood products:

- Wood is by definition an environmentally sound product, no more detailed explanation is necessary;
- The wood industry's problems lie in areas other than the environment;
- The cost of quantification is enormous and exceeds the financial capaci-

ties of the companies involved;

- The heterogeneous nature of the industry and geographic differences mean that data cannot be standardised;
- Life cycle assessments are too complicated; simpler, generalised statements are more readily communicated;
- The data and findings from life cycle assessment can always be disputed;
- Once quantified, the advantage of wood products is not nearly as great as might be assumed.

This list could be continued. On the other hand, it may be argued that the forestry and wood industries process a raw material with unique intrinsic environmental qualities that should be emphasised and documented. The pressure from competing industries in the battle for market share is rising, and environmental arguments are increasingly being used as a weapon. The wood industry would be wise to prepare:

- Making an active contribution to environmental management;
- Including environmental aspects when considering its material and energy flows;
- Endeavouring to make and communicate continuous improvements to the environmental profile of its products;
- Endeavouring to make and communicate continuous improvements to product quality, because durable products are generally environmentally compatible too;
- Accepting the life cycle assessment approach and demonstrating the advantages of using wood right up to the end of a product's service life.

This will require effort not only from individual companies but also from associations and international interest groups throughout the sector. Research must also be conducted into methods for the advantageous compilation and assessment of forest- and wood-specific characteristics in environmental assessments.

Better, more precise quantification of the environmental performance of wood products is certainly not an absolute necessity – environmental aspects are only one criterion for the acceptance of a product. However, if it proves possible to document the relevant information relating both to positive environmental effects and those in need of improvement in a manner better than has previously been the case, this would produce a specific advantage resulting in economic benefits for industrialised nations, at least in the short term. The demand for more precise data and figures relating to economic activity will increase, with regard also to those tests which are just beginning, to provide a clear overview of all aspects of sustainability, namely including economic, environmental and social factors. The forestry and wood industry is in an ideal starting position and is able actively to exploit the advantages by providing the necessary information.

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Forest Certification and the Promotion of Improvement Forest Management

Chris Elliot

1. Introduction

This paper introduces forest certification as a policy instrument and shows how it operates in practice. It also presents the two main approaches to certification, one based on management systems and the other based on performance standards.

2. Objectives of Forest Certification

Two primary objectives of forest certification have been identified in the literature, together with a number of secondary objectives.

Primary objectives:

- to improve the environmental, social and economic quality of forest management; and
- to ensure market access for certified products, particularly in "ecosensitive" markets with high environmental awareness.

The secondary objectives which have been mentioned include: improved control of logging operations and reduction of illegal harvesting; higher recovery of royalties and taxes; increased transfer of funds to forest management; internalization of environmental costs in timber prices; encouragement for investment in wood processing industries; improved productivity and cost-savings in the production chain from forest to end-user; and improved transparency in forest management and trade.

3. Certification as a Policy Instrument

Certification is an economic policy instrument with environmental and trade objectives. Economic instruments for environmental protection have been defined by the Organization for Economic Co-Operation and Development (OECD) as:

instruments that affect costs and benefits of alternative actions open to economic agents, with the effect of influencing behaviour in a way that is favourable to the environment (OECD) 1991:10)

A basic objective of economic instruments is to ensure an appropriate pricing of natural resources in order to promote their efficient use and allocation. In a 1996 report on economic incentives for biodiversity conservation, over 40 types were identified, divided into four categories as illustrated in Table 1.

It will be noted that this table lists certification as an economic instrument, under the heading of ecolabelling which is defined as:

the provision of information about product characteristics, such as those that relate to the environment, to enable more informed consumer purchasing decisions and to differentiate products and create markets for the differentiated products. (OECD 1996:141)

Ecolabelling and certification are classified as "indirect incentives", defined as follows:

any mechanism that creates or improves upon markets and price signals for biological resources, encouraging the conservation and sustainable use of biological diversity. (OECD 1996: 141)

4. Certification in Practice

Certification is a process which involves a number of different actors and steps. These are discussed below. The actors may include, certifiers, accreditors, forest managers, forest owners wood buyers, stakeholders and government agencies. The roles of some of these actors are shown in Box 1.

The steps are normally as follows:

Step 1: The forest manager decides to seek certification because they anticipate some benefits in terms of improved market access, image or forest management.

Table 1: Categories and Examples of Economic Instruments for Biodiversity Conservation (Source: OECD 1996:9)

	Category of Economic Instrument			
	Positive Incentives	**Disincentives**	**Indirect Incentives**	**Removal of Peverse Incentives**
Examples	Agricultural land set-aside schemes; public land purchases; incentive payments for organic farming	User fees; fines for damages; performance bonds	Individual transferable fishing quotas ecolabelling (including certification)	Reform of tax structures; full-cost pricing for water services; reform of public forestry concession pricing

Step 2: Contact is made with a certifier who makes a visit to the operation and carries out a preliminary assessment of the feasibility and cost of certification. A preliminary report is given to the forest manager.

Step 3: If the forest manager decides to proceed, a full assessment is carried out. In this assessment, a team of specialists engaged by the certifier checks forest management practices and procedures against a set of standards. These standards may be those of the certifier itself, be provided by the forest organization, or come from the accreditator. The result of this assessment is a certification report which is normally peer-reviewed. The report will recommend one of the following to the certifier:

1. Unconditional certification
2. Certification subject to some preconditions;
3. Certification followed by some corrective actions
4. No certification

The difference between 2 and 3 is that in the case of 2, the preconditions have to be fulfilled before certification can be granted whereas in the case of 3, corrective actions can be implemented within an agreed time frame after certification. A certifier may recommend both preconditions and corrective actions.

Step 4: The certifier analyses the certification report and if it is positive (i.e. not option) discusses a time frame for implementation of preconditions and/or corrective actions with the forest manager. If this discussion is successful, a certification contract is signed. This contract specifies the rights and responsibilities of both parties in terms of public communication etc. It also specifies the forest area which has been certified, and the length of time for which the certificate is valid.

Step 5: If product labelling is desired by the forest organizations or its clients, the certifier must complete a chain of custody assessment. The purpose of this is to ensure that adequate and reliable mechanisms are in place to track wood from the certified forest through the processing and distribution chain, to the final consumer.

Step 6: Periodic repeat visits and checks are made by the certifier.

5. Costs and Benefits of Certification

As certification is a voluntary market instrument it will only be used if the benefits for the forest organizations (and the managers or owners involved) exceed the costs. There is insufficient data available to be able to carry out a comprehensive cost-benefit analysis, partly because forest managers or owners generally consider this information to be proprietary. However, it is possible to review the categories of costs and benefits involved in certification. It should be noted that two factors have led some authors to cast doubts on the viability of certification as an economic instrument. First, the costs and benefits

Box 1: Key Actors in Certification

Certifiers

The certifier is a third-party which is independent from the forest manager. Certifiers may be non-profit or commercial enterprises. Their task is to assess the quality of the forest organization to be certified using a pre-established set of standards. This involves field visits and checks of the administrative procedures of the organization.

Accreditors

The role of the accreditor is to ensure that the certifier is following reliable and transparent procedures in its assessments, and that the attributes of the certification programme (and accompanying label, if relevant) are clearly presented to consumers. Most countries have government-authorized accreditation bodies, but private accreditation is also possible.

Forest managers

The forest manager is responsible for managing the forests of the organization which is to be certified. The organization may be a private forest owner, a community, a company or a government body. Similarly, the manager may be an individual or group, with the mandate to manage the organizations's forest. In the case of communities it may be an elected body or a professional forester. In the case of companies it would normally be the chief forester, who is a senior manager. In this case he or she will normally have to secure agreement from the CEO or board before proceeding with an important decision such as seeking certification.

Stakeholders

A whole range of stakeholders from local communities to international NGOs may have views on what constitutes appropriate forest management for the organization to be certified. The certifier will normally have procedures for consulting these stakeholders on the standards to be used in the certification assessment, and on the perceptions of the overall performance of the forestry operation to be certified.

Wood Buyers

Companies which directly or indirectly buy wood from the forest organization may encourage the forest owner or manager to seek certification. There have been a number of examples of this particularly from retailers in the UK.

Government Agencies

Governments provide a framework for forest management through policy and legislation. In many countries, governments also own large areas of forests. Thus, governments may be able to encourage or discourage forest managers from seeking certification.

are still subject to divergent estimates. Second, it is not clear whether certification will actually promote improved forest management, or simply recognize management which is already exemplary.

5.1 Costs

There are three categories of costs:

1. The cost of improving forest management to a level which will be adequate for certification;
2. The cost of forest management auditing (certification visit and repeat assessments); and
3. Product certification

The first category is likely to be the most significant and the least predictable. Again, it can be sub-divided into three components (Bach and Gram 1993):

1.1 Lower yields;
1.2 Increased investment in planning; and
1.3 Different distribution of costs and benefits over time.

Lower yields of timber may result from the need to adjust harvest levels to annual increment and to set aside forest areas for biodiversity and watershed protection. Certification requires detailed documentation, including management plans. If these are not available, an investment must be made in preparing them. This investment may be partially offset by improved operational efficiency resulting from better planning. Improved forest management may result in delaying harvesting of certain areas while making initial investments in planning. Depending on the interest rate and costs involved this different distribution of costs and benefits over time may become a significant cost component.

There are various estimates of the cost of certification assessments and of product certification. In both cases, there appear to be clear economies of scale which make certification relatively expensive for smaller scale operators. Table 2 presents some cost estimates from different countries.

Table 2: Estimates of the Costs of Certification Assessments in Selected Countries (Sources: Baharuddin & Simula 1998, Simula 1998). Note: costs are not directly comparable between countries as the certification standards are different in each case and the estimates should be considered preliminary.

Country	Cost Estimates for Certification Assessments
Brazil	So far certification exercises have cost between US$ 20,000 and 100,000. In large operations the cost has been US$ 0.6 to 1.4 per ha.
Finland	Costs of certification assessments vary widely according to the scale of the operation. For a private holding of 30 ha., costs average US$ 24 per ha., whereas auditing a 50,000 ha. Forest Management Association would cost an average of US$ 0.4 per ha., and a 1.4 million ha. regional forestry centre US$ 0.02 per ha.
Indonesia	Certification assessments are estimated to cost between US$ 0.2 and 0.4 per cubic metre and chain of custody costs an additional US$ 0.3 to 1.3. (Bringing forest management standards up to the level required for certification could cost as much as US$ 13 per cubic metre.)
Malaysia	Annual costs for the initial certification assessment and follow-up visits have been estimated at US$ 0.22 per hectare for a 100,000 concession.

5.2 Benefits

The benefits of certification can be divided into two categories:

1. Market benefits; and
2. Non-market benefits.

The clearest market benefit is higher prices, but there are few examples of this. Collins Pine, a certified US company, has had some limited success in obtaining a price premium (Hansen and Punches 1998). In 1998, the Swedish Company AssiDomän was able to obtain a premium of 5% for certified sawnwood and pulp. Even if the first companies to obtain certification can negotiate a price premium because of scarcity value, there is no indication that this will be maintained as more operations receive certification. A number of consumer surveys have been carried out in Europe and North America to try to determine consumers' "willingness to pay" for certified products. These are reviewed in Gale and Burda (1996) and Rametsteiner et. al. (1998). The surveys generally found that consumers and wood buyers were concerned about the impact of timber harvesting on forests. In several Northern European countries there was support for certification as well. However, there is little reliable evidence that consumers would be willing to pay more for certified products.

Other market benefits can include market access and "branding". In an effort to strengthen the market support for certification, WWF and other NGOs have supported the establishment of "buyer groups". Such groups exist in 10 countries and are in preparation in 4 others. The groups include a variety of companies, mostly from the retail sector, which have make a commitment to selling certified wood and wood products. The first group to be established was the WWF UK "1995 Group" which has 89 members covering 20% of UK wood products market. Membership of a buyers group involves a commitment to tracing the origin of all wood products sold by the company and phasing in the supply of certified timber (WWF 1996).

In the Netherlands a Dutch NGO campaign called "Heart for Wood" was started by Friends of the Earth and the development NGO Novib in 1992, with the aim of reducing Dutch tropical timber consumption to a level supplied only from sustainable sources (Murphy 1996). It has involved 252 municipalities, 10 government departments, 72 real estate developers, 139 housing associations and the three largest do-it-yourself chains in Holland (Baharuddin and Simula 1998:23). The campaign was followed by the establishment of a buyers group in 1995.

The reason given by the companies for joining buyers groups vary but generally include a wish to avoid negative publicity on environmental issues, and a desire to seek competitive advantage in the market by demonstrating environmental commitment (Lawton 1997, Bendall and Sullivan 1995). Tetra Pak UK joined the WWF UK 1995 plus group because its Swedish suppliers were committed to obtaining FSC certification and its major UK retail clients were already members of the group, and because the company saw the group as a forum for policy learning about environmental issues (Gunn 1997). Murphy, who has studied the UK buyers group and the Dutch "Heart for Wood" campaign, has suggested that international policy processes are no longer the exclusive domain of national governments but involve an increasing number of actors including international NGOs, local governments, trans-national corporations, grass-roots activists and small businesses. In this context, he argues that buyers groups are a manifestation of the emergence of new partnerships between business and NGOs, influenced by the concepts of corporate social responsibility and sustainable development (Murphy 1996:46).

Some of the members of buyers groups have undertaken exhaustive analyses of their wood suppliers to identify potentially problematical sources such as old-growth forests, and in some cases supplies from these areas have been cancelled. Retailers in the UK and Holland have been able to sell a number of product lines made from certified timber, although the demand for certified timber from buyers groups has exceeded the supply (Knight 1995, Baharuddin and Simula 1996:42.

Buyers groups can thus influence market access by providing a growing market for certified products, and a shrinking market for uncertified products. However, the direct impact of the buyers groups on the market should not be overestimated. Their indirect impact as trend-setters is probably more important. Several certified forest organizations including AssiDomän in Sweden, Collins Pine and Seven Islands in the US (Hansen and Punches 1998, McNulty and Cashwell 1995) have reported that being certified has helped them obtain brand recognition and move towards distinguishing their products from others in what is basically a commodity market.

A number of non-market benefits have been mentioned by certified forest organizations. These include improved staff morale and operational efficiency, minimising the risk of being criticized by NGOs, and organizational image and identity in terms of good forest management. (Baharuddin and Simula 1998. McNulty and Cashwell 1995). The process of preparing for and going through, a forest management audit may help forest managers identify operational improvements in forest management practices, and thus assist on organizational learning.

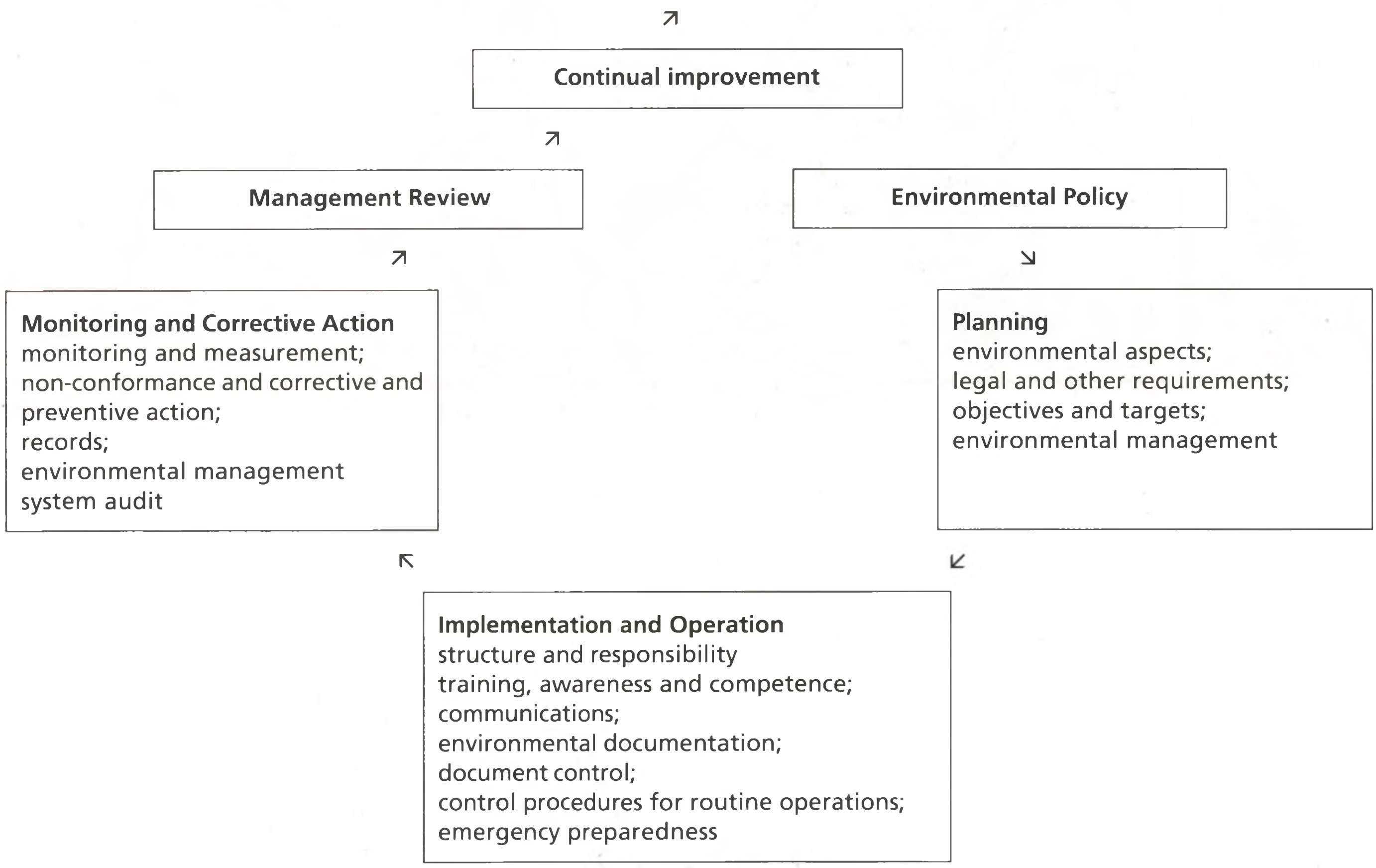

Figure 1: The Environmental Management System Model for ISO 14001

6. Two Approaches to Certification: Systems and Performance Standards

Two types of standards have been used for forest certification, one based on systems and the other on performance. Systems standards define the characteristics of an Environmental Management System (EMS), shown in Figure 1. Certification involves assessing whether the EMS of the forest organization in question is in place, and operating satisfactorily. The International Organization for Standardization (ISO) has played a leading role in the development of systems standards in quality and environmental management.

Performance standards define levels of achievement to be reached by forest operations. Certification in this case involves assessing whether the forest operation meets these levels of achievement in its activities. The Forest Stewardship Council (FSC) been an important promoter of performance-based certification standards for forest certification. Performance standards can be seen as being constituted of various components organized in a hierarchical manner as shown in figure 1.2. The difference between the two approaches can be illustrated by an example. If the size of clearcuts is an issue, a performance standard might specify that clearcuts should not be larger than 10 ha. All forest organizations in the area seeking certification would be bound by this limit. A systems standard would state that the forest manager or owner should define the maximum size of acceptable clearcuts for forest operations, respecting any relevant regulations or legislation. Neighbouring operations might have different maximum sizes.

Both management systems and performance standards can be used as a basis for developing certification programmes. Neither ISO nor FSC are certifiers. ISO's role is to promote and co-ordinate the development of international standards. FSC promotes and co-ordinates the development of performance based forest certification standards and accredits certifiers.

Performance standards for forest certification can be seen as being made up of five separate but interlinked components. These are presented below. It should be noted that this is an idealised framework and that existing standards are generally less systematically organized.

7. Conclusions: Characteristics of a Viable Forest Certification Programme

A number of characteristics of viable certification programmes can be suggested.

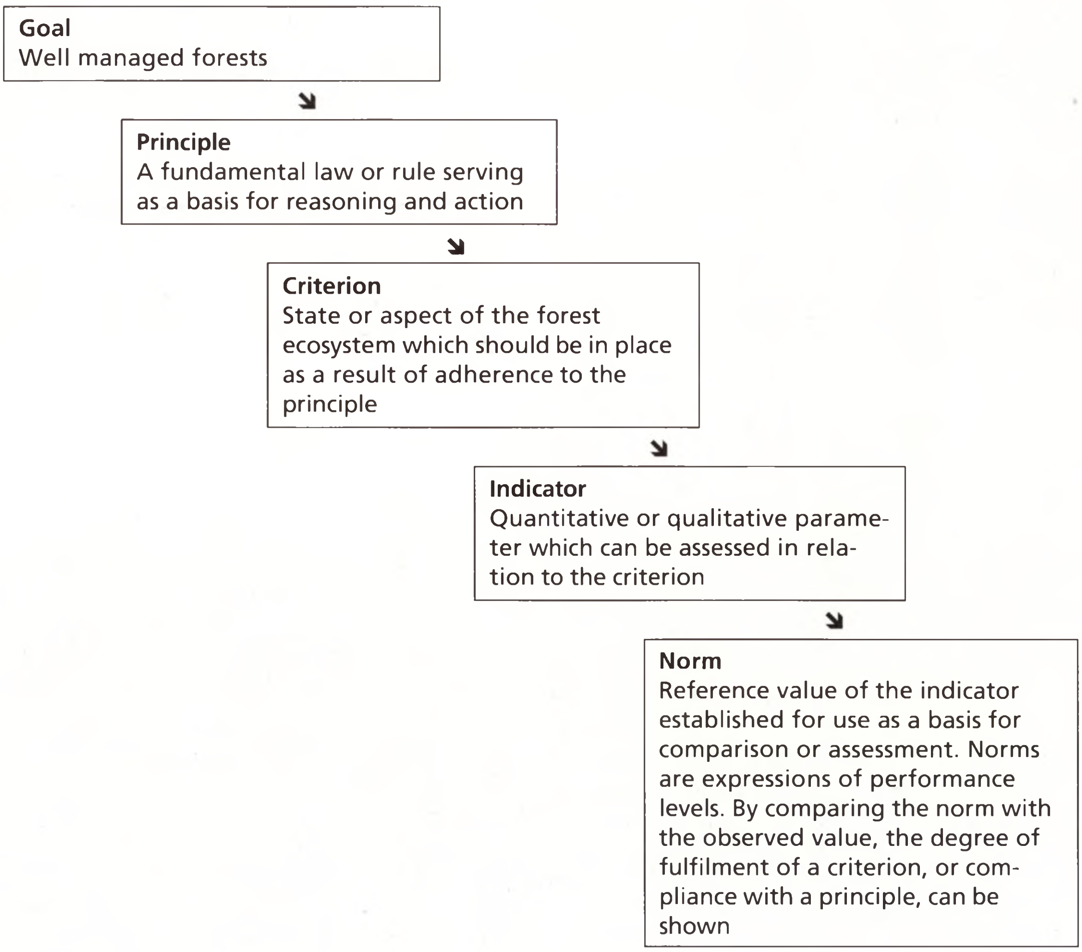

Figure 2: A Hierarchical Framework for Forest Certification Standards. (Source: adapted from van Bueren and Blom (1997))

Table 3: Characteristics of Viable Certification Programmes

Criterion	Necessary Characteristics for Certification Programmes to Meet this Criterion
Credible to consumers	■ Clear performance levels must be either included in the standard, or developed through a process involving the relevant actors and communicated in a reliable and transparent manner; ■ NGOs and consumer groups must support the programme; ■ product label or other communication tool to identify certified products is needed.
Comprehensive to include all types of timber and timber products	The programme must not *a priori* exclude any forest types or regions.
Objective and measurable criteria	The standards in the programme must be clear and specific and the language used must be normative. A framework of principles, objectives, criteria, indicators and norms as proposed by van Bueren and Blom (1997) would be useful here.
Reliable in assessment results	The framework mentioned above would be helpful here. The certifier carrying out the assessment needs to have clear and rigorous assessment procedures.
Independence from parties with vested interests	The certification must be carried out by an independent , third-party, accredited certifiers.
Voluntary in participation	Certification programmes cannot be required by law.
Equal treatment, non-discriminatory in trade impact	The programmes must be independent of government and conform with World Trade Organization agreements and rules.
Acceptable to the involved parties	There must be an open and transparent process for standards and programme development, conducted according to professional norms, which takes into account the views of all the actors in the policy domain, and allows for policy-oriented learning.
Institutionally adapted to local conditions	See above. The process must take into account any special local conditions.
Cost-effective	The programme must be designed to be as efficient as possible in reaching its objectives.
Transparent to allow external judgement	Actors involvement must not be limited to standards development, but should continue through implementation and evaluation.
Goal orientated and effective in reaching objectives	The structure of principles, criteria, indicators and norms will help here.
Practical and operational	The programme should be as simple as possible while complying with the other criteria, and mechanisms for feedback and policy-oriented learning should be included to promote improvements.
Applicable to all scales of operation	Special measures should be taken where necessary to avoid discrimination against small-scale forest organizations.

At the risk of appearing to be radical or polemical, my conclusion is that only the performance standards approach can legitimately be called "forest certification". The development and implementation of management systems, and the certification or registration of management systems, can undoubtedly be beneficial for a forest management unit[1] and for the environment. However, management systems approaches do not include all the necessary characteristics to comply with the criteria for a viable forest certification programme presented in Table 3.

What are the deficiencies of management systems approaches? First, management systems standards such as ISO 14001 are primarily internal management tools. Their target audience is an organization and its clients and suppliers, rather than the general public. As such, they do not include provision for transparency, or public participation in setting performance levels. Second, ISO 14001 does not include any performance levels beyond a commitment to continual improvement and legal compliance. Third, there is no provision for product labelling. There is no obvious way to develop a certification programme which is credible to consumers, has objective and measurable performance criteria, and is acceptable to the involved parties on the basis of ISO 14001 or any other management system standard.

This should not be seen as a failure for these standards. It is simply that they were not designed for forest certification, and despite considerable ingenuity and efforts it has not been possible to "retrofit" them for this purpose in a credible and effective manner. It is also not to say that these standards should not be used by forest managers. On the contrary, both in the case of large vertically integrated forest companies, and small private forest owners, systems standards can provide an invaluable framework for policy-orientated learning within forest management units. In certain cases, it will be useful to have this framework certified. The point is that for the reasons mentioned above, the benefits of this certification are primarily internal and it will not serve as a reliable basis for public claims.

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[1] *The term forest management unit refers to the organization which is responsible for managing the forest to be certified. It may be an individual or community forest, a forest concession, a forest company or a municipal forest for example.*

Innovations in Management of Dipterocarp Forest in Sabah, Malaysia

Herman Anjin

0. Introductory Remarks

It is an honour for me to share some of my views of Sustainable Forest Management based on experience gained in Sabah/Malaysia. Sabah is after Sarawak the second largest state of Malaysia situated at the northeasterly corner of Borneo. With an area of about 7 million hectares, it is comparable to the state of Bavaria in Germany.

My presentation will give you
- **First** some background information about the forestry situation in Sabah
- **Second** a short description of the innovations, from the technical as well as from the political point of view and
- **Third** I would like to share our experience gained in the past 9 years!

1. Introduction and Background

The traditional society always treated the forests with hostility, even though they obtained food, shelter, water and tranquillity from the forests. They indescrimately cut down the forests and cleared them for other uses. This destructive instinct seems to past on to generations of mankind and this instinct seems to thrive and prevail in the civilised and modern society. Modern economic men cleared forests in the guise of agricultural development and they treat the forests as timber mines to finance other economic activities. With these primitive, human instinct and mental behaviour, the task of the foresters in emerging economy is rather difficult.

The main task in bringing changes in forest management in the developing countries is to change the mindset of the society with regard to their perception of the forests and forestry.

This is what innovation is all about in the case of forest management in the State of Sabah in Malaysia. To get the people to think as foresters do or environmentalist do is perhaps the hardest part of this innovation. Though, ITTO's Executive Director, Dr. Freezillah once cited in his keynote address,

"We, in Sabah, were blessed with abundant forests which represented assets of enormous ecological, economic, social and scientific values. The rainforests of Sabah are truly a national heritage. ....",

We are not really that blessed because we are still dealing with traditional society.

The people of Sabah had benefited from forest resources during the past 30 years. The revenue from the sale of forest products contributed to the development of the State. During this period, the forest royalties contributed as high as 70 percent of the State's total revenues. Unfortunately this high contribution was realised by exploitative extraction of the forest resources. Through a statewide forest inventory between 1970 and 1973, it was known that annual allowable cut (AAC) was only 6 million cubic meters per year. This AAC was not being adopted and instead the production was doubled during many of following years up to the 1990s. At that time 86 percent of Sabah was still under forest and it would have been an opportunity to start sustained yield forest management. Today Sabah only has about two million hectares of production forests and out of which only roughly 1/4 million hectares are still primary forests.

The State forest policy is very clear on the issue that the forest estates in the State has to be managed in perpetuity in accordance to the principle of sustained yield management for the benefits of the present and future generation. However, this policy had not been put into practice due to weak administrative instruments and little political will and support. The low level of literacy in forestry, coupled with poor understanding of the multiple uses of forests, set a period of exploitation since the State gained independent in 1963 until today. This resulted in the depleted forest resource condition today. Seeing the declining role of forestry in the State development had prompted the Sabah Forestry Department (SFD) to undertake a Sustainable Forest Management Project (SFMP) with the assistance of the German Technical Co-operation Agency (GTZ) in late 1989. Today, this innovation results in some technical achievements and a notable increase in political awareness. However, these favourable results have some implications on the State forest policy and the future directions of the SFD.

2. Innovations in Technical and Institutional Developments

The technical achievements are mainly in planning concept, development of a model area and implementation of forest management plan of the model area. The planning concept is based from multiple-use forestry practises, a three-tiered management system and a structured process of planning, implementation and control.

2.1 Technical Development

2.1.1 The multiple-use forestry concept

Since 1963 until today, the development policies in Sabah encouraged deforestation. Forests are considered to contribute to economic growth only through the sale of timber or as a source of land bank for conversion to other uses. Forests were not seen to provide the society other array of benefits, which are either tangible (e.g., timber, non-wood forest produces, etc.) or intangible (e.g., water and soil protection, recreation, existence value etc.). In order to bring the society to appreciate these roles of forestry, an intensive dialogue between all relevant stakeholders was initiated through meetings, seminars and workshops.

2.1.2 Forest Management System (FMS)

Putting the forest management in a more structured manner, a FMS, which is known to this region, was introduced. It is characterised by having three levels of management, which have different time horizons to answer the needs of the major components (Tab. 1).

Table 1: Structure of the Forest Management System (FMS)

Management Level	Planning Horizon	Major Components
Forestry Sector	>20 years	■ Forest Sector Plan ■ Forest Policy ■ Legislation
Forest Management Unit (FMU)	10 years	■ Forest Management Planning ■ Monitoring and Evaluation ■ EIA
Compartment	Annual	■ Implementation ■ Resource Accounting

This three-tiered structure, which assigns the tasks and responsibilities to the various management levels, in general, serves to include the economic, social and technical problems of sustainable forest utilisation. The idea of this three-tiered planning is to bring awareness to all stakeholders that the forestry management in the State is a societal responsibility, which needs the involvement of all sectors.

2.1.3 Model Area for Sustainable Forest Management

Having conceptualised the system, the next step was to demonstrate it. For this, the State Forest Department allocated one part of a Forest Management Unit (FMU), and it comprised of the whole of Deramakot Forest Reserve (DFR), covering 55,083 hectares. It was logged 25 years ago under the modified Malayan Uniform System. The establishment of this area demonstrated three main aspects of forest management. Firstly, it laid down the necessity of drawing a ten-year Forest Management Plan (FMP). Secondly, it demonstrated the process of the implementation of the FMP and procedures of control. And thirdly, is meant to show the feasibility of natural Dipterocarp forest management in Sabah. The planning for the ten-year forest management plan was completed at the end of 1994. The implementation has been going on since 1st January 1995.

2.1.3.1 The Forest Management Plan

Management Objective. The management objective in DFR is to sustain the production of high-value timber and to improve the growing stock by means of natural forest management while maintaining a high degree of species and structural diversity. This entails;

- ■ emphasis on natural regeneration,
- ■ rehabilitation of degraded forest areas,
- ■ tending of stands, and
- ■ low-impact harvesting.

Forest Management Planning. The planning processes that were carried out are as follows;

- ■ Resource Inventory
- ■ Analysis of Data
- ■ Resources Planning

And, the results of forest management planning for the logged-over forest of DFR were as follows;

- ■ An annual allowable cut of 20 000 m^3
- ■ A post-harvesting silvicultural treatment of approximately 700 to 1000 hectares annually, aiming at liberating natural regeneration and potential crop trees from competing non-commercial vegetation.
- ■ A rehabilitation of degraded areas of 200 hectares annually by means of planting indigenous commercial timber species.

2.1.3.2 Implementation of the FMP of the Model Area

Organisation. Implementation of the forestry operations is carried out jointly by the Sabah Forestry Department and a private contractor company. The staff of the Department is responsible for planning and supervision of the operations whereas the contractor implements the actual field operations. The contractor is paid for his service according to the agreed rates on the basis of per cubic meter harvested volume and per hectare silviculturally treated or planted in the rehabilitated areas.

Task of SFD. The main task of SFD is to prepare the annual workplans. This plan consists of a comprehensive harvesting plan for the timber extraction, a silviculture plan, and a rehabilitation plan. The more important plan is the comprehensive harvest plan, which consists of detailed tree marking, identification and marking of skid trails for tractor, and skyline corridor.

SFD has to train forest managers, supervisors and technicians of the private contractors in all implementation activities and in environmental consciousness.

Task of Contractors. The task of the contractors who are awarded the timber extraction job is to implement what are written in the comprehensive harvest plan. The contractors who are awarded to carry out silviculture and rehabilitation do the same. The staff of SFD closely supervises all field operations. During the past three years, the contractors did perform the tasks satisfactorily.

2.1.3.3 Certification of Model Area

After having taken extensive planning of the model area and having implemented its Forest Management Plan for two years then, SFD invited SGS Forestry (Malaysia), through its Qualifor Programme, to examine whether the type of natural forest management in this model area was certifiable. Being not a goal for its own sake, the certification by independent third party was aiming at

- ■ National and international confirmation of an environmentally responsible, economically viable and sustainable forest management system and
- ■ Access to niche markets for 'green label' forest products

The Forest Steward Council Certificate was awarded to the SFD in July 1997.

2.1.3.4 Timber Sale

The selling of logs is done by the SFD by conducting public auctions. The participating international buyers are exclusively interested in the acquisition and processing of logs from the certified

Forest Enterprise Deramakot. The growing interest in certified timber, especially of European buyers, resulted in a significant price increase which has already paid off the costs of certification. Since March 1998 in this region, these auctions are providing evidence of an existing niche market for high value tropical timber are produced from sustainably managed and certified forest enterprises. At present, this market could be defined as a sellers' market.

2.1.3.5 Financial Analysis

The model area is and will be under pressure to provide evidence of economic viability of the Forest Management System. One way is the access to special market to get high prices, which was done comparatively easy through certification; the other way is to manage the resources economically. To achieve this, the tool of internal resource accounting is indispensable. This is going to be started this year.

First calculations for the years 1996, 1997 and 1998, resulted in the followings, a subsidy or surplus of RM – 6.15, RM – 0.35 and RM 19.67 per hectare basis respectively. This development shows that SFM can generate profit, but it will never reach the level of windfall profit of exploitative logging in the past. However, I admit that the above figures are obtained by crude method.

2.2 The Political Will – Pre-Requisite for Implementation

Using the operating model area, as an indispensable tool for successful lobbying at higher decision-making levels, finally resulted in the inauguration of SFM at the highest political level. Intensive dissemination of information and public relation was carried out by the SFD, resulting the Prime Minister, Dr. Mahathir Mohamad as well as the Chief Minister of Sabah, Datuk Yong Tek Lee, to visit Deramakot Forest Reserve. This ended up in the signing of ten long-term License Agreements. That fact met the requirement of implementing and extending sustainable forest management to an area about 1.7 million hectares (63 % of the forest reserves of Sabah).

To underline the political will in immediate implementation of sustainable forest management, the government of Sabah conducted a seminar on 'Sustainable Forest Management' on November 22, 1997. The purpose of the seminar was on one hand to promote the new forest policy and on the other hand to ask for support and co-operation from the private sector regarding the joint, new role and responsibility in implementing sustainable forest management. An essential strategy for guiding this transition is the revision of current timber license agreements, which at present are unsuitable to support sustainable forest management. The issuance of ten long-term licensees is an important step to fulfil the requirements of the ITTO-objectives which Sabah, as a State in the Federation of Malaysia, is committed to adhere to by the year 2000. The Chief Minister appealed to the licence holders to accomplish their tasks by establishing 'smart partnership'. He invited them to contribute to the development of new ideas regarding tax allowances or other incentives for rehabilitation of the depleted forest resources.

Thus, the extension of DFR model area has taken place. Although the process had started, the real fruit of success will yet to be seen.

3. Experiences Gained and their Implications

The results of these innovations have implications on the forest policy. These achievements will also change the direction of SFD in its pursuit for practice of professionalism. Definitely the institutional and manpower development will have to go on to meet the challenge ahead. The ongoing privatisation has an implication on the forest resource itself and on the available resources that are required to implement. What are the financing arrangements need to be taken and what type of incentives to be provided. The certification of the model area opens future prospect of marketing certified forest products.

3.1 Change in Policy

The implementation of the FMP in the model area gained recognition from the highest authority in Malaysia, the Prime Minister, who had visited model area himself. Hearing his advice to the State's chief executive during that visit, the State of Sabah may have no choice but to implement the sustainable forest management. A change in policy is necessary. The licensing policy has to change, from fragmented licensing to issuance Sustainable Forest Management Licence Agreement (SFMLA) for each FMU. The policy has to do away with short-term licence and favours the 100-year licence, which provides security of tenure and create an environment for sustainable forest management.

The policy of generating as much revenue from the forests has to be changed. This will definitely affect the revenue from forestry sector. The State will have to accept the fact that it is better to have a little income from now rather than nothing in the end. The State cannot continuously rely on run-down forests to meet their revenue requirement. It will be inevitable that forest income has to be ploughed back to forest management activities, instead to be exported out for other development activities. In the past, very little of this income was being put back to forest management.

This policy change requires a renovation in the entire forestry institution. The staff of FD has to co-operate closely with the staff of the licensees instead of solely playing a policing role. The forest law has to be revised to accommodate the change in policy.

3.2 Manpower Development

Quality and trained staff are indispensable for responsible, effective planning and implementation of sustainable forest management. Professionals, skilled and experienced workers are lacking in the private sector as well as in the SFD. They are not available in the market. We realised that SFD and the private sector must invest in professional development in meeting the challenge of sustainable forest management. Sabah Forestry Department, being the monitoring body, must have staff who are credible and have the confidence of the society. Likewise, the private sector also must build up their pool of credible and trustworthy staff, technicians and workers.

In implementing the FMP in DFR, the private contractors were handicapped as far as trained and knowledgeable forest workers were concerned. We had to train all their workers at the beginning in a new way of timber harvesting using 'reduced impact logging' and, similarly those contractor's workers engaged in silviculture and rehabilitation. In this respect, SFD has to make a greater commitment in providing proper training, not only to ist own staff but also to the private sector's technicians and workers. The model area will continue to house such training.

SFD must build up capacity in all forestry activities and develop more professionalism amongst the staff. It is necessary to build a credible organisation to provide leadership and to provide a high quality policy environment as a basis for sustainable forest management for the State.

3.3 Privatisation Policy

The idea of privatisation of forest management is noble since government has too many handicaps and bureaucracies in run an enterprise and it is also in line with the Malaysia-incorporated concept. In Sabah, privatisation in forestry management is the first case in Malaysia. This means the law has to be revised to legalise such actions. The new type of sustainable licence agreement needs to be backed up by the legal instrument.

Privatisation of service contract in the model area worked very well because they received close supervision from the skilled staff of the SFD. But, initially the project had to tackle numerous problems including positioning interested professional staff at SFD and finding skilled personnel, training people, motivating people, supervising people, overcoming all management problems that would confront any corporation; private sector or public sector, which attempt to achieve SFM at a large scale. The SFMLA holders will face these problems during implementation. Privatisation means that human resources development at all levels, from technicians to professionals, must continue.

3.4 Financial Implication

In promoting 'smart partnership' with the private sector, the government cannot abdicate totally its responsibility to the private sector without giving support and incentives. It must be recognised that the basic ingredient, which the private sector must have, is the foreseeable profit.

We realised that managing a degraded resource is not that easy. Privatisation may be the answer to the inherent limitation of government organisation in running a forest enterprise, but how would it successful if the resources, they are having, are in poor conditions and are not giving immediate cash turnover. The present Sustainable Forest Management Licence Agreement holders find it difficult to raise funds from local or international financial institutions, as these licenses cannot be converted as collateral in borrowing. The problem is further supplemented by the financial crisis that hit the Asian nations; even the public-listed companies who are having these licences are not likely able to raise fund for this purpose.

On the other hand, the government as a partner must bear the responsibility on the part of production of public goods, such as protecting the environment, protecting biodiversity, producing clean water, enhancing carbon sequestration, and so on. Incentive, such as a tax exemption for corporate profits that are invested in this type of resource development, must be given. Other fiscal incentive, such as exemption of import taxes on skyline machineries, tractors, and road-building equipment, must be given.

3.5 Leading Expertise

The only certified forest entity for natural forest management in Southeast Asia is in Sabah. Through innovations in forest management planning and implementation, Sabah has taken the lead in this expertise and she could be the provider of such expertise in the region. Judging from the recent visit of the Asia-Pacific foresters, the demand of this expertise was obvious. SFD can play a major role in providing technical training in reduced impact logging in the region. The model area is well known internationally and therefore it is expected to provide some impacts on the implementation of sustainable forest management in the region.

3.6 Certification

3.6.1 As A Market Tool. There is a new word in the timber marketing today. That is 'greenchip'. Greenchip companies indicate companies that have excellent record of forest management and their products are labelled as eco-friendly forest products. The products from DFR are certifiable as environmentally friendly products. SFD has introduced this product to the niche market, unfortunately DFR only can produce 20,000 m^3 per year. Knowing the existence of this niche market, we are pushing the SFMLA holders to finalise their FMPs and get their FMU certified.

SFD is also commit to assist the local timber industries to handle this certified products as the mills must also obtain 'chain of custody' certificate, which means that these mills do not mix certified products with non-certified products. SFD wants these millers to be honest and credible, so that the 'green chip' buyers will stay in Sabah.

The certifiable forest product from DFR attracted many bidders from the region as well as from the European countries. A few German buyers came to bid during last few auctions. In this case, we have gained some experience in marketing certified forest products. The demand is very encouraging and we only hope that we can produce more of this eco-friendly product.

3.6.2 Certification as a Management Tool. Having a certified forest, which is highly publicised internationally means the demand on SFD staff to continue to carry out good forestry is great, not only in DFR but through the State. The FSC certificate reminds us to upkeep the standard. With third party intervention in certification and the continued surveillance every six months, we are committed to implement all activities according to FSC principles, the Forest Management Plan and the annual work plans.

4. Conclusion

In Sabah most of the technical framework to introduce the sustainable management of our forests is done. The **Deramakot Model** proved to be indispensable not only in terms of technically setting up a FMU. It is prerequisite for (successful) lobbying among political decision-makers, political economists, managers of private companies and last but not least national and international sponsors to support the introduction of SFM. In this respect Deramakot model is successful nationally and internationally.

With all these innovations and available pool of knowledges in containing the better ways to manage these god-given resources, the foresters will still be handicapped if political will is absent. Therefore, strong political will must be continued, and the incoming policy-makers must continue this political process.

We, the foresters, are hopeful that these initiatives in trying to contain the environmental issues in forestry will survive. As I said earlier, the extension of the model has started, but the fruit of it is yet to be seen. And, we pray that our society, people of Sabah, will be wise enough that they will not let this opportunity go by.

Before I leave this podium, I wish to quote the wise words of the Primier of the Province of New Brunswick in Canada during his address to the foresters in 1972, while I was there as a student then, Honorable Richardson stressed,

> 'In the midst of present sophisticated technology, economic, technique, scientific expertise and experience in coping with the expanding importance of forestry profession, the most important resource in forest management is PEOPLE: not machine, techniques and instruments but MEN (and women) who imbued with awareness of the social purpose of forestry'.

With respect to these words, the politicians will ultimately decide over the future of our forests. By the stroke of a pen, the fate of the forest is determined.

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The Use of Timber as a Construction Material
The only chance to save the forests of the world

Julius Natterer

The chances of timber engineering and of the use of timber as load-bearing material depend on the quality criteria. The most important factor is the economic use of timber in order to increase its utilization in construction and make it competitive in comparison to other constructional materials. Timber as a material for supporting systems is an indicative orientation for the use of wood in further constructions. Therefore, all kinds of wood and timber, from roundwood to squared timber through composite sections made of boards and squared timber, as well as glue-laminated timber, plywood, etc, especially when combined with other materials, must be developed and employed.

1 Timber quality wood sampling

The modulus of rupture of massive wood, like roundwood, squared timber, block boards, as well as glue-laminated timber, plywood and other wood materials have different dispersions. The influences on the resistances mostly depend upon the raw density, the nodosity, and further upon the section form, fibre obliqueness, etc, as well as upon other manufacturing criteria like moist, or the use of finger joints to prevent fissuring, etc.

The reliability of optical sampling methods does not correspond to the degree of accuracy presupposed by the engineer's calculations or calculation models. The assumptions of modulus of elasticity and rupture, respectively the admitted stresses, are dispersing between 100 and 200 per cent, while an exceeding stress of 3 per cent measured in a static test already leads to a conflict with the expert. The five-percent fractile given by the statistics, i.e. the five weakest from one hundred which the carpenter is allowed to build in at the most solicited points of the construction, leads to an uneconomical exploitation of available qualities in the very large general dispersion of timber, when compared with other constructional materials.

Fig. 1 and 2: Bridge over the Simme river in Wimmis (CH)

In order to take advantage of better qualities, one needs only to build in the best pieces of timber in the most solicited construction elements. This requires the admission of non-destructive testing equipments which can, like the Sylvatest® ultrasound method, determine single resistances much more precisely; this goes for the elasticity modulus as well as for the modulus of rupture. This testing equipment can be used for roundwood as well as for squared or glued timber. It is also very useful for reconstructions and renovations of old buildings. The non-destructive testing method with ultrasound is very suitable for the latter, as it proves the resistance slope given to the aging of old constructions.

1.1 Material quality – material selection

The manifold material values can also be expanded with the material selection. The selection between different materials like roundwood, squared wood, sawn wood or glued-laminated timber which has been improved through industrial methods, or different sorts of plywood, provides different resistance qualities with economic and competitive construction possibilities.

1.2 Material quality – profiles

Wood sections are a further quality to take into account beside resistance criteria when using round- or sawn wood. The treatment preceding the drying and the considering of the extension of the year rings in different forms of sections, as well as the profiles of the wood sections are most important for an economic formation of detail in the constructive use of timber.

2 Assembling techniques – assembled sections

The many types of material and section forms must be used with new assembling techniques in order to manufacture larger sections. There are many examples of an economic use of roundwood, sawn roundwood, squared timber, profiled sections of squared timber as well as assembled joists, and they will open further economic utilization of raw wood in the future.

2.1 Techniques and means of assembling

New highly efficient means of assembling, i.e. connections with lower section weakenings and needs of steal, have to be developed for a highest possible degree of pre-fabrication in the workshop and in order to reduce the working time on the site as much as possible.

The use of new connecting systems like nailed tinplates, screws, lag bolts as well as connectors with wood contact allow a much higher quality of more filigree supporting systems when linked with deterministic non-destructive testing methods in order to avoid sporadic problems, which arise in highly stressed construction elements. Connectors combining fiberglass and mechanical fasteners allow also a noticeable increase in the load capacity, as shown in a recent study on fiberglass reinforced timber joints.

In order to give timber a new chance as a construction material, the different research, development and marketing programs should not aim at the quantity of material used, but at the manifold quality of material steadiness, section variability, material diversity as well as facilitated construction control and quick usage of the new techniques in timber engineering construction.

3 Composite systems

In the history of timber construction, there have always been composite constructions – timber frameworks with glue or mortar, walls of stone and bricks – the most lasting were in timber architecture. Examples from China and Japan, to Frank and Alsatian framework construction are well known. Essential criteria are the better behavior of the whole construction during a fire, as well as acoustics and vibration properties.

Today, quality criteria – fire, acoustics, vibration – are easily fulfilled through new shape applications, i.e. massive nail laminated floors and wood-concrete composite systems for wide-span and load supporting structures.

Nail laminated decks and wood-concrete decks including a load-bearing concrete slab present new advantages, especially for houses, schools and public buildings. With these techniques the steadiness and bending properties of structures with minor dead loads can be fulfilled economically. Fire resistance times of F30, F60 or F90 AB, as well as phonic insulation criteria up to 60 db for walls and decks can be reached.

4 Planification criteria

Timber as load-bearing material has only a chance if the conception of the construction can show a quality which is not only functional, technical or architectural, but which can also justify its economy. This presupposes, however, a more important planification and a better cooperation between architect and engineer, in order to make the most of the diversity of forms, structures and techniques applicable to timber. It is essential to define clearly the quality criteria of a timber construction and to aim at reading easily the force and load fluctuations, and reducing the material through load- and detail-planification with an optimally functional adaptation to technique and construction.

5 Building shape

The first planification criterion of a timber construction is its shape. The many design possibilities given by the easy manipulation and the low dead loads of timber, especially for houses, halls and roof shapes, are well known. The links between building shape, construction support, energy requirements and costs of maintenance are simple, but do not go without planification.

5.1 Building shape and maintenance

General knowledge of timber constructions being superficially planed in terms of material quality and use of material, and badly executed, leads to an image of high maintenance costs concerning timber constructions. That this is not the way it has to be is proven by timber structures in roofs, bridges and frameworks dating from the Middle Ages.

Nevertheless and in spite of the good experiences made with historical constructions, planification of new timber constructions must not lead to nostalgic, history or museum oriented building or roof shapes.

5.2 Building shapes and energy requirements

In comparison with other construction materials, using timber is already energy saving. Further energy saving measures like the creation of mid-temperate zones in timber-glass constructions have an important impact on the shape and allow a diversity of forms. Integration of active solar techniques can be fulfilled in a satisfactory way only with special planification.

Further criteria concerning energy saving are lighting, ventilation and heating. They can be estimated in different ways, but must be considered first.

6 Supporting structures

In timber construction, each building shape can be constructed economically when the supporting structure is developed adequately in the section,

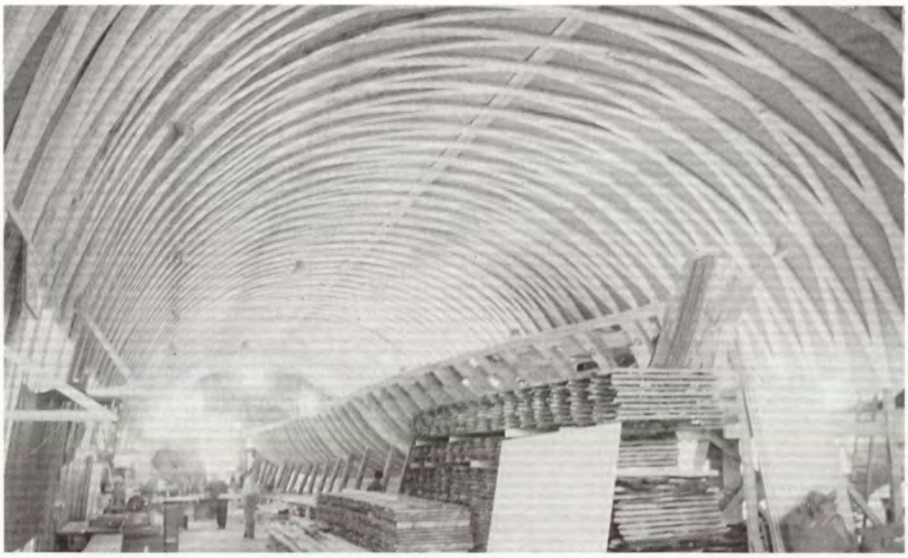

Fig. 3: Housing estate in Schaanwald (FL), with composite wood concrete decks and nail-laminated timber floor systems.

whereas the structure of the inner space as well as the direction of load transmission, and main and secondary support systems have to be considered in the design. Optimization of the supporting structure through reducing of flexion for the benefit of normal forces needs a special planification.

Further reduction of the material needed in timber construction can be achieved by using compressed frameworks, with the advantages of simple contact connectors. Frameworks and bracing structures can be designed in many ways, and are filling the inner space at the same time. When left visible they are part of the inner space arrangement together with the supporting structure.

A further step towards optimization, respectively minimization of the material used, are the statically undetermined systems. New developments are made into this direction, whereby the dispersions of material are balanced through static uncertainties and the deformation behavior becomes decisive for the dimensioning. This way, the construction of orthotrope systems made of roundwood, squared timber, beams or glue-laminated timber in association with concrete becomes economic.

7 Why timber constructions?

Without forest economy, the costs of ecological challenges cannot be coped with. The use of timber as construction material is the only chance to save the world's forests. The use of timber is directly linked to forest conservation and the planting of new trees.

The resistance of forests against wind, snow, frost, drought, insects, and fungus, and of course pollution through emissions, cannot be maintained or improved by only financial support and environmental protection actions.

Furthermore, the different functions of forests, like protection against avalanches, landslide, erosion, flood, fire, etc., or the role of forests as life space for plants and animals, as well as relaxing areas for forest visitors and tourists – especially when in urban neighborhood – cannot be covered with the sole incomes obtained through the sale of fuelwood. Lacking maintenance reduces the forest's health and increases the damages caused to forests.

Two hundred years ago, forestry was financed through the use of timber, not only in rural zones, but especially in the cities where all houses – up to 10 storeys – were built with timber joist floors and wooden roofs.

The role the forests of the future will have to play for mankind and environment cannot be assured only through environmental protection – as little as the role of future cities can be granted through the sole protection of monuments.

Therefore, given the constant decrease in reserves of fossil energy and raw material, the importance of the role of forests as suppliers of timber, respectively raw material, will grow significantly in the future.

8 New techniques in timber construction

The increasing use of timber in the construction depends on engineering developments of timber as a load-bearing material, in order to raise the modest portion of the total construction volume from about 1 per cent to perhaps 2 or 3 per cent.

The criteria of development are: better evaluation of the timber quality, increase of the diversity and better treatment of material varieties, development of new time-sparing assembling techniques which allow the highest possible degree of pre-fabrication.

Quantity related techniques for floors, walls and roofs of the dense housing and public buildings linked with other massive construction materials, as well as quality related high-tech systems, which play a significant role in the modern architecture of roof, hall and bridge construction, should correct the image of timber and offer a competitive alternative to other materials used in construction.

The material selection is no proof for "good architecture". It is, however, an important contribution to the environmental conservation, even if it needs more concentration on the planing phase.

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Workshop: Growth and Supply

Sustainability of Forest Plantations

Julian Evans

Summary

Forest plantations are an increasingly important resource world-wide, a trend that is expected to continue strongly. It is a trend that follows the pattern of farming and food production with the important distinction that for forest products it may help alleviate pressure on the natural resource. This paper is an extract from a larger report by the author entitled 'Sustainability of Forest Plantations -The evidence' published by Department for International Development (UK) in May 1999 and which examines the evidence concerning the narrow-sense sustainability of forest plantations. It asks the question: is growing trees in plantations a technology that can work in the long term? Is plantation silviculture biologically sound or are there inherent flaws which will eventually lead to insuperable problems for this way of growing trees? This extract focuses on the mensurational evidence concerning long-term productivity.

The principal conclusions concerning measurement of yield in successive crops and over time are as follows.

1. Measurements of yield in successive rotations of trees suggest that, so far, there is no significant or widespread evidence that plantation forestry is unsustainable in the narrow-sense. Where yield decline has been reported poor silvicultural practices and operations appear to be largely responsible.

2. Evidence in several countries suggests that current rates of tree growth, including in forest plantations, exceed those of 50 or 100 years ago.

INTRODUCTION

Plantation forests

The present extent of planted forests world-wide probably exceeds 150 million ha. New planting in both tropical and temperate regions is leading to a significant net increase of forest plantation each year. It is predicted that soon a greater proportion of industrial wood will be sourced from plantations than from exploiting natural forests, and that this trend towards increasing reliance on planted forest for wood production will continue (Evans, 1992; Apsey and Reed, 1996; Kanowski, 1997; Pandey and Ball, 1998). It is a trend that follows the pattern of farming and food production, of domestication and development of ever more intensive systems, especially in the last 30 years. In the case of forest products, it is a trend that may help to alleviate pressures on the natural resource.

Planted trees, woodlands and forests are also an increasingly important resource for fuelwood, building poles, fencing materials, food and fodder supplies and other domestic needs particularly important in many tropical and subtropical countries. They can be a significant means of income generation for sustaining rural livelihoods.

Plantation forest can also provide certain environmental services, one of which, creating carbon offsets, may come to dominate developments in the next decade. The role of planting trees to rehabilitate degraded land, provide shelter and shade, to help control soil erosion and to provide amenity all use trees and woodland for the influence they bring, rather than the product they grow. Such services are part of many rural development forestry initiatives.

Already several countries rely heavily on plantations such as Australia, Chile, China Denmark, India, New Zealand, South Africa, Swaziland and the United Kingdom. And many other countries are expanding the amount of tree planting including forest-rich countries such as Brazil, Canada, Sweden and the United States of America. For example, Canada planted over 5 M ha between 1979 and 1995. Forest plantations appears set to become a major, perhaps dominant, form of forest development in the future. But as a way of growing trees is it sustainable?

Sustainability

The question of sustainability in plantation forestry has two components. There are the general or broad issues of whether using land and devoting resources to tree plantations is a sustainable activity from the economic, from the environmental or from the social sense. Is such development unsustainable because it is economically questionable, or environmentally damaging, or a threat rather than a help to people's livelihoods and way of life? The same questions may be increasingly asked about sustainable agriculture. Each of these, and related issues, are important in their own right and fundamentally depend on national policies governing plantation development, understanding their impacts, and ensuring full public participation in the process. For example, it is generally accepted that plantations should not be established on land obtained simply by clearing natural forest formations since there is plenty of already degraded land resulting from past clearance or poor farming practices and which is of no importance for conservation, but will grow trees well: indeed, plantations can help restore degraded land. Thus plantations should not conflict with natural forest but be complementary to them. Hence the debate pointing out how inferior plantations are to natural forest in terms of biodiversity becomes largely irrelevant. Compared with most natural forest, plantations are impoverished in wildlife: compared with abandoned degraded land, perhaps dominated by rank grass, creation of plantations can add diversity and lead to wildlife enrichment. These, and other, issues relate to what is labelled 'broad-sense' sustainability.

The second issue to do with sustainability is to ask the question: is growing trees in plantations a technology that can work in the long term? Is plantation silviculture biologically sound or are there inherent flaws which will eventually lead to insuperable problems for this way of growing trees? This is 'narrow-sense' sustainability and is the subject of this paper.

The question raised is: can tree plantations be grown indefinitely for rotation after rotation on the same site without serious risk to their well-being? More specifically, can their long-term productivity be assured, or will it eventually decline over time? Are some sites, crops, or practices more at risk than others? These questions are pertinent owing to the increasing reliance on plantation forestry, but are also scientifically challenging since in previous centuries trees and woodlands were seen as 'soil improvers' and not 'impoverishers'. Are today's silvicultural and management practices more damaging because of greater intensity and the high timber yield achieved typically 2-4 times that of natural forest increment? And, of course, are resources of genetic improvement, refined fertiliser treatment, more sophisticated manipulation of stand density and so on likely to lead to crop improvement with time, or could they mask or disguise evidence of genuine site degrade or increasing risk of damaging pests and diseases?

Understanding sustainability also applies to non-industrial uses. Sustaining the numerous benefits people derive from plantations should be a top priority and arise out of good management. Does the perpetual gathering and removal of leaves, twigs and litter from beneath tree stands, so widespread in India and China for example, simply loot the site of nutrients? And what of the flow of non-timber products, often of more value than wood, and perhaps less directly damaging to sites when harvested? These are relevant to plantation forestry, even if it is not always possible to answer such questions adequately.

This paper looks at evidence worldwide, mainly from industrial plantation forestry, to address only the first of five critical elements in narrow-sense sustainability analysed in Evans (1999b). What factual evidence is there of productivity change over time? The other elements not considered here are (a) what changes to a site may the practice of plantation forestry induce; (b) what particular risks are tree plantations exposed to; (c) what silvicultural interventions can be made to sustain yields; and (d) how will global impacts of climate change and air pollution affect plantation sustainability? Data have been gathered from research and mensurational records in several countries, personal communications, and from a review of literature covering the last 20 years: a partial annotated bibliography of some 280 references for period 1980-1998 is available separately.

Earlier reviews of this theme will be found in Evans (1976, 1990) and Whitehead (1981). This paper focuses on recent evidence and data.

Evidence of productivity change

Background – agriculture and horticulture

The question of sustainability, at least in the narrow biological sense, has long been a concern in agriculture, particularly with arable cropping. Several long-term experiments exist in different countries of which the oldest and most famous is Broadbalk field at Rothamsted Experimental Station, Harpenden, England. Since 1843 successive crops of wheat have been grown and assessed continuously. One of the experimental treatments has excluded any fertiliser input or other cultural amelioration beyond very occasional soil fumigation and weed control. Over a long period yields from this control treatment have remained low but stable; yield levels are largely determined by nutrient availability, and there is no evidence of the land becoming inherently unfit or 'wheat-sick' and unable to sustain continued cropping (Johnston, 1994). This experiment, along with many other long-term investigations in agricultural and ecological sciences e.g. Sanbourn field at Columbia, Missouri, USA, and several trials in Australia, were reviewed in 1993 on the occasion of the 150th anniversary of John Lawes' original and far-sighted trial at Rothamsted (Leigh and Johnston, 1994).

With some horticultural crops and legumes the situation is less clear with evidence that certain crops render the site unsuitable for a successor of the same species. Fruits such as citrus, apples, cherries and peaches may show this due, it is thought, not to nutrient depletion but a complex disease dynamics labelled, sometime ago, as 'specific replant disease' (Savory, 1966) and probably related to accumulation of soil-borne organisms such as *Phytophthora*, nematodes etc.

Productivity change in successive forest rotations

Problems with data

For forest stands (crops) hard evidence of productivity change over successive rotations is meagre with few reliable data. Compared with agriculture, the long cycles in forestry make data collection difficult. Records have rarely been maintained from one rotation to the next or have simply been lost; funding for such long term monitoring is often a low research priority; measurement conventions and even measurement units may change which confound ready comparison; detection of small changes is difficult; and often the exact location of sample plots is inadequately recorded (Evans, 1984). In addition, because few forest plantations are second rotation, and even fewer third or later rotation, even the opportunity to collect data has been limited. Unfortunately without data it is difficult to demonstrate whether plantation silviculture is robust and so refute (or otherwise) claims that successive rotations of fast growing trees inevitably lead, for example, to soil deterioration.

Moreover, the few attempts that have been made to compare productivity between rotations have often been initiated because of concern that yields are not holding up or about stand health. Thus, investigations have tended to focus on problems; the vast extent of plantations where no records are available or studies undertaken probably suggest no great concern and the likelihood that managers are not finding any very obvious decline problem. The data available in the older literature are probably biased to problem areas and tending to report the exception rather than the rule. More recent studies appear less directly problem-led such as the European Forestry Institute survey (Spiecker *et al.*, 1996) and also several objective trials, such as the recent CIFOR initiative 'Site management and productivity in tropical forest plantations', incorporate systematic establishment of sample plots.

Review of evidence comparing yields in successive rotations

Four major studies have reported productivity in successive rotations along with some anecdotal evidence and occasional one-off investigations. These are grouped by region.

Spruce in Saxony and Other European Evidence

In the 1920s reports began to emerge (Wiedemann, 1923) suggesting that significant areas of second and third rotation spruce (*Picea abies*) in Lower Saxony (Germany) were growing poorly and showed symptoms of ill-health. There was a fall of two quality classes in second and third rotation stands, but this was only recorded over 8 per cent of the plantation area. This became a much researched decline and was attributed to insect defoliation, air pollution, the effects of monoculture, drought and simply the intensive forms of forestry practised. It is now clear that much of the problem arose from planting spruce on sites to which it was ill-suited, particularly the water regime, as also happens with Silver fir (*Abies alba*). Today young stands of pure spruce in Saxony and Thuringia appear to be growing much more vigorously than equivalent stands 50 or 100 years ago (Wenk and Vogel, 1996).

Elsewhere in Europe reports of productivity comparing first and second rotation are limited. In Denmark Holmsgaard *et al.* (1961) indicated no great change for either Norway Spruce or beech though today second rotation productivity in beech is reported as significantly better (Skovsgaards and Henriksen, 1996). In the Netherlands growth of second rotation forest is generally 30 per cent faster than the first where it has been assessed (van Goor, 1985). Similarly, in Sweden second rotation Norway Spruce shows superior growth (Eriksson and Johanssen, 1993; Elfing and Nystrom, 1996). In France some decline was reported from successive rotations on *Pinus pinaster* in the Landes though this was not attributed to site deterioration (Bonneau, *et al.*, 1968). In Britain most second rotation crops are equal to or better than the previous rotation and, in the case of restocking of Sitka spruce (*Picea sitchensis*) the most widely planted conifer, there is no requirement to re-apply phosphate fertiliser which had been essential for establishing the original crop (Taylor, 1990). There is no expectation of a decrease in growth in second rotation crops (Dutch, pers. comm.) and recent evidence points to conifer forests growing faster than they used to (Cannell *et al.*,1998).

Pinus radiata in Australia and New Zealand

Reports of significant yield decline in second rotation *Pinus radiata* emerged in South Australia in the early 1960s (Keeves, 1966) and by the end of that decade fall-off in productivity of about 30 per cent affected most forests in the state. In parts of New Zealand, on a few impoverished ridge sites in the Nelson area, there were also signs, albeit transitory, of yield decline (Whyte, 1973). These reports, particularly from South Australia, were alarming and generated a great deal of research into possible causes. By 1990 it had become clear for South Australia that harvesting and site preparation practices which failed to conserve organic matter and an influx of weeds in the second rotation, especially massive growth of grasses, were the main culprits. With more sensitive treatment of a site, conservation of organic matter, and good weed control, the decline problem was eliminated. With the additional use of genetically superior stock growth of second and third rotation pine was substantially superior to the first crop, a situation which now prevails throughout the State (Boardman, 1988; Woods, 1990). Indeed, a substantial proportion of the second and third rotation has been upgraded from low site qualities (MAIs 13-18 $m^3ha^{-1}y^{-1}$) to high (MAIs 25-33 $m^3ha^{-1}y^{-1}$ (Nambiar, 1996).To summarise the South Australian situation in 1999, i.e. from where the most significant second rotation decline problem has occurred, R. Boardman (pers. comm.) states: "Overall we have been able to restore productivity to at least the original levels for the older plantation sites, and exceed it on the newer ones. We have also raised the productivity of the 'marginal land' (Site Qualities V, VI & VII)."

In the state of Victoria second rotation *P. radiata* is equal or superior to first rotation, but practices were never as intensive as in neighbouring South Australia and, of course, lessons could be drawn from the South Australian experience especially the importance of organic matter conservation and rigorous weed control (Cellier *et al.*, 1986; Squire *et al.*, 1985; Turvey *et al.*, 1986a and 1986b). In New South Wales, where only five per cent of the large area of *P. radiata* is second rotation, a survey in seven widely scattered sites on four different soil types and involving over 40 pairs of plots revealed no overall yield decline but basal area and volume per hectare increases of 13 and 18 per cent respectively (Long, 1998). In Queensland a careful study of first and second rotation *P. elliottii* of the same seed origin shows no evidence of yield decline, but a 17 per cent increase in volume per hectare at 9 years where organic matter was left undisturbed (Bevege and Simpson, 1980).

In New Zealand the limited occurrence of yield decline was readily overcome by cultivation and use of planted stock rather than natural regeneration (Whyte, pers. comm.). On the great majority of sites successive rotations gain in productivity. Will (1992), in a review of the reputation of *P. radiata* as harming soil, concludes the opposite, and suggests that it is not the species grown in monoculture that is harmful but inappropriate management practices such as topsoil and litter repositioning, burning logger debris and soil compaction. Pines are not soil degraders, but some management practices are.

Pines in Swaziland and South Africa

Long-term productivity research by the writer in the Usutu forest, Swaziland, began in 1968 as a direct consequence of the reports emanating from South Australia about second rotation decline. For 30 years measurements have been made over three successive rotations of *Pinus patula,* grown for pulpwood, from a forest-wide network of long-term productivity plots. Plots have not received favoured or research-level treatment, but simply record tree growth during each successive rotation resulting from normal forest management by the Usutu Pulp Company.

The most recent reports appear in Evans (1996, 1999a) and in Evans and Boswell (1998). Tables 1 and 2 (modified from Evans, 1999a) present the results for second and third rotation growth where comparison has been from plots on exactly the same sites. First rotation growth data were obtained through stem analysis and from paired plots and are less accurate: some of these data are reported in Evans (1996).

Table 1 Comparison of second and third rotation Pinus patula on granite and gneiss derived soils at 13/14 years of age (means of 32 plots).

Rotation	Stocking (S/ha)	Mean ht. (m)	Mean DBH (cm)	Mean tree vol. (m^3)	Vol./ha m^3ha^{-1}
Second	1381	17.4	20.2	0.217	294
Third	1267	18.3	21.0	0.233	305
% change		+4.9	+4.2		+3.8
probab'ty signif.		p=0.002 **			p=0.197 n.s.

source: modified from Evans (1999a)

Table 2 Comparison of second and third rotation Pinus patula on gabbro dominated soils at 13/14 years of age (means of 11 plots)

Rotation	Stocking (S/ha)	Mean ht. (m)	Mean DBH (cm)	Mean tree vol. (m^3)	Vol./ha m^3ha^{-1}
Second	1213	16.7	20.0	0.206	244
Third	1097	16.8	21.7	0.227	255
% change		+0.05	+8.3		+4.6
probab'ty signif.		p=0.890 n.s.			p=0.480 n.s.

source: modified from Evans (1999a)

These tables summarise results from amongst the most accurate datasets available on narrow-sense sustainability. They show that over most of the forest where granite derived soils occur (Table 1) third rotation height growth is significantly superior to second and volume per hectare almost so. There had been little difference between first and second rotation (Evans, 1978). On a small part of the forest (about 13% of area), on phosphate-poor soils derived from very slow-weathering gabbro, a decline had occurred between first and second rotation, but this has not continued into the third rotation where there is no significant difference between rotations (Table 2).

The importance of the Swaziland data, apart from the long-term nature of the research, is that no fertiliser addition or other ameliorative treatment has been applied to any long-term productivity plot from one rotation to the next. According to Morris (1987) third rotation *P. patula* probably genetically superior to the second rotation being partly of orchard quality material imported from South Africa (though selections were made for sawtimber parameters not short rotation pulpwood). However, the 1980s and especially the period 1989-92 have been particularly dry, Swaziland suffering a severe drought along with the rest of southern Africa (Hulme, 1996, Morris, 1993a). This is bound to have adversely impacted third rotation growth. These data are also of interest because plantation silviculture practised in the Usutu forest over some 62,000 ha is intensive with pine grown in monoculture, no thinning or fertilising, and on a rotation of 15-17 years which is close to the age of maximum mean annual increment. Large coupes are clearfelled and all timber suitable for pulpwood extracted. Slash and debris are left scattered (i.e. organic matter conserved) and replanting done through it at the start of the next wet season. These plantations are managed as intensively as anywhere and, so far, over three rotations there is little evidence to point to declining yield. The limited genetic improvement of some of the third rotation could possibly have disguised a small decline, but evidence is weak since breeding generally improves net primary productivity (NPP) which cannot be realised if one or more nutrients is deficient. Also, it can be strongly argued that without the severe and abnormal drought growth would have been even better than it is. Overall, the evidence suggests no serious threat to narrow-sense sustainability.

In South Africa there is no evidence of any decline in productivity over successive rotations other than localised small-scale examples arising from compacted soil. Excessive accumulation of undecomposed litter in some high altitude stands of *Pinus patula* does give rise to concern over increasing soil acidity and nutrient immobilisation (Morris, 1993b and Schutz, C. J. pers. comm.). In cultivation of wattle (*Acacia mearnsii*) there is no evidence of yield decline with successive rotations, responsiveness to fertiliser was consistent in each rotation and mainly influenced by the standard of weeding (Herbert, 1984).

Chinese fir in sub-tropical China

About 6 million hectares of plantations of Chinese fir (*Cunninghamia lanceolata*) have been established in sub-tropical China. Most plantations of

Chinese fir are monocultures and are worked on short rotations to produce small poles, though foliage, bark and even sometimes roots are all usually harvested for local use. Reports of significant yield decline have a long history. Accounts by Li and Chen (1992) and Ding and Chen (1995) report a drop in productivity between first and second rotation of about 10 per cent and between second and third rotation up to a further 40 per cent. Ying and Ying (1997) quote higher figures for yield decline between first and second rotation of 29 per cent poorer height and 26 per cent less volume. However, mensurational data are difficult to obtain to indicate the extent of such declines, but Chinese forest scientists attach much importance to the problem and pursue research into monoculture, allelopathy, and detailed study of soil changes etc. Personal observation suggests that the widespread practices of whole tree harvesting, total removal of all organic matter from a site, and intensive soil cultivation that favours bamboo and grass invasion all contribute substantially to the problem. The question of allelopathy and the effect of recruiting coppice shoots for restocking on productivity remain unresolved. Ding and Chen (op. cit.) conclude that the problem is "not Chinese fir itself, but nutrient losses and soil erosion after burning (of felling debris and slash) were primary factors responsible for the soil deterioration and yield decline . . . compensation of basic elements and application of P fertiliser should be important for maintaining soil fertility, and the most important thing was to avoid slash burning . . . These (practices) . . . would even raise forest productivity of Chinese fir." (words in parentheses added by writer).

Teak in India and Java

In the 1930s evidence emerged suggesting that replanted teak (*Tectona grandis*) crops (second rotation) were not growing well in India and Java (Laurie and Griffith, 942, Griffith and Gupta, 1948). Although significant soil erosion is widespread under teak and loss of organic matter as leaves are frequently burnt – see for example Bell (1973) - the research into the 'pure teak problem', as it came to be called in India, did not generally confirm a second rotation problem. However Chacko (1995) describes site deterioration under teak as still occurring with yields from plantations not coming up to expectation. There is a generally observed decline of site quality with age. He attributes the problem to four main causes: poor supervision of plantation establishment; over intensive commercial taungya (intercropping) cultivation; delayed planting; and poor after-care. Chundamannii (1998) similarly reports decline in site quality over time suggesting poor management is a contributory factor. He laments the lack of data from successive rotations as the ideal way of evaluating changes in productivity – teak rotations are typically 60-80 years.

Concern about successive teak crops, soil erosion and loss of organic carbon, has also been expressed in Senegal (Mahuet and Dommergues, 1960). And, in Indonesia, where there are about 600,000 ha of teak mainly in Java, site deterioration is described as a problem and "is caused by repeated planting of teak on the same sites" (Perum Perhutani, 1992).

Southern pines in the United States

Plantations of slash (*P. elliottii*) and loblolly (*P. taeda*) pines are extensive in the southern states. Significant plantings began in mid 1930s as natural stands were logged out (Schultz, 1997) and with rotations usually 30 years or more, some restocking (second rotation) first occurred in the 1970s. In general it appears that growth of the second crop is variable. Burger (1996) reported improved second rotation growth of 4 m and 6 m in height at 23 years depending on site preparation treatment. A major investigation in North Carolina found third rotation *P. taeda* to be of much higher site index to second rotation, especially where good weed control was carried out (NCSFNC, 1995). Haywood (1994) and Tiarks and Haywood (1996) report poorer growth. The latter authors cite 7 per cent poorer height growth and 24 per cent less volume in the second rotation, (*though this is not suggested as representative on all sites*). Changes between rotation are attributed to differences in site preparation treatments, but this was not consistent, and, in particular, to competition from understorey shrubs and weeds. Type and amount of competing vegetation is the main influence (B. Shiver, pers. comm.). Where weeds are well controlled and appropriate site preparation used such as a bedding plough, growth is often superior e.g. Yin *et al.* (1998). Genetically improved stock and use of fertilisers are expected to bring further increases.

A co-ordinated series of experiments throughout the USA is currently assessing long-term impacts of management practices on site productivity, but it is too early for results (Powers *et al.*, 1994).

Other evidence

Other evidence is limited or even more confounded than that reported. For example Aracruz Florestal in Brazil has a long history of continually improving productivity of eucalypts owing to an imaginative and dedicated tree breeding project so that each year many new clones are introduced into the planting and replanting programmes and many less productive ones discontinued (Campinhos and Ikemori, 1988). The same is true of the eucalypt plantations at Pointe Noire, Congo (P. Vigneron, pers. comm.). In these situations it is difficult to judge from yield measurements whether genetic improvement is disguising a possible site degrade problem caused by growing and harvesting plantations intensively, but see comment earlier about tree breeding. It is patently clear that greatly increased productivities are being achieved in practice; the sites so far appear capable of supporting productivities up to 60 or 70 $m^3ha^{-1}y^{-1}$.

At Jari in the Amazon basin of Brazil silvicultural practices have evolved with successive rotations since the first plantings between 1968 and 1982. A review of growth data from the early 1970s to present day suggest that productivity is increasing over successive rotations due to silvicultural inputs and genetic improvement (McNabb and Wadouski, in press).

In Venezuela, despite originally severe and damaging forest clearance practices, second rotation *Pinus caribaea* shows substantially better early growth than the first rotation planted into natural savannah (Longart and Gonzalez, 1993).

Within-rotation Yield Class/Site quality drift

This recently observed phenomenon has two aspects – change from predicted yield to actual over time, and correlation of site quality (yield class) with date of planting rather than only with site fertility.

Inaccuracy in predicted yield

For long rotation (>20 years) crops it is a common practice to estimate yield potential from an interim assessment of growth rate early in life and then to allocate a stand to a site quality class or yield class. This is a good way of planning final yield, though imprecise for detailed outturn from individual stands. A change from predicted to final yield can readily occur where a crop has suffered check or other damage in the establishment phase that delays its development and site occupancy and thus distort early estimates of site potential based on growth:age relationships. Similarly, fertiliser application which corrects a specific deficiency may also have this impact. However, there is some evidence for very long rotation (>40 years) crops in temperate countries that initial prediction of yield or quality class in general will underestimate final outturn, i.e. the crops grow better in later life than expected. Either the models based on relationships derived from data of 40 or more years ago were wrong, or are now inappropriate to present conditions, or that growing conditions are 'improving' in the sense of favouring tree growth. Across Europe this appears to be the case (Spiecker *et al.*, 1996; Cannell *et al.*, 1998) and is attributed to rises in atmospheric CO_2 and nitrogen input in rainfall, better planting stock and cessation of harmful practices such as litter raking.

However, as noted earlier, the opposite is occurring with teak. High initial site quality estimates do not yield the expected outturn and figures are revised downward as the crops get older. Plantation teak does suffer soil erosion in established stands, development of understoreys are rare, and burning of debris especially the large dry leaves commonplace. Like litter raking these practices may contribute to the phenomenon.

Relation of quality (yield) class with time of planting

Closely related to the phenomenon of changing yield potential as a crop grows is the observation that date of planting is often significantly and positively related to productivity i.e. more recent crops are more productive than older ones regardless of inherent site fertility. This shift is measurable and can be dramatic, see for example Leishout's report from Australia in Nambiar (1998). Attempts to model productivity in Britain on the basis of site factors have often been forced to include planting date as a variable. Thus maximum mean annual growth of Sitka spruce increased with planting date in successive decades by 1 $m^3ha^{-1}y^{-1}$ in one study (Worrell and Malcolm, 1990) and by 1.2 m^3 in another (Macmillan, 1991). The equivalent values according to Tyler *et al.* (1996) for Douglas fir, Japanese larch (*Larix kaempferi*) and Scots pine (*Pinus sylvestris*) being 1.3, 1.6 and 0.5 $m^3ha^{-1}y^{-1}$ respectively in each succeeding decade. This phenomenon seems common (J. Methley , pers. comm.) and is commented upon in Cannell *et al.* (1998). It suggests that some process is happening that favours present growing conditions for trees over those in the past such as the impact of genetic and silvicultural improvements (and again cessation of harmful ones) and possibly the 'signature' of atmospheric changes mentioned above.

The impact of these two related observations is that present forecasts of crop yields are likely to be underestimates; yields appear to be increasing. The one main exception is teak.

CONCLUSIONS

Two main conclusion can be drawn from this review of yield assessments made over long periods and often more than one rotation.

1. Measurements of yield in successive rotations of trees suggest that, so far, there is no significant or widespread evidence that plantation forestry is unsustainable in the narrow-sense. Where yield decline has been reported poor silvicultural practices and operations appear to be largely responsible.
2. Evidence in several countries suggests that current rates of tree growth, including in forest plantations, exceed those of 50 or 100 years ago.

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Workshop: Processing and Utilization

New Silviculture and Wood Quality – Do changing concepts have an influence on our forest resource?

Gero Becker

1. Introduction – Changing demands were the driving force for the classical silvicultural concepts

On a given site the growth of trees and as the consequence the wood production in terms of quantity and quality depend to a high extend on inter- and intraspecific competition i.e. for nutrients, light, water. In a natural forest with no interference of human beings, the growth of the trees and the development of the stands depend on the ecological characteristics and potential of the naturally existing tree species. Already in early times men began to make use of the forests as a natural resource by taking out selectively highly appreciated species with specific stem form, dimension and quality. This interference inevitably influenced the remaining trees and stems by changing the natural dynamic and their pattern of reaction.

With industrial development, the demand of wood increased sharply. For the early industries, wood was by far the most important raw material and source of energy. As a consequence, the utilisation of the forests became more intensive and followed specific objectives of the society. This was at first firewood to fuel iron industry, glass industry and salt producing mines. For firewood, volume and wood density were the most important production targets. The respective silvicultural concepts favoured as species beech (*Fagus silvatica*) and other high density broad leaves. The adequate management system was coppice and short rotation systems with natural regeneration.

Later on, wood as source of energy was replaced by coal to a large extend. Fibre mass as such was no longer the governing production target, but timber for construction and the diverse craftmanships was urgently needed. Consequently the management regime shifted to coniferous trees, which combined fast growth, high strength and elasticity and a favourable stem form to saw timber. Regularly planted stands guaranteed homogeneous stem form and maximum volume production. Intensive thinning provided the industry with all types of small and bigger trees showing small crowns and good natural pruning. Rotation periods were relatively short according to this management concept.

A hundred years later, wood was replaced by stone in most parts of the constructions. This was especially true for the growing cities and the industrial buildings. Mass production of conifer trees was at least partly replaced by management concepts which favour big, more valuable trees as production target typically grown in long rotation periods. Big, well formed stem to produce knot free, high value timber or veneer should guarantee high added value. On the other hand, the growing demand of the pulp and paper industry for fresh, long fibres could be met by the early thinnings and selective cuttings of the coniferous stands.

The result of these diverse management concepts and production targets are the stands which we have today. The majority of them is still dominated by one or two species, only. They have been regenerated within short time by planting or natural regenerating, have been schematically thinned throughout the decades and show today a quiet uniform structure and a quiet good average wood quality. Industry has adjusted their processes and products to this homogenous resource and is doing quite well with it.

2. New silvicultural concepts

But these typical more or less homogenous, uniform stands do not only have advantages: Especially in cases, where the "wrong" species were brought to a specific site, the stands were not stable but permanently threatened by wind, snow, ice and biological diseases. Nice, clear boles with low taper where favourable to produce sawn timber but turned out to be not very stable against wind and snow. Big storms periodically toppled hundreds of hectares of these uniform stands creating both problems in regenerating and in marketing the timber surplus.

But not only higher risks and frequent damages contributed to the negative picture of this traditional silviculture. Very often these concepts were also suspicious to result in low biodiversity, falling short in reaching the high goals which had been set by the Rio-Conference, the Helsinki-Process etc. This leads today to the movement towards a "new Silviculture close to nature" which means very often only remembering and adapting old traditional forestry as for instance farmers and small forest owners practised it since hundreds of years. As a consequence, big uniform and homogenous stands are replaced by more structured ones, stands formed out of one or two species only are enriched by planting other natural species underneath the canopy, and natural gaps are used as nucleus to build vertically more structured stands within time. The result is a diverse picture of scattered, uneven stands. The harvest is mostly concentrated on the biggest stem, which are picked out selectively stem by stem or as small groups. The resulting gaps give chances for the remaining intermediate trees to grow into bigger dimensions and form valuable stem.

3. Consequences for wood quality

It is quite obvious that this changing pattern of silvicultural treatment means a change in competition for soil, water and light, which influences the growth of the trees. The most significant influence is directed to the radial growth, whereas the height growth is primarily linked to the site quality. The volume (length, diameter) of the producing green crown is clearly related to the radial growth of the stem. This means more and bigger green branches within the life crown, that means in many cases a slower natural pruning and means as a rule differences in the radial growth and consequently different ring width. Often the competition for light leads to asymmetric form of the crown which may cause eccentricity and ovality of the stem, the formation of reaction wood and for some species also of spiral grain. With other words, the external and internal wood quality can change dramatically, if the treatment of the stands and trees shifts towards a "Silviculture close to nature".

4. Research concepts

The mentioned influences on tree architecture, stem form and internal wood structure can result in a positive as well as a negative effect for the overall wood quality. All depends of the ecology of the trees at the one hand and the dynamic of silviculture treatment during the life span of the tree on the other hand. The Institute of Forest Utilisation and Work Science of the University of Freiburg aims since many years to answer these complex questions on an empirical basis. As a rule this means a quite complicated experimental design. Typically we look for different stands with a well documented silvicultural history. In the best cases we find in the neighbourhood two stands of the same age class, which differ in silvicultural treatment of the past only.

The experimental design typically includes the following steps: Description of the situation of competition of the standing trees. After felling of the selected sample trees, an extensive description of the stem and log quality is executed. Small wood samples (discs) are taken and analysed with respect to internal wood structure, yearrings, density, juvenile wood, reaction wood, swelling and shrinking etc. Out of the same samples trees are typical real size products (sawn timber, peeled veneer, sliced veneer, etc.) are produced and the relevant quality parameters of these products (knots, dimensional stability, drying behaviour, strength and stiffness, surface quality, colour etc.) are tested. Data analysis includes statistical methods to correlate wood anatomic parameters (coming from small samples) and product and processing quality parameters, and both are correlated to the silvicultural history of the trees. Until now we did such experiments among others with Spruce (*Picea abies*), Douglas fir (*Pseudotsuga menziesii*), White oak (*Quercus species*), Ash (*Fraxinus excelsior*) and to a certain extent with Pine (*Pinus silvestris*) and Larch (*Larix decidua*).

Extensive experiments of the similar design are carried out in the moment with Beech (*Fagus silvatica*), which is the most important species in central Europe. As additional quality parameters, the development of red heart and of internal stresses play an important role with these species. Similar experiments are also carried with Fir (*Abies alba*), where branches, internal cracks and whet heartwood cause special species-related problems.

5. Results

As it has been mentioned before, the exact conclusions have to be drawn in a specific way for every species. But there are some rules and tendencies which can be stated today: Ring porous broad leaves (oak, ash etc.) react in general positively to the concepts of new Silviculture: Faster radial growth means wide rings, resulting in higher wood density and consequently in better strength and stiffness parameters. Natural pruning of these species is relatively easy, if the stems are shaded by inter- or intraspecific competitors until the age of approximately 40-60 years. This goes well along with the natural regeneration, which is the rule with these species. As a consequence, high value logs can be produced in much shorter rotation periods, which limits also the risks induced by climatic events or biological attacks (insects, fungi).

With the most common conifer species (Spruce, Douglas fir, Pine) the overall result is not purely positive. Father growth especially in the youth means higher proportion of juvenile wood, which creates not only problems for strength and stiffness, but also shows a much worse dimensional stability when the timber is dried. Less intensive competition means bigger crowns with longer and bigger branches. Because branches of conifers typically do decay very slowly, a bigger proportion of the stem is influenced by dry and sound knots. Asymmetric shape of the crown often results in more compression wood and spiral grain in the upper part of the stem, both having a negative influence on the strength as well as the drying behaviour of the sawn timber. For all these reasons the ultimate goal to produce big trees does not necessarily result in high economic value, if the internal quality of the big trees is doubtful, caused by branches, rot, internal cracks etc.

6. Outlook

The results of our research about the correlation between silvicultural treatment and wood quality show until now a mixed picture, varying from species to species. The big time gap between silvicultural decisions today and the market needs of tomorrow results necessarily in a high degree of uncertainty. This should lead to a tendency to avoid extreme decisions, and should furthermore prevent silvicultural decision makers to follow only one single strategy. Both attitudes result in minimising future risks. To prove empirically the interaction between Silviculture and wood quality the design of the related experiments is, as it has been shown, quite complicate. Taking into account the high natural variability of trees and of their wood many trees and many products of these trees have to be examined. In future, this principal problem can and will be overcome by modern computer supported modelling approaches: Already today it is possible to model the growth of a tree as a reaction of the competition situation during his life span. But up to now, only the dimension and the external shape of this tree can be predicted by these models. Research projects on an European level with world-wide co-operation try to implement in these growth models quality specific features, like radical growth and ring width, branching pattern, dynamic of self pruning etc. Furthermore, quality features of certain key products can be derived on a model base by the external shape and the internal structure of a stem as a result of its growth. Hopefully, in some years it will be possible to add to classical growth models wood quality models, which allow to simulate very different management concepts and their consequences for wood structure and for product quality. This will enable decision makers to find the right way between ecology and biodiversity on the one hand and technically and economically favourable wood quality on the other hand.

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State-of-the-art and development in sawn timber production and solid wood-based building products

Jörg B. Ressel

1. Introduction

As mentioned in the title this contribution to the Forum "Forests as a Source of Raw Materials" covers two areas: the conversion process roundwood into timber and the use of the timber produced in the building industry. Both are focused on the actual situation in Europe, in particular Germany, Austria, Switzerland and the timber producing Scandinavian countries. Due to the limited time available no detailed comments are given on the actual situation of the markets of roundwood, timber and wood residues.

In general in all of these countries the total growth in the forests exceeds the use of roundwood. Approximately 20...30 % of the growth is not used now. There are different reasons for this development, which will not be explained here. It is assumed for future times that there will be more roundwood available with larger diameters than today. This is an important development for the sawmilling industry. Roundwood with small diameters from thinning actions in particular would be a suitable raw material for the wood based composite industry and pulp and paper industry. But because of the cost situation in the raw material market these wood industries actually prefer residues from primary wood processing in sawmills and additionally recycled material, e.g. wood based panels. With respect to this situation some recent developments in sawmilling techniques are related to particularly suitable residues, e.g. chips free of bast and bark, equal size, without fines and free of any other contamination. This requires additionally screening processes.

In short terms the actual situation in the sawmilling industry of Central European countries is characterized by:

- a high production level,
- an insufficient price situation related to raw material and timber products,
- a decreased timber consumption on a constant or falling price level, mainly caused by cheap imports from Scandinavian producers.

Countermeasures against this critical situation are in particular related to:

- the improvement of timber and wood based products consumption,
- the elimination of weak market conditions (raw material market and timber market),
- the reduction of deficits in production processes,
- and further integration of secondary processes to overcome the actually bad economical situation in many sawmills.

This will continuously lead to decreasing number of sawmills – a process which already begun years ago and which did not come to an end today – while the average annual processing capacity of the plants is increasing. Companies and plants respectively with an annual capacity of approximately 20.000 m^3 roundwood will only survive if they are particularly specialized in market niches. On the other hand of the capacity scale the number of big mills is increasing; their annual capacity of roundwood covers a span from 200.000 m^3 up to nearly 1 Mio. m^3, depending on the shifts running and the number of processing lines. This state-of-the-art report is related to recent developments in small as well as in large mills. As already mentioned there is a need for further specialization and the integration of secondary processing technologies in this part of the wood working industry. Such efforts related to the structural and building sector respectively promise good expectations for the manufacturers. Some selected examples will be presented later.

2. Developments in the sawmilling industry

The conversion of roundwood into timber is called a coupled process. The manufacturing of the main product - timber, cants etc. – is inevitably associated with the generation of by-products – side-cuts, thin boards, laths etc. – and residues – bark, slabs, chips, sawdust. The main task within this process is an optimization task, i.e. to maximize the yield materially and/or economically. To meet the requirements of such an optimization, many different information have to be collected and processed. In a sawmill three different production areas can be distinguished: log yard, sawmill and timber yard. These areas are associated with the purchasing and the sales department, altogether led and headed by the management of the company. The target of the optimization process is to produce these timber sortiments which offer the largest economical benefit, to minimize any possible losses and to keep the stocks as small as possible.

Developments in sawmilling industry related to an improved efficiency are e.g.:

- organizational measures to increase productivity,
- improvements of processing technologies and machinery, and
- secondary wood processing to obtain added value products.

QM-systems, e.g. based on DIN EN ISO 9000-9004, follow some internal and external objectives to define preventive measures for any types of faults, which could reduce the economical result directly and indirectly respectively. The overall conversion process is revised; process control and controlling measures have to be introduced and improved, at least resulting in a better product quality – itself an individually rated term. For sawmilling companies producing timber according to such a QM-system the most important benefits are an increased process performance and an higher plant availability.

In a conventional sawmill the economical success or failure is determined mainly by log measuring-off and laying-off on the log yard. Logs of different dimensions and qualities are grouped and stored before further processing. The following log breakdown in such sawmills gives timber sortiments with standard dimensions. Individually changing dimensions – typically for residential buildings in Middle Europe – requires more efforts in roundwood as well as in timber sorting steps. The CIM-concept realized in a sawmill is based on a data-collection and a real-time data-processing system, covering all parts of the company. Different measuring and grading systems (roundwood, timber) integrated in the overall conversion process, quickly adjustable tools in the processing line and suitable sorting and stacking systems are combined and controlled by specially tailored soft- and hardware. The advantages of such a concept are smaller stocks, a highly flexible production process, increased yield, short reaction on customer requirements and orders and at least economical benefits. The key technologies here are modern electronical devices for measuring tasks and tool adjustments, computers and suitable software. All components have to be adjusted to each other to meet the ambitious objectives of such a mill.

Related to the sawmilling machinery – mostly the main machines – different developments have to be mentioned. The most important machine in small sawmills is the framesaw. Due to low feeding and cutting speed the capacity of such plants is limited. For medium-sized mills the framesaw can be replaced by a double-arbor circular saw CSU / KCSU as offered by *Linck* (1997). In- and outfeed units are retained. The machine offers a higher flexibility and a larger capacity, approximately two to three times the capacity of the framesaw. If this machine is the only one in a sawmill, the log, two- or four-sided cant has to be circulated twice or three times. But then the machinery for processing side-cuts can become the new bottleneck in the production flow. Additionally needs are related to larger and faster transportation and sorting devices.

A more advanced machine for the production of structural timber is a processing center, a machine composed of a chipper canter, four profiling cutter heads, a double-arbor circular saw and a pair of flying cut-off saws. Linked with suitable in- and outfeed units this BHZ, developed by *EWD* (1997) can process logs up to 12 m in length. Four-side processing requires multiple log circulation.

To avoid log circulation since 1995 *HewSaw* (Veisto Rakenne) developed a family of compact machine combinations for surface chipping (four chipper canter heads), rip-sawing (horizontally, even following the fibre direction of bent logs) and edging in one passage. Compared to the machinery mentioned the maximum diameter of the butt-end being processed is not much smaller. The machine is tailored to milling small softwood-logs from Scandinavian forests. Equipped with particular cutters profiled members for log cabins can be manufactured.

Both vertical bandsaw types – headrig (and carriage) as well as resaws – are lesser common in Europe. They are preferably machines for cutting hardwoods, but they are also used and suitable for softwoods, and particularly found in Scandinavian countries. Their disadvantages compared to circular saws is the characterizing single cut. Multiple cutting and rip sawing requires combined machines, i.e. double, triple or quadrobandsaw units mounted on one machine base. Additionally tool maintenance is more difficult than with circular saws. Bandsaws as well as circular saws for primary and secondary log breakdown are combined with chipper canters for the direct conversion of slabs into chips. Recent improvements with bandsaws are related to a better product quality, e.g. devices to improve cutting accuracy, electronically controlled machine adjustment, improved tool steels. But the principle of this sawing machine has not be changed.

There are only few horizontal headrigs in industrial use, preferably for cutting large logs of tropical wood species. A new developed horizontal bandsaw BS 220 H from *Lindnerwerk* has been introduced in 1997. Here the log to be cut is fixed on a table while the operating bandsaw is travelling on rails along the log. Cutting occurs with forward and backward movement; the wany board produced is instantly pushed aside on an attached transportation system. Operation of the machine is improved by additional electronical features to adjust cutting thickness, cutting and travelling speed, log alignment and board removement. The efficiency is much better than the efficiency of traditional horizontal bandsaw but the maximum log size being processed is smaller.

The most common machines in large softwood sawmills are processing lines based on chipper canters, profiling cutter heads and double-arbor circular saws. Well known European manufacturers are amongst others *Linck, Esterer, Wurster & Dietz, AKE and Söderhamns*. Recent developments here are related to improved electronic control of the overall line, continuously speed change, more flexibility and faster adjustment of tool-axes (according to the optimization result in the sawmilling process), tool materials, service and maintenance. No particular items have to be specially emphasized.

3. Solid wood-based building products

During the past different new building products have been developed by conversion of roundwood into timber and additional assembling, either as solid wood components, as modules or as complete building systems. Some advantages of these products are:

- improved properties (new or similar properties) compared with conventional timber, simply caused by break-down and additional joining, leading at least to a more homogenous material,
- use of lesser-value by-products of the conversion process, e.g. side-cuts,
- increased yield with the conversion process.

The different products and building systems respectively are mostly not standardized yet. Experiences are partially limited to few application examples in European countries. Despite of the different advantages of wood as an excellent building material it is not used as much here as e.g. in the United States or Canada. But for the future an increasing application is anticipated.

New developed solid wood building materials and elements show similar characteristics in their manufacturing process:

- cutting roundwood to into boards,
- grading of boards and eliminating weak sections, e.g. defects as knots (optional process step),
- finger jointing of board sections (optional),
- gluing, aligning – parallel or crosswise – and joining together of the lamella with (little) pressure application,
- and final processing of the beams, panels or elements.

Gluelam (laminated beam) as solid wood building material is well known since many years. It is particularly made of parallel aligned layers of graded and finger jointed timber lamella. Many application examples and extensive experience are available as well as product standards. A similar, but younger product is made from veneer and called laminated veneer lumber (*LVL*), manufactured as panels and cut to size to be used as structural members. Both products as well as other engineered wood products made from wooden particles will not be discussed in detail here. Some examples to be mentioned are *Parallam®*, *Intrallam®*, *Microllam®*, and Oriented Strand Board (*OSB*). These products are also standardized and already used in several applications.

Concerning the family of new solid building products there are some conspicuous differences related to:

- the cross section shape of the preproducts, e.g. trapezoid or triangular boards (e.g. used in the production of HQL-timber and star-sawing),
- crosswise alignment of the boards in a single layer with spaces between the boards,
- profiled boards or cants as preproducts,
- hollow boxes as preproducts.
- connection of the preproducts by gluing and nailing respectively.

The following illustrations will give a better understanding of these wood building systems and materials:

- HQL-Timber,
- Star-sawing,
- Cross-beams,
- Blockboard panels,
- *Lignotrend* elements and profiles,
- Framework wall and ceiling elements,
- Panel elements sheathed with engineered wood products,
- Prestrained reinforced elements,
- Solid wood ceiling,
- Solid wood elements – *Merk Dickholz*,
- Stacked timber block panels,
- Stacked board ceiling,
- Wood modules – *Steko*,
- Box elements – *Lignatur*, *Lignotrend* elements,
- Timber-concrete compound ceiling.

Most of these products are tailored to particular applications. Standards and quality assurance systems adapted to the performance of these products have to be developed to guarantee their potential as a building material of the future and to convince reserved users.

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Life Cycle Assessment: A Challenge for Building with Wood

Matti Kairi

Abstract

In the Kyoto Agreement the storing of carbon dioxide has been valued with many different methods. One of the main agreement tasks has been the volume estimation of the new forest plantation area. During the last two hundred years many European countries have lost their forests. Some of those previous forest areas have now been replanted and within 20 years coming to the harvest stage. Therefore we will soon face the question, what to do with mature forests, which will not restore carbon dioxide any longer. Thereby there will be an opportunity for the wood industry to develop environmental systems for their production units to show how carbon dioxide has been stored in their final products.

For total energy needed for production of a wood product we need ¾ thermal and ¼ electric energy. However, the wood industry creates more thermal energy potential through its by-products than it uses itself. In this situation the product designer needs to take into account in a new way, how to take advantage at the end of a wood product's life cycle through thermal energy instead of generating useless waste of the product.

In terms of wood products we have a positive energy content. The stored energy content in the product is higher than the production itself requires. To be able to argue for all positive potential energy capacity of the wood product we need to create carefully Life Cycle Assessment (LCA). Particularly in Central Europe wood consumption has a growth potential, because the wood consumption today is on the level of 0,2 m³ per capita whereas the Scandinavian wood consumption is three times higher. In addition to this we need the utilization of new European forests to achieve the goal of storing carbon dioxide.

Natural forest

Forests that have existed for and developed over long periods of time with no or only very limited human intervention are considered natural or virgin forests. Natural forest ecosystems that have been left to grow without disruption for adequately long periods achieve a stable state in forest development called equilibrium flow phase in which the mass of living and dead organic matter is constant. This implies that the amount of biomass and the species composition varies very little and remains close to an average value (see Fig. 1). In this phase gross primary production is equal to the respiration of the forest ecosystem. Therefore, natural forests are not able to store additional atmospheric carbon dioxide (CO_2). With full carbon sinks, these forests have no potential for fixing carbon dioxide.

Commercial forest

Mankind's use and management of natural forest ecosystems has caused considerable changes in these systems and has led to the establishment of so-called commercial forests. The forests of this day and age, in particular in Central Europe, are the result of man's active influence for a period of more than two thousand years, i.e. almost all forests are commercial forests.

In contrast to natural forests commercial forests are not exclusively characterized by natural tree species composition and site conditions (soil, climate), but are the result of silvicultural activities. The effect of silvicultural measures may vary greatly and the forests thus created may convey very different impressions and have totally diverse appearances.

Apart from other functions such as nature conservation and recreation the commercial forest always serve the production and use of wood as a raw material and energy resource. The extraction of wood from commercial forests prevents them from reaching the state of equilibrium inherent in natural forests,

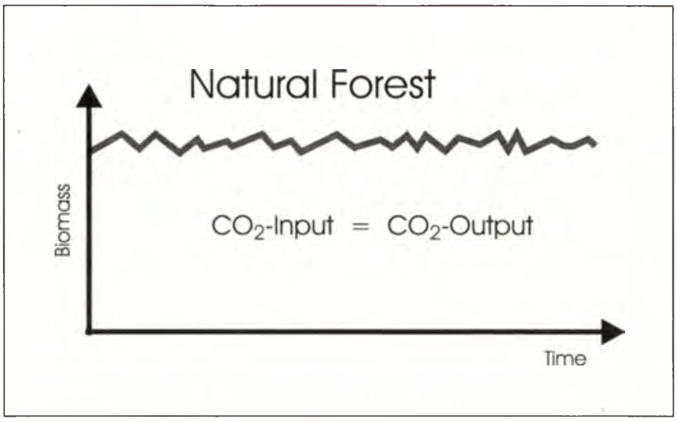

Fig. 1. Biomass development in natural forests that are in an equilibrium flow phase. The carbon sink is full and no further atmospheric carbon dioxide can be fixed

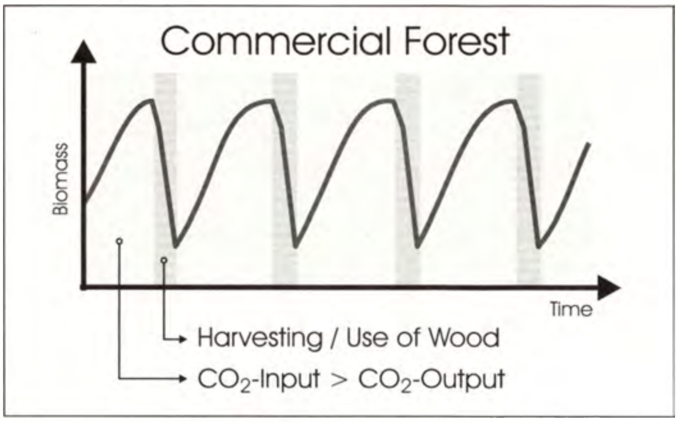

Fig. 2. Development of biomass in commercial forests whose carbon sinks are depleted each time wood is extracted and permits their being replenished with further atmospheric CO_2.

as the carbon sink in commercial forests is depleted **each time wood or trees are extracted,** i.e. gross primary production (of biomass) and intake of carbon dioxide is always greater than respiration by the ecosystem with the release of carbon dioxide into the atmosphere.

This implies that commercial forests have a great potential for the fixation of the greenhouse gas carbon dioxide (CO_2). Hence, commercial forests and the use of wood contribute greatly towards reducing anthropogenic CO_2 emissions.

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Box 1: Storing of carbon dioxide using wood

1. step is to plant a forest

⇨ the next 100 years the trees in the forest are storing CO_2

2. step is to harvest and use the wood in a durable way;
after harvesting, the forest must be replanted

⇨ CO_2 is stored in wooden house buildings the next 100 years

Life Cycle Assessment (LCA) gives an excellent opportunity for wood by arguing that wood has a much better Eco-Balance than concrete or steel.

It is most important that the LCA is clear and open.

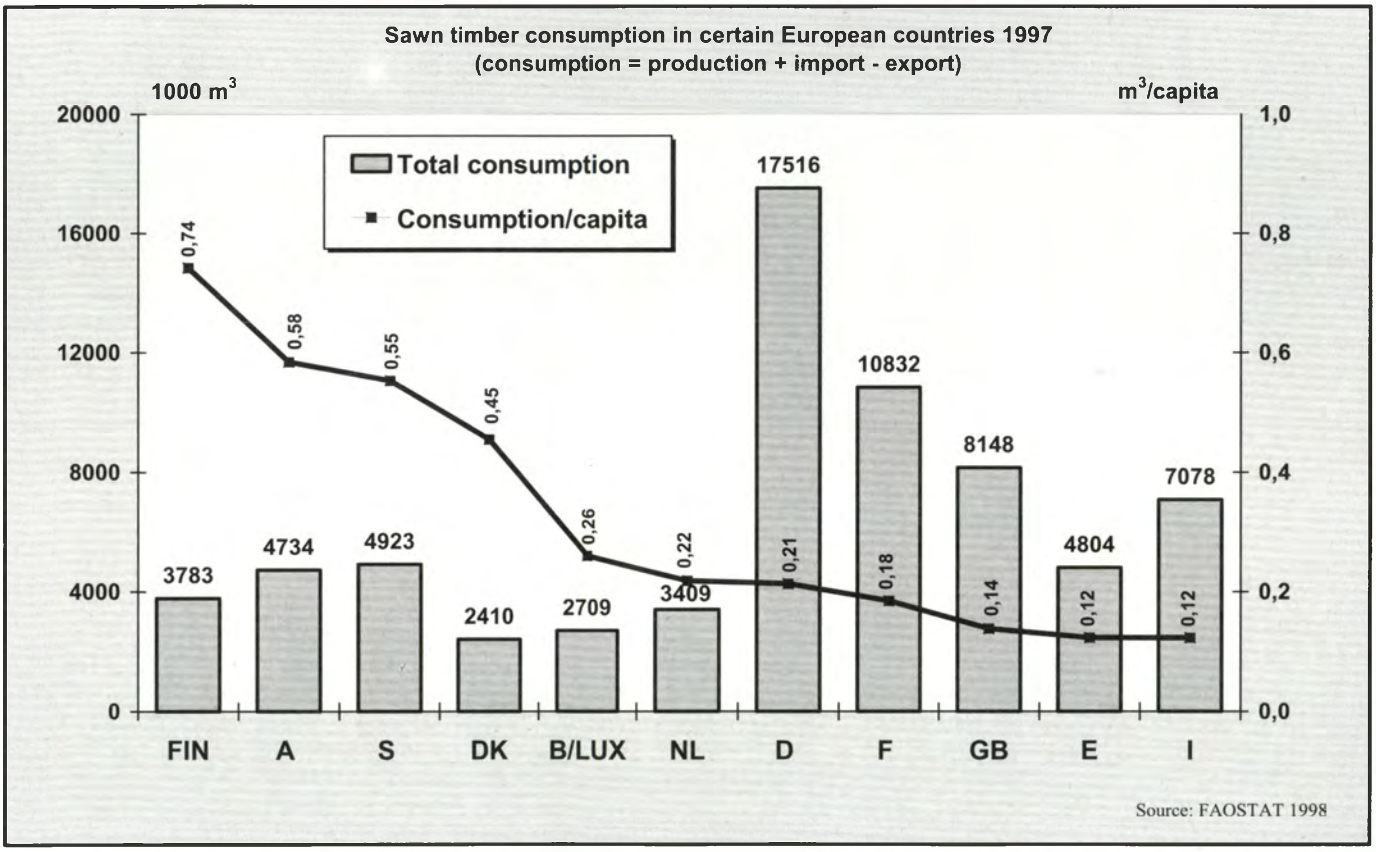
Box 2: Options for CO_2 emission reductions, i.e. in Germany

Today in Germany the annual use of wood is 20 million m^3.

This volume of wood restores 18.5 million t CO_2,
which is about 2 % of the total emission of Germany

In house building the share of wooden construction is 10 %.

Increasing this share up to the 30 % level the reduction of emission is 1 %. Taking into account the reduction in concrete and steel production the total saving of emission is more than double.



Life Cycle Assessment of Laminated Veneer Lumber

Matti Kairi

Summary

This Life Cycle Assessment (LCA) has been carried out for KERTO®-Laminated Veneer Lumber (LVL), which is manufactured by Finnforest Oy. The study is based on the project together with the Institute for Woodresearch University of Munich. The objective of the product-related LCA presented here was to systematically assess and evaluate the environmental effects related to the manufacture of LVL. The aim was also to show which environmental effects occurred during which phase of the LVL life-cycle. The methodological principles for the compilation of this study are based on the standards for product-related LCA, issued or about to be agreed upon in the course of the next couple of years by ISO-standards of the 14 000 series.

The energy calculation for the entire manufacturing process (including the module Forestry and Roundwood Transport) until the products leave the Lohja plant shows that less energy is required to manufacture LVL than the usable energy content stored in the product itself.

KERTO®-LVL manufacture has a negative global warming potential. Using wood as a rawmaterial LVL is storing CO_2 more than 10 times releasing during its life cycle "from the cradle to the grave".

1. Life cycle assessment (lca), Method, goal and scope

International standards, to be issued by ISO (International Standards Organization) in the course of the next two years, form the methodological basis for the establishment of product-related LCAs. These standards stipulate methodological minimum requirements to be fulfilled by LCAs. This concerns the four following standards (ISO 14040 to 14043):

DIN EN ISO 14.040 (1997):
Environmental management – Life Cycle Assessment-Products-Eco balance – Principles and framework

DIN EN ISO 14.041 (1998):
Environmental management – Life Cycle Assessment –Goal an Scope definition and life cycle analysis

ISO 14.042:
Environmental management – Life Cycle Assessment –Life cycle impact assessment (draft international standard)

ISO 14.043:
Environmental management – Life Cycle Assessment –Life cycle interpretation (Committee Draft)

According to the principles laid down in ISO 14.040 LCAs are divided into four independent main components as shown in Figure 1.

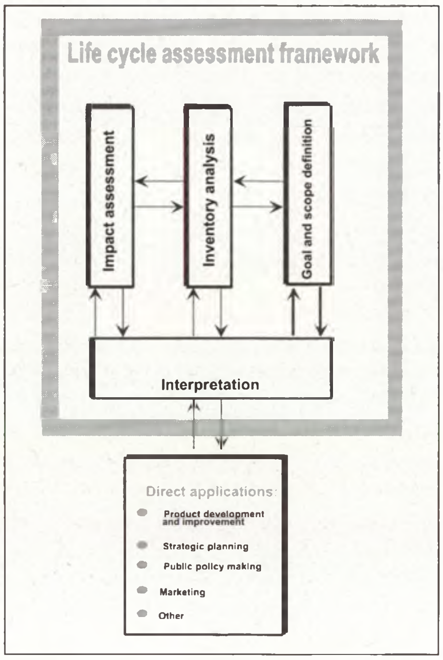


Figure 1: Components of and interactions in product-related LCA (according to ISO)

Against the introductory background given above the following goals were defined for the inventory analysis of LVL:

- A scientific LCA data base shall be elaborated for the production of LVL on the basis of current international standards for the establishment of LCAs.
- An inventory of environmental impacts related to the manufacturing process will be compiled to enable the enterprise to react effectively to growing demands for ecological product declarations.
- The results of the inventory analysis study are intended to augment the currently available product data basis, the better to inform customers and the interested public about potential environmental impacts.
- The results will also be used in the ecological ranking of the product with regard to the consumption of energy and natural resources.

In the present study an inventory analysis was conducted for the production of LVL at the production site in Lohja/Finland. In some instances corresponding results from literature were used for modules preceding or following LVL manufacture. Since LVL is used for a very wide range of building applications (rods, panels etc) no data on the actual service life phase were elaborated in this study. The same goes for the end of the LVL life cycle, as the product has not been in use long enough.

All data refer to the calendar year 1995. No account was taken of costs for infra-structure, machinery and buildings used in production. However, costs for infra-structure, machinery and buildings for energy generation and roundwood transport capacities and the end product were included in the analysis, as were the costs for administrative energy, water consumption and waste disposal. The allocation of material and energy flows to resultant by-products such as chips as a raw material for the pulp and paper industry or for the generation of thermal energy (bark, veneer cut-offs etc.) is based on mass.

All results refer to 1 m³ LVL with a density of 500 kg/m³ and 10 % humidity content.

All data related to LVL manufacture were consistently determined on site. Data on glue production and on the external thermal power station (generation of required thermal energy) were used as provided by the supplier. Data on the preceding chains of fossil energy resources and for the production of electric power were taken from literature and from the data banks of the software used in this study.

2. Inventory analysis of LVL manufacture

The main emphasis in this study was to elaborate the inventory analysis for the manufacture of KERTO®-LVL at the Lohja plant in Finland, with consideration of the preceding and subsequent life cycle phases. LVL is a product that lends itself to any number of uses in the building sector. In the following a representation is given of the typical life cycle of LVL and its individual life cycle phases which were divided into so called modules.

2.1 Life Cycle of LVL

There are four modules in the life cycle of LVL:

- Forestry
- Roundwood transport
- Manufacture of LVL
- Transporting LVL to the customer's building site in southern Germany

The further modules "Construction and Installation", "Use of the Building" and "Dismantling" or "Demolition" are not including in this study.

2.2 Forestry

Metsäliitto-Group is owned by 117 000 private forest owners. They are managing a total forest area of 5.3 million hectares. For the manufacture of KERTO®-LVL at the Lohja plant spruce roundwood is harvested exclusively from owners forests.

The operational data available to date such as energy consumed during harvesting or logging are not yet sufficiently comprehensive for the establishment of LCA according to present standard specifications. In this study the module "Forestry" was calculated based on the roundwood production balance presented by Schweinle and Thoroe (1997), figure 2.

Material and energy flows for the sub-modules "Use of Pesticides", "Road Construction and Maintenance", "Liming", "Debarking" and "Roundwood Conservation by Sprinkling" were not taken into account in this calculation, as they are of no significance here.

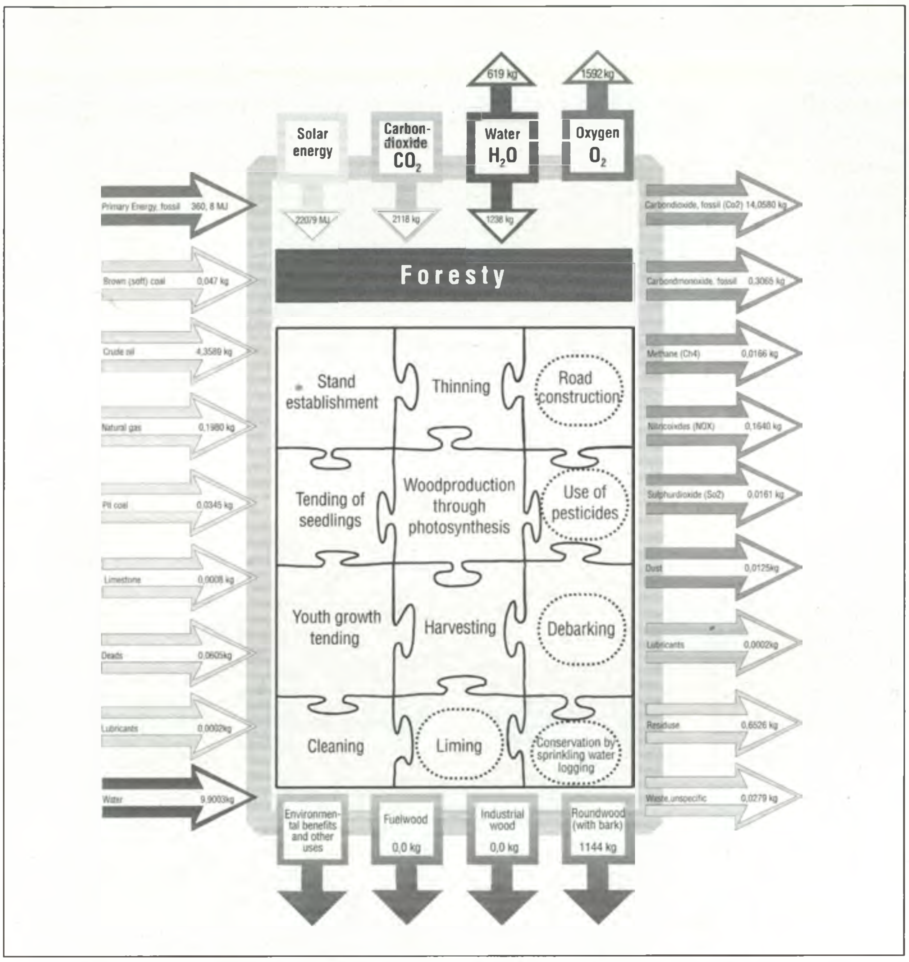


Figure 2: Extract from the inventory analysis of the modulus „Forestry" in the life cycle of LVL. Sub-modules in the white circles were not taken into account.

1 144 kg absolutely dry spruce roundwood with bark, corresponding to a volume of about 3 m³ sprucewood with bark go into the manufacture of 1 m³ LVL. To produce this amount of wood the trees in the forest sequestered 2 118 kg of atmospheric CO_2. The input and output flows originate almost exclusively from the use of fossil energy resources. The preceding chains for the exploration, extraction and supply of these energy resources form part of the calculation.

2.3 Roundwood transport

Roundwood transport into the plant is either by truck or rail. In the period under study 98.7 % of the roundwood used were supplied by truck, with the average transporting distance in relation to weighed mass coming to 84.7 kms. Due to the special truck design for roundwood transport the truck always returns to the forest without any load. For the trips from the forest to the plant it was assumed that the truck was loaded to 100 % capacity. The remaining 1.3 % of the required roundwood were transported to the plant by rail, with an average distance of 475 kms. The calculation is based on an energy mix, in equal parts, of electric and Diesel fuel motive power (IFEU 1995). The preceding chains for exploration, extraction and supply of the energy resources are included in the calculation.

2.4 LVL Manufacturing Process

To determine all material and energy flows that go into the LVL manufacturing process at the Lohja plant the process was broken down into separate units, so called sub-modules, figure 3. For a less confusing representation of the process the energy resources as well as the auxiliary and processing materials used are initially represented as "utilization units", i.e. they are not yet linked to their corresponding resources. This linking process with consideration of preceding chains, as far as these were available, has been deferred to chapter 2.6.

2.4.1 Wet Storage of Roundwood

The roundwood from the forest is transported to the plant's wet storage yard that comprises an area of 8 000 m^2. On average 5 000 m^3 roundwood are stored here. The sprinkling water required to keep the logs wet is pumped up from lake Lohja. The volume of water from the lake required is 4.133 m^3 per cubic meter of manufactured LVL. Bark from the roundwood that collects in the wet storage yard, an amount of about 0.6 kg (ovendry) per m^3 LVL, goes into the thermal power station.

2.4.2 Debarking

From the wet storage yard the roundwood is fed into the debarking machine. The fork lift trucks (trucks with hydraulic lifting units) used to transport the roundwood are included in the sub-module "Internal Traffic" as they are also used in other production sectors. The bark from the debarking process, 150.2 kg (ovendry) per m^3, again goes into thermal energy generation.

2.4.3 Soaking

The logs are soaked in water for 24 hours at temperatures between 35°C and 55°C. The water for this steaming process; 9.7 m^3 per m^3 LVL; is withdrawn from a tank underneath the manufacturing sector and flows through an almost closed circuit. The energy required to heat the water is obtained, via a heat exchanger, from the waste heat given off by the dryer. The logs are transported to the soaking pits by a fork lift truck, which is included in the sub-module "Internal Traffic".

2.4.4 Cutting the logs

Following the soaking process the logs are cut off into suitable lengths. Again, transport is done by truck lift which is dealt with as in the other sub-modules. Chips from this production step are shipped off to the thermal power generating station.

2.4.5 Veneer Peeling

The bolts are rotary cut by two veneer peeling machines into veneer sheets of 3 mm thickness. The peeling waste and cores with a diameter of 8 cm go into residual wood processing.

2.4.6 Clipping and Pre-Grading of Veneers

Following the veneer peeling process the veneer sheets are clipped into suitable width. The veneer clipping from this process could not be determined as a separate quantity and are therefore included with the remnants of the sub-module "Veneer Peeling". Once the veneers are clipped to size they are graded according to moisture content determined by electric conductivity. This grading in sapwood and heartwood contributes towards optimizing the drying of veneers as far as drying quality and consumption of energy are concerned.

2.4.7 Drying and Grading

Veneer drying is carried out in a jet dryer. Drying is controlled via the rate of feed and the influx of steam. The drying time is about 10 minutes.

After drying the veneers have a moisture content of no more than about 5 %.

The exhaust air from the dryer is conducted to a heat exchanger and subsequently heats the water used in the steaming of the stem sections. After the heat exchanger and a de-gassing stage the remaining exhaust air is emitted into the atmosphere. A qualitative analysis was made of this exhaust air in 1995 (terpenes, particles), but it was not possible, for technical reasons, to quantify the components.

A conveyor system forwards the veneers to the grading machine, where they are graded according to moisture content and density by means of radio waves. Subsequently, the veneers are deposited in grading boxes. Transport is effected by fork lifts.

2.4.8 Gluing and Pressing

This sub-module summarizes all processing steps involved in the gluing and edge jointing of veneers. Any veneers graded under 2.4.7 and found too narrow are glued in the edge jointing machine and then returned to processing. Glue is spread across the veneer faces, followed by the assembly of the individual veneers. The glue used is phenolic formaldehyde resin. Resin, hardener and diluting water are mixed at the plant. The preceding chain for the glue is represented in 2.4.15, based on information obtained from the glue supplier.

The glued and assembled veneers first undergo pre-pressing. This is followed hot-pressing at 145°C.

2.4.9 Sizing of Boards

After pressing circular saws cut the boards into the required dimensions. The cut-offs from this process in the amount of 49.45 kg (oven-dry) per m^3 LVL are again supplied to the thermal power station.

2.4.10 Packaging and Shipping

The major part of the finished LVL (about 70%) are machine-wrapped in plastic sheeting (Polyethylene). Another 25% are paper-wrapped or packed into cartons and only about 5% are shipped without any packaging cover.

2.4.11 Filtering and Extraction Unit

At various stages in the manufacturing process dust and chips are removed through a central filtering system. While particles are caught and remain in the filter, exhaust air is emitted into the atmosphere. This filtering system consumes electrical energy in the amount of 54.1 MJ per m^3 LVL.

2.4.12 Maintenance and Waste Disposal

This sub-module comprises the material and energy flows from workshops and other parts of the plant that are not part of administration, e.g. grinding workshop that are responsible for the sharpening of saw blades, veneer peeling knives etc.

The following waste materials are produced in the course of the manufacturing process and are either prop-

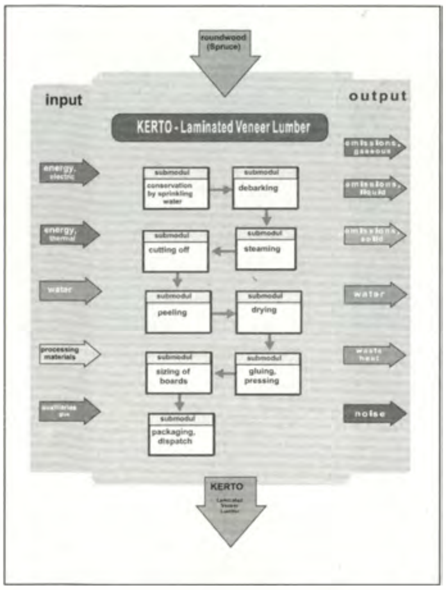


Figure 3: LVL manufacturing process divided in main sub-modules.

Table 1: Produced waste materials in the course of the LVL manufacturing process.

	kg/m³ LVL
Used lubricant for processing	0.0939
Rubbish	1.2212
Waste paper for paper recycling	0.0564
Bark and sand to the dump	0.7515
Metal scraps for re-cycling	0.1879
Waste glue for special waste disposal	0.2818

erly disposed of or re-used in the plant, table 1.

2.4.13 Residual Wood Processing

Two by-products of LVL manufacture result from the processing of residual wood. The first by-product is an assortment of residual wood suitable as raw material for the pulping industry, while the second one is an assortment that can be supplied to the closest thermal power station as an energy resource.

While a calculation of the costs involved in processing these by-products can be made, it would not be fair to attribute them to the LVL manufacturing process. In the table 2 this calculation has taken into account.

2.4.14 Energy Supply

The necessary electric power is supplied through the network of a Finnish power generating enterprise. For the preceding chain "electric power" the model for power generation in Finland by the GaBi Data Bank (version 2.0) by IKP (1997) was used.

The plant's requisite thermal energy is supplied in the form of steam (235°C, 8t/h) by the neighbouring thermal energy generating station that operates on the basis of biomass, paper and coal. The LVL plant in turn supplies this station with 339.2 kg dry mass of spruce wood and spruce bark per m³ LVL as a source of energy. Given an efficiency of the generating plant of 80 % this biomass corresponds to an amount of usable thermal energy of about 4 950 to 5 190 MJ. Data from literature [5] were used for the representation of the preceding chain "Thermal Energy from spruce wood" as a sufficiently accurate inventory analysis of the thermal power station could not be made.

At the Lohja plant the thermal energy consumed per m³ LVL amounts to 3 248.6 MJ, taking into account the energy returned to the thermal power station in the form of hot water (80°C). 71% of this energy are consumed in the manufacturing process, e.g. in log steaming, veneer drying or in heating the presses. The remaining 29% are used, in the form of waste heat, e.g. for the heating of the production facilities.

2.4.15 Glue Production

In the manufacture of LVL a phenolic formaldehyde resin produced by Dynoresin Oy is used to glue the individual veneer sheets together. The input data for the inventory analysis of the resin and hardener was made available, as far as the production of the individual components is concerned, by the supplier. Other data, especially some data concerning energy supply and transport were taken from available data banks (IFEU 1995; IKP 1997).

The inventory analysis data are incomplete due to existing gaps in the data available. Hence, preceding chains are missing e.g. for the production of "Isopropyl Benzene (Cumene)", "Starch", "Wheat Flour", "NaCl" or "Calcium Carbonate". The data on formaldehyde production are incomplete as there were information gaps concerning the methanol production stage during the process. Despite these shortcomings the inventory analysis for glue production elaborated here may help to estimate the portion of glue in the overall LVL analysis.

2.5 LVL Transport

LVL shipments to a wholesaler in the South of Germany formed the basis for the calculation of LVL transport for which two alternatives exist. The first is by truck to Helsinki, from where the consignment goes by ship to Lübeck and then by rail to South Germany, with the final 4 kms by truck. For the second alternative a truck takes the LVL consignment to Helsinki, and again to Lübeck by ship. From Lübeck it is forwarded to South Germany by truck.

2.6. Summarizing Inventory

Analysis for KERTO®-LVL

A summary of the inventory analysis for the manufacture of KERTO®-LVL is given in Table 2.

The allocation of material and energy flows to main and by-products was based on dry mass. In the production of KERTO®-LVL by-products such as bark and residual wood to be used for energy generation or chips for pulp manufacture are produced predominantly at the start of the production process. Hence material and energy flows exclusively occurring in the course of production of the main product cannot be allocated to the by-products. Veneer drying, the preceding chain for glue manufacture and the gluing process etc. were therefore only allocated to the main product. Conversely, the processing of residual wood (milling and screening) was allocated exclusively to the by-products.

On the input side only 0.2 % of the incoming material flows could not be attributed to elementary flows. The preceding chains for the fossil energy resources that were required such as petrol, diesel and natural gas, for elec-

Table 2: Extract of the Inventory Analysis for the manufacture of KERTO®-LVL including the preceding chains for the requisite energy resources, roundwood and glue.

Inputp per m³ Laminated Veneer Lumber per m³ Laminated Veneer Lumber		
Resources		
Barite ore and bentonite	0.005986564	kg
Bauxite	0.000150590	kg
Iron ore	0.000501669	kg
Natural gas	7.015667724	kg
Crude oil	8.281300679	kg
Ferromanganese	0.000000502	kg
Limestone	1.512352968	kg
Coal. Unspec.	0.113622121	kg
Carbon dioxide from air	925.366728000	kg
Cooling water	192.090719453	kg
Renewable fuels	11.418704847	kg
Sodium chloride	4.898564148	kg
Sand	0.000274461	kg
Pit coal	8.054236409	kg
Deads	5.010428318	kg
Clay	0.000010039	kg
Natural uranium	0.001623200	kg
Water	13227.824576838	kg
Water Lake	1807.241910781	kg
Water (wood)	270.503000000	kg
Primary energy		
Primary energy. fossil	2542.521384370	MJ
Primary energy. renewable	3479.652323650	MJ
Solar energy	9648.610400000	MJ
Non-linked materials		
De-resinating agent	0.000492884	kg
lubricanting grease	0.001022760	kg
Antifreezing agent	0.001644007	kg
Hydraulic oil	0.163147548	kg
Isopropylbenzen. Cumene	17.153791200	kg
Motor oil	0.020550086	kg
Packaging paper	0.240846672	kg
Oxygen technical	4.574344320	kg
Lubricants unspecific	0.077472281	kg
Steel	0.073508838	kg
Starch	2.858965200	kg
Wheat flour	5.717930400	kg

Output		
Products		
KERTO®-LVL	500.000000000	kg
Brown (soft) coal	0.614694352	kg
Emissions into air		
Ammonia	0.002022171	kg
Benzpyrene	0.000009970	kg
Benzene	0.002168123	kg
Lead	0.000020896	kg
Hydrochloric acid	0.018178397	kg
Dioxine (TE)	0.000000024	kg
Dinitrogen monoxide	0.137850580	kg
Hydrofluoric acid	0.000982428	kg
Formaldehyde	0.002666268	kg
Carbon dioxide, ren.	344.027007800	kg
Carbon dioxide, fossil	52.473747590	kg
Carbon monoxide, fossil	0.388677696	kg
Carbon monoxide, ren.	0.136441300	kg
Metals. unspec.	0.000002510	kg
Methane	0.068384303	kg
NMVOC. unspec.	0.091611448	kg
PAH	0.000158799	kg
Oxygen	695.899776000	kg
Scandium	0.000000531	kg
Sulphur dioxide	0.112941653	kg
Dust	0.060112999	kg
Nitrogen oxides NOx	0.734672073	kg
VOC. unspec.	0.058810253	kg
Water. steam	27.471494494	kg
Emissions into water		
Waste water (cooling water)	5.147348763	kg
Waste water to cleaning plant	1807.241910781	kg
Waste water into soil	8.995135874	kg
Waste water. unspec.	8403.394741869	kg
Ammonia	0.000148412	kg
Ammonium	0.000042698	kg
AOX	0.000000665	kg
Lead	0.000025349	kg
BSB	0.001424223	kg
CSB	0.008472585	kg
DOC	0.005717930	kg
Sodium	0.000411691	kg
Nitrate	0.000238066	kg
PAH	0.000002082	kg
Phosphate	0.000604199	kg
Sulphate	0.041544603	kg
Water	4519.163559207	kg
Emissions into soil		
Domestic Waste	0.274402881	kg
Waste. unspec.	0.232002730	kg
Waste. radioactive	0.000007925	kg
Rubble	36.553005445	kg
Ash	0.137704077	kg
Waste liquid	0.000585326	kg
Special liquid waste	0.000048383	kg
Gypsum	0.028707853	kg
Waste radioactive	0.000145591	kg
Waste radioactive KKW	0.000250451	kg
Sodium chloride	4.574344320	kg
Plutonium	0.000002080	kg
Tar	0.686151648	kg
De-resinating agent	0.000492884	kg
Natural gas	0.005343022	kg
Grease	0.000834765	kg
Antifreezing agent	0.001644007	kg
Hydraulic oil	0.097349272	kg
Lubricanting oil	0.000081438	kg
Motor oil	0.020550086	kg
PE (LDPE)	0.501965720	kg
Lubricants unspec.	0.077096291	kg
Metals	0.082147360	kg
Bark and Sand	0.751495590	kg
Waste heat	942.094000000	MJ

tric power (electric power model Finland), polyethylene wrapping material etc. were adapted from the data banks of the software that was used (IFEU 1995; IKP 1998). Part of the flows that cannot be linked to the elementary flows belong to the preceding chain for glue, e.g. wheat flour, starch or cumene.

The major part of the material and energy flows shown in Table 2 do not come from production itself but are created by the extraction and conversion of energy and energy resources. The amount of solar energy of about 9 648 MJ that goes into the system corresponds to the lower calorific value contained in 1m³LVL. This energy stored in the wood was converted by forest trees from solar energy by the process of photosynthesis and then fixed in the wood. This energy can be made use of, at the end of the life-cycle, by burning LVL that is no longer being used.

By far the greatest material flows on the input side are about 15 t of water, mainly used for power generation (electricity), for sprinkling stored logs, in steaming and heating; and carbon dioxide, introduced into the system on account of wood formation and photosynthesis, thus withdrawing it only released when LVL no longer in use is utilized for energy generating purposes or subjected to biological degradation.

The data on the output side show a similar result. The greatest airborne emissions are oxygen (from photosynthesis) and carbon dioxide from the energy conversion, with 87% of the CO_2 emissions originating from renewable sources.

3. Impact assessment

The category Global Warming Potential (GWP) determines the portion of gaseous emissions that contribute towards the anthropogenic global warming effect. Reference unit when determining the global warming potential of the individual gases is carbon dioxide (CO_2), with the unit value 1. Since the lifetime of these gases within the atmosphere is included in the calculation, the period under consideration needs to be stated. Total GWP will be the sum of GWP for the individual gases. Table 3 lists the most important global warming potentials for a period of 100 years.

Taking into account only the portion of CO and CO_2 emissions from fossil energy resources as a result of the inventory analysis shown in Table 2, the GWP_{100} per cubic meter KERTO®-LVL comes to 64.9 CO_2-equivalents. If the fact is taken into account that KERTO®-LVL itself is a carbon store, with carbon having been withdrawn from the atmosphere in the form of carbon dioxide during the production process in the forest (Forestry), the net result is a negative GWP_{100} of 860 kg CO_2-equivalents.

Table 3: Global warming potentials (GWP_{100}), in terms of CO_2-equivalents; time horizon: 100 years [1].

Compound	GWP (100)
CO_2	1
CO	3
CH_4	24.5
N_2O	320
NO_x	7
CFCs	3970-5750

The cause for acidification are emissions such as sulphur dioxide (SO_2), nitrogen oxides (NO_x) or ammonia (NH_3) that are being released, inter alia, when burning fossil energy resources; they are then oxidized in the atmosphere where they subsequently form acids (sulphuric acid, nitric acid) in precipitation. An acidification potential can be reference unit (Table 4).

The acidification potential (AP) for KERTO®-LVL is 0.64 kg SO_2-equivalents.

Table 4: Acidification potentials (AP), in terms of SO_2-equivalents [1].

Compound	AP
SO_2	1.00
SO_x	1.00
NO_x	0.70
NO	1.07
H_2S	1.88

4. Evaluation and Conclusions

The manufacture of KERTO®-LVL itself is a coupled production, with several by-products being sold apart from LVL as the main product. This refers to the residual wood from the manufacturing process that is supplied to the thermal power station and is also used as a raw material in the pulp industry. The energy calculation for the entire manufacturing process (including the module Forestry and Roundwood Transport) until the products leave the Lohja plant shows that less energy is required to manufacture LVL; 6 022 MJ; than the usable energy content stored in the product itself; 9 648 MJ.

The greatest amount of used energy; 53 %; goes into the thermal energy required in the steaming of the log sections, veneer drying and gluing as well as hot pressing. However, this part of the energy consumed comes exclusively from renewable energy resources.

As regards climate-related emissions it can be stated that KERTO®-LVL manufacture has a negative global warming potential. The carbon dioxide content that went into the formation of the wood used to manufacture LVL and that remains withdrawn from the atmosphere during the LVL life-cycle, is a multiple of the carbon dioxide released in the course of LVL manufacture.

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Wood for Weather Exposed Structures and Environmental Demands – Not necessarily a conflict

François W. Kropf

Introduction

For an engineer sustainable forestry always implies harvesting of the resource and having economically valid uses for it. In the long run the added value for wood chips is not overwhelming and will not cover the costs of a sustainable forest management. Products of higher value must be found.

Fortunately, timber is in many parts of the world a welcome, often ideal – and sometime the only economically available structural material for weather exposed structures, bridges being the most frequent and significant examples. However, for a number of reasons timber has been loosing market shares in many parts of the world, one of them being the lack of confidence in its durability – not always unjustified.

Of all the wooden structures that have disappeared with time, only very few failed due to engineering errors, but most of them degraded progressively as a consequence of decay by fungi or termites.

(The following considerations have been developed in regard to fungi – the main degradation factor in our moderate climate – but can be extrapolated in many respects for termites as well.)

To grow, fungi need liquid water and some heat. Hence, the major risk factors for exposed structures are rain and direct sunshine. The other climatic variations have only a minor influence on durability. Knowing this, the old builders protected their entire structures with a large roof: Hundreds of covered bridges – in many parts of the world, but mainly in Europe and North America – are still in service today after 150 years and more.

With the availability of chemical treatment in the last 20-30 years, this time proven design was put aside, and the durability achieved by taking advantage of chemical treatment of the entire wood construction: Chemical treatments consist of introducing more or less toxic compounds into the wood matrix. Most of these chemicals are made to stay there during the service life by a process called fixation, but some leaching is unavoidable.

Large quantities of wood preservatives were used quite successfully, but not all of the new structures have done well, showing that in wet climates the chemical treatment alone cannot always guarantee an expected service life of at least 50 years.

At the end of service life the treated wood often ends up in an uncontrolled manner in our environment. It is mainly for this reason that chemical treatment of wood is strongly questioned – today mainly in northern Europe, but tomorrow in other parts of the world as well. In our countries the pressure of an environmentally concerned public opinion has reached a level, where less experienced designers are making a point of not using chemical treatment at all. The "green" Olympics 2000 in Sydney next year are setting an example, which could turn out to be quite harmful for wood construction. When the damages occur, the material wood is being blamed, whereas actually the designer should be held responsible. Some standard design configurations just don not work without the help of chemical treatment, when exposed to the weather.

We fully agree that along with modern ecological concepts the careless dumping of treated wood into the environment at the end of its service life is unacceptable. On the other hand, it is our conviction that the disposal problem after 50 or more years of reliable service may not outweigh all the other ecological benefits of using more timber for structural purposes.

Up to now conventional pressure treatment of sawn lumber has been using way too much chemicals for the uncertain level of protection it did provide to our common softwood species. It is our conviction that the time for indiscriminate chemical treatment of entire elements will come to an end.

But, excluding chemical treatments entirely – for example with a legal ban, like some well-meaning groups are advocating – will backfire against wood and benefit steel and concrete. Already now, market shares have been lost in many countries, and will be hard to win back. It must be demonstrated anew that the durability of exposed wood structures can be comparable to the other materials, mainly steel and concrete.

A first but important step for the renewed acceptance of treated wood in Europe today, is to reduce the quantities (and also the toxicity) of the chemicals being used. We think there is no need to load an entire wood member with preservative, when in the built structure only 1-3% of its volume are at risk of being attacked by decay.

If the chemicals were applied only where they are really needed, much lesser quantities would be sufficient. Therefore, we propose to follow a revised strategy of chemical wood treatment, which insures and even improves the desired durability, while reducing the inputs of wood preservative by a factor of 50 – 100x.

Revised strategy of chemical wood treatment

For many years our institute has been testing on a good number of pilot projects the following strategy for improved durability of exposed timber structures. It is based on three elements:

1- Design, as main feature of durability, i.e. best possible general and detail design and careful execution.
2- Systematic maintenance and periodic cleaning, to keep the planned durability features in working order for the entire service life of the structure
3- Targeted Chemical application, as supplemental measure only, or for rehabilitation.

to 1: **Design**

Design has shown to be an essential feature of durability. If covering the entire structure with a roof (covered bridges) is not wanted, physical protections can be designed to cover the potential moisture traps where decay could develop.

The "traditional" knowledge of providing physical protections and sacrificial elements to the essential parts of the structures must be reactivated. The goals of such "intelligent details" are 1)- protection from rain and sunshine, 2)- quick draining away of liquid water, and 3)- allowing wet areas to dry out more easily

(Unfortunately) there is little high-technology, but substantial additional work involved in such a design work. Good details are not spectacular and are taken for granted missing– unless they are. Only time shows their effectiveness, and usually the designer does not get credit for them – which often dampens his enthusiasm. Still, we think, design for durability should be "state-of the-art" today.

to 2: **Periodic maintenance:**

What is accepted practice for any expensive piece of equipment – inspection, servicing and preventive maintenance – must be applied to structures as well, before damages become quite obvious. This is true for any construction material.

Wood has the major advantage of giving out "early warning signals", such as discolorations, soaked areas, drippings etc., when something is wrong. Correctly interpreted, these symptoms allow to take remedial action early and at low cost – but only if a qualified person does take the effort to crawl under the bridge and give it periodically a thorough inspection. The best preservation measure is of little use, if it has become ineffective.

It must be taken into account that wood as a biologically degradable material does react faster than steel or concrete to adverse climatic effects. Therefore servicing must start sooner, already after 3-5 years of service. Doing so, it has been shown, that over its lifetime wood is not more expensive to maintain than other materials.

to 3: **Chemical preservation**

This shall always be a supplemental measure and should never be a substitute for poor design. Where appropriate, however, chemical application is essential to provide an economically acceptable service life for timber structures, and is often the only practical means of rehabilitation.

In a good design, the chemical treatment can be restricted to the few remaining spots, where an adequate physical protection is not feasible, mainly unavoidable joints and footings.

For this, new methods for local application and new (less toxic) chemicals are becoming available, but are still in the experimental stage. They must still be developed further and will provide a much better protection of risk areas with greatly reduced quantities of wood preservatives. The concept of targeted localized chemical preservation has not yet been implemented by the wood treatment industry, but a number of research institutes are working on these challenges.

Procedures must also be found for permanent marking of the treated parts, in order to identify them and separate them at end of service life. Their total volume is small and can be disposed of along separate proper channels.

The remaining 95-98 % of the wood mass are an ecological asset. Being not contaminated they can be re-used for lesser constructions, used for energy production or left to natural decay without harm to the environment.

Summary

Increased use of wood for exterior constructions is a desirable goal, but all the ecological advantages of wood are powerless arguments, if the economical durability of the structures cannot be guaranteed.

- With good detailing and by tolerating localized small quantities of wood preservatives – not intended to cover up poor design work, but to permit a cost-effective use of sawn lumber – the desired durability can be achieved..
- The need for chemical treatment can be greatly reduced by reactivating the "old" know-how of installing physical covers and sacrificial elements to protect the essential, non-replaceable parts of the structures.
- The second essential element of durability is adequate maintenance. It is a very cost effective and non polluting measure!
- These controlled small inputs of effective chemicals are necessary to give timber a chance against steel and concrete. The disposal problem may not outweigh all the other ecological benefits of using wood.

In order to give timber a chance to compete against steel and concrete in the future as well, this message must be conveyed into the public opinion. To be against these small – I'd call them "homeopathic" – doses of chemicals, is to me like refusing medication to a patient.

Following the suggested strategy of proper design, periodic maintenance and targeted chemical inputs, timber structures will not be in conflict with environmental demands, and will maintain wood world-wide as an economical and ecologically intelligent alternative for weather exposed structures.

To convey this message to a larger public could be our task as knowledgeable specialists.

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The Role of Non-Timber Forest Products in Sustainable Forest Management: Learning from Research in the Tropenbos Programme

Mirjam A.F. Ros-Tonen

1. Introduction

When we speak about the production function of forests, we are usually referring to timber. The exploitation of non-timber forest products (NTFPs), which are also known by the deprecatory appellation of 'minor' or 'secondary' forest products was, until recently, often neglected both in policy and research. Now, however, we know that there is nothing 'minor' about non-timber forest products, at least in tropical rainforest areas (De Beer and McDermott, 1989; Peters *et al.*, 1989). NTFPs in the tropics are the main source of livelihood of forest-dwelling communities, who rely on these products for their food, medicines and as raw materials for their houses, tools and equipment. NTFPs are the main source of cash income for people living in remote rainforest areas. In some cases, NTFPs even contribute to a country's export earnings, as is the case with rattan in Indonesia or Brazil nuts in Brazil and Bolivia. This economic importance of NTFPs has important implications for natural tropical forest management and the planning of land use in tropical rainforest areas.

As the extraction of NTFPs generally leaves the forest structure intact, it has been promoted during the past ten years as a strategy for forest conservation. It was believed that sustainable commercial exploitation of NTFPs, through adding value to the forest, could serve as a stimulus to sound forest management. We may say that NTFPs have grown in the past ten years from minor forest products to a major issue on the international agenda.

The FAO (1991) was the first international organisation to come up with a strategy for NTFP development. Many others followed in its wake. One of those was the Tropenbos Foundation in the Netherlands, which I am representing here today.[1]

2. Defining non-timber forest products

Non-timber forest products can be defined as "all tangible animal and plant products other than industrial timber, which can be collected from forests for subsistence and for trade" (Ros-Tonen *et al.*, 1995). It comprises such diverse products as game, starchy foods, nuts, spices, leaves for wrapping food, medicinal herbs, smallwood for handicraft and tools, fibres, ornamental plants, essential oils, latex for rubber and rattans (De Beer and McDermott, 1996).

Many NTFPs originate both from natural forests and from man-made vegetation types, since economically successful NTFPs tend to be domesticated. Black pepper, bananas and coffee, for example, were once non-timber forest products. An extensive survey of local NTFP use and potentials, carried out under the Tropenbos-Cameroon Programme, demonstrated that an important proportion of NTFPs are not collected from natural forests, but harvested from vegetation types modified by man, such as secondary forests, young fallow vegetation and cocoa plantations (Van Dijk and Wiersum, in press). In the transition from 'wild' to cultivated products, several NTFPs may come from both natural forests and home gardens or plantations. The best known example is that of rubber from *Hevea brasiliensis*, which is collected from natural forests in Brazil, while in Indonesia it comes from plantations. The same occurs within one and the same country with gum Arabic from *Acacia senegal* in Sudan and rosin and turpentine made of the oleoresin of *Pinus merkusi* in Indonesia (Coppen, 1999). When such products appear on the market, they bear no label that clarifies their origin. Several authors therefore apply the term 'non-timber forest product' to 'wild' as well as to domesticated products of forest origin.

This confusion is currently heavily debated in *NTFP Biocultural Digest*, an international Internet mailing list on non-timber forest products. Following discussions during a recent workshop on NTFP certification in Oaxaca, Mexico (Mallet, 1999), the question was raised of whether non-timber *forest* products can also come from plantations.

Early publications on the role of NTFPs in economic development and forest conservation were clear about this question. De Beer and McDermott (1989), for example, state that:

> "The term 'non-timber forest product' encompasses all biological materials other than timber which are extracted from forests for human use. (...) By 'forest' is meant a natural ecosystem in which trees are a significant component. However, forest products are derived not only from trees, but also from all plants, fungi

[1] *The Tropenbos Foundation is a non-profit organisation, based in the Netherlands, which promotes the conservation and wise use of tropical rainforests through (i) strategic research, tailored to the needs of policy makers and forest users; (ii) supporting policy makers and forest users with up-to-date scientific knowledge; and (iii) training and institution building. Tropenbos encompasses a worldwide network of long-term research programmes in Colombia, Guyana, Côte d'Ivoire, Cameroon and Indonesia, where the programme addresses national research priorities, as well as themes from the international forestry agenda. National research priorities include land-use planning, biodiversity conservation in protected areas, sustainable production of forest products and the restoration of degraded areas. Non-timber forest products (NTFPs) is one of the specific themes to which Tropenbos gives attention in order to contribute to international discussions. Other themes that receive particular attention in the Tropenbos programme are biodiversity, principles, criteria and indicators for sustainable forest management and indigenous forest management.*

and animals (including fish) for which the forest ecosystem provides habitat. Human intervention *per se* does not make an ecosystem 'unnatural', although human origination does. Hence, whereas managed, secondary or degraded forests are sources of non-timber forest products, plantations are not." (De Beer and McDermott, 1989: 17-18).

In practice, however, the distinction between natural and human-modified forest ecosystems cannot always be drawn that easily. There is often a gradual transition from the collection of 'wild' products in natural forests to enrichment planting in secondary forest and intensively managed home gardens (Ros-Tonen *et al.*, 1995). Reviewing the history of forest manipulation by indigenous people and various types of indigenous forest management, Wiersum (1997) concludes that there is an evolutionary continuum in forest-people interactions, along which a gradual transformation of the natural ecosystem into an agro-ecosystem takes place. This evolution is characterised by increasing input of human labour per unit of forest land and intensified human intervention in the reproductive biology of desired species.

An example of such an evolution was found in research among Dayak people in West Kalimantan carried out by Wil de Jong, which was jointly financed by Tropenbos and New York Botanical Garden. He described the Dayak's habit of planting trees in the first swiddens they establish when they settle in a new area. As much of the original vegetation returns, accompanied by the planted and tended species, these tree-planted swiddens or *tembawang* eventually evolve into full-grown forest gardens (De Jong, in press). Comparing the species numbers, densities and basal areas of five such plots with two 1-ha plots in natural forest, he demonstrated that this anthropogenic vegetation type is a match for natural forest, as far as its biological diversity and its importance as a source of NTFPs is concerned (De Jong, 1995).[2]

Another example is known from Tropenbos research with indigenous communities in the Colombian Amazon. In this project, detailed knowledge was obtained of the ways in which indigenous people manage and influence the surrounding forest. They manipulate forest succession in order to promote the growth of useful species, such as the chontaduro palm (*Bactris gasipaes)* and the guamo fruit tree (*Inga* spp.) is promoted (Van der Hammen and Rodríguez, 1996).

In spite of these gradual transitions, we need to clarify the terminology in order to be able to formulate clear and transparent recommendations for the sustainable management of NTFP resources and to lay down criteria for the certification of NTFPs. The main question is where to draw the line between agroforests as *forest* ecosystems and agroforests as *agricultural* systems (Mallet, 1999). As the term NTFP was coined in the context of strategies for the conservation of biodiversity in natural forests, many prefer to use it only for products from natural forest systems, whether they are modified by human intervention or not. Several alternative terms have been suggested for products from man-made vegetation types, such as forest garden products (Senanayke, 1999), non-timber plantation products (Melvani, 1999) or agroforestry products (Ottens, 1999).

3. The potential contribution of NTFP extraction to forest conservation

A central hypothesis underlying much NTFP research is that commercial extraction, through adding value to the forest, may provide an incentive to conservation and sustainable forest management. The underlying reasoning is that local authorities and forest resource managers will have an interest in preventing indiscriminate forest use or conversion of forest to other land uses when NTFP extraction contributes to the Gross National Product and export earnings. For local communities, increased income from the trade in NTFPs is thought to provide a stimulus for protecting their forests and manage them sustainably. Many NTFPs can be harvested without significantly altering the forest structure, thus maintaining the forests' environmental services and biological diversity. All these factors have led to the notion that the commercial extraction of NTFPs is a potentially sound conservation strategy (e.g. Peters *et al.*, Fearnside, 1989).

It was with this hypothesis in mind that Johan van Valkenburg (1997) undertook a study as part of the Ministry of Forest (MOF)-Tropenbos Kalimantan Project, in which he made an inventory of commercially important NTFPs and evaluated their economic potential. Focussing on fruit tree and rattan species, he compared the distribution and abundance of NTFPs in various parts of East Kalimantan and studied the ecological and economic aspects of rattan collection. Addressing the question of the potential value of sustainable NTFP extraction, he concluded that the low densities of individual species in natural forests often limit their potential for extraction. However, when he compared the economic aspects of various tree-based land-use options, taking into account such environmental costs as watershed protection and erosion control, he reached the following conclusion:

> "If short-term economic gain at local level is a guideline for land-use planning, then the extraction of NTFPs from primary forest areas in East Kalimantan is not the economically most competitive land use. This is one of the reasons that the ecologically highly disruptive pepper plantations are an economically tempting land use in areas with good market access. If, however, watershed protection, erosion control, biodiversity conservation and other environmental services are given a financial value, it is an economically viable option from a national and regional perspective, but not for individual landowners or users." (Van Valkenburg, 1997: 168).

The commercialisation-conservation link is now being strongly disputed.

[2] *The density of some* tembawang *plots approaches values found in natural forests plots (565 trees/ha). The* tembawang *plots may also be regarded as 'substitute forests' in terms of the average basal area (23,8 m2/ha) and number of species (170/ha) (De Jong, 1995).*

Over-exploitation, substitution by synthetics and exploitative commercialisation systems discourage extractors from managing forest resources sustainably (Richards, 1993). Willem Assies (1997) illustrated how this can work out in practice in a study of the socio-economic and political aspects of Brazil nut (*Bertolletia excelsa*) exploitation in Bolivia and Brazil. This product possesses considerable potential for harvesting in an ecologically sustainable manner. The merit of Assies' study is that he made it clear that the Brazil nut gatherers combine their activities in an 'agro-extractive cycle', of which rubber tapping and agricultural activities also form a part. If one of the extractive activities declines in importance, which actually happened as a result of collapsing rubber prices, they compensate the loss by expanding their agricultural activities. The sustainability of the 'cycle' is thereby threatened because of increasing conversion of forest to farming land. Assies further demonstrated that the organisation and dynamics of the extractive economy is, like any other sector in economic life, profit-driven rather than based on the aim of satisfying social needs or promoting ecological sustainability. The Brazil nut economy is dominated by processing industries, which tend towards vertical integration to secure their supply of raw material. In this process, urban-based labour gangs, who have no affinity with forest conservation at all, are replacing the forest-dwelling extractors, who are becoming increasingly marginalised.

Similar findings are reported from the Tropenbos-Guyana Programme, where several studies on NTFPs and indigenous resource use are being carried out in the Northwest District (Forte, 1997; Sullivan, 1998; Van Andel, 1998; Verhey and Reinders, 1997). In this region, the exploitation of NTFPs is the main source of income and employment for the predominantly Amerindian population. The commercially most important products are palm heart (*Euterpe oleracea*), wildlife, and the aerial roots of 'nibi' (*Heteropsis flexuosa* (Araceae)) and 'kufa' (*Clusia grandiflora* and *C. palmicida* (Guttiferae)), which are used as plaiting material for basketry and furniture. Although less destructive than the logging and gold mining operations in the area, palm heart is currently being over-harvested. Nor is the wildlife trade much concerned with sustainability. Souvenir shops in Georgetown are even selling jaguar and puma skins, although these animals are listed in Appendix I of CITES and are thus officially protected from international trade.[3] Species listed in Appendix II (toucans, monkeys, parakeets and macaws) are being traded in international markets, with no regard for the effects of harvesting on their populations. Only the prospects for the sustainable harvesting of nibi and kufa roots seem to be promising, as these roots are abundant and can be harvested all the year round without killing the host tree. Even so, extractors may over-harvest the products or revert to timber cutting when prices for the raw material are low (Van Andel and Reinders, in press)

The various examples show that, in practice, it is difficult, if not impossible, to reconcile the principles of ecological sustainability with those of economic feasibility and social justice.

4. NTFPs as a means for improving people's livelihoods

One of the attractive promises of NTFP development is its potential for improving the livelihoods of people who depend on the forest for their basic needs and cash income. An important motive for promoting the commercial extraction of NTFPs has been the expectation that increased marketing of NTFPs may lead to higher incomes.

This potential should not be overstated. In the first place, NTFP use is basically associated with poverty. It is the socially most marginalised people who are the main actors in NTFP extraction. This holds true for the Bagyeli ('pygmy') people in Cameroon, the Amerindians in Guyana's North West District, as well as for the Dayaks in Indonesia. Extractors of NTFPs seem to perform a job that most people no longer want to do, once alternative employment opportunities become available. In this respect, many non-timber forest products are still 'minor'. Except for bush meat, society's appreciation of NTFPs is generally low, while extraction is looked upon as an inferior economic activity (*cf.* Dove, 1993). In addition, forest-dependent people generally live in poor conditions, where even the most basic health care and educational services are lacking.

Moreover, the extraction of NTFPs is often based on exploitative labour and trading relations. In all the Tropenbos studies carried out in South America, a similar picture emerges of debt-peonage, in which the extractor is seldom or never paid in cash for his work. Instead, the buyer of his product advances him merchandise, which can be paid off with the harvested products. Because the buyers demand higher prices for the merchandise advanced as compared with what they pay for the NTFPs, they place the extractors in a situation of permanent indebtedness, from which it is hardly impossible for them to escape. This system is called *endeude* in Colombia (Rodríguez and Van der Hammen, in press), 'bonded labour' in Guyana (Forte, in press), *aviamento* in Brazil and *habilito* in Bolivia (Assies, 1997). It will be clear that these in-debt relationships hold little promise for improved livelihoods, where these are based on the extraction of forest products. Promoting commercial NTFP extraction without tackling such unequal production and marketing relationships will not result in a socially desirable land use (Ros-Tonen *et al.*, 1995).

Another reason for not being optimistic about the potential of NTFP extraction to contribute to improved livelihoods is that it is generally a subsistence-oriented part-time activity (Van Dijk and Wiersum, in press). Most products are available on a seasonal basis only and their extraction is part of a

[3] *The Convention on International Trade in Endangered Species of Wild Flora and Fauna is a global treaty which has been in effect since 1975 for protecting plant and animal species from unregulated trade. Appendix I of CITES protects threatened species from all international trade. Appendix II regulates the trade in species not threatened with extinction, but which may become threatened if trade goes unregulated. Appendix III gives countries the option of listing native species already protected within their own borders.*

livelihood strategy which comprises other economic activities as well. The concept of an 'agro-extractive cycle' described above enables us to distinguish between situations in which extractivism is capable of providing a livelihood and situations in which it is an activity complementary to farming, mining or timber logging (Assies, 1997).

In general, the potential contribution of commercial NTFP exploitation to improved livelihoods for forest-dwelling people is limited for NTFPs from natural forests, because of the low densities at which they occur and their irregular distribution (Van Dijk, 1998; Van Valkenburg, 1997). If the primary aim is to generate incomes, focussing on human-modified vegetation types might offer better prospects, as these have a higher species density and are generally located at closer distance to the villages and cultivated lands (Van Dijk and Wiersum, in press).

Other factors which limit the potential of NTFPs to contribute to forest dwellers' incomes is that the successful marketing of NTFPs is hindered by the poor infrastructure and high transport costs in tropical rainforest areas, the lack of organisation among harvesters and lack of access to credit and storage facilities (Verhey and Reinders, 1998; Van Dijk, 1998). Moreover, forest-dwelling people like the Amerindians in Guyana's North West District are handicapped by a failing education system, poor health and poverty, which prevent them from fully developing their economic potential (Forte, 1995).

Despite these limitations, firms like Ben & Jerry's Homemade Inc. from the United States, which became famous for its Rainforest Crunch ice cream made of Brazil nuts, asserts that they have a social mission to fulfil (http://www.benjerry.com). The firm claims that it pays fair prices to forest people, thus ensuring a far larger return than the regular 3% which extractors of Brazil nuts receive of the New York wholesale price (Clay, 1992). Thus, the trade in rainforest products, in addition to the alleged 'helping preserve the rainforest', is 'caring capitalism' or, as stated in a Ben & Jerry's company profile: "You're not eating ice cream because you like it, it's for charity!" (http://www.hoovers.com).

Such claims have been heavily disputed. Whereas it is being suggested that "the sale of Rainforest Crunch helps support native residents of the world's rainforests", the Brazil nuts are in fact being gathered by the very same non-indigenous Brazilian rubber tappers described in Assies' study. Ben & Jerry's intended to buy the nuts from the Xapuri cooperative in the Brazilian state of Acre, which was established with support from the Ford Foundation, Cultural Survival and some other international donors. The cooperative, which was often presented as a success, performed far below expectations and finally had to dismiss its personnel in 1993. The plant subsequently adopted a piecework-based put out system to reduce its labour costs. The claims that the Xapuri plant would be able to substantially increase the gatherers' income and provide improved labour opportunities thus finally had to be tuned down (Assies, 1997).

Moreover, organisations such as Survival International contend that the marketing of NTFPs by indigenous people may do more harm than good, as it is seriously diverting attention from the more critical question of land tenure. According to Survival International's director Stephen Corry (1993), the real fight of indigenous people is that for the recognition of their land and resource rights. He argues that relating such rights to profitable land use and outside marketing weakens their more fundamental land claims for hunting, gathering or subsistence farming. The integration into international markets may also create new dependencies, while the associated influx of cash may lead to social imbalances in native societies, which can seriously disturb existing social structures. This happened, for example, among the Kayapó Indians in Brazil when they began to trade in Brazil nuts, gold and mahogany. Some of the chiefs used their position to secure personal wealth and power to the financial detriment of the community. The resulting internal jealousies and divisions seriously ruptured the community. Corry therefore concludes that:

> "... encouraging tribal peoples to enter global markets to satisfy an artificially-created demand for faddish products, such as Brazil nut candy or hair conditioner, will not promote tribal peoples' self-determination and will not solve their problems. Far from giving forest dwellers more security and control over their own lives, it is more likely to have the opposite effect" (Corry, 1993: 153).

Dove (1993), who interprets the contemporary efforts to develop NTFPs as "attempts to allocate to the forest dwellers the resources of least interest to the broader society" and "to underdevelop rather than develop tropical forest peoples" apparently shares this view.

In sum, the marketing of NTFPs cannot really be expected to function as a vehicle for development. It is inherent to NTFP-based livelihoods that they tend to disappear. Once people get other opportunities, they invest in other economic activities, such as cash crops or trade (e.g. Dijkman, in press; De Jong, in press). Thus, if the aim is to raise forest peoples' incomes, opportunities to do so will probably best be found outside the forest. Support for NTFP development can only be recommended in situations where such alternative options are absent. In such cases, it should be realised that support should also be given to the satisfaction of basic human needs and the improvement of the social conditions under which extractors live and work (*c.f.* Forte, 1995; Browder, 1992; Ros-Tonen *et al.*, 1995).

5. The role of NTFPs in participatory forest management

An important reason why NTFPs have become a major issue on the international agenda is the political struggle of rubber tappers in Brazil. Anthropologist Mary Allegretti and the leader of the rubber tappers' movement, Chico Mendes, launched and made a political success of the concept of extractive reserves (Allegretti, 1990; Schwartzman, 1989). These extractive reserves were proposed as a combined strategy both to secure forest peoples' rights to forest resources and to promote environmental protection at the same time. The combination of scientific interest and political struggle at grassroots level set the stage for an initially almost euphoric belief among scientists and environmentalists in the potential of NTFP exploitation to simultaneously combat deforestation and poverty. Extractive reserves were seen as a model for participatory forest management.

Already from the beginning, several authors questioned the effectiveness of extractive reserves as a conservation strategy (e.g. Anderson, 1990; Browder, 1992; Fearnside, 1989). In general, however, the concept was regarded as a useful way of organising collectors of forest products and mobilising them in order to secure and defend their rights to natural resources, to escape exploitation by landowners and merchants, to build their marketing capacity and to improve their living conditions.

Several studies in the Tropenbos programme have made it clear that the potential of NTFPs to contribute to sound forest management strongly depends on who owns the land. The prospects are better in cases where extraction areas have a legal status, as the development of participatory local resource management models requires confidence among the parties involved and long-term collaboration. In this respect, Tropenbos has an interesting project in Colombia, where Clara van der Hammen and Carlos Rodríguez have a long experience in participatory research with indigenous communities in the Caquetá region, with particular emphasis on the cultural aspects of natural resource use and management. Indigenous households actively participate in the research and conduct their own studies in order to recover traditional knowledge of indigenous management systems. They daily record the consumption of products obtained from farming, fishing, or hunting and gathering. In a slow process by which more and more households gradually became part of the project and a lot of community workshops were organised, a situation was reached in which a whole community became involved in a dynamic discussion on the state of resource use. These discussions and the results of research now form the basis for a participatory natural resource management plan for the legally recognised territory of these indigenous people (Rodríguez and Van der Hammen, in press).

How decisive secured land tenure is in this context, is also illustrated by an experience in the Tropenbos-Cameroon Programme. In this case, efforts are being undertaken to develop participatory methods for the sustainable harvesting of *Garcinia lucida*. This small understorey tree is found on steep slopes at elevations exceeding 500 m above sea level and its bark is used as an additive in palm wine production. Experiments were set up to determine the effect of various harvesting techniques and there are plans to develop a simple sustainable exploitation and management strategy for the *G. lucida* resource, based on local knowledge and practices and participatory monitoring of the harvesting. In this case, however, the resource grows in restricted areas at some distance from the villages (Van Dijk, 1998). Because it is an open-access resource, there is not a specific group who feel responsible for the management of the resource and it is proving difficult in practice to protect the experimental stands from unplanned and unexpected stripping (Van Dijk, personal communication).

Various experiences in the Tropenbos programme have also shown that the intervention of outsiders may help in the development of participatory forest management systems. The Colombian case, for example, is helping to revitalise indigenous knowledge of traditional management techniques and to apply this knowledge in plans for natural resource management. An interesting result of these efforts is the publication of a book by two Indians (Matapí and Matapí, 1997) in which they document the indigenous world view, the use of natural resources and the social organisation of the Upichía tribe (now known as Matapí). Another example can be found in the study among Dayaks in West Kalimantan (De Jong, in press), which was carried out as part of a NTFP enterprise development project. This project – a common effort of the governments of Germany and Indonesia and the Pontianak-based NGO Yayasan Dian Tama – is part of a Social Forestry Development project in the district of Sanggau and is being implemented in what is known as a 'Participatory Forest Management Area'. Analogous to the extractive reserve concept in Brazil, this is a model concession for communal forest management on some 102,250 ha of state forest land (De Jong and Utama, 1998). NTFP development is receiving particular attention in this project with a view to meeting the twin goals of increased incomes and forest conservation, based on the participation of the local stakeholders.

Although such outside-sponsored and supported initiatives may encourage local people to engage in participatory management, in general, the expectations about the sustainable management of NTFP resources should not run too high. For forest people, NTFP extraction is just one way, beside others, of making a living. In general, it is the need to survive and the wish to earn money for desired 'luxury' items that primarily motivate their participation. Although people holding romanticised views of the role of indigenous people in 'saving the rain forest' would like to make us believe otherwise, they are not driven in the first place by a heartfelt responsibility for keeping the forest intact.

6. Conclusion

The role that NTFPs can play in forest conservation, sustainable and participatory forest management or improving the livelihoods of forest-dependent peoples has been the subject of high expectations. Studies carried out under the international Tropenbos programme at various locations in the tropics confirmed that NTFPs play an important role in local peoples' livelihoods, but showed that the scope for commercial exploitation is confined to a few products and may easily lead to over-exploitation.

Because of the important role that NTFPs play in local forest use, it is important to continue research into the possibilities for NTFPs to contribute to sustainable forest management, giving priority to the design of multipurpose and participatory management systems containing a place for NTFP use by local populations. In developing such management systems, it is important to bear in mind that NTFP use forms part of a total livelihood strategy of which other and often less sustainable forms of forest land use also form a part. In order to develop sustainable commercial NTFP exploitation systems, it is important not only to know the ecological parameters, but also to consider local indigenous knowledge and social and economic conditions. The socio-economic situation of forest-dwelling communities cannot be improved on the basis of an extractive economy without policy makers and development efforts giving due attention to the provision of basic needs. In addition, it is necessary to be specific about the aim of NTFP development (conservation, participatory forest management or improved livelihoods) and to consider whether these can better be fulfilled in natural forests or in human-modified vegetation types.

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Appendix: Overview of NTFP Projects in the Tropenbos Programme

Tropenbos-Colombia:

1. *Natural resource management with indigenous communities:* project aimed at drawing up regional natural resource management plans jointly with indigenous communities, through the documentation and analysis of actual forest use. Information collected includes shifting cultivation, hunting, fishing and gathering of NTFPs, as well as the cultural value of natural resources. The project combines indigenous and western knowledge through a participatory approach. Researcher in charge: Clara van der Hammen (Tropenbos-Colombia Programme)
2. *Non-timber forest plant resource assessment in NW Amazonia:* appraisal of resource availability of vegetable NTFPs in NW Amazonia (Colombia, Ecuador, Peru), using a land ecological approach. Includes research on markets and potential NTFP supply of vegetable origin in three pilot areas. Coordinator: Joost Duivenvoorden (University of Amsterdam).[4]
3. *Diagnosis of commercial fishing:* project aimed at the development of a management model for commercial fisheries, based on a comprehensive diagnosis that includes social, economic, cultural and biological aspects, in order to define possible scenarios for sustainable extraction. Researcher in charge: Carlos Rodriguez (Tropenbos-Colombia Programme) (*completed).*

Tropenbos-Guyana:

4. *NTFPs in the NW District and Pomeroon region:* project aiming to increase knowledge about NTFPs in the region through an extensive inventory of NTFPs of vegetable origin and of economic and ecological aspects of their use, extraction and management. To assess the abundance and diversity of NTFPs, 1-hectare inventories are made in different forest types. Includes regular market surveys. A sub-project, executed by Caroline Sullivan of Keele University (UK), deals with economic aspects. Researcher in charge: Tinde van Andel (Utrecht University).
5. *Amerindians as manipulators, consumers, producers and actors in their natural environment:* project aiming to increase knowledge of economic, cultural, social and ecological aspects of the management and use of the natural environment by Amerindian tribes (the Caribs) in the NW district and Pomeroon region, with particular reference to the flora. Special attention is given to changes in management and use resulting from factors like education, contacts with other inhabitants, absorption into the cash economy and changes in government policy. Relationships with timber and gold mining companies also form part of the study. Researcher in charge: Marileen Reinders (Utrecht University).
6. Adaptive strategies of Kariña (Carib) people in the upper Cuyuni/Barama/Barima areas: study of the migratory way of life of scattered groups of Caribs in the area and their response to new extractive industries, gold mining and logging. Researcher in charge: Janette Forte (University of Guyana).

[4] *This project is part of a joint effort of Latin American and European universities to obtain an improved appraisal of the resource availability of non-timber forest plant products in Northwest Amazonia. The project includes research on NW Amazonian markets for non-timber forest plant products and potential supply of these products from mature forests in three pilot areas. The INCO-DC programme of the European Community funds the project as a whole. In Colombia it receives support from the Tropenbos-Colombia programme.*

Tropenbos-Cameroon:

7. *The integration of NTFP resources in multiple-use forest management:* project aimed at assessing the economic and ecological characteristics of NTFPs and at formulating concrete recommendations for the integration of NTFP resource management in sustainable forest management systems and strategies. The objective is to determine the actual and potential value of NTFPs for local people, assess the impact of exploitation on NTFP resources and identify opportunities for increasing the benefits of extraction for local people. Researcher in charge: Han van Dijk (Wageningen Agricultural University).
8. *Peoples' perspective of the forest:* project describing the role of the local population in forest exploitation, their perceptions and knowledge of the forest environment and the possibilities of involving them in sustainable forms of forest management. Researchers in charge: Karin Biesbrouck (Leiden University), Yolanda van den Berg (Wageningen University), Francois Tiayon and Francis Nkoumbele (University of Yaoundé I).
9. *The sustainability of NTFP harvesting: the case of Garcinia lucida.* The aim of this study is to determine the effects of the harvesting of bark and seeds on *Garcinia lucida* populations and to define a sustainable harvest system for *G. lucida* bark, based on participatory monitoring and evaluation techniques. Researcher in charge: Nicole Guedje (University of Yaoundé I).

Tropenbos-Côte d'Ivoire:

10. *Domestication of two fruit tree species from the Taï forest:* project investigating the prospects for domestication and integration through vegetative propagation of two forest fruit trees (*Coula edulis* and *Tieghemella heckelii*) into local farming systems in the Taï region. The ultimate objective of the project is to reduce the pressure on the protected forest areas in the Taï National Park. Researcher in charge: Léonie Bonnéhin (Wageningen Agricultural University).
11. *Hunting wildlife in the region of Taï National Park:* a study focussing on the importance and volume of village hunting and poaching, covering the different stages of game exploitation from hunting and consumption to trade. The study addresses the question of whether the actual exploitation and marketing of game can be transformed into a more sustainable utilisation system. Researcher in charge: Hans-Ulrich Caspary (Humboldt University, Berlin).

Tropenbos-Indonesia:

12. *The economic and ecological potential of NTFPs in East Kalimantan:* study of the economic and ecological potential of rattan and other NTFPs in East Kalimantan, describing the forest vegetation and the abundance and importance of various NTFPs, focusing on rattan and indigenous fruit trees. The inventory gives harvestable volumes of potentially commercial species, with projections of sustainable yield. Researcher in charge: Johan van Valkenburg (Hortus Botanicus/Rijksherbarium Leiden) *(completed).*
13. *Forest management practices of Dayaks in West Kalimantan:* project evaluating the potential of existing indigenous management practices for the development of sustainable and economically feasible smallholder forestry. Researcher in charge: Wil de Jong (New York Botanical Garden) *(completed).*

Bolivia/Brazil:

14. *The social, economic and political aspects of Brazil nut exploitation in the Amazon region:* project aimed at establishing the socio-economic and cultural parameters of sustainable extraction of Brazil nuts. Researcher in charge: Willem Assies[5] *(completed).*

[5] Project jointly financed by WOTRO and Tropenbos and carried out in association with the Programa Manejo de Bosques de la Amazonía Boliviana (PROMAB) based in Riberalta, Bolivia. The latter project is a joint effort of the Instituto para el Hombre, Agricultura y Ecología, the Universidad Técnica del Beni and the Prince Bernard Centre for International Nature Conservation of Utrecht University.

Poster Presentations and Additional Contributions

Optimisation of Forest Use and Regulation of Logging Sizes in State Wood of the Cuban Region

Gennadyi Solntsev, Mikhail Pridnya

Abstract

The forest vegetation of the Cuban is represented by a wide spectrum of forest formations described by a high ecological and resource potential. This forest region has an extremely important value being water protecting, area protecting, recreational and sanitary-hygienic forests. For instance, in the mountainous western part of the region they provide ground power supply of the rivers in size of 35 % of falling precipitation, in the central and South-eastern part – 65 %. On a long of basic power supply of the rivers it is necessary 9 % in first case, in second – 25 % of a flow.

The main forest formations with extremely important values as raw material are oak (54 %) and beech (20 %) forests. The forests, possible for maintenance, cover more than 650 thousands (53 % of total area) hectares. The total stock of timber in state forests of 245 million m³ includes ripe and overaged forests of about 120 million m³.

It is necessary to recognise that usage of forest resources of the Cuban in the present period is unsatisfactory. While the designed cut for main use is 835 000 m³, actual harvest of 800 000 in 1991 has declined in 1998 to 158 000 m³.

The scheduled definitions of intermediate use (cleaning and sanitation cutting) are fulfilled in the planned sizes. However, during the last years it is noticeable, that the tendency of increase of output of timber from cutting of upgrade has mainly commercial character. So, the output of wood in the region from renovation cutting in 1998 has increased in comparison to 1997 by 26 % and has constituted 89 200 m³, which exceeds the designed cutting of this sort of use by 2 times. The cabins of renovation should be conducted in overaged stands, where the main use is not admitted. However, in 1998 more than 50 % of intermediate use is conducted in operation commercial forests. At the same time the sizes, periods and quality of cleaning measures in young forests are reduced.

The technologies of logging in main and intermediate use are regulated by regional rules and manuals designed by the Research Institute of Mountain Forestry and Forest Ecology (RIMFFE). Priority technologies providing saving of the resource and the ecological potential of forests are the technologies on the basis of cable systems and helicopter engineering. The application of tractor technologies is limited to a steepness of inclines up to 20°, apart from protected natural territories (the national parks, local reserves) where soil destructive technology is prohibited completely. However, now all size timber output both from main and from intermediate cut is carried out on the basis of heavy caterpillar tractors, that results in irreplaceable losses of ecological and resource functions of forests. It is proved that the efficiency of a new generation of forest on cutting areas, depending of forest type conditions, is reduced by 10-25%.

Practical stoppage of construction of new forest roads and the unsatisfactory contents available has reduced sharply the sizes of forests accessible to maintenance. Thus, logging is carried on over normative possibilities in the earlier mastered districts. This results in great infringements of the environment and has a negative effect for the quality of forest reproduction.

Today in Russia, there exist no economic responsibility of loggers for the ecological damage of the environment caused by main use cutting. There are legal acts and main normative documents regulating forest use in the region:

1. The Forest Code of the Russian Federation (1997);
2. The rules of cuttings of main use in mountain forests of Northern Caucasus (1992, designed by RIMFFE);
3. Manual on cutting of cleaning in mountain forests of Northern Caucasus (1993, designed RIMFFE);
4. The temporary Guidelines on support of cutting of renovation in forests of Northern Caucasus (1998, designed PIMFFE);
5. Sanitary rules in forests of the Russian Federation (1997);
6. Governmental Order of the Russian Federation "About the minimum rates for wood, saled on roots" 1119 from September 19, 1997.
7. Order of the House of Assembly of the Krasnodar Region "About installation of the rates of card for wood, saled on roots, and rent charge behind use by forest fund" 903-ð from May 26, 1998.
8. Order of the Chapter of Administration of the Krasnodar Region "About the order of collection of card for wood, saled on roots," N 51 from September 14, 1998.
9. Instruction on organisation of operation with permits on the right of transportation and export of wood materials in the Krasnodar Region (1998).
10. Federal law about special protected natural territories, from 15.02.1995.

The strict keeping of mentioned legislation and normative documents on forest use is quite enough not only for optimisation of continuous and inexhaustion of forest use but also for regulation of the stream of wood materials inside and outside of the region. In practice (and it last years became the system), legislation and the normative acts frequently are skipped or are not kept, what the numerous criminal "wood materials" and "forest" businesses testify.

In the Cuban, the priority for forests management should remain the usage of protective properties of forests in relation to raw resources. The mastering of forest resources should be conducted completely with maximal economic effect by continuous and inexhausting

use of timber in view of the age frame of the forest fund. The organisation of main and intermediate use is necessary for realising on watersheds of the rivers in view of their forestness (percentage of forest in total area). The ways and the technologies of cuttings should cause minimum damage to the environment and provide fast natural restoring of cutting areas of main species. Forest users are obliged to carry the responsibility for damages caused to the environment and forests aiming at maintenance of forest resources.

The reproduction of forest resources is determined by the ecology of the region and cuttings of main and intermediate use. It is impossible to accept destruction of the soil, that is accessible by opportune reforestation of cutting areas by valuable native oak species, beech, fir, ash, pear-tree and rapidly growing exotics. Thus the share of silvicultural areas of reforestation should constitute in the oak zone – 35 %, beech – 25 %, fir – 15 %. Silvicultural reforestation should be carried out in strict correspondence with normative documentation designed by RIMFFE (1996).

The perspective of development of multipurpose usage of forest resources of the Cuban consists in the following:

- Accepted in region of forest use solution should promote more complete usage designed cuttings, that will allow follow-up to prepare more than 500 thousand m3 of timber of high quality forest species and essentially increases economic possibilities of the region;
- The intermediate cuttings in the region should be carried out only by forces and resources of organs of the Forest Service, as the destiny of the future forests of the Cuban in this case is solved. The assignment and transmission of these functions to forest loggers practically is reduced to cuttings of seeking and should be prohibited.

For provision of economic incentives for environment protecting technologies of logging, the embedding designed by RIMFFE of specifications of compensating payments for ecological damage by logging is necessarily depending on ways of cutting, steepness of inclines and applied technologies.

The resources, obtained from saling card and rent of forest squares, should completely be transmitted to organs of forestry for the reforestation measure.

In order to rise overall performance of the forest branch and employment of the population, timber should be offered to the market not as raw material but as processed timber, including minor wood materials. The development of accessory and recreational forest use in the first stage should be oriented on surrender of forest areas in rent with an effective control on the art by organs of the Forestry Service.

As a part of scientific support for the forest complex of the region it is necessary to develop:

- Ecological criteria of optimisation of forest use and concepts of sustainable management of the Cuban forest resources;
- Sentence on rise of stability of the Cuban forests, subject to technological contamination;
- Original positions on rise of biological stability and restoring of chestnut forests;
- New version of the computer system "Forest" adapted to taxational and graphic databases of the Forest Service divisions.

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Controls for Sustainable Harvesting of Timber in the Managed Natural Forests of West Africa

Abdul Rahman Adam

Abstract

The humid portion of West Africa has a floristically rich tropical high forest that has been supporting a flamboyant timber industry since the beginning of the 20th century. Large scale logging, timber processing and exports of wood/ products have become important economic activities in the forested countries within the sub-region.

To sustain production of logs for the timber industry and also conserve the forest resource, most countries have instituted regulatory measures. These measures include policy framework, trade regulations and forest management controls.

This paper reviews trends in resource policies and trade regulations vis-á-vis the decline in the forest resource base and global concern for sustainable forestry.

The paper also discusses forest management controls such as frequency of cutting; intensity of cutting, permissible exploitable stem sizes as they relate to sustainable production of timber from managed forest.

In conclusion the paper identifies the information gap which hampers the efficient production of wood in the forest reserves. The need for more studies through collaborative research among scientists and forestry institutions in the sub-region is recommended.

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Use of Resources of Flora and Fauna in the Chocó Biogeographical Area

José Antonio Gomez

Summary of a Poster Presentation

Within the framework of the agreement IIPA – SENA, a study was carried out on the use of resources of flora and fauna in the Chocó region, located in the municipalities of San José of the Palmar, Canton of San Pablo and Bahía Solano, Dpto. of the Chocó, Colombia.

This study was carried out between January of 1998 and February of 1999, with participation of the local communities. The study comprises three methodological elements: agreement, diagnose and identification of alternatives.

The inventory of flora and fauna, its valuation, assessment of handling and use by part of the communities allowed to identify 13 alternatives, grouped in 4 categories: conservation, investigation, food security and direct trade. The socialisation process and spreading of information is conducted by community shops, making delivery besides providing pedagogical materials. These materials are summarized in a set of 5 posters.

Keywords: Ethnobiology, promising resources, primary forest products, Chocó-Colombia

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Preservation of Timber in a Non-Oxygen Atmosphere

Gerold Mahler

Abstract

The Forestry Research Institute of Baden-Württemberg and the Technical University of Dresden developed a new method to preserve round-timber for a long time. The projects has been sponsored by the German Ministry of Food, Agriculture and Forestry.

As a natural product wood would rot if there is no protection. Especially after windthrow or bark beetle calamities together with an excessive supply of timber, it is essential to store round-timber for a longer period. Another reason could be the supply of the timber industry all over the year.

The depreciation of wood is mainly caused by activities of fungi and insects. The new preservation method for round-timber is based on the storage in a non-oxygen atmosphere. In the absence of oxygen, fungi and insect have no base of living. The stems are packed airtight in a polyethylene-sheet. The activity of wood cells being still alive reduce the concentration of oxygen to an immeasurable level. This atmosphere contains no oxygen but much carbon dioxide. It must be maintained during the storage to guarantee the successful preservation of the packed round timber.

Since 1994, 2.200 cubicmeters round timber have been preserved in 45 packages. A pile contains between 20 and 140 cubicmeters of timber. There are experiences in preservation of round timber of spruce (*Picea abies*), pine (*Pinus sylvestris*) and beech (*Fagus silvatica*). Timber of beech was successfully stored for one year, pine for two years and spruce for four years. Last year the method was tested in co-operation with different branches of the timber industry as a part of different timber processing systems. Round timber was preserved for the lumber, furniture and veneer industry.

The most important advantages of the new method, under the political framework conditions in Germany, are to:

- offer reliable protection against damage by fungi and insects
- be independent of the weather
- avoid the use of water and chemicals
- require no authorisation
- conserve timber in nature reserves and water protection areas
- have a high flexibility in place and size of the packed pile and the wood species
- cause minimal costs for control and maintenance.

Storing round timber in a none-oxygen atmosphere could be an alternative for the common preservation method of water spraying.

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