

ALLGEMEINE FORST UND JAGDZEITUNG

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Realising the Environmental Benefits of Forests

As a result of globalisation processes, economies based in the main urban centres drive today's societies. These urbanisation processes have had their impact on forests and other natural resources by e.g. demanding for a wide range of forest goods and services. Apart from the traditional timber production function, the emphasis is increasingly on providing social and environmental services. Forests are popular playgrounds for urban residents, offering a healthy escape from the hectic city life. Moreover, forests have become recognised as regulators and protectors of our water resources, reducers of air and noise pollution and CO₂-levels. Foresters and other natural resource managers are thus increasingly dealing with the manifold demands of urban societies. They have to respect and meet these demands by managing a resource that is under growing pressures.

In recent years, IUFRO (International Union of Forest Research Organisations) has focused on these challenges by setting up a Special Project on "World Forests, Society and Environment". The project is focusing on identifying, monitoring and critically analysing key issues and changing paradigms concerning global forests, in support of sustainable development and the well being of people. The project aspires to promote global cooperation in disseminating scientific knowledge and to enhance the dialogue between policy makers, scientists and researchers. The main outcome of this process was aimed at the XXII IUFRO World Congress in Brisbane, Australia in 2005, by publishing a book entitled "Forests in the Global Balance – Changing Paradigms", focusing on the ongoing or foreseen changing paradigms in the forests, society and environment interface.

At the same IUFRO World Congress, a session entitled "Realising the Environmental Benefits of Forests" was chaired by Prof. Dr. NIELS ELMERS KOCH and Prof. Dr. h. c. KLAUS VON GADOW. As guest editors of this issue, we are glad that AFJZ are contributing to disseminating scientific knowledge in this melting pot of changing paradigms.

The selected papers from the session will cover themes like *globalisation*, *multi-functional forestry* and the *interface between the forest and the city*:

The global scale is taken up by H.-F. ESSMANN et al. (University of Freiburg, Germany). Stressing, that until now, the most evident

feature of the globalisation process has been the intensive interweaving of the financial centres in world-wide operating markets. In this process, the links to national economies, particularly within the forestry sector, are declining rapidly, and the largest enterprises (namely the multinationals) are operating exclusively on a global scale. As a conclusion, an overview of the operative systems of the NGO's in this context is given.

U. PRÖBSTL (BOKU – University of Natural Resources and Applied Life Sciences, Austria) asks the question: Forests in balance? And discusses whether the predominantly European concept of multiple-functional forestry – which is integrating economic interests with those of recreation and conservation in the same areas – now is being questioned? It is emphasised that research can offer a multitude of answers and solutions to these questions. However, it seems that the tradition of multiple uses of European forests is scrutinised for several reasons. It will therefore depend on science, the application of forest management and society at large to maintain the multi-functionality of the forest vis-à-vis short-term and short-sighted changes and re-structuring.

The last paper, by C. C. KONIJNENDIJK et al. (woodSCAPE consult, Denmark), takes up the interface between the forest and the city, and the discussion relating to the fact, that many environmental and social services provided by urban and peri-urban forests are difficult to assess and quantify, for example, in monetary terms. To illustrate the presented problems, examples of tools for assessing the multiple benefits of urban woodland are given. It is concluded, that a number of assessments show that the services provided by urban forests can be considerable – and there is a need to develop assessment approaches that can strengthen the policy-science interface by acting as decision-support tools.

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Die Vielnutzung der Wälder und ihre Umsetzung

Bedingt durch die allgemeine Globalisierung ist die Wirtschaft der Ballungsgebiete eine treibende Kraft der Gesellschaft. Die Urbanisierung hat inzwischen einen großen Einfluss auf die Nutzung der Wälder und anderer natürlicher Ressourcen, zum Beispiel durch die Nachfrage nach einer breiten Palette von Produkten und Dienstleistungen aus dem Wald. Abgesehen von der traditionellen Holzproduktionsfunktion, werden in zunehmendem Maße soziale und ökologische Dienstleistungen erwartet. Wälder sind beliebte Erholungsräume für Stadtbewohner, sie bieten einen gesunden Ausgleich zum hektischen Stadtleben. Außerdem hat man erkannt, welche bedeutende Rolle den Wäldern zukommt, nicht nur in Bezug auf die Regulation und den Schutz der Wasserressourcen, sondern auch im Hinblick auf Verbesserung der Luft, Lärmschutz und Reduktion der CO₂ Konzentration. Förster und Umweltmanager befassen sich daher vermehrt mit den vielfältigen Ansprüchen der urbanen Gesellschaft. Sie müssen diese Ansprüche erkennen und in Einklang bringen mit der zunehmenden Belastung der Ressource Wald.

In den letzten Jahren hat sich die IUFRO (der Internationale Verband Forstlicher Forschungsanstalten) verstärkt diesen Herausforderungen gestellt, zum Beispiel in Gestalt des Sonderprojektes „World Forests, Society and Environment“. Dieses Projekt hat sich zum Ziel gesetzt, die Schlüsselprobleme und den Paradigmenwechsel bezüglich der Wälder der Erde zu identifizieren und kritisch zu bewerten, unter Berücksichtigung nachhaltiger Entwicklung und zum Wohl der Bevölkerung. Das Projekt fördert die globale Kooperation durch die Verbreitung wissenschaftlicher Erkenntnisse und durch den verbesserten Dialog zwischen Politik, Wissenschaft und Forschung. Ein wichtiges Ergebnis dieses Prozesses war die Veröffentlichung des Buches „Forests in the Global Balance – Changing Paradigms“ zum XXII. IUFRO Weltkongress in Brisbane, Australien im Jahr 2005. Hauptthema dieses Buches sind gegenwärtige und zukünftig zu erwartende Paradigmenwechsel an der Schnittstelle Wald, Gesellschaft und Umwelt.

Während dieses IUFRO Weltkongresses leiteten Prof. Dr. NIELS ELERS KOCH und Prof. Dr. KLAUS VON GADOW eine Veranstaltung mit dem Titel „Realising the Environmental Benefits of Forests“. Als Gastherausgeber dieses Sonderheftes freuen wir uns, dass die *Allgemeine Forst und Jagdzeitung* in diesem „Schmelztiegel wechselnder Paradigmen“ zur Verbreitung wissenschaftlicher Erkenntnisse beiträgt.

Die ausgewählten Beiträge der Veranstaltung befassen sich mit den Themen *Globalisierung, multi-funktionale Waldnutzung* und mit der *Schnittstelle zwischen Wald und Stadt*.

Das Thema Globalisierung behandeln H.-F. ESSMANN et al. (Universität Freiburg). Sie betonen, dass die intensive Vernetzung der

Finanzzentren in weltweit agierenden Märkten als bisher offenkundigste Erscheinung der Globalisierung zu werten ist. In diesem Prozess werden die Bindungen zur nationalen Ökonomie immer schwächer, besonders im Sektor Forst. Die größten Unternehmen (die sog. „Multinationals“) agieren ausnahmslos global. In diesem Zusammenhang wird abschließend eine Übersicht der operativen Systeme der NGO's gegeben.

U. Pröbstl (Universität für Bodenkultur, Wien) stellt die Frage: Wälder im Gleichgewicht? Steht das vornehmlich Europäische Konzept der multi-funktionalen Waldnutzung – welches wirtschaftliche Interessen und Ansprüche der Walderholung und des Naturschutzes auf gleicher Fläche zu vereinbaren sucht – derzeit zur Debatte? Es wird betont, dass die Forschung eine Vielzahl von Antworten und Lösungen für diese Fragen anzubieten vermag. Anscheinend wird die europäische Tradition der Vielnutzung aus unterschiedlichen Gründen hinterfragt. Ob das bewährte Prinzip der Multifunktionalität angesichts kurzfristiger und kurzfristiger Veränderungen und Umstrukturierungen erhalten bleibt, wird bestimmt vom Dialog zwischen Wissenschaft, Forstpraxis und der Gesellschaft.

Der letzte Beitrag, von C. C. KONIJNENDIJK et al. (woodSCAPE consult, Dänemark), befasst sich mit der Schnittstelle Wald und Stadt. Es wird betont, dass zahlreiche umweltrelevante und soziale Dienstleistungen, die durch urbane und peri-urbane Wälder erbracht werden, schwierig zu erfassen und zu quantifizieren sind, zum Beispiel in monetären Einheiten. Zur Veranschaulichung dieser Probleme werden Beispiele gegeben, wie die vielfältigen Leistungen urbaner Waldlandschaften erfasst werden können. Einige Auswertungen zeigen, dass die durch Stadtwälder erbrachten Dienstleistungen beträchtlich sein können. Es besteht ein Bedarf an Verfahren der Erfassung und Bewertung, sodass die Schnittstelle Wissenschaft-Politik durch Hilfsmittel der Entscheidungsunterstützung gestärkt wird.

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Influence of globalization on forests and forestry

(With 3 Tables)

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Economic Globalization; Forest Values; Non-wood Forest Products; Civil Society.

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INTRODUCTION

At the beginning of the 1990s, a broad public debate over globalization was initiated in most the developed countries. Within this timeframe, globalization processes have firstly been seen as coincident with and strongly characterized by the expansion of multinational companies, as a quasi imperialistic conquest and domination of new markets by capitalistic societies, particularly by the highly developed industrial nations.

This development was very critically noticed and for the most part negatively judged by outside observers, especially by NGOs and grass-root movements both in developed and developing countries. Globalization was considered a trap that presented a danger for the people, even threatening the existence of the societies themselves (REIMANN, 2002; MARTIN and SCHUMANN, 1998).

In the meantime, the discussion has changed considerably. Globalization is no longer only seen as a negative process but also understood as providing an opportunity for further development. Moreover, it is noticed that the phenomenon is not restricted to the economy. It fosters the development of a new worldwide view (NASSEHI, 1998). It has become evident that occurrences in one part of the world can massively affect people in distant places, whether they are military conflicts, environmental, economic, and financial crises or issues related to population growth (just to name a few). This harsh judgment is gradually being replaced by scientific analyses, which are based on objective criteria as generally assumed.

“In this so-called era of rapid change, it may be difficult to distinguish between changes that are superficial and those that are fundamental” as recently NAIR (2001) wrote about changing forestry scenarios; nevertheless, it is important to identify which will possibly be the driving forces – within the main global trends – in modifying the existing situation in forestry and which will be the challenges that forests will face in the new socio-economic scenarios.

Though globalization has to be understood as a phenomenon that affects all spheres of human life, in public discussion globalization is almost always equated with financial as well as economic globalization and mainly regarded by many people in the developed countries - but certainly not only there - as a danger to prosperity and social stability. BECK (1997) describes this pessimistic view of development as “globalism”, an interpretation that the world market drives out or replaces political action, that is to say the ideology of world market dominance, the ideology of neo-liberalism. It proceeds mono-causally, economically, reduces the multidimensionality of globalization to one dimension, the economic dimension, which is also still thought of in linear terms, and places all other

dimensions – ecological, cultural, political, civil-social globalization – if at all, into a subordinate position in the world market system. This is certainly true if economic globalization is viewed as a part of universal globalization. Nonetheless, it is the most important part and the actual engine of universal globalization. This also applies when its effects on forestry are considered. In fact, the following hypothesis may be formed: economic globalization influences forestry the most intensively and, furthermore, gives rise to other changes beyond those that are purely economical in nature.

In the following, economic globalization is described along its main features (chapter 1), the influence of globalization on forests and forestry (chapter 2) and their values (chapter 3) referring to wood production and trade and the production and trade of non-wood forest products (NWFP) are being outlined, and the role of new actors governing the forestry sector is being discussed (chapter 4). Results and findings as well are interpreted in the conclusions (chapter 5).

1. ECONOMIC GLOBALIZATION

1.1 Main features

Globalization is accelerating to include more and more aspects of economic activities. In fact, it appears as though no possibilities exist to evade this trend in the long term. The pressure to adjust leaves no room for alternatives. Economic activity is increasingly taking less consideration for national boundaries. Multinational corporations (MNCs) already appear at times to ignore national borders and the rules that are valid therein. In these instances, WEBER (2002) simply states that national politics is being ousted by the politics of larger, globally-acting enterprises and associations.

The main characteristics of economic globalization are:

1. growing number of international or transnational *direct investments* in new businesses, which as a rule are the daughter companies of the investing enterprises.
 2. financial flows (*financial transactions*), the extent of which in the meantime is larger than that of the exchange of goods, and
 3. large diffusion of the *new technologies* on the world-wide markets
- and – as a result of all of these phenomenon - highly accelerated commercial flows of goods and services.

The process is positively supported by those countries or communities that have a special interest in globalization, e.g. those that profit from it the most. They alleviate access to their markets through the abolition of customs and duties; they allow the free convertibility of currencies; they support the liberalized transfer of finance over national borders. Tax havens for off-shore-banking arise; state controlled economic sectors are deregulated; free-trade zones allow for the establishment of new production sites – especially in the least developed countries. National political decisions, such as the liberalization of immigration and the easing of restrictions on residence and work permits for foreigners, additionally enhance and ease economic globalization.

1.2 Direct investments

In the public consciousness, it is the transnational direct investments that are generally equated with economic globalization but

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also with the negative concomitants that were previously associated with the term “globalism”. Whereas between 1975 and 1985, direct investments had roughly the same value as production or export in the industrial countries, today their value has doubled (DICKEN, 1998). In the meantime, not only the largest companies (MNCs) are taking part in these ventures but so are the middle-sized enterprises.

Lower wage costs in the newly industrializing and developing countries, the proximity to growing consumer goods markets (e.g. China), and small transportation costs (due to the increased efficiency of the transport systems and to comparably low fuel prices not regarding externalities) for the needed raw materials, as well as semi-finished and finished products have, for the time being, played the most important roles. The developed industrial nations supported direct investments in the developing and newly industrializing countries through awarding credit under the most favorable conditions and providing technical and logistic know-how. The affected countries, on the other hand, created incentives through tax and duty exemptions or through the inexpensive, in part even free supply of production facilities. Wage-intensive businesses were the winners of this development.

With the rising level of pay in the newly industrializing countries, these branch businesses of the large enterprises became so-called run-away-factories in just a few years; that means they were delocalized to the developing countries. In other words, they followed the smaller wage costs. The transfer was bound together with only a slight loss of fixed capital costs, because these were small and the production techniques were easily transportable. However, soon it was seen that the work productivity in the developing countries was too small because of the deficiency of qualified personnel and other comparable factors and the declining public funding parallel to the reduction of the impact of the national policies.

On the other side, globalization trends are offering unique opportunities to local small-scale business to have large (virtually global) potential market. A Chihuahua wood artisan may have his products sold in Europe simply by a web-page, describing and offering the local craftsman to wherever. The role of the global tools – Internet is the main instrument of them – is providing opportunities to a larger number of consumers to act directly on the global markets, both as individuals and as parts of larger networks. Maybe, that the Internet is applicable to specialty products only and not to large volume of (timber) commodities. However, that cannot be denied in the future.

The expanding role of the MNCs is ‘balanced’ by the growing role that the individual initiatives can play in globalized socioeconomic scenarios (see chapter 4). In fact, the expected overall standardization of the mass consumes – as predicted by many analysts at the beginning of the 1990s – is not yet occurring, mostly due to the growing chances for the consumers to have access to a larger sphere of goods and services.

1.3 Financial transactions

In the sphere of the production of goods and services, a strengthened decentralization is to be observed. In contrary, financial transactions are increasingly carried out from global centers: foremost from London and New York still. The global centers having gained influence as national financial markets in the developed countries could no longer reinvest accumulated capital within the borders of their own countries. New transnational opportunities for investment were sought and found. Enormous flows of capital resulted, which were distributed throughout the entire globe into and out of global financial centers. In addition, a number of smaller places still exist for off-shore-banking, which may be used for money laundering and tax evasion.

In the past, strict state-control and observance of national borders and points of entry limited the widespread international flows of finances and their concentration in a few large centers opposite other financial markets. First, large-scale deregulation permitted the increased networking between different financial institutions such as banks, pension funds, and insurance agencies, leading, in this case as well, to increased concentration and eventually global linkage. The result has been a greater interdependence of financial markets on one another in good times as well as bad.

1.4 New technologies

Recent globalization phenomena have been tremendously accelerated by the impact of the latest technologies and their large diffusion on the world-wide markets.

The digital era and the “informatisation” of most of the production, the free flow of information from individuals, as well as distribution – features are changing considerably the role and the importance of the traditional economic sectors. Amongst them, forestry has always played an instrumental role, to the establishment of both the agrarian and industrial society (cleared by the agriculture and exploited by the industries – source of energy, food, shelter and physical material).

The future socio-economic scenarios rely less and less on the availability of the local natural resources; the ‘immensely expanding flow of information is electronically based, and has no need for material paper-based support’ (DI CASTRI, 2001)¹⁾. “Virtuality” tends to dominate to materiality and the trend is increasing in the dematerialized societies. Most of the recently created job placements are no longer in the manufacturing sectors (most of the traditional forestry jobs are disappearing).

While globalization is increasing the interdependency of countries and societies, more pluralistic institutional arrangements are emerging (FAO, 1999). The rapidly expanding access to information and the growing long-distance operational tools are dramatically changing the centers of power and authorities. The traditionally State-focused decision-making and -taking processes are being more and more delocalized at regional and sub-regional levels.

2. INFLUENCE ON FOREST AND FORESTRY

2.1 Common trends

Within the framework of the accelerating globalized scenarios, it is interesting to analyse the precious “duality” of forests, as renewable natural resources – on one side – and key elements of territorial development, on the other. In fact, since its inception management of forests has always implied components of the sustainability principles; the identification of the ratio of wood exploitation – not exceeding the natural average increment to guarantee the perpetuation of its productive function – is just one of the aspects of the operative framework that has made forests “living laboratories” of sustainable resources management.

Forests will continue to play an important role in the global economic scenario, being estimated their 5,000 commercial products – mainly construction timber, furniture, paper and firewood – contribute to some 2 percent of the world GDP (FAO, 2000). Consequently, forests and forestry are affected in various ways by economic globalisation. This is especially true with regards to the environmental policy affecting forests, such as climate protection and the conservation of biodiversity

In all cases in which there was a lack or complete absence of suitable conditions for sustainable development, the harvesting of

¹⁾ If somebody may object the present paper consumption is still increasing does not mean that in the middle run described effect will not occur.

wood was carried out without any great consideration for the forest and the environment. The damages often extended far into the adjacent woodlands. As a result of logging roads, hunters, farmers and others had easy access to the forest and further exploited its resources (WEBER, 2002).

The issue of the “disappearing forests”, considered as one of the most drastic and evident outlook of a globalized market, is, nevertheless, still controversial. It is interesting to notice, that there is to observe a controversy about whether there is a continuous loss of forestry resources worldwide²⁾ going on or not accompanied by some attempts in putting order within the available data on those aspects. “It is difficult to determine what actually constitutes forest, because there is a gradual transition from dense rainforest to savannah to bush steppe, in the same way as trees become less tall and stand further apart as one approached the tree lines” remarked LOMBORG (2001) “but there is no ground to make such a claim (of a steady loss, the authors). Globally, the overall area covered by forests has not changed much since 1950.”

The multi-actors international community tends to reflect this dualism also in terms of combining the commercial use of forests for timber production and the non-wood forest products (NWFP) with stronger protection regimes of the remnants of pristine stands. The “Congo Wildlands Protection and Management Project”, developed in 1991 by World Bank (WB) and the Global Environment Facility (GEF)³⁾, represents an exemplary case of a controversial intervention related to forestry, reflecting how this globalized dualism is far from being solved. The project was devised exclusively by the WB, in consultation with officials from Congo, and aimed ‘to protect bio-diversity in the rich, untouched Nouabele rainforest in the North of the Republic of Congo’ (RICH, 1994). Yet this GEF project was soon overshadowed by leaked reports that the WB was simultaneously planning to finance separately commercial logging in the country through funds designed to facilitate the transport and export of logs.

More and more the global phenomenon of the growing urban sprawl is offering forestry a challenge outside its traditional rural domain: “Forestry serving urbanised societies” as the title of the IUFRO Conference organised in Copenhagen, Denmark, 27–30 August, 2002, stressed the growing attention posed by the international scientific community to the assessment of the positive externalities of well managed forests within and nearby cities. The task oriented comprehensive urban forestry (KROTT, 2002) has become a structural and functional factor for health benefit in highly urbanised contexts, oriented towards a more ‘natural living environment’ (DE VRIES, 2002).

Parallel, a growing trend in considering forests as key elements of a larger ‘territorial dimension’ of the sustainable development⁴⁾ is emerging and being reflected in relevant international policy documents (treaties, conventions and strategies).

²⁾ “Deforestation: the global assault continues”, as titled by the World Resources Institute in its 2000 report or the Worldwatch Institute perspective (1998) denouncing that “deforestation has been accelerating in the last 30 years”, just to mention two of the best known.

³⁾ The consolidating position of the World Bank has moved in the 90s as “the lead agency in ‘sustainable development’, assuming the mantle of ‘global environmental manager’ through its control over ‘green’ aid flows between the First and the Third Worlds” (BRYANT and BAILEY, 1997). The primary way in which it has done so has been through management of the newly created Global Environment Facility (GEF).

⁴⁾ To make a better use of the spatial planning as the correct arena and instrument of the sustainable policies is the major political message derived from the recent ENTO (European Network for Training Organisation) meeting (March, 2005), held at the Council of Europe in Strasbourg, where experts on training for sustainable land use planning gather to discuss the best way to make use of the natural emergencies for local development plans.

Starting from the pure biological side, the *Convention on Biodiversity* represents an international legal frame inside which forests find a relevant location “The Convention of the Parties (COP) has urged the GEF to give high priority to the allocation of resources to activities that advance the objectives of the Convention in respect of forest biological diversity”.⁵⁾ In operative terms, „in its long-term programme of work the COP decided that forests would form on the three priority themes for COP6“. ⁶⁾ It also called on Parties to take a number of practical steps to address urgently the conservation and sustainable use of forest biological diversity, noting that such work should contribute to the future work of the United Nations Forum on Forests (UNFF).

Furthermore, the role of forestry is recognised of crucial importance within the Council of Europe framework related to the *European Landscape Convention*. In particular, the *Pan European Biological and Landscape Diversity Strategy* (PEBLDS) – similarly to the European Union Biodiversity Strategy also introduces the concept of nature restoration zones. In particular, when the focuses are mentioned, the action plan implementation will help to – *inter alia* – “use the opportunities provided by sustainable forest management and a-forestation for the development of national ecological networks as part of the *Pan-European Ecological Network*, especially for ecological corridors and stepping stones, while promoting the use of the site selection guidelines for a-forestation to be developed under the joint PEBLDS/MCPFE work programme”.

2.2 Regional variations

Globalization processes are not occurring everywhere in the world with the same features and intensity. In fact, a FAO analysis⁷⁾ shows how, despite some common trends and threats concerning the development of the forests and forestry sector expected by the year 2050, relevant difference can be identified in the diverse regions of the globe.

As the former aspects (common trends) are concerned, it seems clear that in all regions natural and semi-natural forests will be further managed to respond to the growing issues identified by the international debate platforms, as reflecting a larger public demand (in developed countries for sure, in developing countries with less intensity yet). Among them, forest will be serving an increasing demand of outdoor recreation, mostly expressed by an expanding urbanized society. Traditional landscape conservation and maintenance will be part of the related strategies to be adopted by the forestry managers, while plantations are expected to produce the bulk of the fiber needs.

Watershed protection, carbon sequestration and biodiversity protection have been identified as the key elements to be included in any sustainable forest management plan where necessary⁸⁾. Some concrete steps in this direction are defined by the efforts to develop and refine globally applicable criteria and indicators for sustainable forest management, certification and labeling, codes of logging practices and the extension of protected areas.

Due to the diffusion of the “close-to-nature” silvicultural approach in the forest management plans (I.S.E.A., 1986), harvesting in natural forests will be diminishing⁹⁾; on the other side, more

⁵⁾ Decision VI/16, annex I.

⁶⁾ *ibidem*.

⁷⁾ Unasylva issue, volume 52, p. 33–51.

⁸⁾ The ratification of the three most important conventions resulted from the 1992 *UN Conference on Environment and Development* (the Convention of Biodiversity, the Convention on Climate Change and the Convention for Combating Desertification), reflected into the forest management, by modifying the traditional goals and instruments (new sets of criteria and indicators have been identified to implement sustainable forest management).

⁹⁾ In the developing countries the use of these forests for fuel wood may last for a unpredictable period of time though.

wood demand will be supplied by production from forest plantations. Furthermore, the production of wood and wood products will be boosted through technological improvements, including development in biotechnology and optimization in production chains. Government funds for forestry will be reducing and investments for plantation, management and processing will be more in the private hands.

3. IMPACT ON FOREST VALUES

3.1 Production and trade of wood

The basic role of forestry in providing physical supply to the wood and wood based products will remain (most likely stable) but the overall importance of the sector is likely to decline (DI CASTRI, 2001) because some forest products are becoming obsolete, uncompetitive vis-a-vis other materials or they are out of fashion.

More specifically, scientific and technological advances “enhanced utilization potential for several selected species, reduced raw material requirement through improved efficiency in processing, substitution and lowered emission of pollutants” (NAIR, 2001). On the other side, recycling techniques and processes have been adopted by a larger public, thus resulting into a reduction in the demand of round wood (ABRAMOWITZ and MATTON, 1999), while the use of wood based materials is slightly increasing still.

The globalizations of the results of the scientific research on genetic selection, tree breeding, and rapid multiplication techniques have disseminated new tools in traditional forest management, thus radically transforming the local uses and greatly increasing growth rates and productivity of plantations.

As it was observed the tendency towards the further liberalization of world trade, massively supported by the WTO with the reduction of duties affecting traded forest products, the liberalization of agricultural production, and the facilitation of transnational direct investments and services make the conservation of forests and ensuring the sustainable use of their resources all the more difficult. There is evidence that the increases in direct investments and trade through transnational acting enterprises have caused and continue to cause damages to forests, especially in the tropics and subtropics, but also increasingly in the boreal forests of Russia, additionally to several other impacts as the population growth accompanied often by forest clearing for agricultural use.

According to FAO (Forestry web site) “...forest products sector is estimated to contribute about one percent of world gross domestic product and to account for three percent of international merchandise trade. The annual turnover of roundwood, sawnwood, panels, pulp and paper exceeds USD 200 billion.”¹⁰⁾ In fact, of all the raw materials traded on the world market, wood stands in third place. The MNCs control 80–90 percent of this tradable wood

(WEBER, 2002), a market position that leaves little room for competition or the effective control of policies, e.g. forest policy.

Furthermore, it is important to notice that the engagement of large MNCs in the forestry sector has increased over the past several years. A number of mergers in this economic sector have allowed newly formed enterprises to increase their influence on production and trade enormously. All the while, such companies are becoming more and more independent from national and international policy (see table 1)¹¹⁾. In order to remain competitive and reduce production costs, they have acquired new concessions and have established production facilities in countries where wages are smaller, state-subsidies convenient, and environmental laws relatively lax. In fact, recently most direct investments in the forestry sector were made in low-wage countries with extensively forested areas (WEBER, 2001; RICE *et al.*, 2000).

Referring to table 1 and regarding other development trends to be recognized globalization in the forestry sector seems to become a concentrating, not to say monopolizing force. It has also extended its influence to the ownership of forest land. As is also the case with other raw materials, forest resources are passing in growing magnitude into the possession of a few large enterprises. It is estimated that the fifty largest forest enterprises own around 140 million ha of forest land, comparable in area to all of the lands managed by European and Scandinavian forest enterprises put together. Moreover, numerous other forests are subject to the agreed upon sale of their wood to these MNCs¹²⁾. Otherwise, from an economic point of view globalization in terms of concentration may be evaluated as a positive impact because of stimulating competition for more efficiency worldwide.

Looking at supply and demand for wood and wood products, SEDJO (2001) predicts that by the year 2050 most industrial wood will come from a small area of plantation forests (75 percent against 34 percent in 2000), while natural forests will remain as sources of environmental and other non-wood service. Surely, a continue innovation in wood processing technologies will be needed to maintain wood competitive with other materials (SALES, 2001).

The rapid spread of technical innovation, propelled by economic globalization, has a notable impact on forestry and its important product, the raw material wood. Solid wood substitutes, like MDF or OSB, have allowed the demand for high quality wood to sink.

¹¹⁾ <http://www.fao.org/forestry/foris/webview/forestry2/index>.

¹²⁾ The role MNCs playing in the forestry sector is pointed out in this paper without any judgement of being “positive” or “negative”. As IIED (Bass, St. and Hearne, R., 1997: *Private Sector Forestry: A Review of Instruments for Ensuring Sustainability*. IIED, London, 70 p.) reported the concentration process is also resulting in accountability of large enterprises and their vulnerability against the protest and request of the civil society which one may call “positive”. IKEA, for example, is much more exposed to critics of NGOs than other smaller-scaled furniture sellers.

¹⁰⁾ <http://www.fao.org/forestry/foris/webview/forestry2/index>.

Tab. 1

Some of the main Multinational Corporations operating in the forestry sector.
Einige der wichtigsten im Forstsektor tätigen multinationalen Unternehmen.

Multinational Corporations (MNC)	Turnover in €	Countries with plants	Employees	Ownership and concession on forest in ha
International Paper	19,250,000,000	40	83,000	7,800,000
Weyerhaeuser	15,323,000,000	18	55,000	15,400,000
Stora Enso	12,400,000,000	40	45,000	3,400,000
UPM Kymmene	7,546,000,000	16	33,400	2,300,000

Source: web sites; data referred to 2004.

But if the economic foundation is endangered, the consequences for forestry on the whole can be far-reaching. The question of whether or not such a development is advantageous or disadvantageous for forests does not allow itself to be answered in general form, because the answer depends in great deal on the economic, social, and cultural importance that forests have for a country's society with regard to the benefits the people are gaining from them.

3.2 Production and trade of non-wood forest products

Non-wood forest products (NWFPs) are crucial resources for livelihoods in many parts of the world, but their primary significance is for subsistence and/or income at the household and village levels in rural forested areas (ARNOLD, 1995; CHANDRASEKHARAN, 1994). So how can globalization have an influence on the use of

NWFP, when these products are mainly for subsistence or informal local markets? Some NWFPs are export commodities and are significant in international trade.

In the following, trends in global trade of major NWFP are analyzed to identify why their importance for international trade is changing and if these changes can be (partly) attributed to globalization factors. However, it must be noted that the impacts of globalization on NWFP production are not limited to those from trade only. The use of NWFPs, even at the subsistence level, is also influenced by other globalization factors such as easier access to information (via internet, radio, TV, movies, prints) which facilitates a rapid and global dissemination of concepts like sustainability, indigenous people rights, fair trade as well as other phenomena with increasing global impacts such as fashion, mass tourism, or growing concern for the environment.

Tab. 2

Global import values of key NWFPs for 1992 and 2002 (in USD 1000).

Wert weltweiter Importe von Nicht-Holz Waldprodukten in 1992 und 2002 (in 1.000 USD).

HS 2002 Code**	Commodity description	Global Import value (USD, in 1,000)	
		1992	2002
060410	Mosses and lichens for bouquets, ornamental purposes	9 352	25 476
070952	Truffles, fresh or chilled	4 201	23 656
070959	Mushrooms other than <i>Agaricus</i> , fresh or chilled	n.a.	364 412
071239	Mushrooms (excl. 071331/33) & truffles, dried	n.a.	219 458
200320	Truffles, prepared or preserved, not in vinegar	3 049	11 012
080120	Brazil nuts, fresh or dried	44 344	59 848
080240	Chestnuts, fresh or dried	109 958	184 663
230810	Acorns and horse-chestnuts for animal feed	1 216	7 380*
120792	Shea nuts (karite nuts)	5 155	5 136*
121110	Liquorice roots	33 455	24 310
121120	Ginseng roots	389 345	221 435
121190	Plants & parts, pharmacy, perfume, insecticide uses	689 926	777 980
121210	Locust beans, locust seeds	22 395	40 239
130110	Lac	25 286	25 653
130120	Gum Arabic	101 312	105 510
130190	Natural gum, resin, gum-resin, balsam, not gum arabic	92 755	96 535
400130	Balata, gutta-percha, guayule, chicle and similar gums	26 726	13 605
130214	Pyrethrum, roots containing rotenone, extracts	27 865	26 173*
140110	Bamboos used primarily for plaiting	37 562	50 054
140120	Rattan used primarily for plaiting	118 987	51 327
140210	Kapok	11 920	2 826*
170220	Maple sugar and maple syrup	43 632	116 202
200891	Palm hearts, otherwise prepared or preserved	16 082	67 514
320110	Quebracho tanning extract	51 938	45 173
320120	Wattle tanning extract	63 877	34 168
320130	Oak or chestnut extract	8 653	917*
450110	Natural cork, raw or simply prepared	7 874	110 702
530521	Abaca fibre, raw (<i>Musa textilis</i>)	15 221	20 374
	Total of 28 (26) products	1 992 086	2 731 738 (2 147 868)

Source: Comtrade data (www.unsd.org/comtrade).

n.a.: not applicable as this code did not yet exist in the HS 1992 version.

nes : not elsewhere specified.

* values for 2001 (as no longer in HS 2002).

** The Harmonized Commodity Description and Coding System (HS), is a multipurpose international product nomenclature developed by the World Customs Organization (WCO, 2004). It comprises about 5,000 commodity groups, each identified by a six digit code, arranged in a legal and logical structure and is supported by well-defined rules to achieve uniform classification. The system is used by more than 190 countries and economies as a basis for their Customs tariffs and for the collection of international trade statistics. Over 98% of the merchandise in international trade is classified in terms of the HS (<http://www.wcoomd.org>).

Twenty-eight of the most important commodities traded internationally that can be considered as, or include NWFPs, are listed in *table 2* and with their global import values given for the years 1992 and 2002, of which we assume that during that period globalization phenomenon spread remarkably.

In 2002, the world's total (declared) import value of the 28 products in *table 2* amounted to USD 2.7 billion and of which approximately USD 1 billion is from developing countries. Excluding the 2 commodities, for which specific HS codes did not exist in the 1992 data, the total import value of these 26 NWFPs increased (in current dollars) from USD 1.99 billion in 1992 to USD 2.15 billion in 2002, while the value of all international trade increased 2.5 times over the same period (COMTRADE, 2004).

Trends in the trade of NWFPs need to be interpreted very cautiously. The above statistics suggest a very modest increase (in current USD value) of the trade in these 26 NWFP. In absolute values however their importance for trade is diminishing. However, a closer look at the table reveals different trends for different type of products.

Half of the 26 commodities see their international trade values declining (or stagnating). The biggest losers are the raw materials type of products like: Balata; kapok: rattan cane; wattle-, oak- and chestnut extracts; liquorice and ginseng roots; brazil, shea or karite nuts; lac; gum Arabic and other gums; and pyrethrum roots and rotenone extracts (STEWART, 2003). This is either because their resources have been depleted or they became obsolete and/or replaced by synthetic materials (Iqbal, 1993). In general, globalization will further marginalize the importance of these NWFP, and particularly those traded as raw materials, as their supply simply can't cope with the global demands or these products no longer fit consumer demands (FAO, 2005).

International trade increased significantly for natural cork, mosses and lichens for bouquets, truffles, mushrooms (other than *Agaricus*), chestnuts, bamboo, palm hearts and maple syrup. Interestingly, these NWFPs originate mainly from, and are traded among developed countries. Also, these commodities are processed locally into semi-finished products with raising unit prices. Of particular interest is the fast increasing value of trade in "specialty" food products like maple syrup, palm hearts (canned); mushrooms and truffles (fresh, dried, graded and packaged; New World Truffleries; 2003). Specialty foods are among the fastest growing segment in the food catering business and several edible NWFP are ideally fit for niche marketing, such as pine nuts, bamboo shoots or wild edible mushrooms. The reduction (and/or elimination) of import tariffs, increasingly globally applicable (food) quality standards and changing consumer (food) preferences are creating global markets for products which previously were only locally available.

For example the American Pacific Northwest region is now the world's major supplier of quality shiitake mushrooms (ALEXANDER *et al.*, 2003). It is expected that the value of trade in these products will further increase, particularly in view of the rapid growing numbers of affluent consumers in Asia. Globalization will indeed further stimulate more demand for such products for which their trade is expected to further expand.

However, while trade is increasingly becoming global, the increasing demand results in serious supply problems for many of the "wild-gathered" NWFPs. Unlike timber, that is widely available from many species and suppliers from all over the world, NWFPs are basically "local" products, obtained from few species with a limited geographical occurrence, often in a few countries only. Global trade requires products in quantities that by far exceeds their sustainable supply from the forests and in qualities which can no longer be met through a myriad of dispersed artisan producers (DE BEER *et al.*, 1989; BELCHER *et al.*, 2001; FAO, 2001).

But globalization also provides strong incentives to investors and (industrial scale) producers for domestication of forest species and their mass production outside the forests through intensive farming techniques often in a much wider geographical region than its original native occurrence (HANKINS, 2000; SHACKLETON, 2002). Although domestication of NWFP species may have many benefits, it ultimately reduces the value of these species in the wild and as such, of the (native) forest as a whole. The full impact of globalization on NWF production needs further clarification, particularly regarding the resource sustainability and the social consequences on the livelihoods of forest dependent people, and when considering how fragile NWFP extraction systems are when trade volumes increase and how limited the options are for forest gatherers to adjust to global trade, when these NWFPs are now produced by farmers (WFC, 2003).

4. CIVIL SOCIETY AS NEW ACTOR

For many years the forestry sector has been dominated by three key actors operating at national and local levels (KORTEN, 1992): public forest agencies, forest schools, forest owners and wood working industries. Public forest administration agencies have defined policies and the regulative framework to control forest exploitation. Forest schools have been in charge of the process of developing management techniques and educating young forest professionals. Forest managers and the wood working industries have been responsible of applying the most profitable techniques for wood exploitation and processing.

In the last three decades these key actors have been involved in a process of globalization and networking at international level, but meanwhile other actors have entered in the forestry sector playing new and increasing roles. As a result of this process, besides a process of globalization serving the need for coordination of public policies or the business interests, stakeholders have emerged from civil society; which are promoting active citizenship based on ethical principles like: environment conservation, equality, participation, and human diversity and solidarity. These stakeholders operate through an increasing number of non-governmental organisations (NGOs) with a large diversity in the field of activities, in scope (from local to international), in the system of accountability.

It is widely accepted that the role of NGO's in the governance of the forestry sector at international level is remarkably increased in the last decades (MANKIN, 1998), thanks also to the NGOs' diversity, their active presence in many areas of concern related to the management of forest resources and the different relationships with the traditional key actors in the forestry sector (from collaborative partnership to strong opposition).

In analysing the NGOs advocacy and concrete operations in the global governance, WEISS (1999) points out three distinct ways for setting agendas: (a) consultations and lobbying; (b) surveillance; (c) policy-making and decision-making.

The role of NGOs in *consultations and lobbying* in the forestry sector has increased both through the organisation of international meetings (the parallel NGOs conferences or forums starting from the 1972 Stockholm Conference) and the formalised participation to the deliberations of intergovernmental institutions. For the United Nations (UN) system, for example, through the Economic and Social Council, 41 NGOs were granted consultative status by the Council in 1946; by 1992 more than 700 NGOs had attained consultative status and the number has been steadily increasing ever since to 2,613 organizations today; they all have the right to participate to the activity of the UN Forum on Forests (UNFF). As the WWF-World Bank Alliance for Forest Conservation and Sustainable Use demonstrates, even in the financial sector the role of NGOs is becoming quite influential.

Tab. 3

**Operative instruments of international NGOs in the forestry sector.
Eingesetzte Instrumente internationaler NGOs im Forstsektor.**

Instruments	Some examples of international NGOs
Networking	World Conservation Union (IUCN); Forests and the European Union Resource Network (FERN); World Rainforest Movement; Taiga Rescue Network; International Forestry Students Association (IFSA)
Research, reporting, mass media information, campaigning and others instruments to inform and influence private citizens, companies and public authorities	Environment Investigation Agency; Forests Monitor; Global Witness; Forest Campaigns of World Wildlife Fund, Greenpeace, Friends of the Earth
Development of ethical codes and standards, environmental and social audit, certification and labelling systems, promotion of procurement policies of socially and environmentally responsible forest products	World Resources Institute's Global Forest Watch; Forest Concession Monitoring System for Central Africa (FORCOMS); Forest Stewardship Council (FSC); Forest Certification Watch; Lembaga Ekolabel Indonesia
Control of credit activities, creation of ethical funds and alternative financial institutions	ECA-Watch International NGO Campaign; Sink Watch; CDM Watch; Carbon Trade Watch; Corporate Watch; CEE Bank Watch; Eco Equity; Forest Trends
Supports forest peoples' rights to control the use of forest land and to carry out sustainable use of their resources	Forest Peoples Programme; Rainforest Foundation; Down to Earth; International Alliance of Tribal and Indigenous Peoples; Global Caucus on Community Based Forest Management of the Tropical Forests

Surveillance activity is another function where NGOs working in the forestry sector are playing a major role. For sure if the topics of illegal logging, corruption and law enforcement in wood harvesting and trade are in the first position of many forest agendas of inter-governmental institutions and large companies, this is the result of the "mobilization of shame" by many local and international NGOs. Many other examples could be provided of the effectiveness in the surveillance and information activity by NGOs: development of the network of protected areas (WEBER and CHRISTOPHERSEN, 2002), investments in the "Kyoto forests" and use of financial instruments like the Clean Development Mechanism (Anon., 2005), protection of community rights to control the use of forest land (BUCKELL *et al.*, 2005).

As a result of the recent expansion of the above mentioned activities, the non-profit organisations representing many different components of the civil society have changed their international role in policy making from a first phase where NGOs were working with governmental institutions mainly as "outsiders", to a second phase where they have assumed a position of informed „insiders“ working unofficially behind governmental officials, to the actual phase where they are officially participating in deliberations (WEISS, 1999). As stated in the UNFF web site "The UNFF supports and welcomes non-governmental participation by organizations representing all women, youth, business, workers, land owners, indigenous peoples, local NGOs scientists, and local authorities. Their participation infuses new ideas, challenges, informs and thus enriches the inter-governmental debate. Major Group participants in the UNFF have organized coordinated statements, held dozens of side events to share experiences, and successfully lobbied for particular initiatives that they felt the UNFF should undertake or support. The participatory traditions of the UNFF and the need for it to continue have been widely acknowledged and are fully supported by the UNFF Secretariat".

A mix of instruments (see *table 3*), sometimes adapted from the set normally employed by traditional policy actors but in some cases totally new ones, have been developed by NGOs for an effective implementation of their role in governance of the forestry sector. In some cases NGOs' instruments have been successful in catalysing and setting the pace for other similar or alternative initiatives (MANKIN, 1998), like in the case of the certification system devel-

oped by the Forest Stewardship Council causing others to make progress in the sector of third party certification of well managed forests.

As the experience of the Tropical Forest Action Programmes (TFAP) shows, participation of civil society is not only a spontaneous, bottom up process induced by stakeholders but also a process stimulated by institutions, well aware of the essential role of NGOs not only in shaping forestry policy and programmes, but also in their practical implementation. While the role of public institutions in the direct management of forest resources forest tends to be reappraised and public spending reduced, NGOs are filling a gap, becoming an essential partner for any activity connected with social forest problems.

Thanks to the experience of the TFAP, the National Forest Programmes (GLÜCK *et al.*, 1999) are now probably the most advanced instruments developed to enable identification and involvement of stakeholders, including previously marginalised groups, and create space and responsiveness for negotiating agendas, vision, and partnerships.

Nowadays, the power of trans-national corporations, financial institutions and of the other for-profit organisations is only marginally balanced by that one of the non-profit NGOs. Nevertheless it is remarkable how cost-effective has been the investment of many organised components of the civil society in conditioning the pattern of development in the forestry sector. By sure the globalisation of the information system has been much more helpful in reinforcing the NGOs network and their political power than for other institutions.

5. SOME CONCLUSIONS

Globalization today seems to touch all aspects of human life. Economic globalization initiated this process and is its true driving force. Forests and forestry, as all other spheres, are also affected by globalization. And here, as well, economic globalization exercises the greatest influence.

The effects of economic globalization on forests and forestry are ambivalent; one may see its drawbacks but also its positive aspects. Indeed, globalization is not only a negative process, but has different positive aspects as described above. Ultimately, the valuation of

forests functions and their importance for forestry is a subjective process. Assessments are based on principles and perceived goals as to how the forest should be used and as to what forestry has to offer. Clearly, predominant societal attitudes to forests and forestry, including the level of esteem that these entities are given, may differ greatly among countries, even within the same one.

The open up of new and unpredictable markets to locally produced forest and wood products is an example of potentialities that a globalized market can offer. The improvement of market opportunities is also affecting such unique goods as products from medical and aromatic plants – which were formerly used only locally – and ethnic foods, as well as special services.

Nonetheless, economic globalization has effects on forestry that, generally speaking, are to be critically observed, foremost of which is the increasing concentration of the forestry sector. The ownership of forests and capital is accumulating into the hands of a small number of multinational companies. National forest policy is no longer or hardly capable of influencing the corporate policy of these companies.

Especially severe consequences on forestry can be observed in those countries with significant woodlands where forestry is of importance. One of the relevant detriments has been the movement of sawmills, pulp and paper, and the wood-processing industry away from sites where these historically played an essential role in local development. Following the criteria of rationalization and competitive advantage, local and regional economic cycles are being interrupted, and, especially on a regional level, economic relations are being dissolved and in many segments markets suspended. What generally is described as a wood-chain is tearing apart in favor of a global alignment of markets based on supply and demand. This can plunge entire regions with adapted structures in the forestry sector into economic problems. The competitiveness of native raw materials especially in developed countries with high standards with regards to sustainable forest management is decreasing in favor of global supply streams. This occurrence has far-reaching consequences for the forest, environment, employment and more.

Confronted with this situation, international policy (more and more with regard to civil society demands for participation), may provide the only effective means for ensuring that globalization proceeds sustainable. This would require the activation of all social forces to support international policies, including the broad participation of civil society in decision-making processes. In particular, the large and also globally acting NGOs would play an important role in bringing about these desired results.

So far, the role of the participatory approaches is becoming a crucial one: local communities are gaining importance at the stakeholders' tables as far as natural resources management is concerned. Contemporarily, the involvement of the private sector in forestry, including forest research, is increasing (ENTERS, NAIR and KAOSSARD, 1998).

The expansion of information access tools brought higher public opinion awareness in natural resources and forestry sound management; it is resulting in an "emergence of democratically functioning and transparent institutions" (NAIR, 2001), combined with a growing demand of direct participation in the decision taking processes.

On the other hand, it should not be overlooked that many problems, e.g. supply of goods and services in the world cannot be solved without collaborating with large transnational enterprises, in great deal without taking advantage of their enormous financial and technical resources, not to say their influence on policies. Hence, some amount of cooperation between politics and enterprises is called for. The key word used to describe this relationship is a

"public-private-partnership" with regard to both sides interest (WEBER, 2002).

But aside from the international platform, national policy is also necessary to ensure that globalization does not have effects on forests and forestry that stand contrary to societal objectives within a country. For example, an important goal of a state may be the attainment of a high quality of life throughout all parts of the country. In rural areas, forests could still play an important economic role; forestry offers work places, and supplies raw materials for the local and regional wood industry. The economic and social stability of these areas is strongly influenced when transnational forest enterprises operate their business without any consideration for local or regional circumstances. Clearly, solutions to this problem may differ greatly from area to area, depending upon the respective local or regional conditions. But one thing holds true for national policy in general: the powerful, worldwide trend towards globalization will not allow itself to be halted through national decisions.

The traditional, sector oriented forecasting techniques can no longer capture the radical system-wide changes affecting forestry, as well as all the other sectors of the socio-economic overall picture: "Many international efforts to bring about changes in forestry had little impact, while most changes were unintentional and not necessarily the outcome of the planned efforts" (NAIR, 2001).

The overall impact of the globalization phenomena, which result in the easy movement of capital, technology, goods and services across national boundaries are difficult to assess and complex to predict: "the set of criteria previously used for measuring comparative advantages for investment in forestry (e.g. nearness to markets and raw material supply; quality and quantity of raw material) is expanding to include very different criteria (e.g. need to reduce pollution; degree of openness of economies; barriers to trade)" (NAIR, 2001).

Ultimately, will forestry and forest benefit from the expanding globalizing trends? Most likely it will depend very much on the capacity of generating flexibility within itself. If it true that – paraphrasing George Santayana – a profession that does not learn from its past is condemned to repeat it.

ABSTRACT

The most recent years of worldwide socio-economic development have been characterized by accelerated phenomena with clear supranational features, all of which have been identified with the term globalization. Until now, the most evident feature of the globalization process has been the intensive interweaving of the financial centers in worldwide operating markets. In this process, the links to national economies, particularly within the forestry sector, are declining rapidly, and the largest enterprises (namely the multinationals) are operating exclusively on a global scale. As forest management is still traditionally oriented on local, regional and, at most, national levels, timber markets and wood processing industries have already been strongly affected by the globalization process. The same seems true to the non-timber produce, as far as it is following the development of wood production. The paper discusses – partly argumentatively, partly empirically – the impacts of globalization on forests and forestry by looking closer to the territorial value of forestry, the non-wood forest production, and the role of civil society on forest policy exemplarily. The findings are being discussed in the (tentative) conclusions.

Kurzfassung

Titel des Beitrages: *Einfluss der Globalisierung auf Wald und Forstwirtschaft.*

In den jüngst zurückliegenden Jahren ist die weltweite sozio-ökonomische Entwicklung durch sich stetig beschleunigende Phä-

nomene mit deutlich transnationalen Eigenschaften charakterisiert, die sich alle mit dem Begriff der Globalisierung beschreiben lassen. Bis in die Gegenwart hinein ist die intensive Verflechtung der großen Finanzzentren in die weltweit operierenden Märkte die hervorstechendste aller dieser Eigenschaften. Im Zuge dieses Prozesses der Globalisierung nehmen die Verknüpfungen mit den nationalen Ökonomien, insbesondere mit der Forstwirtschaft, rapide ab, und die großen Wirtschaftsunternehmen (vor allem die multinationalen) operieren ausschließlich in globalem Maßstab. Während die Forstwirtschaft traditionell auf die lokale und regionale und im höchsten Fall auf die nationale Ebene hin ausgerichtet ist, sind die Holzmärkte und die Holz verarbeitenden Industrien bereits stark vom Globalisierungsprozess beeinflusst. Das Gleiche scheint für Nicht-Holz Waldprodukte zu gelten, soweit diese der Entwicklung der Holzproduktion folgen.

Der Aufsatz diskutiert – in Teilen argumentativ, in Teilen empirisch – die Auswirkungen der Globalisierung auf die Wälder und die Forstwirtschaft, in dem er sich – beispielhaft – näher mit der Bedeutung der Forstwirtschaft in ihrem räumlichen Kontext, mit der Erzeugung von Nicht-Holz Waldprodukten und der Rolle der Zivilgesellschaft für die Forstpolitik auseinander setzt. Die Befunde werden zuletzt in den (vorläufigen) Schlussfolgerungen diskutiert.

Resumée

Titre del'article: *Effets de la mondialisation sur la forêt et l'économie forestière.*

Au cours des toutes dernières années l'évolution socio-économiques mondiale se caractérise par des phénomènes, en constante accélération, dont les caractéristiques sont nettement supranationales et peuvent être toutes décrites par le concept de mondialisation (= l'anglicisme «globalisation»). Parmi toutes ces caractéristiques, celle qui prédomine jusqu'à l'instant présent est la puissante interconnexion des grandes places financières dans les marchés opérant à l'échelon mondial. Au cours de ce processus de mondialisation les liens avec les économies nationales, et tout particulièrement avec les économies forestières, se relâchent rapidement et les grandes entreprises (avant tout, les multinationales) opèrent exclusivement au niveau global. Alors que traditionnellement l'économie forestière se déploie aux niveaux locale, régionaux et plus généralement nationaux, les marchés du bois et les industries transformatrices du bois sont fortement influencés par le processus de mondialisation. Il semble en être de même pour les productions non ligneuses de la forêt, dans la mesure où celles-ci évoluent comme la production de bois. Le présent article discute – dans des parties de façon argumentée, dans d'autres empiriquement – des conséquences de la mondialisation sur les forêts et sur l'économie forestière et analyse de plus près – à titre d'exemples – la signification de l'économie forestière dans son contexte spatial, l'obtention de produits de la forêt non ligneux ainsi que le rôle de la société civile vis à vis de la politique forestière. Enfin les résultats trouvés ont été examinés dans les conclusions (provisoires). J.M.

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Forests in balance?

Forest under the spell of economic, ecological and recreational requirements – Considerations about the European Model.

(With 5 Figures)

By U. PRÖBSTL^{*)}

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KEY WORDS – SCHLAGWORTER

Multifunctional forestry; functional classification in forest planning; European comparison.

Multifunktionale Waldwirtschaft; Funktionsplanung; europäischer Vergleich.

1. Introduction

New directions and the need for reform – these two catch phrases dominate the political discussions around forests, forestry, and forest research in many European countries. In Germany there is concern about the reduction of university positions in forestry, as there is across Europe about the new, more economically oriented direction of forest management. For example, in 2004 the Bavarian electorate defeated a referendum about the restructuring of the forest administration, largely because of concern about changes to nature conservation and recreation management. Obviously, the new trends in forest management imposed by commercial interests stand in stark contrast to the overall expectations society has of effective multi-functional forest management (Deutscher Rat für Landespflege, 2004). The administrative desires for reform on the one side and – often contradictory – societal demands on the other are the reason to undertake an investigation of the European model of multi-functional forest management.

The goal of this paper is to briefly sketch out the historic development of forest management in Europe as it leads up to multifunctional forestry with its regional variations. At the end of the paper, two case studies will be presented to document the potential of this forest management tradition, as well as the potential dangers associated with the restructuring of forest education and administration in selected European countries.

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2. METHODS

After presenting a brief historic overview and literature review of the various forest functions and their importance, selected results of a recent survey are presented. The survey consulted forestry experts from 17 European nations and was undertaken for the COST Action (FORREC E33) program, which supports the exchange of scientific knowledge within the European Community.¹⁾

Survey questions were designed to reflect expert knowledge, and pertained to forest functions, forest management, and forest based recreation management. One survey was sent to a representative of each country, who was asked to complete the survey in collaboration with other national experts knowledgeable in the respective fields (see *Figure 1*). This type of questioning prevented that one single expert would respond solely based on personal observations and opinions. This question format also eliminated the need for translation into several languages, as the survey was purposely circulated more widely.

The results include the answers from practitioners, researchers and foresters working within the respective regional or national administration. The survey was addressed to the national representative member of the Cost-action programme, who was invited to be responsible for the questionnaires in his/her country based on a mostly personal invitation. Therefore the respond rate has been very high (more than 80%). Only in one country with different regional conditions there have been difficulties to harmonize the results to create one single national response. The representatives reported that in most cases the main findings of the different

¹⁾ I thank the participating experts from Belgium, Croatia, Cyprus, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Iceland, Latvia, The Netherlands, Norway, Portugal, Slovenia, and Switzerland, and for the European Science Foundation – Cost Action E 33 FORREC for their support of the project.

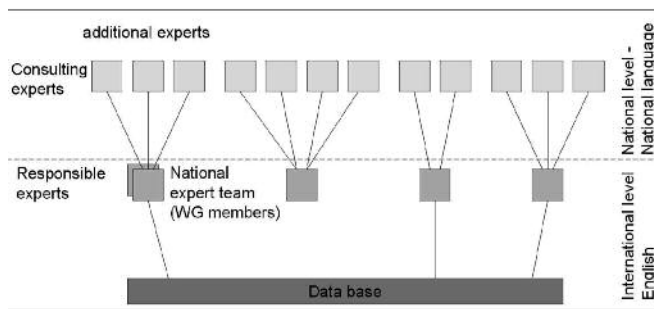


Fig. 1

The concept of the expert based survey ("WG-members": members of one working group of the Cost action E33 Forrec).

Konzept der expertenbasierten Befragung (WG-members: Mitglieder einer Arbeitsgruppe im Rahmen der Cost action E33 Forrec).

experts corresponded well with each other. The interpretation of the results was carried out together with the representatives and additional local or regional partners to include and explain the background and possible regional differences.

3. FOREST FUNCTIONS

3.1 From wake theory to multi-functionality

A review of the European history of forestry shows that discussions about the functions of the forest and possible priorities arose rather early. The earliest discourse focused on forest aesthetics (HIRSCHFELD, 1785; BORCH, 1824; V. SALISCH, 1885; V. DIMITZ, 1909), but proponents were not really successful in their call for integrating aesthetic concerns into forest management. Throughout the first half of the 20th century the "wake theory" became the dominant concept of European forestry (RUPF, 1960). It is based on the simple assumption that proper classical forest management, without any particular concern for any of the other forest functions (i.e. nature conservation, soil conservation, recreation) will automatically result in proper forest conditions and accommodate all the other concerns.

At the beginning of the 1950s, a new emphasis on research on recreation and other forest functions challenged the wake theory (see AMMER and PRÖBSTL, 1991; JENSEN and KOCH, 2004, among others). The fledgling discipline of ecosystem research also identified deficiencies associated with the traditional forest management goals, especially with regards to forest structure and management methods (MITSCHERLICH, 1975). Despite the valid critique, the concept of using one single forest estate for wood extraction as well as for nature conservation and recreation remained the guiding principle of European forestry (HELLPACH, 1950; DIETRICH, 1953; LEIBUNDGUT, 1975).

This observation also applies to the former communist eastern European nations. For example, Estonia protected coastal coniferous forests from early harvest by the Soviet masters by purposely defining them as protected areas because of their high conservation and recreational value. Similar multi-functional concepts were presented in eastern European teaching and research. THOMAS (1978) emphasised the "Komitativwirkungen" (the social and socialistic value) of the forest in the DDR, and emphasized the contribution of the various forest functions to the socialist society.

Across Europe change occurred during the 1970s, when the classification for forest planning was introduced. This mapping system documented which special forest functions (e.g. protection from soil erosion, from avalanches, recreation, etc.) should have priority in a given area. Since one forest stand may certainly provide several functions concomitantly, de facto the concept of multi-functional

forest use was retained, albeit with a certain prioritization. In the 70s, a worldwide definition of multiple-use forestry was established: it concerned managing a forested area to simultaneously provide more than one of the following resource objectives: fish and wildlife, wood products, recreation, aesthetics, grazing, watershed protection, hazard protection, and historic or scientific values. Multiple-use forestry has been established in many parts of the world, but one should be aware of the fact that the application of the concepts differ somewhat between Europe and in North America (ZHANG, 2005; SAHAJANANTHAN et al., 1998; VINCENT and BINKLEY, 1993). The differences appear in

- their relevance for private, in addition to community and public forests in most European countries,
- the much smaller scaled application of these functions and
- the higher frequency of spatially overlapping functions.

3.2 From multi-functionality to sustainability as a concept

The concept of multi-functional forest management found renewed support in the recommendations of the Rio Convention of 1992, where sustainability was defined as managing for ecological, economic, and social concerns. Agenda 21 proposes that forestry shall enable forest owners (public forests, community forests, and private forest) to accrue profit from the sales of wood and woods products, while at the same time providing services for recreation, water- soil-, and erosion protection (Deutscher Rat für Landschaftspflege, 2004).

At that time, European forestry could already document in theory and practice how economic, ecological, and social concerns can be accommodated concomitantly. In the meantime, other uses, such as tourism, are also required to document how they accommodate these sustainability concerns (MUNDT, 2004).

On 15 December 1998 the European Council adopted a "Resolution on a Forestry Strategy for the EU" that established as overall principles for action the sustainable forest management and the multifunctional role of forests (European Communities, 2003, p.9), as defined in the Ministerial Conferences on the Protection of Forests in Europe of Helsinki in 1993, Lisbon in 1998 and Vienna in 2003 (STOCK et al., 2004). The improved catalogue of pan-European criteria and indicators of sustainable forestry developed in Lisbon represents the diversity of possible targets of a multifunctional forestry (SPELLMANN, 2003; RAMETSTEINER, 2001). The concept and understanding of multifunctional forestry in Europe must be seen as a holistic approach: multifunctionality should be aimed on the level of the single forest stand as well as on local and regional level (European Communities, 2003, p.8) and differs from more zoning oriented concepts in North America.

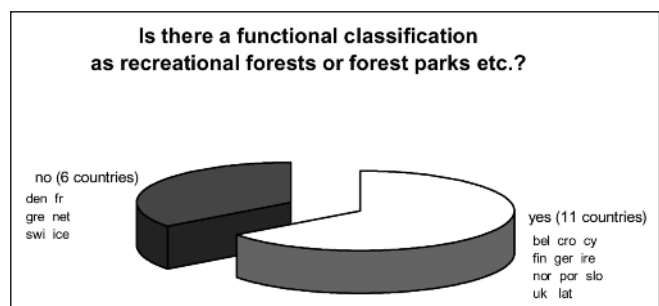


Fig. 2

11 of the 17 European countries have recreation concerns included in their functional classification for forest planning processes.

11 von 17 europäischen Ländern berücksichtigen in ihrer Waldfunktionsplanung die Belange der Erholung.

Many European countries have anchored the concept of multi-functionality in their respective judicial frameworks, and the majority of countries have implemented relevant functional concepts as documented in the literature and in the survey reported here. (PRÖBSTL et al., 2007; Figure 2). In the following the European approach to multi-functionality will be summarized for forest based recreation, whose importance has increased significantly in most European countries over the past two decades.

The heavy emphasis on operationalizing multi-functionality on a small-scale provides one among several explanations why in contrast to North American approaches, no specific management frameworks, such as for recreation management, were developed. The basic idea was that fundamental functions such as erosion, recreation, and conservation would be implemented under different priority settings, but should be present everywhere.

In most countries applying this functional forest classification, the recreational function of the forest must be considered in the planning process (Figure 3).

In order to learn more about the relationships between the respective forest functions, experts were asked to provide additional explanations in an open ended question. Responses showed that even in countries where the recreational functions were considered to be of equal importance; de facto they were regarded as more important in tourism regions, and in proximity to urban areas (Fig-

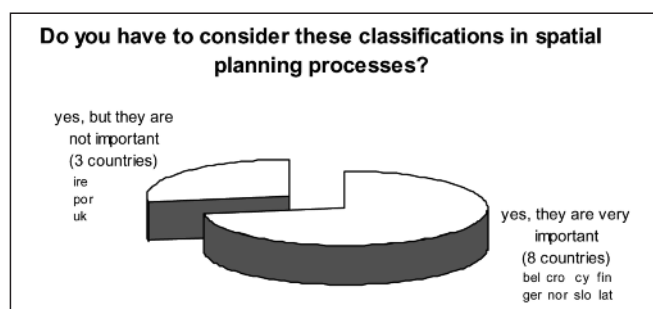


Fig. 3

The recreational services and corresponding classifications must be considered during spatial planning in most of these countries.

Die Belange der Erholungsvorsorge und die Erholungsfunktion müssen in den meisten Ländern bei räumlichen Planungen berücksichtigt werden.

ure 4). It became also obvious that more specific coordination between conservation and recreation goals was usually necessary.

The survey also revealed regional differences in the definition and priority setting of multi-functional and integrative forestry. Overall, five groups of countries emerged which are characterized within them by similar foci and importance of functions (Figure 5):

- The Atlantic region
- The Central European region
- The Mediterranean region
- The Nordic region
- The Continental region

Below, the main concerns and challenges are described for each region. The relative priority of these topics is influenced significantly by the overall amount of forests present, the population density, judicial foundations, and especially access.

The *Atlantic Region* is characterized by a very low proportion of forest. In Ireland, Denmark, Great Britain and the Benelux-countries, the provision of recreation opportunities is of utmost importance. The high population density and relatively low proportion of forest ($\leq 11\%$) leads to an emphasis on recreation in research and practice. For a long time multi-functional forest research has focused on the aesthetic enhancement of plantations for the purpose of recreation and urban forestry (HEYTZE, 1990; MCCORMACK, 1995; BELL, 1997, among others). Research also covers the effects of crowding, the recreational demands of different ethnic groups, and in the Benelux countries and in Great Britain the combination of intensive recreation and nature conservation poses a special challenge. Currently, a group of European researchers is searching for exemplary solutions for densely populated regions (Stichting Recreatie, 2004; ROOVERS, 2004).

In the *Nordic region* challenges for a multi-functional forestry are completely different. These countries contain an extremely high proportion of forest (up to 69%). In Sweden, Norway, and Finland, multi-functional forestry must include the traditional right of “every mans rights”, which include berry picking, mushroom collecting, and free access for all recreation and sports activities, which are considered of utmost importance by the entire population (SIEVÄNEN et al., 2004). In addition to these classical recreation topics, multi-functionality added new demands, such as ecotourism, as mentioned by several of the interviewed experts. Ecotourism requires an adjustment of classical forest management methods, e.g. avoiding large clear cuts. Public sector decision mak-

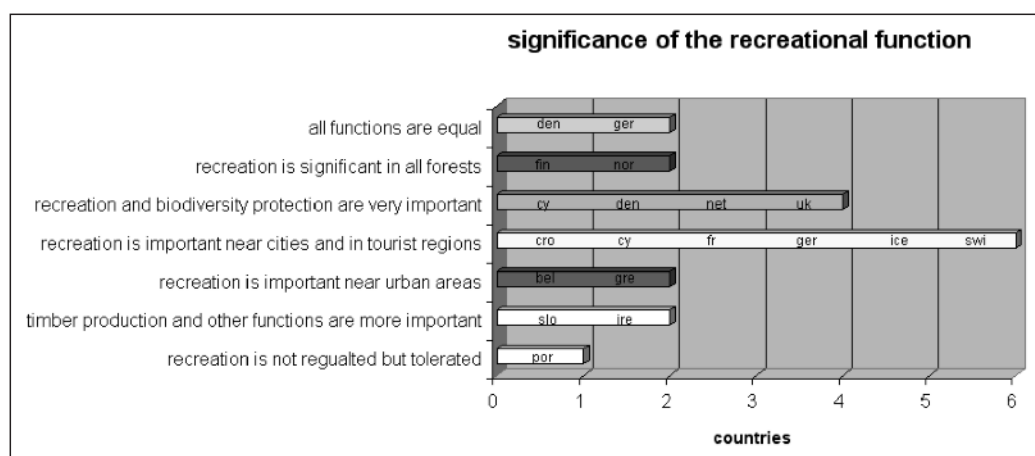


Fig. 4

The importance of recreation in comparison to other forest functions.

Die Bedeutung der Erholungsfunktion im Vergleich mit anderen Waldfunktionen.

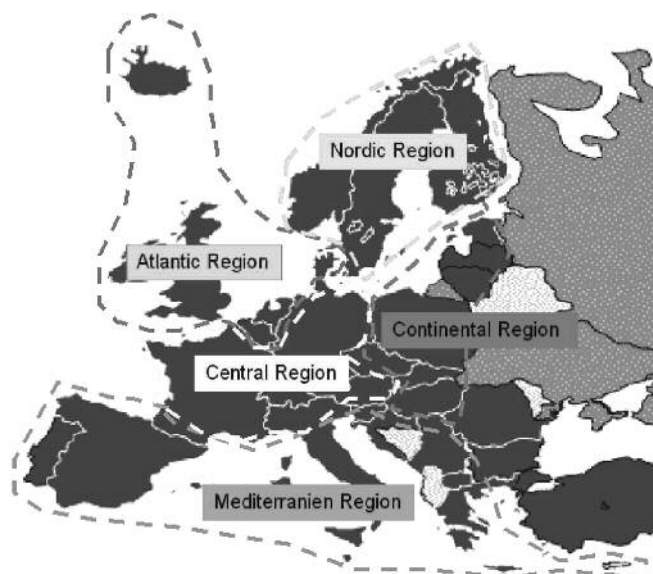


Fig. 5

Importance of forest functions differs between the various regions.

Die Bedeutung der Waldfunktionen ist in den verschiedenen Regionen unterschiedlich.

ers in Sweden and Finland have recently set new impulses in these areas by establishing new research chairs at several universities in their respective countries.

In countries of *Central Europe*, such as Germany, Switzerland, and Austria, as well as large areas of France, typically about one third of area is under forest cover and all countries provide free access to the forest. Die "naturnahe Waldwirtschaft" ("close to nature forestry"), i.e. to produce while managing the productive forest stands sustainable under consideration of flora, fauna and soil, as well as nature conservation are the most important themes of forestry. Extensive forest areas have now been defined as protected areas. In the mountainous areas, especially in the Alps, multifunctional forestry also implies soil and erosion protection, as well as avalanche and rock slide protection. Over the past few years climate change has added new challenges in this regard.

The planning of recreational infrastructure has a long tradition in Central Europe. Visitor management is an ever prevailing challenge for managers, especially in and close to densely populated areas.

Additional challenges are imposed by political decision makers who desire increasing forest productivity via shorter rotation periods or introduced fast growing species.

The *Continental Region* (i.e. Poland, the Baltic states, the Czech Republic, Slovakia and others) face a different set of challenges. Recreation has always been one of the management concerns, but frequently appropriate infrastructure, or controlled access may be absent. Many prerequisites for more intensive tourism use are missing. The restructuring of agriculture, and the widespread conversion of arable land to shrubs and eventually forests leads to significant changes in the rural landscape. The reforested areas will also pose new challenges to forest management in the future. In many forests of the continental region, future forest management will need to adapt gradually from the traditional production focused approach to a truly multi-functional approach which accommodates ecological and recreation concerns. In some areas, these challenges are intensified with the rehabilitation of contaminated sites.

Experts in the region also mentioned the education of future management personnel as a challenge, especially with regard to training in the areas of recreation. Finally, adapting their manage-

ment structures to EU directives and other legislative requirements in the area of nature conservation will continue to pose challenges.

The *Mediterranean Region* also contains about one third of its area as forested, but here one is dealing with a rather different type of forest. For multi-functional forestry, one of the main additional uses is tourism, which requires landscapes of high aesthetic quality, and also leads to further demands such as fire management, the provision of recreational infrastructure, and the restoration of previously intensively used areas. Some areas are currently subject to intensive reforestation, or at least to stabilization of marginal forests in semi-arid areas. All these activities also need to consider demands for nature conservation.

4. MULTI-FUNCTIONALITY – THE BASIS FOR THE SUCCESSFUL IMPLEMENTATION OF THE CONCEPT OF SUSTAINABILITY

Over the past decade the overall concept of multifunctional forests has re-emerged as a guiding principle in the implementation of the notion of sustainability, which has emerged as the focus of European forest management and research both nationally and internationally. The traditional perspective of European forestry actually proved to be one important guiding principle for international cooperation and research. The subsequent two case studies certainly will not be able to document the multitude of actual management challenges experienced and their respective solutions, i.e. how to manage large scale habitats for vertebrates. However, these examples will show how the concept can be applied in principle.

The example from the Alpine region documents multifunctional forest management under consideration of recreation, biodiversity, protection from natural hazards and enhanced forest production with an alien species. The example from Africa shows the international relevance of the concept as traditional ecological integrity can be conserved despite the thoughtful introduction of a commercial species. Both examples deal with forested areas in landscapes of outstanding aesthetic value, but where the challenges of productivity, nature conservation and aesthetics also need to be considered.

4.1 Case study: Multifunctional research in the Alpine region (Douglas fir)

The first example deals with ecological research about Douglas fir plantations in the alpine foothills of Central Europe. This research project focused on how concerns about nature conservation and the economic concerns of forest productivity could be reconciled in the most productive forests. In the past, introduced tree species, such as the Douglas fir, were generally associated with negative ecological effects. One four year long study investigated the ecological quality and biodiversity of these stands and focused on birds, insects, snails, macrosaprophages, beetles, bugs and dipteres. Stands under various types of treatment, including non-treatment were compared (AMMER and UTSCHICK, 2002).

The study showed that under strict forestry and landscape protection regimes a high level of biodiversity can be reached despite a high component of conifers (60% fir) and up to 10% of Douglas fir. Overall, the results document that

- Pure conifer stands should be avoided. Deciduous trees of about 30–40% should occur in separate groups of at least 0.3 ha to enable a continuation of small fauna that is typical for deciduous stands. Adding single deciduous trees, as was usual in earlier days should only occur when the deciduous component is above 50%.

- Introduced commercial species, such as the Douglas fir should principally not be introduced in monocultures. In beech forests, up to 30% of Douglas firs are recommended.

– In addition, a network of pure deciduous stands or protected areas is required to enhance biodiversity.

– Single trees, especially oaks should be supplied (even if in the form of street alleys).

Such a management approach can be maintained in the long term and is characterized by high economic productivity, while still accommodating several crucial conservation concerns and a high level of recreational quality.

4.2 Case study: Multifunctional research in Africa (teak plantation)

The example of an international research initiative on sustainability and multifunctional forest management comes from teak plantations in Benin (West Africa). The project was guided by a team of local and Swiss researchers (NAGEL et al., 2004). A comparative study of last remnants of a rainforest – savannah – plantation land use mosaic in West Africa investigated its biodiversity by compiling an inventory of local and introduced species. The results which are relevant for the argument here show clearly that a multi-functional approach can contribute to sustainability:

Even teak plantations provided suitable habitats for the most sensitive, stenoeic rain forest insects. A precondition was that the plantations be kept under a rotation period of at least 40 years. Biodiversity also appears to be influenced by the density and diversity of the understory, and especially the trees of the secondary canopy. The report concludes that “nature conservation and forest production do not exclude each other” (NAGEL et al., 2004). Instead, the two can be combined in an ecologically and economically sensible manner by adjusting the rotation periods accordingly.

Especially the African example shows that the concept of multifunctionality as the best available “Integrated” system may provide a blueprint for future sustainable management actions, and constitutes valuable lessons which may be transferred from Europe to other parts of the world. Nowadays it is frequently the global markets which demand more sustainable forest management systems. The concept of sustainability forces researchers and managers to evaluate critically the propagation of introduced species, and the kind of species compositions which are economically desirable and ecologically justifiable. These examples document the need and the potential for future research and for forest management.

5. SUMMARY AND FORECAST

European forestry was required early on to address forest management in a multi-functional manner. Nowadays, this tradition has provided a basis for a successful model of sustainable forest management. Given the regional differences across Europe, the emphasis of the fundamental concept is applied in many permutations and with focus on a range of different topics. For example, in most regions, the increasing importance of recreation is unmistakable.

There are also some concerns about the future of multi-functional forestry. For example, the German Council for Landscape management (Deutscher Rat für Landschaftspflege, 2004) fears that if the economic crisis continues in some member countries, the notion of multi-functional forestry will continue to be challenged. The balanced situation of the past seems to be declining (ZHANG, 2005; Deutscher Rat für Landschaftspflege, 2004). Several nations lack or are in the process of reducing the multi-disciplinary educational framework in forestry, which is quintessential for the continuity and expansion of multifunctional forestry in the future. In order to guarantee its continuation, universities must provide curricula in nature conservation, wildlife ecology, recreation planning, and transdisciplinary research, in addition to forestry.

The purpose of this contribution is therefore to argue in favor of maintaining the European tradition of small-scale multi-functional

forestry, which must not become a victim of short-term economic and profit oriented decisions. The continuation of European multi-functional forestry is not only important for meeting a wide array of societal demands, but also for the continuation of a time-proven management concept. The two examples from Europe and Africa have shown how multi-functional forestry may contribute to the global goal of sustainability.

6. ABSTRACT

This paper focuses on the traditional European concept of multi-functional forest management, which accommodates economic and ecologic concerns, as well as considerations for conservation and recreation. Lately, European discussions about the future of forestry have lead to several controversies under economic pressures for restructuring, and the concept of multi-functional forestry has been challenged. A survey of experts across Europe showed that the functional classification in forest planning is applied in most countries. The survey also revealed that recreational use has gained importance. The concept of multi-functional forestry has significantly increased since the signing of the Agenda 21 agreement at the Rio Conference in 1992. Two case studies from Europe and Africa show the contribution that the concept of multi-functional forestry can make to sustainable development. The role of science and research in this new management environment is to ensure together with applied forest management that the traditional European strength in integrated forest management is not sacrificed for short-term economic gains. Furthermore, the society at large should be informed about these new trends.

7. Zusammenfassung

Titel des Beitrages: *Ausgewogene Forstwirtschaft? Wälder im Spannungsfeld von ökonomischen, ökologischen und erholungsbezogenen Anforderungen – Überlegungen zum Europäischen Modell.*

Dieser Beitrag beschäftigt sich mit dem traditionellen europäischen Konzept der multifunktionalen Waldbewirtschaftung, die wirtschaftliche, ökologische, naturschutzfachliche und erholungsbezogene Belange miteinander verbindet. Die Diskussion um die Weiterentwicklung der Forstwirtschaft in Europa wird unter dem Druck ökonomischer begründeter Umstrukturierungen kontrovers diskutiert.

Dabei wird auch das traditionelle Europäische Modell hinterfragt. Eine europaweite Befragung von Experten zeigt, dass die Waldfunktionsplanung in den meisten Ländern angewandt wird. Dabei wird auch deutlich, dass in vielen Ländern die Erholungsfunktion erheblich an Bedeutung zugenommen hat. Die multifunktionale Waldwirtschaft wurde durch die Agenda 21 der Umweltkonferenz in Rio de Janeiro weiter gestärkt. Beispiele aus Europa und Afrika zeigen die Bedeutung dieses Ansatzes für eine nachhaltige Entwicklung. Deshalb kommt der Wissenschaft die besondere Rolle zu. Sie muss gemeinsam mit der praktischen Forstwirtschaft dafür sorgen, dass diese besondere europäische Stärke nicht zugunsten kurzfristiger ökonomisch begründeter Umstrukturierungen aufgegeben wird. Weiterhin ist es wichtig, die Gesellschaft auf diese Entwicklungen aufmerksam zu machen.

8. Résumé

Titre de l'article: *Les forêts en question? La forêt face aux exigences conjointes de l'économie, de l'écologie et du délassement. Considérations sur le modèle européen.*

Cette contribution est consacrée au concept traditionnel européen de la gestion multifonctionnelle des forêts qui lie entre elles les exigences relevant de l'économie, de l'écologie et de la protection de la nature. La discussion autour d'un nouveau développement de

l'économie forestière est examinée sur tous les points controversés portant sur les changements de structure fondés sur des considérations économiques. On est ainsi conduit à s'interroger sur le modèle traditionnel européen. Une enquête européenne auprès d'experts montre que la plupart des états utilisent une planification des fonctions de la forêt. Il est également manifeste que dans de nombreux pays la fonction de délassement a pris une importance considérable. La gestion multifonctionnelle des forêts s'est trouvée de nouveau renforcée par l'Agenda 21 de la conférence sur l'environnement de Rio de Janeiro. Des exemples pris en Europe et en Afrique montrent toute l'importance de ce principe pour un développement durable. De ce fait, c'est à la science que revient le rôle principal. Avec la gestion forestière pratique elle doit veiller à ce que cette force européenne essentielle ne soit pas consacrée à des changements de structures fondés sur des considérations économiques à court terme. En outre il est important de rendre la société attentive à ces développements.

J. M.

9. Literatur

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Decision-support for land-use planning through valuation of urban forest benefits

(With 4 Figures and 2 Tables)

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1. INTRODUCTION

Many forests have become physically incorporated in expanding urban and suburban areas. Yet even more forests have become functionally dominated by urban areas, as urban societies have been imposing their values, preferences and lifestyle on the management of forest areas. If forests and forestry are to play a role in urban and peri-urban areas, the connection with overall urban issues and challenges needs to be made (KONIJNENDIJK, 2003; OTTITSCH and KROTT, 2005). Forests and other green areas provide important economic, but also social and environmental benefits to urban societies. In order for these benefits to be duly recognised in decision-making, they need to be comprehensively valued in monetary or other terms.

Many attempts have been made to classify the multiple goods and services provided by forests. A recent and quite developed example of this is provided by DE GROOT (2005), who builds on previous works (e.g., DE GROOT, 1992; COSTANZA, 1997) when setting up a system based on ecosystem functions. These are defined as the capacity of natural processes and components to provide such goods and services to satisfy human needs, directly or indirectly. DE GROOT (2005) distinguishes between five classes of functions. Regulation functions are related to the ability of ecosystems to sustain and reproduce themselves. Habitat functions refer to ecosystems providing habitats to species, including mankind. The provision of marketed products is encompassed by production functions, while information functions refer to the ability to carry biological information (DNA), as well as, for example, cultural and social information. Finally, carrier functions relate to ecosystems physically carrying human activity – in many cases a function which irreversibly destroys the wider functionality of the original ecosystem. DE GROOT (2005) derives from these functions a multitude of values which he classifies into ecological values, socio-cultural values and economic values.

TYRVÄINEN et al. (2005) present a list of the benefits derived from the many functions of urban forests, i.e. forests and other tree-dominated vegetation in and close to cities and towns, in line with other authors. These benefits comprise: (1) social benefits, such as offering recreational opportunities and positive impacts on human health; (2) aesthetic and architectural benefits such as defining open space and screening views; (3) climatic and physical benefits

such as cooling, wind control and air pollution reduction; (4) ecological benefits such as providing biotopes for flora and fauna; and (5) benefits in terms of timber and non-timber products.

Products obviously have a directly measurable economic value, as they are traded regularly on markets. However, many other of the mentioned benefits also have an impact in terms of economic activity. Recreational opportunities and aesthetic values form the base for many a tourism attraction in forest or urban areas; these values may be so important that they (partly) come to dominate forest management decisions. Another obvious example concerns the benefits related to improvement of living and working environments. Woodland and other green space can have dramatic positive influence on property values; values that reflect the private benefits related to living in their proximity.

In spite of recognition of the many goods and services provided by forests in or close to cities and towns, and the fact that markets for goods – directly or indirectly – reflect parts of these, a significant part of the values of urban forests are not easily observable and brought forward in decision making processes. To raise appropriate attention for the merits and importance of sound forestry in urban settings, decision-support tools need to be provided which are able to incorporate the many values in the appropriate form and setting. Various ways of assessing values, in monetary terms or other, need to be developed and probably also combined.

This article discusses the valuation of social and environmental services of forests as important input to land-use planning and decision-making. Case studies from Finland, Denmark and Malaysia are used to demonstrate and evaluate examples of promising economic, social and multiple use valuation approaches. Their potential as decision-support tools based on effectiveness, efficiency and equity considerations is discussed.

2. DECISION-SUPPORT TOOLS FOR ASSESSING FOREST SERVICES IN URBAN SITUATIONS

2.1 Assessment of urban forest benefits

The need to develop an integrated methodology to assess the benefits of urban forests and other green space has been advocated by, for example, DE RIDDER et al. (2004). The methods developed within the field of environmental economics may – to some extent – be able to assess parts of the many benefits not traded on markets, but these methodologies are complicated to use, not flawless and not sensitive to all values and attributes of importance in urban forests. Therefore, alternative approaches to evaluate the possible uses, designs and management systems of urban forests must be studied simultaneously in urban forestry research. The aim of this is to pave the way for the development of well-tailored decision support tools of value for practical and day-to-day planning and management of urban forests.

2.2 Economic valuation of urban forest benefits

In environmental economics, the text-book classification of economic values (e.g., TURNER et al., 1994; FREEMANN, 2003) is typically the one shown in *Figure 1*, where value types have been exemplified with urban-forestry relevant examples. An example of a direct use of urban forests is their provision of a pleasant living

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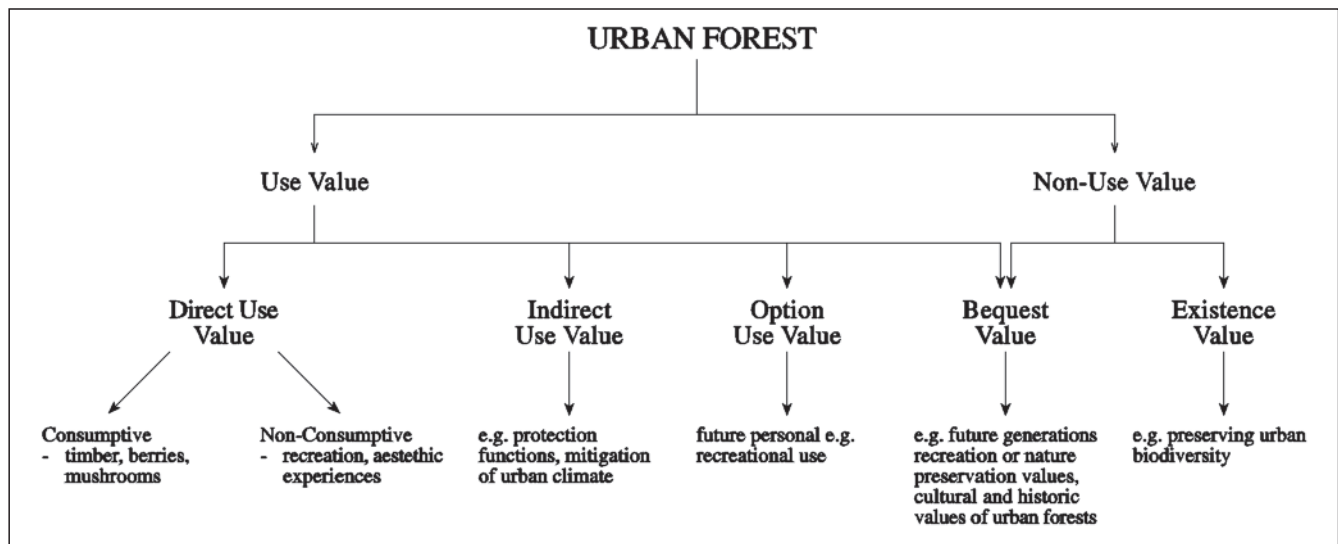


Fig. 1

Overview of the different use and non-use values of urban forests (TYRVÄINEN, 1999, adapted from TURNER et al., 1994).

Übersicht der unterschiedlichen Gebrauchs- und Nicht-Gebrauchswerte urbaner Wälder (TYRVÄINEN, 1999, in Anlehnung an TURNER et al., 1994).

environment, whereas air pollution mitigation is an example of an indirect use.

The different values arise from the various functions of urban forests, and the best approach for assessing the monetary value of each will differ across cases and types of benefit. The benefits of an urban forest may be assessed using *direct* or *indirect valuation* techniques. These techniques include *revealed preferences* techniques such as the hedonic pricing method using, for example, observed market data on house prices or rents in which urban forests benefits are expected to be reflected (PALMQUIST, 1991). *Stated preference* techniques like Contingent Valuation Methods (e.g., WOLF, 2004) or Conjoint Analysis Methods (Contingent Ranking and Choice Experiments) have also been applied to directly value (elements of) urban forests.

Revealed preference techniques have been used for assessing urban forest values (e.g., TYRVÄINEN et al., 2005), but they tend to capture only those parts of the benefits turned into private benefits through markets. For example, the value of the right to live nearby a forest and to enjoy a view on it from your window may be captured in the price of the marketed and private good of a nearby house. If the urban forest also has value through, for instance, pollution mitigation on a larger scale or as a cultural site for a larger population, then revealed preferences techniques may partly fail to capture these values. In such cases, stated preference techniques like the contingent valuation method, or other techniques may be relevant.

Hedonic pricing studies have shown that mature forests possess significant values to nearby residents (e.g., POWE et al., 1997; TYRVÄINEN and MIETTINEN, 2000) but little is known about the effect of establishing new forests. Only one study (DAMGAARD and ERICHSEN, 2000) has indicated that significant values of urban fringe forest may be identified at an early stage.

2.3 Social valuation of urban forest benefits

Involvement of users, residents and community groups is fundamental to the long-term sustainability of urban forests and trees (VAN HERZELE et al., 2005a). Involving local stakeholders in urban forestry decision-making also means involving them in valuation.

The social values of urban woodland and other green areas refer to what kinds of local environment are (perceived as) attractive, restorative, positive and stimulating in everyday life. Without proper assessment and communication this important information, i.e. what kind of qualities current forest areas actually provide, does not reach decision makers. Especially the aesthetical benefits of urban forests are difficult to evaluate, although a significant body of literature exists today on these issues (see TYRVÄINEN et al., 2005 for an overview). Approaches used to assess aesthetic values have included psychophysical, cognitive (psychological), experiential (phenomenological) and expert approaches, all providing different types of information for planning and management. Often, however, it has proven difficult to find techniques that are directly suitable to decision-making contexts, providing information that can be included in a wider valuation exercise (PRICE, 2005).

Environmental psychology, studying for example emotional ties between people and their environment, provides the theoretical background to social value mapping (e.g., KAPLAN and KAPLAN, 1989; GRAHN, 1991). Mapping the social values of green areas reveals what values a particular green area possesses and where the areas are located in relation to the users. The method of social value mapping was initially developed for regional and urban planning in Stockholm, Sweden (UPPLEVELSEVÄRDEN, 2001; STÄHLE and SANDBERG, 2002). Social value maps (sociotope maps) can be compiled by experts using information collected from local residents by questionnaires and interviews, indicating for example what kinds of natural environment are most used, restorative, and preferred by local residents.

2.4 Multiple use valuation

Urban land use decision-making is highly complex. Many different demands for often-limited space must be weighted against each other (e.g., DE GROOT, 2005). Economic and especially monetary information plays a central and even dominating role, frequently at the expense of ecological and social values that have not been incorporated in economic models. Thus a combination of decision-support tools will be needed that assesses all relevant values and interests as comprehensively as possible. Environmental economic analysis can help to – at least – create awareness about the econom-

ic costs and benefits of alternative land use and resource management options. Full cost-benefit assessment is required that extends beyond the scope of narrow market economics.

Multicriteria approaches are one example of how multiple value assessments can be incorporated in actual decision-making contexts. They have a long history of application in traditional forest management planning research and practice, where values and trade-offs are not always easy to assess (e.g., BUONGIORNO and GILLES, 2003). The performance of various forest management options can be studied through operations-research modelling. An urban forestry-related example of this is the study by STRANGE et al. (2002) who evaluated the potential design of peri-urban forests in Denmark using GIS as the basis for a cellular automata procedure, which helps identify preferable options for afforestation plans. Alternative plans take into account the costs and benefits of marketed products, but also incorporate spatial issues such as which species are to be grown close to the city boundaries and situation of open meadows for better recreational access and use.

Decision support tools need to be tailored to the specific decision maker. A full cost-benefit analysis may for example be an adequate support at the society level. At a local government level, however, transfers like taxes, subsidies and the like may be of interest, because they affect local budgets. Furthermore, equity (who wins and loses) may become an issue as the electorate becomes relatively smaller. At a local community level, welfare-economic effects may be entirely uninteresting, and instead the actual design and management of the urban forests become of interest. Thus, at this level participatory processes are important for sound decision making.

Various methods for participatory planning have been developed within urban forestry over the years (see BOON and MEILBY, 2000; SIPILÄ and TYRVÄINEN, 2005; VAN HERZELE et al., 2005b). HJORTSØ (2002), for example combined operations research methods with deliberate and thorough stakeholder involvement to evaluate possible management options for a large urban forest area in the Copenhagen area. JANKOWSKY and NYERGES (2003) stress the important role that GIS can play in spatial and participatory decision-making, as GIS can help to combine and structure information (including valuation information), as well as present it in an understandable and accessible form. TYRVÄINEN et al. (2006) elaborate on the potential contributions of various visualisation tools that can present alternative landscape design and management options in ways understandable to a broader group of stakeholders.

In the following sections, three recent cases of application of valuation tools in land use decision-making involving urban forests are introduced. The first case describes an example of economic valuation of urban forest benefits, namely the impact of nearby afforestation on house prices assessed through hedonic pricing in two Danish towns. The second case provides an example of social valuation; it shows how social value mapping was used to describe residents' use of and preferences for neighbourhood forests and other green areas in Helsinki, Finland. The third case, involving a peri-urban forest reserve in Malaysia, shows how valuation of multiple benefits can be done through combining different valuation techniques.

3. METHOD AND CASE STUDIES

3.1 Case study 1: Economic valuation

In Denmark, house owners' willingness to pay (WTP) for proximity to an urban-fringe afforestation project was studied for the case of two new forests (see ANTHON and THORSEN, 2002; ANTHON et al., 2005 for details). The first forest of 101 ha (True Forest) is situated near the city of Aarhus, and the second of 60 ha (Bakkely

Forest) close to the village of Vemmelev. Afforestation started in the mid-1990s, thus making house sales data available for a reasonable period of time, both before and after the afforestation took place. Furthermore, the new forests are situated close to residential areas sufficiently large and homogeneous to provide suitable data.

The residential area nearest to True Forest (Skjoldhøjparken) is a typical Danish suburban area, primarily consisting of detached single-storied houses. Residents have easy and safe access to the forest. The afforestation area is visible from the houses nearest to the new forest. There are no other recreational areas nearby. Bakkely Forest is situated to the south of the village of Vemmelev, on the opposite side of a rather trafficked highway on sloping ground so that most of the forest cannot yet be seen from the houses. The area around Vemmelev is intensively cultivated farmland with very few recreational opportunities.

In the present context, a house is considered a composite good, the price of which can be described by a general hedonic price function:

$$P_i = P(S_i, N_i, Q_i) \quad (1)$$

where P_i is the price of house i , S_i is its structural characteristics (e.g., size, age), N_i stands for the neighbourhood characteristics (e.g., social status of the area) and Q_i represents the environmental characteristics. The environmental characteristics are non-market goods (in this case recreational possibilities and aesthetic goods). For the hedonic pricing technique to be useful for obtaining at least partial welfare measures a number of assumptions should be fulfilled; cf. ANTHON (2003) for a more thorough discussion of these in the current context and otherwise the papers by PALMQUIST (1991, 1992). The environmental good was modelled as the distance to the forest edge as a proxy for the accessibility to the new forest. This provided continuous variation across the examined houses.

Note that since the hedonic pricing method only captures the implicit price of proximity to the new forest, and hence the related local use values, it does not capture the total benefits of afforestation projects. Timber production values as well as non-use values and use values that are not dependent on the residents' preferences are not covered (TYRVÄINEN and MIETTINEN, 2000).

Data were obtained from a central housing register and included selling prices and a large number of structural characteristics. The environmental characteristics were modelled as the shortest linear distance from the house to the forest edge, obtained using GIS. To account for the natural increase in house prices over the years, the price variable was deflated using the official house price index from The Tax Agency (TOLD OG SKAT, 2001).

The definition of the hedonic price function in (1) does not imply any restrictions to the functional form, except for the linearity implied by the assumption of weak separability. Hence, the choice of functional form is free, but also important and often discussed in the literature (e.g., HALVORSEN and POLLAKOWSKI, 1981; PALMQUIST, 1991). A number of functional forms for the model were tested, and the representation used is the one that provides us with the best residual and model properties (see ANTHON and THORSEN, 2002 and ANTHON, 2003 for details). Also investigated were the performance in the model of a wide range of different structural variables, S_i and a smaller number of neighbourhood variables, N_i . In Vemmelev the proximity to the highway, the motorway and the railway was tested to see if it influenced the house prices. Skjoldhøjparken is very homogeneous and we found no neighbourhood variables of interest in the model.







		Green area number, where the quality is found:	Cannot find within my housing area	Cannot say
	'BEAUTIFUL LANDSCAPE' Places or areas that you find beautiful and attractive (beautiful scenes etc.)		<input type="checkbox"/>	<input type="checkbox"/>
	'VALUABLE NATURE SITE' Valuable nature area or place with a special feeling of nature (e.g. natural vegetation, fauna, fascinating rocks, bedrocks, shorelines).		<input type="checkbox"/>	<input type="checkbox"/>
	'FOREST FEELING' Area or place that feels like a "real" forest.		<input type="checkbox"/>	<input type="checkbox"/>
	'SPACE AND FREEDOM' Area or place where you can enjoy space and freedom.		<input type="checkbox"/>	<input type="checkbox"/>
	'ATTRACTIVE PARK' Constructed park that is exceptionally beautiful (flower beds, constructions, valuable trees, tree lines, places to stay).		<input type="checkbox"/>	<input type="checkbox"/>
	'PEACE AND TRANQUILITY' Area or place that is peaceful and quiet.		<input type="checkbox"/>	<input type="checkbox"/>

Fig. 2

Part of the questionnaire (translated in English) used for social value mapping in Helsinki (TYRVÄINEN et al., 2007).

Teil des Fragebogens (übersetzt in die Englische Sprache), der bei der sozialen Wertkartierung in Helsinki eingesetzt wurde (TYRVÄINEN et al., 2007).

3.2 Case study 2: Social valuation

The presented study in Helsinki, Finland had the overall objective to bring information on the experiences and values of residents' to the decision-makers and planners in an appropriate map form (see TYRVÄINEN et al. (in press b) for a detailed description). A simple and effective tool was to be developed for gathering social information for various decision-making processes as part of ongoing strategic management planning of municipally owned woodland in Helsinki (SIPILÄ and TYRVÄINEN, 2005). Social value mapping shows what kind of values residents have actually experienced in the green areas. This method enables the assessment, analysis and presentation in the form of maps of subjectively valued characteristics of green areas. Social information in map form provides an opportunity for multiple analyses and comparison of social data with other types of information such as ecological inventories, as well as with expert assessments and valuations.

The Helsinki study area, selected together with city authorities included housing areas in Eastern Helsinki, hosting 20,000 residents (Helsinki Metropolitan Area Council, 2002). Some of the areas were built in the 1960s and 1970s and are dominated by blocks of flats. Others were mainly built between 1950 and 1970; they are dominated by single family houses. About 200 ha (35%) of the case study area of 570 ha consists of green space owned by the city of Helsinki. These green spaces are mainly young woodland situated within the housing areas (approx. 65%), former agricultural lands and narrow forested belts within the housing areas (Helsinki Green Area Division, 2002).

A postal questionnaire was sent to 1000 residents aged 15–75, randomly sampled by the Finnish Population Register Centre, during March 2003. The main part of the questionnaire dealt with mapping the social values of green areas. Selected green area values were listed on one page and respondents were asked to identify different values from the study area according their knowledge and experiences. For this purpose, a map with numbered green areas

was included in the questionnaire. Respondents were asked to identify areas with the following positive values: beautiful landscape, valuable nature site, the feeling of forest, space and freedom, attractive park, peace and quietness, opportunities for activity and history and culture. Furthermore, they were asked to identify areas with negative values: unpleasantness, scariness and noise (see Figure 2). Selection of the values used was based on in earlier studies in Sweden (see above) and Belgium (VAN HERZELE and WIEDEMAN, 2002). However, since the values were to be identified by local residents, further simplification and additional values were deemed necessary. Terms and drawings were used to suggest associations with their own green area experiences and to stimulate responses to the mapping part of the questionnaire.

The questionnaire results were analysed by using SPSS (version 11.5); see TYRVÄINEN et al. (2004) for detailed statistical information, for example on the influence of background characteristics. Compilation of background data as well as the compilation and analyses of the results related to the identification of green-area qualities were done using GIS (ArcView 3.2). The background data consisted of numerical data on the extent and characteristics of green areas, infrastructure (Helsinki Metropolitan Area Council, 2002), green area register and forest inventory data (Helsinki Green Area Division, 2002). A database was created for each green area with values identified by the respondents. This then allowed for the plotting of thematic maps for each value and combination of values. The response rates differed between different green area qualities. Therefore, the scale of individual thematic maps was adjusted manually to obtain reasonable value classes. In the second phase of the analysis synthesis maps of both positive and negative values were compiled by selecting the areas of the highest score classes from every thematic map.

3.3 Case study 3: Multiple use valuation

The Malaysian study had the aim to assess multiple forest values in a process of considering forest and alternative land use options.

Studies undertaken included a cost-benefit analysis of the forest preservation option against the alternative of intensive development for the case of a forest reserve near Kuala Lumpur. Moreover, the multiple values assessment also included a stakeholder involvement component, as a stakeholder workshop was used to determine how to set up the valuation, which benefits to include, and so forth.

The study area, Ayer Hitam Forest Reserve (AHFR) is one of the last remaining relicts of formerly widespread lowland rainforest in the rapidly urbanising state of Selangor. The reserve, 1,248 ha in size and leased to a local university for its teaching and research activities, is now on the outskirts of the fast-growing city of Kuala Lumpur, and hence under a high pressure to be developed for other uses. Its size has dwindled over the years to about one fourth of its original size. A special feature of AHFR is the suburban development projects that currently surround the forest. Besides being rich in flora and fauna, AHFR has a few nearby settlements of indigenous people from the Temuan subgroup who still derive part of their livelihoods from the forest.

Based on a stakeholder analysis workshop conducted during 2004, seven areas valuation were identified. First of all, the *importance of the reserve to the Temuan ethnic subgroup* was studied. Data were gathered using a structured questionnaire, whose items included respondents' socioeconomic background, perceptions of development, and relationship to/dependence on AHFR. Interviews were held with the heads of households.

If the reserve is developed, the *carbon content* of the forest will sooner or later be released to the atmosphere, and therefore it is relevant to estimate the possible magnitude of this release. A field survey was conducted in AHFR to estimate the carbon (C) stock. Six 10 m x 100 m transects were laid out in forest areas representing the range of forest conditions in the forest reserve's primary elevation. Complete enumeration of all trees (≥ 10 cm dbh) was conducted in each transect. Tree biomass was computed using results of BROWN (1997). Major C pools measured were above-ground biomass and forest litter. For understorey vegetation (saplings and seedlings ≤ 10 cm dbh), three 1 m x 1 m plots were randomly laid out. All individual trees and woody species were harvested. Fresh weight of leaves, branches, and stems was determined in the field. Oven-dry weight of the different plant parts and wood density was determined in the laboratory. The above-ground tree biomass measurements were to be taken twice – at the beginning

and towards the end of the study – to be able to estimate C sequestration per year.

If AHFR is developed, the *current stumpage value* will be salvaged, and therefore this should be estimated. The residual-value method was used to estimate stumpage value of AHFR. Stumpage value per hectare for a compartment was calculated using the following formula:

$$\Sigma sv_{ij} = v_{ij} * (p_{ij} - c - pm_{ij}) \quad (2)$$

where sv is stumpage value (RM/ha), v is timber volume (m^3/ha), p is log price (RM/ m^3), c is average logging cost (RM/ m^3), pm is profit margin (RM/ m^3) allowing for capital costs and other long-run average cost components and i and j are index for species and diameter class, respectively.

The contingent valuation method was used to elicit *respondents' willingness to pay for recreational purposes*. The data were collected using a structured questionnaire that contained questions pertaining to description of AHFR, likely impact on management options, willingness to pay, and socioeconomic characteristics of respondents. The survey used five bid prices (RM 1, RM 2, RM 3, RM 4, and RM 5). The dichotomous choice with follow-up question was used. The payment vehicle adopted was an entrance fee to visit AHFR. A logit model was used to estimate the mean and median WTP as well as the total conservation value of AHFR. A total of 107 respondents were interviewed.

If AHFR is developed, it may also be worthwhile to salvage the *existing value of medicinal plants*. A market-based approach was adopted to determine the economic value of medicinal plants in AHFR. This required an estimate of physical resources of medicinal plants, price, cost, and profit margin. On the other hand, the physical resources of medicinal plants were estimated using two forest inventory techniques with an inventory block measuring 200 m x 200 m (strip sampling) and 100 m x 200 m (100% census). The value of medicinal plants (VMP) was estimated based on the following equation:

$$VMP = Av. P - (Av. HC + PM) \quad (3)$$

where VMP is value of medicinal plant species per kg, $Av. P$ is average price of medicinal plants per kg, and $Av. HC$ is average harvesting cost of medicinal plants per kg and PM allows for other than variable costs.

Tab. 1

Results of the hedonic analysis (see also ANTHON, 2003). Significance at 99 % = *, 95 % = **.**
Ergebnisse der hedonischen Analyse (s. a. ANTHON, 2003).
Signifikanzniveau bei 99 % = *, 95 % = **.**

Variable	Skjoldhøjparken		Vemmelev	
	Parameter estimate	t-value	Parameter estimate	t-value
Ln floor area	0.491 ***	18.25	0.621 ***	11.97
Ln lot size	0.111 ***	5.07	0.0879 ***	3.18
Age			-0.007 ***	-10.11
Traffic			-0.135 ***	-3.17
Ln age	-0.030 **	-3.22		
Period 1988-89	0.110 ***	-5.49		
Distance	14.012 ***	3.00	4.916 **	2.43
N	526		176	
F-value for model	137.85		84.31	
R-square	0.57		0.71	

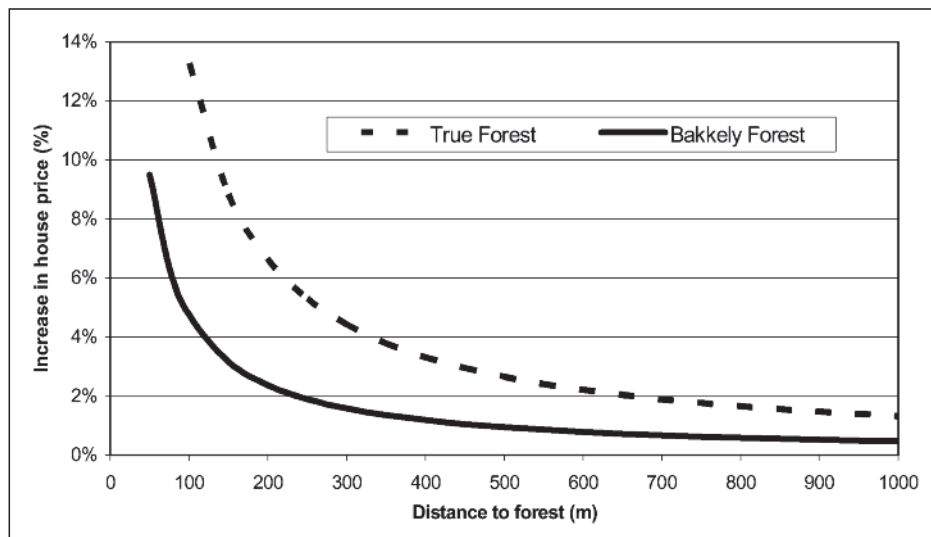


Fig. 3

The estimated recreational value as a function of 'Distance' from forest edge to house. True is the forest next to Skjoldhøjparken and Bakkely that close to Vemmelev.

Geschätzter Erholungswert als Funktion der Distanz from Waldrand zum Wohnhaus. True bezeichnet den Wald in der Nähe von Skjoldhøjparken und Bakkely den Wald nahe Vemmelev.

Data required in estimating the *economic value of conservation* by means of contingent valuation were collected through a survey conducted amongst people living in areas surrounding or adjacent to AHFR. A structured questionnaire was prepared that contained six sections (general questions, plan to restore AHFR, reasons for conservation, willingness to pay, type of experience to be gained in AHFR, and socioeconomic variables). The survey used five bid prices (RM 5, RM 10, RM 15, RM 20, and RM 25). Dichotomous choice with follow-up question was used. The payment vehicle adopted was that of a trust fund, which is to be used solely for the management and conservation of AHFR. A preliminary analysis of the logit model was carried out on 115 respondents to estimate the mean and median WTP as well as the total conservation value of AHFR.

Conserving a forest area for education, research, biological diversity, wildlife, and other environmental protection reasons involves direct costs of conservation. It also involves opportunity cost of conservation, such as foregone benefits from timber harvesting or loss of potential income from other land-use options. The opportunity cost associated with forest conservation was assumed to be mixed property development. The method used to value the proposed development project is the residual value technique, which use market data and expert knowledge of implementation timing and phases to assess the net present value of the development. The proposed development mix on a 1,176-hectare (excluding 72 ha of swamp area) portion of AHFR includes low-cost flats, double-story low-cost houses, two-story shop houses, single-story shop houses, single-story terraces, two-story terraces and two-story semi-detached houses. Other areas that are used for public facilities were also considered, which include water tank, power station, school, oxidation pond, road reserve, and buffer zone. Data on sale prices of property and cost of development were based on projected market price and historical data of a proposed development project for the given area.

4. RESULTS

4.1 Case study 1 – economic valuation

Table 1 shows the final model estimated for the Danish hedonic pricing study. The floor area and lot-size (both log-transformed)

were found to affect the price positively as expected. The age of the house was log-transformed for the Skjoldhøjparken model and untransformed for the Vemmelev model, and in both cases older houses are cheaper. Note again that functional form is not prescribed by theory and here we have chosen the representation resulting in the best statistical model, to ensure valid inference – even if the representation differs across areas. 'Traffic' is a dummy variable of the houses in Vemmelev situated next to the railway or motorway in Vemmelev – as expected it is negative. "Period 1988–89" is an impulse dummy variable that counterbalances a shock to house prices in that period, believed to be related to a severe fiscal contraction known as the 'Potato-cure' implemented by the Danish government in 1987, which reduced the tax-deductions for interests on house-loans dramatically. The dummy was not significant in the Vemmelev-area, probably due to the smaller number of houses and hence few observations in that brief period. Without the dummy, the implicit price of the later afforestation good would perhaps be overestimated. The environmental variable, "Distance", is constructed to measure the distance dependent effect of the afforestation event, i.e. the difference in house prices before and after the afforestation – as a reciprocal function of distance. It is significant and with the expected sign.

The implicit price of proximity to the forest depends on the distance from house to forest edge (see Figure 3). In Skjoldhøjparken the shortest distance is 150 m, implying a price rise of 9.3%. In Vemmelev the corresponding figures are 50 m and 9.8%. The influence of the afforestation project on house prices falls quickly. A house in Vemmelev 600 m from the forest has only gained 0.7% in value, in Skjoldhøjparken 2.2%.

The increase in house prices represents a windfall gain to house owners. For the area in Skjoldhøjparken close to the new True Forest, the windfall gain is a total of 4.662 million euro, and for the homeowners in Vemmelev close to the new Bakkely Skov the windfall amounts to 1.243 million euros.

4.2 Case study 2 – social valuation

The survey showed that green areas are very important to local residents in Eastern Helsinki. Over 97% thought that green areas

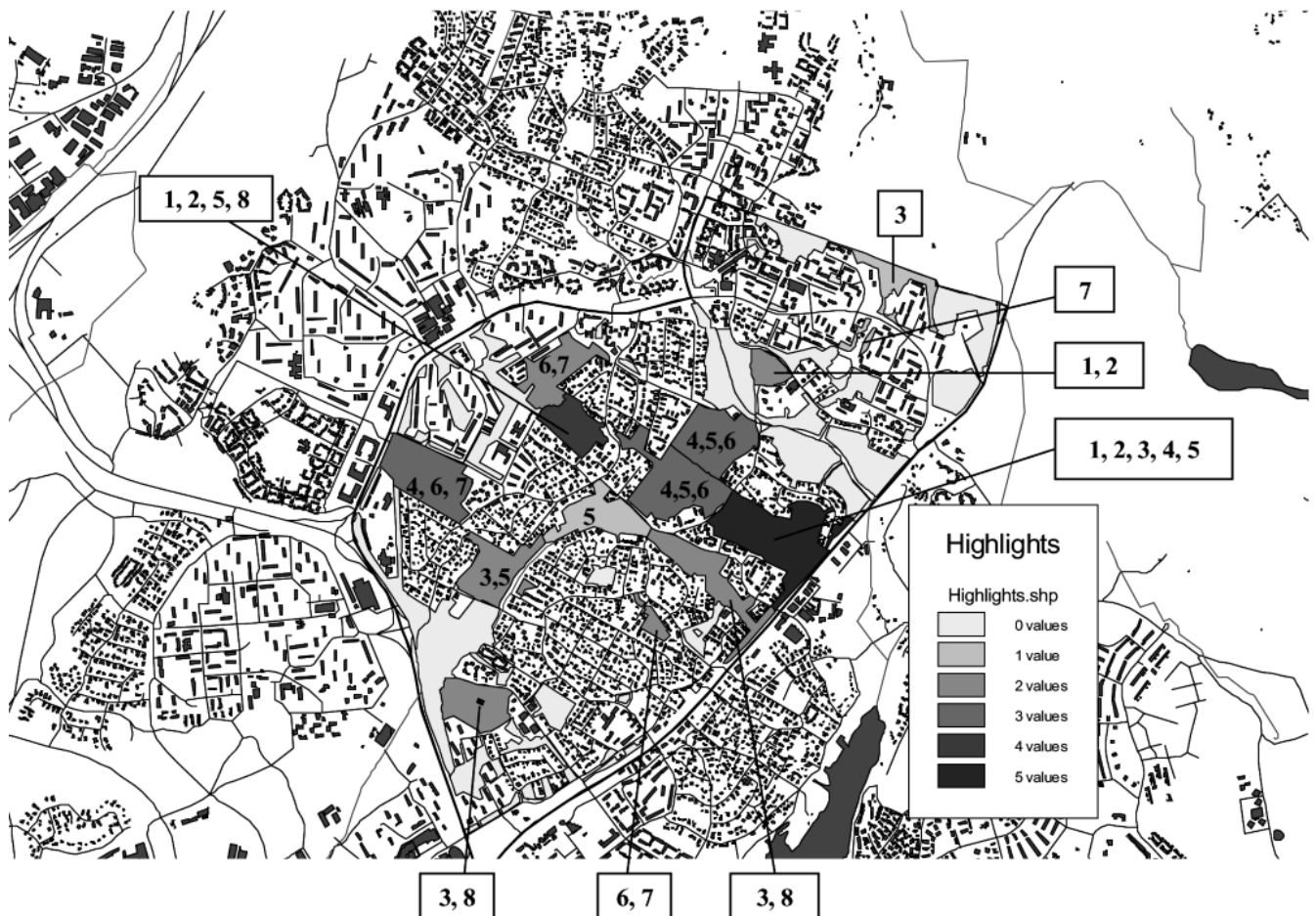


Fig. 4

A synthesis map of the areas with the highest scores on various social value classes.

Explanation of numbers: 1 = beautiful landscape, 2 = valuable nature site, 3 = the feeling of forest, 4 = space and freedom, 5 = peace and quietness, 6 = attractive parkland, 7 = opportunity to activities and 8 = history and culture (TYRVÄINEN et al., 2007).

Eine Synthesekarte der Bereiche mit den höchsten Sozialbewertungen.

Erklärung der Zahlen: 1 = schöne Landschaft, 2 = wertvoller naturnaher Standort, 3 = das Waldgefühl, 4 = Raum und Freiheit, 5 = Frieden und Stille, 6 = attraktiver Park, 7 = Gelegenheit zur Aktivität und 8 = Geschichte und Kultur (TYRVÄINEN et al., 2007).

made a very important or a relatively important contribution to the quality of the living environment. The most important benefits were outdoor recreation possibilities, nature contacts, stress recovery and aesthetic experiences. Residents appreciated a green city structure and wide-spaced building in the suburbs, and infilling of existing housing areas was strongly disapproved of, especially by new-comers and families with small children.

A thematic map for each value or quality was plotted based on received votes per area. These maps illustrate where each specific value is located within the study area. To mention one example: 70% of respondents indicated areas with a “feeling of forest”. One fifth of the respondents stated, however, that woodland in the case study area did not provide an experience of being in a “real forest”. Typically, a feeling of forest is found in larger natural forest areas with natural ground vegetation. The tree stands are mature and relatively dense, but the topographical variation is also important. Probably due to the scarcity of larger mature forest areas within the study area, half-open areas with pine forests (rocky outcrops) were also pointed out as places experienced as a forest.

A synthesis map revealing the highlights of the study area is based on green areas scoring highest, i.e. the green areas seen as the most valuable within the study area. The most valued areas are

large, natural ones with open landscapes and diverse forest (Figure 4). In contrast, small forests patches within the housing areas were regarded to have lost their “forest feeling”.

In line with the above, a synthesis map of negatively experienced areas was also compiled to identify problem areas. Dissatisfaction towards green areas is usually caused by untidiness (in particular litter and dog faeces), but vandalism and noise also decrease the experienced qualities of areas. In addition, lack of management causes irritation and the areas concerned are perceived as neglected and uncontrolled. These most problematic areas are primarily located along major roads with noise problems and some areas within one suburb which has a lower status due to high unemployment and associated social problems.

4.3 Case study 3 – multiple use valuation

The total estimated annual economic value in financial terms collected by the Temuan communities from the AHFR was estimated to be around RM 77,000 (on 1 January 2005, 1 RM equalled about 0.2 euro) with economic value from animals constituting the largest share (57%). In terms of species collected, the two sub-groups of Temuan were more dependent on the forest reserve for

Tab. 2

Different values of different functions for Ayer Hitam Forest Reserve, a peri-urban forest.
Note that values are to some extent overlapping and hence should not be added up;
in other cases values obviously exclude each other.

Werte für unterschiedliche Funktionen der Ayer Hitam Forest Reserve, ein peri-urbaner Wald.
Teilweise ergeben sich überlappende Werte, die nicht aufaddiert werden sollen;
in anderen Fällen schließen sich die Werte gegenseitig aus.

Value component	Development option (RM)	Preservation option (RM)
Value of non-timber forest products to indigenous people		773,090
Value of carbon storage		(No financial assessment yet >930.000 t CO ₂)
Roundwood stumpage	64,180,000	
Value of medicinal plants	212,000 – 1,367,000	
Conservation value (WTP)		863,000,000 (– 4,800,000,000)
Value for property development	926,000,000	

A rate of 10% is used for discounting.

food (wildlife, plants, fish) than for other purposes like housing construction, handicraft-making, and medicine.

Preliminary results based on the first measurement showed that total above-ground C storage of AHFR amounted to approx. 187 t/ha or approximately 930.000 t CO₂ for the whole reserve.

The average estimated stumpage value for all compartments was RM 51,423/ha. Therefore, the total value of timber resources from AHFR's 1,248 ha was estimated to be RM 64,180,000.

Mean and median WTP for recreational use were estimated at RM 4 and RM 4.17 per visit per person, respectively. The bid range was too narrow and therefore the survey was unable to reach the demand choking point, or alternatively, that too many respondents did not take the answer seriously and provided answers based on, for example, "warm glow" or strategic considerations. Based on this estimate, the calculated potential recreational benefit for the whole adult population of Selangor was around RM 86,600 and the present value of recreational benefits was estimated at RM 866,000, again using a discount rate of 10%.

The estimated average economic value of medicinal plants per kg was RM 5.6. Using the physical quantity estimated from the two inventory methods, the economic values of medicinal plants per ha were estimated at RM 1,100 (100% sampling) and RM 170 (strip sampling). Thus, the total economic value of medicinal plants in AHFR (1,248 ha) ranged from RM 212,000 to RM 1,367,000.

Mean and median WTP for conservation were estimated at RM 26 and RM 27 per person per year, respectively. This exceeds the maximum bid offered in the questionnaire, which indicates that the design was unable to reach the demand choking point, or alternatively, that too many respondents did not take the answer seriously and provided answers based on, for example, "warm glow" or strategic considerations. Nevertheless, based on this estimate, and recognizing the importance of the reserve for example as rare relict of lowland forest in the state, the calculated conservation present value for the whole adult population of Malaysia (70% of the population of 25 million people) was RM 4.8 billion, and for the state of Selangor the estimated conservation value was RM 863 million. The latter estimate should be seen as the better one, even if the AHFR has value for people outside the Selangor province. Also, this value may overlap with e.g., the recreational value estimate above. Thus, they should not be added up.

The total land value of AHFR under the proposed housing project is about RM 926 million for a 1,176-hectare portion (NPV at 10%, 3-year development project).

The values are summarised in *Table 2*; in some cases they are overlapping, i.e. they should not be simply added. Some exclude others, e.g., realising the stumpage value as estimated exclude the benefits related to preservation. *Table 2* shows that the threat of development is a very real one, because of the huge profitability of logging and developing the area – even in this rather conservative measure. The fact that the development option sums up to about one billion RM evidently outweighs the value of the current use for tradable goods (non-timber forest products, medicinal plants) by more than a factor of 1,000. Including the benefit of carbon sequestration ensured by preservation will not help much to alter this. Only when including the WTP for the preservation option does preservation gain enough weight to warrant another consideration. WTP-estimates are very high compared to the max bid in the questionnaire design. This suggest that either the choke-off point has not been reached in the design or that too many answers accepting the highest bid are illegitimate (induced by "warm glow" or for strategic reasons).

Harvesting and developing the land is an irreversible path – and hence a so-called quasi-option value in the Arrow-Fisher-sense (ARROW and FISHER, 1974) is likely to exist for this case as its future value is uncertain and could perhaps grow as the Malaysian society becomes wealthier. This value is likely not to be captured in the current value estimate from the contingent valuation study, and should be added to the preservation option.

5. DISCUSSION

Methods and tools for decision making can be evaluated based on aspects of effectiveness, efficiency and equity. The valuation tools tested in the cases have all proven to be effective in at least demonstrating part of the multiple benefits of urban forests, extending beyond the traditional focus on market-based goods and thus (potentially) serving as decision-support tools in land-use planning. Findings for the Danish economic valuation case were included on the benefit-side in a larger and more comprehensive cost-benefit analysis (CBA) which included opportunity costs of land, avoided agricultural pollution, and so forth (ANTHON and THORSEN, 2002). While these additional components were impor-

tant in getting the best possible estimate of the welfare-economic value of the new urban forests, they are also very often specific to the case areas. The hedonic effects of the new forests estimated here may, however, form the basis for benefit transfer and hence more generally offer themselves as key-components in more easy-to-use decision support tools for, for example, city councils wishing to assess the potential effects of “greening” the city. The Danish studies have attracted a broad general interest and have been in demand from local governments, agencies and others involved in land management and urban development.

The social valuation in Helsinki was carried out in close collaboration with local government agencies dealing with planning and management of the urban forest and thus has had a direct impact on decision making. The valuation method allowed for incorporating residents’ values into decision-making in a systematic way. The method is a mixture of both qualitative (personal experiences, memories) and quantitative aspects (numerical social value maps) permitting examination of residential information spatially. The developed maps show areas with qualities that should be sustained in the future as well as development areas where key qualities are currently missing. For land-use planning, the results show the ‘highlights’ of green areas that should be protected from being developed for other land-uses. The method facilitates communication of green area values, and otherwise silent groups can also express their opinions (TYRVÄINEN et al., 2007). Administrators, planners and residents evaluated the method positively and it has already influenced routine green area planning in the city. The maps have been used to establish a dialogue with local communities and to provide planning professionals with basic understanding about the perceived qualities of existing green areas.

The studies in Malaysia have already generated broad public interest (e.g., Li, 2005), although the impacts on actual land use decisions are still unknown. The used methods have proven valuable for determining the multiple (economic) values of selected forest resources in a particular area, rather than focusing on one type of valuation as in the other two cases. Opportunity cost of conversion of forest land to other alternative uses can be estimated; information which can assist policy-makers in evaluating land-use options of forests, also in the tropics. In spite of the studies’ comprehensive approach, several of the economic and other values of the forest reserve are still unknown; various ecological services of the forest ecosystem have for example not been given much attention.

In terms of *efficiency*, many of the methods shown seem rather complex to use and require the involvement of scientists or at least skilled professionals. No information has been provided here on cost and resources involved in the assessment, but it is clear that considerable cost are involved in compiling and analysing information, as well as in consulting with stakeholders.

Economic valuation is often complex and requires expert involvement and the compilation of large data sets. In the Danish and Malaysian cases, outside research expertise was recruited. In both cases, rather large datasets were available beforehand, thus facilitating the work. Especially in Malaysia, however, data for several of the assessments had to be collected ‘in the field’, thus raising cost.

In Helsinki, close links to ongoing municipal planning offer opportunities for efficient implementation of the social mapping tool. Good questionnaire design also requires specific expertise, because each area has its local features that should be taken into account. The use of questionnaires may, however, increase planning costs.

Equity refers to the proper involvement of stakeholders and the equitable sharing of costs and benefits. All cases paid attention to

the equity aspects of allocation of costs and benefits. Equity aspects were covered strongest in the Finnish and Malaysian case studies, which had clear participatory components. In Helsinki, the social values of local residents were the main topic of evaluation. Social value mapping was used as a participation tool in an ongoing strategic management planning process. In Malaysia, the set up of the multiple use valuation was decided upon in close collaboration with several key stakeholders, including members of local communities. Through household surveys and contingent valuation methods, valuation of benefits by stakeholders was combined with more ‘expert-based’ valuation approaches, for example for carbon sequestration, stumpage values, and development of the land for housing.

When looking at the three types of valuation methods, they all have their clear merits and drawbacks. Social value mapping results in partly qualitative information that is difficult to ‘weigh’ against economic values, for example. Economic valuation through hedonic pricing is often complex. The methods provide different types of information about only urban forest benefits and only assessments in monetary terms can be part of a wider cost-benefit assessment. In the Malaysian example, economic valuation of various benefits was combined with a stakeholder analyses and involvement process which assisted scientists and decision makers in broadening their knowledge and understanding of the forest reserve and its values to different stakeholders. Yet, the method had a less direct link to land-use decision making as in Helsinki. As the three cases have illustrated, it is also important to tailor valuation to the local context in terms of, for example, decision-making process, urban forest benefits in focus, and availability of funding, data, expertise and technologies. It is clear that the Malaysia case stands out because of its tropical and developing country context. The latter, for example, might be reflected in an even higher predominance of urban development in land-use planning.

Comprehensive assessments of values, combining economic and social assessment tools, seems to be the most promising way forward for decision support in urban forestry. Other studies such as the one by MOONS et al. (2005) have attempted to take into account a range of benefits, opportunity cost of alternative land use, as well as forest planning and management cost. GIS-methodology has assisted in combining, analysing and presenting the large amounts of information that result from this type of assessments; see Balram and DRAGICEVIC (2005) for a combination of GIS user preference surveys. Multi-criteria analysis and other decision-support tools can assist in weighting valuations of different benefits. Important here is to combine economic and social valuation tools. Future research and development work could be based on experiences like these and the ones presented in this paper, searching for sets of methods that assess different urban forest benefits in a format directly applicable in a socially-inclusive decision making context.

6. ABSTRACT

Many environmental and social services provided by urban and peri-urban forests are difficult to assess and quantify, for example, in monetary terms. This weakens the position of urban forestry in urban development and land use planning discussions. Therefore, there is a need to develop assessment approaches that can strengthen the policy-science interface by acting as decision-support tools within wider urban and regional policy-making contexts. Examples are presented where different methods for assessing social and environmental values of existing and new urban woodland were applied. These include an economic valuation study applying hedonic pricing assessing the effect of peri-urban afforestation on house prices in Denmark. Social valuation through social value mapping was studied in Helsinki, Finland. Finally, in Malaysia, various tools were combined to assess the multiple costs and benefits association

with preserving one of the last remaining original forest areas near Kuala Lumpur. The different assessment tools have their respective strengths and weaknesses from a decision-support perspective, and for use under different circumstances. Combining different urban forest valuation tools is the preferred option in land-use planning.

7. Zusammenfassung

Titel des Beitrages: *Entscheidungsunterstützung für die Landnutzungsplanung durch die Bewertung der Wohlfahrtswirkungen von Stadtwäldern.*

Zahlreiche umweltrelevante und soziale Dienstleistungen, die durch urbane und peri-urbane Wälder erbracht werden, sind schwierig zu erfassen und zu quantifizieren, zum Beispiel in monetären Einheiten. Dadurch wird die Position der urbanen Waldnutzung (*urban forestry*) in der öffentlichen Diskussion um Stadtentwicklung und Landschaftsplanung geschwächt. Aus diesem Grund besteht ein besonderer Bedarf an Verfahren der Erfassung und Bewertung, sodass die Schnittstelle Wissenschaft-Politik durch Hilfsmittel der Entscheidungsunterstützung im Kontext regionaler Politik gestärkt wird. Zur Veranschaulichung dieser Probleme werden Beispiele gegeben, wie die vielfältigen Leistungen bestehender und neu zu begründender urbaner Waldlandschaften erfasst werden können. Ein Beispiel befasst sich mit einer ökonomischen Analyse der Auswirkungen peri-urbaner Aufforstungen auf die Hauspreise in Dänemark, unter Verwendung hedonischer Preise. Eine sozial-ökonomische Bewertung mit Hilfe sozialer Wertkartierungen wurde in Helsinki durchgeführt. In Malaysia wurden schließlich mehrere Verfahren kombiniert, um die vielfältigen Kosten und Nutzen im Zusammenhang mit der Erhaltung eines letzten verbleibenden Naturwaldes in der Nähe von Kuala Lumpur zu beschreiben. Die verschiedenen Methoden besitzen, aus Sicht der Entscheidungsunterstützung und im Hinblick auf die jeweilige Anwendung, spezifische Stärken und Schwächen. Die Kombination unterschiedlicher Bewertungsverfahren der urbanen Waldnutzung scheint ein vielversprechender Ansatz in der Landnutzungsplanung zu sein.

8. Résumé

Titre de l'article: *Aide à la prise de décisions pour la planification de l'usage de l'espace rural, basée sur les méthodes d'évaluation des apports des forêts périurbaines.*

De nombreuses productions à caractère social et environnemental assurées par des forêts urbaines et périurbaines sont difficiles à appréhender et à quantifier, par exemple en unités monétaires. De ce fait la position de la production forestière urbaine (*urban forestry*) se trouve affaiblie lors des discussions publiques sur le développement des villes et la planification de l'espace rural. Ainsi il existe un besoin tout particulier de méthodes de saisie et d'estimation, de telle sorte que l'interface science-politique se trouve renforcée, dans le contexte de la politique régionale, par des aides aux prises de décisions. Pour illustrer ces problèmes on donne quelques exemples de la manière selon laquelle peuvent être cernées les productions des paysages forestiers existants ou à créer. Un de ces exemples concerne l'analyse économique des effets, au Danemark, des reboisements périurbains sur le prix des maisons, analyse ayant recours aux prix hédonistiques. Une estimation socio-économique a été établie à Helsinki à l'aide de cartographies des valeurs sociales. Enfin on a combiné plusieurs méthodes en Malaisie pour décrire les multiples coûts et productions entraînés par le maintien d'une dernière forêt naturelle qui subsiste dans les environs de Kuala-Lumpur. En ce qui concerne l'assistance aux prises de décisions et selon l'usage que l'on en fait, les différentes méthodes ont leurs forces et leurs faiblesses. La combinaison de procédés divers d'estimation de la production des forêts urbaines semble la voie la plus prometteuse pour la planification des usages des paysages.

J. M.

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Neuerscheinung:

Waldbauliche Behandlung der Auenwälder am Oberrhein unter besonderer Berücksichtigung der Stieleiche (*Quercus robur* L.)

Schriften aus der Forstlichen Fakultät der Universität Göttingen
und der Niedersächsischen Forstlichen Versuchsanstalt, Band 140

Von CHRISTIAN KÜHNE, NORBERT BARTSCH und ERNST RÖHRIG

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138 Seiten mit 15 Abbildungen und 43 Tabellen

Der vorliegende Band stellt die Ergebnisse umfangreicher Versuche zur Verjüngung der Stieleiche in den Auenwäldern am Oberrhein vor. Daraus werden Empfehlungen für die künftige waldbauliche Behandlung dieser Standorte abgeleitet. Berücksichtigt werden hierbei auch die aktuellen Diskussionen und Planungen zum Hochwasserschutz.

Auenwälder sind in ihrer Artenzusammensetzung, Struktur und Dynamik abhängig von Dauer, Häufigkeit, Stärke und zeitlichem Auftreten von Hoch- und Niedrigwasser. Sie haben für den Landschaftshaushalt eine nicht zu ersetzende Bedeutung. Wegen des Nährstoff- und Humusreichtums bieten die Auenwälder vielen Baumarten die Möglichkeit zu hoher Produktion auch von wertvollen Holzsortimenten. Ihre Biodiversität ist so hoch wie in keinem anderen mitteleuropäischen Waldtyp. Durch vielfache wasserbauliche Eingriffe zum Ausbau des Rheins wurde die ehemalige Aue in ihrem Landschaftsgefüge fast völlig umgewandelt und die Wälder stark zurückgedrängt. Die Stieleiche war neben den Ulmenarten die dominierende Baumart der Auenwälder. Ihr Vorkommen in den Beständen ist im vergangenen Jahrhundert stark zurückgegangen. Waldbauliche Anstrengungen ihren Anteil wieder zu erhöhen, waren wenig erfolgreich.

Um den Gründen hierfür nachzugehen, wurde im Jahr 1997 durch das Institut für Waldbau der Universität Göttingen und die Landesforstverwaltung Rheinland-Pfalz ein Forschungsvorhaben zur natürlichen und künstlichen Verjüngung der Stiel-

eiche in den Pfälzer Rheinauen begonnen. Ziel des Forschungsprojektes war es, in Zusammenarbeit mit der forstlichen Praxis waldbauliche Verfahren zu entwickeln, mit denen sich der Stieleichenanteil unter den gegenwärtigen Standorts- und Bestockungsverhältnissen der Rheinauenwälder erhöhen, zumindest aber erhalten lässt. Die Kulturversuche in der Überflutungsauere ergaben, dass sich die Stieleiche durch Naturverjüngung und Saat nicht verjüngen lässt. Die Stieleiche kann nur durch sehr sorgfältige Pflanzung von Großpflanzen eingebracht werden. Auch hierbei können je nach Hochwassersituation im Pflanzjahr hohe Ausfälle auftreten. Unter den derzeitigen Standortsverhältnissen lassen sich auch andere Baumarten nur unzureichend verjüngen oder weisen nach Hochwasser Schäden auf.

Daraus ergibt sich die Folgerung, die Standorte der Überflutungsauere forstlich extensiv zu bewirtschaften und die Stieleiche nur sehr begrenzt als Mischbaumart einzubringen. In den pfälzischen Rheinauen ist die Anlage von Hochwasser-Rückhalteräumen (Polder) im Planungs- oder Baustadium. Eine regelmäßige „Ökologische Flutung“ der beabsichtigten Retentionsräume wird zweifellos zu einer Veränderung der Hochwassersituation führen. Die in diesem Band vorgestellten Untersuchungen zeigen, dass eine Verkürzung der Hochwasserdauer in der Vegetationszeit und eine Verminderung der Überflutungshöhe die Verjüngungs- und Aufwuchsbedingungen für die typischen Laubbaumarten des Hartholzauenwaldes verbessern könnten.

J. D. SAUERLÄNDER'S VERLAG · FRANKFURT AM MAIN

Neuerscheinung:

Der Naturwald Bruchberg im Nationalpark Harz – Vegetation, Waldstruktur und Arthropodenfauna

**Schriften aus der Forstlichen Fakultät der Universität Göttingen
und der Niedersächsischen Forstlichen Versuchsanstalt, Band 141**

Von MARTIN WECKESSER, JÖRG E. U. SCHMIDT, PETER MEYER,
WILHELM UNKRIG und ANNE WEVELL VON KRÜGER

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„Aus Urwäldern lernen“ – dieser Gedanke ist bereits frühzeitig von mitteleuropäischen Forstleuten und Vegetationskundlern formuliert worden. In Deutschland kommen vom Menschen weitgehend unberührte Wälder allerdings nur in verschwindend geringen Flächenanteilen vor. Um dieses Manko auszugleichen, wurde in den letzten 35 Jahren ein Netz von unbewirtschafteten Waldschutzgebieten aufgebaut, zu denen auch die so genannten Naturwälder gehören. In diesen Totalreservaten finden keinerlei Eingriffe durch die Forstwirtschaft mehr statt. Für Forstwissenschaft und Biologie bilden solche Gebiete einzigartige „Forschungslaboratorien“, in denen die ungestörte Entwicklung von Wäldern samt ihrer Tier- und Pflanzengemeinschaften studiert werden kann.

Der Naturwald Bruchberg liegt inmitten der natürlichen Fichtenzone des Harzes und zeichnet sich durch ein vielfältiges Mosaik aus Wäldern und baumarmen Mooren aus. Bereits seit 1970 wird das Reservat nicht mehr bewirtschaftet und eignet sich daher gut zur Untersuchung der natürlichen Dynamik von Fichtenwäldern. Dies gilt insbesondere für die Auswirkungen großflächigen Borkenkäferbefalls auf die Struktur und Zusammensetzung der Lebensgemeinschaften.

Durch die Nordwestdeutsche Forstliche Versuchsanstalt wird seit nunmehr 30 Jahren die Waldstruktur im Gebiet dokumentiert. Es erfolgte eine flächendeckende waldkundliche Erfassung im Rahmen einer Stichprobeninventur, und parallel wurden faunistische sowie floristische und vegetationskundliche Forschungsarbeiten durchgeführt. Auf Grundlage dieser Datenbasis wird das Beziehungsgefüge zwischen Waldstruktur, vorhandenen Lebensgemeinschaften und standörtlichen Verhältnissen untersucht, und aus der Synthese werden Schlussfolgerungen für Waldbau und Waldnaturschutz in Fichtenwäldern gezogen.

Die Arbeit „Der Naturwald Bruchberg im Nationalpark Harz“ stellt erstmals die wichtigsten Forschungsergebnisse über ein solches Waldreservat in den Harz-Hochlagen monografisch zusammen und soll einen Ausgangs- und Bezugspunkt für weitere langfristig angelegte Forschungen bilden. Im Mittelpunkt stehen dabei die Veränderungen des Waldökosystems nach dem großflächigen Absterben ganzer Bestände. Das Buch wendet sich an alle Forstwissenschaftler, Naturschützer und Biologen, die an den Tier- und Pflanzengemeinschaften und der natürlichen Dynamik naturnaher Fichtenwälder interessiert sind.

J. D. SAUERLÄNDER'S VERLAG · FRANKFURT AM MAIN