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# Tools for assessment of human health dimensions in forests

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## Tools for assessment of human health dimensions in forests

Human health related to forests can be evaluated by Health Impact Assessment (HIA) methodologies and by using indicators of Sustainable Forest Management (SFM). The HIA systematically reviews the health aspects associated with a development policy, plan or project for a forested area, whereas the indicators of SFM can be used to monitor and give information on the existing forests, and their management, including planning. A prerequisite for the assessment of human health aspects in forestry context is defining the relevant indicators. The physical and mental aspects of human health as well as human diseases related to forest conditions are not covered comprehensively and in an operational way for use in current forest management. The health aspects need more multidisciplinary research on the cause-effect relationships between health, forest management and biodiversity. It is also necessary to develop methodologies for the estimation of the economic value of the non-market forest ecosystem services. This article outlines several possibilities to collaborate and develop joint approaches between forest and health sector to assess the health aspect in forests and to ensure that the health aspects in forest management are taken into consideration.

**Keywords:** health impact assessment, indicators of sustainable forest management, health aspects in forests, determinants of human health

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Forests contribute to human well-being through many important ecological, social, cultural and economic functions and services. Apart from the production of wood, forestry goals include, for instance, maintainance of forest biodiversity, management of groundwater resources, landscape management, use of forests for recreational purposes and tourism, serving as a traffic noise barrier, prevention of avalanches and erosion and provision of non-wood goods such as berries, mushrooms and game. Additional important functions include mitigation of climate change by sequestering carbon from the air into the forest vegetation, soils and wood. These functions may also be reflected in the profitability of forestry and in timber prices; aspects which are important to maintaining the forest conditions and safeguarding the forest utilities.

Many cause-effect relationships between forests and human health have already been established (Colfer 2008). However, a further clarification of the linkages between human health and forests is considered timely and valid. Modern life styles and urbanization in the developed world, especially in countries with dense populations, have led to in-

creased physical and mental stress for people. Recreation in forests or design and utilization of forest landscapes can act as therapeutic means to recover from stress (Figure 1). However, there are huge differences within industrialized and European countries in the human relations to the forests depending on the population densities and areal distributions, as well as on traditions (MCPFE 2006).

Also in developing countries the linkages between forests and human health need increased attention, especially in the connection with deforestation and land-use change. In the developing countries the forests are often associated with transforming the forest land to agricultural land, supplying food to animals and forest communities, meeting the needs for fibre, pharmaceutical products and clean water, or with adverse effects such as infectious diseases (e.g. malaria). The forest-dwellers suffer from the effects of deforestation and may suffer from health problems not only through the nutritional loss and infectious diseases, but also through the destruction of peoples' cultural living habitats (Colfer 2008).

The human health dimension in a forest context is recognized to represent a very wide, interdis-



**Fig 1** Outdoor activities in forests help people to recover from stress. Cross-country skiing is a popular winter sport in Finland.  
Photo: Metla/Erkki Oksanen

disciplinary, but so far vaguely-defined, field of research and with potentially valuable applications. Abraham et al (2007) proposed including ecological, aesthetic, physical, mental, social and pedagogical factors for establishing links between forested landscapes and human health.

The aim of this article is to introduce tools (both procedures and indicators) for assessment of health related issues in forests, to bring attention to the potential of using Sustainable Forest Management (SFM) principles and indicators in addressing human health, and to identify possible areas for bridging Health Impact Assessment (HIA) determinants and indicators of SFM.

### Human health dimensions in a forest context

Human health aspects related to forests can be described and evaluated by HIA methodologies and by using indicators of SFM. Other possible tools are forest certification schemes and, for instance, the EU Forest Law Enforcement, Governance and Trade (FLEGT) procedure.

A prerequisite for addressing human health issues is defining relevant concepts and indicators applicable to the forestry contexts. In that respect the basic concepts may include: a) the definition of health and its determinants, and b) clarification of the concept of SFM and its relevant criteria and indicators related to human health.

The indicators for evaluating the status of forests can be quantitative and qualitative. For operational use especially the quantitative indicators

should be measurable, clear and well defined, realistic and practical, committed to by all major parties involved and cost-effective (Köhl & Rametsteiner 2007). Ideally, the human health aspects should be linked with forest sustainability indicators in the same manner as other forest functions such as forest resources, health and vitality, productivity, biodiversity, protective and socio-economic functions of forests (Parviainen 2009, Parviainen & Lier 2007).

### Definitions of human health

Human health has been defined by the World Health Organization (WHO) in 1948 as: *a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*. In addition the WHO (2009)<sup>1</sup> has defined environmental health as follows: *addressing all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviours. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments*.

Due to the complexity of the environmental health concept and a huge variation in forest conditions depending on societies and geographical forest zones, it is difficult to define a common or priority list of health aspects. A starting point will be addressing the environmental health risk factors with known epidemiological links to forest ecosystems.

<sup>1</sup> Definition of environmental health: [www.who.int/topics/environmental\\_health/en/](http://www.who.int/topics/environmental_health/en/) (7.1.2010).

## Sustainable Forest Management

The concept of sustainable management of forests has received worldwide recognition. The modern concept of forest sustainability will soon be 20 years old. However, the term “sustainable” was first mentioned and utilized related to the sustainable yield of forest resources already in the 18<sup>th</sup> century (von Carlowitz 1713). Based on the UNCED Rio Declaration in 1992, European countries agreed in the Ministerial Conference for the Protection of Forests in Europe (MCPFE) in Helsinki in 1993 the principles of SFM with simultaneous respect to ecological, economic and social aspects.

SFM was defined as follows (MCPFE 1993, Resolution H1, item D): *Agreeing that, for the purposes of this resolution, “sustainable management” means the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.*

To date, a total of nine intergovernmental regional sets of criteria and indicators for various forest zones and a total of 185 countries have subscribed to the concept of SFM. These countries include MCPFE countries, Montreal Process countries of temperate and boreal forests outside Europe, International Tropical Timber Organization (ITTO) and African Timber Organization countries, Amazon region, Central American, Dry Zone Africa, Near East

and Dry Forest Asia countries. This coverage provides a basis to extend the use of SFM criteria to all continents and forest situations (FAO/ITTO 2004).

In the follow-up work by MCPFE in 1993–2003, 35 quantitative indicators, 12 qualitative indicators and five overall policy instruments were developed for monitoring SFM (Table 1). The reports based on this set of indicators provide a balanced compendium of information on the status and trends of SFM. There exist several indicators under various criteria related to well-being and human health such as accessibility to recreation, employment including safety and health, forest services, non-wood forest goods and cultural values.

At the fourth MCPFE conference in Vienna 2003, a resolution was adopted for preserving and enhancing the social and cultural dimensions of SFM in Europe (MCPFE 2003). This resolution includes several aspect of human well-being such as:

- popular artefacts and traditions (folklore, fairy tales and legends, traditional songs, forest and religion), arts (paintings, literature, music, wood carving, photography);
- vestiges of previous generations in forests (archaeological, historical, religious, spiritual forests and battlefields), aesthetic or culturally valuable forests and landscapes, forest and sport, forest and health;
- (traditional) know-how in wood construction (wooden houses, churches, hewing logs, furniture, ornaments, boat building, wooden musical instruments, oak casks for wines etc.), use of wood and wood properties, edible plants, berries, mushrooms, herbs and natural medicines in everyday life.

However, these aspects are not yet fully developed into measurable qualitative indicators for immediate use by health assessment. In addition, the human health issues defined as physical or mental well-being or diseases depending on forest conditions are missing from the present SFM criteria and indicator sets. On the other hand, several cultural and spiritual values are included in the multiple forestry goals, but are not reflected in the profitability calculations of forest uses. There is a need to develop methodologies for the estimation of the economic value of these non-market forest ecosystem services, in order to create economic incentives for forest owners or forest communities to maintain these forest functions (Köhl & Rametsteiner 2007).

## Tools for assessment of the human health dimensions in forests

### Health Impact Assessment methodologies

HIA systematically reviews the health hazards and promoters associated with a development policy, plan or project and, furthermore, analyzes deter-

Criteria and indicators	
Criterion 1: Forest Resources	4.5 Deadwood
1.1 Forest area	4.6 Genetic resources
1.2 Growing stock	4.7 Landscape pattern
1.3 Age structure and/or diameter distribution	4.8 Threatened forest species
1.4 Carbon stock	4.9 Protected Forests
Criterion 2: Health and Vitality	Criterion 5: Protective Forests
2.1 Deposition of air pollutants	5.1 Protective forests – soil, water and other ecosystem functions
2.2 Soil condition	5.2 Protective forests – infrastructure and managed natural resources
2.3 Defoliation	Criterion 6: Socio-Economic Functions
2.4 Forest damage	6.1 Forest holdings
Criterion 3: Productive Functions	6.2 Contribution of forest sector to GDP
3.1 Increment and fellings	6.3 Net revenue
3.2 Roundwood	6.4 Expenditures for services
3.3 Non-wood goods	6.5 Forest sector workforce
3.4 Services	6.6 Occupational safety and health
3.5 Forests under management plans	6.7 Wood consumption
Criterion 4: Biological Diversity	6.8 Trade in wood
4.1 Tree species composition	6.9 Energy from wood resources
4.2 Regeneration	6.10 Accessibility for recreation
4.3 Naturalness	6.11 Cultural and spiritual values
4.4 Introduced tree species	

**Tab 1** MCPFE criteria and 35 quantitative indicators for Sustainable Forest Management (SFM). Indicators directly related to human health and well-being are: 3.3 Non-wood goods, 3.4. Services, 6.5 Forest sector workforce, 6.6 Occupational safety and health, 6.10 Accessibility for recreation and 6.11 Cultural and spiritual values.

minants of health as they may change in the course of a development activity. HIA addresses changes in health determinants and predicts the health impacts before “the first tree has been cut”. In addition it develops evidence-based recommendations to inform the decision-making process on health protection and promotion. The output of HIA is a Public Health Management Plan.

HIA can be defined as: *a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended effects of a policy, plan, programme or project on the health of a population and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects* (Quigley et al 2006).

The determinants of health are classified into three categories (Table 2). Several of the above-mentioned human health aspects of SFM correspond to these determinants. However, HIA as a qualitative frame for the human health dimension does not define a specific list of measurable quantitative health indicators.

In most cases HIA has been applied for the tropical countries. Examples<sup>2</sup> of application of HIA are:

- Monitoring the effects of air pollution on health in Europe,
- the impacts of forest degradation on medicinal plant use and implications for health care in eastern Amazonia,
- an ethno-botanical study of medicinal plants used by the Zay people in Ethiopia and integrated impact assessment of managing the Pak Mun Hydro-power Dam in Thailand: The future of the Mun River and the health of its people.

#### Use of SFM criteria and indicators for the assessment of human health aspects

The assessment of the human health aspects can be implemented on the basis of the SFM approach with creating separate “health” indicators. The most relevant and measurable new indicators for human health aspects in forests should be defined and

agreed. These are most likely connected to the social criterion (Table 1, Criterion 6; Harshaw et al 2007). Such indicators could be, for example, infectious diseases (such as Lyme disease), chronic diseases, allergy or mental aspects depending on forest conditions (Kinnunen et al 2007). In tropical countries, parallel indicators might include, for example, forest management methods causing increased risk for malaria. While to date there exists very little evidence-based research on the linkages between the forest management and human health, for the practical applications the indicators may be firstly qualitative.

For the health sector, the challenge is to develop new forest-related human health indicators, which may be used for HIA assessment. The SFM indicators may help to improve the understanding and coordination between the sectors. Separate forest-related human health indicators can be included in the reports of public health in a similar manner as they are often included in reports of the water, energy, mining, biodiversity and agriculture sectors.

The SFM indicators have been applied in Europe for reporting the Status of Europe’s Forests in 1998, 2003 and 2007, and numerous times since 1993 for national reporting with various applications in all European countries. The evaluation is carried out periodically at national level, often with intervals of five years. The reports are based on the available data from field measurements, separate studies and statistical surveys (e.g. national forest inventory data, forest statistics information services) conducted by various agencies (such as environmental institutes, labour authorities and research institutes).

The forest reports provide information for forest policy making, forest management, as well as for forest research and education purposes. These reports have also been a framework for national and regional forest programs, and they are a useful communication tool for both policy makers and the general public.

<sup>2</sup> www.who.int/hia/examples/en/ (7.1.2010).

**Tab 2** Examples of the determinants of human health (Quigley et al 2006).

Categories of determinants of health	Examples of specific health determinants
<b>Individual factors:</b> genetic, biological, lifestyle/behavioral and/or circumstantial. Some of these factors can be influenced by proposals and plans, others cannot	Gender, age, dietary intake, level of physical activity, tobacco use, alcohol intake, personal safety, sense of control over own life, employment status, educational attainment, self esteem, life skills, stress levels
<b>Social and environmental factors:</b> physical, community and/or economic/financial conditions	Access to services and community (health, shopping, support); social support or isolation; quality of air, water and soil; housing; income; distribution of wealth; access to safe drinking water and adequate sanitation; disease vector breeding places; sexual customs and tolerance; racism; attitudes to disability; trust; land use; urban design; sites of cultural and spiritual significance
<b>Institutional factors:</b> the capacity, capabilities and jurisdiction of public sector services	Availability of services, including: health, transport and communication networks; education and employment; environmental and public health legislation; environmental and health monitoring systems; laboratory facilities

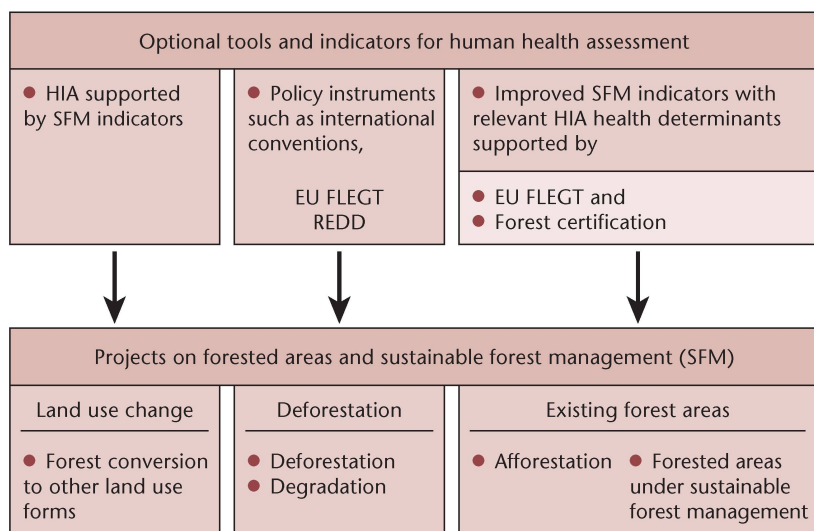


Fig 2 Optional tools and indicators for human health assessment in various forest conditions.

### Forest certification

Voluntary forest certification was introduced in 1993 as a market-driven tool to inform consumers of wood products that certified products come from forests that are managed in a sustainable way. certification auditing against the agreed standards is always carried out by an independent party, which issues Certificate (a label) to those forests that meet the conditions. An important character of forest certification is the commitment of all stakeholders to the standards. Two global forest certification systems are in operation: Programme for the Endorsement of Forest Certification Schemes (PEFC) and Forest Stewardship Council (FSC).

Forest certification supplements other efforts to promote SFM, but cannot replace the forestry infrastructure created by legislation, national agreements, forestry financing systems and active organizations. Human health aspects are not fully included into the standards at present. The health aspects can be integrated into the present standards in a similar manner to that in they can be integrated into the SFM indicator sets. In a given situation also HIA may take up forest certification as a possible recommendation for prevention of ill health related to unsustainable forest management.

### Forest Law Enforcement, Governance and Trade

Preventing illegal logging would slow the rate of tropical forest loss and creates a possibility to integrate human health aspects with this procedure. The EU has developed the so-called Flegt procedure, which aims to prevent the sale on EU markets of illegally-felled timber and derived products. By means of a country-specific partnership system, the Flegt licensing system promotes and supports SFM in developing countries and encourages Member States and developing countries to work more closely.

The assessment of human health may be taken in consideration by FLEGT through the criteria of SFM or certification procedures, if these aspects are integrated into the criteria set or standards.

Also the new REDD (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries) mechanism for carbon trading will provide funds to tropical countries, helping preserve rainforests and delivering economic benefits to impoverished rural communities. This instrument can also contribute to maintain the health status of forest-dependent communities.

### Scheme for the assessment of health aspects in forests

Figure 2 shows a proposal for how to integrate the various approaches and tools for the assessment of health aspects in various forest projects and management situations. The challenge is to develop operational, combined indicators for human health aspects related to forest conditions.

By monitoring/assessment of the health aspects the information for the indicators can be gathered by forest inventory methods and surveys, satellite imagery supported by field measurements, case studies and new remote sensing methods, such as laser scanning. For planning purposes, by implementing these human health issues into practical forest management and projects, various methods (participatory planning, consultations, committees, public hearings, informal networking, public excursions, landscape ecological planning, planning systems with GIS) can be used depending on the various levels and situations (National Forest Program, regional level programs, management plans for individual holdings, national parks, conservation areas, local community forests etc.).

### Conclusions and recommendations – bridging forestry and health

Human health aspects defined as diseases and physical or mental well-being are not described comprehensively in the SFM and in the HIA tools as operational and measurable indicators. There is a strong need for increased inter-sectoral communication and multi-disciplinary research between forest conditions and human health, and to develop a harmonized indicator list for forest-related health aspects, including the definitions and terms. This article outlines several possibilities to collaborate and develop joint approaches between forest and health sectors to assess health aspects in forests (Kinnunen et al 2007).

The indicators have two roles: on the one hand, they deliver information on the important health characteristics for decision-making, whilst

on the other hand they serve as a basis for guidance of the forest management according to the society's needs. For the international use of indicators, the heterogeneity and diversity of countries should be taken into account. Focusing on the main messages and increasing the clarity of the assessment may lead to concentration on the most important, common, easily measurable and cost-effective indicators. The aim should be that the health-related forest indicators can be reported and verified, and then used for many different purposes in both forest and health sectors. ■

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## Instrumente für die Bewertung der Gesundheitsaspekte des Waldes

Die Zusammenhänge zwischen menschlicher Gesundheit und dem Wald können mithilfe einer Gesundheitsverträglichkeitsprüfung (GVP) und unter Verwendung von Indikatoren für eine nachhaltige Waldbewirtschaftung evaluiert werden. Die GVP untersucht systematisch die gesundheitlichen Aspekte einer Entwicklung, eines Planes oder eines Projektes in einem gegebenen Waldgebiet, während die Nachhaltigkeitsindikatoren dazu dienen, Informationen über Zustand und Entwicklung des Waldes und seiner Bewirtschaftung inklusive Planung zu liefern. Voraussetzung für die Bewertung der Gesundheitsaspekte eines Waldes ist die Wahl der relevanten Indikatoren. Die physischen und psychischen Dimensionen menschlicher Gesundheit sowie Krankheiten in Verbindung mit dem Waldzustand sind noch zu wenig gut bekannt, um auf operationeller Ebene in der Waldbewirtschaftung Eingang zu finden. Es braucht interdisziplinäre Forschung zu Ursachen und Wirkungen zwischen Gesundheit, Waldbewirtschaftung und Biodiversität. Zudem müssen Methoden entwickelt werden, mit welchen der ökonomische Wert der nicht marktbestimmten Waldökosystemleistungen ermittelt werden kann. Dieser Artikel entwirft mehrere Möglichkeiten für eine Annäherung und eine Zusammenarbeit zwischen dem Wald- und dem Gesundheitssektor, damit in Zukunft der Gesundheitsaspekt eines Waldes bewertet und in der Waldbewirtschaftung mitberücksichtigt werden kann.

## Outils pour évaluer la relation entre la santé humaine et les forêts

La relation entre la santé et la forêt peut être décrite par les méthodes de l'évaluation d'impact sur la santé et l'utilisation des indicateurs de gestion durable des forêts. L'étude d'impact examine systématiquement les aspects sanitaires liés à une politique de développement, un plan ou un projet de surface boisée. Les indicateurs de gestion durable, quant à eux, peuvent fournir des informations sur l'état et le développement de forêts existantes et de leur gestion (y compris planification). La définition d'indicateurs pertinents est une condition préalable à l'analyse des effets d'un contexte forestier sur la santé. Les aspects physiques et psychiques de la santé ainsi que les maladies en relation avec l'état de la forêt sont encore trop peu étudiés pour pouvoir être utilisés de manière opérationnelle dans la gestion forestière. Une recherche interdisciplinaire serait nécessaire pour déterminer les relations de cause à effet entre la santé, la gestion forestière et la biodiversité. Il serait également essentiel de développer des méthodes pour estimer la valeur économique des services non-marchands de l'écosystème forestier. Le présent article esquisse plusieurs possibilités de collaboration et de rapprochement des secteurs de la santé et de la forêt afin d'intégrer et évaluer à l'avenir les aspects santé dans la gestion forestière.