Forest health: A global overview

The world's total forest area is just over 4 billion hectares which represents 31 percent of the total land area and an average of 0.6 ha per capita (Figure 1).

Deforestation – mainly the conversion of tropical forests to agricultural land – shows signs of decreasing in several countries but continues at a high rate in others. Around 13 million hectares of forest were converted to other uses or lost through natural causes each year in the last decade compared to 16 million hectares per year in the 1990s.

While there are signs that the net loss of forests in Africa is decreasing – from 4.1 million hectares per year in the 1990s to 3.4 million hectares per year in the last decade – few countries have reliable data from comparable assessments over time, so the resulting trends should be treated with caution.

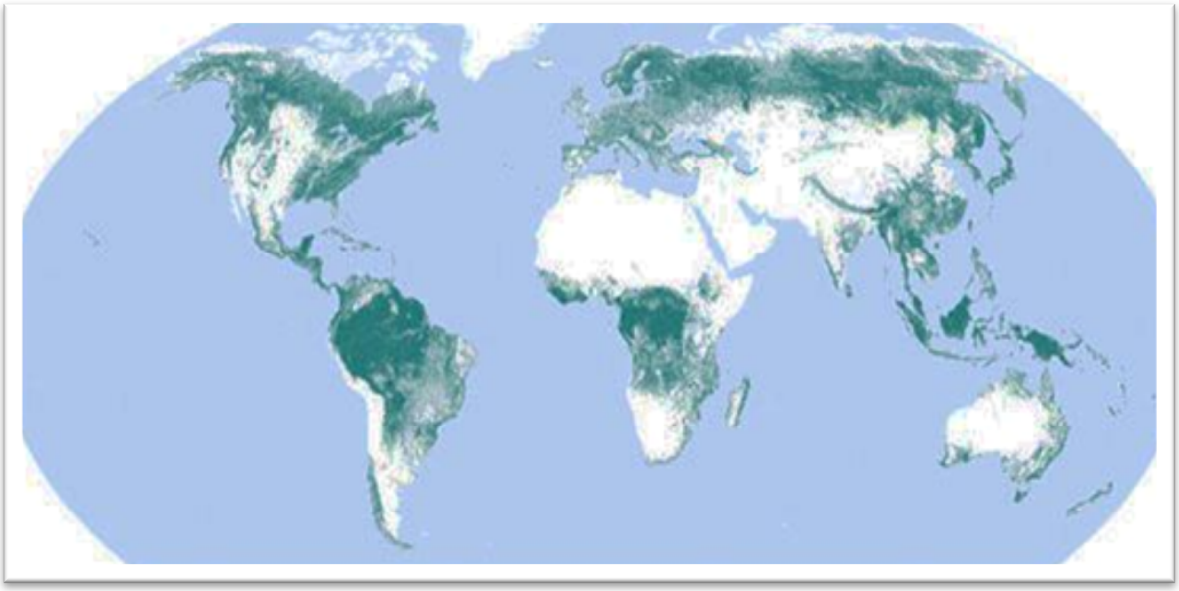

Figure 1. Global forest area

Other threats to the world's forests include:

- insects and diseases (endemic & invasive);
- plants (woody invasive species);
- other biotic agents (e.g. wildlife browsing, grazing, physical damage, nematodes);
- abiotic disturbances (e.g. storms, floods, drought, earthquakes, landslides, tsunamis, air pollution, etc.);
- fire.

All of these threats are having severe impacts on forests, the forest sector and local communities. They impact tree survival and the yield and quality of forest products. They negatively impact the socio-cultural and recreational values of forests. They can

negatively impact wildlife habitat and biodiversity, and disrupt natural fire, nutrient and hydrological cycles. Finally these disturbances can negatively affect the international trade in forest products.

Abiotic disturbances - disturbances caused by non-living factors - are a natural and integral part of forest ecosystems that have major impacts, positive and negative. They influence forest structure, composition and functioning and can be important for maintaining biological diversity and facilitating regeneration. When disturbances exceed their normal range of variation, however, the impacts on forests can be extreme, affecting entire landscapes, causing large-scale tree mortality and complete destruction of undergrowth and soils. Some examples of devastating abiotic disturbances from the African region include Tropical Cyclone Gafilo in Madagascar in 2004, and the recent events - floods in southern Africa and the Horn of Africa drought.

Large wildfires, or mega-fires, have been noted in all regions of the world & their occurrence likely increases as droughts deepen, fuels accumulate, & landscapes become more homogeneous. The most costly, destructive and damaging of all wildfires, they are not always a single wildfire but rather a group of multiple fires across a large geographic area. Mega-fires are often extraordinary for their size, but they are more accurately defined by their complex, deep and long-lasting social, economic and environmental impacts such as adversely altering energy, water, nutrient and carbon cycles, declines in biodiversity, increased carbon emissions and weed invasion. In places where climate change increases the risk of wildfire, measures should be taken to reduce this risk by putting in place effective fire management measures, including prevention, detection, control and rehabilitation.

While the impacts of abiotic disturbances and wildfires are clearly staggering and concerning, forest pests – insects, diseases, nematodes and woody invasive species - are the main emphasis of this presentation & workshop.

Insect pests, diseases and invasive plants cause substantial environmental and socio-economic losses, but existing estimates are difficult to confirm. Data from FAO's Global Forest Resource Assessment (FRA 2010) shows that the extent of forest adversely affected by insects alone was 35 million hectares per year, primarily in the temperate and boreal zone. One particularly noteworthy outbreak is that of the mountain pine beetle (*Dendroctonus ponderosae*) which, since the late 1990s, has devastated more than 11 million hectares of forests in Canada and the western United States spreading outside its historical range. This unprecedented outbreak has been exacerbated by drier summers and warmer winters. The current outbreak in BC Canada is the largest ever recorded with a peak of 9.2 million ha affected in 2006 alone.

Figure 2 illustrates the average forest area affected by insects by country. Northern Africa, North America, East Asia and Europe excluding the Russian Federation reported the highest percentage of forest area significantly affected by insect pests, while

countries with tropical moist forests generally reported a very low proportion of their forests affected. This is most likely due to the high diversity of tree species in tropical moist forests.

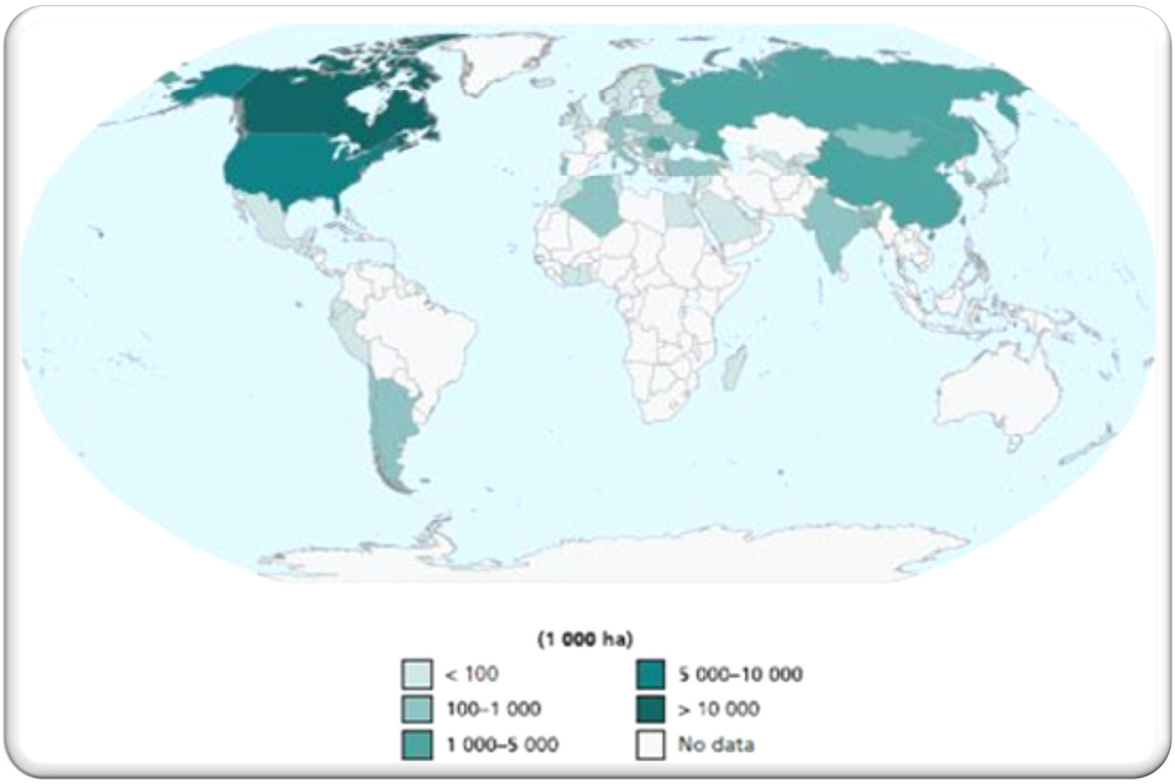

Figure 2. Average area of forest annually affected by insects by country, 2005

Disease affected 3.8 million hectares (5-year average) representing 0.3 percent of the total forest area of the 80 reporting countries (Figure 3). For the latest reporting period, East Asia and Europe provided data for over 90 percent of the forest areas within the region. However, for many countries information on diseases was missing, not available or was recorded as zero, particularly by countries in Africa, Central and North America and the Caribbean.

FRA 2010 concluded that the availability of global data on forest health is poor and as a result the data represented in the previous slides are clear underestimates of the impacts of pests and diseases. Data collection methods are also highly variable and methods need to be devised to obtain, analyse and report data on forest pests.

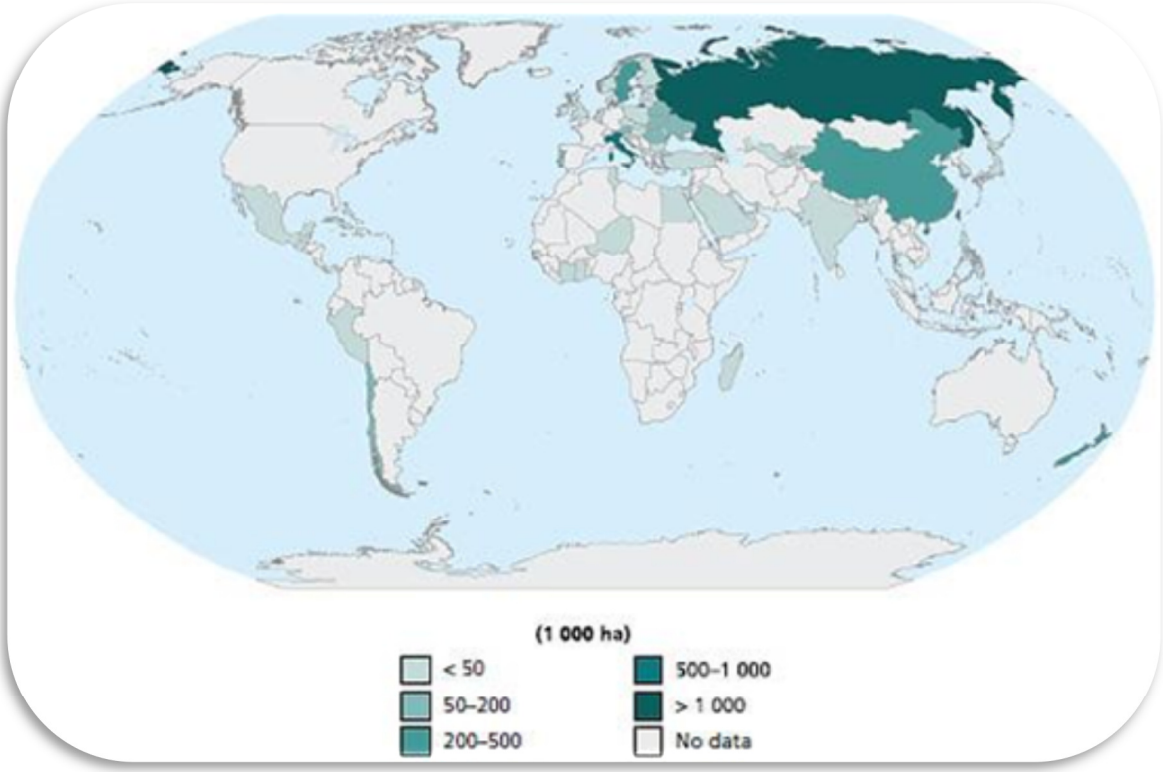

Figure 3. Average area of forest annually affected by diseases by country, 2005

As part of the FRA 2010 process, countries were asked to report major outbreaks of insects and diseases affecting forest health and vitality. Tables 1 and 2 list the most commonly reported pest species worldwide.

Table 1. Ten most prevalent insect pests reported (FAO, 2010)

Pest	Number of reports	Countries
***Lymantria dispar*, gypsy moth (European and Asian strains)**	27	Algeria, Armenia, Belarus, Bulgaria, Croatia, Georgia, Germany, Hungary, Israel, Kyrgyzstan, Latvia, Lithuania, Lebanon, Maldives, Mongolia, Morocco, Republic of Moldova, Russian Federation, Serbia, Slovakia, Switzerland, The Former Yugoslav Republic of Macedonia, Tunisia, Turkey, Ukraine, United States of America, Uzbekistan
***Ips typographus*, European spruce bark beetle**	19	Austria, Croatia, Czech Republic, Denmark, France, Georgia, Germany, Hungary, Latvia, Lithuania, Netherlands, Poland, Romania, Russian Federation, Serbia, Slovakia, Sweden, Switzerland, Turkey
***Tortrix viridana*, European oak leaf roller**	10	Croatia, Czech Republic, Germany, Netherlands, Poland, Republic of Moldova, Romania, The Former Yugoslav Republic of Macedonia, Tunisia, Ukraine
***Thaumetopoea pityocampa*, pine processionary caterpillar**	9	Albania, Algeria, Bulgaria, Croatia, Morocco, Syrian Arab Republic, The Former Yugoslav Republic of Macedonia, Tunisia, Turkey
***Neodiprion sertifer*, European pine sawfly**	7	Belarus, Georgia, Latvia, Norway, The Former Yugoslav Republic of Macedonia, Turkey, Ukraine
***Panolis flammea*, pine beauty moth**	7	Belarus, Germany, Latvia, Lithuania, Poland, Ukraine, United Kingdom
***Pityogenes chalcographus*, six-toothed spruce bark beetle**	7	Austria, Croatia, Czech Republic, Germany, Serbia, Slovakia, Switzerland
***Bupalus piniarius*, pine looper moth**	6	Estonia, Germany, Latvia, Poland, Ukraine, United Kingdom
***Dendrolimus pini*, pine lappet moth**	6	Belarus, Georgia, Germany, Lithuania, Poland, Ukraine
***Lymantria monacha*, nun moth**	6	Belarus, Czech Republic, Germany, Latvia, Lithuania, Poland

Table 2. Most prevalent pathogens reported (FAO, 2010)

Pest	Number of reports	Countries
***Armillaria* spp., Armillaria root disease**	10	Austria, Bhutan, Brazil, Croatia, Germany, Malawi, Mauritius, New Zealand, Peru, Slovakia
***Cryphonectria parasitica*, chestnut blight**	6	Albania, Croatia, Georgia, Germany, The Former Yugoslav Republic of Macedonia, Turkey
***Heterobasidion* spp., annosum root rot**	6	Austria, Belarus, Finland, Germany, Russian Federation, The Former Yugoslav Republic of Macedonia
***Melampsora larici-populina*, poplar rust**	4	Belgium, France, Iceland, Uzbekistan
***Mycosphaerella pini*, red band needle blight**	4	Belgium, Croatia, France, New Zealand
***Sphaeropsis sapinea*, diplodia tip blight**	4	Austria, Croatia, France, Germany
***Chalara fraxinea*, ash dieback**	3	France, Germany, Norway
***Gremmeniella* sp.**	2	Finland, Sweden
***Melampsora allii-populina*, poplar rust**	2	Albania, France

Woody invasive species are increasing concern worldwide. Some species of particular concern to the African region include:

- *Lantana camara*
- *Prosopis* spp.
- *Broussonetia papyrifera*
- *Caesalpinia decapetala*

Some other notable forest pests of concern to the African region include:

- *Cinara cupressivora*
- *Thaumastocoris australicus*
- *Leptocybe invasa*
- *Gonometa podocarpi*
- *Sirex noctilio*

Increased international trade and increased number of pathways combined with climatic changes are contributing to the global problems in forest health.

Several major pathways have been identified for the introduction of invasive species (Table 3). As well as the more conventional pathways of wood as a commodity there is growing concern about the increased interest in new trade, especially in plants: the

desire for the new, the exotic, and of most concern, the semi-mature "instant" garden plant or tree. These larger pathways are harder to inspect and easier for pests to hide in.

Wood packing materials, such as pallets, boxes, and crates, may be a pathway for invasive species such as the Asian longhorned beetle (*Anoplophora glabripennis*) and wood-inhabiting fungi. Wood-boring beetles have also been detected in artificial plants, furniture, and other non-treated wood products. Plants for planting can be pests themselves, or they may provide a pathway for invasive fungi, insects, and nematodes. Escapes and releases from the exotic pet trade and horticultural smuggling also provide pathways for a variety of pests.

Table 3. Pathways for pest movement in international trade

Wood as a commodity	• Roundwood with/without bark • Sawnwood with/without its natural rounded surface • Processed wood, such as plywood, MDF, etc. • Fuelwood
Packaging wood	• Pallets, crates, drums, skids, boxes, wood containers, cases, dunnage
Plants for planting	• Live plants ranging in size from rootless cuttings to large trees complete with root balls
Cut plants	• Ornamental & other cut plant materials could harbour pests, e.g. floral displays, Christmas trees, etc.
Germplasm	• Cones & seeds, tissue culture materials directly in trade & as contaminants in a very wide range of goods and substrates
Hitchhikers	• Any organism could be carried inadvertently in containerized or human transport, i.e. cars, trucks, planes, trains, boats, etc.

Numerous pest species have been spread around the globe through international trade (Table 4). What is being done to contain these pest movements and what can foresters do to help mitigate these problems without impinging on trade? The most important preventative mechanism is the International Plant Protection Convention (IPPC) which aims to secure common and effective actions to prevent spread and introductions of pests of plants and plant products. There are 177 countries who have signed as contracting parties. The governing body of the IPPC, the Commission for Phytosanitary Measures (CPM), develops International Standards for Phytosanitary Measures (ISPMS) which provide guidance for harmonized regulatory measures. Forestry-related ISPMs are developed by a Technical Panel on Forest Quarantine (TPFQ). National Plant Protection Organizations (NPPOs) implement the standards and use national legislation to protect natural resources from pests.

NPPOs have historically dealt mostly with agricultural crops. In recent years, however, forest pests have become a more prominent concern, and while communication between the forest sector and NPPOs has increased, more is needed. Forest sector personnel have a vital role in developing and implementing phytosanitary standards and therefore need to develop a better understanding of what the IPPC is and how NPPOs work.

To address this problem, FAO and partners initiated a multistakeholder activity to prepare the *Guide to implementation of phytosanitary standards in forestry*. The guide provides the forest sector with clear and concise guidance on forest health practices, including plain language descriptions of international phytosanitary standards and suggestions for their improved national implementation.

Although climate change presents a global challenge, the influence on pest infestations is spatially and temporally constrained in their native range. Changes of range and severity are usually gradual. But increased global trade presents an increased opportunity for pest establishment in new locations remote from their native range.

What needs to be done?

- Be proactive not reactive - stop it from happening!
- Increase monitoring for new pest threats before they arrive
- Identify new trade trends, especially of plants
- Adapt policies/legislation to rapidly respond to new challenges

Table 4. Examples of forest pests that have spread through international trade.

European woodwasp (*Sirex noctilio*)

- Major global threat to forests & forest sector causing considerable damage & costs for control
- Introduced from Europe/North Africa to South Africa, Oceania, Latin America & the Caribbean, North America

Red turpentine beetle (*Dendroctonus valens*)

- Accidentally introduced into China in 1980s presumably on unprocessed logs imported from Western USA
- Infested over 4 000 km^2 of Chinese pine stands (*Pinus tabulaeformis*) in Shanxi, Hebei, Henan & Shaanxi Provinces - nearly 10 million trees killed
- Several consecutive years of drought have severely stressed host trees contributing greatly to the outbreak

Emerald ash borer (*Agrilus planipennis*)

- Killed millions of trees in Canada, US
- Russian Federation - most ash trees within 100 km of Moscow killed; infestation spreading rapidly threatening European forests
- Spread from Asia through movement of plants, wood packaging materials, forest products, in particular fuelwood

Asian longhorned beetle (*Anoplophora glabripennis*)

- Wood-boring beetle – major threat to broadleaved trees in both urban and forest environments
- Introduced into Europe & North America from China & Korea on wood packaging materials

Pine wood nematode (*Bursaphelenchus xylophilus*)

- Caused extensive tree mortality in some areas where it has been introduced
- Millions of trees killed annually in Japan