Session 13. Forest dieback and mass mortality: Assessment and early warning

Summary report

Participants noted the following recent changes in forest ecosystems that could be attributed to climate change:

- dieback of aspen in boreal/steppe boundary zone of North America;
- outbreak of *Diprion pini* in central Finland;
- dieback of relicts of *Cedrus atlantica* in Algeria;
- dieback of *Abies koreana* on a southern Korean island.

Some of the expected future impacts on forests noted by the participants included the following.

- Aspen productivity will decline, together with future harvest levels; mortality is projected. The question of how to, and how urgently to, salvage the timber is not clear.
- Most causal or predictive models were still under construction and were not yet used for early warning. In many cases remote sensing (with Modis, Laser or other remote sensing tools) supplied input data for causal models for tree decline or to assess the impact of climate change on environmental services, such as water runoff, water purification and nitrogen load. Field data observation was used less extensively (only in aspen and Korea fir) but seemed to provide the best correlations. Some imaginative indicators used for early warning were indicator plants, crown structure, leaf dimensions, leaf deformation (curling in *A. koreana*), basal area, biomass or diameter growth.
- It was noted that in all cases, the studies focussed on events that had already materialized. Projecting the future impacts needs much more time.
- None of the models were ready to be used as a formal vulnerability assessment tool in forestry. The Center for International Forestry Research (CIFOR) is striving to build such a tool, given that the United Nations Framework Convention on Climate Change (UNFCCC) compendium does not contain a forestry tool for vulnerability assessment. At this time, focus is on exposure and sensitivity assessment. All other components of vulnerability assessment are missing.

The future impacts of climate change on forests were discussed. Participants noted that only the ongoing work by CIFOR considers these impacts in Asia and two African countries and results are not yet available. In general, decline of forests and forestry in certain areas will cause economic problems or even collapses. For instance, the mountain pine beetle will cause economic hangover in the forest sector when growing stock is gone.

The ability to reduce the impact of forest mortality on local communities and economies is needed. This too is part of adaptation, not just the forest. It may not be possible to mitigate the cost of adaptation in poorer countries.

While neither of the presentations considered possible adaptation measures, discussions touched on the trend towards purely reactive adaptation, such as salvage logging. One possible option for anticipatory adaptation is spreading of risk, e.g by using different species or genets. Forestry needs to learn to live with, use tools for, and adapt its management to uncertainty.

Participants expect that there will be changes in forest species composition as a result of climate change. Some species will die but other will take over. Good management should be able to predict and utilize the dying species to the best use for society. Forest management needs to adopt species compositions to make the forest landscape ecologically sound and well adapted to the changing climatic conditions. Secondly management should go beyond wood and look into the ecological services and amenities of forests.

The concept which prevails now is reaction adaptation, which is simple responding to the changes which happened in the past. Participants noted the need to act proactively. We should be able to forecast threats probabilistically, act in anticipation in agreement to our perception of risk, and, generally, introduce adaptive forest management in an operationally feasible form. Harvesting schedule should be revised periodically after calamities. Hedging our bets is a good strategy. Predicting what will happen and react effectively to prevent or mitigate negative consequences.

While a lot of knowledge has accumulated, science cannot yet project and predict, for instance, if Korean pine (case addressed by the Korean colleagues in the session) will be able to survive and adapt autonomously o the new conditions. The Intergovernmental Panel on Climate Change (IPCC) is not yet able to project such impacts on forests. This limits the readiness and willingness of policy makers to introduce new policies. Scientists may only predict forest cover change with probability; uncertainty will remain and risk management is needed.

More experiments and case studies are needed to create better, more reliable and more comprehensive models. Forest inventory should be complemented with newly important parameters. Reducing forestry staff, and reducing the intensity and frequency of assessments would be counterproductive under emerging climate change.