

Session 15. Scenarios and modelling for forest management planning

Summary report

Through presentations and discussions, participants noted the following recent and future impacts of climate change on forests.

- Changes in climate conditions (temperature increase, wind patterns, precipitation/moisture regime (moister or dryer conditions may occur depending geographical region)) expose forests to more stress resulting in increases in pest outbreaks. In general this leads to changes in forest types, changed distribution of forest ecosystems or, as in the case of Western Canada, to a change in tree line in mountain areas and an expansion of grassland.
- In western Canada, changes in fire patterns and increased fire frequency has not increased the risk of mountain pine beetle outbreak much, but epidemics are expected to become more severe, since forests are weaker and there is a decrease in number of tree species in vegetation zones.
- Expansion of vegetation period due to temperature increase (Germany, Canada, UK).
- The habitat of species will shift, including the habitat of endangered species, which will have impacts on protected areas and their management. As a result the designation of protected areas should take this information into account. The distribution of pest species will also change allowing for the introduction and establishment of pest populations in areas that have previously been protected.
- There are also positive effects of climate change on forests such as increased forest growth as noted in Germany.

Participants noted that all predicted future impacts are uncertain and dependent on model (uncertainty of models, input variables used, climate baseline used). The quality of site classifications and forest inventory data that are used as input for models could, in general, be improved substantially.

The impact of climate change on people and institutions were discussed. Session participants pointed out the impacts on protected areas and their management (discussed above) and also noted that it is important to include people who rely on forests in the development of models (decision support tools) and adapt models to their needs.

Participants considered potential adaptation measures or management actions that could assist in addressing the impact of climate change on forests and suggested the following.

- Changing tree species composition, choosing adequate proveniences and changing silviculture regimes (e.g. thinning) and management (e.g. shorter rotation age) were noted. Austrian modelling outcomes showed that increased diversity and complexity reduced vulnerability of forests. The identification and production of vulnerability indices and maps were suggested to lead to development of strategies.
- Climate change has to be taken into consideration when designating protected areas. For example, in the case of interior British Columbia, Canada, areas least susceptible to fire should be designated as protected areas.
- Urgent model applications are needed to decide what species and genotypes should be used for reforestation and to predict whether, and where, production forests can be maintained in the future in order to focus efforts. It is very important to identify sources of uncertainty in predictive models and to acknowledge uncertainties, i.e. there are often a wide range of possible scenario outcomes. It is a challenge to learn to make decisions that are resilient to an array of outcomes. Using the Ministerial Conference on the

Protection of Forests in Europe (MCPFE) or Montreal Process criteria and indicators to assess vulnerability of forest ecosystems was recommended.

The following policy considerations were noted by participants as the most effective in supporting adaptation of forests and the forest sector to climate change.

- To better understand climate change, and in particular as decision support tools, models of forest ecosystems and forest management are crucial for management decisions. Models can be based on site conditions (soil and current climate), current vegetation, and driven by climate scenarios (IPCC or national). As a result vulnerability of tree species can be predicted and different forest management options (tree species composition, thinning regimes, rotation age) assessed.
- When using decision support models, first the goals of the user (decision-makers/practitioners/society) have to be determined. Often the uncertainty of future goals is not considered, only the biophysical uncertainty of models, however this dimension of uncertainty is equally important (and mostly neglected). Research on decision making has to widen. Insecurity in time scale must also be accounted for.
- The process of decision making has to be understood in order to properly use the tools and explain and communicate the results. For example in British Columbia, Canada models on climate change adaptation or results have been ignored by forest industry. It was stated in the discussions that it is of utmost importance to also include aspects of sociology, political science, psychology and cognitive science in order to get a deeper understanding of the process of decision making.
- It is crucial to teach forest practitioners how to use outcomes of models or how to deal with probability distributions, since climate modellers will never be able to give one likely scenario. Thus forest models are inherent even more complex, basing on the probabilities of the climate models. Information needs to be presented in a way that is useful for policy-makers, which is not yet the case. Messages to policy makers have to be different than messages to researchers (e.g. when presenting results for scenarios). Results must be adapted to the time scale of the respective stakeholder (politicians, business, etc). Other scientists than foresters are needed to interact adequately with society
- Local communities need to become involved in developing strategies for climate change adaptation.
- Models need to be adapted to appropriate geographical scale (global, national, local) and geographical region. Most models are currently in countries with sophisticated forest management and research.