Adaptation and Mitigation Strategies in Northern Eurasian Boreal Forests

Anatoly Shvidenko, Florian Kraxner, Michael Obersteiner, Dmitry Schepaschenko*
Ecosystems Services and Management Program (ESM), International Institute for Applied Systems Analysis (IIASA),
Schlossplatz 1, A-2361 Laxenburg, Austria
www.iiasa.ac.at

Abstract: Boreal forests of Northern Eurasia are experiencing ongoing changes in climate, strong impacts by humans including transformation of previously untouched landscapes, and dramatically accelerating disturbance regimes. Current global and regional climatic models predict for this region the most dramatic climatic change over the globe. Unregulated and often destructive anthropogenic impacts on the environment and natural landscapes may substantially accelerate the negative consequences of climatic change. Complexities of the situation are evident: need to take decisions for underspecified dynamics systems under uncertainties; relevancy to consider dual strategy that integrates mitigative and adaptive measures, particularly under no-regret and win-win considerations; necessity to derive minimum mitigation standards from the limits of adaptation; inevitability of non-linear responses and feedbacks and probability to meet surprises in the biosphere's behavior; etc. It defines a need for development of new philosophy of cognition and policy making by using open, iterative, distributed-modular systems based on shared pools of models, tools libraries, and data sets.

Such a situation defines an obligatory need to comprehensively use methodologies of applied system analysis and integrated modeling. Following the basic steps of applied systems analysis (fixation of the problem; diagnostics; (list of) stakeholders; problem mess; setting the goal; criteria; experimental research; analysis of input information; selection of the strategy, development and improvement of the model; depiction of alternatives; and decision making implementation) put the modeling on a solid scientific basis. Integrated models that include components of different nature (ecological, economic, social) are considered as a major tool of perception of future trajectories of forests in a changing world in spite of the fact that application of integrated modeling generates many cognitive problems, trade-offs and challenges.

A central point of adaptation and mitigation strategies is development of robust policies. Robust policies should (1) ensure long-term stability of systems' behavior against multiple events (scenarios); (2) account for extreme events that require specific models; (3) consider uncertainties in a possible comprehensive and explicit form; (4) allow for flexibility to form a diversity of decisions dependent on associated risks and costs, performance indicators of stakeholders, (5) consider in an explicit spatio-temporal way ecological, economic and social dimensions, (6) collective risk; (7) include safety criteria, constraints, and performance indicators of involved agents.

Adaptation and mitigation measures in the forest sector could be effective if they are part of a wide strategy which would involve all relevant sectors of national economy, particularly energy, industry, agriculture, tourism etc. combined in common political and institutional

frameworks. Adaptation and anticipatory strategy should be an inherent part of transition to sustainable forest management. However, background philosophy of classical forestry becomes less and less reliable in a continuously changing world. Thus, modeling becomes a working tool for practical adaptive forest management. Adaptive forest management is defined as a management approach that acknowledges the lack of unequivocal and definite knowledge about the ways in which forest ecosystems work, and the uncertainty that dominates interactions with them.

We consider major requirements to and specifics of adaptation and mitigation strategies in boreal forests which include *inter alia:* (1) a concept of sustainable development and sustainable forest management of regions of high latitudes; (2) integrated land observing systems; (3) a new system of specially protected territories; (4) new strategy and institutional background of forest fire protection; (5) legislative and normative base of adaptation and mitigation as a background of adaptive forest management; (6) system of adaptation of structure of boreal landscapes to climate change; and (7) considering management of major biogeochemical cycles, primarily carbon cycle, as a crucial issue of future strategies. We illustrate some practical results obtained by IIASA-ESM Integrated Modeling Cluster and other approaches. These examples show that recommended strategies could result in higher stability and productivity of forest ecosystems, increased abundance of favored species and reduced fragmentation of forests. However, the biggest problem deals with difficulties to reduce losses from worsening the environment and disturbances. No single strategy appears able to achieve all possible forest management objectives, and adaptation and mitigation strategies should be connected to regional climatic, ecological and social peculiarities.

* Presenting Author