Optimization in the forest sector can simultaneously reduce global warming and improve economic results, international relations and environmental conditions

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Operations Research for the Future Forest Management,
University of Guilan, Iran, March 8-12, 2014

Saturday March 8, 10.00-12.00:
Derivation of the principles of optimal expansion of bioenergy based on forest resources in combination with fossil fuels, CCS and combined heat and power production with consideration of economics and global warming.

In the production of district heating, electricity and many other energy outputs, we may use fossil fuels and renewable inputs, in different combinations. The optimal input mix is a function of technological options, prices of different inputs and costs of alternative levels of environmental consequences. Even with presently existing technology in combined heat and power plants, it is usually possible to reduce the amount of fossil fuels such as coal and strongly increase the level of forest based energy inputs. In large parts of the world, such as Russian Federation, forest stocks are close to dynamic equilibria, in the sense that the net growth (and net carbon uptake) is close to zero. If these forests will be partly harvested, the net growth can increase and a larger part of the CO_2 emitted from the CHP plants will be captured by the forests. Furthermore, with CCS, Carbon Capture and Storage, the rest of the emitted CO_2 can be permanently stored. The lecture incudes the definition of a general optimization model the can handle these problems in a consistent way. The model is used to derive general principles of optimal decisions in this problem area via comparative statics analysis with general functions. The lecture also includes case studies from different parts of the world. In several countries, it is presently profitable to replace coal by forest inputs in CHP plants. In Norway and UK, CCS has been applied and a commercially attractive option during many years and the physical potential is large. Carbon taxes on fossil fuels explain this development. With increasing carbon taxes in all parts of the world, such developments could be expected everywhere. With increasing levels of forest inputs in combination with CCS, it is possible to reduce the CO_2 in the atmosphere and the global warming problem can be managed. Furthermore, international trade in forest based energy can improve international relations, regional development and environmental conditions.

Saturday March 8, 13.30 – 15.00
Rational Research in Forest Production and Forest Management with Consideration of Mixed Species Forest Management and Risk

In order to solve the forest management optimization problems, it is necessary that the most relevant and important management options are well investigated and formulated. Models of biological growth should be developed that describe the production options available over time and space. The latest decades clearly show that detailed deterministic long term planning is irrelevant. Energy prices, prices of industrial products and environmental problems rapidly change in ways that cannot be perfectly predicted. Research in forest production planning should focus on the development of growth models that are useful when stochastic optimal control theory is applied. Since biological production takes considerable time, it is very important to create options to sequentially adjust the production to new relative prices, growth conditions, ecological problems and possible damages caused by parasites, fire or storms. In particular, valuable options can be obtained via mixed species stands. When several species are available in the young stands, the species mix can sequentially be adapted to changing product prices, costs and growth conditions. The analysis concerns the structure of relevant stochastic optimal control problems and consistent development of research in forest production. General mathematical models are analyzed. Comparative statics analysis and numerical methods are used to derive optimal results.