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Paper abstract for special session 7.13:  
“Ecosystem services and natural resources of the north – sustainability, values and trade-offs”

Session by Wilbert van Rooij:

**‘An assessment of the Arctic Biodiversity with the GLOBIO model’**

Modelling biodiversity to assess the contribution of human induced threats and test the impact of potential policy measures that aim to reduce biodiversity loss.

#### **Summary abstract**

A pilot study of the assessment of human impact factors on Arctic biodiversity is carried out with the GLOBIO model as part of the Economy of the North project. This model is developed by Netherlands Environmental Assessment Agency (PBL) and is used to calculate the contribution of 5 pressures on the loss of biodiversity. The context of the analysis, which starts with detailed data from Norway, is to relate environmental change and ecological impacts directly to human activities, in order to strengthen the integrated knowledge basis for sustainable development. The contribution of pressures in the arctic is different in comparison to the impact in the rest of the world. Climate change will also increase the pressure caused by land use change. Results of the model can be used to select, test and prioritize policy measures that are likely to have a positive impact on the reduction of biodiversity loss.

#### **Extended abstract**

In spite of several international intentions biodiversity in the world is still declining. There is a need to quantify the impact of different human induced pressures in order to understand the contribution of each pressure and prioritize solutions to reduce the overall impact.

The terrestrial GLOBIO biodiversity model has been tested for its use to assess the impact of these pressures in the arctic region as part of a pilot study for the Economy of the North project (ECONORIII). In the first round of the pilot study detailed data mostly from Norway are used.

The model has been developed by the Netherlands Environmental Assessment Agency (PBL). It uses a natural intactness indicator to assess the impact of five pressures: Land use, Infrastructure, Fragmentation, Climate Change and Nitrogen deposition (Alkemade et al. 2009). Due to the limited scope of the pilot study, only restricted data could be gathered and used to assess current biodiversity in the arctic regions. As more data was available for Norway both an assessment of the current and future biodiversity could be carried out and special attention was given to the analysis of the results for the arctic region.

Pressures in the Arctic differ from those in the rest of the world. While population pressure and land use change are in general the most important causes for biodiversity loss in tropical developing countries, these pressures are less significant in the arctic regions. Traditional fishing, hunting and reindeer herding have a relative low impact as they are extensive methodologies that use low inputs. However, climate change will play a more significant role in these areas as it opens up new lands that can be used for agriculture, forestry and livestock grazing. In addition petroleum and mineral

extraction are expected to increase and new arctic shipping routes are already established. As a consequence infrastructure and agricultural and urban development will increase the pressure on the environment in these areas.

The terrestrial GLOBIO model, that initially was developed to assess global biodiversity, has successfully been implemented at national scale for many countries (Yongyut et al. 2011) by using sub-national datasets and local expertise. As part of the pilot study some adjustments have been suggested for arctic conditions, such as the differentiation of grazing intensities on large semi natural open lands and inclusion of the impact of reindeer tracks in northern Norway. However, some typical arctic impacts could not be assessed with the current model such as the climate change impact of melting permafrost and shift of the snow and ice coverage. Traditional hunting is another pressure which is not separately dealt with in the model yet.

To investigate whether the GLOBIO and the Norwegian Nature Index models strengthen each other a quick comparison is made based on the results of both models.

The model results show some insights in the major pressure impacts and strengthen the integrated knowledge basis for policy for sustainable development. This knowledge needs to be translated into policy measures that address a reduction of biodiversity loss. But sustainability aims at equilibrium of social, environmental and economic conditions that are in harmony with each other. The above mentioned developments imply a shift to favorable economic conditions but put at the same time more pressure on the environment. The social consequences will be more complex as there will be an increased pressure on lands that are used for subsistence livelihoods but also this development also offers new opportunities for farming and forestry. Policy measures that aim at sustainable development need to consider all three domains. But this does not imply that each domain should get the same attention for all geographical locations. By using a landscape approach in spatial planning current and future claims on land will first be analyzed before to define an optimal land use distribution in an area.

## References

Alkemade et al. 2009: Globio3 A framework to investigate options for reducing global terrestrial biodiversity loss in Ecosystems DOI: 10.1007/s10021-009-9229-5. With contributions by Rob Alkemade, Mark van Oorschot, Lera Miles, Christian Nelleman, Michel Bakkenes and Ben ten Brink

Yongyut et al. 2011: 'Land Use, Climate Change and Biodiversity Modeling, Perspectives and Applications', by Yongyut Trisurat, with contributions by Rob Alkemade, Wilbert van Rooij and others, 2011