



## **Enhancing the resilience capacity of sensitive mountain forest ecosystems under environment change (SENSFOR)**

Kari Laine (1) and Oddvar Skre (2)

(1) Thule Institute, FIN-90014 University of Oulu, Finland, (2) Skre Nature and Environment, N-5243 Fana, Norway, (3) Forest Research Institute, Bulgarian Academy of Sciences, BG-175 Sofia, Bulgaria (zhiyanski@abv.bg), (4) Democritus University of Thrace, Dept of Forestry, GR-68200 Orestadia, Greece (apkyriaz@fmenr.duth.gr), (5) University of Osnabrück, DE-49074 Osnabrück, Germany (gbroll@uni-osnabrueck.de), (6) The James Hutton Institute, Aberdeen AB15 8QH, UK (maria.nijnik@hutton.ac.uk)

The main objective of the SENSFOR COST Action (ES 1203) was to enhance sustainable governance of sensitive treeline ecosystems and related ecosystem services, and to build the capacity of local and regional actors to cope with future changes using fresh approaches to knowledge integration.

According to the results of Working group 1, the major pressures related to the climate changes are warmer climate in the north and drought summer in the south, while the main pressures related to land use changes are the land abandonment and the increased tourist activities. Regarding the state of the ecosystems human activities are considered as the main reasons for the problematic conditions. The results enlighten the lack of policies, governance or management instruments specialized in treeline ecotone ecosystems.

Working group 2 introduced indicators that help to understand the resilience of treeline ecosystems. Findings are based on literature, previous and in-project scientific work of SENSFOR working groups and experimental work testing practical validity in several courses and workshops. Indicators are listed in the report published in SENSFOR website. Discussions focused on the following main questions: what kind of indicators can be identified and if they are useful for stakeholders and policy makers

In Working group 3, reports on an initial assessment of end users' requirements have been produced by means of questionnaire based investigations of stakeholder needs as linked to ecosystem services, governance, and science in European tree-line areas. Scenarios for future development have been identified and presented at various scales of observation. A common protocol for the best management practices has been developed as well as policy proposals for sustainable ecosystem management.

SENSFOR included scientists from 23 countries, and has achieved a wider impact through the developed methods for knowledge integration between science and practice and the generated holistic understanding concerning the vulnerability and resilience of European treeline ecosystems, and their services and supports sustainable governance. SENSFOR has facilitated natural-social science interactions throughout the project. The benefits of these activities include new networks and knowledge for scientists to develop holistic and interdisciplinary expertise.

Promising concepts to integrate social and natural sciences include DPSIR (=Driver-Pressure-State-Impact-Response) approach, that helps to systematically assess links between global drivers, local social-ecological impacts, and governance responses that mitigate pressures, help people to adapt to change and restore preferable state. Another promising approach has been to assess the resilience of treeline social-ecological systems to sustain ecosystem services. People do not only consume ecosystem services, but also produce them for example by traditional grazing and by management decisions and practices. Finally, the idea of heritage associated to treeline landscapes combines past, current, social and ecological issues and holds promise to function as a fertile ground for developing nature-based solutions and innovations that are beneficial for local people and economy