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Abstract

The project Motive aims at delivering knowledge about forest management strategies under the pressure of the climate change. Forests are a crucial element not only of landscapes but also of human living conditions. They provide habitats for a multitude of animal and plant species and are essential for the biodiversity of large areas in Europe. Climate change will strongly affect forests in the future. Thus, the development of adaptive forest management strategies under climate change is a key challenge for sustainable resource management. The options to adapt the forest management to climate change are little studied in Romania. The research done in the forest district Frasin (Northern Romania, Suceava county) brings information about the evolution of the forest ecosystem to the expected changes in the temperature and rainfall regime. The research also provides information for the forest managers about the options to adapt the forest management to the climate change.

The simulations using the LandClim model (Schumacher and Bugmann, 2006) were run on the forest district landscapes designed from a digital elevation model, stand and soil information, climate data and forest ownership maps. The simulations have considered three climate scenarios (CCSM3, ECHAM5 and HADCM3) and three forest management scenarios (BAU – busines as usual, AM1 and AM2). As compared to the current climate, the climate scenarios will bring an increase of the temperature and a decrease of the rainfall, which means drought risk, but also risk for stronger bark beattle attacks. The climate scenario of minimum warming (+1.9%) is in fact the driest climate, with a decrease of the rainfall by 21.5% compared with the present situation.

The management scenarios were defined according to the intensity and frequency of the thinning and according to the harvesting age. The increase of the intensity and frequency of the thinning was a fist choice option for adaptative management, due to the thinning positive effect on preventing windfall and improving the stands water balance. The harvesting age was established at 110 and 100 years, respectively, in the adaptative management scenarios AM1 and AM2, compared with the 120 years in the BAU scenario. The excess of the over-mature stands will impose to the forest manager to progressively harvest them along the next four decades. Therefore, in the Frasin forests, the adaptation of the forest management to the climate change will be mainly dictated by the age structure of the existing stands, and will be under the constraint of the stands low accessibility. Current goals such regeneration after final cutting or spatial optimisation of cuttings for better soil protection may become impossible to achieve if climate-related disturbances occurred on large scale.

The modelling results show that in the period 2000-2100 important changes will take place in the Frasin forests under the climate change considered. The Norway spruce proportion will significantly decrease. In fact, many pure Norway spruce stands existing today were artificially created in the period 1960-1980. In that sense, the climate change risk should push the managers back to the naturally existing type of

the forests. However, in a drier and warmer climate, all species, including decidous species will suffer, e.g. the beech will be replaced at the lower altitudes by other decidous species. Mainly the Scottish pine, beech and sessile oak will compose the future forests, with high presence of the birch and other pioneer species. The composition of the future stands should be sought to follow this natural evolution and to favor the drought-resistant species. Nevertheless, a part their positive effect on the biodiversity, the changes in the species composition will bring a negative effect on the economic side. The forest managers should take into account a potential severe reduction of the income, as far as the biomass produced by the future stands should be lower than today, and that regardless the management type or the climatic scenarios used.