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Effects of climate change on forest ecosystems in Iceland

Bjarki Kjartansson (1,2), Ben Smith (1), David Warlind (1), and Haraldur Olafsson (3)

(1) Department of Physical Geography and Ecosystem Science, Lund University, Sweden, (2) Icelandic Forest Research, Reykjavik, Iceland, (3) Engineering and Natural Sciences - Faculty of Physical Sciences, University of Iceland

The subartic region has been considered an area of high impact under future climate change senarios. We investigated the climatic effect on the change in potential forest distribution, structure and growth in Iceland from 1900 to 2100 by applying climatic time series to the dynamic vegetation model LPJ-GUESSN.
For the historical period we utilized a combination of gridded climatic datasets to create a time series for monthly means of temperature, precipitation and radiation. These datasets where provided by the Icelandic Metrological office (IMO) and the Climatic research unit at East Anglia (CRU). For the future climate we added data from three different general circulation models (GCM′s) where each model had three different representative concentration pathways (RCP). In order to compensate for topographical differences within modeled grid cells we divide each grid cell into elevation zones with 50 meters vertical interval. Each elevation zone is modeled explicitly with downscaled temperature values adjusted for the elevation. This gave us the opportunity to observe different ecosystems with in each grid cell and how they developed over time both horizontally and vertically.
We applied the climatic time series to drive the dynamic vegetation model LPJ-GUESSN. The model includes the features of the LPJ-GUESS model with added module where nitrogen is modeled explicitly. The addition of the nitrogen cycle allowed us to examine the nitrogen availability in soils and its effects on vegetation growth.
Our results show that under the future scenario there is increased NPP under all RCP′s and GCM′s. We observe a general trend of increase in carbon pool buildup with varying degree around the island. There is an advance in forest limits into higher elevation areas. The lowland areas show a shift in species composition where conifers retreat upward from broadleaved species dominating the lower altitudes into the future. Increased temperature opens up areas in the southern parts of the country for species that have not been climatologically applicable in Iceland before.