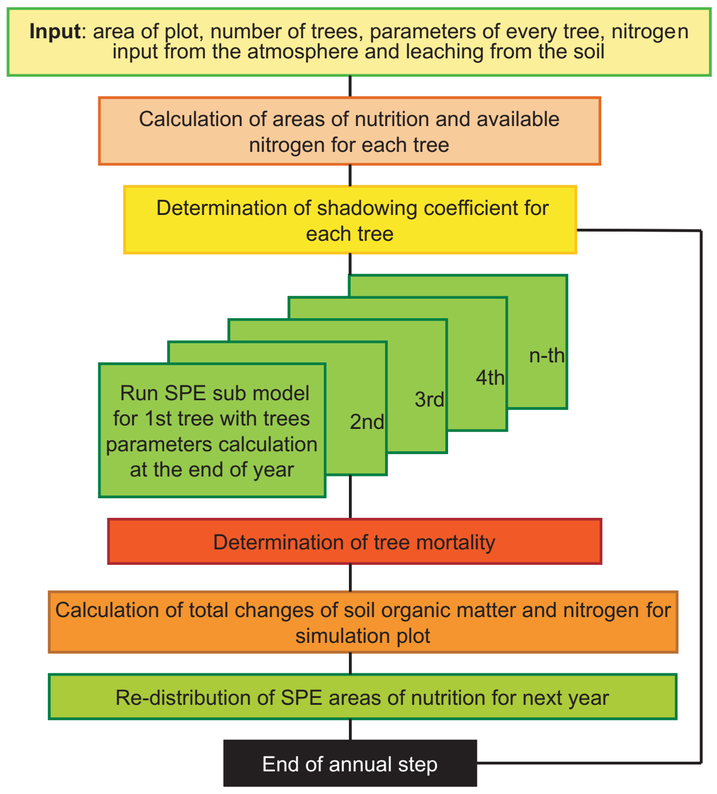
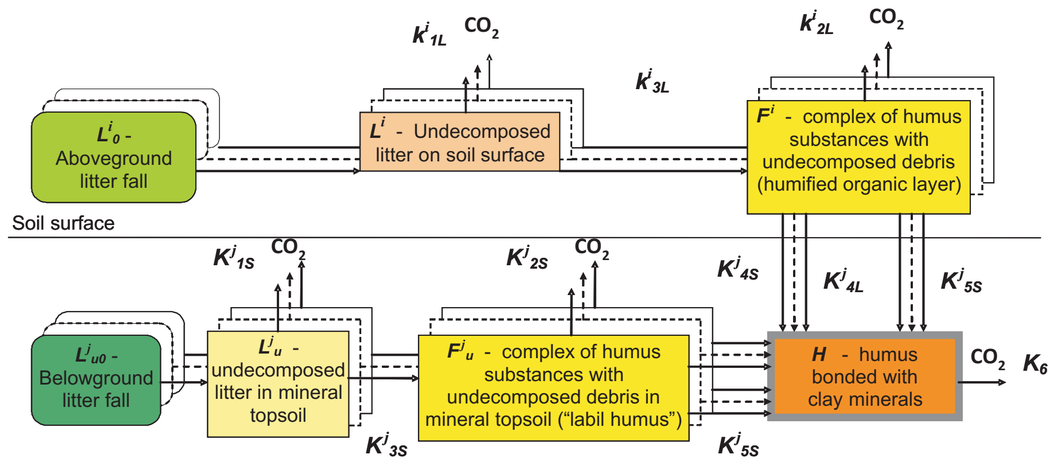
DYNAMIC MODELLING OF FOREST GROWTH AT DIFFERENT LEVELS OF NITROGEN DEPOSITION AND CLIMATE CHANGE, ECOSYSTEM MODEL EFIMOD AS AN EXAMPLE

A.S.Komarov, V.N.Shanin, S.S.Bykhovets



Flowchart of the annual step of the EFIMOD model



Flowchart of the SOM dynamics model ROMUL

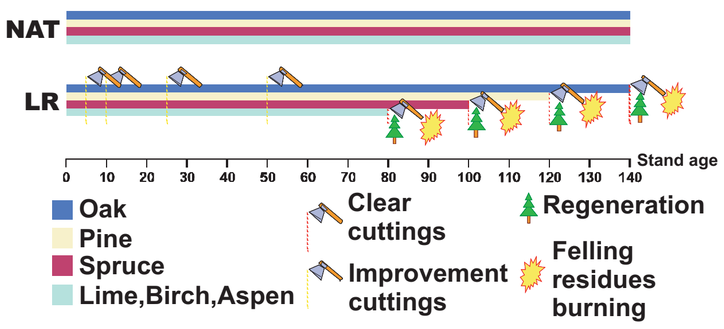
Model outputs:

Soil data - pools of soil organic matter and nitrogen in organic and mineral soil horizons

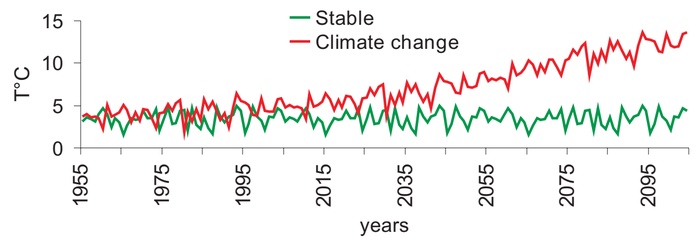
Forest data - tree species, number of trees, height, diameter, growing stock, biomass, coarse woody debris

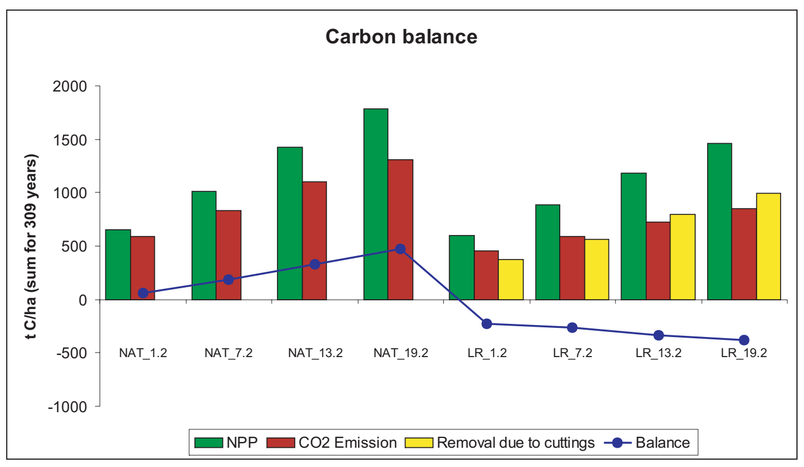
Silvicultural data - harvested wood

Forest management scenarios:

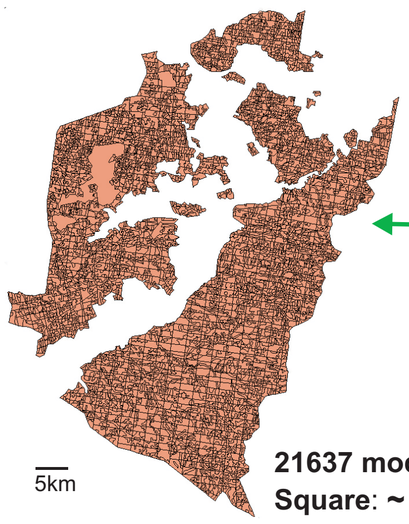


Climatic scenarios:

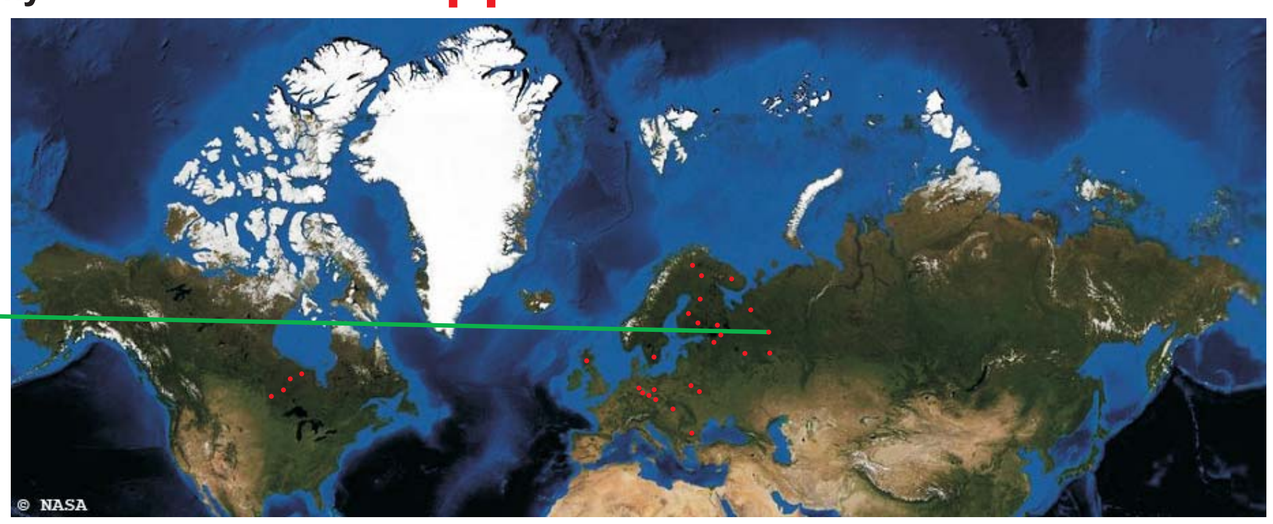




Study area – Manturovsky forestry (Kostroma administrative area):

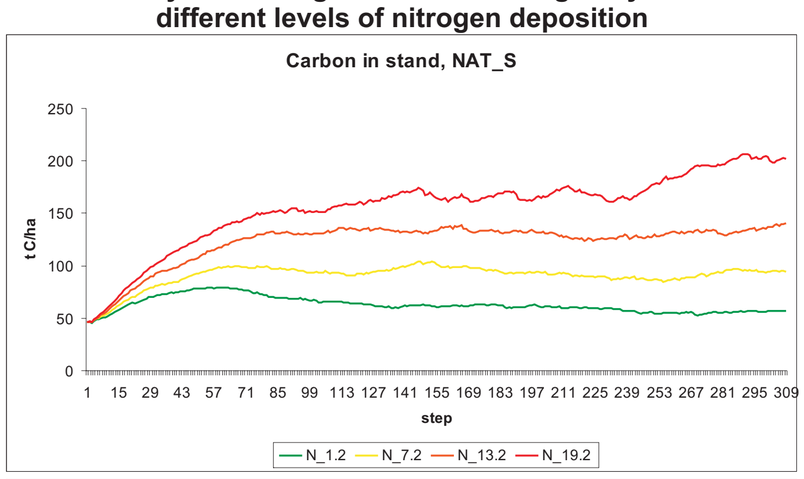


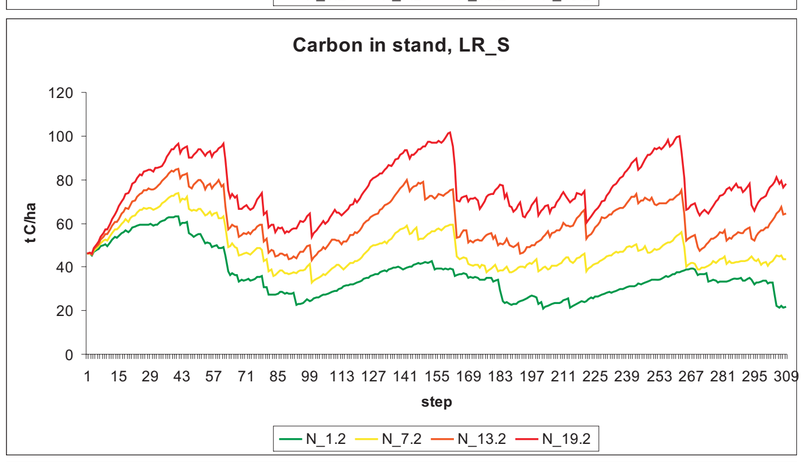
EFIMOD applications:

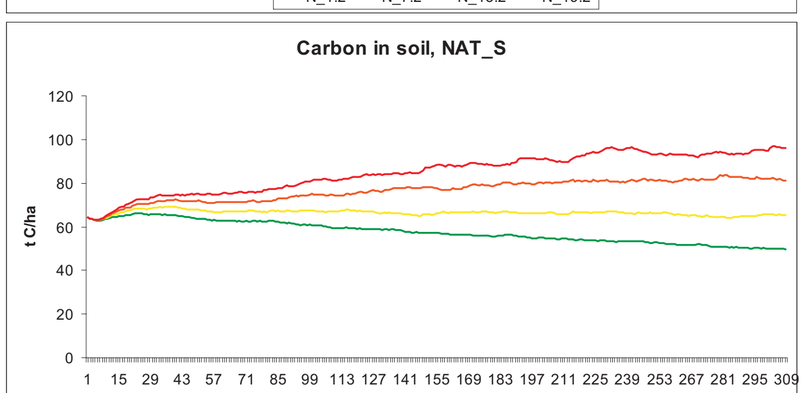


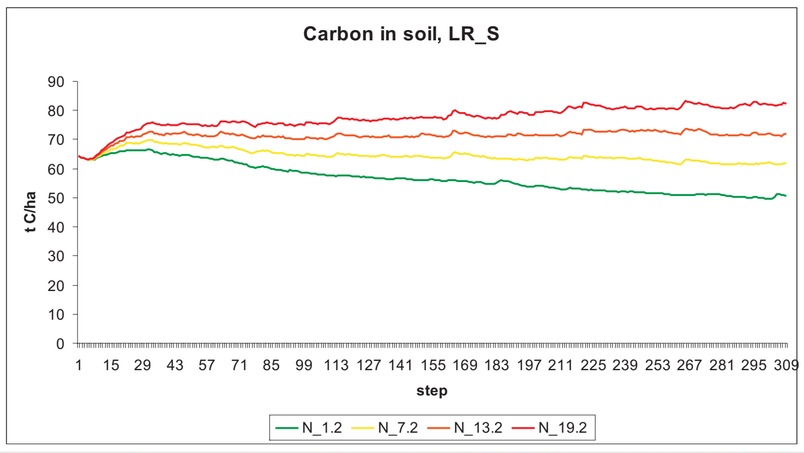
21637 model sites
Square: ~ 1806000 hectares

Case study: modelling carbon and nitrogen dynamics at different levels of nitrogen deposition

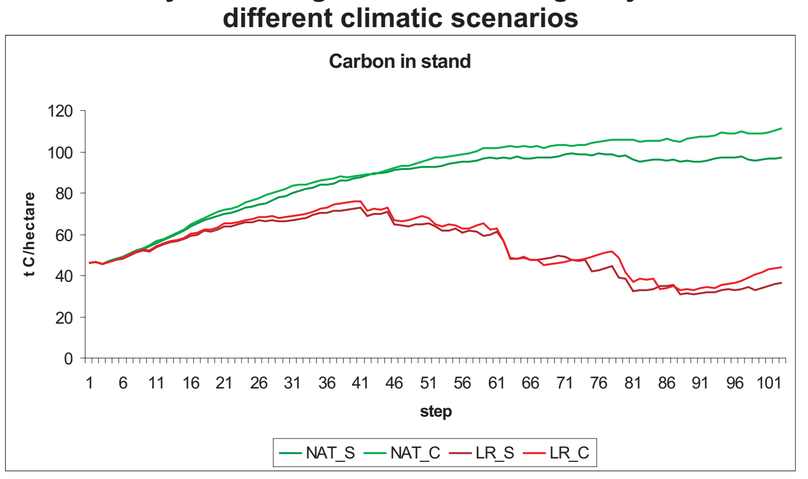


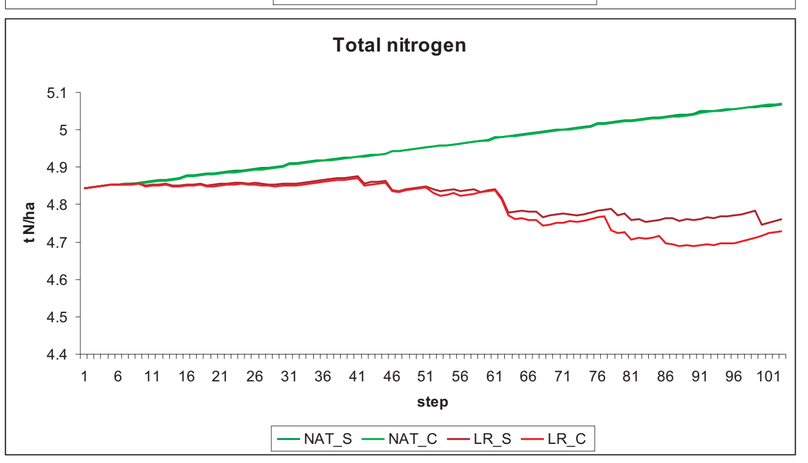


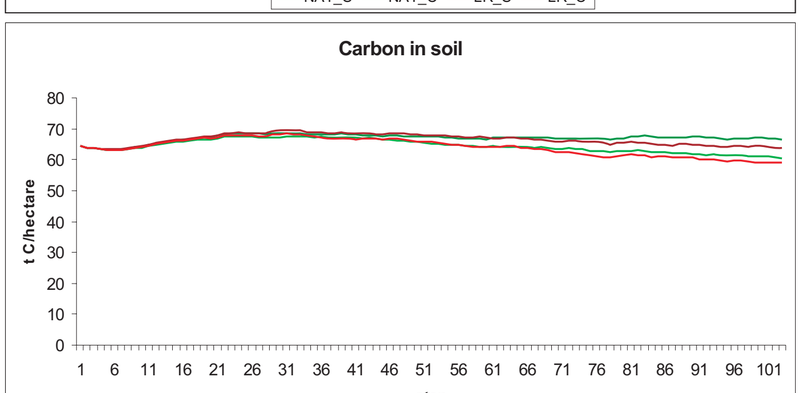


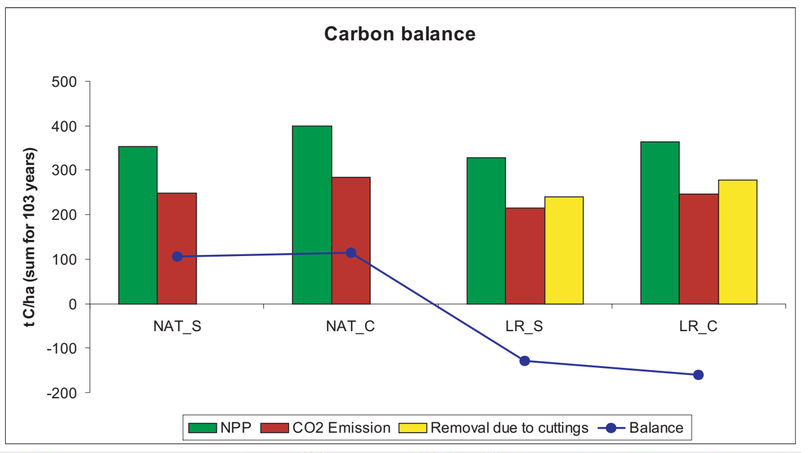


Case study: modelling carbon and nitrogen dynamics at different climatic scenarios









CONCLUSIONS:

Scenario without cuttings demonstrates maximal accumulation of carbon in forest.

Under scenario without cuttings forest ecosystem is a carbon stock, and it is a carbon sink under scenario with clear cuttings.

The analysis also shows that increase of the average annual temperatures has an influence on repartition of carbon pools between soil organic matter and tree biomass in favour of the former.

The impact due to cuttings is more significant then effect of climate warming.

Nitrogen deposition has a direct impact on forest ecosystems due to increased productivity.

References:

Chertov, O.G., Komarov, A.S., Nadporozhskaya, M., Bykhovets, S.S., Zudin, S.L. ROMUL - A model of forest soil organic matter dynamics as a substantial tool for forest ecosystem modeling (2001) Ecological Modelling, 138 (1-3), pp. 289-308.
Komarov, A., Chertov, O., Zudin, S., Nadporozhskaya, M., Mikhailov, A., Bykhovets, S., Zudina, E., Zoubkova, E. EFIMOD 2 - A model of growth and cycling of elements in boreal forest ecosystems (2003) Ecological Modelling, 170 (2-3), pp. 373-392.
Khanina, L., Bobrovsky, M., Komarov, A., Mikhajlov, A. Modeling dynamics of forest ground vegetation diversity under different forest management regimes (2007) Forest Ecology and Management, 248 (1-2), pp. 80-94.
Chertov, O., Bhatti, J.S., Komarov, A., Mikhailov, A., Bykhovets, S. Influence of climate change, fire and harvest on the carbon dynamics of black spruce in Central Canada (2009) Forest Ecology and Management, 257 (3), pp. 941-950.

Institute of Physicochemical and Biological Problems in Soil Science of the Russian Academy of Sciences
Laboratory of ecosystem modelling