The use of forest ecosystem model EFIMOD for research and practical implementation at forest stand, local and regional levels

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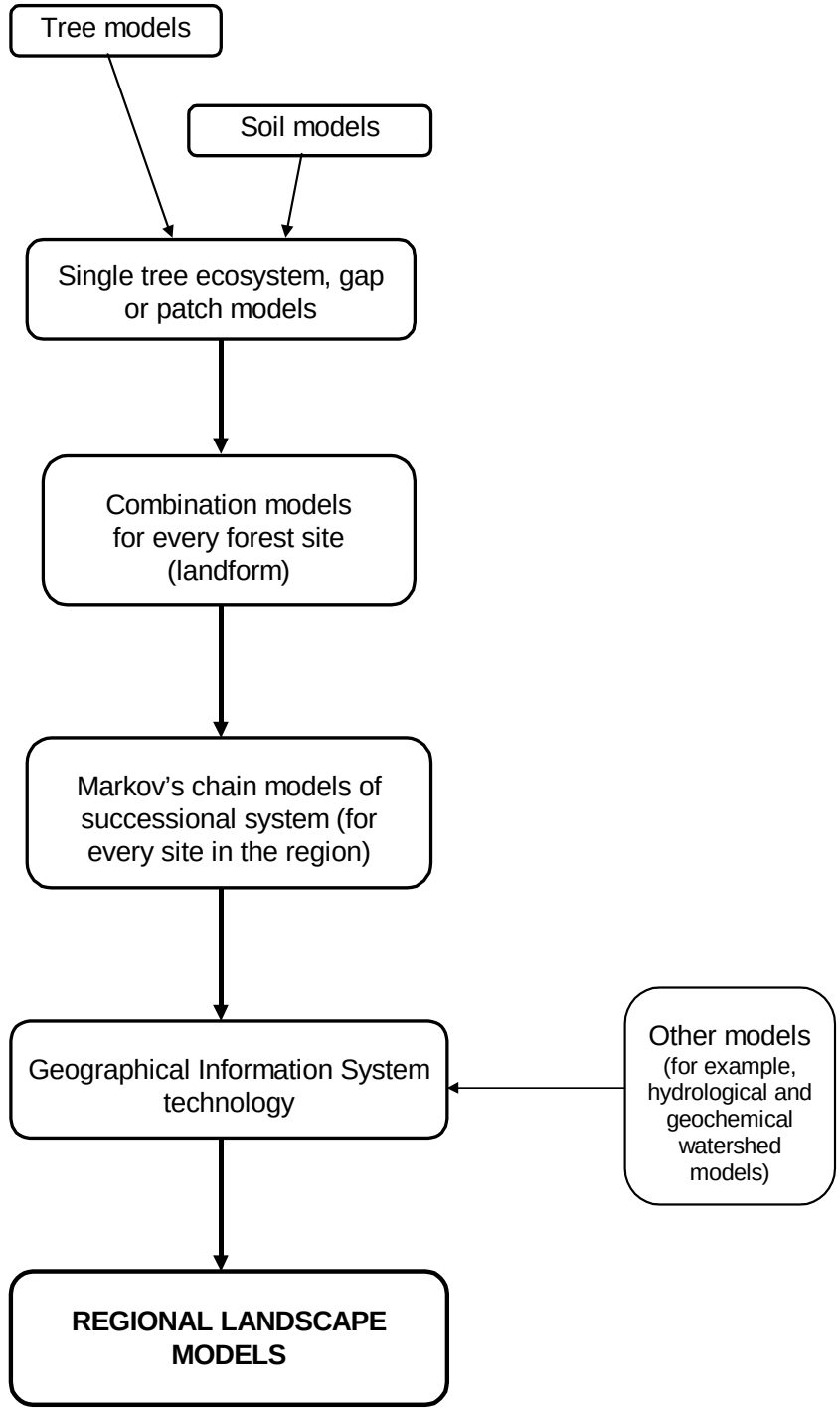
Introduction

- Recently, the idea on the necessity to have a cascade of forest ecosystem models with a different spatial resolution was dominated in the terrestrial ecosystem modelling
- Now there are technical opportunities allowing for a use of one basic model type at any spatial levels without the loss of information obtained at the lower levels.
- Some results of and prospects for the implementation of one basic model type to cover different spatial scales in forest ecosystem modelling are discussing here.

An example of the methodology for the compilation of the Markov chain local and regional models



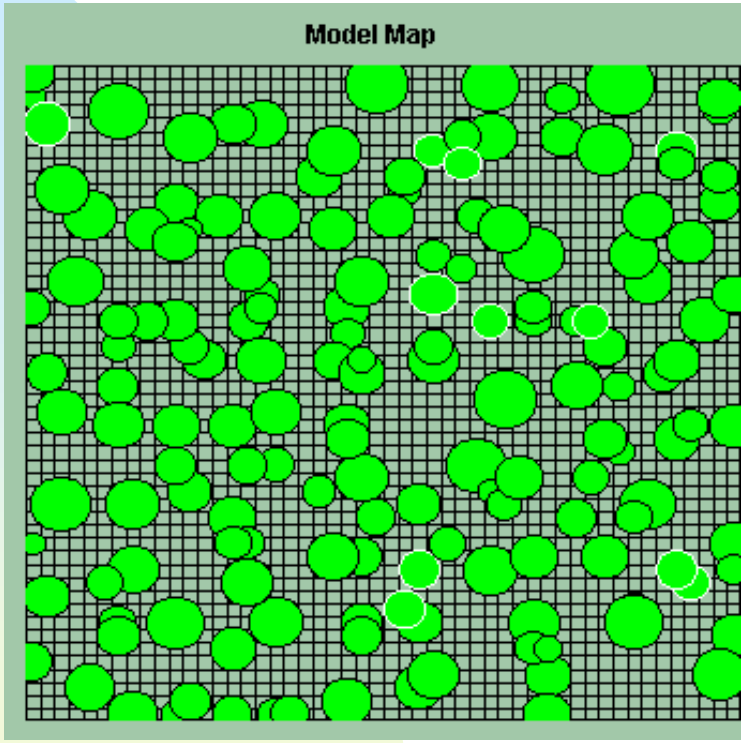
The model

- The EFIMOD model (Chertov and Komarov, 1997; Komarov et al., 2003) was used to test multi-scale application of one model type
- It is a spatially explicit individual-based stand-level simulator for several boreal and temperate tree species on different forest soils
- Tree biomass growth is modelled depending on the tree 'silvics', tree's position within the stand, and local light and available soil nitrogen

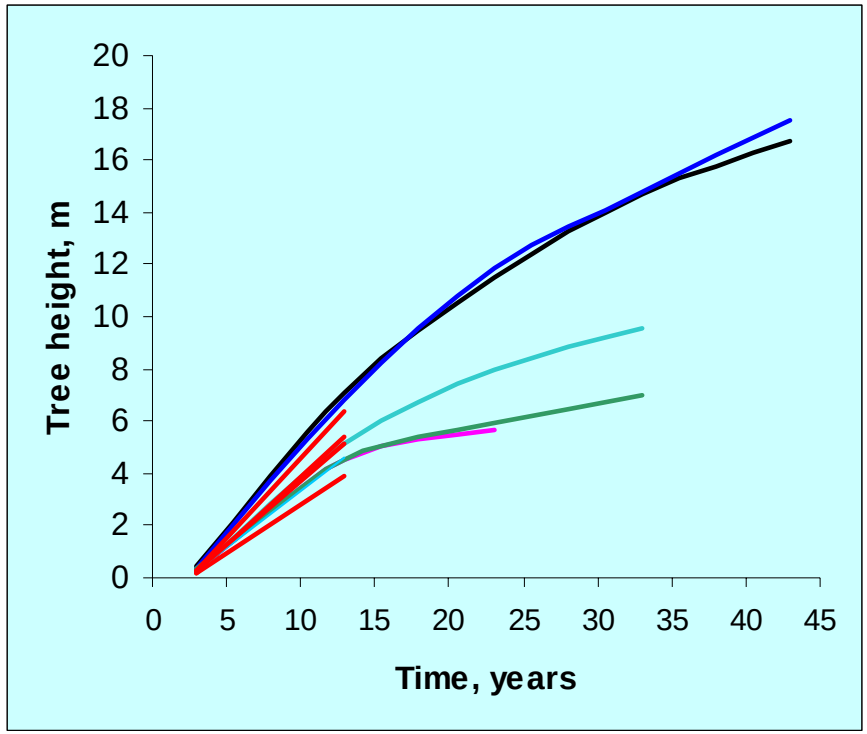
Methods and Material

- Standard EFIMOD simulations of a single stand growth and soil changes were performed for the model use at different scales:
- Individual tree growth
- Stand level:
  effects of environmental changes;
  thinning regimes
- Local (landscape) level:
  silvicultural regimes in forest enterprise
- Regional level:
  soil carbon dynamics for a big forest area

Individual tree growth

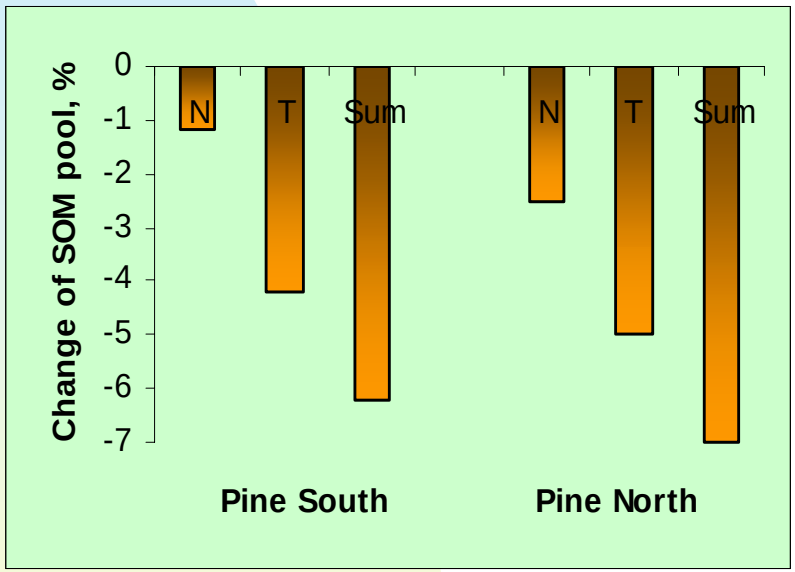


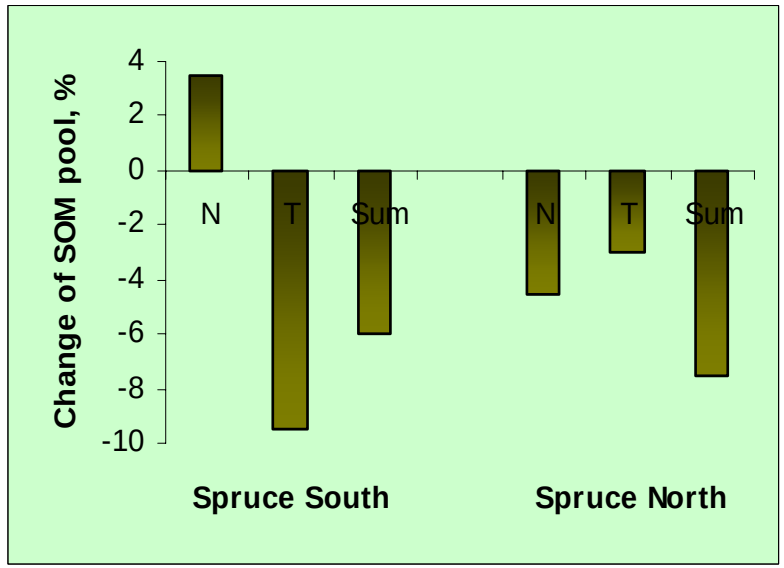
Map of individual trees' disposition on the modelled plot



Trajectories of individual tree growth on 25-m transect in a modelled Norway spruce stand

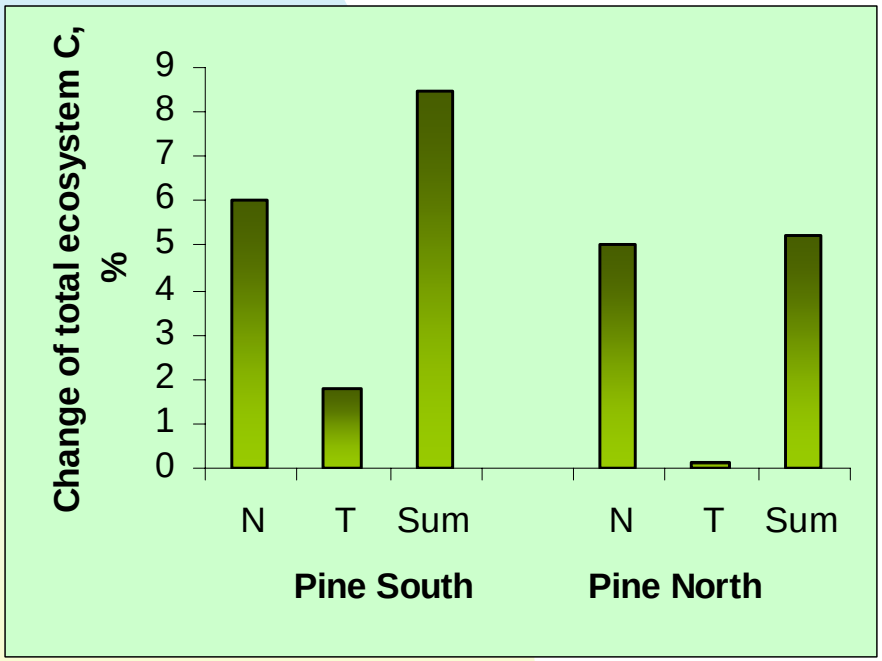
STAND LEVEL
Simulated effect of environmental changes on SOM pool in forest soils in Europe (RECOGNITION Project)

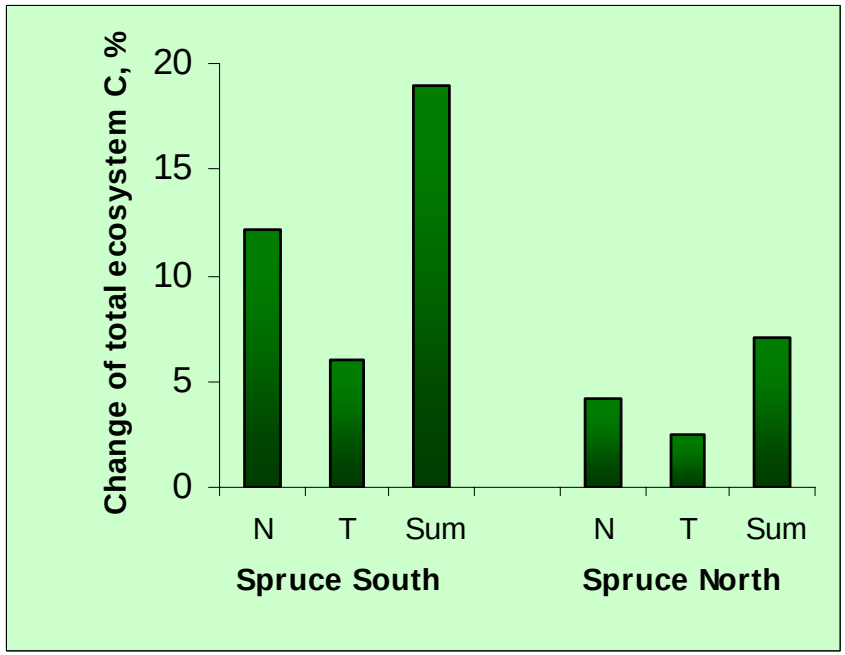




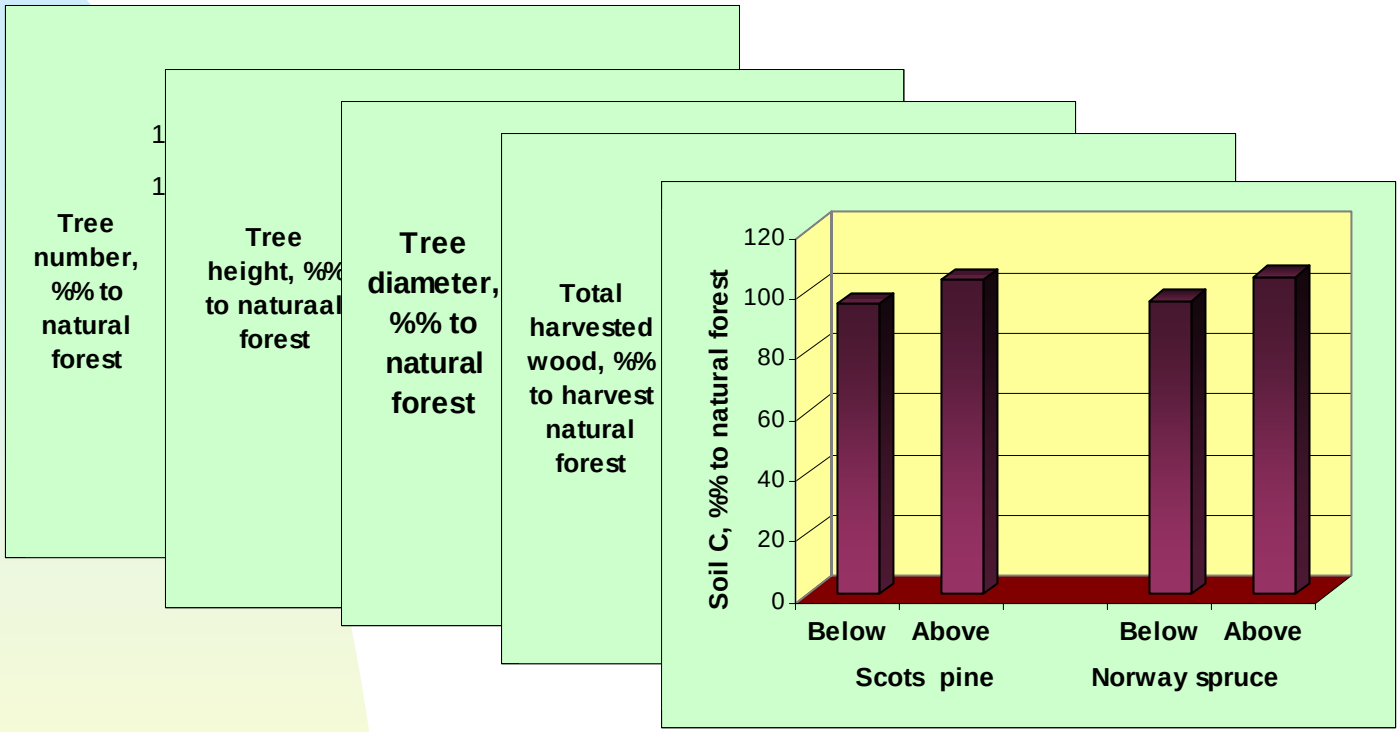
N - nitrogen deposition;
T - temperature increasing,
Sum - cumulative effect of nitrogen deposition and temperature

STAND LEVEL
Simulated effect of environmental changes on total ecosystem Carbon pool

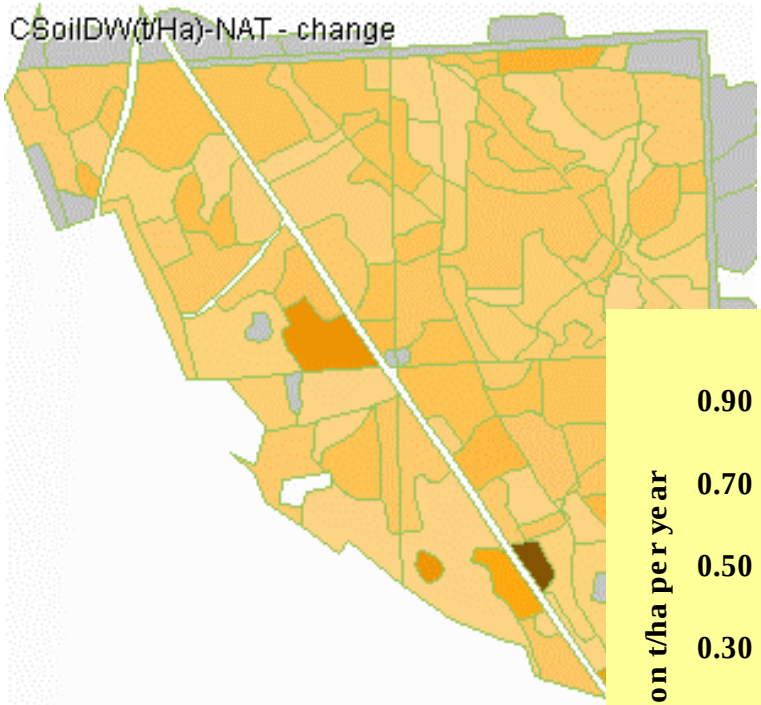




STAND LEVEL
Effects of different thinning regimes



LOCAL LEVEL
Russky Les Case Study



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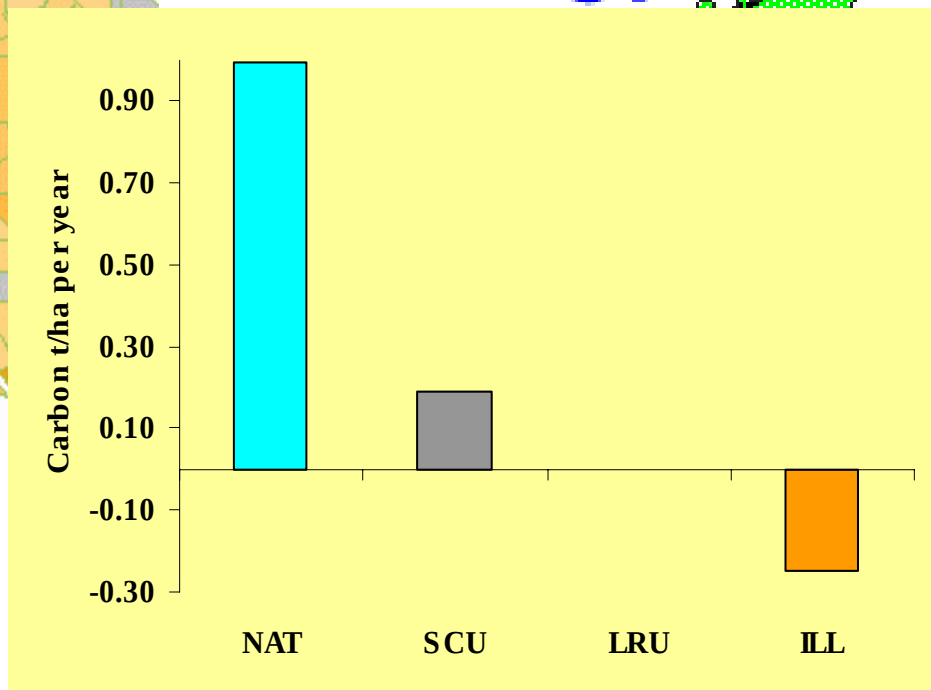
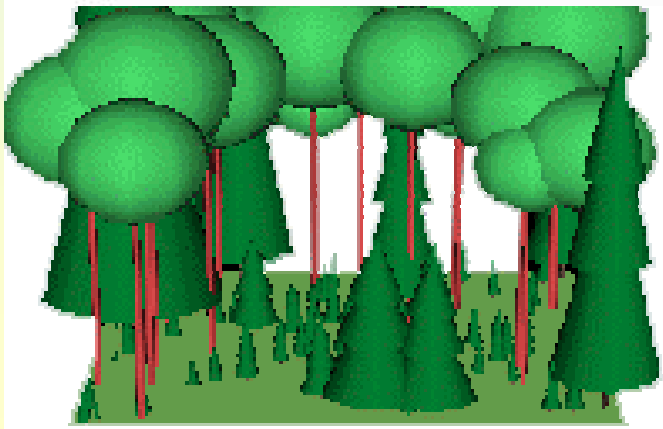
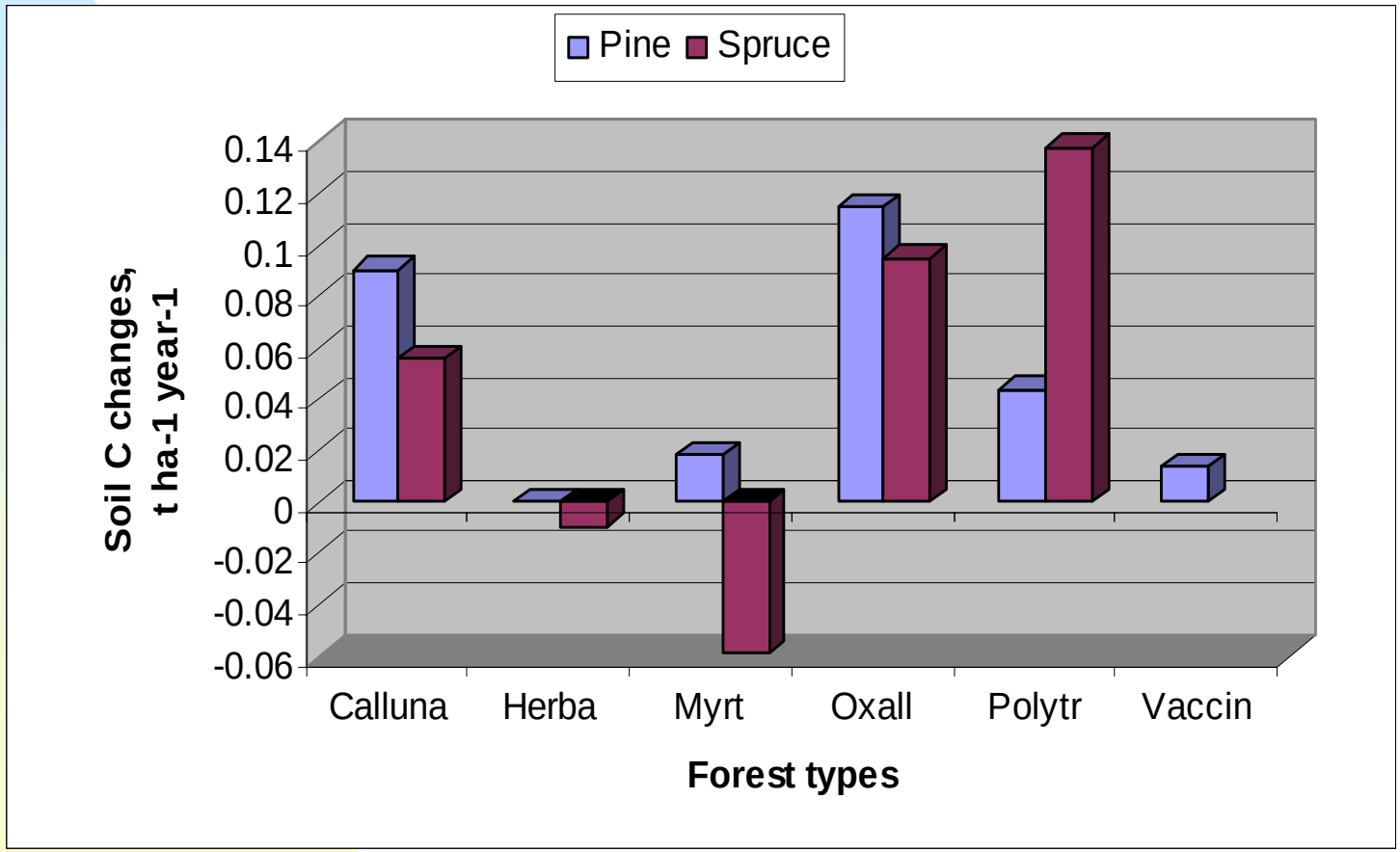




REGIONAL LEVEL
Normalised soil carbon balance on 3.7 mln ha forests of St. Petersburg region



REGIONAL LEVEL
Total changes of soil carbon in forests of Leningrad region, thousand ton annually

Forest types	Young stands	Total
Calluna	1.3	4.01
Vaccinium	-1.1	8.7
Oxalis	4.1	97.6
Myrtillus	-0.4	70.7
Polytrihum	3,0	18.3
Herbo-Philipendula	-11.7	-26,3
TOTAL	**-4,8**	**173.01**

Hierarchy of spatial scales for the application of a stand level model

Stand level:
Parameters of individual trees' growth
Stand/soil parameters in detail
No

Local/landscape level:
Optionally parameters of individual tree growth
Stand/soil parameters in detail
Generalised parameters of any format for forest
area

Regional level:
No parameters of individual tree growth
Optionally stand/soil parameters in detail
Generalised parameters of any format for forest area

Conclusion

- The application of one basic stand-level forest model for different spatial scales shows promising results
- At local and regional levels, this approach was used by Chumachenko et al. (2003: ForRus), Kurz & Apps (1999: CBM-CFS2) and Nabuurs et al. (2003: EFISCEN)
- The approach can be an additional methodological option that will be more effective for the practical implementation of the forest modelling for the realisation of the concept of Sustainable Forest Management

Aknowledgements

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