

# **COST FORSYS**

## **Meeting in Thessaloniki**

### **WG1**

**Khanina, Larisa**  
**Institute of Mathematical Problems in**  
**Biology of Russian Academy of Science**

**Pushchino**  
**Russia**

# DEVELOPER TEAM

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## Institutional Framework Composition



Institute of Physico-Chemical and  
Biological Problems in Soil Science of  
RAS, Pushchino



Institute of Mathematical Problems in  
Biology of RAS, Pushchino

ab.10 persons of ecologists, IT, modellers

**My role** biodiversity assessment & prognosis

# EFIMOD-DLES

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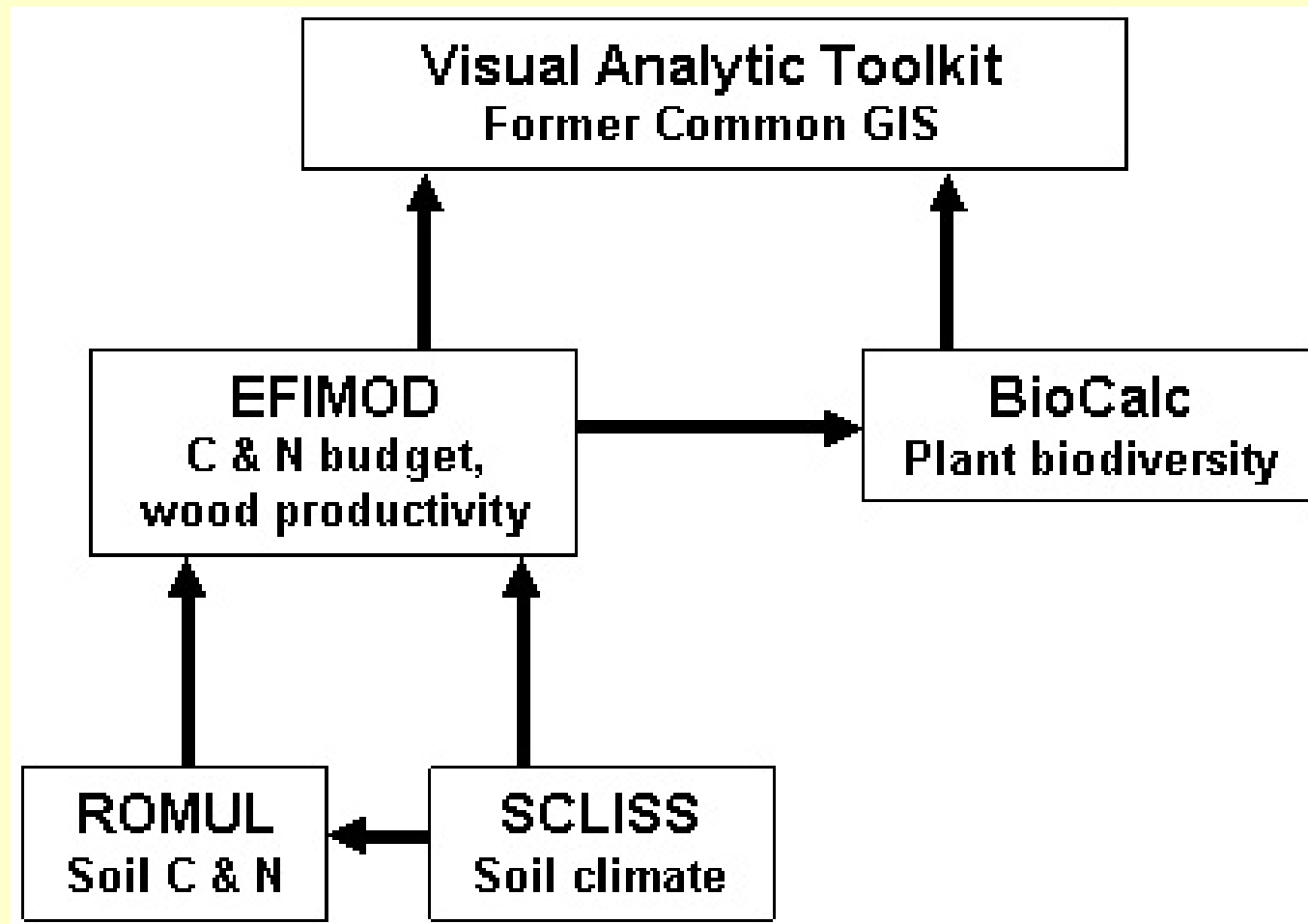
tool to forecast carbon and nitrogen flows in forest ecosystems with strong feedback mechanism between soil and stand.

It allows for description and spatial analysis of mixed stand dynamics in boreal and temperate forests at different management and external impacts

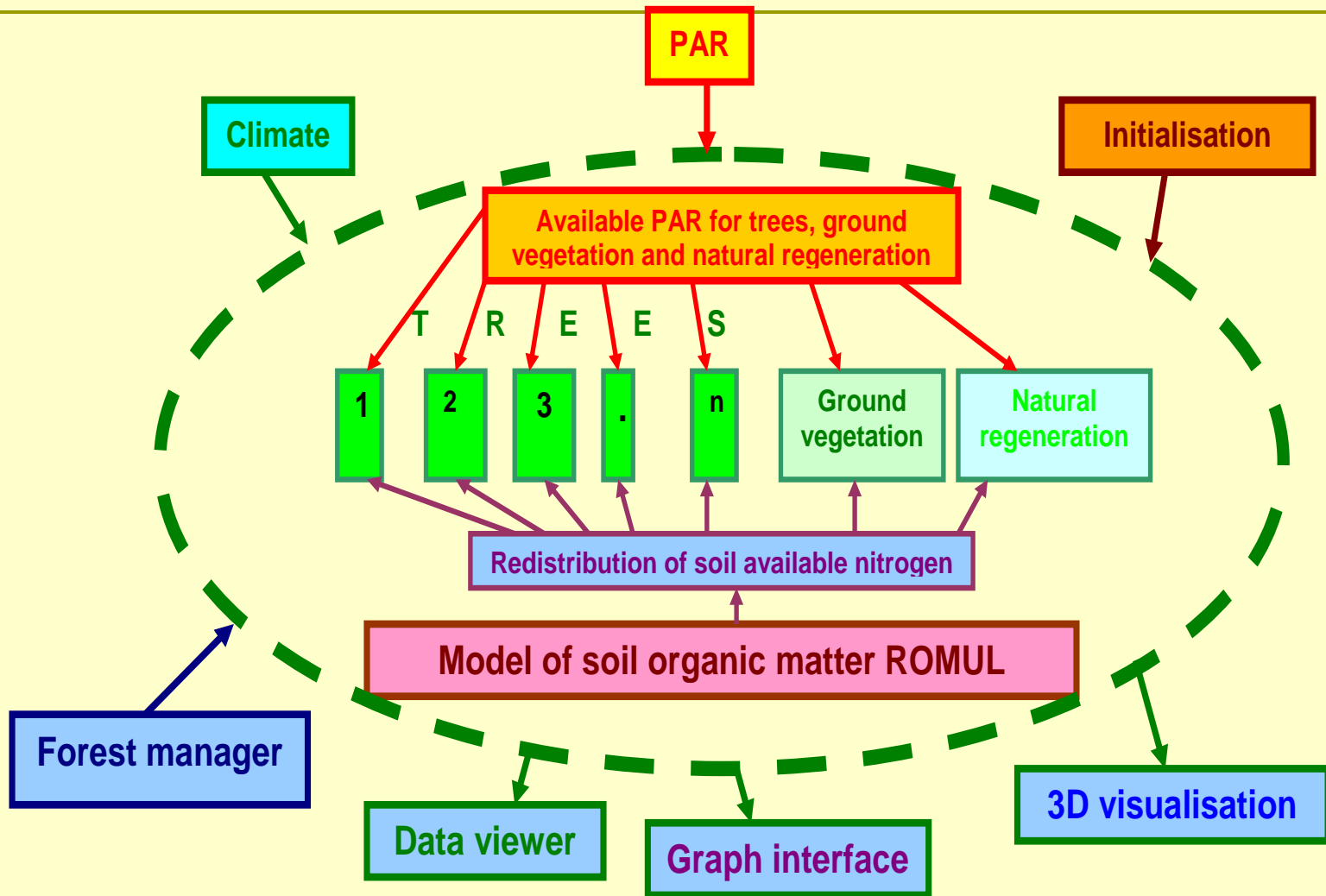
Carbon & nitrogen balances

Biodiversity assessment

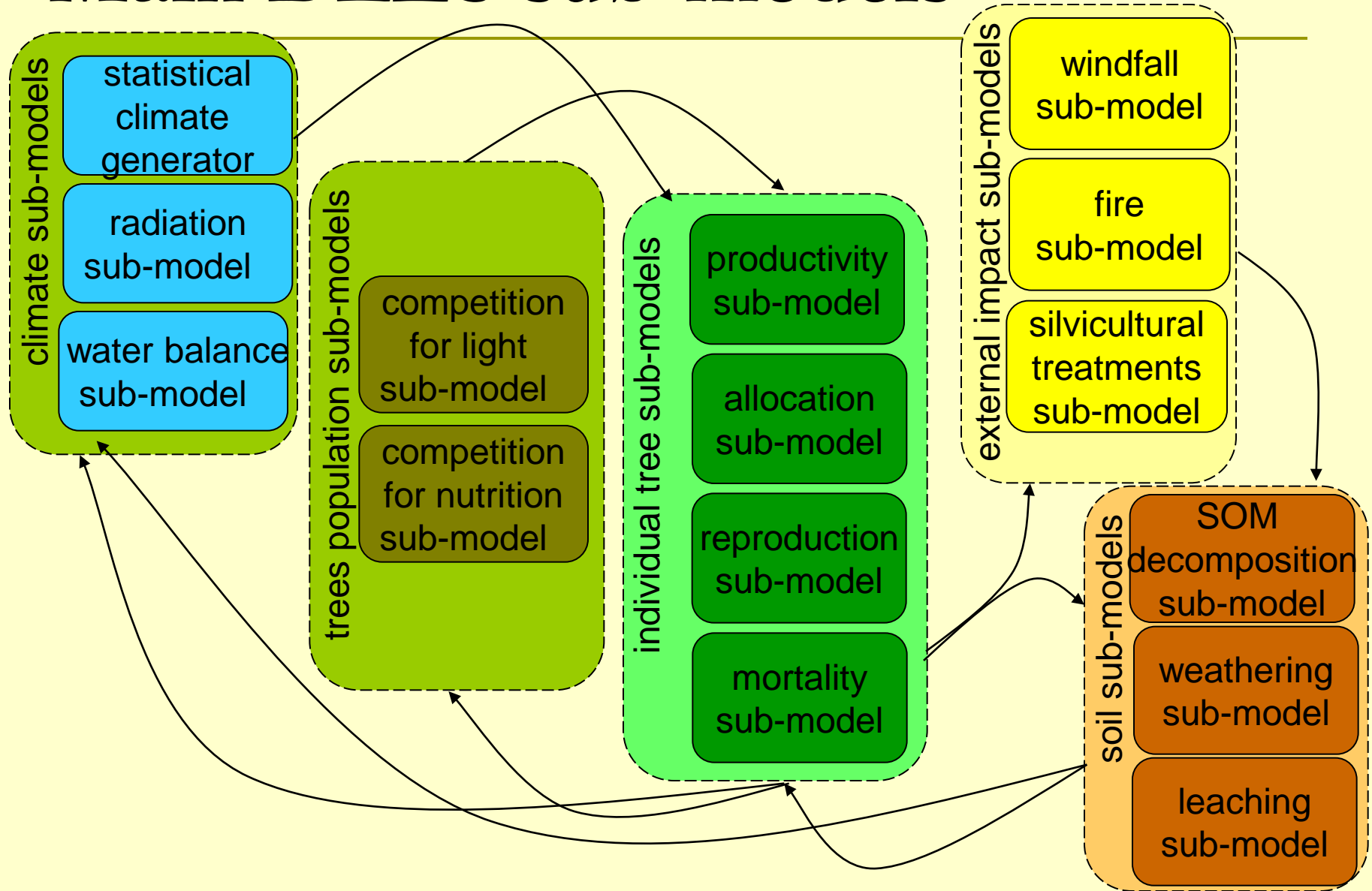
# Flow-chart of DLES



# EFIMOD



# Main DLES sub-models

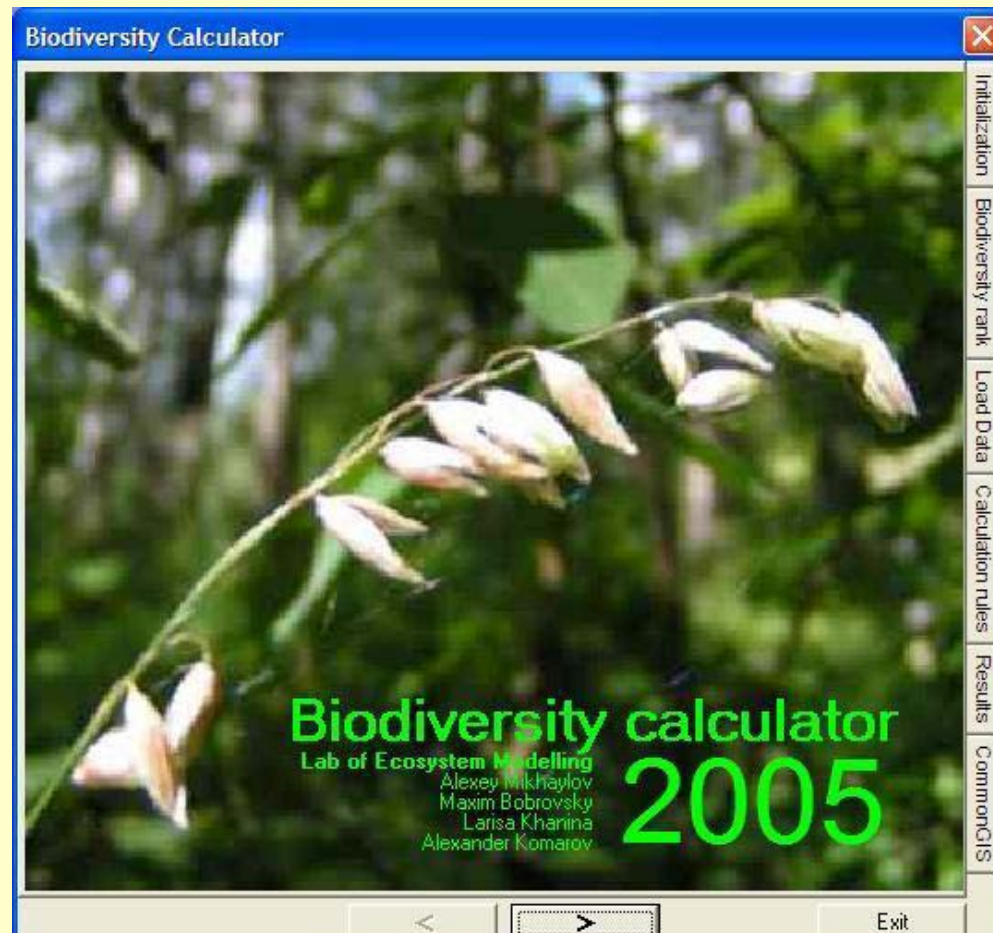


# EFIMOD

	<i>Input</i>	<i>Output</i>
<i>Climate data</i>	Air & soil temperature, Precipitation (Recalculated into forest floor & soil moisture)	Soil temperature and moisture with monthly step
<i>Soil data</i>	Pools of Soil Organic Matter and Nitrogen in forest floor and mineral soil	Pools of Soil Organic Matter and Nitrogen in organic and mineral soil horizons
<i>Tree Species data</i>	Potential growth, specific nitrogen consumption, allocation of biomass between tree organs	
<i>Forest data</i>	Tree species composition, number of trees, height, diameter with standard deviation	Tree species composition, number of trees, height, diameter, Growing stock, BA, biomass
<i>Silvicultural data</i>	Cutting regimes, type of cutting, rotation length	Harvested wood, removal of carbon and nitrogen from the ecosystem

# BioCalc - a software for calculation of forest ground vegetation diversity

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Khanina et al., For. Ecol. Manage. 2007: 80-94



## Functional species groups

**Nemoral**  
Nm

under the crown of broad-leaved trees  
*Asarum europaeum, Aegopodium podagraria,*  
*Galeobdolon luteum, Milium effusum*

**Boreal**  
Br

under the crown of spruce and fir  
*Vaccinium myrtillus, Maianthemum bifolium,*  
*Pyrola rotundifolia, Linnaea borealis*

**Piny**  
Pn

species of pure pine forests  
*Vaccinium vitis-idaea, Pteridium aquilinum,*  
*Antennaria dioica, Calluna vulgaris*

**Nitrophilous**  
Nt

species of richest microsities (dominated  
in flooded black alder forests)  
*Aconitum septentrionale, Stellaria nemorum,*  
*Urtica dioica*

**Meadow-edge**  
Md

species of meadows,  
steppes and forest edges  
*Fragaria vesca, Alchemilla sp., Dactylis*  
*glomerata*

**Water-swamp**  
Wt

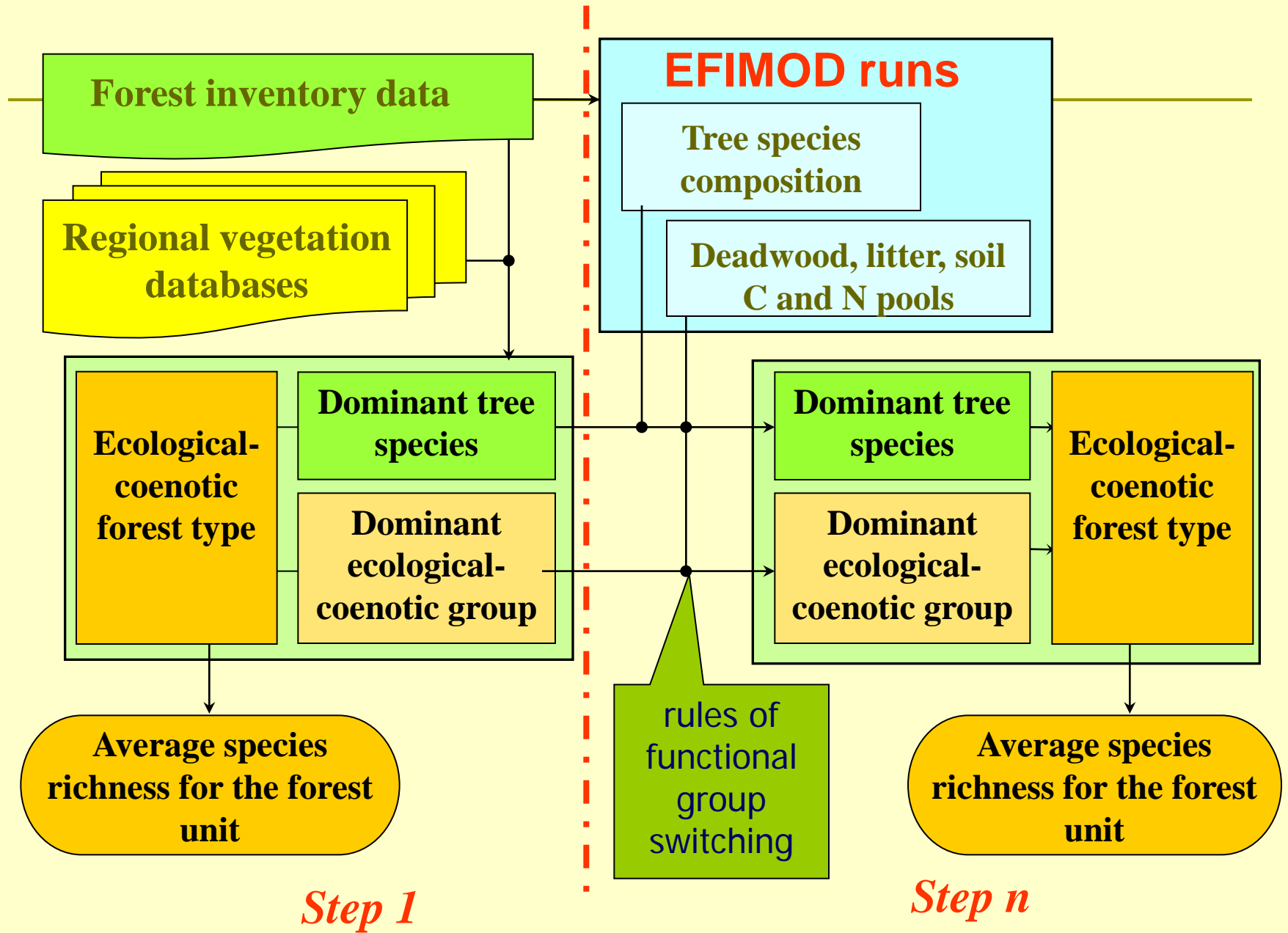
species of coastal and  
intrawater habitats, lowland bogs  
*Caltha palustris, Typha angustifolia,*

**Oligotrophic**  
Olg

plants of oligotrophic bogs  
*Carex globularis, Sphagnum sp.*



# DYNAMICS OF GROUND VEGETATION DIVERSITY



## System origin

by a researchers' team in the Institute of Physico-Chemical and Biological Problems in Soil Science (Pushchino, Russia) and Biological Institute of Sankt-Petersburg State University with support of European Forest Institute (Joensuu, Finland) and Joensuu University (Joensuu, Finland).

First prototype was implemented in 1996 being not a commercial product and based on earlier models by O.Chertov.

What is the IT-environment of these tools and what types of tools are they?

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operating system MS WINDOWS

programming language Borland Turbo Delphi 2005  
IDE, C++

stand-alone desktop application

simulation modeling approach.  
open modular architecture

COM interfaces

What sort of methodology is applied to develop the tools (reference) ?

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Component-based approach (Richard Veryard, 2001)

How is the development process structured (overview of the main processes) ?

- (1) Collecting of the field data.
- (2) Analyzing data to reveal main processes and relationships.
- (3) Constructing the verbal model.
- (4) Formalization of the verbal model.
- (5) Implementation of the model.
- (6) Calibration and verification.

What are the main modelling techniques used to design the IT-solutions ?

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Individual-based modelling,  
simulation modelling,  
dynamic modelling,  
data mining,  
Monte-Carlo method,  
Bayesian method,  
multivariate upscaling

# EFIMOD-DLES Applications

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Russia, Finland, Sweden, Canada, the Netherlands, Bulgaria, Czech Republic, and in several international projects

three projects in INTAS EU Program, FP5 EU-Programme Project CT98-4124 RECOGNITION, FP6 EU Programme INCO - 013388 OMRISK, etc.

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**Thank you for your attention!**