

FOREST MONITORING AND MODELLING

The 3D-CMCC Forest Model (Three Dimension Forest Model of Mediterranean Center for Climate Change) is a generic, dynamic, hybrid model for predicting forest growth, carbon allocation and the dynamic of "natural" forest and managed forest developed by Dr. Alessio Collalti and Prof. Riccardo Valentini at the University of Tuscia - DIBAF (Former DISAFRI) institute, Italy and euroMediaterranean Centre for Climate Changes (CMCC). The model incorporates the key elements of empirical and process approaches into an hybrid ecosystem modeling approach. Based on the simulation of the main eco-physiological processes the model can simulate in both short and long term:

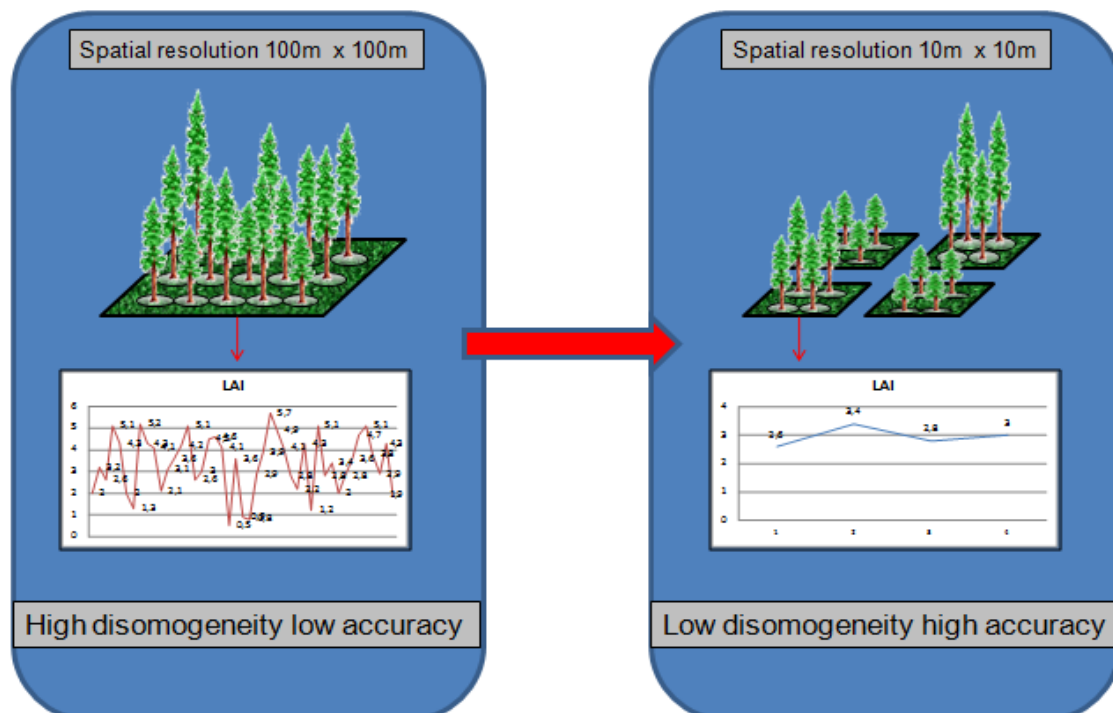
- The Forest productivity (GPP,NPP, CO2 fluxes)
- The Carbon Stock dynamic
- The Forest structure dynamic

The 3D-CMCC Forest Model can be applied not only to plantations, or even-aged, or homogeneous forests but also to natural forests, defined as multi-species, multi-age (uneven aged stand), multi-layered (light competition) and multi-phenology.

In the framework of the ESA KLAUS Project, the 3D-CMCC model has been spatially extended and integrated with remotely sensed data, to increase the spatial resolution down to 10m x 10m and to use real vegetation status observation over the analysis domain instead of modeled ones.

This model is a perfect tool to be used in the forest management, supporting in identifying the best management practices, quantifying the forest carbon budgets, assessing the effects of climate change on forests, simulate the evolution of a forest and so on.

Thus it is proposed as a tool able to help in the forest management planning, giving the possibility to consider the management decision effects.



INPUT and OUTPUT

Input

Vegetation Data: number of trees, height diameter at breast height, tree age and biomass pools: stem, root and foliage for each class.

Soil Data: pedological variables as Soil Classes, Max and Min Available Water Content and Fertility etc

Satellite data: seasonal LAI maps

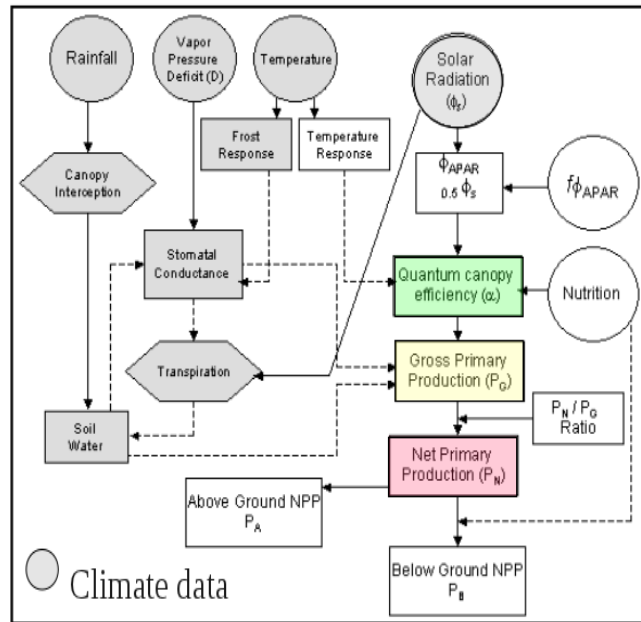
Climatic Data: Solar Radiation, Precipitation, Average maximum and minimum Temperature , Vapour Pressure Deficit etc.

Output:

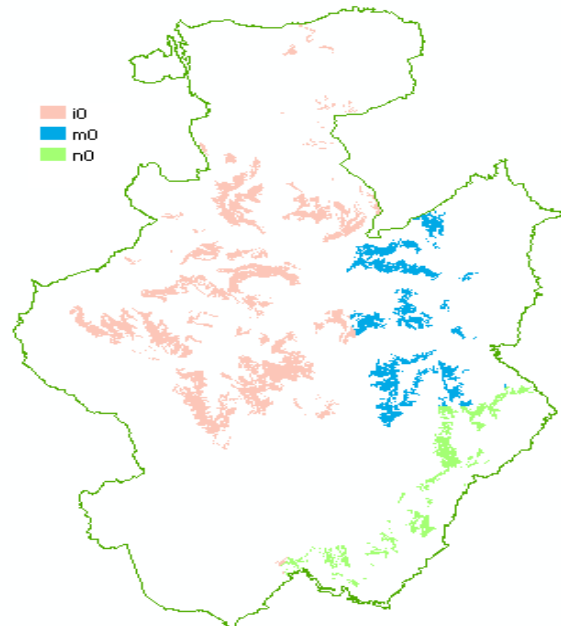
The Forest Model gives as output monthly and annual results in text file format for each month and year of simulation. Each output file of the main forest variables is converted into maps of GeoTIFF file format depending on resolution:

- on monthly (12 bands per year) time scale:
- Gross Primary Production [gC m^{-2}]
 - Net Primary Production [t_{DM} resolution⁻¹]

- and on annual time scale of:
- Yearly GPP [gC m^{-2}]
 - Yearly NPP [t_{DM} resolution⁻¹]
 - AboveGB [t_{DM} resolution⁻¹]
 - BelowGB [t_{DM} resolution⁻¹]
 - Stem Biomass [t_{DM} resolution⁻¹]
 - Root Biomass [t_{DM} resolution⁻¹]
 - Foliage Biomass [t_{DM} resolution⁻¹]
 - Mean annual Volume Increment (m^3 resolution⁻¹)
 - Current annual Volume Increment (m^3 resolution⁻¹)



Model flow chart



Map of *Fagus Silvatica* areas on the "Parco Nazionale dei Monti Sibillini", Test site, Italy