Environmental factors affecting natural regeneration process in a beech forest in Italian peninsula

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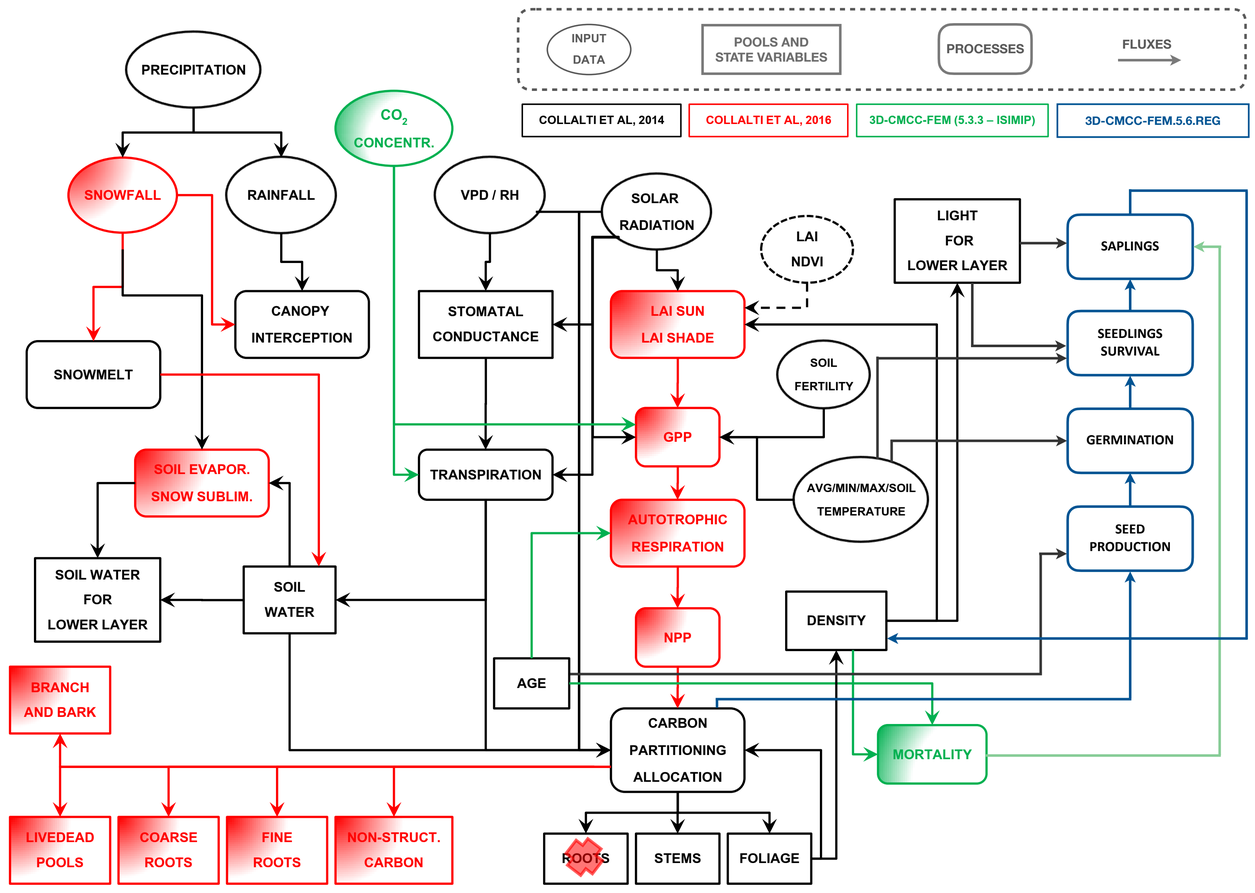
Introduction

- Mantaining forest structure, forest composition turnover, recover from disturbance, regulating climate-driven range shift are just a few of the fundamental factors of the natural regeneration forest.
- Forest regeneration is a series of processes such as flowering, seeds production, seeds dispersal, seeds germination, seedlings survival and new saplings recruits.
- Enviromental factors such as temperature, light and water availability can significantly affect all of those processes.
- Here we would like to present the conceptual model of the new regeneration module and its implementation within the 3D-CMCC-FEM process-based-model.

Area of study

- Three regions across the Italian penisula are choosen as the study sites.
- All the sites are beech dominated forest.
- Every region has 9 plots of 1ha, managed and unmanaged.
- The age of the stand in the Veneto region site is about 140 years, Abruzzo and Calabria regions sites ~70 years old.

3D-CMCC-FEM-v.5.6.regeneration scheme



Improvements

- *Polinomial equation to allocate carbon to fruits:*

$$Cfruit = fNPP * (-0.00004 * (age^2) + (0.0098 * age) - 0.3872)$$

- *Seeds production module:*

$$nfruit = \frac{Cfruit*1e6}{Wfruit} \qquad Sex\ age \geq Svalue$$

$$nseed = \begin{cases} \frac{nfruit}{seedshell} & Sex\ age \geq Svalue \\ 0 & Sex\ age < Svalue \end{cases}$$

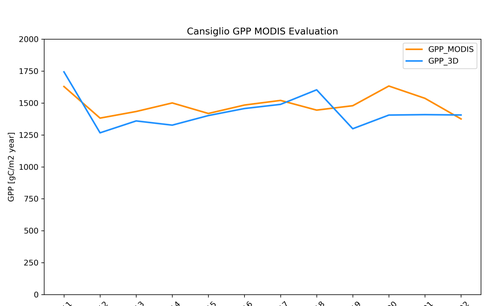
- *Germination:*

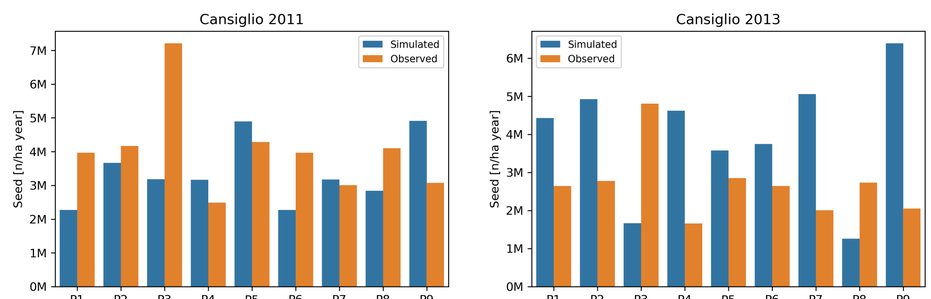
$$Seedlings = \begin{cases} (nseed * Seedvitality) * Germcapacity & Spring\ Thermic\ sum \geq GDD \\ 0 & Spring\ Thermic\ sum < GDD \end{cases}$$

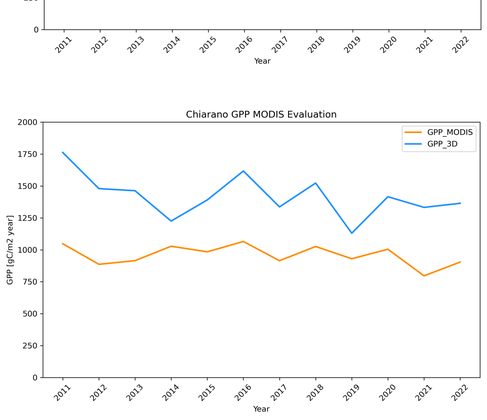
- *Establishment survival:*

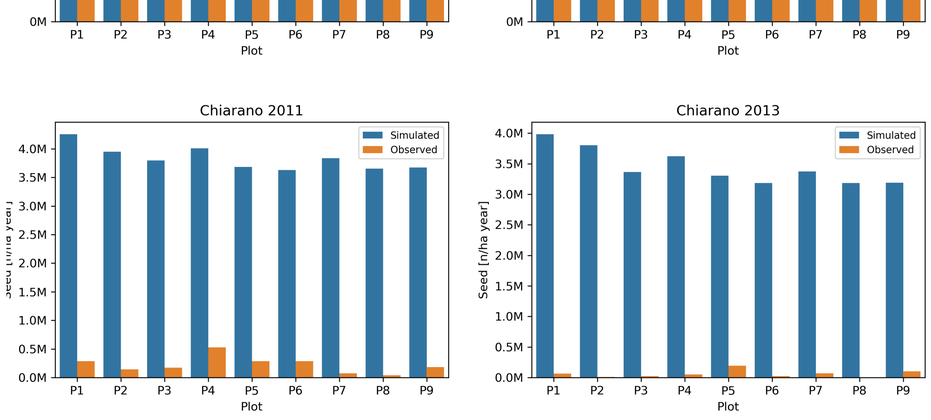
$$nseedlings = \begin{cases} Seedlings * 0.7 & PAR \geq Svalue\ and\ Tair \leq Svalue \\ Seedlings * 0.5 & PAR \geq Svalue\ and\ Tair > Svalue \\ Seedlings * 0.3 & PAR < Svalue\ and\ Tair < Svalue \\ Seedlings * 0.2 & PAR < Svalue\ and\ Tair > Svalue \\ 0 & \end{cases}$$

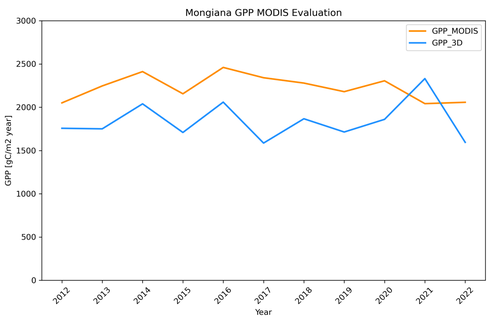
Preliminary results and Evaluation

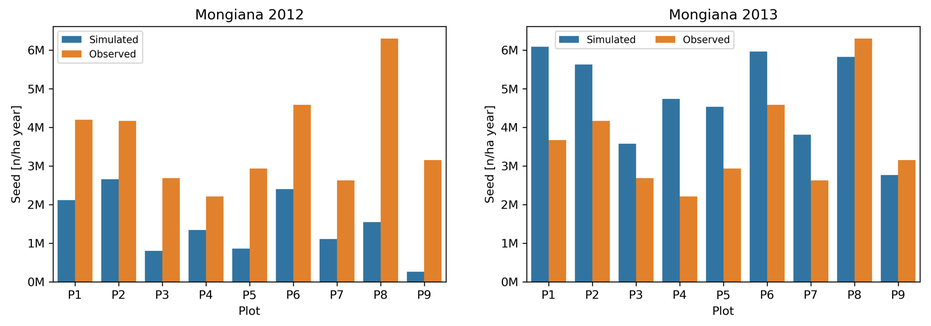




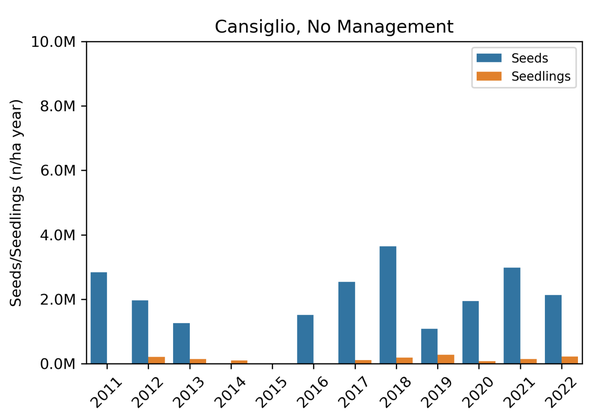


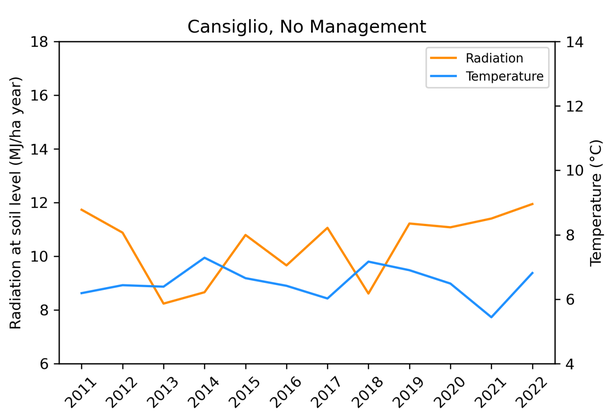


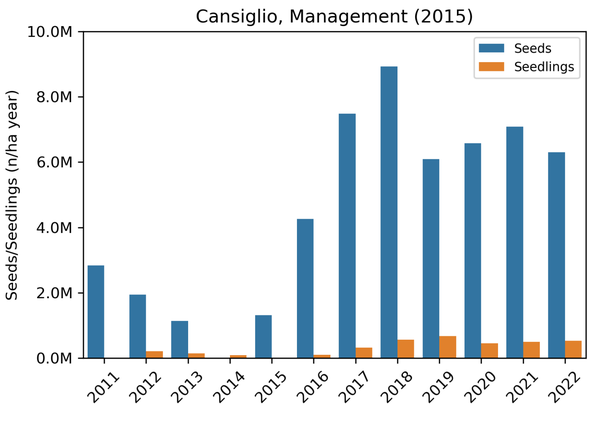


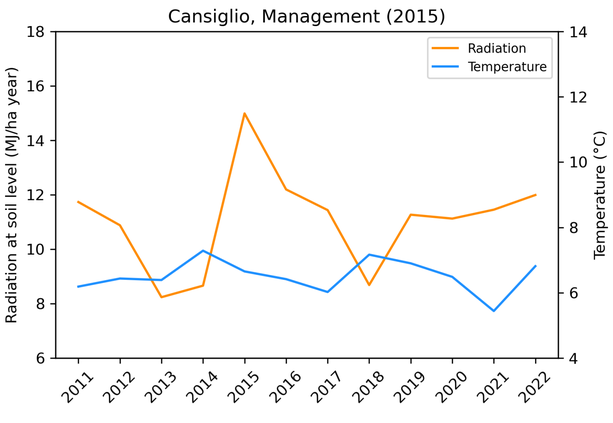


Case study management

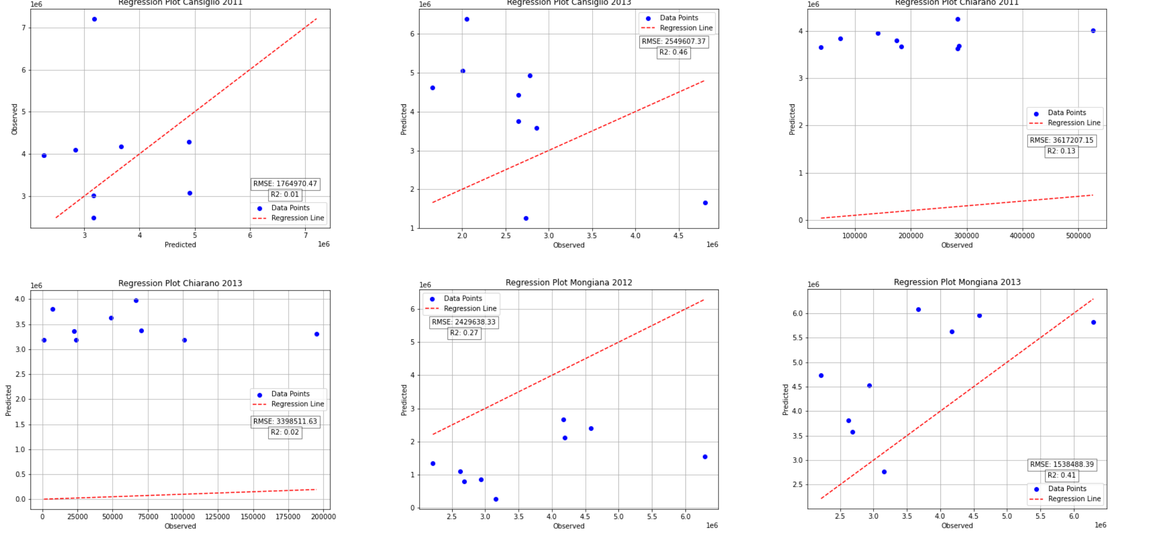








Statistical analysis



Future work

- Improve mortality module that affect seedlings based on environmental factors;
- Evaluation of the seedlings simulated by the model and observed;
- Evaluation using INFC data.

Website

Github source code