

Reconstituting a pre-Neolithic territory by implementing Plant Functional Types: Application to the Roussillon territory (France)

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The study of the impact of human activities on a non-humanly modified landscape is confronted with an essential need to define the initial state before farmers arrived. Particularly, vegetation cover (biomass but also vegetation type distribution) is hard to reconstitute once we postulate there is no such thing as climatic vegetation. Here we present the first steps of a reconstitution of a self-evolving vegetation cover of the French department of Pyrénées-Orientales (also, Roussillon) - an area cultivated since the 5th millennium B.C. To simulate the vegetation state at the neolithic period, we first classify the 94 tree and bush species identified in the archeological record into 10 PFTs (Plant Functional Types) according to their sensitivity to the three variables that were most cited in the four prominent French flora of the region for affecting them: *soil water availability*, *mean annual temperature*, and *soil pH*. This guides the modeling choices in terms of spatial data and dynamics to be integrated into the model: climate and soil (temperature, rainfall, pH) and water dynamics (runoff, river flows, groundwater balance). The model is run on a 90m*90m elevation grid: on each pixel, water availability and PFT evolution are simulated at seasonal temporal resolution (using climate and soil data). The evolution of the landscape is simulated over a period of 500 years. From a working perspective, such a long period implies considering an additional step by introducing some extreme events (frosts, fires, storms, droughts) that prevented the forests from reaching a stable equilibrium. As a result, we obtain a dynamic reconstitution of vegetation and biotopes that: (i) can be tested against archeological data such as palynological or anthropological remains; and, (ii) can be used for the next step, namely the implementation of Neolithic farmers and herders, including their fishing, gathering, pruning and hunting activities, on this reconstituted Roussillon territory. Constructing dynamic evolution rules from scratch seems easy, but calibrating this set remains difficult. Even more difficult is to make choices between different versions of these rules which, paradoxically, are very often described in the literature in a purely qualitative way.

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