FOREST MANAGEMENT FOR WATER FLOW REGULATION WITHIN A CLIMATIC CREDIT MARKET SCHEME

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CLIMARK is a climate change mitigation project funded by the European Union (LIFE16 CCM/ES/000065) aiming to compensate forest management actions leading to improve ecosystem services of climate regulation, water flow regulation and biodiversity. It relies on three indicators: C sink capacity, water use efficiency and a potential biodiversity index applied to six Mediterranean landscape units in Catalonia, Spain. Approximately 120 ha distributed among forest stands of different structural characteristics are selected and treated for demonstration purposes.

1 INTRODUCTION

The overall purpose of CLIMARK project is to promote multifunctional forest management for climate change mitigation, through the design of a local market of "climatic credits". Climatic credits are derived from a holistic perception of forest management –aligned with the newly developed Climate Smart Forestry – which i. takes into account the local characteristics of the territory to identify the most cost-effective management options, and ii. applies solutions that capitalize adaptation-mitigation synergies. The project takes place in Catalonia (Spain) and it is replicated in Veneto (Italy).

The specific goals of the project are:
1. To maintain and improve the mitigation capacity of European Mediterranean forests through the application and promotion of locally identified forestry practices (from the needs of local public and private forest owners) and to assess their impact on three ecosystem services: climate regulation, water flow regulation and biodiversity. Three key indicators have been identified (C sink capacity, water use efficiency and biodiversity potential). Valuation of these services will allow the definition of the new "Climatic Credit" concept.

2. To design a local market of "climatic credits" as a tool to promote multifunctional forest management under pervasive rural abandonment conditions, and to provide the means for its replicability in other European regions, through specific transfer and context-validation actions.

The basic requirements of Emissions Trading System-ETS schemes, permanence, additionality and a defined baseline (no-management), are discussed here for water flow regulation.

2 METHODS

2.1 Preparatory actions

Preparatory actions have included an environmental diagnosis of six Mediterranean Landscape Units (LU) followed by the selection of the demonstrative sites (forest stands) through local participation (bottom-up approach) and the signature of agreements with forest owners. Inventories are being designed and performed in the selected sites to define the baseline. Companies with environmental compensation needs also are identified.

2.2 Implementation actions

Five forest management actions are to be implemented and monitored included in European Union Decision 529/2013/UE and of interest in the selected landscape units (Figure 1), consisting of different forest typologies (*Pinus halepensis, P. sylvestris, P. nigra, Quercus suber, Q. faginea*), in order to evaluate their impact on the water flow regulation ecosystem service and to evaluate its ability to generate climatic credits.

Figure 1. Location of the study areas in Catalonia

Management actions evaluated include: i. Forest management after wildfires, ii. Forest management in mature stands, iii. Reforestation with trees and agroforestry systems, iv. Forest management for soil carbon storage, and v. Forest management for wildfire prevention.

The forest management actions applied (Figure 2) seek to increase water use efficiency for mitigation purposes by gaining greater carbon stocking for the same water availability [1]. Water is the growth limiting factor in the Mediterranean. Being a reduced water availability an expected consequence of climate change in the region, a multifunctional forestry for adaptation must also aim to decrease water stress by regulating competition for the water resource.

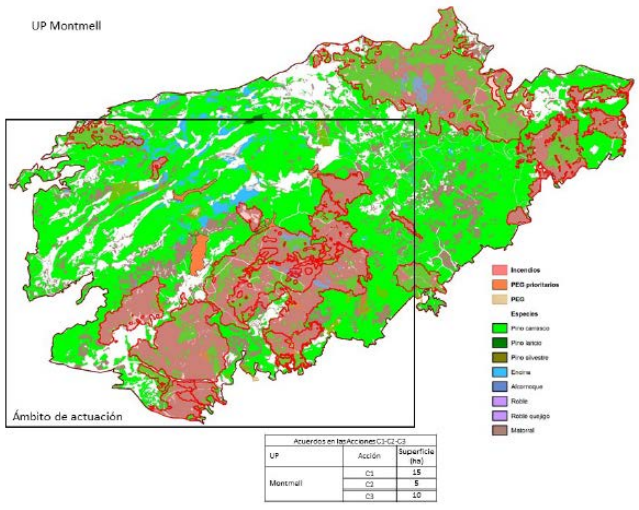

Figure 2. An example of a landscape unit and the location of the demonstration forest stand areas.

3 RESULTS

Evapotranspiration calculations, temperature and precipitation anomalies are analyzed for the past years, with extreme climatic events. Forest stands are classified according to a Drought Persistence Index [2] and then stand parameters and site quality are matched for specific silvicultural itineraries and treatments. In targeted stands, we measure the isotopic carbon relation (δ13C) in leaves of dominant trees for evaluating water use efficiency (WUE). WUE after planned treatments is projected to the future by the use of a mechanistic stand-level model in with water balance is variable with management action [3]. Parametrization of the model is achieved with field measurements of roots depth for dominant species and soil texture. In treated stands, sensors are in place to provide a continuous measurement of soil moisture and adjust model soil moisture dynamics and relate them to tree growth. Efficiency is obtained as m3 of wood by m3 of water used. Model validation will proceed in following years.

Beyond the stand level, implications of silvicultural treatments applied to stand typologies across landscapes according to the purposes of mitigation and adaptation of Mediterranean forest are expected to be relevant for water regimes and water flows in the landscape units selected. These impacts will be derived from available watershed-level data and models to be determined later in the project.

4 CONCLUSIONS

As a project is described here that it is still ongoing there are no conclusions at this time, but evidences suggest that forest treatments that regulate competition increase WUE in Mediterranean environments. Valuation of forest management effects on WUE within a climatic credit voluntary market presents challenges, but water is a scarce resource that needs to be considered in climate change mitigation strategies for the future.

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