Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Shaping future forestry for sustainable coppices in southern Europe: the legacy of past management trials (FutureForCoppiceS)

Project ID: 99

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PROJECT DESCRIPTION

Project objectives:

FutureForCoppiceS will improve the knowledge base for the development of future, sustainable forest management (SFM) of coppice in southern Europe.
Coppice covers ca. 23 million ha in the Mediterranean (ca. 3.7 millions ha. in Italy) and are barely considered in SFM scenarios, which are mostly based on modelling exercises. FutureForCoppiceS adopts a different concept: on the basis of a network of management trials installed 10-45 yrs. ago, it will demonstrate, post-hoc and by real data on SFM indicators, how different management approaches have actually favoured/limited the sustainability and efficiency of coppice forests. Given that concurrent, substantial changes (e.g. greenhouse gases, temperature, precipitation) have occurred over the past 45 yrs. both locally and globally, the results will improve the knowledge base for SFM in view of anticipated future changes in key environmental drivers.
FutureForCoppiceS has the following objectives:

1**. Demonstrate the sustainability of different management approaches**
Management trials (traditional coppicing, natural evolution, active conversion by selective felling) were regularly monitored over time. Existing and newly collected data on consolidated SFM indicators (see below) will be evaluated to demonstrate the value of different approaches in ensuring provision of forest ecosystem goods and services (FGS). This will contribute to the knowledge base for SFM and support resource efficiency-related policy.

2. **Test, demonstrate and disseminate the value of SFM indicators**
FutureForCoppiceS will use consolidated SFM indicators and develop and implement new methods for the collection and reporting of new, functionally-oriented ones. This will demonstrate indicator's ability to assess/ monitor the effects of different management approaches, and evaluate their applicability and transferability within the project context and beyond. This will broaden the knowledge base and strengthen the confidence in the SFM reporting.

3. **Synthesise and upscale the results at broader geographical scales**
FutureForCoppiceS wishes to demonstrate the potential effects that different approaches may have at geographical scales larger than the management trials.

Results will be synthesised and spatialized in relation to the distribution/extent of the concerned European Forests Types (EFT) in the local forest districts, the administrative regions (Toscana and Sardegna), Italy, and southern Europe (<45° latitude).

Actions and means involved:

FutureForCoppiceS builds on management trials selected among those installed by the Co-ordinating Beneficiary (CB) in the late 1960s and continuously monitored though time for a series of forest mensurational variables. Details about the sites and their location are reported under Form B.2. Nine implementation Actions were planned to accomplish the project's objectives. They are conceived in two groups:
Actions B.1-B.6 are relevant to individual SFM criteria; Actions B.7-B.9 support, and use data from, B.1-B.6.

Objective 1 will be achieved by:

(i) Collection of new data for consolidated SFM Criteria 1-6 indicators (Actions B.1-B.6). This will extend existing datasets and supplement them with indicators not covered so far. Actions are designed in a pro-active form (e.g., soil sampling and analysis under Action B.2 will provide data necessary to Action B.1).
(ii) Collection/harmonization/organization of existing data produced by the CB since management trials were installed and/or by other agencies operating at local/regional/national/international level for those SFM indicators not covered by CB data (e.g. forest health data from forest inventorying and monitoring networks - Action B.7).
(iii) Evaluation of existing/newly collected data (Actions B.1-B.6).

Objective 2 will be achieved by:

(i) collection/evaluation of original field data for consolidated SFM indicators (see above) and newly suggested indicators relevant to SFM Criteria 1-6.
(ii) Preparation of field Manuals for new indicators.
This will support/link the results of consolidated SFM indicators to the functionality of forest ecosystems, and will promote the applicability and transferability of the project's results to other, similar situation. It will be done by Actions B.1 - B.6 and will contribute data to Action B.7.

Objective 3 will be achieved by the results of Actions B.1-B.6, the spatialization of Action B.8, and the statistical evaluation and synthesis of Action B.9. Objective 3 will ultimately enhance the potential of project results with respect to its demonstration character and contribution to resource efficiency-related management and policy. Overall, the demonstration scale of the project is consistently considered by Actions B.1 - B.8 and will be evaluated under Action B.9.

Description and methods employed (what, how, where and when):

What

The increasing interest in selecting appropriate management options and understanding their real effects on current forest has led to a renewal of efforts for developing effective methods to predict forest evolution under different management approaches. Spatially explicit models realized through the combined use of field data and GIS-based approaches, recently gained importance as support tool for forest policies since they can help understanding forest dynamics and justify current implementation of management actions towards sustainability. The spatial prediction and mapping of quantitative data on SFM indicators (see Actions B.1 - B.6) and of expected forest dynamics under different management options (i.e expected rate of gain or loss of basal area increment; expected gain or loss of biodiversity), has therefore major importance to forest managers. Building on results from Actions B.1-B.6, Action B.8 intends to provide a rapid and cost-effective

framework to provide a synoptic view (over the forest types considered by the project, an at different spatial scales) about the expected change if SFM indicators in case of adoption of different management approaches.
Action B.8 will make use of:
(i) the quantitative data on the recorded rate of change at the project sites resulting from Action B.1 – B.6 for the various indicators under the considered management approaches.
These data will provide the expected rate of change for the concerned European Forest Types (EFTs) and management approaches.
(ii) Site, stand, composition, health, soil and diversity data collected at the plots of the local, national and international inventory and monitoring networks. When sorted for the different EFTs, these data (based on sample surveys and purposively selected sites) will allow to estimate the condition of the given EFTs and will form the basis to estimate the potential (expected) effect if a given management approaches was applied at the EFTs.
The main aim of Action B.8 is to estimate and visualize in a synoptic manner the potential impact of management approaches for each of the three European Forest Types (EFTs) considered, and at different spatial scales. Specific activity of Action B.8 include:
(i) Collection of data from Actions B.1 – B.6
(ii) Collection of data from local, national and international inventory and monitoring networks.
(iii) Summarizing, modelling and mapping SFM indicators at present time and their expected variation, and to link the obtained information to the management approaches under scrutiny.

How

Within the Action B.8 a series of extensive existing datasets at local (e.g. local and regional plots), national (NFI plots, local ICP Forests plots) and international (ICP Forest plots) scale, will be used (according to data availability) to upscale the results obtained in the previous implementation actions. The data will be divided into classes according to EFTs, in order to make them comparable with those of the project sites (9 sites, 45 plots). These data will be processed to simulate a multi-temporal change in the measured values in the above-mentioned set of data based on changes measured in the plots of the project. The simulation model assumes that the future gain or loss in a given indicator for the additional sites, will follow the similar definable and predictable development pattern recorded at the management trials, for which we have a time series of data. The domains within which the information obtained through the implemented modelling will be mapped, corresponds to the area of distribution of each of the three EFTs covered by this project (mountainous beech forests, thermophilous deciduous forests and broadleaved evergreen forests) in the local forest districts, in the two regions, in Italy, and in southern Europe (i.e. < 45° latitude).
The models that will be implemented are mainly based on map algebra performed by the mostly used GIS Free and Open Source Software (GRASS GIS). With the aim of calculating landscape metrics in GIS to ensure robust analysis output, particularly where complex algorithms are concerned, the full access to the source code is crucial. There are well known examples of FOSS in research fields such as Statistics (e.g. R Language and
Environment for Statistical Computing), while GIS scientists and more generally landscape ecologists may benefit from the powerful GIS named GRASS (Geographical Resources

Analysis Support System, http://grass.osgeo.org), which includes more than 350 modules for managing and analyzing geographical data. GRASS GIS was originally created in 1982 by the U.S. Army Construction Engineering Research Laboratories, by further adopting the
GNU GPL (General Public License, see http://www.gnu.org) in 1999. Currently, it is one of the cutting-edge projects of the Open Source Geospatial Foundation (OSGeo.org, founded in 2006). Adoption of the FOSS license changed the development process of GRASS with contributions to the source code becoming decentralized. The legal statements declared in the GPL allow the user to use the software's full range of capabilities, and to distribute study and improve it. A number of GRASS modules deals with the analysis of raster matrices, continuous and discrete data. Among them we developed the r.regression.multi tool will be used, allowing to performing multiple regression for species distribution modelling relying on big data matrices.
Furthermore, *spatial interpolation methods* will provide tools to potentially estimate the values of an environmental variable at unsampled sites using data from point observations within the same region. Predicting the values of a variable at points outside the region covered by existing observations is called extrapolation. Spatial interpolation methods fall into three categories: 1) non-geostatistical methods, 2) geostatistical methods, and 3) combined methods. Within the Action B.8 we will rely on Geostatistical approaches (e.g.
Simple Kriging), that are usually used to describe spatial patterns and interpolate the values of the primary variable at unsampled locations, and model the uncertainty or error of the estimated surface.

Where

Action B.8 is entirely based on computing and data processing and will be carried out at the premises of the involved Beneficiaries and of the sub-contractors whenever external assistance is foreseen.

When

Action B.8 will last 30 months, starting on January 2016 and finishing on June 2018. Specific time steps include:
- Geo database (connected with the project database, see Action B.7) implementation and data transformation at the three different scales (regional, NFI and ICP Forest data), will be carried out between January and December 2016.
- Spatial models at local (forest districts) and regional scale will be performed between January and March 2017.
- Spatial models at national scale will be performed between March and June 2017.
- Spatial models at international scale will be performed between July and September 2017.
- Models assessment and multiscale analysis will be performed between September 2017 and March 2018.

Reasons why this action is necessary:

Action B.8 is necessary to expand results obtained from the management trials (e.g. Action B.1 – B.6) to a larger domain, and to provide an estimate of the effect the various management approaches may have on (a selection of) SFM indicators over defined forest types in southern Europe. The development of a framework that will be adopted within this action is essential to have an insight into future, expected development of the concerned

EFTs . Spatial models and GIS-based representation of SFM indicators are extremely useful to developing effective management policies and are invaluable tools for forest habitat conservation since they can aid in the process of focusing action into the right geographical locations and in ranking areas in terms of conservation value.
Action B.8 will also provide data from which, in combination with the data of the time series available for the project sites, infer both the historical legacy and the future development of forests at large scales. This aspect will allow to better understand the multi-temporal patterns of SMF indicators under management approaches tested at the project sites, and to individuate sustainable treatments.

Constraints and assumptions:

The following possible constraints can be foreseen:
- Reliability of the dataset chart representing the distribution of the three EFTs- The adoption of a single dataset may limit the accuracy of the reference domain to smaller scales, in particular the regional one. This will be explicitly reported.
- Obtaining data from external sources (e.g. forest monitoring and inventory data) – Data will be requested following the official procedures and upon proper motivation. We do not expect substantial problem here, and allowance was made for possible delays in the procedure.
- Absence of a systematic or at least homogeneous distribution of data at plot scale. This may always occur and will be taken into account in reporting findings.
- Uniformity of spatial data related to observation points belonging to different datasets and mistakes in the coordinates of the plot needed for the spatial models. These can only be evaluated upon their actual occurrence and possible solutions will be considered when necessary.

Expected results:

- Six series of maps representing the current values of selected indicators for each SFM criterion at forest district (7 maps), regional (2 maps), national (1 map) and supranational (1 map) scale for each EFT (when present).
- Six series of maps representing the inferred variation of selected indicators for each SFM criterion at forest district (7 maps), regional (2 maps), national (1 map) and supranational (1 map) scale for each EFT (when present).
- Spatial models predicting the distribution (continuous data) of the estimated values of the gain or loss of the selected SFM indicators at forest district (7), regional (2), national (1) and supranational (1) scale for each EFTs and SFM Criterion.