IV CONGRESSO NAZIONALE DI SELVICOLTURA

IL BOSCO: BENE INDISPENSABILE PER UN PRESENTE VIVIBILE E UN FUTURO POSSIBILE

TORINO 5-9 NOVEMBRE 2018

DEVELOPMENT OF INTEGRATED WEB-BASED LAND DECISION SUPPORT SYSTEM AIMING TOWARDS THE IMPLEMENTATION OF POLICIES: AN INTEGRATED FORESTRY APPROACH

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Horizon 2020 European Union Funding for Research & Innovation

Rationale

LANDSUPPORT is a Horizon2020 project (Call RUR-03-2017) officially launched on May 1st 2018 and will last 42 months. LANDSUPPORT is coordinated by CRISP Research Center of the University of Napoli Federico II and it involves 19 beneficiaries, including 17 from European countries (Austria, Belgium, France, Germany, Hungary, Italy, Slovenia, Spain) and 2 from non-European countries (Malaysia and Lebanon).

LANDSUPPORT aims at building up a web-based smart geoSpatial Decision Support System (S-DSS), which shall provide a set of operational tools devoted to: i) support sustainable agriculture and forestry; ii) evaluate trade-off between land uses; iii) contribute to implementation, impact and delivery of about 20 European land policies and selected 2030 UN Sustainable Development Goals including climate change resilience goals.

The vision of LANDSUPPORT is rooted in a change in paradigm for both soil/landscape scientists and also public institutions. In fact, LANDSUPPORT shows that it is possible to overcome both current disciplinary and policy fragmentation over landscape issues and to offer integrated geospatial knowledge archive which can be used directly and freely by any end-user and institution.

Objectives

Within LANDSUPPORT a family of tools (h) is under development to support sustainable forest management as required by EU Forestry Strategy, specifically designed for forest owners and policy makers to adopt best forest practices. LANDSUPPORT will use EO data and simulation modelling in order to:

a) map and monitor forest productivity;

b) identify forestry best practices to increase climate change resilience;

c) assess the impact of selected forest best practices indicators and criteria with modelling applications;

d) quantify forest ecosystem services through the development of relevant indicators for a preliminary FES estimation also according to forest types.

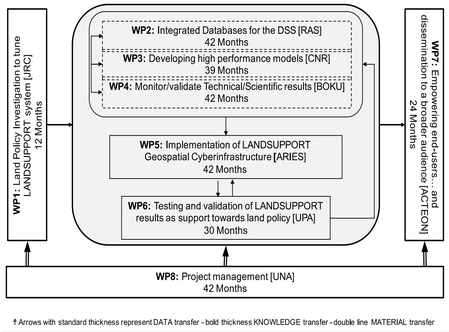
The above-mentioned objectives will be achieved through the integration of existing available databases and the development of high performance modelling chains.

Process based models (PBMs) will be applied to local and regional level, taking into account forest structural complexity and soil properties in an integrated Forest Ecosystem Models (FEMs). 3D-CMCC-FEM model (Collalti et al., 2018) will be implemented in LANDSUPPORT and will investigate carbon and water fluxes, including biomass pools and their partitioning, for complex multi-layer forests.

Thanks to parallel processing and HPC the project will enable to tackle the mentioned objectives and actions at the local scale, but integrated over large areas.

The forestry tool will work at different geographic scales including EU Member States (Austria, Italy, Hungary) and European Regions (Marchfeld, Campania Region and Keszthely Mountain District), plus one local test-site in Slovenia.

Project structure



LANDSUPPORT GCI workflow will be implemented through 9 interconnected work packages that will develop and test the Geospatial Cyberinfrastructure platform:

- preliminary land policy and socioeconomic investigation will be analyzed in WP1;
- four R&D work packages (WP2, WP3, WP4, WP5) will develop the LANDSUPPORT platform;
- WP6 will better adapt LANDSUPPORT for the sake of multilevel land policies public bodies;
- In WP7 demonstration, dissemination and outreach activities will be performed;
- project coordination activities are carried out in WP8;
- WP9 will take care of ethical requirements.

Overall methodology

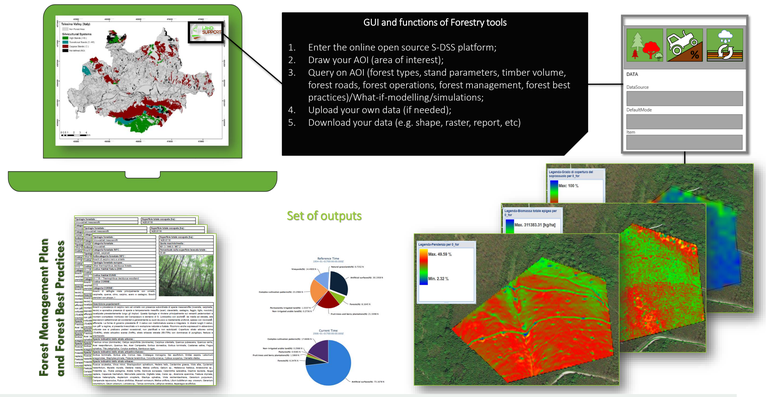
The strong linkage between databases, modelling and graphical user interface (GUI) in LANDSUPPORT will provide both large and operational set of tools to be applied to forest land analysis and management to be strongly connected to land policies. LANDSUPPORT will improve (in terms of thematic accuracy, thematic content, timing of delivery, spatial detail and representativeness) currently available land cover / land use layers for Europe (mainly based on six IPCC land categories and on a sample of field data producing an aggregated). Our starting point will be the maps of Copernicus High Resolution Layer catalogue. For forest areas, BOKU will provide a yearly update starting from the existing layers and include disturbances (fires and burned areas, diseases, etc.) mapping to highlight areas under change. Assessment of existing products for forest ecosystems, productivity mapping and adaptation will refer to Sentinel-2 and -3 data. BOKU, ARIES and SFI will:

1) compare the results of different Gross Primary Production (GPP) and Net Primary Production (NPP) physical models (e.g. MODIS, C-Fix and Biome-BGC) and datasets via a literature review;

2) evaluate the suitability of Sentinel-2 (fAPAR and LAI, land cover, phenology) to estimate GPP and NPP estimates for three case studies in Slovenia, Italy and Austria.

With respect to climate change mitigation policies in Europe and to use of land use, land-use change and forestry (LULUCF) sector to mitigate national greenhouse gas emissions (EU decision 529/2013) LANDSUPPORT will develop a LULUCF tool, coupled with forestry tool, for LULUCF estimation and reporting verification in forestry and agricultural lands. For instance, LANDSUPPORT will provide an evidence base approach (rooted in EO and modelling) to verify the methodologies and data currently used in the LULUCF.

Expected results



A first attempt of building up an integrated set of forestry tools can be traced back in DSS SOILCONSWEB (Terribile et al., 2015) where leaf-off dedicated airborne LiDAR data were collected in a 20,000 ha inland patchy area which was representative of soil land use in the Apennines mountains of southern Italy. Furthermore, categorization of productive and non-productive mixed forests, both in term of stand attributes and structural diversity was developed, based on detailed land-use map, high-resolution LiDAR data and field surveys (Teobaldelli et al., 2017). In LANDSUPPORT we intend to combine field surveys, satellite and LiDAR data and then to run 3D-CMCC-FEM applying several forest management modules with different climatic scenario, starting from common forest stand variables input data (height, diameter, volume). The user will interact with the system through an interface and choose to design its own AOI , save it on the server and query it (e.g. identifying areas with higher biomass productivity, carbon stock, soil characteristics, etc.). The expected outputs might consist of reports containing data and information useful for forest management, also at cadastral unit scale, maps and tables.

Conclusion

In literature a very large range of available DSS tools can be found for facing agriculture, forestry and environmental issues. However, these are typically designed to tackle a specific problem/scale/end-user group. Instead, LANDSUPPORT aims at managing land resources in an integrated way: i) developing integrated interdisciplinary modelling chains and approaches for informed decision making; ii) data management (WP2, WP4) and modelling (WP3) capable to handle very high spatial detail using, as far as possible, physically based modelling engines (also HPC codes) such as biophysical modelling thus including evaluation of uncertainty; iii) developing procedures (type of modelling, data, open source, HPC) to allow replicability elsewhere (WP6); iv) developing applications in agriculture, forestry and spatial planning for operationalizing SDGs. By achieving the above interconnected scientific and technical objectives –will deliver RUR03-2017 challenges/scope and by doing that will contribute to implementation, impact and delivery of about 20 European land policies. We believe that LANDSUPPORT:

-can effectively support the decision making process;

-can provide a set of tools (forestry, ecotourism, spatial planning) with an integrated forestry approach at landscape scale;

-can be replicable at any other Italian Regions, EU and no-EU countries.

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