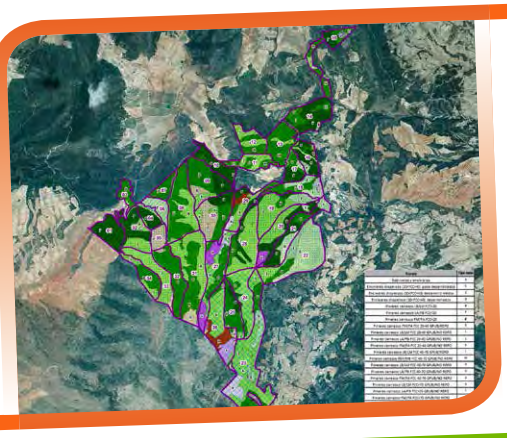

DEVELOPMENT OF FOREST BIOMASS MANAGEMENT PLANS

Setting up of integrated strategies for the development of renewable energies

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Promotion of residual forestry biomass in the Mediterranean basin

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Promotion of residual forestry biomass in the Mediterranean basin

Work package 4: Setting up of integrated strategies for the development of renewable energies

FINAL REPORTS OF PILOT ACTIONS

PILOT ACTION 1.7

DEVELOPMENT OF FOREST BIOMASS MANAGEMENT PLANS

September 2014

This report was supported by project "Promotion and renewable energy and improvement of energy efficiency" (acronym: Proforbiomed), a strategic project under objective 2.2 of the MED Programme. MED Programme is an EU transnational cooperation programme among the "Territorial Cooperation objective" of the EU Cohesion Policy.

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Institutions involved:

1.- Servicio de Gestión y Protección Forestal. Dirección General de Medio Ambiente. Consejería de Agricultura y Agua. Región de Murcia

2.- External expertise

3.- Grupo Generala, S.L.

4.- Centre régional de la propriété forestière de Provence-Alpes-Côte d'Azur

5.- Slovenian Forestry Institute

6.- Dirección General del Medio Natural. Conselleria de Infraestructuras, Territorio y Medio Ambiente. Generalitat Valenciana

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8.- Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA).

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Contents

Table of figures:

1 Background

The aim of the PROFORBIOMED PROJECT is to promote renewable energies in Mediterranean regions by developing an integrated strategy for the use of the forest biomass as a renewable energy source, recovering the forest biomass potential, developing the fundamental technical and legal aspects and promoting the use of forestry biomass for energy through the involvement of the key stakeholders in a forestry biomass production chain that takes into account sustainability and compatibility with other uses of the Mediterranean forest.

To accomplish this objective, the Project has been organised in 4 work packages (WP). The WP 4 is referred to the "setting up of integrated strategies for the development of renewable energies."

The objective of this work package is to provide support to biomass producers, forest owners and forest-based companies and to local and regional authorities for the implementation of strategies for the promotion of residual forestry biomass, taking into account environmental, social and economic constraints and providing technical and economic information to key stakeholders (local and regional administration, forest owners and companies and energy actors). There will be three kinds of activities to carry out this objective, with one of them involving the advancement of "Pilot actions: Development of pilot experiences in the partner areas."

The aim of the Pilot projects is the development of a FOREST MANAGEMENT FRAMEWORK FOR THE DEVELOPMENT OF SUSTAINABLE FORESTRY BIOMASS PRODUCTION CHAINS. Pilot projects include various activities that cover different key axes in the forest biomass chain, and that will be developed in 4 axes, 2 of them have been developed in this WP 4. The Axis I is called "Biomass production: technical, logistic, environmental aspects and tracing wood biomass origin."

In Axis I, the technical, logistic and environmental aspects of the biomass production have been developed in order to provide the technical knowledge needed in partner areas, filling the current gaps that hinder the development of this activity. The activity **"Forest biomass management plans**" is included in this axis.

The final stage of the work in this axis is the setting and pre-test of forest biomass management plans in public and private forests. They will be based in the current knowledge, and the work developed previously in this axis and will go through the studies of the biomass chain in each site involved into the project; analyses of the main regulatory barriers for the market development; analyses of the principal financial instruments in the territory; evaluation and optimization of the biomass chain to guarantee the sustainability criteria in supply, production and valorisation; analyses of different type of the bodies involved into the project; creation of standards for the use of solid biomass sources in the Mediterranean area to answer to the last COM of EC about sustainability requirements for the use of solid biomass (study of existing standards to coordinate and summarize the actual situation in the UE); definition of specific actions for a good management and sustainable use of forestry biomass. However, also potentials for production of wood biomass in short rotation plantations will be included in forest biomass management plans. Where applicable, the possibility of implementation of forest biomass management plans into forest management plans will be studied. These plans will be developed as technical guidelines with different approaches and solutions offered in order to make them transferable and applicable in the whole MED area.

2 Objectives

Related to the PROFORBIOMED PROJECT context, the activities involved in it have to take into account the 'energy shortage,' meaning the difficulty of a part of the population to access sufficient energy resource in order to satisfy its basic needs. This aspect has to encourage the promotion of low-cost technical solutions and improve accessibility to energy efficiency solutions. One of these solutions is the drafting of a Forest Biomass Management Plan by each partner, that is, a structured method to achieve the assigned management objectives in a forest, in this case with particular emphasis in the harvesting of forest biomass, in an organized and sustainable way, and taking always into account the preservation of the natural heritage. The design of this Plan is proposed for minimal spending, reducing inventory costs.

To meet the final stage of the work in the Axis I "setting and pre-test of forest biomass management plans," several procedures have been developed to facilitate and integrate common actions into drafting Forest Biomass Management:

- Development of a methodology/structure to elaborate forest biomass management plans. For this purpose, the following documents has been drafted:
- a technical Guide of contents and structure of the Forest Biomass Management Plans.
- a General Methodology for the Drafting of a Forest Biomass Management Plan (Summary of typical steps)
- Development of a common legal framework to regulate the elaboration of a management plan. Therefore, a Basic legislative ordinance has been drafted.
- a web link to consult all the referent documents developed during this pilot action by each partner.
- The main objective is to apply the pilot actions and integrate them in a sustainable forest management plan.

3 Partners involved

PARTNERS										
Country	Region	Organisation	Type of organisation	Position	Skills	Address	Name Contact Person	Post	E-Mail	Telephone
FRANCE	Provence-Alpes-Côte d'Azur	Centre régional de la propriété forestière de Provence-Alpes-Côte d'Azur (CRPF)	Third sector organization	Partner	Public body	7, impasse Ricard Digne 13004 Marseille	Louis-Michel DUHEN	Project Manager	louis-michel.duhen@crpf.fr	+33 4 95 04 59 04
SLOVENIA		Slovenian forestry institute (SFI)	Research	Partner	Researcher	Vecna pot 2, SI-1000 Ljubljana	Dr. Nike Krajnc	Project Manager - WP4 Leader	nike.krajnc@gozdis.si	+3862007817
SPAIN	MURCIA	Directorate-General for Environment, Regional Ministry of Presidency. Region of Murcia	Public Admin – Region	Lead partner	Forest manager	C/ Catedrático Eugenio Úbeda, 3 - 3ª planta. 30008. Murcia. Spain.	Roque Pérez	Project Manager - WP 1	palazon.roque@carm.es	+34968228845
							Ana Atienza	P.A. Coordinator	anam.atienza@carm.es	+34968228841
	COMUNITAT VALENCIANA	Generalitat Valenciana. Directorate-General for Natural Heritage	Public Admin – Region	Partner	Forest manager	Ciudad Administrativa 9 de Octubre- Torre 1 C/ Castán Tobeñas 77 46018 Valencia	Pilar Ara	Project Manager - National Coordinator	ara_pil@gva.es	+34961208632
							Javier Hermoso	P.A. Coordinator	hermoso_jav@gva.es	+34961208632
ITALY	LAZIO	Institute for Environmental Protection and Research (ISPRA)	Operational	Partner	Technological and scientific research centre	Istituto Superiore per la Protezione e la Ricerca Ambientale, Via Vitaliano Brancati 48, 00144 Rome, Italy	Lorenzo Ciccarese	P.A. Coordinator	lorenzo.ciccarese@isprambiente.it	+39 06 5007 4824
	SICILY	Regional Department of Public Forests Agency – Regional Ministry of Agriculture and Forests – Region of Sicily (DRAFD)	Public Admin – Region	Partner	Forest manager	Viale Regione Siciliana, 4600 - 90145 Palermo Italy	Massimo PIZZUTO ANTINORO	Project Manager	mpizzuto@regione.sicilia.it	+39 091 7077457
							Donato Salvatore LA MELA VECA	P.A. Coordinator	donato.lamelaveca@unipa.it	+39 091 23861210

PARTNERS										
Country	Region	Organisation	Type of organisation	Position	Skills	Address	Name Contact Person	Post	E-Mail	Telephone
	LOMBARDY	Fondazione Lombardia per l'Ambiente (FLA)	Operational	Partner	Research and protection of natural resources	Largo 10 Luglio 1976, 1 20822 Seveso (MI) Italy	Antonio Ballarin Denti	Scientific Coordinator	antonio.ballarin@unicatt.it	+39 335 1387647
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							Eleonora Fontanarosa	P.A. Coordinator	eleonora.fontanarosa@flanet.org	+39 02-806161.13
							Mauro Masiero	Technical Expert	mauro.masiero@etifor.com	+39 331 5677765
GREECE	RWM	Region of Western Macedonia	Public Admin - Region	Partner	EU projects management	Z.E.P. Area Kozanis, 50100 Kozani, Greece	Dimitris Kouras	Project Manager	dkouras@gmail.com	+3024610 53561
PORTUGAL	Algarve	Directorate-General for Forest in Algarve (previous NFA)	Public Admin - Regional	Partner	Forest Manager	Braciais - Patacão 8001-904 Faro Portugal	Francisco Bettencourt Keil Amaral	Project Manager	francisco.amaral@icnf.pt	+351 289 870 700
	Algarve	ALGAR	Municipal Enterprise	Partner	Technological research	Barros de São João, São João da Venda, 8135-026 Almancil	Miguel Nunes	Project Manager	miguel.nunes@algar.com.pt	+351 289894480

4 Common actions

4.1 Legislation

4.1.1 Legal framework of each partner

PARTNER	LEGAL ORDINANCE NAME	WEB LINK
SFI (Slovenia)	Forest Act	Forest act
	Rules On The Forestry Management And Silviculture Plans	Rules on the forestry management and silviculture plans
	Climate Change Act	Climate change act (in process of adopting)
	Strategy For The Use Of Biomass From Agriculture And Forestry In Energetic Purposes	Strategy for the use of biomass from agriculture and forestry in energetic purposes (draft)
	Resolution On National Forest Programme	Resolution on National Forest Programme
	National Energy Programme	National energy programme
	National Renewable Energy Action Plan 2010-2020	National Renewable Energy Action Plan 2010-2020
CRPF-PACA (France)	Code Forestier nouvelle version article L 222 – 1	Forest Code new version article L 222 - 1
	Code Forestier nouvelle version article L 222 – 2	Forest Code new version article L 222 - 2
	Code Forestier nouvelle version article L 222 – 3	Forest Code new version article L 222 - 3
	Code Forestier nouvelle version article L 222 – 4	Forest Code new version article L 222 - 4
	Code Forestier nouvelle version article L 222 – 5	Forest Code new version article L 222 – 5
	Code Forestier nouvelle version article L 222 – 6	Forest Code new version article L 222 - 6
	Article L222-1 of the Energy Law	
	Decree of 19 July 2012 determining the mandatory elements of the content of the FMP of private forests and related documents to be attached	Minutes that describes the contain of a FMP
	Decree of 19 July 2012 determining the mandatory elements of the content of the FMP of private forests and related documents to be attached	Decree of 19 July 2012 determining the mandatory elements of the content of the FMP of private forests and related documents to be attached

ICNF-ALGAR (Portugal)	Law no 33/96, 17 of August – Base law	http://dre.pt/pdf1sdip/1996/08/190A00/25682573.pdf
	Regulatory Decree no 17/2006, 20 of October – Publishes the Algarve Regional Forest Plan	http://dre.pt/pdf1sdip/2006/10/20300/73027327.pdf
	Dispatch no 1518372009 – Management Plans standards.	http://dre.pt/pdf2sdip/2009/07/128000000/2616226162.pdf
ISPRA-FLA (Italy)	Royal Decree Law of the 30th December 1923, n. 3267, Re-organisation and reform of the legislation on forest lands and mountainous areas. Published on Gazzetta Ufficiale, 17 maggio 1924, n. 117.	Royal Decree Law of the 30th December 1923, n. 3267, Re-organisation and reform of the legislation on forest lands and montanous areas
	Tutela degli ecosistemi dagli incendi (Legge 21 novembre 2000, n. 353)	Tutela degli ecosistemi dagli incendi (Legge 21 novembre 2000, n. 353)
	Regional Law no. 39 of the 28.10.2002: Provisions on management of forest resources (Official Bulletin of the Lazio Region, n. 32 od the 20.11.22. Suppl.Ord. n. 7]	Regional Law n. 39 of the 28.10.2002: Provisions on management of forest resources
	Regional Law no. 31, 5th December 2008	Regional Law n. 31/2008 on Agriculture, Fishery and Forestry
SICILY (Italy)	Region Sicily Regional Law, n.16/1996	Region Sicily Regional Law, n.16/1996
	Region Sicily Regional Law, n.14/2006	Region Sicily Regional Law, n.14/2006
WESTERN MACEDONIA (Greece)	Legislative decree No. 86/1969: "Forest code"	http://www.geotee-anmak.gr/img/nomoi/nd86_1969.pdf (not available in English version)
	2000-2006: Afforestation of agricultural land 2007-2013: Measure 221 (First afforestation of agricultural land).	http://www.ypeka.gr/Default.aspx?tabid=752&language=el-GR (not available in English version)
GENERALITAT VALENCIANA (Spain)	Instructions of Forest Management of 1971	Instructions of Forest Management, 1971
	LAW 10/2006, 28th APRIL, THAT MODIFIES LAW 43/3003, OF FOREST	Law 10/2006, 28th April, that modifies law 43/3003, of forests
	LAW 43/2003, 21st NOVEMBER, OF FOREST	Law 43/3003, of forests
	DECREE 98/1995 TO APPROVAL THE FOREST BYLAWS BYLAWS OS LAW 3/1993, OF 9th DECEMBER, FORESTRY OF VALENCIA REGION	Decree 98/1995, to approval the forest Bylaw of Law 3/1993, of December 9th, of Valencia Region
	DECREE 58/2013 TO APPROVAL PATFOR - Forestry Territorial Action Plan of Valencia Region	http://www.docv.gva.es/datos/2013/05/08/pdf/2013_4617.pdf

MURCIA REGION (Spain)	Instructions of Forest Management of 1971	Instructions of Forest Management, 1971
	Law 10/2006, April 28th, amending the Law 43/3003, November 21st, of Forest	Law 10/2006,April 28th, amending the law 43/3003, of forests
	LAW 43/2003, November 21st, of Forest.	Law 43/3003, of forests
	Resolution of the General Directorate of Natural Heritage and Biodiversity, approving the Instruction for the interpretation of the general rules for the study and drafting of Sustainable Forest Management Plans in Murcia Region, July 2011	Resolution of the General Directorate of Natural Heritage and Biodiversity, approving the Instruction for the interpretation of the general rules for the study and drafting of Sustainable Forest Management Plans in Murcia Region, July 2011
	Forest fires prevention Murcia Grants	Forest fires prevention Murcia Grants
	Natura 2000 Murcia Grants	Natura 2000 Murcia Grants
	Law 14/2012, December 27th, of tributary, administrative and re-order of regional public sector	Law 14/2012, December 27th, of tributary, administrative and re-order of regional public sector
	Royal Decree 661/2007, that regulates the energy production activity in special regime	Royal Decree 661/2007, that regulates the energy production activity in special regime

4.1.2 Compilation of the main legal guidelines

Elaboration of common legal guidelines to regulate the drafting of Management Plans or, at least, description of the most-important legal aspects used by each partner.

This document can be consulted on the Proforbiomed website (Law_compilation_english.pdf):

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

4.1.3 Main measures to avoid deterioration and disturbance in Natura 2000 sites

Europe's nature is protected by two key pieces of legislation, the Birds Directive and the Habitats Directive. The latter obliges Member States to maintain a number of designated habitat types and species at favourable status at selected sites agreed with the Commission. Together with sites from the Birds Directive, these sites then become part of Natura 2000, the biggest ecological network in the world. Nearly 22000 sites are designated under the Habitats Directive, covering some 13.3% of EU territory. In total, the Natura 2000 network contains over 25,000 sites (Birds and Habitats Directives combined) and covers around 17% of EU territory.

LP DGMA

In Murcia Region, “Management Plans of Protected Natural Areas (Natura 2000 site)” have been developed (or are been developed) as the tool that allows a comprehensive planning, in order to preserve its environmental values and to make it compatible with harvests and uses in that area. There are as many Plans as protected natural sites in Natura 2000, and each one has its own recommendations and limitations. Therefore, the Forest Biomass Management Plan has to be consistent with those Management Plans of Protected Natural Areas and their conservation measures.

These “Management Plans of Protected Natural Areas (Natura 2000 site)” set management measures and actions necessary to create favorable conditions for both key elements and the whole of habitats and species of interest of the area. To this end, guidelines and regulations have been established: in a general level and a

particular one related their uses and activities; as well as actions for the conservation and management. These measures are based on:

a) Directives: guidelines and rules to guide the procedures of the Public Government.

b) Regulations: limitations or regulations of certain incompatible uses and activities with the Plan conservation targets.

The General Directives and Regulations are based on:

Habitats and wild species threatened species, local landowners and users, involvement of the private sector and local authorities, land stewardship, environmental education, rural development, goods and services, tourism.

The specific Directives and Regulations relating to uses and activities are based on:

Environmental conservation and management; use of water resources; agricultural and livestock use; hunting and river fishing; public use; road infrastructure and circulation; industrial; energetic and mining uses; urban regime, land development and building; research; ecological connectivity.

c) Actions for the conservation and management: measures and actions designed to maintain, improve or, where appropriate, restore the preservation state of elements. The main targets of these actions are:

- Contribute to consolidating the Natura 2000 sites.
- Establish direct management measures for the conservation of species and their habitats.
- Promote the monitoring and research as a tool to support the management of Natura 2000 sites.
- Encourage the Natura 2000 sites as a stimulus for sustainable development.
- Promote environmental education as a management of Natura 2000 site and encourage public use of protected areas.
- Strengthen the coordination and participation in the management of Natura 2000 sites.

CRPF-PACA (FRANCE)

The management plan we have worked on applies to a very wide forest. Some local measures can be applied in the forest management, to avoid disturbances to protected species, like the *Aquila fasciata.*

SFI (SLOVENIA)

Slovenia has designated 354 Natura 2000 sites:323 according to the Habitats Directive (SAC + pSCI) and 31 according to the Wild Birds Directive (SPA). The sites in total encompass 37% of the country, which is the highest rate in EU. The Government of Slovenia adopted the Natura 2000 sites on April 29, 2004 (Decree on special protection areas – Natura 2000 sites) and April 19, 2013, based on article 33 of the Nature Conservation. Natura 2000 sites have a significant share in our forests and management of those sites is included in forest management plans.

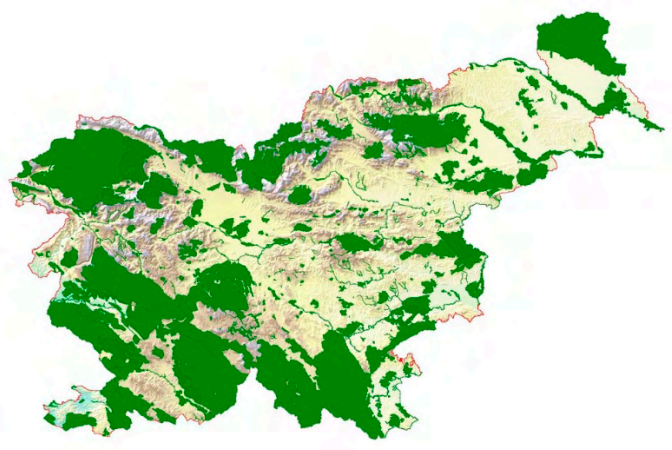


Figure 1: Map of Natura 2000 sites, Natura 2000 MKO , http://www.natura2000.gov.si/index.php?id=150&L=1

In the process of making plans Slovenian Forest Service works with organizations responsible for the protection of nature. Forests, which are defined as special-purpose forests and all forests located in Natura 2000 areas, benefit from special attention, which means that here all the guidelines and actions, taking into account the broader interests of nature conservation.

GoV (VALENCIANA-SPAIN)

In Valencia Region, "Management Plans of Protected Natural Areas (Natura 2000 site)" are being developed in order to preserve its environmental values and to make it compatible with harvests and uses in that area. There are as many Plans as protected natural sites in Natura 2000, and each one has its own recommendations and limitations. Therefore, Forest Biomass Management Plan has to be consistent with those Management Plans of Protected Natural Areas and their conservation measures.

REGION OF WESTERN MACEDONIA (GREECE)

In the case of there are sites in the study area that belong to the Natura 2000 network, these sites are placed under a special management plan according to Greek and European legislation. This plan includes the following:

- Zone mapping on a scale of 1:20,000
- Description of the general characteristics of the protected site
- Measures for the protection and the maintenance of the site
- Definition of permitted and forbidden activities in these areas
- Action plans to protect and enhance the protected area
- Management of the protected area in cooperation with communities, specialists and scientists
- Proposal of the appropriate projects for the implementation of the action and management plans

However, as it is shown in the picture below, in this study area there are no sites that belong to the Natura 2000 Network

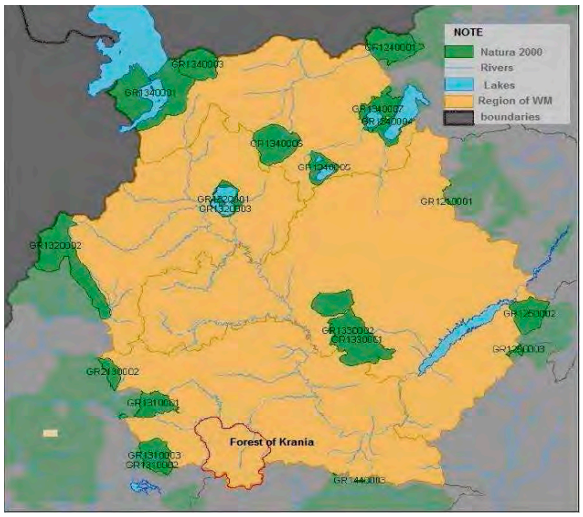


Figure 2: Forest of Krania; RWM 1

ISPRA-FLA (ITALY)

- In Lombardy Region Nature 2000, sites shall be managed according to Management Plans developed in accordance with the Manual for the Management of Natura 2000 sites (and related guidelines) developed by the Ministry of Environment. The Ministry has also approved a Decree defining "Guidelines for the management of Nature 2000 sites" (2002). Additional technical documents include a Manual for the drafting of management plans developed by Pavia University, the Regional Ecological Network system, etc.

The 'Management Plans for Natura 2000 sites,' while considering socio-economic factors within a certain area, define management measures for the *in situ* conservation of key species and habitats in the long term. Their main goal is the maintenance, improvement and recovery of a good state of conservation. Stakeholder consultation and public participation are essential issues within the process for the development and implementation of the Management Plan for a Natura 2000 site. Each plan includes:

- a description of the site and the main ecological values within it;
- the definition of the normative framework relevant for the management of the site;
- an identification of key factors and threats;
- the setting of the management objectives and strategy;
- the definition of conservation measures and actions to be implemented;
- the definition of monitoring tools for the control of impacts.

DRAFD- REGION OF SICILY (ITALY)

In Italy, in 1955, the Ministry for the Environment gave life to the "Bioitaly" project with the aim to adopt and give actualization to the "Habitat" and "Birds" Directives, by identifying some areas in which specific habitats and species of Community interest were present, pointing them out to the European Commission in order to have them included within the Natura 2000 Network.

In Sicily, by Decree n. 46/GAB of 21 February 2005, the Regional Councillorship for the Territory and Environment established 204 Sites of Community Importance (SCI), 15 Areas of Special Protection (ASP), 14 areas marked as both SCI and ASP for a total of 233 areas to protect. Almost all the Sites of Community Importance are equipped with management plans, whose main objective is to reconcile the conservation of biodiversity and the scientific, economic, social, cultural and regional needs.

In particular, the management plans define the general and specific objectives (management indications), for the safeguard and sustainable development of the forestry, environmental and anthropic aspects. Most of the territory subject to the planning falls within the SCI and ASP areas.

The use of residual biomass undoubtedly represents a form of environmental friendly management of the territory; however, the Forest Management Plan for the use of biomasses must be coherent with all the indications for the protection and safeguard of the biodiversity present within the management plans of the Natura 2000 sites.

ICNF-ALGAR (PORTUGAL)

In Portugal, the management of the Natura 2000 sites is regulated by a Sectorial Plan. This document, approved in 2008, is "a territorial management instrument to consubstantiate the national biological diversity and nature conservancy policy, by safeguarding and valuing sites in the national, continental territory, as well as the maintenance of species and habitats at a favourable state of conservancy." This document binds public instances, and its guidelines must be included in local plans.

The Natura 2000 Sectorial Plan includes the list of occurrence of species and natural habitats of fauna and flora in each site, a document characterizing each of the natural habitat, fauna and flora species referred in the above document, one file for each site and cartography of the sites, natural habitats and management guidelines;

The management guidelines, included in each of the site files, are a set of recommendations related to the ecological demands of the natural values identified, and to their respective conservancy objectives. They are grouped in thematic blocks:

- Agriculture and cattle breeding;
- Forestry;
- Buildings and infrastructures;
- Other uses and activities (not related to the previously listed);
- Specific orientations (orientations related to the direct management of specific species or habitats)

4.2 General methodology for the drafting of a forest biomass management plan.

This document can be consulted on the Proforbiomed website (general_methodology_for_drafting_a_FBMP_english.pdf):

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

Broadly; this document includes common stages to consider in a forest management plan as much on-site as out-site work; which could be summarized as follows:

- Previous forest review
- Compilation of available technical information
- Cartographic work (Deskwork)
  - Provisional ecological/management zoning
- Site data collection
  - Site definition of the ecological and inventory units
  - Inventory
  - Type of inventory

Sampling plots

- Data processing (Deskwork):
  - Inventory data processing
  - Provisional definition of the cutting units (treatments)
- Management Plan drafting (Deskwork)
- Approval and validation by the Environmental authority

4.3 Technical guide of contents and structure of a management plan:

This document has been delivered among the partners involved in this pilot action, and it can be consulted on the Proforbiomed website (Technical_guide_FBMP_english.pdf):

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

This document describes and analyses the content and structure of the forest biomass management plan. It contains these sections:

- Inventory status (legal; natural; forestry; socioeconomic and conservation)
- Uses study: objectives and zoning
- Main Plan: silvicultural reference models/ Dasometric reference models (management methods)
- Secondary (direct) Plan: cutting plan

Individual actions: forest management plans

PARTNER	MANAGEMENT PLAN TITLE
LP DGMA	Sustainable Forest Management Plan: MUP no 36 "Sierra de Burete." Cehegín Municipal District (Murcia)
CRPF	Local Supply scheme (SAT Schéma d'Approvisionnement Territorial)
SFI	Posestni nacrt Agrarne skupnosti Cezsoca
GoV	Forest Management Plan "Sierra del Negrete" (Utiel)
W. MACEDONIA	Forest Management Plan of Krania-Monaxiti-Kipourio Forest
ISPRA-FLA	Forest biomass management plans Valsassina area, Municipalities: Casargo, Margno and Parlasco (Lombardy, Italy)
DRAFD-SICILY	Forest Management Plan of the public forests in the Municipality of Bivona (Agrigento Province)
ICNF-ALGAR	Mata da Herdade da Parra Management Plan

All the forest management plans (electronic versions) are available in publications section of the WP4/pilot action 1.7.:

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

4.4 Forest management plans summary

4.4.1 Description of the pilot areas chosen by each partner

Summary of the following data:

4.4.1.1 Introduction

LP DGMA

The Forest Management Plan is focused on the North-western Murcia Region. This area corresponds to the largest areas of forest biomass in the Region, with a forest broad tradition and a homogeneous continuous surface of pinewood (Pinus halepensis, especially).

CRPF-PACA (FRANCE)

Our objective was to find an area that already has a sensitization to the topics of the private forest and the wood energy. After several meetings and exchanges with municipalities, we decided to implement our pilot site on the Communauté de Communes du Pays d'Aix (CPA). Our choice has been guided by several points, all in favour of the CPA:

- A Mediterranean territory, with the biotic constraints of Mediterranean climate
- The pressure of the city, with Aix-en-Provence nearby, and a great frequenting
- The realization, in 2007, of a study dealing with the available wood resources on the territory of the CPA
- The presence on the site of the storage platform in Lambesc
- A group of sensitized mayors/local councillors, ready to have a fruitful cooperation with the CRPF on the wood energy topic.

SFI (SLOVENIA)

The forest property management plan for Agrarna skupnost Čezsoča is a management plan written on the basis of Forest unit Bovec management plan (official government approved plan made by Slovenian Forest Service), Local energy concept plan for Municipality Bovec and interests of members of Agrarna skupnost Čezsoča. The Forest property management plan for Agrarna skupnost Čezsoča is a pilot management plan with an aim to estimate wood biomass potential of known forest owners and how can they contribute to covering local energetic needs. Developed framework of this pilot management plan can be now used for larger individual forest owners or association of forest owners in the phases of local supply chain establishment.

GoV (VALENCIANA-SPAIN)

The pilot area is the V095 "Sierra Negrete" forest**,** managed by the regional government and belonging to the municipality of Utiel. The total surface of this forest is 7.576,84 ha of which 6.388,82 ha are public.

The main objective is to create a planning management tool that integrates all the values and functions of the forest, focused on the exploitation of forestry biomass.

REGION OF WESTERN MACEDONIA (GREECE)

For the purposes of this study, the Forest of Krania of the Prefecture of Grevena was chosen. The main advantage of this forest complex is its small size compared to the size of other forest complexes in the Region of Western Macedonia, which helps to simplify the evaluation of the implementation of a new management plan.

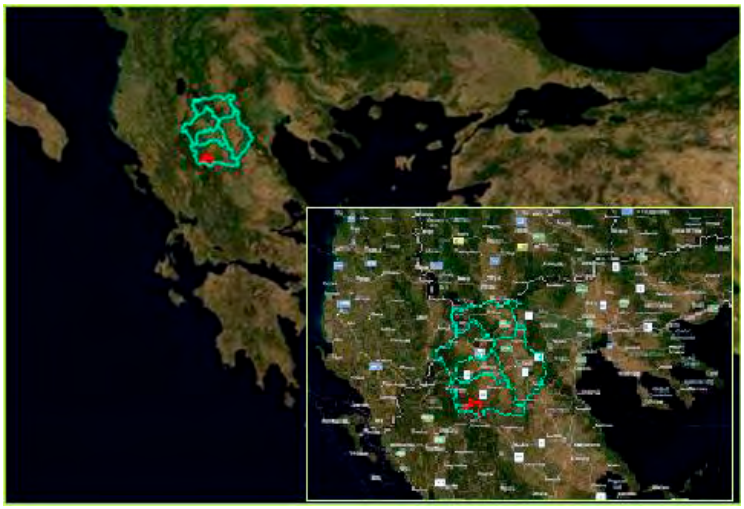


Figure 3: Pilot area of Forest of Krania (RWM)

The total area of the forest complex of Krania amounts to 14,986.6 Ha and is separated into the following land uses:

- Forested area of 7,242 ha, (48.45%)
- Partly wooded area of 3,162 ha, (21.15%)
- Agricultural crops & settlements 1,913.9 ha, (12.80%)
- Bare land 2,014.2 ha, (13.47%)
- Arid land 616.5 ha, (4.13%)

Moreover, in the forest of Krania that is divided into 41 forest departments and 263 forest stands and the forest species that occur are the following:

- Pinus nigra,
- Pinus leukodermis or Pinus heldreichi,
- Abies borisi Regis,
- Fagus silvatica,
- Quercus (cerris, sessiliflora and others)

ISPRA-FLA (ITALY)

The Forest Management Plan refers to the area managed by the Comunità Montana Valsassina, Valvarrone, Val d'Esino e Riviera (Northern Lombardy), with special reference to forest areas located within Casargo, Margno and Parlasco municipalities (Lecco Province). The paragraphs below report details regarding the background information and methodological approaches adopted for the development of the Plan. In general terms, methodology includes: (i) a general description of forest sites; (ii) a forest inventory; (iii) a biomass estimate; (iv) management indications and guidelines.

DRAFD- REGION OF SICILY (ITALY)

The area chosen for the realization of the forest plan spreads on a total surface of 963 ha, of which 460 ha are covered with forests (48%), mainly reforestation.

These reforestations have been carried out mainly between 1950 and 1970, primarily with the aim of protection. The forest management plan, for the use of residual biomasses in the district of the Sicani Mountains, represents a pilot project of remarkable importance, not only for the area in which it has been realized, but for the whole region given that, in a great part of the regional territory, the silvicultural interventions executed by the Regional Department of State Forests Agency (DRAFD) are carried out without a suitable activity of forest planning.

ICNF-ALGAR (PORTUGAL)

The concept of National Forest should be understood as a forest area where all management is conducted and supervised by the State, differing from the concept Forest Perimeter.

The management plan for the National Forest Herdade da Parra, corresponds to a policy inventory and ordering of forest in Algarve, required for Mediterranean forest and Plans required by the Regional Forestry.

4.4.1.2 Legal justification for management plans elaboration

LP DGMA

- Law 10/2006; April 28th; amending the LAW 43/2003; November 21st; of Forest.
- Instructions of Forest Management from 1971.
- Murcia Region Forestry Strategy.
- The Royal Decree 661/2007 that regulates the energy production activity in special regime establishes that only can be certified the biomass that comes from properties with an approved Forest Management Plan. This is the only specific law that regulates the forest biomass extraction for energetic purposes, but only specifies this item in relation to it.
- Resolution of the General Directorate of Natural Heritage and Biodiversity; approving the Instruction for the interpretation of the general rules for the study and drafting of Sustainable Forest Management Plans in Murcia Region; July 2011
- Forest fires prevention Murcia Grants and Natura 2000 Murcia Grants, 27th of November, 2011; the Region of Murcia launched two different grants inside European Agricultural Fund for Rural Development (EAFRD). To apply to these grants is **necessary to have a Forest Management plan for the property**.
- Taxes law in Murcia Region (Law 14/2012, December 27th, of tributary, administrative and re-order of regional public sector). Article 5: Discounts: it has been established a **70% reduction on woodcut taxes** in forest properties that have an approved forest management plan.

CRPF-PACA (FRANCE)

- Code Forestier nouvelle version article L 222 – 1
- Code Forestier nouvelle version article L 222 – 2
- Code Forestier nouvelle version article L 222 – 3
- Code Forestier nouvelle version article L 222 – 4
- Code Forestier nouvelle version article L 222 – 5

- Code Forestier nouvelle version article L 222 – 6
- Article L222-1 of the Energy Law
- Decree of 19 July 2012 determining the mandatory elements of the content of the FMP of private forests and related documents to be attached
- Decree of 19 July 2012 determining the mandatory elements of the content of the FMP of private forests and related documents to be attached

SFI (SLOVENIA)

Forest property management plan does not need legal justification as its present an extraction from legally approved plans. Two of that kind of plans present a base for the forest property biomass management plan "Forest management plan for forest management unit Bovec 2004 – 2013" and "Local energy concept of municipality Bovec." Forest management plans have legal justification in "Forestry Act" and in "Rules On The Forestry Management And Silviculture Plans." Local energy concepts have legal justification in Energy Act.

GoV (VALENCIANA-SPAIN)

- LAW 43/3003, November 21st, of Forest.
- Law 10/2006, April 28th, amending the LAW 43/3003, November 21st, of Forest.
- Instructions of Forest Management of 1971
- Forestry Territorial Action Plan of Valencia Region

At this moment, the regional instructions for forest management plans are being drafted as well as specifications for forest exploitation.

REGION OF WESTERN MACEDONIA (GREECE)

Full legal regulation name

- Legislative decree No. 86/1969: "Forest code,"
- 2000-2006: Afforestation of agricultural land
- 2007-2013: Measure 221 (First afforestation of agricultural land)

Main objective of this regulation

- The measure aims to regulate the management and sustainability of public and non-public forests.
- The measure aims to expand and improve forest resources, by supporting the first afforestation of agricultural land to protect and improve the environment with emphasis on enhancing the corrosion protection, biodiversity conservation and climate change mitigation.

ISPRA-FLA (ITALY)

- Regional Law, no 31, 5th December 2008
- Criteria for the development of Forest Management Plans in Lombardy Region (Regional Council Decree 53262, 21st March 1990)
- Draft Orientation Forest Management Plan for Valsassina area (2007)
- "Forest-Wood-Energy supply chain" agreement in Lombardy Region (2010) and related annual working plans
- Rural Development Grants under Regional Development Programme for 2007-2013 period, including for example Measure 122 "Improving the economic value of forests." Only activities implemented within forest areas under valid forest management plans can receive grants.

DRAFD- REGION OF SICILY (ITALY)

Region Sicily Regional Law, n.14/2006;

Region Sicily Regional Law, n.16/1996.

ICNF-ALGAR (PORTUGAL)

Law no 33/96, 17 of August – Base law

4.4.1.3 Pilot area basic data

Geographic position

LP DGMA

The MUP No. 36 "Sierra de Burete" Forest; is located in the North-western Region of Murcia; in the Municipal District of Cehegín. This area corresponds to a forest broad tradition area; with a homogeneous continuous surface (more than 200.000ha) of pinewood (Pinus halepensis).

TM coordinates from site geometric centre (ETRS89 Projection)	
X: 607668	Y: 4209679
Upper and lower UTM coordinates; site demarcation (ETRS89 Projection)	
X maximum: 612301	Y maximum: 4214396
X minimum: 603034	Y minimum: 4204962

CRPF-PACA (FRANCE)

The CPA has been founded in 2001 and is now comprising 33 municipalities of Bouches-du-Rhône and Vaucluse (Pertuis). It covers an area of approximately 130,000 hectares and has 333.000 inhabitants. Among those 33 municipalities, we decided to focus on 4 in particular: Saint Cannat, Lambesc, Rognes and La Roque d'Anthéron.

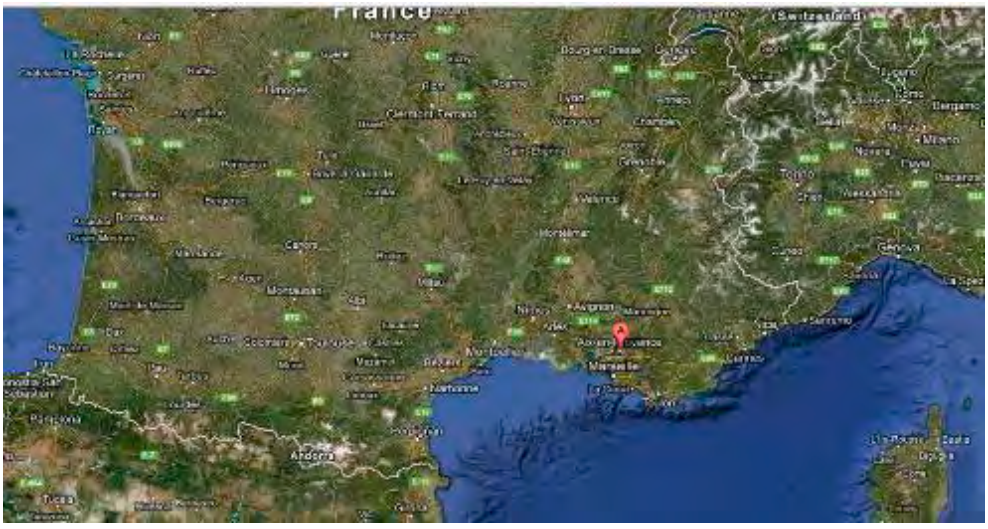


Figure 4: General localisation of Aix en Provence

Figure 5: Map of the 33 municipalities of the CPA

The afforestation rate of the CPA is 57%. The territory is covered by more than 70 000 ha (74 077ha) of natural areas. The breakdown between private and public forests (state-owned or communities) is consistent with the national average is 70% and 30%.

SFI (SLOVENIA)

The property of Agrarna skupnost Čezsoča is located in North West part Slovenia in Municipality Bovec and in the Forest Management Unit Bovec on the slopes of mountain Polovnik and Javorščček (the approx. centre point is located on: Lat:46°18'26,59'' (46,307385°) Lon:13°32'42,46'' (13,545129°)). All property area presents 2688.42 hectares while forest presents 2314.34 hectares or 86.09 % of the area.

GoV (VALENCIANA-SPAIN)

The Sierra Negrete Forest is located in the Northwest of Valencia province and belongs to the foothills of Serrania de Cuenca, south limit of Castilian plateau.

The forest is located between the meridians 1º 15´ 30´´ and 1º 5´ 15´´ East longitude and the lines of latitude 39º 41´ 00´´ and 39º 35´ 30´´ North latitude.

REGION OF WESTERN MACEDONIA (GREECE)

The forest extends between 40' 091160 - 40'152457 W and 20' 121012- 21' 005218 N and at altitude H = 560m – 2.160m above sea level.

The pilot area's dimensions are 15.000 ha.

Main density of the road network = 469m / km2

ISPRA-FLA (ITALY)

Forest areas covered by the forest management plan occur within the area of the Comunità Montana Valsassina, Valvarrone, Val d'Esino e Riviera (Northern Lombardy). In particular forest areas occur within Casargo (46°03'00''N 9°23'00''E), Margno (46°02'00''N 9°23'00''E) and Parlasco (46°01'00''N 9°21'00''E) municipalities in Lecco.

DRAFD- REGION OF SICILY (ITALY)

UTM WGS84 coordinates (Zone 33N) from site geometric centre	
X: 360218	Y: 4167399
Upper and lower UTM WGS84 coordinates (Zone 33N), site demarcation	
X maximum: 364308	Y maximum: 4169362
X minimum: 357484	Y minimum: 4164934

ICNF-ALGAR (PORTUGAL)

Faro district, Silves municipality, São Marcos da Serra parish (in Interior Silves mountain Algarve, southern Portugal), 14 km from the town of Silves (37º19'27'' N; 8º26'45''W)

Legal status: property

LP DGMA

The "Sierra de Burete" Forest is owned by City Council of Cehegín (Public ownership); although it is managed by Autonomous Community "Murcia Region."

CRPF-PACA (FRANCE)

The CPA has 72,484 hectares of forest that represent 55.9% of the area of the territory.

24.8% (17 538.84 hectares) is part of the public forest managed by the National Board of Forestry (ONF).

75.2% (54 945.16 hectares) are owned and managed by private owners with the support of Regional Centre of Property Forest (CRPF) and the Cooperative Provence forest. It represents a deposit of approximately 1.7 million tons of wood, and the annual growth rate is about 80,000 tons / year

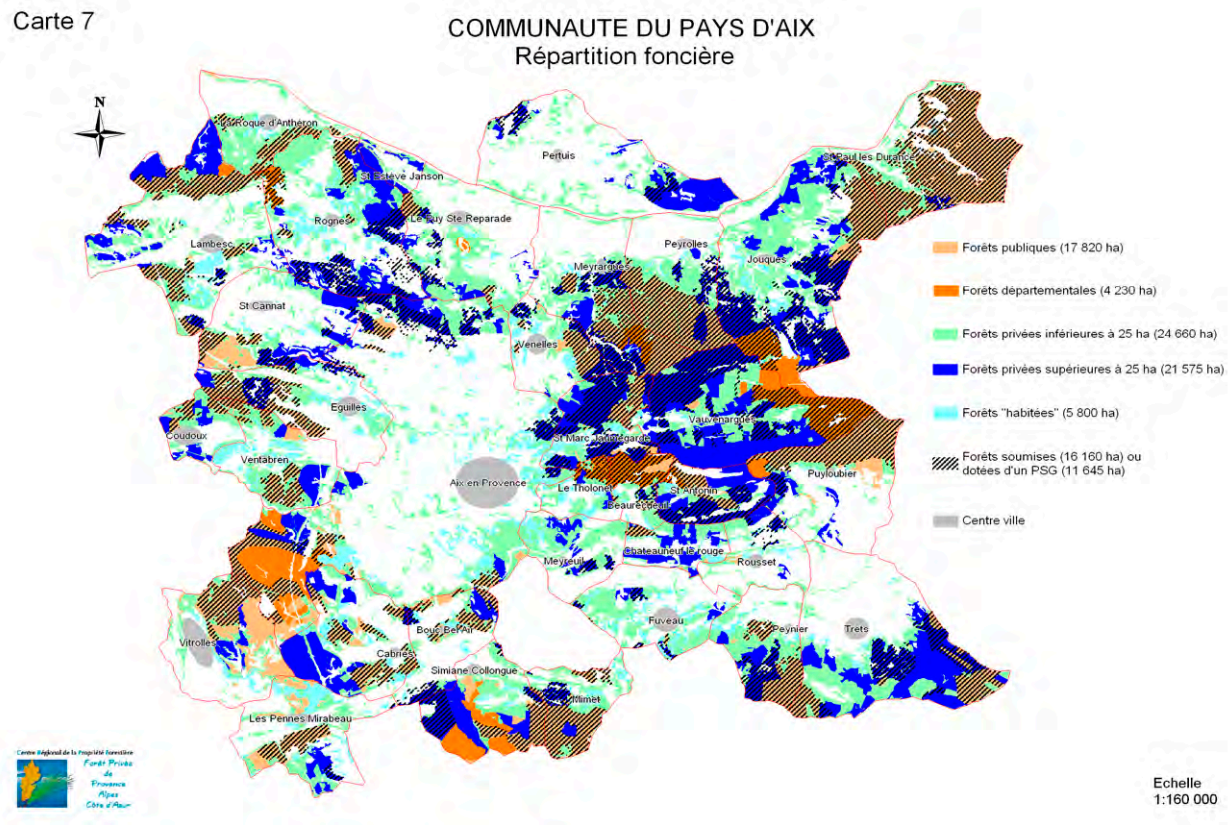


Figure 6: Forest property status in PACA Region

SFI (SLOVENIA)

Property is owned by members of Agrarna skupnost Čezsoča. Agrarna skupnost – agrarian common is not a legal person but is a society of individual co-owners or common owners traditionally local inhabitants – farmers. It is a traditional collective ownership model in the past mainly established for pasture porpoise, but today forestry prevails.

GoV (VALENCIANA-SPAIN)

The "Sierra del Negrete" Forest is owned by the City Council of Utiel (Publica ownership), although it is managed by the regional government.

REGION OF WESTERN MACEDONIA (GREECE)

The Forest Directorate of Grevena is responsible for this pilot area, and we have full access to the raw data. This is a public forest.

According to Greek Law, the temporal interval between inventories is 10 years

Last time the inventory took place (Year of data collection) is 2004, and there are no events that could significantly alter the results in recent years (forestation policies, fires).

ISPRA-FLA (ITALY)

About 76% of forest areas within Casargo, Margno and Parlasco municipalities are public owned, while the remaining proportion is represented by private areas.

DRAFD- REGION OF SICILY (ITALY)

The forest surface present in the pilot area of the Proforbiomed Project on the Sicani Mountains is state owned and pertaining to the State Forests of Sicily Region. The managing body is the Regional Department of State Forests Agency.

ICNF-ALGAR (PORTUGAL)

The state forest is managed by the Portuguese forestry services (ICNF, I.P.); The entire area is in a Natura 2000 network site (Monchique site) and is a Corine Biotope (Monchique highland); Approximately 94% of the area is included in a national environmental protection regime (REN – National Ecological Reserve);

Physiography

- Topography: mean elevation; slope

LP DGMA

The Nº36 Forest ("Sierra de Burete") is a land dominated by Southeast-Northeast aspect of the "Burete Mountain"; with an altitude range of between 555 m ("Cabezo de las Minas" Forest House; in the northern part of the forest) and 1;198 m ("Morra del Pozo"). Steep slopes; greater than 25%; are predominant in high mountain area of the forest.

Surface (ha)	Dominant Aspect	Elevation (m)			Surface by slope (ha)					
		Maximum	Mean	Minimum	0%-3%	3%-12%	12%-24%	24%-45%	45%-60%	>60%
1.518	SE	1.198	897	555	8,99	139,65	356,76	633,44	291,21	87,94

CRPF-PACA (FRANCE)

Two major landforms structure the landscape of the CPA: Mont Sainte-Victoire (1011 m) and the Etoile Mountain (781 m). These two reliefs are east-west oriented and are therefore exhibits very trenches. They are of a big importance in the sociological history of the landscape, for local and national population.

SFI (SLOVENIA)

Property is located in very step and agitated surface of Julian Alps with an altitude from 400 to 1700 amsl. Average slope is 21,24 % with maximum slope of 199,33 %. Information for slope calculation was taken from DEM 12,5X12,5.

Slope class	flat	up to 15 %	up to 30 %	up to 40 %	up to 50 %	up to 70 %	up to 100 %	up to 200 %	Sum
AREA (ha)	14,33	1131,22	901,23	264,69	132,02	109,91	44,28	11,47	2609,14

GoV (VALENCIANA-SPAIN)

In a general way, the Forest is divided into three zones: the upper in the east, the middle in the centre and the lower in the west. The top is the most-rugged terrain. In the central part dominates average sloping hillsides, where are the best forest coverture. The lower part, where the slope is gentler, and was ploughed in the past for agricultural needs, is currently formed by worked areas together with abandoned terraced plots that have been colonized spontaneously by forest vegetation.

Altitudes range varies from the minimum of 812 meters up to 1305 meters in "Pico del Remedio."

REGION OF WESTERN MACEDONIA (GREECE)

The forest extends between φ= 20^{o} 12’ 10” - 20^{o} 21’ 30” W and λ = 390^{o} 49’ 50” - 390^{o} 59’ 40” N and at altitude H = 560m – 2.160m above mean sea level.

ISPRA-FLA (ITALY)

Altitude ranges between 2,409 (Grigne Settentrionali) and about 600 m above sea level.

Average altitude: Casargo: 788 m above sea level; Margno: 1,341 m above sea level; Parlasco: 1,373 m above sea level.

DRAFD- REGION OF SICILY (ITALY)

Surface (ha)	Dominant Aspect	Elevation (m a.s.l.)			Surface by slope (ha)						
		Maximum	Average	Minimum	0%-10%	11%-20%	21%-30%	31%-40%	41%-50%	51-60%	>60%
963	S	1435	1055	519	36,21	129,77	206,24	182,81	165,54	113,29	128,6

ICNF-ALGAR (PORTUGAL)

Low altitude (between 102 and 325 meters); high slopes (average values range from 25 to 50%)

- Reference climatic data: mean precipitation and temperature

LP DGMA

- Different bioclimatic diagrams or models have been applied in relation to temperature and precipitation characteristics in the forest. These useful diagrams have been used to predict the type of the forest mass can develop in each area. The assessment explanation and the index interpretation can be consulted in the following link:

https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwcHR0bndtdXJjaWF8Z3g6NjQxNDQ2YzhlZmZlYzQxMQ

Months Elevations (m)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	Total
575	T (º)	8.1	9.4	11.4	13.4	17	21	25	24.8	21	16.3	11.7	8.8	15.7
	P(mm)	25	30	32.4	34.7	37.6	26	6.4	12.4	31	48.8	39.4	31	354.4
850	T (º)	6.6	7.7	9.7	11.7	15.4	20	24	23.5	20	14.5	10	7.2	14.1
	P(mm)	29	35	38.2	40.9	44.3	31	7.5	14.6	36	57.4	46.3	37	417.2
1100	T (º)	5.5	6.5	8.4	10.4	14.2	19	23	22.4	18	13.2	8.7	6	12.9
	P(mm)	33	40	43	46	49.9	34	8.5	16.4	41	64.7	52.2	41	469.7

CRPF-PACA (FRANCE)

The climate of our pilot site is Mediterranean, characterized by a very strong sunlight, clearly marked dry season in summer rainfall rare but sometimes violent, warm temperatures in summer and mild in winter. Temperatures remain relatively mild in all seasons. The average annual temperature is 15.9 ° C.

Thus, the average temperature in January (the coldest month) is 9.3 ° C with average maximum temperatures of 12.7 ° C and average minimum temperature of 5.8 ° C. The average temperature in July (the hottest month) is 23.9 ° C, with average maximum temperatures of 29.1 ° C and average minimum temperature of 18.8 ° C.

Rainfall: 665 mm per year. The driest month is July with 6.6 mm; the wettest is October with 93.9 mm. It rains less than 60 days per year (59.7 on average), and distributions of rainfall are very uneven. February is the month where it rains more often with 7.1 days of rain but only 88.3 mm while October has only 5.9 days of rain. The month, when it rains less often, is July with 1.3 days. The driest months and when it rains the least often go from May to September. Autumn is characterized by brief but heavy rains, winter by heavy rainfall but more distributed.

SFI (SLOVENIA)

Climate conditions in the area are influent by alpine and sub mediterranean climate factors. Average year temperature is 10°, average June temperature 20° and Januar 0°. Average participation is 3.000 mm (data refer to local meteorological station in the valley). Vegetation period last from 100 to 120 days.

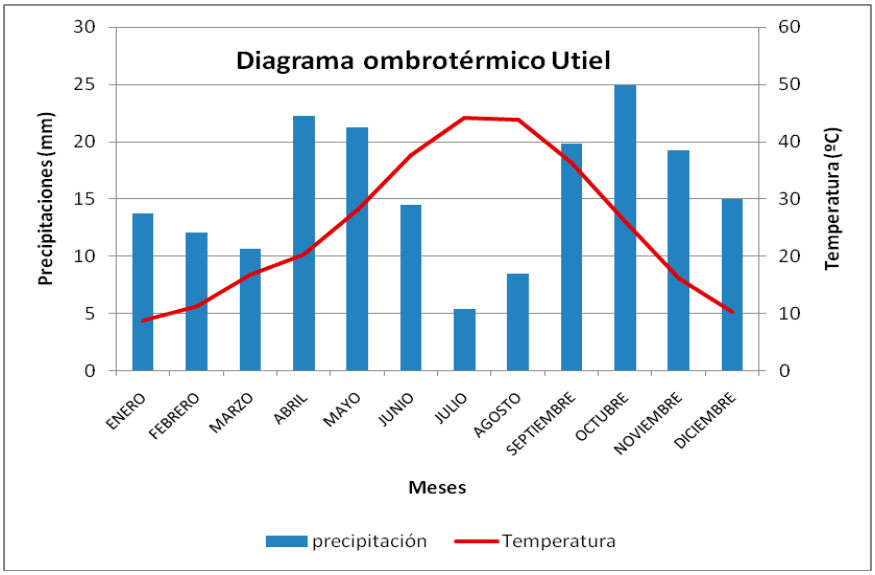
GoV (VALENCIANA-SPAIN)

The climate of Forest area is characterized by a climate which has an annual rainfall around to 450 mm, uniformly distribute throughout the year, except summer dry period from July to August.

The Utiel climate study was performed based on the analysis of meteorological variables measures in the station of the municipality, which belongs to the network of the State Meteorological Agency (AEMET, 2012). The data set studied is between the years 1978-2011, data from 1980 were removed by wide gaps in its temporal evolution

Months	MAX. T (ºC)	MIN. T (ºC)	AVERAGE T (ºC)	Dif. MAX/MIN (ºC)
JANUARY	16,16	-7,48	4,34	23,64
FEBRUARY	18,59	-6,84	5,59	25,43
MARCH	23,21	-4,62	8,38	27,83
APRIL	23,95	-1,90	10,14	25,84
MAY	28,29	1,90	14,08	26,40
JUNE	33,28	6,16	18,84	27,12
JULY	36,76	9,09	22,06	27,67
AUGUST	35,57	9,48	21,93	26,09
SEPTEMBER	32,19	4,95	18,14	27,24
OCTOBER	25,90	0,72	13,02	25,17
NOVEMBER	20,28	-4,17	8,05	24,45
DECEMBER	16,67	-6,88	5,14	23,55

VARIABLE	
Total annual rainfall (mm)	374,4
Average spring rainfall (mm)	89,88
Average summer rainfall (mm)	56,72
Average autumn rainfall (mm)	127,91
Average winter rainfall (mm)	81,55
Average No snow days by year	1,45
Average No hail days by year	1,31
Average No fog days by year	4,34
Average No dew days by year	0,17
Average No rain days by year	54,03



REGION OF WESTERN MACEDONIA (GREECE)

- The closest meteorological station is at altitude of 952m, and the following table gives the weather data for the period 1994-2003

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	No of years of observation
Mean rainfall (mm)												
70	110	103	96	51	23	16	17	47	104	182	149	10
Mean wind speed (m/sec)												
1,2	1,5	1,6	1,7	1,5	1,5	1,4	1,1	1,2	1,2	1,2	1,1	10
Mean relative humidity (%)												
79	75	70	71	68	60	57	61	71	75	82	86	10
Mean wind temperature (°C)												
0,2	1,1	3,7	6,8	13,6	18,3	19,9	19,6	13,8	10,4	5,6	0,2	10

ISPRA-FLA (ITALY)

Mean rainfall: 1,200 mm/year, mostly during spring and autumn time. Precipitations are mainly concentrated within 4-500 and 8-900 m above sea level.

Mean annual temperature: 9.6°C (i.e. close to mean spring and autumn temperature).

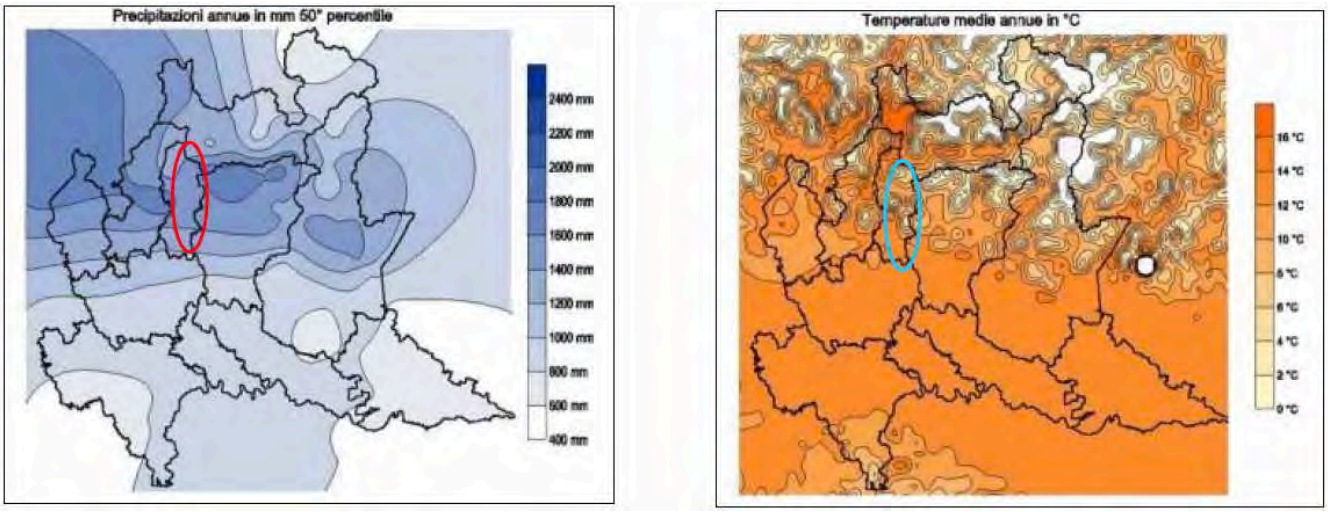


Figure 7: Rain and temperature regimes in the area

DRAFD- REGION OF SICILY (ITALY)

The climate characteristics of the area have been inferred from the thermal and rainfall data of some stations whose values, depending on their proximity, height and orientation, are comparable with the area of investigation. The following table shows the temperature and rainfall data of such station, indicating for each of them their altitude.

Months Elevations (m a.s.l.)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	Total
Bivona (503 m a.s.l.)	T (º)	9	9,6	11,4	14,1	19,2	23,6	26,3	26,2	22,8	18,2	13,5	10,2	17,0
	P(mm)	110	100	80	70	29	13	4	23	54	86	99	125	794
Piano Leone (831 m a.s.l.)	T (º)	6,5	6,9	8,6	11,3	15,5	19,2	22	22,6	19,8	15,6	11	7,6	13,9
	P(mm)	108	81	65	75	31	12	5	22	50	87	113	122	772
Prizzi (1100 m a.s.l.)	T (º)	4,6	4,8	6,4	8,9	14,3	18,8	21,9	22	18,2	13,8	9	5,9	12,4
	P(mm)	93	85	64	65	35	11	8	16	51	88	101	111	728

It is useful to bear in mind that the altitudes of the highest hills of the State forests area reach 1,400 m a.s.l. and, most likely, temperatures in these areas tend to be much lower compared to the data taken from the Prizzi station. By comparing the average monthly temperature rates of the first half of the year with those of the second half, these appear to be warmer. This typical tendency of the thermal regime is due to the influence of the sea that keeps its temperature quite high also during the fall by means of the summer heat release to air masses moving towards the inland, in fact compensating the fewer quantity of solar radiation that reaches the soil during fall.

Another indicator of such Mediterranean influence is the limited annual temperature range (difference between the daily average temperature of the warmest and coldest months), lower than 20 °C, which is considered the limit between the marine and continental climates. The monthly distribution of rainfalls is typically Mediterranean, with a peak in the fall-winter period, between November and February, and the minimal summer levels during June – August, when the average rainfalls reach 50-70 mm. Therefore, The 150 mm of rainfalls are not reached on average. Thus, summer has to be considered drought.

According to the Rivas Martinez bioclimatic classification, a great part of the territory is included in the thermal-hydrometric regime of the Upper subhumid Mesomediterranean, while the highest parts (above 1,200-1,300 m a.s.l.) are placed in the area of Upper subhumid Supramediterranean.

ICNF-ALGAR (PORTUGAL)

Temperate Mediterranean climate (Koppen classification Csa); hot and dry summer; medium temperature range between 15- and 17 ºC; average precipitation of 600 mm

- Soil description

LP DGMA

- The principal pedological material in the highest mountain area of the study site are Jurassic limestones and dolomites; also appearing Cretaceous marls; as well as Triassic clays and marls and eluvium in the lowest mountain areas.

CRPF-PACA (FRANCE)

Most of the soils of our study site are calcisols. We can find Cretaceous limestone, as well as white limestone slabs

SFI (SLOVENIA)

Bedrocks in the area are carbonate rocks. Soils are mainly rendzick leptosols on the limestone and dolomite. On the gravel of Soča river, riverine soils are present.

GoV (VALENCIANA-SPAIN)

The area in which is located the Forest is mainly covered by Cenozoic Tertiary sediments and Mesozoic of Cretaceous. In the eastern part of the Forest, appears interaction between Jurassic and Cretaceous, while, in the Northwest area, there is a small representation of Quaternary deposits.

In the study area appear frequently lithic Leptosols in the central area of Forest, Calcisols on the western, calcium Chernozems in the far north, and calcareous Regosols in the eastern. Some inclusions of chromic Luvisols are in the central part of the Forest.

REGION OF WESTERN MACEDONIA (GREECE)

The rocks found in the area belong to the class of sedimentary rocks created in tertiary and metatritogeni geological period (gneiss, ophites, granite). After the formation of the current topological configurations because of erosion and deposition occurred in the lower parts, modern geological period quaternary rocks, shells, and sandstones conglomerates are found.

ISPRA-FLA (ITALY)

The main pedological materials in the area are represented by gneiss and limestone. Soils are mostly brown soils or podsols, with good depth and compactness.

DRAFD- REGION OF SICILY (ITALY)

The geological substratum of the area mainly consists of Mesozoic carbonate rocks, generally massive or thickly layered limestone: in lower quantities also marl, dolostone, dolomized and silicified limestone are found.

This kind of rocks is consistent with good geomechanical properties and low alterability, very low porosity and high permeability, due to phenomena of cracking and karst.

From the point of view of soil (see following table), brown soils, brown limestone and lithosols prevail.

Soils Association		Surface	
Fao Classification System	U.S.D.A System	ha	%
Rock outcrop/Lithosols	Rock outcrop/Lithic Xerorthents	105,09	10,92
Lithosols/Rock outcrop/Eutric Regosols	Lithic Xerortlients/Rock outcrop/Lithic Haploxerolls	79,18	8,23
Eutric Cambisols/Calcic Cambisols/Lithosols	Typic Xerochrepts/Calcixerollic Xerochrepts/Lithic Xerorthents	754,49	78,38
Eutric Cambisols/Orthic Luvisols/Eutric Regosols	Typic Xerochrepts/Typic Haploxeralfs/Typic Xerorthents	23,9	2,48

ICNF-ALGAR (PORTUGAL)

The National Forest comprises about 30% of Px and about 70% Eg Soils. There are some Mudslides and agricultural soils covering an area of 0,585 ha.

Current vegetation

LP DGMA

The current vegetation is composed by Pine tree stand (*Pinus halepensis*); characteristic form low and mean lands in the Mediterranean environment; with abundant ground cover.

Vegetation formation	Surface (ha)	Main species			
		Arborea	Shrubby	Frutescent	Herbaceous
Nonwooded land; shrubs	9;49		Quercus coccifera; Juniperus sp.; Pistacia lentiscus	Rosmarinus officinalis; Anthyllis cytisoides	Stipa tenacissima
Pine halepensis tree stands	1.473;75	Pine halepensis	Quercus coccifera; Juniperus sp.; Pistacia lentiscus	Rosmarinus officinalis; Anthyllis cytisoides	Stipa tenacissima
Evergreen oak forests	9;06	Quercus ilex	Quercus coccifera; Juniperus sp.; Pistacia lentiscus	Rosmarinus officinalis; Cistus sp.	

CRPF-PACA (FRANCE)

The vegetation is mainly composed by *Pinus halepensis* stands with *Quercus ilex* underwood. The map below shows the different kinds of vegetation on the territory of the CPA. We can differentiate three main vegetation types: hardwood, softwood, and mixed forest.

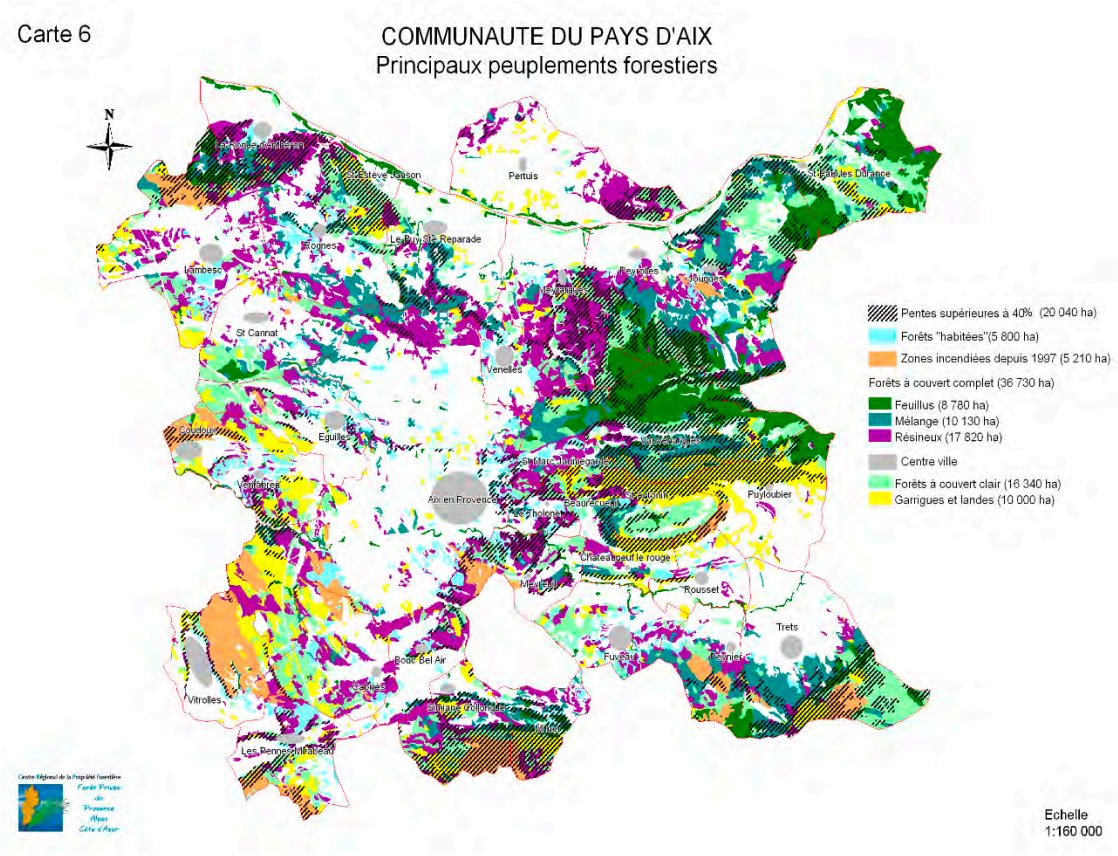


Figure 8: Forest stands

SFI (SLOVENIA)

According to the cadastre data: forests present 48,49 %, pasture 44,57 % and unproductive 6,86 %. Another land use has a minor share.

For the forest management propose, forest management classes are used in Slovenian forestry management. On the property, there are eight forest management classes. The most-important one (according to the area) are Protected forests (62,08%), Prealps fir and beech forests mixed with conifers (23,12 %), Alps beech forests mixed with conifers (8,96%).

GoV (VALENCIANA-SPAIN)

The Forest is characterized by the presence of sclerophyllous vegetation species led by Pinus halepensis and Quercus ilex, which become mixed stands in many areas of forest. Are also other species such as Pinus nigra, Pinus pinaster, and Juniperus phoenicea, Juniperus oxycedrus that interact with the two above mentioned species. There are also species such as Rosmarinus officinalis, Cistus albidus and Quercus coccifera, Thymus vulgaris, Ulex parviflorus, and Olea europea. Floristic Courtship consists of several species of the genus Helichrysum, and Lavandula Cistus.

REGION OF WESTERN MACEDONIA (GREECE)

- Pinus nigra,
- Pinus leukodermis or Pinus heldreichi,
- Abies borisi Regis,
- Fagus silvatica,
- Quercus (cerris, sessiliflora and others)

ISPRA-FLA (ITALY)

Vegetation is composed by several different forest types. They are indicated in the table below.

Forest types	Area [ha]	Area [%]	Main species
Fir forests	16.4585	1.6%	Trees: Abies alba, Picea abies and Fagus sylvatica Shrubs: Vaccinium myrtillus and Luzula albida
Green alder forests	63.3093	6.0%	Trees: Alnus viridis Shrubs: Aconitum napellus, Rumex alpestre, Senecio cordatus Herbs: Adenostyles alliariae, Cicerbita alpina, Achillea macrophylla, Peucedanum ostruthium, Athyrium distentifolium, Dripetrys sp.
Secondary birch forest	24.9529	2.4%	Trees: Betula pendula and Corylus avellana
Chestnut forests	7.1500	0.7%	Trees: Castanea sativa
Beech forests	720.1421	68.3%	Trees: Fagus sylvatica
Larch forests	159.1241	15.1%	Trees: Larix decidua
Ash and hornbeam forest	9.9366	0.9%	Trees: Fraxinus ornus and Ostrya carpinifolia
Spruce forests	53.5808	5.1%	Trees: Picea abies
Total	1,054.6543	100.0%	

DRAFD- REGION OF SICILY (ITALY)

In the area involved by the plan, forests cover the great part of the surface, with a prevalence of Mediterranean conifers reforestations (Aleppo pine, Cypress), and a minor presence of mountain conifers (Black pine and Atlas cedar). Surfaces occupied by natural woods are on the whole modest. Shrubs and herbaceous vegetation formations occupy an overall area of about 270 ha (see following table, "Land use classification"):

Land use	Surface (ha)	Main species		
		Arboreal	Shrubby	Herbaceous
Conifers plantation with predominance of Aleppo pine and cypress	293,49 (30,5%)	Pinus halepensis, Cupressus sp., Pinus domestica.	Rosa canina, Prunus spinosa, Rubus ulmifolus, Asparagus acutifolius, Cistus creticus	Ampelodesma mauritanica, Galium lucidum, Thalictrum calabricum, Geranium robertianum, Rubia peregrina,
Conifers plantation with predominance of Atlas cedar and black pine	193,47 (20,1%)	Cedrus atlantica, Pinus nigra,	Rosa canina, Prunus spinosa, Rubus ulmifolus, Daphne laureola, Euphorbia amygdaloides	Thalictrum calabricum, Opopanax chironium, Brachipodium sp.pl.
Eucalyptus plantations	24,76 (2,6%)	Eucaliptus camaldulensis	Asparagus acutifolius, Cistus creticus, Prunus spinosa	Gladiolus italicus, Hedysarum coronarium, Trifolium sp.pl, Arundo pliniana
Downy oak forest	12,85 (1,3%)	Quercus pubescens s.l., Quercus ilex	Rosa canina, Prunus spinosa, Rubus ulmifolus, Euphorbia characias, Hedera helix, Smilax aspera	Paeonia mascula, Tamus communis , Acanthus mollis , Allium subhirsutum, Cyclamen sp.pl.
Holm oak forest	68,36 (7,1%)	Quercus ilex, Quercus pubescens s.l.	Smilax aspera, Lonicera etrusca, Hedera helix, Ruscus aculeatus	Cyclamen sp.pl. , Galium lucidum, Geranium robertinum, Thalictrum calabricum

Other deciduous forests	7,27 (0,8%)	Acer campestre, Ulmus communis, Fraxinus ornus, Fraxinus angustifolia, Populus nigra	Rosa canina, Prunus spinosa, Rubus ulmifolus, Hedera heli,	Acanthus mollis , Cyclamen sp.pl., Opopanax chironium, Thapsia garganica, Rubia peregrina
Scrubland	109,33 (11,4%)	-	Rosa canina, Prunus spinosa, Rubus ulmifolus	Ampelodesma mauritanica, Brachipodium sp.pl., Opopanax chironium, Ferula communis, Thapsia garganica
Grassland	157,11 (16,3%)	-	-	Ampelodesma mauritanica, Brachipodium sp.pl., Ferula communis, Thapsia garganica, Lolium perenne, Asphodelus microcarpu, Asphodeline lutea, Orchis sp.pl., Oprhys sp.pl.
Others natural and semi-natural areas	82,73 (8,6%)	-	Clematis vitalba, Hedera helix	Anthemis cupaniana, Antillys vuneraria, Dianthus sp.pl., Euforbia rigida, Brassica rupestris, Umbulicus rupestris
Agricultural or artificial areas	13,24 (1,4%)	-	-	-
Total	962,61			

ICNF-ALGAR (PORTUGAL)

1/3 natural cork oak and arbutus unedo forest and 2/3 planted forest (*Cork oak, Maritime pine, Pinuspinaster, Cupressus, Eucaliptus, fraxinus*, etc.).

Silvicultural and management characterization

Current forest types/structure

LP DGMA

Understanding “forest structure” as the diameter class distribution, generally, the forest stands are classified as even-aged stands (regular distribution), two-aged stands (semi-regular distribution), and uneven-aged stands (irregular distribution).

The forest in the study, “Sierra de Burete," is covered primarily by *Pinus halepensis sp.* stands. According to the vegetation type of this forest, strata cartography has been carried out, allocating them in homogeneous stratus and structures. Once the strata map, the forest division in basic management units (district) is performed, which are defined according to the objectives of the forest management that we want to apply in each one of them. Base on this forest stratification, we obtain three main forest units with three main forest types or structure:

DISTRICT A (Production/Protection): Even- or two-aged stand

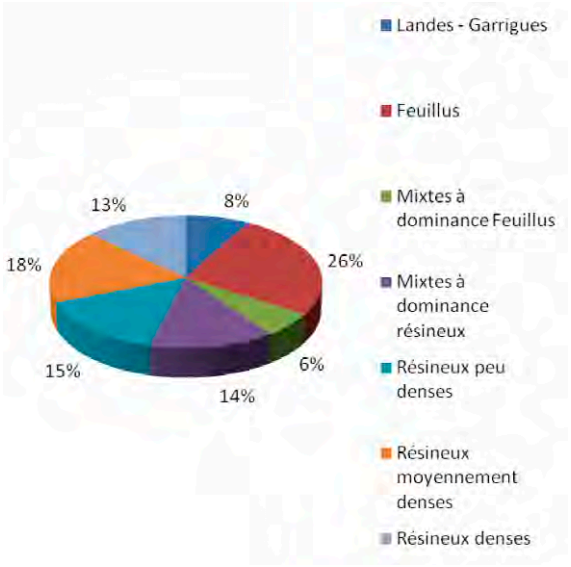
DISTRICT B (Protection): Even- or two-aged stand

DISTRICT C (Preservation): Even- or two-aged seedling forest (district level)

CRPF-PACA (FRANCE)

We have some young forest of *Pinus halepensis*, winning spaces on former agricultural lands.

- On 65000ha, the main forest types are:
- scrub and moorland and young stands:8%
- Hardwood: 26%
- Mix with hardwood domination: 6%
- Mix with softwood dominance: 14%
- Softwood at low density: 15%
- Softwood at mid-density: 18%
- High-density softwood: 13%



SFI (SLOVENIA)

Stands categorisation on the property varies according to the development phase. The majority of potential allowable cut on the property is in the mature forest stand than in the regeneration stands and in the coppice stands.

GoV (VALENCIANA-SPAIN)

The main representative vegetation forest types are pure stand of *Pinus halepensis* pole and woodland that occupies 2.315 hectares, which is 47% of the forestry surface of the forest, followed by mixed stand with more than 40% of canopy cover, which means 1.014 hectares, 21% surface. The stands with less representative surface are the one covered by *Quercus ilex*, with 337 hectares, 7%.

REGION OF WESTERN MACEDONIA (GREECE)

Generally, we have Uneven-aged forests but there are some parts that there are Even-aged forests, Two-aged forests.

ISPRA-FLA (ITALY)

Casargo, Margno and Parlasco municipalities host 13 out of 77 forest types identified within the *Comunità Montana Valsassina, Valvarrone, and Val d’Esino e Riviera* area. All forests are semi-natural and managed under the form of either coppice or high stands.

DRAFD- REGION OF SICILY (ITALY)

The following table “Structural type of the forest stands” shows the main crop types present within the area. The forest stands, largely being of artificial origin, are mainly attributable to the type of even-aged high forest, while the Holm oak and Downy oak forests are mostly irregular.

Forest types/structure	Surface	
	ha	%
Irregular forest	62,54	6,50
Even-aged stand	473,48	49,19
Uneven-aged stand	5,63	0,58
Irregular aged stand	19,24	2,00
Mediterranean maquis	20,45	2,12
Non-forest area	381,28	39,61
Total	962,63	100

ICNF-ALGAR (PORTUGAL)

88% forest; 5% Bush; 5% other uses (houses, infrastructures); 2% water.

- Forest natural trend

LP DGMA

The characteristics of the Pinus halepensis (main species): light demander; heliophilous; resilience to fire and large disturbances; high capacity for colonization of bare soils joined to great production and dispersal of viable seeds; improve the even-aged stand as main stand structure in plots; stand divisions and compartments.

CRPF-PACA (FRANCE)

The forest in our region is expanding. In the pure stands of *Pinus halepensis,* we can see the development of an underwood of *Quercus ilex,* which is taking advantage of the shadow provided by the Pinus. In front of the climatic change, the repartition of species in our area is going to change.

SFI (SLOVENIA)

According to the forest management plan goals, development of forests is going towards sustainable forest management practices on the basis of native tree composition and concrete ratio between forest development phases.

GoV (VALENCIANA-SPAIN)

At present, the pines that populate the vast majority of forest surface are the regressive states of the optimal serial or climatic vegetation, although it is possible to find, in the area with the highest altitude in the Northeast, places dominated by oaks, situation closer to the optimum climate zone.

REGION OF WESTERN MACEDONIA (GREECE)

Mixed oak forests of Quercus pubescens, Quercus petraea, Quercus macedonica, Quercus sessiliflora, Quercus conferta, and Quercus cerris.

Broad-leaved forests of Fagus silvatica, Castanea sativa, Platanus orientalis, Broad-leaved maintaining their leafage.

Coniferous forests of Pinus halepensis, Pinus sylvestris, Pinus nigra, Pinus leucodermis, Abies borisi Regis.

Mixed forests of Pinus sylvestris, Pinus nigra, Abies borisi Regis.

ISPRA-FLA (ITALY)

The forest area has been expanding and ageing during the last years, mostly because of lack of direct forest management in marginal areas.

DRAFD- REGION OF SICILY (ITALY)

Many stands are characterized by a dynamic evolution towards the re-naturalization, as can be noticed from the natural regeneration and development of native species (mainly Downy oak and Holm oak).

A considerable surface of plantations in the planning area shows a remarkable structural and ecological fragility, mainly due to high tree density and the lack of appropriate management.

ICNF-ALGAR (PORTUGAL)

The area is dominated by the cork oak vegetation series. Naturally the forest spaces of this region would evolve to complex cork oak forests.

- Target forest type/structure in the property in the study

LP DGMA

Regarding the forest division (district) defined according to the target forest type, the objectives of the forest management in each district are:

DISTRICT A: The main aim is the “timber and biomass production," where forest produce will be allocated to energy production through biomass combustion. Moreover, the district also has a “protective function”; therefore, the adequacy of silvicultural treatments is necessary to maintain the best state of the stands in coverage and vigour, allowing better protection against soil erosion risks.

For these purposes, the forest structure to achieve in this district, it will be “even- or two aged stand."

DISTRICT B: The main aim in this district is also the “protective function” and livestock use; therefore the same silvicultural conditions in “District A” will be applied. The products resulting from preservation silvicultural treatments will be allocated to energy production through biomass combustion. In steep slopes areas, fragile soils and inaccessibility conditions, soil protection is prioritized against water erosion risk. The resulting stand structure is a good canopy cover by reducing competition, good phytosanitary condition and self-protection against pests, diseases, fire and other abiotic damage. This is combined with free grazing sheep and goats.

According to these targets, the forest structure to achieve in this district, will be two-aged stands or first level of uneven-aged stand (district level).

DISTRICT C: The main aim in this district is also the “preservation function” combined with cynegetic use, according to the uniqueness of their plant formations, the existence of protected fauna and/or flora, fragility, forest maturity… The objective is to maintain the current forest structure, with minimal or no forest management intervention aimed at the protection, promotion and development of habitats, species and biodiversity. This will be combined with small game (*Perdix sp*.) and big game (*Sus scrofa*).

In relation to these targets, the forest structure to achieve in this district, will be two-aged stands or first level of uneven-aged stand (district level).

CRPF-PACA (FRANCE)

- We have presented the forest of the whole area, and the management plan we worked on was for the entire sector. In this sector, the main actions regarding wood biomass production are settled in a *Pinus halepensis* forest. These forests are young and most of the time, have never been managed. The operations carried out are often some retaking thinning, with whole tree harvesting in younger plots. The idea is to reach a good quality of softwood production in order to valorize the pinus for industrial purposes.

SFI (SLOVENIA)

After studying possibilities for management taking in the consideration access possibilities, limitations and silvicultural treatments we have selected four areas which have different access location. Anyway management in those areas has to be the same as prescribed in the official forest management unit management plan. The main three silviculture guidelines prescribe following actions: progressive change thinning of forest stands, progressive renovation of forest stands, silviculture works in mature stands.

GoV (VALENCIANA-SPAIN)

DISTRICT A: The main goal will be the production of timber and forest biomass. Subordinated to that and under-use sustainability criteria will ensure maximum services, notably hunting uses, livestock, bee-keeping, and agricultural works for hunting fauna.

DISTRICT B: The main goal will be the protection and conservation of soil, flora, fauna and landscape. Subordinate to this is the production of wood and biomass, hunting, livestock, bee-keeping, agricultural works for hunting fauna and social use.

DISTRICT C: The main goal will be the production of timber and forest biomass. Subordinated to that and under-use sustainability criteria will ensure maximum services, notably hunting uses, livestock, bee-keeping, agricultural works for hunting fauna and social use.

DISTRICT D: The main goal will be the production of timber and forest biomass. Subordinated to that and under-use sustainability criteria will ensure maximum services, notably hunting uses, livestock, bee-keeping, and agricultural works for hunting fauna.

DISTRICT E: The aim is the conservation, with special emphasis on reducing the risk of wildfire. This is an area that is regenerating after suffering forest fires where nonadult trees densities are excessive and often impassable. Thus, silvicultural actions will aim to achieve structures that provide protection against forest fires. Subordinate to this target will also be the uses for wood and biomass production, hunting and bee-keeping, and social use.

REGION OF WESTERN MACEDONIA (GREECE)

We maintain the current stands and species except some parts that I will explain below.

It depends on the forest types. At mixed oak forests, we use conversion cutting aim to reach seedling forest types if we had coppice forests.

We follow this road because, in the seedling forest, the stock wood and the biomass are ranging between 150 - 200 m3 per hectare (poor forests) to 1000 - 1200 m3 per hectare (rich forests).

Also, the timber production is high. In Greece, the seedling forests are 35% of the total forest area, one of the lowest in the Europe.

At the coppice forests, the stock wood is low (50 to 150 m3 / ha), and the products are mainly fire woods. In addition, they facilitate the soil degradation.

At mixed forests (Pinus nigra, Abies borisi regis) we try to reach a coniferous forest by Abies borisi Regis.

Abies borisi Regis is a fast-growing type and produces wood for many uses and enhances the soil properties.

Finally, at coniferous forests we choose the appropriate method (regeneration method/cutting, silvicultural treatment, improvement cutting, cultivation cutting etc.) in order to have a healthy and productive forest.

ISPRA-FLA (ITALY)

Planned forest management activities are aimed to keep and - whenever possible - improve the quality of forest stands within the area, at the same time we are trying to optimise the flow of products and services from the forest.

Forest management operations aim to make the forest more stable over time and to improve forest structure by favouring the conversion from coppice forests to high forests when it is possible. Finally, forest management operations aim also to maintain high conservation values that are present in the area.

DRAFD- REGION OF SICILY (ITALY)

The main target in the planning area is focused on the re-naturalization of the plantations with even-aged stand structure. This target will be carried out with different intensity and frequency of thinning cuts, depending on the natural evolution and tree density level of the different forest stands. The other native forest formations, having a high degree of structural degradation, low accessibility and low coverage will be destined to the free evolution.

ICNF-ALGAR (PORTUGAL)

Forest and Bushes

Forest management history

LP DGMA

The first Forest Management Plan in the forest under study was developed in 1956; with provisional character, and became the definitive version after the first five-year period; in 1962. This Management Plan was applied during the following ten years; until 1973; at which moment the Management Plan Review of “Forest No 36” was approved. This Review remains part of the planning; as forest inventory zoning; management method or silvicultural treatments; but the rotation period is modified to 60 years divided by fifteen-year periods. This new rotation period is considered suitable both for natural reforestation as for getting a better quality wood.

A new Forest Management Plan was drafted in 2003; although it did not approve; so the District and Compartment division remained the same (with some aggregated units). The floating periodic block method with shelter wood cuttings and a rotation period of 100 years was applied as management method for stands without significant environmental restrictions and a check selection system for more fragile stands.

The present Forest Management Plan is based on the previous one (drafted in 2003) but adapted to our Regional legislation.

CRPF-PACA (FRANCE)

In 2003, the CPA redacted its environmental charter, wanted to commit itself to a voluntary approach of the integration and participative management of natural resources in the development actions of its territory.

From 2008, this commitment has resulted in the implementation of specific actions designed within the AGIR programs (MDE AGIR, AGIR WOOD ASTER) and the establishment of a Territorial Climate Action Plan.

Two studies dedicated to the wood industry and more particularly to the Wood Energy helped to settle the basis of the strategy of development of the supply chain:

- - 2004 - Cabinet TRIVALOR “feasibility study, for a biomass supply chain”
- - 2007 - C.R.P.F "Study of forestry potential of the CPA "

SFI (SLOVENIA)

The forests on the property are sharing quite the same history as others in the area. The main factors which have the biggest influence on the forests were:

- Centuries long pastoral and silvopastoral activities
- Unsustainable exploitation of forests for covering urban area timber needs
- Relief and climatic conditions negative influence on soils – degradation of sites
- I WW front line
- After II WW deagrarization and urbanization stopped over-exploitation and turned it in the afforestation and overgrowth of abandoned land.

First management plans in the area were made after second WW. In the year 2014 the forth ten years management plan for "Forest management unit Bovec" entered into force.

GoV (VALENCIANA-SPAIN)

The first Forest Management Plan in the forest under study was developed in 1971. It is explicitly contemplated the main purpose of persistence, conservation and enhancement of productive capacity, with a preference for wood resources and subordinate resources grazing, hunting, truffle and agricultural works. Silvicultural treatment was planned as regular high forest. And the sorting method was shelter wood on a transformation turn of 75 years.

The first review of the development project was approved in 1981. The Special Plan was for the period between 1982 and 1991, and it explicitly contemplated wood as main destination and subordinates grazing, hunting, truffles and agricultural works. Silvicultural treatment was planned as regular high forest. And the sorting method was the periodic block method, applying successive shelter wood with a round of 75-year transformation.

REGION OF WESTERN MACEDONIA (GREECE)

ISPRA-FLA (ITALY)

The present Forest Management Plan is based on the previous one (drafted in 2005).

DRAFD- REGION OF SICILY (ITALY)

The area has never been interested by a management plan. After a thirty-year period, going from early Fifties to half of the Seventies of the last century, mainly characterized by an intense reforestation activity, starting from the Nineties the management carried out was especially focused at the renaturalization of artificial stands. From a silvicultural point of view, this objective results in thinning cuts aiming at supporting the evolutionary dynamics of these stands.

ICNF-ALGAR (PORTUGAL)

The area of the Herdade da Parra National Forest was acquired by the state in 1980. The responsible for the management was, at that time, the Portimão Forest Administration. The first management action was the forestation of the west part with *Pinus pinaster* (still resorting to animals), and *Quercus suber* which took place in 1984. The plants were produced in state tree nurseries.

In 1994, another project (supported by European funds and framed in an action called Forest Action Plan), took place, recurring to the same species and located in contiguous areas. At that moment, the extraction of cork in some of the existent *Quercus suber* was carried away, and the *Pinus pinaster* areas were thinned.

In 1997, with a new management responsible (Regional Agriculture Directions), a few small areas were afforested with *Cupressus* spp.

During august of 2003, a big forest fire affected nearly 99% of the area (only the built areas were unaffected). The Pinus pinaster areas were hopelessly affected, and the *Quercus suber* and *Arbutus unedo* ones were severely damaged.

After the fire, the *Arbutus unedo* recovered quickly with high natural regeneration. The *Quercus suber* responded a few months later but suffered high mortality during the dry season. The only areas of *Pinus pinaster* that survived were the adult ones (less affected by the fire).

In 2005, a public campaign by a wine company awarded the Herdade da parra National Forest with a monetary prize to promote the recovery of fire affected zones. With the prize, several areas were plated with *Quercus suber* and *Pinus pinaster*. This activity had the particularity of, for the first time in Portugal, a "retro-spider" machine being used for afforestation purposes. The use of this machinery allowed the plantation in high slope zones in the area.

Finally, in 2008 and 2009 (resulting from a 2005 project for afforestation of burned areas); approximately 437 hectares were planted with *Quercus suber*, *Pinus pinaster*, *Pinus pinea*, *Cupressus*. spp, *Eucalyptus* spp., *Fraxinus excelsior*, *Casuarina equisetifolia* and *Quercus* spp.

4.4.2 Methodology

4.4.2.1 Forest inventory methodology

LP DGMA

The methodology designed for the forest inventory wants to provide; with enough accuracy; the management parameters that will be needed for a suitable sustainable management of forest resources; and spending minimum expenses on its elaboration.

This is based on three main premises:

- The availability of the inventory plots data from the previous "Forest Management Plan"; drafted in 2002 (141 plots). These inventory plots have provided a better representation of the data than the ones in the 4th National Forest Inventory (4NFI); used in case of no data or unrepresentative data.
- The availability of the digital cartography related to the vegetation types; established on the 4th National Forest Inventory. Its accuracy has been improved to fit this cartography to the Northwest Region and; more specifically; to the forest.
- The carrying out of a specific stratified inventory (considering the different vegetation types); complementing the available data previously collected; hence improves the accuracy of the final results.

The methodology proposed in the forest inventory is a stratified led sampling.

The stratified inventory assigns homogeneous results for the whole stratus. However, these results can become more precise for each stand; using a weighting factor; for example; using the proportion between the canopy cover in a specific stand and the mean of the canopy cover in the whole stratus.

As stated before; the inventory has been designed to provide a lowering of expenses; based on the measurement of a few inventory plots within the forest (10 plots using led sampling), and using management data of plots already measured in previous inventories (141 plots measured in 2002 using systematic sampling) or the ones contained in 4NFI (not considered in this case).

The organized process of inventory can be divided into the following stages:

- Previous cartographic works

  a) Elaboration of a detailed type strata map for the property; based on the Forest National Map strata, and corrected with the orthophotos that are available for the area.

  b) Elaboration of the management zoning map of the property: stands; compartments; divisions; etc.; based on the detailed type strata map elaborated for the property. The management zoning definition

according to the legal regulation existing in Murcia Region for the "Elaboration of Sustainable Forest Management Plans in Murcia Region"

- Site data collection works:

  a) Previous review; at site; of the final management zoning done with a computer.

  b) Silvicultural report of each compartment: silvicultural diagnosis based on site review.

Site data was collected in plots that were representative of interesting strata/compartments (stratified led sampling). 10 circular plots with a variable radius were measured. Their radiuses vary according to the stand density and the forest type (containing, at least; between 15 and 25 trees in every plot). For example; the area of the plot can be 0.015 hectares (radius = 7 m; round plots) in high-density low polewood, or it can be 0.1 hectares (radius = 18 m; round plots) in low-density standard trees. In each plot; the following tasks were carried out:

- Measuring of the normal diameter in every tree with a normal diameter over 7.5 cm; located in the plot (an automatic calliper has been used; in order to do faster work).
- Locating the plot centre using a GPS (we have used a metric precision one).
- Delimiting the plot limits (we have used an ultrasonic range finder with angle and height correction).
- The minimum requested information measured in each plot was its area (ha); the number of the plot and of the trees that are measured; the species of the measured trees and their normal diameter.

As an example of a local methodology (Murcia Region) the "Methodology for the design of forest inventory by the use of specific software, for the elaboration of Forest Biomass Management Plans in Murcia Region" (English and Spanish) can be consulted at the following link in the publications section of the WP4/pilot action 1.7/ specific tools developed by partners:

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

CRPF-PACA (FRANCE)

The development of the SAT has two distinct phases: a first analysis phase followed by a phase of proposals.

- Phase 1: diagnosis and analysis

It aimed to precisely identify the potential biomass quantities of wood that could be put on the market, assess the impact of other types or biomass (including green waste), an inventory of public facilities or private operation in the project, identify the major economic stakeholders in the timber industry in the territory and neighbouring territories.

The data collection allowed us to have an accurate diagnosis with a detailed analysis. These data are collected from the services of CPA involved (Forest, Energy, Waste) and the main partners: CRIGE, municipality forested 13 OFME, ONF, CRPF, and the Cooperative Provence Forest. An additional work of investigation helped to complete the collection: they have made to owners for projects of large-scale boiler, loggers and Wood Energy suppliers.

All these data are then processed by a Geographic Information System that will output thematic and crossed data maps and data.

- Phase 2: proposals

These proposals are of three types: proposals of improvements necessary to promote the mobilization of resources and propose solutions to optimize the structure of the sector, provide technical, administrative and financial solutions to foster the use of local wood.

These proposals are the result of the analysis performed in the first phase and the work of data linkage produced in GIS, complemented by field surveys conducted with key actors.

Note: the SAT study has been led by EGA and Emmanuel Bonaimé, with the participation of the CRPF PACA.

SFI (SLOVENIA)

As explained above, our forest property biomass management plan presents an extraction from the official forest unit management plan. Because of that, there was no need for additional measurements of forests on the field. Necessary information was extracted from available databases.

In Slovenia forest management plans are based on three sustainable piles, multipurpose and close to nature management. They are elaborated for all forests, regardles of ownership or size of property. It is obligated to forest management according to the plans that are approved by ministry responsible for forestry.

Information for forest management plans is also coming from field work. In the 1994 method of permanent sample, plot was introduced by Slovenian Forest Service in the forest management system. In the mean time on the majority of permanent sample plots second measurement was done. A net of sample plots is different according to needed precision: 250x500 m, 200x500m, 250x250 m. Sample plots are placed in a concentric circle. On the area of 500 $m^{2,}$ we measure all trees above 30 cm DBH on the area of 200m^2 we measure all trees above 10 cm DBH.

Forest management plans are made for forest units. In our case we have chosen the Forest management unit Bovec. Inside of that unit we have made a management plan for the property of Agrarian common Čezsoča. Data as growing stock, yield for FMU Bovec are coming from 185 permanent sample plots. Sample plots are established on a 1000 x 250 m grid for more productive forests and a 1000 x 1000 m grid for less productive forests. So basically we have two stratums. On those plots, trees are count and measured, and quality of timber is estimated. Additionally they are using field work description of stands.

Permanent sample plots are not the only source of information about forest, a second source is the inventory of stands. In this inventory foresters on the field are evaluating forests stands and prescribing forest management guidelines.

The slovenian forest management systems knows four different management plans:

- Regional forest management plans,
- Silviculture management plans,
- Unit forest management plans.
- Regional haunting-breeding plans,

The first three above listed plans influence more on logging activities and with that also on wood biomass utilization, even though none of them explicitly talks about it.

On different spatial levels from the forest stand to region, they include information about forests and for forest management useful information. Typical information is: growing stock, wood increment, and tree species, harvesting possibilities and limitations, GIS information, socioeconomic information... The majority of the information is also included in Forestry Geo Information System.

Those plans are general not directly applicable on the level of forest holding as information are gathered and published on different spatial level, not on the level of land cadastre parcel or holding. The result is that property owner without GIS analyses cannot directly use this information. In a forest ownership structure in Slovenia, we mainly have forest owners who own few hectares of forests but there are also bigger individual forest owners. Mainly they do not have their own management plan.

Because of that the SFI has decided to prepare a pilot forest property management plan with a special focus on wood biomass. To achieve this goal we have used existed Slovenian Forest Service databases and other databases. To modify and recalculate information on the property area we used GIS tools. Additionally we have made meetings with owners' representatives and employees of Slovenian Forest Service. For the energetic part of the property plan, we have used information from local energy concept plan.

GoV (VALENCIANA-SPAIN)

The management is based on conventional technology, field work and forestry inventory, as well as LIDAR technology, using statistical sampling procedure. The method for the management in "Sierra Negrete" is stands management method. The use of this method increases forest management's flexibility, and it will facilitate adjusting the management to the characteristic changes of Mediterranean forests.

The structure of the works included in the pilot action is:

a) Diagnosis

This is the first phase to compile all the information related to the forest:

- legal, natural, socioeconomic
- field work: Inventory division/ forestry inventory: INVENTORY+LIDAR

The implementation of the LIDAR technology to the forestry inventory is based in regression models, which relate to direct variables obtained by LIDAR data processing (explanatory variables) with information obtained by field work using conventional techniques of forestry inventory (response variables).

These models are obtained from a statistical study that guarantees its mathematical consistency and accuracy, as well as the essential predictive capability.

The response variables that determine the regression models are the descriptive variables of the forest tree vegetation that allow diagnosing its condition and planning the actions. In particular, they are weight stock of above-ground tree biomass, volume stock of stem, basal area, trees density, mean and stand diameter, average and stand height.

The LIDAR data used for this pilot action belongs to the National Plan for Aerial Photography (PNOA) for 2009. The Cartographic Institute of Valencia has the responsibility to process and provide these data.

The average point's density in PNOA's LIDAR flight is 0.5 points/m2. The LIDAR classification is to assign a value for each point according to its nature: land, vegetation (low-medium-high vegetation), construction or infrastructure, etc.

Once this classification is done digital models are calculated, with an equivalent resolution of the average point density of LIDAR's flight, in this case 0.5 meters.

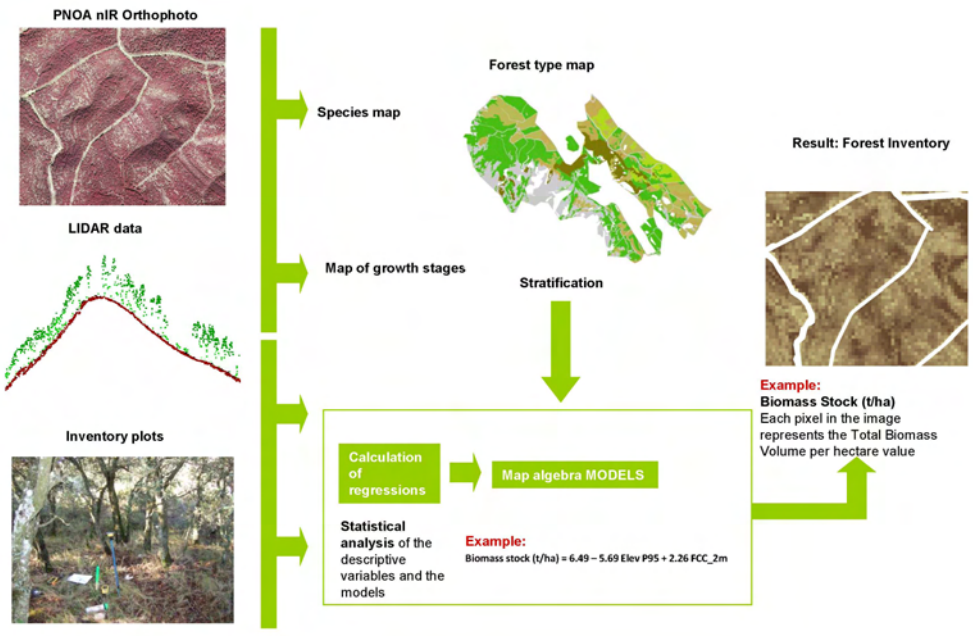


Figure 9: Picture Forestry Inventory Methodology. Estimated forestry variables in an indirect manner with LIDAR data

b) Planning

This part belongs to the data process and results analysis:

- General Plan: focusing on model management
- Special plans: focusing on exploitation plan and uses regulation. This is a short-period planning
- Document drafting

This part of the pilot action is the last one; it is to write the Forest Management Plan document in its last version. In this part, the final cartography and maps are produced.

The document includes an interactive tool with all the information including a map viewer.

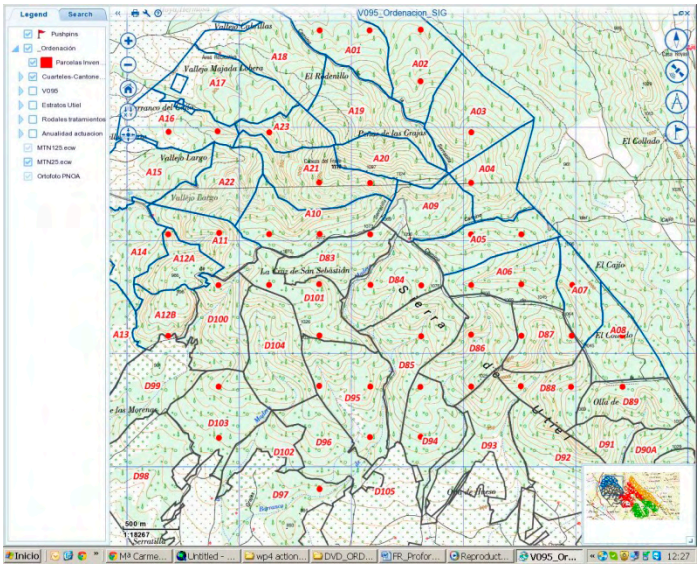


Figure 10: Picture Map viewer of Utiel Forest Management

As an example of a local methodology (Valencia Region) the document "*Design of the forestry inventory methodology with LIDAR application*" (English and Spanish) can be consulted at the following link in the publications section of the WP4/pilot action 1.7/ specific tools developed by partners:

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

REGION OF WESTERN MACEDONIA (GREECE)

The main procedure followed to obtain the data is

- by Field Plots
- measured in a non-systematic (irregular) manner.

In specific:

- 213 filed plots were measured in total in the pilot area.
- The biggest was 1ha and the smallest 0,1ha.
- The shape is rectangular and the dimensions are approximately 50mX20m=0,1ha, 50mX40m=0,2ha, etc. up to 50mX200m=1ha

- forest species considered:
  1. Pinus nigra,
  2. Pinus leukodermis or Pinus heldreichi,
  3. Abies borisi Regis,
  4. Fagus silvatica,
  5. Quercus (cerris, sessiliflora and others)
- Age classification: The age is calculated by piercing a sampled number of trees. The tree diameter is measured at breast height (1,30m) above ground.
- In each plot, all the trees, with a diameter of ≥10cm (for the species of *Pinus nigra*, *Pinus leukodermis*; *Abies borisi Regis*, *Fagus silvatica*) or a diameter of ≥4cm (for the species of *Quercus*), have been measured.

ISPRA-FLA (ITALY)

The forest inventory was performed based on the following sources:

- Data from the previous "Forest Management Plans" for the same forest areas;
- The availability of the digital cartography and other data (still being improved) at regional level on Regional Forest Types;
- The performing of a specific stratified inventory (considering the different vegetation types) to complement available data.

The methodology proposed in the forest inventory is a stratified sampling, based on forest categories.

Two main methodological stages can be identified:

- Elaboration of pre-existing cartographic sources and information based on existing maps taken from the previous edition of the Plan, the Regional Forest Type Map and the National Forest Inventory Map strata.
- Different, homogenous and non-overlapping strata have been identified corresponding to different forest categories (see 5.1.2.2 below), then for each stratum a variable number of plots have been identified depending on stratum characteristics and features in terms of composition, density, age, etc. including the relevance of the stratus for the purposes of forest management and forest production (e.g. high biomass levels).
- Data collection at single plot scale: for each plot the plot-centre and limits were identified by means of a GPS device. For each plot, diameter measures were performed with the relascope at stand scale. Dendro-chrono-auxometric parameters were collected considering:
- number of trees distinguished according to diameter classes, starting from a minimum diameter (DBH) of 7.5cm;
- density (expressed on a decimal scale, where 10 means normal density), by considering an area of 100m^2 around the centre of the sampling plot;
- model tree parameters (species, DBH diameter, growth during the last ten years);
- chronological class (where relevant, e.g. for even-aged coppices in conversion to high stands);
- DBH diameter and height of the biggest tree in the case of uneven-aged/irregular stands.
- For each stand specific silvicultural and ecological profiles have been developed, to provide *ad hoc* information on stand composition state and management orientation.

DRAFD- REGION OF SICILY (ITALY)

The main objective of the management plan is to indicate the sustainable forest management systems suitable for the structural and physiognomic characteristics of the main forests present: the core objective is to increase their stability, resilience and ecological-functional resistance and their degree of naturalness.

The forest plan also aims to quantify the solidity, state and potential use of forest woody resources that could be obtained by these interventions, especially in view of the development of a supply chain for the use of residual biomass for energy production.

The realization of the management plan represents, in the scope of forest resources planning in the Sicilian territory, the first planning experience at company level connected with the sustainable use of forest resources for energy production, This activity can be considered a pilot action for the definition of a methodology to replicate in other territories of the Mediterranean environment.

The plan has been basically realized through the following phases carried out both on field and computer analyses and elaborations:

a) collection of information material available for the area: regional and local regulations, historical and present forest management, dendrometric data, cartographies etc.,

b) subdivision of the planning area into management units and subunits in order to achieve a distribution of surface according to administrative and territorial (forest sections and lots) and ecological - functional (forest sub-particles) criteria. In this phase of works the forest particle map is drafted,

c) realization, in a GIS environment, of the forest types, map, starting from the verification and increase of the detail of the Regional Map of Forest Types,

d) on field verification of the forest types map and forest particles, and contextual description of the station, physiognomic - structural and management attributes, of each sub-particle through an appropriate form,

e) acquisition, in a GIS environment, of the field data and contextual processing of the dendro-auxometric data available for different forest typologies from research conducted in the area by the Department of Agricultural and Forest Sciences of the University of Palermo,

f) Identification of the areas in need of intervention and estimation of the biomass that can be obtained,

g) Economical analysis linked to the possibility of a hypothetical use of residual biomass for energy production.

ICNF-ALGAR (PORTUGAL)

Herdade da Parra Management Plan did not involve inventory measures when characterizing the plots was made. It was only a qualitative assessment of the area, having been drawn to partition the property for management purposes. The various plots demarcated were characterized according to their occupation and classified by their main and secondary functions. Under this exercise, there were only considered the portions, classified with the timber production function.

4.4.2.2 Forest inventory zoning methodology and growing stock assessment

LP DGMA

Forest inventory zoning

The forest under study; in order to inventory and subsequent planning; will be divided into the following Forest Management Basic Units:

- Forest Management Units or forest under study
- Districts
- Stretch
- Compartments
- Stands

The criteria used for the definition of the management reference units (**compartments**) are:

- Clear and well defined limits; using permanent lines: watersheds; water courses; paths; firebreaks; fences; etc.
- Composition and growth level of the different parts of the forest; trying to divide it into homogeneous parts.
- Physiography: slope; orientation; edaphology.
- Need of silvicultural treatments; targets proposed.
- Area bigger than 10 and smaller than 50 ha; according to the current Spanish legislation.

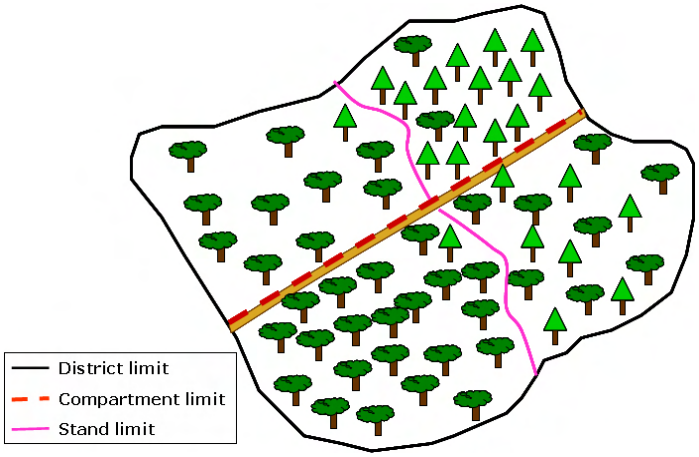


Figure 11: Schematic management zoning

By joining the compartments the **districts** are formed; which are defined according to the target forest type and; consequently; the objectives of the forest management that we want to apply in each one of them.

Once the compartments have been defined; we can also define the **stands** inside those compartments. The stands must be considered as the final zoning for the silvicultural management; in which we have to apply the same techniques (type and time of cutting; etc.).

The stands are defined following the limits of the strata delimited in the forest; and; consequently; are based in vegetation units/types; distinguished according to their species composition; canopy cover; silvicultural treatments that have been done, etc. They are the final units where the treatments and actions are planned, and it is very possible they will not be the same for the next period/project.

The management zoning is based on the standing definition. Joining them; the compartments are obtained, and the districts are obtained joining the compartments. The stands have been obtained intersecting the strata with the compartments limits.

Since the strata identify homogeneous vegetation units and with similar characteristics; the intersection between strata and compartments was a quick method of dividing a compartment into different strata; using a GIS software. We have chosen this procedure because it is an easy; precise and quick way of dividing the compartments into vegetation units.

The strata definition and classification for the whole Murcia Region area has been made with basis in the strata definition and classification defined in the National Forest Map (E: 1/25.000); which was elaborated considering the data obtained in the 4th National Forest Inventory (year 2010). Based on this; the strata classification made for Murcia Region inside the Proforbiomed project was elaborated considering these parameters:

- main tree species (species; covered area and growth level)
- vegetation cover
- property (public or private)
- origin of the forest (natural or coming from afforestation)

Therefore; the specific strata types obtained for the forest under study are the following:

Stratus
Dense evergreen oak forests (45<CC<80)
Pinus halepensis polewood/high forests (CC <20)
Pinus halepensis polewood/high forests (CC 20-40) Public & Non afforested
Pinus halepensis polewood/high forests (CC 40-70) Public & Non afforested
Pinus halepensis polewood/high forests (CC 40-70) Public & Afforested
Pinus halepensis polewood/high forests (CC>70) Public & Non Afforested
Non-wooded land; shrubs
Non-forest (Agriculture area; Urban area; Water surface)

(CC=Canopy cover; %; Public public forest management; Afforested= from artificial reforestation)

In the table below; the Forest Management Units which divided the "District A" are showed until "stands level"; by way of illustrating. Following; it showed the Compartment divisions within each District. The completed stands divisions can be consulted in the Management Plan (web link in 5th section);

District	Compartments	Stands	Surface (ha)
A	1	a	0;08
		b	0;07
		c	24;38
		d	3;37

District	Compartments
A	
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
	12
	13
	14
	16
	18
	20
	28
	36
	37
	38
	39

District	Compartments
B	15
	17
	19
	21
	22
	23
	24
	25
	26
	27
	29
	30
	31
	34
	35
	40
C	32
	33

District	Compartments
	41
	42
	43
	44

District	Compartments

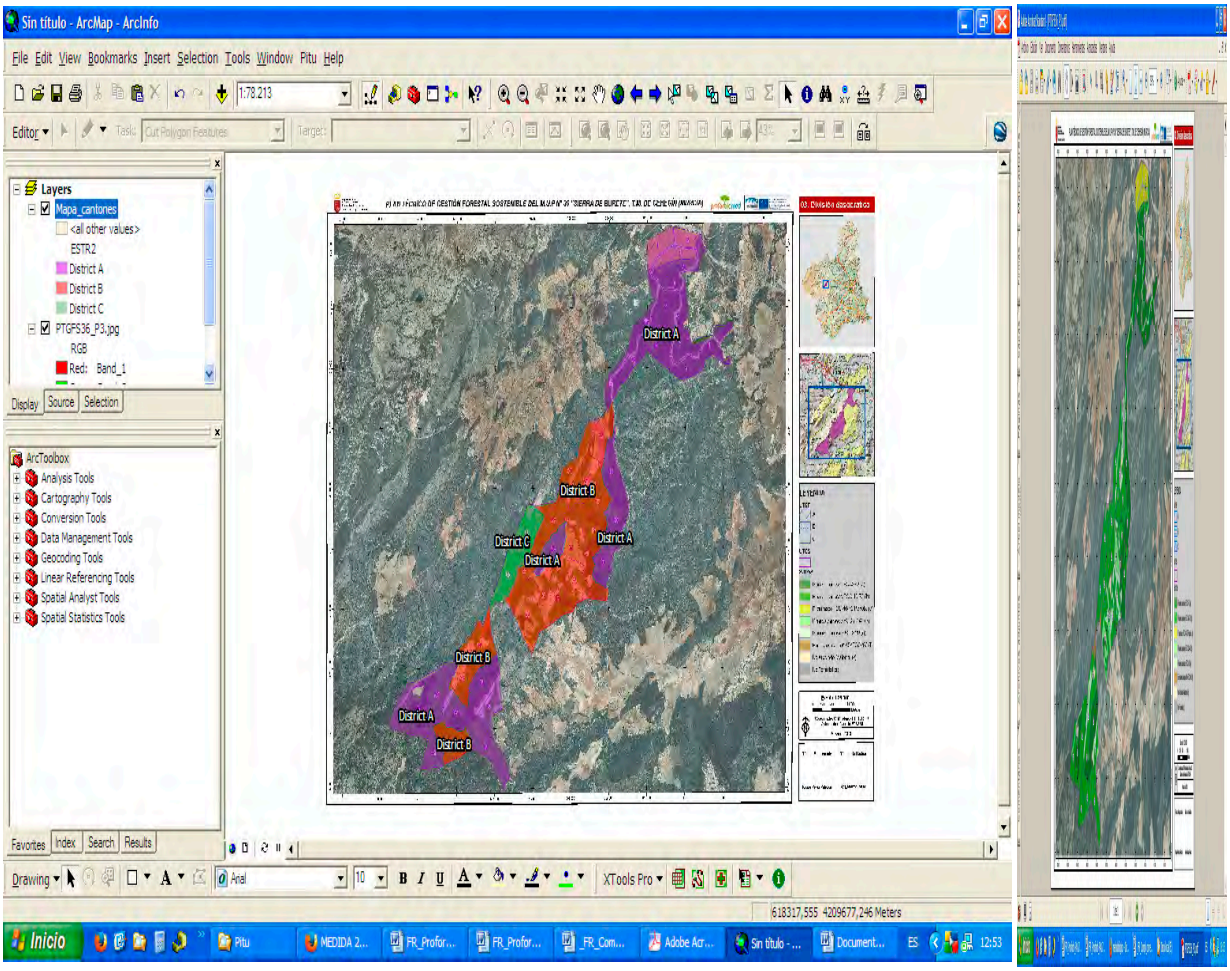


Figure 12: Management units (districts)

Stands typology showed in the previous table:

- Stand type “a”: Pine forest (Pinus halepensis); polewood and high forest; CC > 70% (2452)
- Stand type “b”: Pine forest (Pinus halepensis); polewood and high forest; CC 40-70% (2442)
- Stand type “c”: Pine forest (Pinus halepensis); polewood and high forest; CC 40-70%; from artificial reforestation (2441)
- Stand type “d”: Pine forest (Pinus halepensis); polewood and high forest; CC 20-40% (2432)
- Stand type “e”: Pine forest (Pinus halepensis); polewood and high forest; CC <20% (242)
- Stand type “f”: Dense evergreen-oak forest; CC 45-80% (6)
- Stand type “x”: Treeless land (997)
- Stand type “ z”: Non-forested land (999)
- Growing stock assessment
- The software calculation created for the PROFORBIOMED Project was used for data processing and growing stock assessment. This tool was developed for the Northwest Territorial Unit; Service of Environmental Management and Protection; Directorate-General for Environment; Regional Ministry of Presidency; in the Region of Murcia.

The sampling used is a stratified led one; intensifying or not; the plots number in a stratus depending on the interest of the stratus for the forest management (high level of biomass; for example).

Once the site plots have been measured; the cartography and the data collected and the actualized ones (from 2002 to 2012) are included in the software. The software automatically performs all assessments; which can be resumed in the following steps:

- the volume equations are applied to all the trees of each species that were measured in the plots
- the program calculates the results for each stratum (mean result per hectare) of each one of the variables calculated with the volume equations.

The results are obtained in several tables:

- Total growing stock for each species
- Growing stock for each diameter class in each species
- Total growing stock for the entire species group
- Growing stock for each diameter class; total for the entire species group
- Sampling errors for species
- Sampling errors for the entire species group

All these results can be referred to a specific part of the management zoning; or to the whole management zoning. This must be selected previously by the user.

Own volume equations have been elaborated for this project; using the National Inventory data (4NFI); with the aim of basing on them the software calculations.

In the site works; the only data measured was the trees diameter. So; it was necessary to obtain equations for each species based only on the diameter (cm units). The volume equations allow obtaining the growing stock in biomass and timber for each one of the tree species; using only the normal diameter of every tree. The equations have been obtained trough regressions between the normal diameter (independent variable) and several dependent variables (total height; TH; over bark volume; OBV; under bark volume; UBV; fuelwood volume; FV; yearly volume increment; YVI); obtaining an equation for each dependent variable. These equations have been calculated for each one of the four more frequent species in the Murcia Region under study: *Pinus halepensis Pinus nigra; Pinus pinaster* and *Quercus ilex*. These single entry volume and growth equations have been assessed used the timber data from the 4NFI plots in North-western Murcia Region; for each one of the four more frequent and harvested species: *Pinus halepensis Pinus nigra; Pinus pinaster* and *Quercus ilex*.

The software calculation incorporates these single entry volume equations (normal diameter; in cm) to calculate; by each tree in the measured plot; the total height; over bark volume; under bark volume; fuelwood volume; yearly volume increment; and biomass volume. For this last variable calculation; the equations proposed by the National Research and Rural and Food Technology Institute (that were elaborated by Gregorio Montero; 2005) have been used. They are generic equations that are valid for the whole national territory, and they were done using modular values of sample trees that were cut in different places. In this estimation; the timber part of the tree and the rest are considered separately. Values provided by each single entry volume equations are tree height (in m); volumes (in dm3) and current annual increment (dm3/year). In the latter case; in each species; data were taken from the trees measured on 3NFI and 4NFI.

Bellow; the single-entry volume equations (normal diameter; nd; in cm) are shown. The other single-entry equations can be consulted in the Management Plan (web link in 5 sections);

The equations are designed for:

Pinus halepensis Mill.

Over bark volume (dm^3)

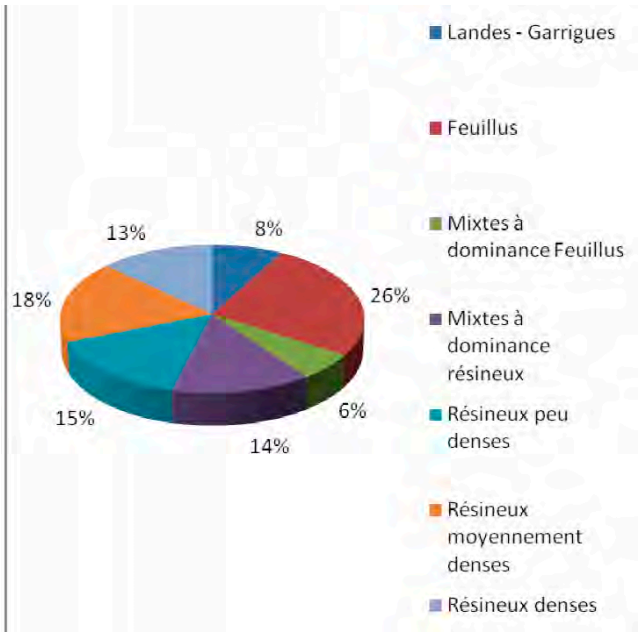
$OBV=p \cdot nd^q$			
	q	NL(p)	p
Coefficients	1;89813852	-0;86549249	0;42084424
Coeffs Error.	0;00638834	0;01944849	
R^2	0;88637627	0;27265264	Standard error of estimate
F	88283;6708	11317	Degrees of freedom
SS Regression	6562;96046	841;299674	SS Residual

CRPF-PACA (FRANCE)

Forest inventory zoning

The forest resources have been evaluated according to several data:

- Analysis of the management documents for public forests
- Analysis of the Forest Management Plans for privately owned forest in case of explicit agreement of the owner
- National Forest Inventory (new version)
- Aerial photography of 2009
- Analysis of the documents provided by the Provence Forêt Coopérative (inventory of woodcuts realized from 2000 to 2012, and foreseen woodcuts until 2015)
- Those analyses have been completed by field inventory and by meetings and interviews with all the main stakeholders of the area.
- On the 65000ha of the CPA area, the main forest types are:
- Moor, Garrigues, young stands: 8%
- Hardwood: 26%
- Mixed forest with Hardwood domination: 6%
- Mixed forest with softwood predominant: 14%
- Sparse Softwood: 15%
- Softwood medium density: 18%
- Dense Softwood: 13%



Growing stock

No growing stock assessment has been made, all the data are average observed on realized woodcuts and are validated by forest workers and forest managers.

But an Excel tool was developed to allow foreseeing the volume of softwood that will be collected every year in every municipality of the CPA (the study area of "Communauté de Communes du Pays d'Aix"). This tool uses the CRPF's database that includes all the characteristics of every single Forest Management Plan in the region. By

crossing the data of the database with the table of productivity, a volume per ha, and a % of coniferous trees can be assigned for each kind of forest stand, and a volume for the woodcut can be estimated

This tool is very interesting for a municipality, for example, because it gives them: a volume actually available, year per year vision of the evolution of the availability of the resource, produced with strict environmental scheme, locally produces…

SFI (SLOVENIA)

Forest inventory zoning

Information about forest stands and forest compartments is derived from the Slovenian Forest Service database. This database is based on the Slovenian Forestry Service inventory system. For our purpose, we have identified different zones according to harvesting possibilities. These harvesting zones are presented on the following map.

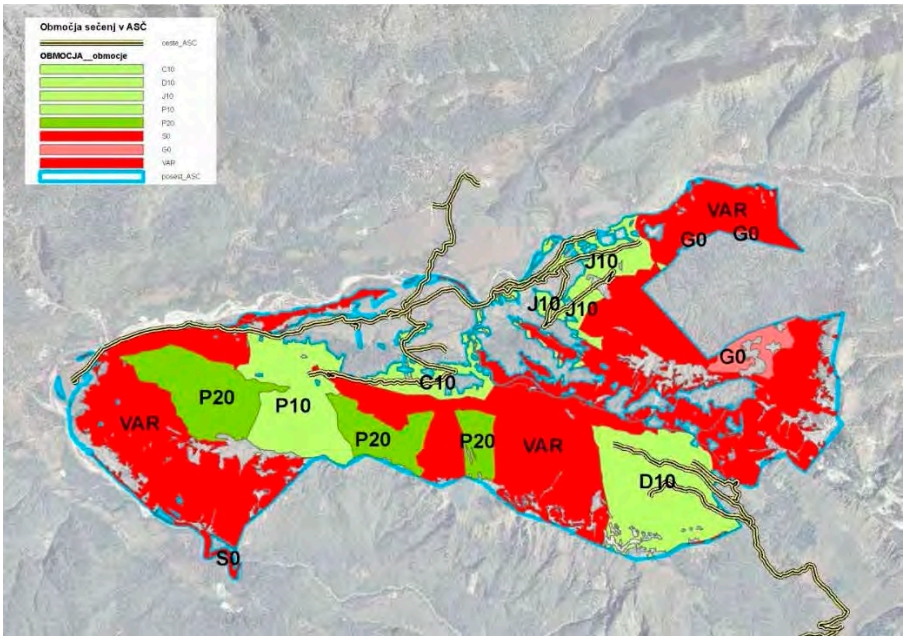
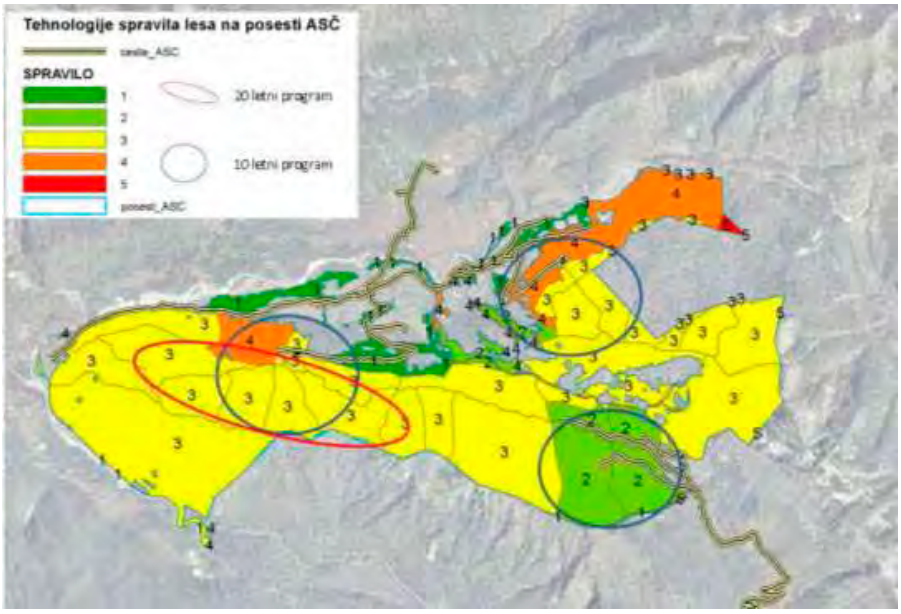


Figure 13: Harvesting zones

From the plan for Forest management units, we can see that we have the following possible technologies:



Growing stocking

We have used the existing Slovenian Forest Service databases information about growing stocks. Instead of field work measurements, GIS tools and other database programs have been used to modify and recalculate information on the property area.

GoV (VALENCIANA-SPAIN)

Forest inventory zoning

First, have been defined the inventory forest types, which aim is to improve quality and accuracy results of the forestry inventory, reducing the coefficients of variation in the measures of the field work and in the forest parameters deduced through them.

The standardizing of the inventory forest types is done by the types of vegetal covers and the silvicultural structure, and it is:

- Tree cover or brush, considering tree surfaces those with canopy cover of trees more than 5% and brush surfaces those with canopy cover less than 5%.
- Pure stands or mixed stands, according to its specific composition and considering pure stands where more than 90% of individual tree belong to the same species.
- Natural age class, which is the indicator of the development condition of the trees of the principal specie. In *Pinus halepensis*, there are different types: reforest, for *Pinus halepensis*, between young stands and pole and woodland.
- The trees canopy cover, as the estimator of the stands thickness, which in mixed stands is different depending on having more or less than 40%.

The cartography of types of forestry stands and forestry inventory forest types was obtained from:

- Orthophoto: National Plan for Aerial Orthophotography (PNOA).
- National Forestry Inventory third review (IFN3), 1997 to 2007.
- Works of signposted and demarcation recovery, done by the Supporting Service in Topography and Cartography of the Territorial Service of Valencia of the Environmental Regional Ministry, 2011-2012.
- The digital vegetation model (MDV) from LIDAR data of the National Plan for Aerial Orthophotography (PNOA) of 2009.

The forestry inventory forest types and its surfaces are listed below:

Inventory Forest types	Surface (ha)	Surface (%)
Pure stand of polewood *Pinus halepensis*	2.315	47
Wooded mixed Stand with c.c. f.> 40%	1.014	21
Wooded mixed stand with c.c.f.< 40%	611	12
Pinus halepensis, growth; c.c.f. > 70%	486	10
Pure stand of Quercus ilex	337	7
Shrubs	176	4
TOTAL	4.939	-

Plots and field work

According to the methodology exposed, several plots were done to measure direct silvicultural parameters, by using conventional technology of forestry inventory. In addition, other complementary parameters related to physic, biotic and phytosanitary characteristics of plot's trees were simultaneously collected.

Plots design

Circular plots, with fixed surfaces of 10 meters diameter have been used, with systematic surface distribution for all the forest, based on the recommendations of current General Instructions for Forestry Management 1971 (ICONA, 1971).

The circular shape has been used because it is a more effective for the field work, and also because it doesn't give preference to the aspect, and it has less perimeter geometric figure for the decision to include or not include the limit stands into the plot.

Plots surface distribution is done by a regular quadrangular net of 500 meters long, which covers the entire forestry studied surface. So, the plot selection is hazard, eliminating those not representatives of the forest.

Then, for each forest inventory type there is a distribution of plots and in each one there will be designed a regression model for every forestry parameter. So, there will be a minimum number of plots for each forest inventory type to ensure the consistentcy of the models and to have also a big range of variables to get the real representative of the forest. The table nº 12 (see below) indicates the number of plots for each forestry vegetation type:

Forest Vegetation Type	Surface (ha)	Nº plots
Pure stand of polewood *Pinus halepensis*	2.315	60
Wooded mixed Stand with c.c. f.> 40%	1.014	42
Wooded mixed stand with c.c.f.< 40%	611	30
Wooded Pure stand of *Quercus ilex*	337	20
TOTAL	4.277	152

Plot Measures

The considered trees to be inventoried are those with a diameter (1,30 m high) equal or larger than 7.5 cm, including bark, and for each individual that meets it, was measured its normal diameter and identified its species.

Among all the trees designated in a plot, only two of them were selected to determine more parameters. The selection has been made according to the species present, those which are no dominated, with straight up timber and closer to the plot centre point in the four cardinal main directions.

In those "average trees" were measured:

- Normal diameter (at 1.30m high) in cross
- Two radial bark thickness
- Two radial growths of the last five years with Pressler driller
- Maximum high until the apex with a digital hypsometer
- Species and volume tree determination based on the third Spanish forestry Inventory (F parameter)

Additionally, in some average trees of *Pinus halepensis*, the age was measured (Pressler driller) in those representative stands belonging to the artificial age class, with the objective to establish the quality of the site and evaluate the management options. This work is based on the Study of "production tables for *Pinus halenepsis Mill* (MONTERO et al., 2000).

Besides, in the Plot were also compiled the specific composition, age natural classes, vertical structure, the stand principal shape, tree thickness index, canopy cover, composition of the stand, natural class ages, *stand structure, tree density index*. Other complementary parameters as physics and biotics were measured (slope, aspect, stone content, erosion, brush cover, pests and diseases).

Then, inside this plot, a small concentric circular plot, 5 meters radius was done to measure the natural regeneration and trees below minimum diameter limit.

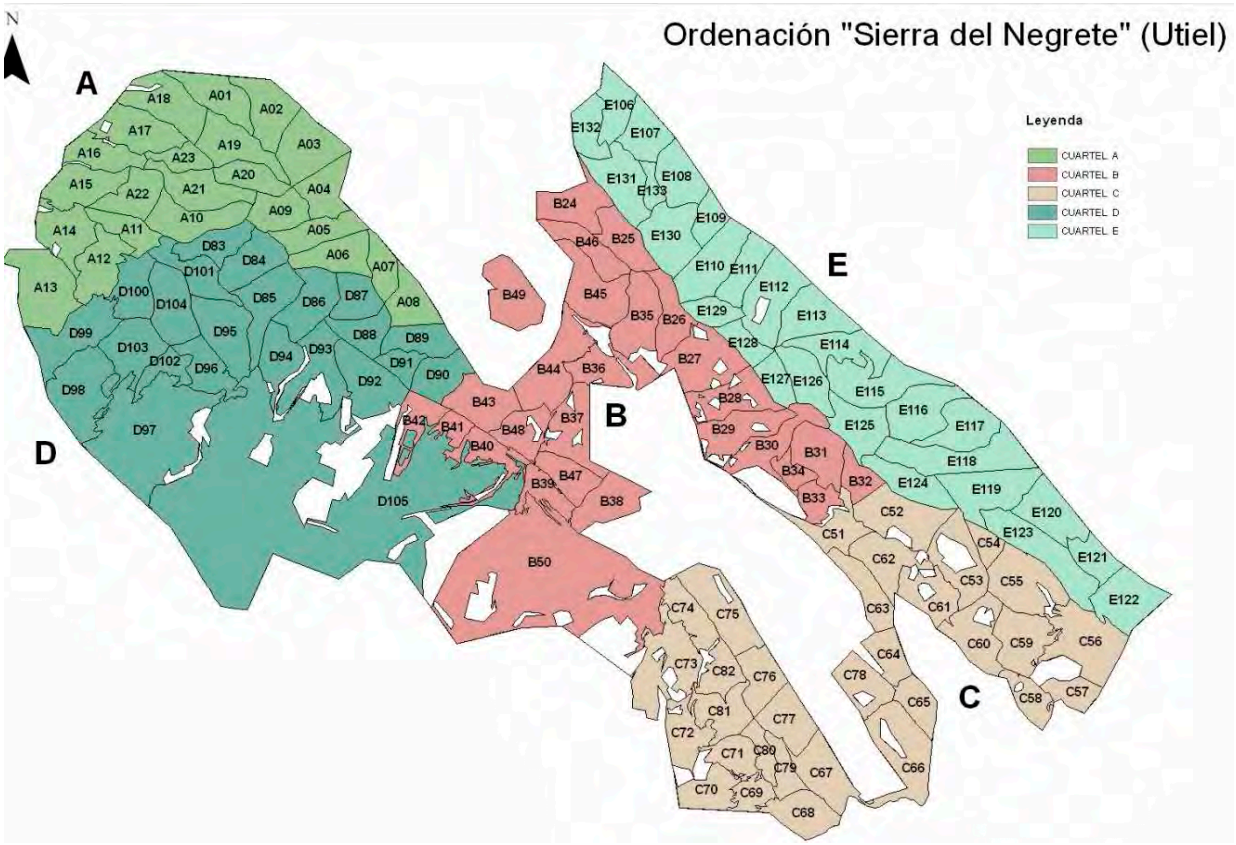


Figure 14: Map of definitive stands

Growing stock assessment

- **Curves and equations, biomass content and wood volume**

For getting the estimated biomass stock and wood volume, for the main plot tree species, it has been used existing curves and equations to deduce and relate the results of field normal diameter (1,3m) data.

- For the estimation of biomass stock: has been used the equations from the National Agronomic and Food Research and Technology Institute by Gregorio Montero (MONTERO, 2005). It is a general equation applicable to the whole national territory that has been prepared through several values of different average trees of different geographical areas.

The biomass estimation stock contains all the wood and nonwood parts from the trees as susceptible of the integral application, except the roof part.

- For the estimation of wood volume: it has been used the equations of the Third National Forestry Inventory for the Valencia Region (IFN3, 2008).

In the same way, there have been calculated regressions that relate the tree height with normal diameter, using the information compiled of every average tree in the field work.

In addition, for the principal specie *Pinus halepensis*, it has been created a specific equation for the forest studied. A cutting of 30 average trees has been made and calculating of its commercial calculation using the Smalian method. With this, the resulting accuracy it's improved than using the general equation. Those 30 average trees have been selected from representative stands of the whole forest (study area), trying to equilibrate the volume defect/excess errors. The rate is for a medium quality.

- **Multiple linear regressions**

The results of the forestry inventory of stock biomass, timber volume and number of stems, basal area, mean diameter, stand diameter, mean height and stand height, have been determined from linear regression models that relate each of these variables, response variables, with explanatory variables (Lidar Data).

The statistical technique used has been the multiple lineal regression. According to this model or equation [b], the response variable of the dependent (*Y*) is interpreted as a linear combination of a group of K explanatory variables or independents (*Xk*), each of them goes with a coefficient (ß*k*) that indicates the relative weight of that variable in the equation.

$$Y = \beta_0 X_1 + \beta_1 X_2 + \beta_2 X_3 + \ldots + \beta_k X_k + \epsilon \quad [b]$$

Facing the large number of potential explanatory variables, LIDAR data and spectral responses of bands that integrate the PNOA orthophotographs, to decide which variables will integrate each regression, a rule of decisions based on statistical criteria has been used. It is an accepted and automatic procedure, using computer applications for statistical assessment, named “stepwise” method or “step by step regression." This procedure is designed to select from a large number of variables which can obtain the best-possible attachment.

The regression models obtained for this forest inventory are:

Parameter	Model	R^2	Average	RMS	RMS%
VEGETATION TYPE 1 Pure stand of polewood *Pinus halepensis*					
BIOMASS	B (T/ha) = 6,49 + 1,01 FCC - 30,6 NVDImin	0,82	47,00	9,79	20,83
VOLUME	V (m^3/ha) = 3,26 + 30,9 g1 - 51,2 NVDImin	0,81	81,84	17,98	21,97
BASAL AREA	G (m^2/ha) = 2,11 + 0,364 FCC - 9,81 NVDImin	0,81	16,04	3,16	19,70
DENSITY	D (trees/ha) = 633 - 9,44 Intensity+ 806 NVDIm	0,54	496,41	175,43	35,34
MEAN DIAMETER	dg (cm) =- 7,52 + 0,327 STD_Ir - 0,652 g2+ 0,240 Int Mean + 0,0650 Transparence	0,67	20,70	3,20	15,46
STAND DIAMETER	do (cm) = 2,77 - 0,499 g2 + 1,43 P90 + 0,382 Gd	0,73	26,58	3,61	13,58
MEAN HEIGHT	Hg (m) = 0,62 - 0,209 g2 + 0,0460 Intensity+ 0,106 Gd + 0,333 P90	0,74	8,42	0,89	10,57
STAND HEIGHT	Ho (m) = 5,28 + 0,102 IRd- 0,238 g2	0,73	9,43	1,05	10,68
VEGETATION TYPE 2 : Wooded mixed stand with cover canopy > 40%					
BIOMASS	B (T/ha) = 6,49 - 5,69 P95 + 2,26 FCC	0,79	48,45	15,80	32,61
VOLUME	V (m^3/ha) = - 21,3 + 31,2 Hd - 14,0 P50	0,85	56,01	14,95	26,69
BASAL AREA	G (m^2/ha) = 1,14 + 4,57 Hd - 11,8 NVDImin	0,79	11,31	2,78	24,57
DENSITY	D (trees/ha) = 1036 + 9,24 Return2 - 18,9 Gd	0,57	493,13	152,87	31,00
MEAN DIAMETER	dg (cm) = 16,2 + 4,34 Hd - 12,1 NVDImin	0,79	17,83	3,21	18,00
STAND DIAMETER	do (cm) = 4,43 + 6,89 Hd - 2,15 P50 + 0,185 Gmin	0,87	23,68	3,42	14,44
MEAN HEIGHT	Hg (m) = 4,72 + 0,0502 Transparence + 0,0574 Gmin	0,79	7,21	1,02	14,14
STAND HEIGHT	Ho (m) = 5,40 + 0,384 Cv - 0,486 P60 + 0,0649 Gmin	0,86	52,88	1,01	1,91
VEGETATION TYPE 3 : Wooded mixed stand with cover canopy < 40%					

Parameter	Model	R^2	Average	RMS	RMS%	
BIOMASS	B (T/ha) = - 54,1 + 50,1 P50 + 24,1 Hd + 0,929 Int Mean	0,89	49,58	16,51	33,30	
VOLUME	V (m^3/ha) = - 23,2 + 13,6 P95 + 29,7 NVDImin	0,88	41,00	13,06	31,85	
BASAL AREA	G (m^2/ha) = 16,5 + 2,50 P95 - 0,0855 Gmax	0,90	9,55	2,56	26,80	
DENSITY	D (trees/ha) = 1170 + 11,3 FCC - 4,47 Gmax	0,64	399,50	135,63	33,95	
MEAN DIAMETER	dg (cm) = 2,64 + 1,75 hmax	0,67	14,19	3,80	26,77	
STAND DIAMETER	do (cm) = - 7,98 + 3,01 P95 + 0,0747 IRm	0,79	17,78	4,15	23,34	
MEAN HEIGHT	Hg (m) = 1,87 + 0,621 hmax	0,57	5,96	1,69	28,36	
STAND HEIGHT	Ho (m) = - 2,81 + 0,816 hmax + 0,0288 IRm	0,66	6,86	1,78	25,93	
VEGETATION TYPE 4: Pure stand of *Quercus ilex*						
BIOMASS	B (T/ha) = - 98,7 + 32,7 Cv + 0,721 IRm - 1,59 Gmir	0,85	61,02	20,43	33,48	
VOLUME	V (m^3/ha) = - 1,27 + 8,69 Cv+ 16,9 NVDImin	0,79	17,55	6,06	34,53	
BASAL AREA	G (m^2/ha) = - 5,91 + 10,9 AAD + 5,68 NVDImin	0,83	7,20	2,01	27,91	
DENSITY	D (trees/ha) = - 661 + 342 P80 + 500 NVDImin + 12,3 Gd	0,74	560,25	175,19	31,27	
MEAN DIAMETER	dg (cm) = 2,33 + 2,43 P95	0,68	11,54	1,16	10,05	
STAND DIAMETER	do (cm) = 6,56 + 2,60 P95 - 0,610 g2	0,82	14,04	1,75	12,46	
MEAN HEIGHT	Hg (m) = 2,81 + 0,725 P95 - 0,187 g2	0,70	4,86	0,70	14,39	
STAND HEIGHT	Ho (m) = 0,39 + 0,739 P95 - 0,279 g2 + 31,5 NVDIstd	0,83	5,52	0,62	11,23	

REGION OF WESTERN MACEDONIA (GREECE)

Forest inventory zoning

The management units resulted form the overlaying of the following information layers. The resulted units were 41 forest departments (named with numbers) and 263 forest stands (named with letters) in Krania Forest.

The data collection, the technical characteristics and the data sources are presented in the table below:

Data	Metadata - Technical characteristics
Metadata - Technical characteristics	Date: 2011 Ground resolution (m): 30 m
Landsat satellite imagery	Date: 2006-2008 Ground resolution (m): 0,5 m
Color Orthophoto maps KTHMATOLOGIO S.A	Grid size (m): 30 Height accuracy (m): 16
Digital Terrain Model ASTER / GDEM V2, 1arcsec	Digitised from 1:100.000 – 1:50.000 maps
Municipal Boundaries ANKO / EL.STAT. maps	Ministry of environment, Energy and Climate change. Sites included in Natura 2000 Network, identification (name and site number), the area and the perimeter
Conservation areas	RoWM
Forest District Boundaries	GPS Digitised from 1:5.000 orthophoto maps, ~1-5m planimetric accuracy, Kozani Reg. Unity

Data	Metadata - Technical characteristics
	Digitised from 1:100.000 EL.STAT. maps, Rest of Region
Main road network ANKO	RoWM
Forest road network	RoWM
Forest ownership division	RoWM
Forest Management Plan Data	RoWM
Slope map	Spatial resolution: 30 m

The slope and road network map with the forest boundaries is presented in the figure below:

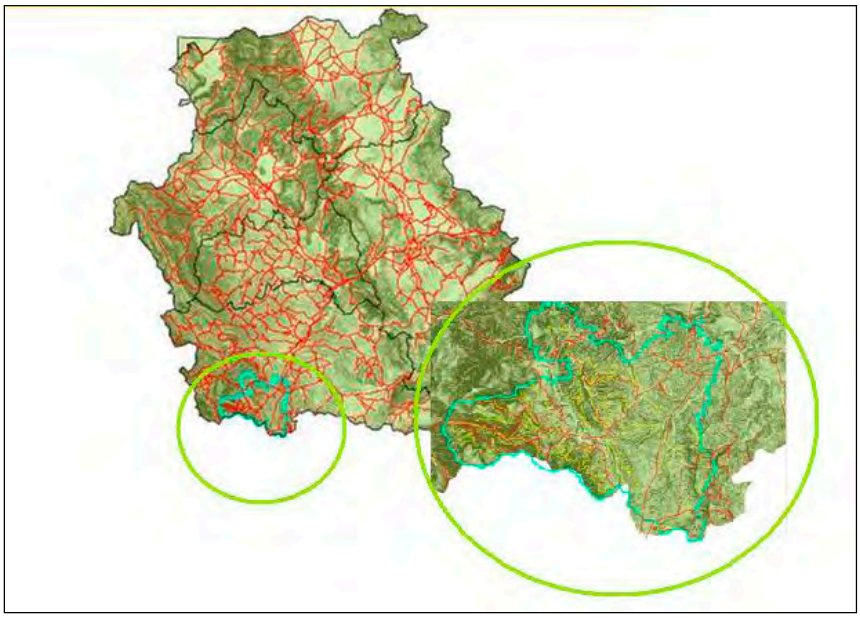
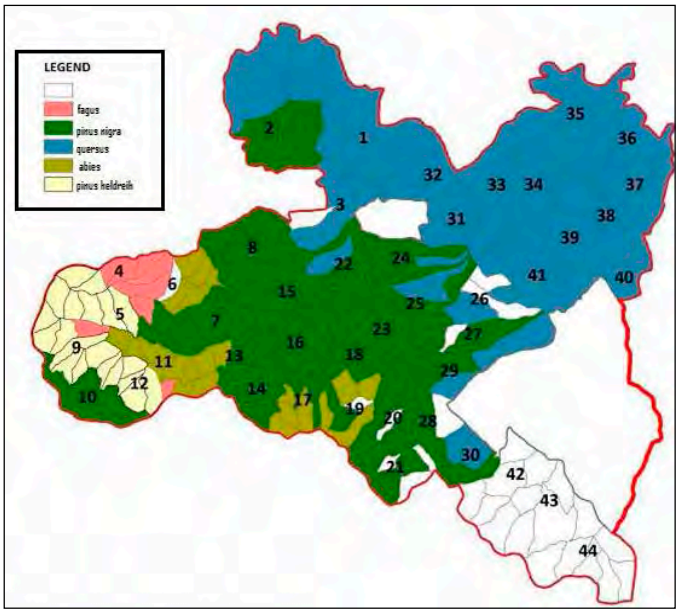


Figure 15: Slope and road network map of Krania Forest

Forest of Krania	
Area	14.948,6 Ha
Tree species	Pinus Nigra; Pinus leukodermis; Abies borisi Regis; Fagus silvatica, Quercus
Management Categories	1. Pinus Nigra
	2. Pinus Nigra & Abies Pegis
	3.Fagus Silvatica
	4. Pinus heldreich
	5. Quersus (conferta; cerris and pubescens)
	6. Quersus (conferta and pubescens)
Main wood products	1. Roundwood
	2. Firewood
	3. Industrial wood
Other uses	Fire Protection, hunting, livestock



Growing stock assessment

The methodological steps undertaken to obtain the statistical data:

- Each plot zone was identified by azimuth and length measurements using a compass and two 50m long tapes.
- In each zone, typical trees were identified, cut and their volumes were measured:

(a) with skin,

(b) skinless and

(c) skinless 10 years old.

- The typical trees were identified and classified according to the following diameter classes:

1	Low	≤ 20cm
2	Middle	20 - 34cm
3	Upper	34 - 48cm
4	Superior	≥ 48cm

- The yearly volume increase Zv was calculated with the volume data using the following volume equations:

$Zv = 0,1849 + 0,0656*V - 0,000177*V^2$ (for *Quercus*)

$Zv = 0,59860 + 0,03023*V - 0,00003*V^2$ (for *Fagus silvatica*)

$Zv = 0,19004 + 0,02926*V - 0,00002*V^2$ (for *Abies borisi Regis*)

$Zv = -0,82874 + 0,004026*V - 0,00004*V^2$ (for *Pinus nigra*)

where: Zv : the yearly volume increase

V : the skinless volume per hα

- The calculation of V is based on the tree diameter at breast height, and on the height of the typical trunk for each diameter category
- other statistical results calculated within the inventory:

1. Growing stock in skinless volume per ha, and aggregated per administrative unit

2. Yearly stock increase in skinless volume per ha and aggregated per administrative unit

3. Mature stock in skinless volume and aggregated per administrative unit

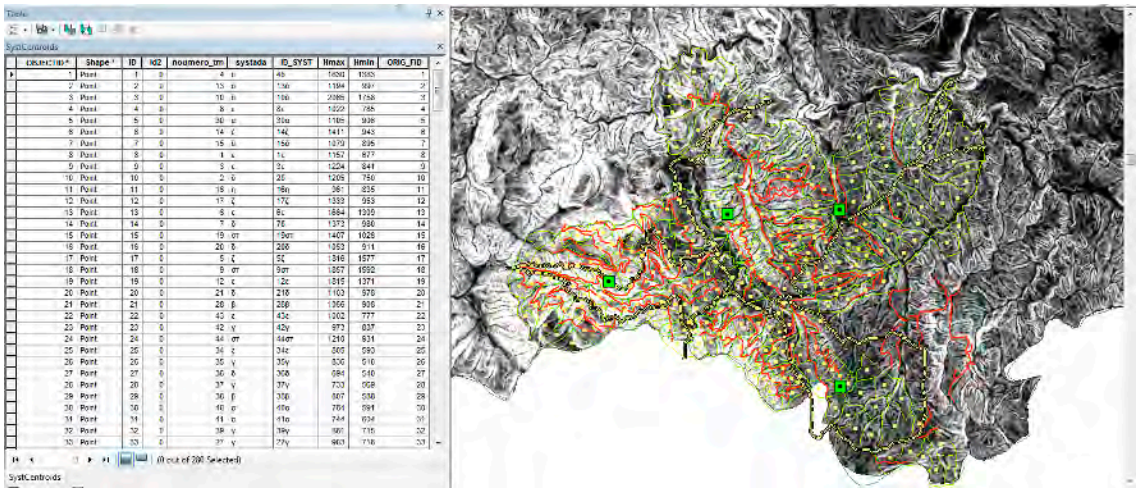


Figure 16: Zonal statistics

ISPRA-FLA (ITALY)

Forest inventory zoning

For the purposes of forest inventory and the development of the management plan, the forest area has been divided into forest management basic units, including:

- Stands – they represent the smallest forest management units, characterised by homogeneity in terms of forest management techniques and silvicultural management. By joining stands, compartments are obtained;
- Compartments – identified on the basis of boundaries corresponding to permanent lines, such as roads, streams, etc., they include areas characterised by homogeneous characteristics in terms of forest composition, physiography, and silvicultural treatments;
- Districts – are obtained by joining different compartments according to forest management goals;

The table below provides a summary of the stands identified within the three areas included in the forest management plan.

Stand n.	Area (ha)	Main aim	Productive Area (ha)	Forest type
CASARGO				
1	8,0452	Production	3,5607	Secondary mountain spruce forest
2	17,0485	Protection	16,900	Secondary mountain spruce forest
3	28,4871	Protection	28,300	Secondary mountain spruce forest
4	17,9022	Production	17,7000	Beech forest
5	13,9116	Production	13,7000	Beech forest
6	22,2049	Production	21,5000	Beech forest
7	23,2347	Production	23,8000	Beech forest
8	16,4288	Production	16,0000	Beech forest
9	15,0400	Conversion to the high stand	11,4264	Beech forest
10	29,9436	Conversion to the high stand	21,1515	Beech forest
11	18,6017	Production	18,4000	Beech forest
12	23,2124	Production	20,1755	Beech forest

Stand n.	Area (ha)	Main aim	Productive Area (ha)	Forest type
13	20,1985	Production	17,1259	Larch forest
14	23,5684	Production	18,7902	Beech forest
15	15,7693	Production	15,6000	Beech forest
16	20,4432	Production	14,5407	Larch forest
17	22,1579	Protection	14,7530	Larch forest
18	18,5118	Production	18,2000	Beech forest
19	22,5907	Production	21,5731	Beech forest
20	28,2560	Production	21,6843	Beech forest
21	20,8063	Production	19,3470	Beech forest
22	31,7821	Production	30,0000	Beech forest
23	33,5697	Production	33,0000	Beech forest
24	16,6971	Production	16,0000	Beech forest
25	31,7336	Protection	30,5938	Beech forest
26	37,9770	Protection	37,1000	Green alder forest
27	32,1707	Protection	31,6000	Larch forest
28	20,0767	Production	19,4010	Beech forest
29	16,7464	Production	13,9847	Beech forest
30	21,1754	Protection	20,4000	Beech forest
31	16,4585	Protection	16,0000	Fir forest
32	25,6085	Protection	25,2000	Larch forest
33	25,3323	Protection	24,8000	Green alder forest
34	7,1500	Production	7,1000	Chestnut forest
MARGNO				
1	24,7450	Production	24,2000	Beech forest
2	24,9529	Production	23,2283	Birch forest
3	27,5649	Production	27,0000	Beech forest
4	27,7246	Production	25,4048	Beech forest
5	22,5616	Production	21.3414	Beech forest
6	25,4543	Production	34,3907	Larch forest
7	13,1000	Protection	9,9611	Larch forest
8	12,3543	Production	9,3771	Beech forest
PARLASCO				
1	19,5353	Production	19,3000	Beech forest
2	21,8577	Production	21,1178	Beech forest
3	17,7000	Protection	18,1110	Beech forest
4	23,6721	Production	20,8265	Beech forest
5	16,1998	Production	12,2686	Beech forest
6	24,0524	Production	15,9039	Beech forest
7	9,9366	Production	8,2005	Ash and hornbeam forest

- Growing stock assessment
- Based on data collected in the field (see 5.1.2.1 section) total and unit volumes were calculated through a simplified approach with stereometric tables according to the following steps:
- within each plot, a sample (called main sample) is identified to determine Gha – i.e. the relascopic ratio (m^2/ha);
- within a sub-sample of the main sample, volumes are determined by means of specific stereometric tables for the main species in the area (beech, fir and spruce);
- the average volume for each stand and, then, for the entire area is determined using the following: $V_{ha} = RG_{ha}$

- Where R is given by: $R = \frac{\sum_{u=1}^{n_{ss}} V_{hau}}{\sum_{u=1}^{n_{ss}} G_{hau}}$ and
- V_{hau} = volume (m^3/ha) determined through stereometric tables after diameters have been measured in the u sampling area within the sub-sample;
- G_{hau} = basal area (m^2/ha) determined through relascope in the u sampling area within the sub-sample;
- n_{ss}= size of the sub-sample
- G_{ha} = average basal area (m^2/ha) measured with the relascope in the main sample.

DRAFD- REGION OF SICILY (ITALY)

Forest inventory zoning

The whole planning area has been divided into territorial and silvicultural units functional to the forest management. The basic level of such subdivision is the one based on the identification of units delimited by natural and permanent boundaries (woodlots), or on the basis of easily identifiable boundaries both on the ground and on the map. These boundaries can be either natural (watersheds, impluvium, waterways, etc.....) and anthropic (roads, trails, power lines, etc.).

Inside of the forest particles some subunits were then identified, characterized by homogeneous characteristics of the stands for land use, species' composition, age or stage of development, function assignable and applicable forestry care. These units are called sub-particles. During the preparatory phase for the practical verification, the limits of the forest sub-particles were tentatively identified through the photo interpretation in a GIS environment, also using the information provided by forest maps developed in previous works (Fig. 9).

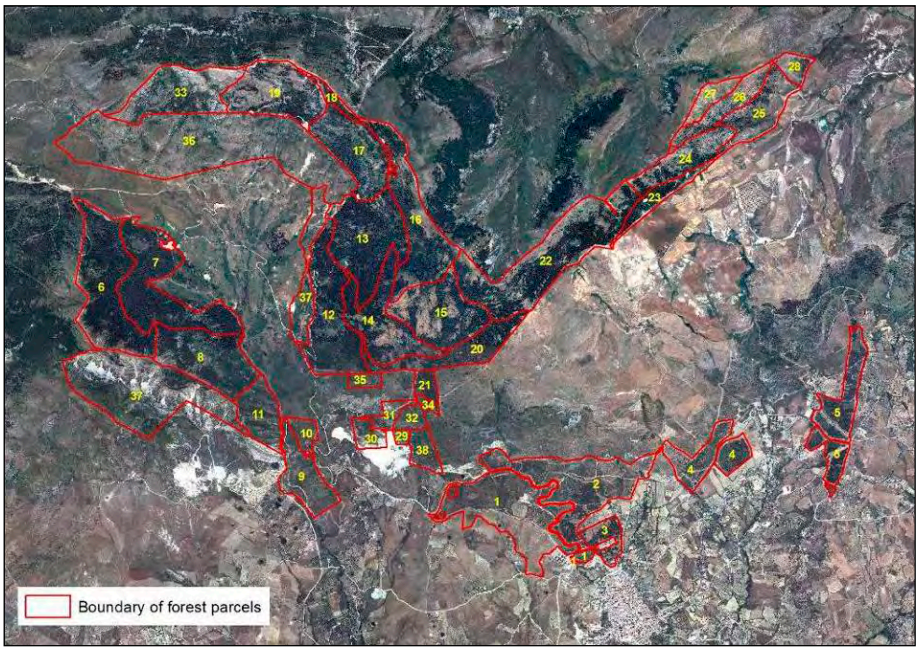


Figure 17: Particles subdivision of the area of study

The subdivision of the area led to the identification of a total of 39 particles with an average surface area of 25 ha, and 436 sub-particles, on average 17 for each particle.

On the study area also some macro areas (section) were identified, each corresponding to a body separated from the others. This division of the surface to plan does not correspond to a purely managerial criterion, but to

a territorial and administrative division that could be useful in the plan implementation phase. In the area the following three sections have been identified:

a) Contrada Torcitore;
b) Monte Rose,
c) Contrada Prato-Canfuto.

During the on field surveys the forest sub-particles ultimate limits were identified, distinguishing what was not possible to determine by photo- interpretation (silvicultural system, differences in height, average diameter, tree density and specific composition, operations performed).

Another very important phase of the surveys was to describe, for each sub-particle, a set of stational, physiognomic - structural and management parameters of the forest stands. The acquisition of these parameters is crucial for the attribution of the predominant function and the consequent silvicultural orientation to be assigned to each sub-particle.

- Growing stock assessment

Following the field surveys, the final version of the map of forest types was edited, also estimating for each sub-particle the wood volume. In particular, the volume of logs was determined according to the dendrometric data collected in 26 sample plots realized in previous experimental works carried out by the Department of Agricultural and Forest Sciences of the University of Palermo. The sample plots available can be considered representative of the structural and dendrometric characteristics of forest stands pertaining to each typology. For each tree belonging to each sampling area the diameter at 1.30 m (D) and the total height (H) were measured.

The unitary volume per hectare was determined using double entry volume tables, on the basis of the average tree density/hectare values, the average height for each of the three main species and the average diameter considered representative of the entire forest stands.

By way of example, the methodology used for the volume calculation of a single sub-particle is reported below. The following table shows the equations used for the determination of the average height (H) of each species on the basis of the average diameter of the stand (D) and the equations for the volume estimation.

Equations used to calculate the height value for each species based on average diameter:

Species	Height function
Aleppo pine	H = 7,1894*Ln(D) - 8,953
Cypress	H = 6,0391*Ln(D) - 6,0015
Atlas cedar	H = 5,9365*Ln(D) - 6,7675

Volume equation for each species (for our sample only the equation for three species are shown)

Aleppo pine
$v = a + b_1 d^2 h + b_2 d + b_3 h + b_4 dh + b_5 d^2 + b_6 d^3 + b_7 d^3 h^2$
Where: v = volume (m3) h = height (m) d = diameter at breast height (cm) a = 0,129174 b1 = 3,01592E-05 b2 = -0,0141482 b3 = -0,0125895 b_4 = 0,000904472 b_5 = 0,000279059

Aleppo pine
b_6 = -6,45571E-07 b_7 = 2,58438E-09
Cypress
$v = a+b_1d^2h+b_2d+b_3d^3+b_4h^2+b_5dh^2+b_6d^2h^2+b_7d^3h$
Where: v = volume (m^3) h = height (m) d = diameter at breast height (cm) a = 0,000956615 b_1 = 3,51034E-05 b_2 = 0,00018268 b_3 = -1,09054E-06 b_4 = -0,000084823 b_5 = 1,37602E-05 b_6 = -1,35874E-07 b_7 = -4,56717E-08
Atlas cedar
$v = a+b_1d^2h+b_2d+b_3h+b_4dh+b_5d^2+b_6h^2+b_7dh^2+b_8d^2h^2+b_9d^3+b_{10}d^3h$
Where: v = volume (m3) h = height (m) d = diameter at breast height (cm) a = 8,79E-04 b_1 = 2,50E-05 b_2 = -4,71E-04 b_3 = 1,08E-03 b_4 = 5,63E-05 b_5 = 8,49E-05 b_6 = 3,08E-05 b_7 = 7,58E-06 b_8 = 5,32E-08 b_9 = -1,09E-06 b_{10} = -2,82E-08

Dendrometric data

Parcel/subparcel	Forest type	Species	Mean stand diameter (cm)	Mean height* (m)	Unit volume** (m^3)	Tree density (N° tree/ha)	Volume (m^3/ha)
13/14	Mixed Aleppo pine and Cypress forest	Aleppo pine	25	14,19	0,36	306	110,16
		Cypress		13,43	0,31	122	37,82
		Atlas cedar		12,34	0,28	59	16,52
Total values						487	164,50

* See the table above of the of the height functions

** See the table above of the volume equations

ICNF-ALGAR (PORTUGAL)

Forest inventory zoning

Plots with wood production function

In the Management Plan were only selected portions classified for timber production (from this group were excluded about 7 hectares corresponding to a portion of cypress species for which we do not have growth models), including parcels nº 3, 5 and 11. These plots consist of stone pine and maritime pine, with two age classes (2 and 20 years). The total area of these plots is 142 hectares (17% of the total area of the property).

Plot	Occupation	Area (ha)	% from total
Plot 3	Pinus pinaster (2 anos)	101.5	72%
Plot 5	Pinus pinaster (20 anos) X Pinus pinea (2 anos)	19.8	14%
Plot 11	Pinus pinaster (20 anos)	20.3	14%
TOTAL		141.6	

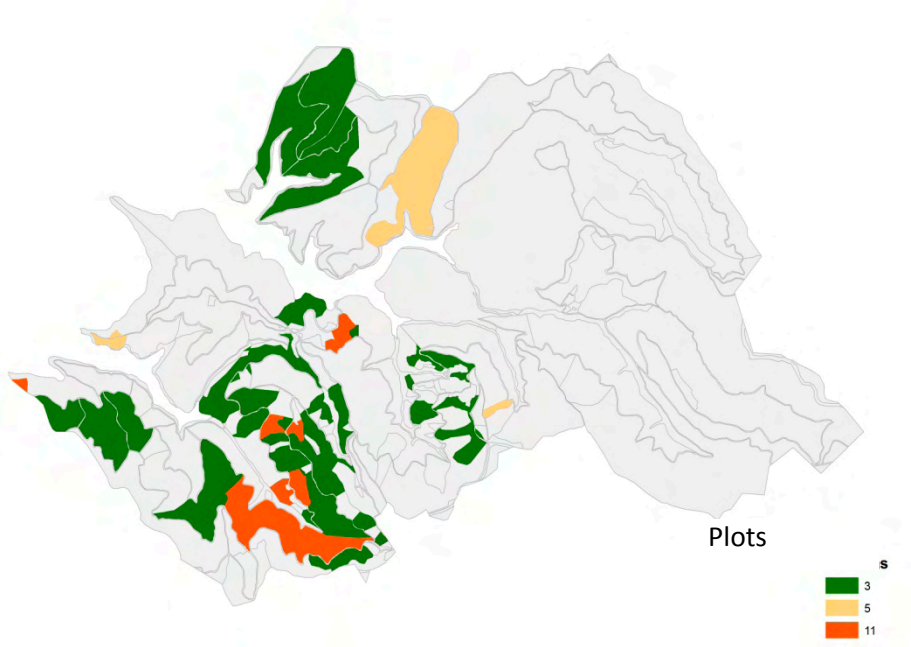


Figure 18: Selected plots

Growing stock assessment

For this assessment, the methodology followed was the one used on the National Forest Inventory 5 (IFN5), which is based on sample plots and biomass equations. It will be used 2000 m^2 circular plots in stands of cork and holm oak and 500 m^2 in stands of other species.

Following these sampling units for homogeneous plots and using the equations set out below we obtain estimates of biomass for the areas to manage.

The biomasses reported for different forest species, and different biomass components were dry weight estimated. For each species, we used a mathematical growth model (see below in “tables production model”) to obtain the two dendrometric variables (diameter at breast height and total height) needed for the IFN biomass equations.

- Equations for estimating biomass – *Pinus pinaster* and various softwoods

(1) $Wi = \beta 0\ d\beta 1\ h\beta 2$ (i = s, b)

(2) $Wi = \beta 0\ d\beta 1\ (h/d)\beta 2$ (i = br, l)

(3) $Wi = \beta_0\ d^{\beta_1}$ (i = r)

Component	Model	β_0	β_1	β_2	Source
Trunk (ws)	1	0,0146	1,94687	1,106577	Tomé et al.,2007
Bark (wb)	1	0,0114	1,8728	0,6694	Tomé et al.,2007
Branches (wbr)	2	0,00308	2,75761	-0,39381	Tomé et al.,2007
Needles (wl)	2	0,09980	1,39252	-0,71962	Tomé et al.,2007
Total area (wa)	Wa = ws + wbr +wl				
Roots (wr)	Wr = 0,2756 * wa				Tomé et al.,2007

d - Diameter of the tree measured in height (cm) at 1,30 m;

h - Total height (m);

wi - Biomass of tree component i (kg);

wa - Total aerial biomass of the tree (kg).

- Equations for estimating biomass – *Pinus pinea*

(1) $Wi = \beta_0\ c^{\beta_1}\ h^{\beta_2}$ (i = w, b)

(1) $Wbr = \beta_0\ c^{\beta_1}$

(2) $Wl = \beta_0\ c^{\beta_1}\ (h/d)^{\beta_2}$

(3) $Wr = \beta_0\ d^{\beta_1}$

Component	Model	β_0	β_1	β_2	β_3	Source
Wood (ww)	1	18,8544	1,6755	0,9485	-	Tomé et al., 2007
Bark (wb)	1	8,0810	1,5549	0,4702	-	Tomé et al., 2007
Branches (wbr)	2	184,9365	3,0344	0,4702	-	Tomé et al., 2007
Leafs (wl)	3	22,2677	1,7607	-0,5003	-	Tomé et al., 2007
Total area (wa)	Wa = wl + wbr + wb + ww					
Roots (wr)	4	0,4522	1,1294	-	-	Tomé et al., 2007

c - the Tree circumference measured at 1.30 m height (m);

d - Diameter of the tree measured in height (cm) at 1,30 m;

h - Total height (m);

wa - Total aerial biomass of the tree (kg);

wi - Biomass of the tree component (kg).

The simulations were made to the moments (ages) when the thinning operations (or final cuts) are foreseen and, knowing the dimensions of the average tree at that moment, and the number of trees removed in each operation is possible, recurring to the equations, to obtain productivity values.

Methodology to be applied to scrub areas

The methodology for calculating the residual forest biomass (FB) coming from the bushes was based on calculating the volume occupied by each species (fitovolume), combining it with the density of each species.

In every plot, vegetation was evaluated in several height levels. In each of these height levels (of predefined volume) the percentage of occupation of each species was evaluated, as a % of the total volume of the level.

The calculation of each species fitovolume is determined in two steps:

1) Calculate the total volume of each height level;

2) Multiply the % values of covered in each of the species present.

Therefore, we obtain, for each plot and for each species, the volume occupied (fitovolume). After obtaining the fitovolume values for each species, these are multiplied by their bulk density. Based on a literature research, and considering the most-common species, the use of the table below is suggested, which is described in Silva et al. (2006), always reported in terms of a dry basis.

Espécie	Densidade aparente ($kg.m^{-3}$)
Phillyrea latifolia L. ouRhamnusaleterbus L.	1.943
Rosmarinusofficinalis L.	1.943
PistacialentiscusL.	1.943
Ilexaquifolium L.	1.943
Pterospartumtridentantum L.	3.488
Quercuscoccifera L.	1.305
Quercuslusitanica Lam.	1.305
Pyrusspp.	1.943
Adenocarpusspp.	1.929
CistusladaniferL.	1.208
Cistusspp., Genistaspp. ouSpartiumspp.	1.929
Ruscusaculeatus L.	1.943
Phillyrea angustifolia L.	1.943
Arbutusunedo	1.476
Lavandulaspp.	1.593
Cistussalvifolius L.	1.888
Rubusspp.	0.930
Dittrichiaviscosa (L.) W. Greuter	1.943
Ullexspp.	3.666

Espécie	Densidade aparente ($kg.m^{-3}$)
Thymusvulgaris L.	1.593
Daphne gnidium L.	1.943
Ericaspp. ouCallunaspp.	1.947
Juniperusspp.	1.943
Outras	1.943

Considerations

Once the biomass estimation is made by tree component, it's possible to adapt the estimations to each parcel and to the required final use.

When the main purpose of the settlement is to use timber in sawmill or other than the use of biomass for energy purposes, it is more appropriate to designate this component by residual forest biomass (BFR) which is the biodegradable fraction of products, and waste from forestry. It includes only the resulting material from management operations, driving operations and exploration of the forest.

Tables production models and forestry

For each species, we used a growth model to estimate the size of the trees. Models were adopted forestry included in PGF. The calculation of the biomass productivity was estimated using the equation used for IFN, described above. The following tables present the values considered.

Pinus pinaster (2 years)

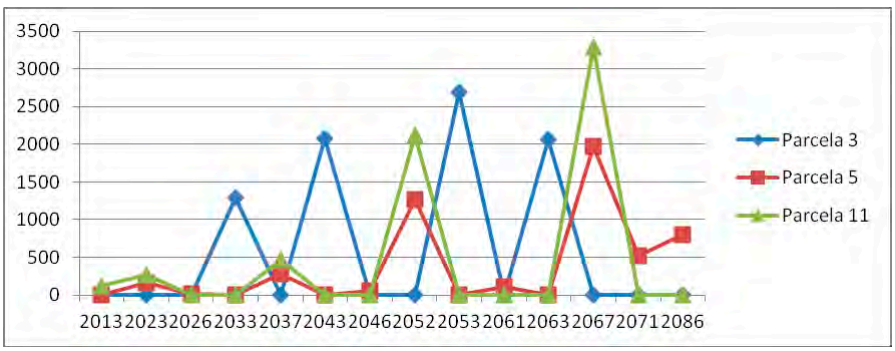
Pinheiro bravo jovem (2 anos)								
iAge	hdom	CQ	d	N	Year	Trees	Biomass (ton/ha)	Averange- (ton/ha/ano)
2	0.4	15	0.3	909	2013			
7	3.5	15	12.6	909	2018			
12	6	15	11.6	908	2023			
17	8	15	16.1	908	2028			
22	9.6	15	19.2	909	2033			
desbaste (15%)						137	12.8	0.6
27	10.9	15	22	772	2038			
32	12	15	24.2	772	2043			
desbaste (15%)						116	20.5	2.1
37	13	15	26.3	656	2048			
42	13.8	15	28.1	656	2053			
desbaste (15%)						99	26.5	2.7
47	14.5	15	29.9	557	2058			
52	15.2	15	31.5	557	2063			
Corte realização						557	204.0	20.4
TOTAL							263.8	5.1

Pinheiro bravo adulto (20 anos)								
20	9	15	16.6	612	2013			
desbaste (15%)						92	6.1	0.3
25	10.4	15	20.5	520	2018			
30	11.6	15	23.7	520	2023			
desbaste (15%)						78	12.9	1.3
35	12.6	15	26.7	442	2028			
40	13.5	15	29.2	442	2032			
45	14.3	15	31.4	442	2037			
desbaste (15%)						67	23.3	1.6
50	15	15	33.7	375	2042			
55	15.6	15	35.6	375	2047			
60	16.2	15	37.4	375	2052			
Corte realização (50%)						188	104.1	6.9
65	16.7	15	40.1	187	2057			
70	17.2	15	42.5	187	2062			
75	17.6	15	44.8	187	2067			
Corte realização (100%)						187	162.0	10.8
TOTAL							308.4	4.1

Pinus pinea (2 anos)								
10	0.9	14	9.0	960	2021			
15	1.9	14	11.6	960	2026			
desbaste (15%)						125	1.1	0.1
20	2.9	14	14.1	835	2031			
25	5.0	14	16.6	835	2036			
30	5.9	14	19.0	835	2041			
35	6.8	14	21.4	835	2046			
desbaste (15%)						109	7.7	0.4
40	7.6	14	23.8	726	2051			
45	8.4	14	26.1	726	2056			
50	9.1	14	28.3	726	2061			
desbaste (15%)						95	13.9	0.9
55	9.7	14	30.6	631	2066			
60	10.4	14	32.8	631	2071			
Corte realização (50%)						316	66.0	6.6
65	11.0	14	34.97424	315	2076			
70	11.6	14	37.12081	315	2081			
75	12.1	14	39.24351	315	2086			
Corte realização (100%)						315	101.5	6.8
TOTAL							190.2	2.5

Production schedule

Taking into account the structure of the plots and the values included in the tables above a calendar of biomass production was prepared.



4.4.3 Forest management planning process

LP DGMA

As an example, the information about the Long-Term Plan for the District A (with production function) has been summarised in the following table. It can be taken as a model or, otherwise, the information must be filled in the corresponding sections.

DISTRICT A		
Principal species	Scientific name	Pinus halepensis
	Common name	Pino de Alepo
	Shade tolerance	Heliophilous
	Regeneration method	Even- or two-aged seedling forest (district level)
Secondary species 1	Scientific name	-
	Common name	-
	Shade tolerance	-
	Regeneration method	-
Main species rotation period (years)		75
Previous standardisation period (in case) (years)		-
Main species regeneration period (years)		15
Main function of the District		Production/protection
Principal uses		logging/woody uses
Other possible uses		Livestock; cynegetic; recreational uses
Current stand structure		Even- or two-aged stand
Target stand structure		Even- or two-aged stand
Ideal Forest Management System		Floating periodic block method
Regeneration method/cutting		Shelterwood cuttings in plots or Shelterwood cuttings using intensive seed cuts.
Other important silvicultural treatments		Precommercial thinnings; thinnings; Improvement cuttings; phytosanitary cuttings.

CRPF-PACA (FRANCE)

The available resource of softwood is around 50000 tons/year (850kg/m^3), with the following distribution and can be divided as follows:

					Stand volume			Harvestable softwood		
Forest type	**Softw. potential**	***Description***	**Surface (Ha)**	**%**	**Total (m3)**	**Softwood (m3)**	**Softwood (m3/ha)**	**m3/ha r=20 ans**	**m3/an**	**%**
Landes, Garrigue		*Vol/ha < 20 m3/ha*	5097	8%	62782	25466	5	0	0	0%
Hardwood		*Vol/ha Res < 50 m3/ha*	17011	26%	679199	34700	2	0	0	0%
Mixed with hardwood predominant	**Low**	*Vol/ha Res < 30 m3/ha*	1689	3%	82279	32921	19	0	0	0%
	Medium	*Vol/ha Res > 30 m3/ha*	1677	3%	141673	56577	34	20	1677	3%
Mixed with softwood predominant	**Medium**	*40 <Vol Res /ha < 70 m3/ha*	7190	11%	540710	352684	49	40	14101	24%
	High	*70 <Vol Res /ha*	2153	3%	253062	164720	76	60	6460	11%
Softwood low density		*20 <Vol Res /ha < 50*	9458	15%	339363	251870	27	0	0	0%
Softwood medium density	**Medium**	*50 <Vol Res /ha < 70*	3781	6%	198321	188852	50	10	1891	3%
	High	*70 <Vol Res /ha < 90*	7670	12%	581442	551318	72	30	11505	20%
Softwood dense	**Medium**	*90 <Vol Res /ha < 120*	6623	10%	718585	680925	103	40	13245	23%
	High	*120 <Vol Res /ha*	2651	4%	345751	329946	124	70	9268	16%
TOTAL			**65000**	100%	**3943166**	**2669979**	**41**		**58148**	100%

SFI (SLOVENIA)

A pilot forest property management plan was made following those steps:

- Selection of a potential region
- Selection of the potential owner willing to contribute to forest biomass use in the region
- Analyse of the forest on the property according to available information from forests GIS
- Analyse of energy demands in the area
- Presentation of analyse results to different participants
- Adjustment of the forest property management plan
- The main three silviculture guidelines prescribe following actions: progressive change thinning of forest stands, progressive renovation of forest stands, silviculture works in mature stands.

GoV (VALENCIANA-SPAIN)

An example of the description and proposal of silvicultural treatments to do in a stand is presented. There is the same document for every stand of each department and district:

Forest name: Sierra Negrete (Utiel)	DISTRICT: A
Data: 28/02/2012 Equipment: *JLMM*	Compartment: 01 Stand: 01

SURFACE	**TOTAL** *42,09* (ha)	**FOREST** *41,11* (ha)	**NON FOREST** *0,98* (ha)
UTM X: 651797,87 m **UTM Y:** 4393582,13 m	ALTITUDE Mín. *878* (m) Máx. *998* (m)	DOMINANT ASPECT NORTH	DOMINANT SLOPE 16 (%)

KIND OF STAND	Pure stand of polewood-sapling Pinus halepensis

WOODED

STRUCTURE: two-aged stand FCC (%): 60 % Density index: Incompleta hueca

Species	Pinus halepensis	Quercus ilex	-
FCC (%)	60	05	-
% trees	90	10	-
Tree stratum	all	dominated	-
Vitality:	good	good	-

REGENERATION

Species	Pinus halepensis	-	-
% presencia	100	-	-
Height (m)	0,50	-	-
Vitality // % assured regeneration	good // 80%	-	-

BRUSH

Species	Quercus coccifera	Juniperus oxycedrus	Rosmarinus officinalis
Canopy cover (%)	10	20	40
Height (m)	0,50	1,20	0,40

SELVICULTURAL DESCRIPTION

One stand's compartment populated by Pinus halepensis evenly distributed across its surface and with frequent clears. There is a scanty understory of Quercus ilex. Presence of some Juniperus phoenicea trees. The main form of the mass is two-aged stand, with a bi-stratum structure. The main age classes are high polewood and low sapling. The tree density is adequate and only rarely elevated. The trees have good increases in height but have tortuous and twisted shanks. The brush is typical Mediterranean garrigue, composed of Quercus coccifera, Juniperus oxycedrus and Rosmarinus officinalis.

Fuel model (Rothermel): 7

FORESTRY MANAGEMENT PROPOSAL AND PRIORITY
Seed cutting that affect Pinus halepensis, leaving standing trees with better phenotype of department, and so as to achieve an even distribution across the surface. Strong intensity is cutting, leaving 1/4 trees of the initial mass. Development of Quercus ilex submerged trees with potential growth. Will be respected Juniperus phoenicea trees. Special precautions to ensure vegetation cover in areas with low densities, avoiding these cases reduce canopy cover.
Priority: Medium

LIDAR ESTIMATE DATA			
Trees/ha: *431*	Dm (cm): *16,17*	Hm (m): *5,97*	Wood vol. (m^3/ha): *61,55*
AB (m^2/ha): *10,65*	Do (cm): *20,80*	Ho (m): *7,83*	Biomass (Tn/ha): *30,51*

OBSERVATIONS
- Waste is cutting overall department.
- The department includes agricultural land in production.
- Forest inventory plots numbers 232 and 233.
Accessibility infrastructure: Close to forest road (easy accessibility to department).

REGION OF WESTERN MACEDONIA (GREECE)

In the table, below, is presented the logging plan of the forest Krania per forest stand for the period 2005-2014

Forest of Krania	
year of cutting treatment	Forest stand
2005	**22β** (1680 m^3), **3α** (588 m^3) **,31α** (1260 m^3)
2006	22β (260 m^3), 22γ, 3α, (588 m^3), 31α (1260 m^3)
2007	**25β**, **25ζ**, **25θ** (342 m^3), **3α** (588 m^3), **31α** (810 m^3), **31β** (450 m^3)
2008	**25θ** (262 m^3), **26 γ** (1418 m^3), **3β** (588 m^3), **31β** (1260 m^3)
2009	**26γ** (426 m^3) , **29γ, 29δ** (195 m^3), **3β** (588 m^3), **31β** (1260 m^3)
2010	**29δ** (455 m^3), **29ε** (1225 m^3), **3β** (588 m^3), **31β** (104 m^3), **31γ** (1156 m^3)
2011	**29ε** (539 m^3), **29ζ, 30α** (255 m^3), **3β** (588 m^3), **31 γ** (1260 m^3)
2012	**30α** (1680 m^3), **3β** (588 m^3), **31γ** (521 m^3), **31δ** (1260 m^3)
2013	**30α** (371 m^3), **30β** (1309 m^3), **3β** (270 m^3) , **3δ** (318 m^3), **31δ**(322 m^3) ,**33 α** (938 m^3)
2014	30β (264 m^3), 30γ, 3δ (588 m^3), 33α (1260 m^3)

ISPRA-FLA (ITALY)

For each stand specific profiles have been developed, to provide *ad hoc* information on stand composition state and management orientation.

As an example, the profile for stand nr. 1 in Margno municipality is provided below.

COMUNE DI MARGNO — **PARTICELLE BOSCATE** — **Part. 1** — **LOCALITA'** Valle Grasso - Stalle Piazza

Particella:	1
Classe colturale	Bosco
Classe economica	Ceduo
Attitudine prevalente:	Produzione
Tipologia forestale prevalente:	Faggeta montana dei substrati silicatici dei suoli mesici
Anno di inventario:	

CEDUO

RIEPILOGO DEI DATI PRINCIPALI PER CLASSE ECONOMICA — STIMA DELLE MASSE E DEGLI INCREMENTI

Superficie produttiva forestale (ha)	fertilità	età media [anni]	densità media	h media [m]	Area basimetrica Unitaria [m2 ha -1]	Area basimetrica Totale	diam medio [cm]	Vol pianta media [m3]	N° medio piante	Provvigione Reale [m3 ha -1]	Provvigione Reale [m3]	Incremento Corrente [m3 ha -1]	Incremento Corrente [m3]	Incremento %
24,2000	VI	38	0,78	17,52	28,13	680,8	23,94	0,34	625	219,75	5317,98	9,62	232,815	4,377

Tipo di rilievo	relascopico diametrico per particella forestale
Superficie totale lorda [ha]	24,7450
Superficie colturale [ha]	
Improduttiva	
Incolti non arborati	0,5450
Incolti arborati	
Multifunzione forestale	
Produttiva forestale	24,2000

CEDUO

COMPOSIZIONE E RIPARTIZIONE IN CLASSI DIAMETRICHE DEL SOPRASSUOLO RILEVATO

Specie	Piante piccole (12,5 - 30 cm) Piante [n.]	Massa [mc]	Massa [%]	Piante medie (30 - 50 cm) Piante [n.]	Massa [mc]	Massa [%]	Piante grosse (> 50 cm) Piante [n.]	Massa [mc]	Massa [%]	TOTALI Piante [n.]	Massa [mc]	Massa [%]
Fagus sylvatica	267	40,16	18,27	162	79,88	36,35	30	56,4	25,66	459	176,44	80,29
Castanea sativa	56	9,06	4,12	22	10,12	4,6		1,63	0,74	79	20,82	9,47
Betula alba	15	1,72	0,78	7	2,13	0,97	3	2,86	1,3	25	6,72	3,06
Quercus petrea	7	1,49	0,68	4	2,11	0,96				11	3,61	1,64
Larix decidua												
Picea abies												
Abies alba												
Tilia plathyphyllos	13	1,6	0,73	9	4,92	2,24	1	1,66	0,75	23	8,19	3,73
Fraxinus excelsior												
Altro	26	2,62	1,19	1	0,49	0,22	1	0,82	0,37	28	3,94	1,79
	384	56,68	25,79	205	99,67	45,35	35	63,38	28,84	625	219,75	100

Classi di accessibilità [ha] I	II	III
6,7000	17,5950	0,4500

Sviluppo lineare viabilità forestale 1 cat [Km]	2 cat [Km]	3 cat [Km]
----	0,200	----
4 cat [Km]		

FUSTAIA

RIEPILOGO DEI DATI PRINCIPALI PER CLASSE ECONOMICA — STIMA DELLE MASSE E DEGLI INCREMENTI

Superficie produttiva forestale (ha)	fertilità	età media [anni]	densità media	h media [m]	statura [m]	Area basimetrica Unitaria [m2 ha -1]	Area basimetrica Totale	diam medio [cm]	Vol pianta media [m3]	N° medio piante	Provvigione Normale [m3 ha -1]	Provvigione Reale [m3 ha -1]	Provvigione Reale [m3]	Incremento Corrente [m3 ha -1]	Incremento Corrente [m3]	Incremento %

COMUNE DI MARGNO — **PARTICELLE BOSCATE** — **Part. 1** — **LOCALITA'** Valle Grasso - Stalle Piazza

DESCRIZIONE DELLA STAZIONE

ALTITUDINE m. s.l.m.

Prevalente	Minima	Massima
1.040	830	1.250

ESPOSIZIONE PREVALENTE: Nord - Ovest

PENDENZA MEDIA: Molto inclinato

MORFOLOGIA: Non accidentato

SUBSTRATO LITOLOGICO: Morenico

CARATTERISTICHE PEDOLOGICHE

Suolo bruno, mediamente profondo con tessitura limosa sassosa, di consistenza sciolto, fresco.

DESCRIZIONE DEL SOPRASSUOLO

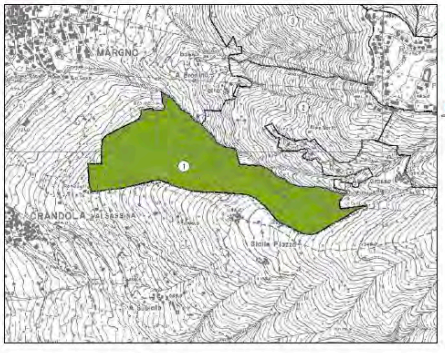
Particella forestale interessata dalla presenza di una faggeta montana di discreto interesse e con buone provvigioni, in parte non utilizzata da circa 50 anni.
La composizione è alquanto varia ma la specie nettamente dominate è il faggio, che in termini percentuali di massa supera il 60%. Il bosco ceduo è edificato da ceppaie molto ricce in polloni, con soggetti anche abbastanza alti ma spesso malconformati. Nella zona centrale della sezione si ha la parte migliore del soprassuolo, con piante talvolta isolate, praticamente con portamento da fustaia. Nel complesso la massa ad ettaro raggiunge quasi i 220 m3/ha, quindi presenta valori elevati. E' prevista un'utilizzazione nella parte più ricca della sezione, nei tratti meno acclivi, con taglio di circa 1.200 m3. In alto la densità del bosco e la necessità di intervento sono inferiori in quanto, il terzo superiore di particella, è stato già percorso da un taglio di conversione all'altofusto nell'inverno 1998-99; inoltre, presso il confine superiore, il soprassuolo si impoverisce, divenendo progressivamente più ricco in betulla. Sarebbe importante prevedere la realizzazione di una bretella di accesso dalla strada agrosilvopastorale Crandola – La Piazza, per servire questa sezione forestale.

PIANO DEI TAGLI

RIPRESA

FUSTAIA	accessibilità codice trattamento	
Volume corm lordo unitario particella (mc / ha)		
Superficie presa (ha)		
Volume lordo ripresa (mc)		
Volume netto presunto ripresa (mc)		
Tasso di utilizzazione particella (%)		
Anno intervento / urgenza		
MASSA INTERCALARE	accessibilità codice intervento	
Volume cormometrico lordo (mc)		
Anno intervento / urgenza		
CEDUO	accessibilità codice trattamento	II 155
Volume dendrometrico (mc)		1.200,00
Ripresa (qli)		12.000,00
Anno intervento / urgenza		II

INQUADRAMENTO TERRITORIALE



PIANO DELLE MIGLIORIE

INTERVENTI

INTERVENTI COLTURALI

Taglio raso matricinato

Codice	Urgenza	Accessibilità	Unità di misura	Quantità
155	II	II	ha	12.00.00

INTERVENTI INFRASTRUTTURALI

Codice	Urgenza	Accessibilità	Unità di misura	Quantità

ALTRI INTERVENTI

Codice	Urgenza	Accessibilità	Unità di misura	Quantità

CRITERI GENERALI INTERVENTO PIANI TAGLI E MIGLIORIE

TAGLIO RASO MATRICINATO nei terzi inferiori di particella, consistente in: taglio del soprassuolo con rilascio di almeno 90 matricine per ettaro scelte tra i soggetti meglio conformati e più vigorosi

DRAFD- REGION OF SICILY (ITALY)

The following table shows, a brief description of the measures planned, the areas of intervention and the forest types involved, for each forest category.

Forest categories	Characterization	Forestry operations planned	Surface affected by silvicultural operations (ha)
Downy oak forest	Forests generally with sparse cover and irregular structure strongly degraded due to past uses, grazing and fires. During the term of the plan, they are only expected to follow their natural evolution.	-	0,00
		Subtotal	0.00
Holm oak forest	Forests generally with sparse cover, partly located inside of rocky areas, where no forestry operations can be carried out. Stands located in less accidental areas present, an irregular structure however, strongly degraded due to past uses, grazing and fires. During the term of the plan, they are only expected to follow their natural evolution.	-	0,00
		Subtotal	0.00
Autochthonous broadleaf forest (maple, elm, ash, poplar)	Woods typically of natural origin with scarce surfaces, located on marginal areas with ecologically unsuitable stational characteristics for the most-common forest species (low fertility, high rockiness, riparian areas). No active management is foreseen except in some rare units of artificial origin.	Planting to increase forest density	0.60
		Subtotal	0.60
Mediterranean conifers reforestations	Even-aged high forests aged between 40 and 60 years, with usually high coverage and tree density. In many areas, it is possible to find natural regeneration of native hardwood species (Downy oak and Holm oak), for which the forestry orientation is towards naturalization.	Thinning cuts	116.89
		Localized thinning cuts	7.46
		Monitoring	5.28
		Planting to increase forest density	4.46
		Thinning cuts on young stand to decrease forest density	1.27
		Underplanting	0.97
		Operation for retraining recreation areas	0.51
		Subtotal	136.84
Mountainous conifers reforestations	Even-aged high forests aged between 30 and 50 years, with high coverage and density. In many areas, it is possible to find natural regeneration of native hardwood species (Downy oak and Holm oak), for which the forestry orientation is towards naturalization.	Thinning cuts	108.68
		Underplanting	7.86
		Planting to increase forest density	1.11
		Localized thinning cuts	0.54
		Monitoring	0.44

Forest categories	Characterization	Forestry operations planned	Surface affected by silvicultural operations (ha)
		Subtotal	118.63
Eucalypt forest	Mostly high forests with presence of scattered groups of coppice in degraded or burnt areas. Average coverage of 60%, poor natural regeneration. The main silvicultural orientation is towards naturalization through the underplanting with native hardwoods and the control of the number and vigor of sprouts from stumps.	Underplanting	14.77
		Thinning cuts for forest restoration	6.45
		Thinning cuts	4.45
		Subtotal	25.67
Total			281.74

ICNF-ALGAR (PORTUGAL)

The planning process was carried on in a 3 phases sequence: characterization of the current situation, definition of objectives and construction of planning proposals. These phases are legally defined and structured.

The first phase permits the total characterization of the area (topographical, climatologically, edaphically and forest occupation). Also the associated resources (houses, beekeeping apparatus, etc.) are identified. This characterization is the basis for the planning proposals.

In order to obtain the planning proposal from the existing situation, this information is modulated with the main management objectives. These objectives depend on the ones included in upper levels planning instruments (regional and national plans) and on forest spaces functions adopted for the area. These functions include production, protection, conservancy, recreation and cattle breeding and hunting. These functions are then affected by each of the management units (plots) defined for the area.

In the case of Herdade da Parra National Forest the management units definition was mainly defined accordingly to the main occupation. Other factors considered, in crescent order of importance were: age classes, type of terrain preparation (important to establish future intervention options), as accessibility (the areas closer to roads will present higher priority for exploration).

For each of these units, a set of silvicultural prescriptions was defined and coordinate among all, constituting the final management plan.

4.4.3.1 Main species

LP DGMA

DISTRICT A: Pinus halepensis

DISTRICT B: Pinus halepensis

DISTRICT C: Pinus halepensis

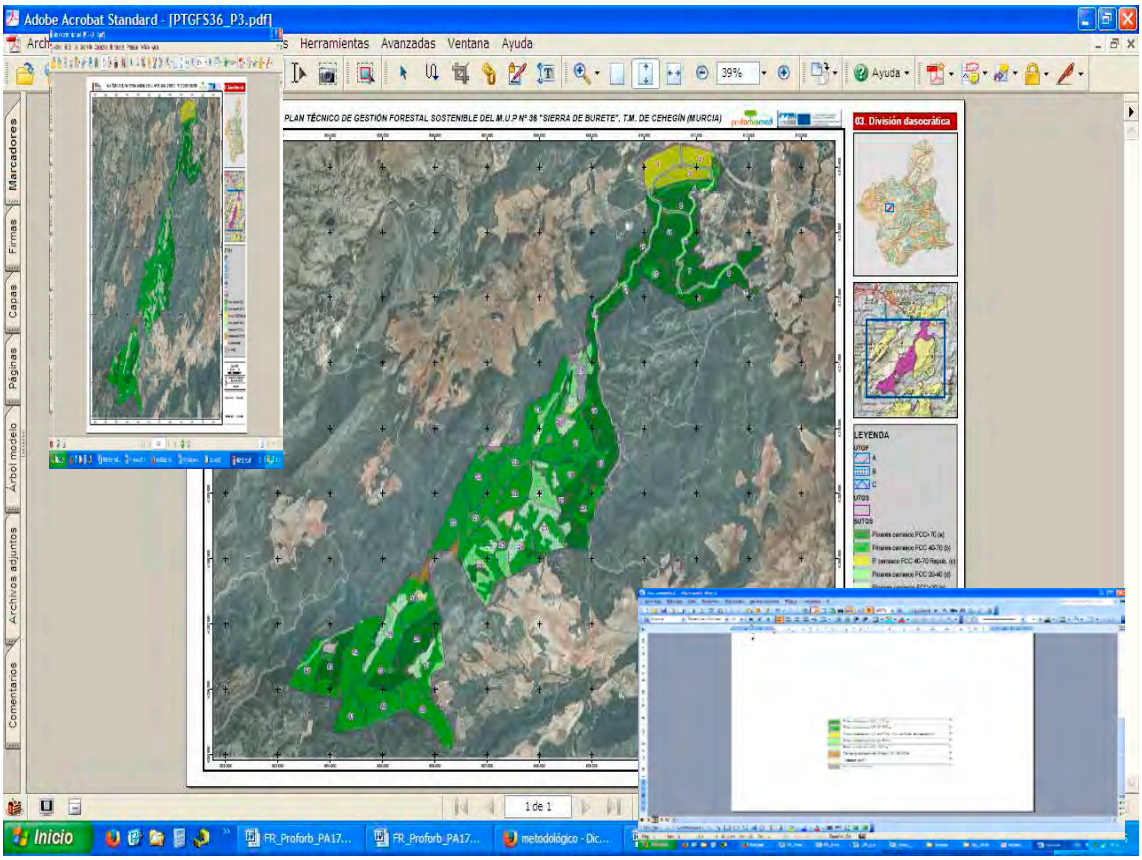


Figure 19: Main species distribution

Quercus ilex has an occasional representation in District "C."

CRPF-PACA (FRANCE)

The main specie will be *Pinus halepensis*

SFI (SLOVENIA)

The main species in the forests are beech *Fagus silvatica*, fir *Abies alba*, spruce *Picea abies*, Hop Hornbeam *Ostrya carpinifolia*

GoV (VALENCIANA-SPAIN)

DISTRICT A: Pure stands of Pinus halepensis, mixed stands of Pinus halepensis and Quercus ilex.

DISTRICT B: Pure stands of Pinus halepensis, mixed stands of Pinus halepensis and Quercus ilex.

DISTRICT C: Pure stands of Pinus halepensis, mixed stands of Pinus halepensis and Quercus ilex.

DISTRICT D: Pure stands of Pinus halepensis; mixed stands of Pinus halepensis and Quercus ilex.

DISTRICT E: Pure stands of Quercus ilex; mixed stands: main specie Quercus ilex, secondary's Pinus nigra and Pinus halepensis.

REGION OF WESTERN MACEDONIA (GREECE)

- Pinus nigra,
- Pinus leukodermis or Pinus heldreichi,
- Abies borisi Regis,
- Fagus silvatica,
- Quercus (cerris, sessiliflora and others)

ISPRA-FLA (ITALY)

- CASARGO: Fagus sylvatica
- MARGNO: Fagus sylvatica
- PARLASCO: Fagus sylvatica

DRAFD- REGION OF SICILY (ITALY)

"20" shows the geographical distribution of the main soil uses, while the following table "**Surface and main species of the forest categories**" shows a list of forest categories with indication of the most-representative tree species for each of them.

More than 50% of the forest area is occupied by reforestation of Mediterranean conifers and 30% by reforestation of mountain conifers (Atlas cedar and Black pine). Natural forests are less extended, occupying a total area of nearly 90 ha, with a prevalence exceeding 10% of Holm oak woods.

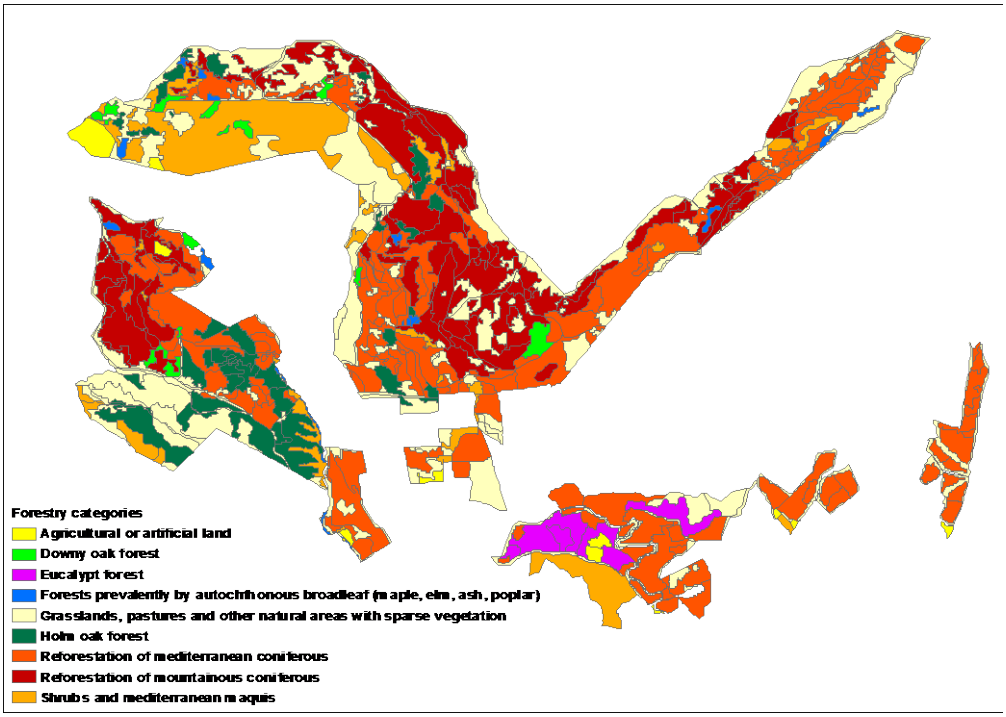


Figure 20: Map of the distribution of the forest categories

Surface and main species of the forest categories

Forestry categories	Main species	Surface	
		(ha)	%
Downy oak forest	Downy oak, holm oak	12,85	2,05
Eucalypt forest	*Eucalyptus* sp., Aleppo pine	24,76	3,96
Forests prevalently by autochthonous broadleaf (maple, elm, ash, poplar)	Field maple, field elm, flowering ash, narrow-leaved ash, black poplar, white willow	7,27	1,16
Holm oak forest	Holm oak, downy oak	68,37	10,93
Reforestation of mediterranean coniferous	Aleppo pine, Italian cypress, stone pine	318,88	50,97
Reforestation of mountainous coniferous	Atlas cedar, black pine	193,48	30,93
Total		625,61	100,00

ICNF-ALGAR (PORTUGAL)

The main species of the area are Quercus suber (560 ha), Pinus pinaster (139 ha), Cupressus spp. (32 ha), Salix alba (20 ha), Eucalyptus botryoides (17 ha), Quercus faginea (8 ha), Pinus pinea (3 ha) Fraxinus angustifolia (2 ha) and Casuarina equisetifolia (less than 1 ha).

Arbutus unedo is probably the second major specie in the area, but its exact figures are difficult to account for, once it's dispersing over all the area.

4.4.3.2 Management method

LP DGMA

The forest management methods are defined in the document: "Guide Technical Plan of contents and structure of the Forest Biomass Management Plans," drafted for Murcia Region.

DISTRICT A: Floating periodic block method

DISTRICT B: Conservation method (Groups Selection method; Double Floating periodic block method; Small blocks method).

DISTRICT C: Conservation method (According to the characteristics of this District; it will be applied a silvicultural treatment with non- or minimal intervention).

CRPF-PACA (FRANCE)

We are talking about a global document. The management method will be a usually practiced in our region. For this, all exploitation in private forest must be done following the rules of the Regional Scheme of Silviculture (Schéma Régional de Gestion Sylvicole – SRGS). This document indicates for each forest type the rules of exploitation to certify a sustainable management of the forest stands.

SFI (SLOVENIA)

Shelterwood - An even-aged regeneration method that removes trees in a series of three harvests: 1) Preparatory cut; 2) Establishment cut; and 3) Removal cut. The method's objective is to establish new forest reproduction under the shelter of the retained trees. *This method is the most-common method.*

Coppicing - A regeneration method which depends on the sprouting of cut trees. Coppicing is generally used to produce fuelwood, pulpwood, and other products dependent on small trees. *And also in our case it is like this.*

Group selection - The group selection method is an uneven-aged regeneration method that can be used when mid-tolerant species regeneration is desired. The group selection method can still result in residual stand damage in dense stands. However, directional falling can minimize the damage. *This method is recommended for protected forests.*

GoV (VALENCIANA-SPAIN)

In all cases, stands management method has been chosen.

REGION OF WESTERN MACEDONIA (GREECE)

It depends on the forest types.

1. At mixed oak forests, we use conversion cutting aimed to reach seedling forest type if we had coppice forests.

We follow this road because, in the seedling forest, the stock wood and biomass are ranging between 150 -200 m3 per hectare (poor forests) to 1000 - 1200 m3 per hectare (rich forests).

Also, the timber production is high. In Greece, the seedling forests are 35% of the total forest area one of the lowest in the Europe. At the coppice forests, the stock wood is low (50 to 150 m3 / ha), and the products are mainly fire woods. In addition, they facilitate the soil degradation.

2. At mixed forests (Pinus nigra, Abies borisi regis) we try to reach a coniferous forest by Abies borisi Regis. Abies borisi Regis is a fast-growing type and produces for many uses and enhances the soil properties.

3. At coppice forests, we usually cut 78% of the total area, and the 12% of the trees that remain are the best in terms of health and form. The products are firewood.

Finally, at coniferous forests we choose the appropriate method (regeneration method/cutting, silvicultural treatment, improvement cutting, cultivation cutting e.t.c) in order to have a healthy and productive forest.

In all the above methods we ban grazing (10 years for goats, 7 years to sheep and 5 years to cows).

ISPRA-FLA (ITALY)

Due to the high variability of stands within the forest area different management methods and actions have been identified, in order to tailor management operations according to forest characteristics. Different interventions have been identified according to plot specific characteristics and based on previous management activities (i.e. activities performed during previous management periods), as well as in accordance to law prescriptions. Full operational indications for the implementation of forest operations are provided, on a case-by-case basis, within stand profiles already shown at paragraph 5.1.3.

Municipality	Stands																																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Casargo	TC	T	T	CS	CS	CS	CS	CS	CH	T	CST	CST	CP	CP	CP	CP	CP	CS	CS	CS	CS	SCCS	SC	SCCS	CS	-	-	CS	CS	CS	S	-	-	T
Margno	CS	TC	TC	TCSSC	SC	TSC	SC	TSC																										
Parlasco	-	CS	CS	CS	-	T	-																											

Legend:

-: no intervention

C: plant care

CH: conversion to high forest

CP: clear cutting on small patches

CS: clear cutting with saplings

S: selective cutting

SC: selective cutting on small patches

T: thinnings

DRAFD- REGION OF SICILY (ITALY)

For each sub-particle, based on the stational attributes, the stand characteristics detected and the dendrometric data, specific management orientation has been assigned, to be achieved during the term of the plan through specific forest operations.

The management guidelines definition was carried out through the following steps:

- - definition of the prevailing function of the sub-particle,
- - definition of the silvicultural orientation of the sub-particle,
- - definition of the cutting series, i.e. macro categories with the same forest orientation,
- - definition of the operation plan and plan of cuts.

The prevailing use or function expresses the type of function that can be assigned to the sub-particle (naturalistic function, timber production, hydrogeological protection, recreation, etc.....), while the silvicultural orientation expresses the type of treatment for a particular stand (naturalization, free natural evolution, etc.....) to achieve their goals.

For these details, see the table in "5.1.3 "Forest management planning process" section. These table shows, for each forest category, a brief description of the measures planned the areas of intervention and the forest types involved.

ICNF-ALGAR (PORTUGAL)

Once the majority of the area is a result of artificial afforestation actions, the several species area conducted in an even-age structure.

4.4.3.3 Regenerative cutting or selected treatment

LP DGMA

DISTRICT A: Shelterwood cuttings in plots or shelter wood cuttings using intensive seed cuts.

DISTRICT B: Shelterwood cuttings in plots or shelter wood cuttings using intensive seed cuts.

DISTRICT C: According to its own characteristics (mature stand; protected fauna shelter; unique forest formation; fragility…); this district will remain as "forest and biological reserve"; in order to the stand evolves naturally. Therefore; it will carry out no or minimum forest management and only improvement or phytosanitary cuttings will be applied.

CRPF-PACA (FRANCE)

As we are dealing with a very large scale management document, we cannot indicate the regenerative cutting or the selected treatment. They will be adapted according to the forest stand, its age, and its health state. All of this information is available in the management document of the forest whether it is public or forest.

SFI (SLOVENIA)

About the type of cutting we are classifying them according to silviculture guidelines on: shifting thinning, silviculture thinning in younger stands, and regeneration cutting, silviculture works in coppices.

GoV (VALENCIANA-SPAIN)

Generally, uniform shelter wood cuttings will be applied to *Pinus halepensis sp.*, except in steep areas where only improvement or phytosanitary cuttings will be made.

In the case of *Quercus ilex, Pinus pinaster* and *Pinus nigra,* only improvement or phytosanitary cuttings will be applied.

REGION OF WESTERN MACEDONIA (GREECE)

We use both methods (regenerative cutting or selected treatment) according to the forest categories, the forest species and the plant density.

For each management category, it will be essential to determine the silvicultural treatment to apply. We don't use regenerative cutting or selected treatment at coppice forests.

ISPRA-FLA (ITALY)

See paragraph 5.1.3.2.

DRAFD- REGION OF SICILY (ITALY)

The main actions envisaged in the area of planning are shown in the table "5.1.3 "Forest management planning process" section (a brief description of the measurements planned, the areas of intervention and the forest types involved, for each forest category):

1) thinning cuts for the gradual elimination of exotic conifers or broadleaf trees (eucalyptus), in order to support the re-naturalization processes with native hardwoods (Holm oak, Downy oak, etc.). This intervention involves the reforestation of a total area of about 230 ha. The modality of cuts (whole surface or localized) and the intensity of the thinning (strong, moderate, weak) were determined from time to time based on several factors: coverage, tree density, site conditions, the developmental stage of the re-naturalization processes,

2) Underplanting with native species (surface of 24 ha): planned where fertility conditions and the coverage allow the survival and development of the trees planted. It is especially expected in the *Eucalyptus* stands,

3) Minimal interventions (surface of 8 ha) include a series of composite interventions (localized thinning, low branches cut, underplanting) performed on small areas,

4) Measures for the recovery of degraded forest surfaces (6.5 ha).

ICNF-ALGAR (PORTUGAL)

The only specie to be used for wood is *Pinus pinaster*. This specie is divided into two different age-classes.

Natural regeneration of Pinus pinaster is being promoted in the older age classes areas. The younger age class areas will be replanted when cut and, once it's expected to be cut in non-contiguous plots (as referred above), the area will evolve to a series of even age areas of different ages to permit a scalable and sustainable wood production.

4.4.3.4 Rotation and regeneration period (or normalization)

LP DGMA

DISTRICT A: 75 years/ 15 years

DISTRICT B: 120 years/—.

DISTRICT C: Given its status of "forest and biological reserve"; it has no sense neither in silvicultural nor in management terms; as the rotation period.

CRPF-PACA (FRANCE)

In general, the management plans for the forest are edited for 10 to 20 years. Each document treats the Management Units (a combination of a homogenous forest, with a common management purpose, and a year of management operations) according to their orientation, specified by the owner (public or private) and provided that the management proposed follows the rules presented in the Regional Scheme of Forestry Management. The rotation on a Management Unit depends on all the parameters cited above.

SFI (SLOVENIA)

The production and regeneration period varies from one forest management class to another. Generally the production period is quite long and can last from 120 to 180 years; the regeneration period also lasts from 20 to 50 years. All harvesting activities are made according step by step philosophy and on a small scale level.

GoV (VALENCIANA-SPAIN)

80 years/ 20 years for Pinus halepensis

REGION OF WESTERN MACEDONIA (GREECE)

Tree species	Rotation period	Regeneration period
Pinus nigra	90	30
Pinus nigra- Abies	100	20-40
Fagus silvatica	120	40
Pinus heldereich	240	80
Quercus (conferta; cerris and pubescens)	120	40
Quercus (conferta and pubescens)	120	40

ISPRA-FLA (ITALY)

CASARGO: 30 years/ 15 years
MARGNO: 120 years/ -
PARLASCO: 120 years/ -

DRAFD- REGION OF SICILY (ITALY)

Given the prevalence of interventions to increase the degree of naturalness and for the recovery of degraded woods, there are no defined turns of cutting. Therefore, it is possible to assume a distribution of the surface of intervention for each year according to a temporal sequence that takes into account each stand to be subjected to cutting by a periodicity to be evaluated from time to time depending on the conditions of a forest stand to be treated.

ICNF-ALGAR (PORTUGAL)

The only specie to be used for wood is Pinus pinaster. This specie is divided into two different age-classes. The younger ones are scheduled to be cut (in non-contiguous plots) between 60 and 75 years from now. These areas will still suffer 3 thinning operations to remove 15 % of the total trees each time. The older ones (20 years old) will be taken to the final cut without any thinning operation.

4.4.3.5 Allowable cutting study

LP DGMA

- Total allowable cut

The total allowable cut in the forest under study has been considered as the total volume increment; that is, the total annual growth; in District A (the only District with production as the main function. Surface: 815;8 ha):

Total over-bark volume (m^3)	Total volume increment (m^3/year)	Total biomass (dmt)
52.248;63	1.433;38	38.814;76

dmt= tonne of dry mass

- Actual allowable cut

The actual allowable cut is the biomass total volume to extract throughout the Short-term Plan validity (15 years):

Total allowable cut (m^3)	Total biomass (dmt)
5.402;61	3.575;03

dmt= tonne of dry mass

- Annual allowable cut

Year	District	Compartment	Silvicultural treatment	Allowable cut (m^3)	Biomass (dmt)
2013	A	8	Pt/T	416;23	272;97
2013	A	9	Pt	632;75	418;72
Total 2013				1.048;98	691;69
2016	A	5	Pt/T	201;24	134;02
2016	A	6	T	477;23	319;48
2016	A	7	Pt/T	368;27	241;56
2016	A	11	T	481;69	320;34
Total 2016				1.528;43	1015;4
2020	A	10	Pt/T	371;02	242;76
2020	A	13	Pt/T	420;75	278;44
2020	A	14	Pt	25;87	16;70
2020	A	16	T	522;53	346;76
Total 2020				1.340;16	884;66
2023	A	36	P/Sw	550;85	365;09
2023	A	39	Pt/T	275;84	181;02
2023	A	42	P/Sw	284;27	192;09
2023	A	43	P/Sw	374;08	245;08
Total 2023				1.485;04	983;28
General total				5.402;61	3.575;03

- Pt: Precommercial thinnings; T: Thinnings; P: Preparatory cut; Sw: Shelterwood method

CRPF-PACA (FRANCE)

- Total allowable cut
- Actual allowable cut

The amount of biomass harvested per ha takes into account the potential of each forest type and is based on a sustainable management allowing the improvement of forest quality on long term. The allowable cut to extract on the whole territory of the CPA is estimated at 50.000 tons per year.

- Annual allowable cut

The allowable cut a year is of 12.000 tons.

SFI (SLOVENIA)

- Actual allowable cut

Area	C10	D10	J10	P10	sum
Quality timber allowable cut (m3)	515,184	1694,392	320,104	2431,412	4961,092
Low-quality timber allowable cut (m3)	2073,006	1973,858	2060,086	3498,968	9605,918
Sum of allowable cut (m3)	2588,19	3668,25	2380,21	5930,38	14567,03

The allowable cut is one of the information which tells us how much timber we can get from the forest. But to calculate wood biomass potential quantities we have to take into consideration timber quality and prices. Wood biomass represents low-quality timber. Because of that we have developed a model which takes into consideration different factors. In the above table, we present structure of quality and low-quality timber on the forest property.

GoV (VALENCIANA-SPAIN)

- Actual allowable cut

DISTRICT	Forest Surface (ha)	TOTAL STOCK			STOCK/HA		
		Nº Trees (trees)	Biomass (ton)	Volume (m3)	Nº Trees (trees/ha)	Biomass (ton/ha)	Volume (m3/ha)
A	841	297.108	26.071	54.012	353	31,00	64,22
B	1.088	232.829	21.465	30.516	214	19,73	28,05
C	985	465.385	40.836	60.929	472	41,46	61,86
D	974	317.057	35.004	59.546	326	35,94	61,14
E	1.051	532.316	52.341	28.950	506	49,80	27,55

- Annual allowable cut

YEAR	STAND	TREATMENT	SURFACE	VOLUME		BIOMASS	
				initial (m3)	extract (m3)	initial (ton)	extract (ton)
2013	7	Low thinning	22,66	1.482	298	959	258
	8	Preparatory cutting	31,92	2.391	494	1.385	411
	88	Seed cutting	29,73	1.195	514	1.409	589
	89	Preparatory cutting	29,97	2.709	759	1.415	415
	90A	Preparatory cutting	21,38	1.734	509	1.281	471
	93	Low thinning	34,18	2.827	656	1.441	309
	94	Mixed thinning	35,25	2.834	728	1.449	352
		Total	**205,09**	**15.172**	**3.958**	**9.339**	**2.805**
2014	57	Preparatory cutting	16,37	1.616	422	1.313	590
	58	Preparatory cutting	25,24	1.782	562	1.610	676
	59	Preparatory cutting	42,31	3.516	1.151	1.891	697
		Total	**83,92**	**6.914**	**2.135**	**4.814**	**1.963**
2015	32	Low thinning	14,36	778	273	622	225
	51	Preparatory cutting	28,26	2.343	776	1.518	523
	52	Low thinning	57,26	3.481	484	2.462	358
	61	Preparatory cutting	24,77	2.413	822	1.283	470
		Total	**124,65**	**9.015**	**2.355**	**5.885**	**1.576**
2016	14	Preparatory cutting	38,18	2.478	585	1.290	290
	15	Preparatory cutting	32,13	2.127	410	1.096	204
	16	Low thinning	26,50	1.667	545	901	418
	17	Low thinning	43,69	2.451	876	660	256
		Total	**140,50**	**8.723**	**2.416**	**3.947**	**1.168**

YEAR	STAND	TREATMENT	SURFACE	VOLUME		BIOMASS	
				initial (m3)	extract (m3)	initial (ton)	extract (ton)
2017	83	Preparatory cutting	30,28	1.489	438	1.496	425
	84	Low thinning	34,33	3.594	943	2.025	710
	95	Seed cutting	49,10	3.825	1.435	1.846	671
	96	Low thinning	36,85	2.568	682	1.268	321
	101	Preparatory cutting	34,72	2.239	699	2.111	632
		Total	**185,28**	**13.715**	**4.197**	**8.746**	**2.759**
2018	3	Final cutting	47,52	3.607	2.278	1.825	1.180
	4	Final cutting	33,55	2.077	1.031	849	479
	5	Mixed thinning	32,23	3.017	866	1.634	446
	6	Low thinning	39,71	3.240	635	1.545	435
		Total	**153,01**	**11.941**	**4.810**	**5.853**	**2.540**
2020	36	Preparatory cutting	30,27	3.375	1.125	1.771	573
	37	Preparatory cutting	45,10	4.361	1.420	2.413	757
	38	Low thinning	31,73	2.373	636	1.472	371
	49	Low thinning	48,06	1.855	578	1.105	335
	50	Low thinning	98,77	3.773	806	2.420	560
		Total	**253,93**	**15.737**	**4.565**	**9.181**	**2.596**
2021	1	Corta diseminatoria	41,11	2.532	1.110	1.254	535
	2	Seed cutting	45,87	3.312	1.118	1.527	497
	20	Low thinning	25,62	1.481	222	190	33
	23	Low thinning	19,30	741	133	253	61
		Total	**131,90**	**8.066**	**2.583**	**3.224**	**1.126**
2022	63	Preparatory cutting	32,38	2.496	805	2.215	991
	65	Final cutting	24,86	1.400	1.016	820	616
	66	Final cutting	50,63	3.331	2.535	1.554	1.221
		Total	**107,87**	**7.227**	**4.356**	**4.589**	**2.828**

REGION OF WESTERN MACEDONIA (GREECE)

- Actual allowable cut

The actual allowable cut is the total allowable cut if we subtract the total skinless volume from steep slopes areas where we can't extract wood products (timber, firewood).

The mass of the forest residues (tree tops, twigs) is calculated by dividing the mass of the wood (technical, firewood) that produced by the coniferous species with the moisture percentage of the trees which is amounted to 40%.

The coefficient factor from m3 to tn for coniferous trees is 0.83.

year	Allowable cut (cm^3)		Biomass (dtn)
	Technical wood	firewood	
Total	54,378	31.026	5520.82

- Annual allowable cut

The allowable cut of the period 2005-2014 is presented in the table below

year	Allowable cut (cm^3)		Biomass (dtn)
	Technical wood	firewood	
2005	5383	2898	489.8
2006	5592	3028	438.24
2007	4454	2395	511.62
2008	2300	1962	295.36
2009	9215	5540	1058.5
2010	5946	3201	683.3
2011	5824	3141	669.69
2012	6419	3459	1051.13
2013	3862	2504	507.71
2014	5383	2898	406.53
Total	54,378	31.026	5520.82

The annual allowable cut per forest department/ stand and forest specie

year	Forest department/ stand	Forest specie	Allowable cut (cm^3)		Biomass (dtn)
			Technical wood	firewood	
2005	16α,16β,16γ,16δ, 16ε, 16στ, 16ζ, 4δ,4ε, 6στ	Pinus Nigra	3971	2137	456.27
		Abies	80	45	9.33
		Fagus silvatica	1121	603	0
		Pinus heildreich	211	113	24,20
	Total		5383	2898	489.8
2006		Pinus Nigra	2409	1304	277.36

year	Forest department/ stand	Forest specie	Allowable cut (cm^3)		Biomass (dtn)
			Technical wood	firewood	
	14α, 14β, 14γ, 11α, 11β 11γ, 11δ, 6α, 6β, 6γ, 6δ,9δ,	Abies	809	443	93.52
		Fagus silvatica	1790	963	0
		Pinus heildreich	584	318	67.38
	Total		5592	3028	438.24
2007	14δ, 14ε,14στ, 14ζ, 14η,6ζ	Pinus Nigra	3527	1896	405.1
		Abies	500	269	57.44
		Pinus heildreich	427	230	49.2
	Total		4454	2395	511.62
2008	19β,19ε,19στ,19ζ, 19α, 19γ, 19δ, 32β, 1η,1θ, 5ζ, 5η	Pinus Nigra	1593	853	182.72
		Abies	507	276	58.49
		Fagus silvatica	200	108	0
		Pinus heildreich	0	725	54.16
	Total		2300	1962	295.36
2009	7α, 19θ, 20α, 20β, 20γ, 20δ, 20ε, 20στ, 20ζ, 20η, 20θ, 20ι, 22δ, 22ε, 22στ, 22ζ, 22η, 9ε, 9στ,19η,32γ	Pinus Nigra	8693	4677	998.74
		Abies	310	164	35.4
		Fagus silvatica	0	585	0
		Pinus heildreich	212	114	24.36
	Total		9215	5540	1058.5
2010	21α, 21β, 21γ, 21δ, 21ε, 17δ, 17στ, 7β, 7γ, 7δ, 7ε, 12ε, 12ζ, 12η	Pinus Nigra	5568	2996	639.6
		Abies	123	67	14.19
		Pinus heildreich	255	138	29.36
	Total		5946	3201	683.3
2011	21στ, 21ζ, 21η, 21θ, 21ι, 17ζ, 17η, 7στ, 8θ	Pinus Nigra	5147	2776	591.85
		Abies	313	169	36.01
		Pinus heildreich	364	196	41.83
	Total		5824	3141	669.69
2012	22α, 24α, 24β, 24γ, 24δ, 24ζ, 24θ, 8γ, 8δ, 8ε, 8ζ, 13β, 13γ, 13δ	Pinus Nigra	5938	3200	682.61
		Abies	384	207	294.32
		Pinus heildreich	97	52	81.67
	Total		6419	3459	1051.13
2013		Pinus Nigra	3764	2026	432.51

year	Forest department/ stand	Forest specie	Allowable cut (cm^3)		Biomass (dtn)
			Technical wood	firewood	
	23α, 23β, 23γ, 23δ, 23ε, 23στ, 15α, 15β, 15γ, 8α, 8β	Pinus heildreich	98	53	75.2
		Quersus	0	425	0
	Total		3862	2504	507.71
2014		Pinus Nigra	3971	2137	378.70
		Abies	80	45	7.74
		Fagus silvatica	1121	603	0
		Pinus heildreich	211	113	20.08
	Total		5383	2898	406.53

ISPRA-FLA (ITALY)

- Total allowable cut

The total allowable cut in the forest under study has been considered as the total volume increment.

Total over-bark volume (m^3)	Total volume increment (m^3/year)
131,306	2,538.46

DRAFD- REGION OF SICILY (ITALY)

- Total allowable cut

The following table shows, for each category forest, the biomass (expressed in volume) obtainable from forestry operations compared to the overall size of stands subject to intervention. In the same table, the volume of the stem and Branch-wood, is reported separately.

The data does not consider the values of biomass present in the forest area where there are no operations to be performed.

Forest type	Total volume (m^3)		
	Trunks	Branch-wood	Total
Mediterranean conifers reforestations	25429,90	14345,38	39774,30
Mountainous conifers reforestations	19745,16	6259,90	26005,06
Eucalyptus forest	1323,95	459,81	1783,76
Total	46499,01	21065,09	67563,12

Actual allowable cut

Existing biomass and obtainable from the implementation of forestry operations

Forest type	Allowable cut volume (m^3)			
	Trunks	Branch-wood	Total	Allow.V/Total V. (%)*
Mediterranean conifers reforestations	5961,87	3413,42	9375,29	23,57
Mountainous conifers reforestations	3339,11	808,99	4148,10	15,95
Eucalyptus forest	115,88	30,49	146,37	8,21
Total	9416,86	4252,9	13669,76	20,23

- Annual allowable cut

This report does not contain the Sicilian "Plan of cuts" with the distribution of interventions for cutting series, particles, subparticles divided for each year of the plan (plan of cuts) because it is in preparation.

ICNF-ALGAR (PORTUGAL)

- Total allowable cut

There is no cutting study made to this area.

- Actual allowable cut

Biomass (ton/ha)

Parcelas	TOTAL
Parcela 3	8140
Parcela 5	5188
Parcela 11	6261
Total anual	**19589**

- Annual allowable cut

Biomass (ton/ha)

Parcelas	ANOS														TOTAL
	2013	2023	2026	2033	2037	2043	2046	2052	2053	2061	2063	2067	2071	2086	
Parcela 3	0	0	0	1299	0	2081	0	0	2690	0	2071	0	0	0	8140
Parcela 5	0	157,1	8,712	0	283,8	0	60,98	1268	0	110,1	0	1973	522,7	803,9	5188
Parcela 11	123,8	261,9	0	0	473	0	0	2113	0	0	0	3289	0	0	6261
Total anual	**123,8**	**419**	**8,712**	**1299**	**756,8**	**2081**	**60,98**	**3381**	**2690**	**110,1**	**2071**	**5262**	**522,7**	**803,9**	**19589**

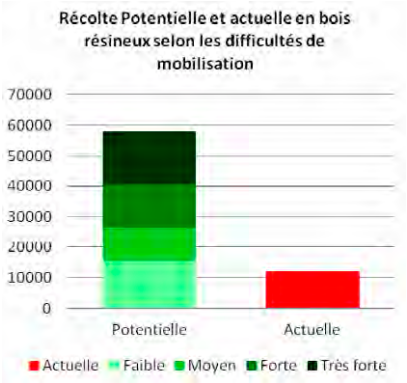
4.4.3.6 Mean timber and biomass volume obtained

LP DGMA

District	A (ha)	N (trees/ha)	BA (m^2/ha)	OBW (m^3/ha)	VI (m3/ha/año)	B (dmt/ha)	NT (trees)	TOBW (m^3)	TVI (m^3/año)	BT (dmt)
A	815,8	475,4	16,546	64,046	1,757	47,58	387.830	52.248,628	1.433,380	38.814,77
B	624,2	280,3	12,276	47,018	1,304	35,95	174.969	29.344,852	813,584	22.434,43
C	78,3	303,9	14,828	56,333	1,564	44,15	23.790	4.409,486	122,460	3.455,70
Total	1.518,30	1.059,60	43,65	167,40	4,63	127,68	586.589,00	86.002,97	2.369,42	64.704,90

A=surface; NT= Total number of trees (trees); and; N= per wooded hectare (trees/ha); BA=Basal area per wooded hectare (m^2/ha); TOBW=Total over-bark volume (m^3); and; OBW= per wooded hectare (m^3/ha). ; TB=Total biomass (dmt); and; B= per hectare (dmt/ha); TVI=Total volume increment (m^3/year); and; VI= per wooded hectare (m^3/ha·year).

CRPF-PACA (FRANCE)



The document presents the potential available biomass according the different levels of difficulty to mobilize it. We can see that the actual consumption is almost consuming all the easily mobilisable biomass. An improvement of consumption will lead to harder exploitation conditions, and maybe to a rise of biomass prices.

SFI (SLOVENIA)

	C10	J10	D10	P10	P20	Sum
Growing stock – conifers m^3	6741,9	8439,04	29645,64	15403,87	39735,23	99965,68
Growing stock broadleaves m^3	10681,94	18889,94	43300,24	49777,84	56226,43	178876,39
	17423,84	27328,98	72945,88	65181,71	95961,66	278842,1

Growing stock on the property of Agrarian common Čezsoča

GoV (VALENCIANA-SPAIN)

		TIMBER + BIOMASS	TIMBER		BIOMASS
wet	Ten yearsl	41.381 ton	31.736 m^3	31.673 ton	9.708 ton
	Annual	**4.138 ton**	**3.174 m^3**	**3.167 ton**	**971 ton**
Normal	Ten yearsl	25.293 ton	31.736 m^3	19.359 ton	5.934 ton
	Annual	**2.529 ton**	**3.174 m^3**	**1.936 ton**	**593 ton**
dry	Ten yearsl	20.483 ton	31.736 m^3	15.678 ton	4.805 ton
	Annual	**2.049 ton**	**3.174 m^3**	**1.568 ton**	**481 ton**

REGION OF WESTERN MACEDONIA (GREECE)

The figure below shows the wood volume produced during the periods 1995-2004:

The wood production of the years 2005 – 2014 is showed in the figure below

ISPRA-FLA (ITALY)

The table below provides summary information on the estimated mean values for timber and biomass in the area included within the Plan. Data are distinguished according to the municipality and, within each municipality, according to different forest types (i.e. Production high stands; Protection high stands; Coppice in conversion to high stands; Production coppice; and Protective coppice).

Municipality	Forest type	A	NT/ha	BA	TOBW	OBW	TVI	VI
Casargo	Production high stands	148.62	484	29.39	28,644	215.12	351.37	4.99
	Protection high stands	132.75	403	34.50	12,848	112.82	54.89	3.72
	Coppice in conversion to high stands	32.58	301	17.64	4,213	134.64	73.02	2.34
	Production coppice	253.74	256	18.17	37,825	143.38	714.58	3.09
	Protective coppice	112.89	265	19.16	9,266	81.68	100.46	3.28
Margno	Production high stands	55.11	545	26.61	10,474	181.86	210.73	4.46
	Protection high stands	9.96	527	26.33	1,523	152.92	74.76	7.51
	Production coppice	99.83	711	28.56	21,165	212.17	824.09	8.27
Parlasco	Production coppice	97.52	346	9.28	5,003	48.29	116.86	1.12
	Protective coppice	17.70	-	-	885	50.00	17.70	1.00

A=productive area (ha); NT/ha= Total number of trees per hectare (trees/ha); BA=Basal area per wooded hectare (m^2/ha); TOBW=Total over-bark volume (m^3); and; OBW= per wooded hectare (m^3/ha); TVI=Total volume increment (m^3/year); and; VI= per wooded hectare (m^3/ha·year).

DRAFD- REGION OF SICILY (ITALY)

On the basis of biomass, obtainable from silvicultural operations provided, was made an estimate of the total gross profit for the period of validity of the plan (see the following table). It should be noted that were considered the prices of fresh biomass (moisture content about 50%) on the selling point (landing). Moreover, in the absence of readily available market prices for the area, prices for biomass supplied by the National Institute of Statistics (ISTAT) have been taken as a reference.

Estimate of the gross profits

Type of biomass	Forest Biomass (m3)			Assumed unit price of biomass at the selling point (€/m³)*	Amount (€)
	Trunks	Branch-wood	Total		
Conifers	9300,98	4222,41	13523,39	24,15	326589,869
Broadleaf	115,88	30,49	146,37	54,50	7977,165
Total	9416,86	4252,9	13669,76	-	334567,034

*Bibliographic source: Istat: Merchant wholesale prices of timber assortments. Prices refer to 2011.

link: http://agri.istat.it/jsp/dawinci.jsp?q=plFPR0000010000010000&an=2011&ig=1&ct=856&id=7A

ICNF-ALGAR (PORTUGAL)

Taking into account the structure of the plots and the values included in the tables above a calendar of biomass production was prepared.

Biomass (ton/ha):

Parcelas	ANOS														TOTAL
	2013	2023	2026	2033	2037	2043	2046	2052	2053	2061	2063	2067	2071	2086	
Parcela 3	0	0	0	1299.2	0	2080.8	0	0	2689.8	0	2070.6	0	0	0	8140
Parcela 5	0	157.12	8.712	0	283.79	0	60.984	1267.9	0	110.09	0	1973.2	522.72	803.88	5188
Parcela 11	123.83	261.87	0	0	472.99	0	0	2113.2	0	0	0	3288.6	0	0	6261
Total anual	**123.8**	**419**	**8.712**	**1299**	**756.8**	**2081**	**60.98**	**3381**	**2690**	**110.1**	**2071**	**5262**	**522.7**	**803.9**	**19589**

4.4.3.7 Economic balance: income and expense

LP DGMA

Estimated revenues come from transferring the forest biomass products obtained in intermediate treatments to energy production. It would be desirable that the total amount to be achieved from this resource would be used entirely to fund these intermediate treatments; since it has been proven that these treatments can be self-financed with the transfer of removed biomass. This practice can even provide some return when the amount of removed biomass exceeds certain thresholds (15 dmt/ha).

The remaining revenues could come from the improvements fund (15%) obtained from other forest harvests and concessions (hunting; pastoral; quarries).

Planned expenses correspond to improvement treatments (silvicultural; roads network; fire protection) required throughout this Short-term Plan.

Thus, the balance of income-expense is showed as follows:

Kind	Type	Total amount (€)	%	Amount (€)
INCOME	Forest biomass	232.376;95	100	232.376;95
	Pastoral	6.210;00	15	931;50
	Hunting	91.962;00	15	13.794;30
	Quarries	1.006.500;00	15	150.975;00
	Total income			398.077;75
EXPENSE	*Silvicultural improvement treatment			315.322;7
	Various operations			58.623;55
	Fire management			38.761;00
	Study y projects			15.700;00
	Total expense			428.407;25
BALANCE (INCOME-EXPENSE)				-30.329;50

*NOTE= In Murcia Region; up to now; the wood obtained from silvicultural improvement treatment have not been considered as "commercial wood." That is the reason it supposes an expense. With the promotion of biomass; products derived from these treatments, it will become an income; with a consequent transformation in a positive economic balance.

CRPF-PACA (FRANCE)

Step	Cost
Felling	12€/ton manual
	10€/ton mechanized
Skidding	11€/ton
Price of the wood	6-8€/ton
Chipping	12€/ton

This table presents the different costs of exploitation. There is an average, but can give an idea on how the price of the woodchip is fixed. To have an idea, the woodchip with no drying period is about 54€/ton, and the woodchip with 30% moisture is about 80€/ton.

SFI (SLOVENIA)

For the economical part of property plan we have taken in the consideration the following factors:

- harvesting costs: for this factor we have made a technology surface map. In the area, we have mainly two skidding technologies: cable and skidders harvesting manually with a chain saw. We have made a survey among foresters to get the technology costs
- timber value: we have estimated timber quality structure from forest management database and from the survey among foresters. Additionally we have made a survey for the timber prices

	C10	D10	J10	P10	sum / average
timber stump value	116284,1	114529,3	95118,58	174940,6	500872,5
average timber stump value EUR/m3	44,93	31,22	39,96	29,50	34,38

Timber stump value and average timber stump value on the property of Agrarian common Čezsoča

GoV (VALENCIANA-SPAIN)

The total economic balance is estimated by comparison between income from forest exploitation and the estimated costs of the improvement plan for the ten-year period 2013 -2022.

Based on the Forest Exploitation Plan and the Improvement Plan, an income and the expenses been calculated for each sub-period of time that has divided the Special Plan and for each acting group.

Kind	Type	Amount (€)
INCOME	Forest biomass	577.281,83
	Pastoral	20.779,00
	Hunting	41.070,00
	Beekeeping	7.430,00
	Agricultural works	9.360,00
	Total income 655.920,83 €	
	15% Improvement Fund 98.388,12 €	

NGRESOS

EXPENSE	*Silvicultural improvement treatment	375.975,93
	Study y projects	80.014,92
	Total expense	375.975,93 €

REGION OF WESTERN MACEDONIA (GREECE)

Costs refer to the following:

1) Logging, 2) Transportation, 3) Taxis to Public authorities or municipalities

The expenses of the Forest Management of Forest Krania 2005-2014 are as follows:

Kind	Type	Total amount (€)	%	Amount (€)
EXPENSE	soil and forest improvement			928.000
	Road network			52.000
	Forest management			115.000
	Fire protection			120.000
	regeneration			340.000
	Total expense			1,555,000

It is mentioned that, in the Forest Management of Krania, there are economic data for incomes, because the total incomes (hunting, wood products sales, etc.) are been estimated for the total forest area that is under the responsibility of the Forest Directorate of Grevena, and not separately for each forest complex.

ISPRA-FLA (ITALY)

Estimated costs and revenues are reported in the summary table below

Kind	Type	Amount (€)
INCOME	Forest biomass (assuming 50% of the increment is harvested)	380,769
EXPENSE	Silvicultural operations	285,000
	Fire management	45,000
	Study y projects	15,000
	Total expenses	345,000
BALANCE (INCOME-EXPENSE)		35,769

DRAFD- REGION OF SICILY (ITALY)

The estimated net income was determined assuming the gross profit of the biomass sold on the felling point and considering the following expenses:

- - Felling, limbing and subsequent sawing plants. The cost categories considered in this phase were:

- daily fee payable to the individual forest workers;

- daily fuel consumption of chainsaws;

- depreciation and maintenance rate of tools.

Considering the total of 7 hours per day of work, the average daily productivity for a team of 6-8 workers is about 30 m^3/day.

The cost for this phase, compared to the daily productivity (30 m^3) is around 5 €/m^3.

- - Skidding. The items of expenditure related to this phase were:

- daily fee payable to the individual forest workers;

- daily fuel consumption of the tractor;

- depreciation and maintenance rate of the machines.

The cost for this phase is around 8 €/m^3. The data on productivity and the cost of the various operations have been derived from a study carried out in Contrada Torcitore (Sicani Mountains) (Casesi A. 2006 - Economic evaluation of forest utilization in Mediterranean conifers afforestation in the Sicani Mountains. Thesis Department of Agricultural and Forest Sciences, University of Palermo).

Economic balance for the extraction of biomass

Income	
Biomass selling at the landing	334.567
Expense	
Cutting and processing (5 €/m3)	68.348
Skidding (8 €/m3)	109.358
Balance (income-expense)	156.861

ICNF-ALGAR (PORTUGAL)

No data available

4.4.3.8 Manager or owners preferences towards wood biomass utilization

LP DGMA

The market of forest products for biomass energy purposes opens the possibility for those products devoid of commercial values from silvicultural treatment (trees with normal diameters under 30cm from thinnings and pre-commercial thinnings). It is not dismissed that a fraction of these forest products can be used as sawmill destination (pellets; wooden board or plank…). Either way; the biomass energy market can be supplied by any timber size.

CRPF-PACA (FRANCE)

As far as possible, the woodchips should be occupied in some local development, to limit its carbon print and foster the CO2 saving. Nevertheless, the owner doesn't manage the final market of the woods. We also tried to valorise the wood at its maximum, by making selections in the qualities we are selling (biomass, pulp mill, industry).

SFI (SLOVENIA)

The owners of the property and representatives of the Agrarna skupnost Čezsoča are highly motivated to step in the wood biomass supply chain as a producer of wood chips for the local town district heating station which is in the future municipal plan. They are very active in the road construction on their property and because of that they are active in searching different options for selling their timber. The local district heating plan is seen as a good opportunity for selling their low-quality timber while to get quality timber they are thinking of joining into the supply chain of local sawmills in the establishment process.

GoV (VALENCIANA-SPAIN)

In the Utiel municipality, there are no local forestry companies and the market for forest products is available at county level. There are hardly any companies willing to buy products of primary processing. The only company located in Utiel, Utisa, a company dedicated to producing boards from chips, has been closed after restricted chip entry over the past five years. Thus, wood products have had to find their destination outside the region. In recent years the main recipients of products have been sawmills located in the town of Mogente, in the south of Valencian province.

The current value of the timber is very low, having suffered in recent years large depreciations. In spite, the emerging biomass sector is still regionally limited, and being necessary to strengthen the market making economic investments or through incentives or subsidies to raise their utilization, forest owners look at it as a way to produce high added value, in order to obtain income and to achieve rural development of this area.

REGION OF WESTERN MACEDONIA (GREECE)

The increasing of heating fuel oil prices in combination with the use of forest residues for energy purposes strengthens the interest of forest owners to produce high added value wood products. In this context, the exploitation of forest biomass and the use of GIS models to assess biomass resources are expected to lead to increasing the wood production in the framework of sustainable development.

ISPRA-FLA (ITALY)

In the last few years, the demand for energy wood has increased very much at both local and regional level. As a result, forest management activities have been encouraged, and an efficient use of wood resources has been pushed. Although there is limited timber demand by local sawmills, forest owners and managers would prefer

to use better logs and materials for industrial purposes and use products from coppice management, thinning and other minor products for energy purposes. It is believed a 'cascading' approach would fit very much the area.

DRAFD- REGION OF SICILY (ITALY)

The possibility of realizing a supply chain for the use of residual biomass for Energy purposes could allow the economic use of a resource that, given the technological qualities of the material obtained from the wood species, could not have any other possible use.

The realization of a biomass valorisation system would obviously have some important social and economical consequences on the local communities. In addition to the creation of new jobs related to the subsequent phases of transformation of the raw product (storage, chipping, staff dedicated to the station), it would represent an important income source in the balance sheet of the Regional Agency of State Forests, allowing to pay back the staffing costs given that for the great part of the working days, employees do not carry out any profit-making activity. Moreover, as previously mentioned, the model developed for the territory of Bivona could be taken as a reference for the realization of other management plans and local supply chains in other territorial contexts in Sicily.

ICNF-ALGAR (PORTUGAL)

Once the wood production areas are still in a very early stage, it's not possible to establish a wood biomass utilization strategy.

5 Elaborated documents and tools, for forest biomass management plans drafting

Some of the documents here mentioned are available (electronic versions) in the publications section of the WP4/pilot action 1.7.:

http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

LP DGMA

The Pilot Action involving the drafting of the Forest Management Plan for the forest: MUP nº 36 "Sierra de Burete," managed by the regional government.

Furthermore, the following documents and tools have been developed, with PROFORBIOMED founding, by DGMA Murcia Region, as complementary information of those developed in this pilot action. They are available (electronic versions) in the publications section of the WP4/pilot action 1.7/specific tools developed by partners/DGMA_Murcia:http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17

- Technical Guide, with the contents and structure, to draft a BFMP according to legislation in Murcia Region (*Estructura_Gral_PTMurcia_v12.pdf*): only in Spanish.
- Silvicultural treatment simulation (*Silvicultural treatment simulation.xls*).
- Summarize of the forest stands growth model (*Summarize of the forest stands growth model.pdf*): only in Spanish.
- Methodology for the design of forest inventory by the use of specific software, for the elaboration of forest biomass management, plans in Murcia Region (*Methodology_inventory_proforbiomed_Murcia_english.pdf* and *Methodology_inventory_proforbiomed_Murcia_spanish.pdf*): available in English and Spanish.
- Single entry volume equation of forest species (*Single entry volume equation of forest species.pdf*): only in Spanish.
- User's manual for the software tool to assess the growing stock: "Inventory of Forest of Murcia" (11/07/2013) (*user manual software inventario montes murcia.pdf*): only in Spanish.
- Software tool to assess the temperature and precipitation data for the North-western Murcia Region (Bioclimatic diagrams of "Montero de Burgos" software tool) (*Bioclimatic diagrams software tool.zip*).
- Climatic model and bioclimatic diagrams of "Montero de Burgos" for the North-western Murcia Region (*Climatic model and bioclimatic diagrams.pdf*): only in Spanish.
- Forest management criteria to preserve the birds of prey (*Forest management criteria to preserve the birds of pray.pdf*): only in Spanish.
- General guidelines for sustainable forest management in the Region of Murcia *(General guidelines for forest management in the Region of Murcia.pdf*): only in Spanish.

CRPF-PACA (FRANCE)

The fact that most of the resource studies forget to take into account the problem of the ownership of the forest made the CRPF think of a concrete, simple tool to assess the available biomass in the private forest under the management plan. The CRPF has got a database compiling all the data of each forest management plan approved. This database contains surfaces of forest stand, the type of forest, and the type of intervention for each year of the forest management plan. Based on this database, we developed a tool that can convert all this information into the volume of hardwood biomass available, for each municipality, and each year.

This information is very valuable for the mayors because:

- Announced volumes are very well identified
- We know their specie composition
- They are actually available as they have been planned by the private forest owner
- The exploitability has been approved by a forester
- They are available in a sustainable way

Thanks to this tool, we can foresee the available volumes for several municipalities and several years. Public stakeholders can use this tool to secure their supply, and have a better knowledge and foster the local supply chain.

SFI (SLOVENIA)

The SFI has designed a FOREST PROPERTY MANAGEMENT PLAN. A tool as it is not generally used by Slovenian forest owners. But we think it can be an essential tool for planning wood biomass supply chains and a tool that can foster forest management activities. FPMP is based on the Slovenian Forest Service databases and databases of The surveying and mapping authority of the Republic of Slovenia. Together with the databases also the literature as the "Forest management unit Bovec management plan 2003-2013" and the "Local Energetic Concept of Municipality Bovec" was used.

For GIS data analyses, ESERI programme ArcGIS was used in the first step. In the second step Microsoft office, Excel was used.

GoV (VALENCIANA-SPAIN)

The Pilot Action involved the drafting of the Forest Management Plan for the forest V095 "Sierra Negrete," managed by the regional government and belonging to the municipality of Utiel.

Also, the following documents and tools have been elaborated to facilitate the dissemination of results and to foster forest management plans in the Valencia Region (some of them are available in the publications section of the WP4/pilot action 1.7/specific tools developed by partners/GOV_Valencia: http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17):

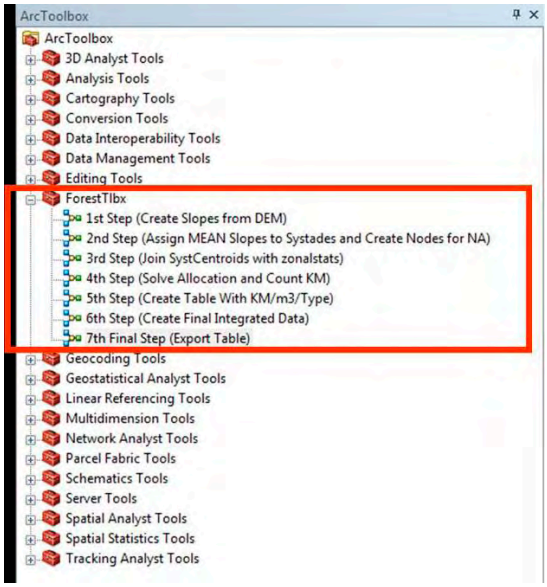
- An interactive tool with all the information of the V095 "Sierra Negrete" Forest Management Plan has been elaborated, including a cartographic viewer and links to the different pictures of the inventory plots of the "Sierra Negrete" Forest.
- An abstract of the Inventory Methodology used in the Project mentioned above, using both conventional and LiDAR technology (*02.en.Inventory_methodology_abstract.pdf and 02.Resumen_metodologia_inventario.pdf*): English and Spanish version.
- Leaflet of methodology to spread among European, national and local stakeholders (*brochure_english_PA17.pdf and brochure_spaniish_PA17.pdf*): English version and Spanish version.
- A public presentation of the plan in the municipality of Utiel is being preparing after its approval.
- A summary of Management Plan of Utiel Forest to participate in Innovation Awards of Expobioenergía 2012 (*summary_management_plan_expobioenergia2012.pdf*): Spanish version.
- A presentation of the project and the Inventory Methodology used has been elaborated to participate in the course "Logistics of biomass exploitation in forest systems" organized by University of Cordoba (*presentation_plan&methodology.pdf*): Spanish version

REGION OF WESTERN MACEDONIA (GREECE)

The Forest Management problem is very complicated and multi-parametric. It actually consists of three distinct sub-problems:

- 1. Forest production problem
- forest property nodes
- quantification of timber production
- determination of the harvesting levels in the stands that will supply timber in each period
- use of the volumetric growth of the forest as an input (coming from some external model of growing projection)
- guidance of other types of decisions at strategic level, such as the planning and design of the transportation networks and other decisions of forest harvesting
- 2. Forest facilities location
- sites in areas of forest properties

- sites in demand area
- sites in inter-areas
- 3. Forest freight distribution
- identification of the timber and product flows that will be generated among the different couple source-targets in each period so that the total transport of forest freight can be planned from the forests to the forest facility and from the latter to the demand centres
- evaluation of possible routes that will be used for the transportation of timber and products, and the estimation of the number of the trucks, which will be necessary for the distribution
- Our Proposed Logistic Model has been programmed as a toolbox in ArcInfo ver.10 as follows:



The system requirements in terms of minimum Data Base structure and data are:

a) Elevation Data

b) Forest Strands

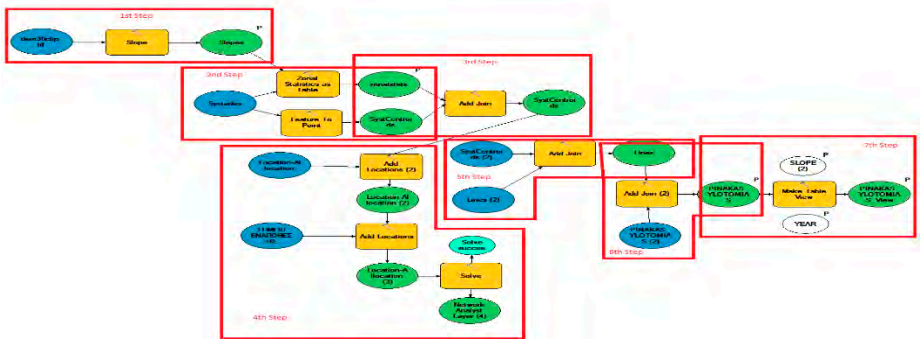
c) Road network

d) Timber production

- Stand ID
- Year
- Tree type
- Timber volume

e) Deposition points

The following chart depicts the general 7-step Workflow



ISPRA-FLA (ITALY)

Forest management planning is not a common practice in Italy. The plan developed for the Valsassina area includes specific studies and figures dealing with the biomass sector and is linked to a parallel study aiming to analyse the opportunity to develop a biomass trade centre in the area in order to optimise the collection, trade and use of biomass resources.

DRAFD- REGION OF SICILY (ITALY)

ICNF-ALGAR (PORTUGAL)

6 Individual conclusions

LP DGMA

The Murcia Region is intended to fulfil the need to have "Forest Sustainable Management Plans" in every forest ownership (in accordance with current legislation) focused in biomass uses. A methodology to develop these Plans has been established that aims to decrease the elaboration costs of Forest Management Plans and to consider first the silvicultural and ecological items *vs*. the productive ones.

CRPF-PACA (FRANCE)

We have two main conclusions on the topic of a biomass management plan. First of all, the local willingness must be strong, in order to produce a quality document. We must keep in mind that for a public body, especially when talking about a grouping of municipalities like the CPA, forest biomass is just part of the biomass available, the "green waste" is a big part of potential biomass, and it is important to take it into account when assessing the available biomass on a territory. Planning the biomass production, when talking to decision makers, must be done on a territory scale.

Then, in a more technical way, we would like to underline that the blocking points to the mobilization of biomass are very numerous. Global management plan must take into account that the available biomass is much lower than what can be seen in the field. This information must get to the decision maker.

SFI (SLOVENIA)

On the property level, we were mainly facing a problem of accessibility of the forests for management with economical visible technologies. Another challenge is respecting other functions of forests specially the protected function where all management or harvesting activities have to be subordinated to the forest protection function (small scale forest operation, low intensity of harvesting).

GoV (VALENCIANA-SPAIN)

This is equal to advantages of each used methodology

REGION OF WESTERN MACEDONIA (GREECE)

The region of Western Macedonia intends to adapt the forest management to the growing demands of forest biomass sources in the context of sustainability with the aim to:

- protect Forest Ecosystem
- maintenance biodiversity
- produce wooden products of high added value
- improve forest income and
- use new technologies and tools for forest sustainable assessment

ISPRA-FLA (ITALY)

Although prescribed by national and regional laws, planning is not a common practice within the Italian forestry sector. The main aims behind the development of forest management plans include the promotion of responsible forest management practices over time. Given the growing importance of energy wood in the local as well as global context, it is believed specific technical tools, including planning ones, are needed to improve the forestry sector capacity to face future market challenges while remaining committed to ecosystem conservation and enhancing.

DRAFD- REGION OF SICILY (ITALY)

This forest plan has been drafted to provide a management model aiming at the ecological and structural improvement of the wood topsoils and their maintenance according to some criteria of sustainable management, thus also providing a quantitative evaluation of the usable forest biomass deriving from the silvicultural interventions envisaged.

The general objective of this work was, therefore, to provide a management model that could be taken as a reference within the several forest sites of Sicily, characterized by the lack of forest plans and the presence of forests with woods of poor commercial value, therefore only usable as fuel.

ICNF-ALGAR (PORTUGAL)

In Portugal, the use of forest biomass doesn't have a big expression in forest management. This activity is mainly looked at as a sub-product of forest management and therefore not yet included in the main regulatory documents both at political/regulatory as well as technical level. The main uses are fulfilled at an industrial level (paper pulp companies, sawmills) and not commonly pre-defined at the property management level. This fact leads to the almost complete inexistence of regulatory and management guidelines concerning the construction of management plans which could frame this activity.

The methodology adopted proposes the adaptation of existing management plans guidelines, to allow the inclusion of forest biomass related information.

6.1 Advantages of each used methodology

LM DGMA

The methodology designed for the forest inventory has provided; with enough accuracy; the forest management parameters that will be needed for a suitable sustainable management of forest resources; and spending minimum expenses on its elaboration.

Besides these advantages; the following ones can be added:

- The availability of the plots data got in the 4th National Forest Inventory (dated in 2010).
- The availability of the digital cartography related to the vegetation types; established on the 4th National Forest Inventory. This can be improved in its accuracy and adapted to the specific forest where the works are going to take place.
- The possibility of carrying out a specific stratified inventory (considering the different vegetation types); that can increase the data collected for the forest of study; so that improve the accuracy of the final results. This sampling can be systematic; random or directed.

This methodology allows:

- Decreasing the necessary effort to realise the Forest Inventory
- Simplification of the collected data processing.

To get this, the methodology is based on:

- The use of the big amount of information that is available in the National Forest Inventory (NFI).
- Adding to the data collected in traditional site inventory.
- Data assessment: it has been designed a specific software to get, in an easy and quick way, the results of growing stocks of the forest.

Therefore; the main advantages of our methodology can be summarized as follows:

- Management plans drafting **costs decreases**
- **Quicker** plans elaboration
- **Standardisation** of plans contents and structure; thus, it results easier later evaluation
- More **reliable** results; according to the elaboration costs and available finance

CRPF-PACA (FRANCE)

Only one method has been used for the elaboration of the SAT. We can point out that the previous work of consultation has been made. This allows the elaboration process to be quite fast and satisfactory for all the stakeholders involved in the process.

SFI (SLOVENIA)

On the SFI, we have developed the methodology to use the Slovenian forest service databases on the level of property. We have figured out after evaluation from the side of local foresters and forest owners that the Forest unit management plan is a useful tool for the forest owner. The main advantage of a forest management plan and a biomass forest management plan on the level of property is that all information is related to the property and because of that have greater practical use for the forest owner.

GoV (VALENCIANA-SPAIN)

The combined methodology (classical inventory + LIDAR) has allowed an increase of the reliability due to the continuous surfacing of data and also the reduction of the number of field plots of the forestry inventory which involves a reduction of economic costs of the field work. We have estimated, in the forest studied, that the cost reduction is about 3-4 euro/hectare, taking into account the characteristics and performance of the "Sierra Negrete" forest.

Note: The LIDAR data used for this pilot action is free accessibility with no charge. In other case it has to be considered the cost of buying this information.

The main results obtained from calculated variables of forest inventory are the distribution of species, the annual growth, the height of the trees and the calculation of stocks,

REGION OF WESTERN MACEDONIA (GREECE)

- The proposed model is characterized by the following condition advantages:
- The model should adequately describe all the important parameters
- The model should be easily programmable in existing GIS systems
- The model should be easily comprehensible
- All partners should have available data to work with such a model

ISPRA-FLA (ITALY)

The planning methodology combines traditional forest management planning techniques and approaches, with a new focus on an emerging sector such as the wood energy one.

The main advantages of the methodology include:

- the adoption of traditional methodologies, well known by local technicians;
- the inclusion of specific data and figures regarding the potential demand for energy from wood in the area;
- the support given by external experts;
- the possibility to analyse links between different renewables, i.e. wood biomass and biogas (from local farms), in order to promote local and rural development;
- the existence of robust background information (e.g. cartography) at both local and regional level;
- the possibility to keep planning costs low.

DRAFD- REGION OF SICILY (ITALY)

The methodology developed to draft the forest management plan represents an approach, able to reconcile the needs related to the limitation of times and costs of realization and the requirements of sufficient accuracy, needed to define the main function and the management orientation for each area and to provide a quantification of the biomass obtainable from the thinning interventions planned.

More in detail, the methodology proposed is characterized by the following aspects and advantages:

- Possibility of integrating the information and data that have been acquired during this work with the databases available at regional level, and in particular:
  - Regional Forests Map;
  - Database of the Regional Forest Inventory;
  - Regional Climate Maps;
  - Regional Soils Map;
  - Regional map of sensitivity to the risk of desertification.
- Possibility of integrating the information and data that have been acquired during this work with the information and data at local level (maps of detailed forest types, dendrometric and auxometric evaluations, surveys on the vegetation, flora and fauna, etc.);

ICNF-ALGAR (PORTUGAL)

As stated before, the methodology adopted in Portugal was the adaptation of pre-existent management plans guidelines. These guidelines are promoted by the national forest services (ICNF) and must be fulfilled by every forest property in order to obtain an approved management plan. These plans, besides promoting a professional management of forested areas and therefore an increase in productivity and sustainability, are essential to frame the European funding within the CAP framework. Because of this fact, in recent years, a large portion of forested lands are managed accordingly to management plans.

Regarding what stated above, the management of the forest biomass use should, in our view, be developed not with the resource to a separate plan, but by privilege a strategy of adaptation of the currently used (and mandatory) guidelines.

The advantages of this option are:

- The legal framework doesn't need to suffer any transformation. It's mandatory (for a lot of situations) to have a forest management plan and to develop it accordingly to a set of guidelines publish by the ICNF. This would only imply the change of the guidelines document;
- The use of forest biomass would be framed with the national (and regional) forest policy and its recommendations, once the state body responsible for the guidelines is also responsible for the development of the main regulatory and strategic documents;
- The guidelines to promote the management of forest biomass production and use would be perfectly articulated with the ones devoted to other uses and functions of the forested areas;
- The inclusion of this new option in the guidelines would be a way to promote the sustainable use of forest biomass and therefore an increase in forested areas management sustainability;
- New plans will easily adopt the new guidelines and older (already approved and in execution plans) ones would easily include it their management plan structure, reducing that way, the problem of adopting the use of forest biomass as a new activity to their properties.

In conclusion, this option would be a very easy way to promote forest biomass use, at a low cost of implementation, and with the possibility to use currently valid plans to spread the management guidelines of this specific action to a great deal of forest areas and their managers/owners.

6.2 SWOT analysis

LM DGMA

Strengths	Weaknesses
Maximize the extraction of residual biomass: The main problem to maximize the extraction has been detected: Reducing transportation costs and improving the road network. Besides, it would be necessary to establish, in the Murcia Region, recollection and distribution points to others places (pellets, district-heating, urban or domestic consume…)	**Lack of planning to date:** Especially in the private level, the forests of Murcia have lacked documents to develop a planning silvicultural works. To date, in a private forest the main silvicultural treatment was the cutting trees with larger diameter causing: rejuvenation of the stand, two-aged stand, lack of management... Traditionally, a Management Plan document had a high price, which made it difficult for the owners would be encouraged to have one for their farms....as a Management Plan document was expensive, the owner did not have that document. Currently, it is not feasible or logical to develop plans for small forests.
Political push to the sustainable and planning management of the forest.	Valuation of resource: resulting low biomass volume. Once drafted several Management Plans, we realised that the resource volume for biomass use is limited in most of the territory. Regarding the silvicultural treatments applied till now (thinnings and improvement cuttings instead of regeneration cuttings), the extracted biomass volumes are lower.
Administrative incentives for drafting management plans (taxes reduction for forest uses, grants to draft technical plans, exclusively targeted grants to ownerships with drafted technical plans…)	High cost of an on market process: In Murcia Region does not exist any Biomass Power Plant, being the nearest at 300km. Therefore, to promote the biomass market it will be recommendable not to sell the biomass resource to Power Plants. It has confirmed as “distances factor” raises the cost of the biomass market, so it is necessary managing and transforming the product in a closer centre. The further decreased the transportation factor, the more profitable will be an action.

	Lack of dissemination and confidence: - Dissemination of the biomass resource and confidence of the biomass market, to bet on a competitive product which gives confidence to owners to manage the forest. - Promotion of the biomass use as a source of heat/cold...and not just as a Biomass Plant resource.
	Lack of reliable studies: - more studies and tests necessary to allow the resource traceability management, reducing the extraction and transportation cost to the maximum, without harming the suitable forest management. - more transparency is necessary in the studies and test data carried out by external consultant, since there are many gaps in relation to the management and profitability of the biomass.
Opportunities	Threats
Distribution and recollection points in Murcia Region. To make profitable the biomass use and reduce the transportation cost, some distribution points (or other alternatives) would be necessary in the Region, since reducing the cost the use would be feasible with wooden volume lower than 20Tm/ha.	Lack of viability in the trees extraction by environmental characteristics: - Wood resource limited, join to a preserving silvicultural methods which prioritize protecting forest. - Hard physiography in most of the area. - Need to improve the road network in order to reduce costs in the extraction of the resources. - A large area is “protected area," which involves the implementation of corrective environmental measures, rising even more the extractions cost.
Joint work with different sectors. To offer the biomass use as an opportunity for forest management, with cost reducing, it is necessary to work together with the industry, the environmental government, and forest owners … to promote the sector related to biomass (CLUSTER).	Lack of viability in the trees extraction by external causes: - Low current profitability of forest products. - Low opportunities of sale and biomass use to date in the Murcia Region.
Social awareness to sustainable forest management by FBMP The biomass resource is an opportunity to use it in a sustainable way, for which is essential to meet the FBMP prescriptions.	

In Murcia Region, such Plan should be as more reliable as possible, fitting the drafting cost to the accuracy of data and own resource.	
Creating social incentives to promote the FBMP implementation. To promote and disseminate the biomass sector, the law of taxes has been modified, and a Grant for private sector has been financed for them to implement the FBMP for the forest management.	
Political interest To encourage the biomass market at regional level, due to the benefits it would generate. These are: - Improvement of the silvicultural condition of the stands. - Reducing the forest and pest-attack risks. - Promoting the rural employment in the disadvantaged areas a (vital aspect considering the severe economic crisis in the Region). The technical plans are tools to guarantee the sustainability of the whole environmental resources. Thus, it is important to promote them as support tools for natural resources management of the forest ownerships.	

CRPF-PACA (FRANCE)

Strengths	Weaknesses
High availability of forest biomass as an "inexhaustible" resource Creation of added value and "green jobs" Competitive prices, compared to fossil fuels Several actors in the supply chain Willingness of the local public bodies to develop the biomass, and to have a global reflection Existence of grouping of private forest owners associations and an active syndicate to represent them.	Fragmentation of private forests Low forest mechanization level Low price of the biomass means low price for the wood and low interests of the private forest owners for the management Low social acceptability of forest harvesting) Infrastructure problems (roads)
Opportunities	**Threats**

Strengths	Weaknesses
National or regional programs: target of 23 % of renewable energy in the national energy mix by 2020 (Grenelle de l'environnement in France) Improvement of forests stands with an appropriate forestry New market for the valorisation of low-quality woods New, big consumers in the region (E-ON and INOVA)	Environmental threats (pollutants emissions of NO2, dioxin, small particulates; risks of soil fertility decrease) Loss of one or more actors of the chain Discontent of the other parts of the wood industry (timber industry, pulpwood, etc.) (FR) New, big consumers in the region (E-ON and INOVA)

SFI (SLOVENIA)

Strengths	**Weaknesses**
Agrarna skupnost Čezsoča is one of the biggest forest owners in the area ASČ has experiences in forest management ASČ has a vision how to develop their timber marketing and supply chain ASČ starts with road network development in their forests	ASČ owns a hard accessible forest ASČ's toady accessible forest doesn't provide enough wood biomass for the most-visible scenario of wood biomass district heating ACČ has a problem in the current commons legal framework Building of district heating depends on the public tender
Opportunities	**Threats**
The Municipality of Bovec is developing a local energy concept based on wood biomass district heating In the area, there are facilities present for sawmill and wood-based industry	The developing of a forest road network is costly and depends on the Rural development program funds lack of financial sources and interest to invest in wood biomass district heating

GoV (VALENCIANA-SPAIN)

In the forest management plan of Sierra del Negrete hasn't applied any SWOT analysis

REGION OF WESTERN MACEDONIA (GREECE)

Strengths	Weaknesses
High production of firewood, roundwood and industrial wood Existence of forest roads Existence of forest management organizations in the region of WM Employment of the local population in forest works GIS Capability Short distance from electric power plants Existence of educational and research institutions	Personnel shortage Lack of forest mechanization Land Ownership problems Lack of financial resources for forest management Lack of marketing experience Unexploited forest residues Lack of experience in forest biomass supply chains
Opportunities	**Threats**
New standards for forest management plans Improvement of forest income Participation in projects New tools for forest sustainable assessment Improvement of forestry infrastructures Personnel training in new forest management techniques Local population personal interest	Greek forestry legislation Lack of funds for investments Illegal logging Danger of erosion Impacts on biodiversity

ISPRA-FLA (ITALY)

Strengths	Weaknesses
Local mountain community is very active and has skilful and open-minded staff Political push to biomass production and renewables. On-going projects and feasibility studies for the creation of a biomass trade centre in the area High potentials for the development of short (i.e. local) biomass supply chains involving local actors Possibility to encourage a cascading approach, with appropriate use of both industrial timber and energy-wood	Cost of planning operations and low profitability of forest operations Ageing stands and potential lack of active forest management Incidence of transport in terms of both costs and CO2 emissions Lack of pilot tests and field-experience to include specific measures for biomass production within forest management planning Strong fragmentation of private forest estate (matter of economy of scales for investments)
Opportunities	**Threats**

General attention and interest on biomass for energy issues and wood mobilisation Potential links with other renewables (e.g. biogas) Existence of good practices at regional level (energy-contracting, short supply chains, forest certification, etc.) Potentialities from future rural development programmes (mountain-specific measures, forest owners associations, support to renewables, etc.) Potentialities depending on the approval of the new EC Directive on sustainability criteria for solid biomass	Lack of adequate viability means and infrastructures. Low rate of forest management planning within forest owners (in particular within private ones) Under-exploitation of high-value timber in favour of energy biomass Local wood industry largely dependent on wood materials from outside

DRAFD- REGION OF SICILY (ITALY)

Strengths	Weaknesses
Sufficient viability for the use of forests in the areas characterized by active forestry.	Lack of previous forest plans to which refer. In the Proforbiomed pilot area, there are no management plans. As a consequence, there was no opportunity to refer, from a methodological point of view to forest plans of ecologically similar areas already tested on the territory.
Lack of alternative economically advantageous markets for the use of forest resources due to: - poor technological quality of wood; - absence of a market for firewood;	Lack of a supply chain for the use of biomasses: In the area of the Sicani Mountains, no plant for the use of residual biomasses exists; therefore also other components of the supply chain are lacking (usage, transportation, transformation etc.). The actual applicability of the forest management plan will greatly depend from the level of confidence of investors and from State subsidies.
Possibility of access public incentives to support the implementation of supply chains in the forestry sector and the implementation of forest management plans.	Systems of traditional forest usage based on general purpose technologies: Currently, the organization of forest working sites is based on traditional working systems characterized by a poor mechanization and an elevated employment of low-skilled workers, therefore, not able to ensure a high yield. As a consequence, problems could arise related to the biomass supply depending on its power and requirements.
Biomass productivity levels able to significantly reduce the cost of felling and skidding: The current estimated average productivity is around 30 tons / ha of fresh weight. On the basis of the estimated costs in the area of	Lack of awareness and confidence of local communities: The dissemination activities carried out within the Proforbiomed project territory while bringing to the knowledge of many stakeholders the potentialities related to the

Strengths	Weaknesses
investigation, it appears to impact significantly on the overall budget.	creation of a biomass supply chain proved however to be insufficient to create a widespread awareness in the local communities about the opportunities related in this production sector. We especially note the need of a greater number of workshops and on field demonstration activities.
	Lack of certification of the production process: Currently, there is no document or study of the certification of all or part of the production process. The absence of a certified production process, as well as having a negative impact on the efficiency levels of the supply chain, may have negative consequences in the process of authorization and when fully operational, in the compliance and managerial and administrative efficiency.
Opportunities	**Threats**
Possibility of exporting the model of biomass production in the territory of other municipalities of the Sicani Mountains: Within the territory of the Sicani Mountains, there are other areas with extensive reforestation, having similar forest formations and territorial conditions to that in which the management plan was applied. In the case of development of small power plants scaled on the municipal territory, the production model designed in such a plan could be adapted to other contexts.	Absence of an effective regional policy for the use of biomass as an energy source: Despite some measures of public subsidy provided under the Rural Development Plan (RDP Sicily) and the Regional Operational Plan (ROP Sicily), we note the absence of an effective policy framework designed to encourage the spread of biomass energy chains and, more in general, of all sources of alternative energy. The current spread of wind and photovoltaic power, in fact, more than meeting the needs of the regional population, is aimed at financial speculation, which often leads to special interests and illegal activities.
New employment opportunities: The creation of a biomass supply chain could have some positive effects both on the public sector, thanks to the abatement of costs derived from the biomass sale, and on the private sector (carriers, workers in charge of the plant, workers for biomass storage and transformation etc.).	Possibility of failure linked to the lack of know-how required in the various steps of the production process.

Strengths	Weaknesses
Stimulus for the realization of forest management plans: the possibility of use of biomasses as an economic resource could be a stimulus for the creation, especially at public level, of forest management plans aiming at the safeguard of the ecosystems and at the aware and sustainable use of forest resources.	

ICNF-ALGAR (PORTUGAL)

Strengths	Weaknesses
Promotion of an activity based in professional management guidelines, supported by advanced knowledge and a network of European partners already developing advanced solutions.	Low profitability of the forest areas (small properties, low productivity soils, lack of infra-structures, and lack of forest markets) causes disinvestment and low interest in new management solutions;
Current sensibility of forest managers/owners to the use of management plans;	Low scientific knowledge of the average forest manager/owner regarding forest biomass use
Easy implementation of the proposed guidelines in new plans as well as adaptation of older documents;	The guidelines adaptation for inclusion of forest biomass related points may be regarded as a new set of impositions and therefore as a barrier to normal forest management
Opportunities	**Threats**
The promotion of the forest biomass use may increase average forest area income, promote their sustainability, and lead to a more professional management of these zones;	Low interest from forest managers/owners due to market problems.
Reduction of rural areas abandonment and creation of new industries directly or indirectly related to forest biomass use, reactivating local economies	An unfriendly legal framework that promotes other uses of green energy in opposition to forest biomass.

Reduction of fire risk.	Pressure from lobby groups with an interest in reducing forest biomass use (saw mills, paper pulp industries).
Possibility of a large area already provided with forest management plans adopting forest biomass use guidelines easily.	Difficulty to reconcile biomass use with other uses already proposed in the forest management plans.

7 General conclusions

Partner	LM DGMA (Spain)	CRPF-PACA (FRANCE)	SFI (SLOVENIA)	GoV (SPAIN)	W.MAC. (GREECE)	ISPRA-FLA (ITALY)	DRAFD- RoS (ITALY)	ICNF-ALGAR (PORTUGAL)
FMP	MUP nº 36 "Sierra de Burete." Cehegín (Murcia)	Local Supply scheme (SAT Schéma d'Approvisionnement Territorial)	Posestni načrt Agrarne skupnosti Čezsoča	"Sierra del Negrete" (Utiel)	Krania-Monaxiti-Kipourio Forest	Valsassina area, Municipalities: Casargo, Margno and Parlasco (Lombardy, Italy)	Public forests in the Municipality of Bivona (Agrigento Province)	Mata da Herdade da Parra Management Plan
Area (ha)	1570.00	130000.00 (55.9 % forested)	2688.42 (86,09 % forested)	7.576,84	14986.6 (48.45% forested)	1054.65	963.00 (48% forested)	142.00 (timber production)
Forest inventory	Led sampling method	GIS implementation completed by field inventory and personal interviews	regular 200x200 m grid plot	Systematic 500m grid distribution (conventional and LIDAR technology)	non-systematic (irregular) plots method	stratified sampling method	GIS implementation and "on the field" validation	National Forest Inventory 5 (IFN5)
Management units	District, compartments and stands	---	Gravitation districts according to the road network	District, compartments and stands	By main species and administrative units.	District, compartments and stands	Section, forest particles and sub-particles	According to the main vegetation occupation (homogeneous plots).
Growing stock	Single entry volume equations	CRPF's database tool and a qualitative estimation from woodcuts and	SFS databases	By regression models (combining field work and LIDAR technology)	Volume measure in plots. yearly volume increase by volume equations.	Stereometric tables (basal area was measured by relascope)	Double entry volume tables	Growth models tables (for d and h) and biomass equations from IFN5.

Partner	LM DGMA (Spain)	CRPF-PACA (FRANCE)	SFI (SLOVENIA)	GoV (SPAIN)	W.MAC. (GREECE)	ISPRA-FLA (ITALY)	DRAFD- RoS (ITALY)	ICNF-ALGAR (PORTUGAL)
Main species	Coniferous forest: *Pinus halepensis*	Coniferous forest: *Pinus halepensis* with *Quercus ilex* underwood	Coniferous and broadleaves forest: Fagus silvatica, Abies alba, Picea abies, Ostrya carpinifolia	Coniferous forest: *Pinus halepensis,* and mixed with *Quercus ilex.*	Coniferous, mixed Oak and broadleaves forest: Pinus sp (Pinus nigra), Abies borisi Regis, Fagus silvatica, and Quercus	Coniferous forest:Abies alba, Picea abies, Larix decidua and Broadleaves Fagus sylvatica, Alnus viridi, Betula pendula, Corylus avellana Castanea sativa Fraxinus ornus Ostrya carpinifolia	Conifers reforestations: Pinus halepensis, Cupressus sp, Cedrus atlantica and Pinus nigra	Artificial afforestation of Coniferous forest: *Pinus pinaster and pine.*
Forest structure	Even- or two-aged stands	Hardwood, softwood and mix with softwood dominance	uneven-aged mixed stands and coppice stands	pure stand of *Pinus halepensis* pole and woodland	coppice forest	semi-natural and managed under either coppice or high stands	Even-aged (mainly) and uneven-aged stands.	Even-aged stands.
Regeneration period (year)	15	20	20-50 production period 160 -180	20	20 (P*inus nigra-Abies*) to 80 (*Pinus heldereich*). 40 for the rest.	15	Not possible to define turns of cutting	20
Main management method	floating periodic block (in productive district)	---	Shelterwood, chopping and group selection	Stand management method	Conversion method (seeding or fast-growing forest)	Selective cutting on saplings or small patches and conversion method to seeding forest.	---	---
Silvicultural treatments	Shelterwood cuttings in plots (in productive district)	---	Shifting thinning, silviculture thinning in younger stands, regeneration cutting, silviculture works in coppices	Shelterwood cuttings	Improvement cutting, cultivation cutting	Improvement thinnings, clearcutting and selective cuttings.	Improvement thinning, planting and underplanting	Three improvement thinnings to remove 15 % of the total trees each time, and final cutting.

7.1 Most used inventory and sampling types

In the previous table, the main characteristic parameters of different methodologies are shown. It can observe a variety of forest inventory: from plots sampling on field to cartographic works by layer overlapping (with field validation). Between plots sampling, the systematic or regular grid distribution is the most-common inventory type, also using the led, irregular and stratified method.

7.2 Most-used management and treatment types

The management method is the most-complex parameter to obtain a conclusion as it can be seen in the previous table. In most cases, no explicit reference is made to the management method either by absence of this concept in the FMP or by its understanding difficulties. Hence, there is no more common method. Arguably the method most used is the “selective cuttings” focusing on small stands, plots or even individual trees.

Among the most-common types of silvicultural treatments we can find the improvement thinnings and shelterwood cuttings.

7.3 Suitability of traditional silvicultural harvesting vs. biomass/energetic harvesting

LP DGMA

The North-Western Murcia Region is the largest area of forest biomass. The traditional silvicultural harvesting applied in this region has not to be modified respect to biomass use. Although, the aim of the traditional silvicultur has focused on the “protection target," the FBMP purpose places the protection objectives before the production ones. Therefore, the silvicultural procedures have not supposed a deep modification. It can consider the main repercussion in the forest products: with the promotion of biomass, all the products have a place in the biomass market (chips, wood, pellets…), even those considered as “non-commercial wood” in the traditional silvicultural harvesting.

Regarding the biomass extraction, currently, the “Management Plans of Protected Natural Areas” in the North-Western Murcia Region is being developed, what implies conservation measures and specific actions to protect the species and habitats. The biomass use is compatible with the uses included in the Plan, provided the rules and guidelines were respected, and the management measures were carried out.

In that sense, the biomass uses are limited by several factors:

- Protected area criteria.
- Presence of protected flora and fauna, to consider when planning and implementing forestry works, producing both area and temporal constraints.
- Areas burned by wildfires. The landscape of this areas shows zones of bare soils or excessive vegetation cover which prevents the development of normal growth of vegetation.
- Areas of understocked (low density of canopy cover): amount of shade<40%
- Working in excessive slope areas (more than 45%) can cause soil erosion
- Others restrictions are:

- Infrastructures and equipment limitations. They have to be enough to provide services and utilities demanded from the forest.
- The topography slope modifies the technique conditions of the forestry works.
- Feasibility of the forest biomass extraction, which depends on extraction costs (distance, mechanization, transport...).

Regarding the "Sustainable Forest Management Plan: MUP nº 36 "Sierra de Burete." Cehegín Municipal District (Murcia)," considering the gotten results, it could affirm the sale of biomass incomes (particularly, the silvicultural improvement treatment) would cover most of the costs arising from this silvicultural work.

The Murcia Management Plan results show that the profitability of the forest biomass use is achieved in areas where the amount of the extracted biomass exceeds 15 Tms / ha (in general, this value depends mainly of spending product transport).

CRPF-PACA (FRANCE)

For us, biomass is more a market for woods we couldn't valorise until now. The lack of silviculture has led to a lot of delay in the treatment of the forest. The production of woodchips allows lowering the price of intervention that wouldn't have been done otherwise. It makes wood biomass extraction very spreadable, and the Biomass management plan, by using national and easily available data can be repeated easily. On the environmental point of view, the document promotes the concrete and existing tools and laws for the sustainable management of the forests (planning document in public forests, forest management plan, Regional Scheme of Silviculture, etc. in private forest).

SFI (SLOVENIA)

- In the management plan, we have identified 8 areas. We have merged different areas on the criteria of accessibility and its gravitation tendency and forest functions. Among those, we have found 6 areas were potentially wood biomass extraction is visible.
- Among 8 selected areas, we have one area of protected forests. In those areas, all forest operations are very limited and because of that we didn't include it in the potential areas where wood biomass could be extracted.
- From 8 areas on the property we have 3 areas were wood biomass extraction is impossible or not feasible:
- Area VAR: (Protected forests) forest with protected function, almost without road networks, with a very limited options for harvesting
- Area G0: inaccessible forests where investment into the forest road also depends on others forest owners. It is not feasible to have any investment in the forest road in the next 10 years.
- Area P20: is an area with inaccessible forests. Road construction is planned in the next 10 years. Today it is accessible with long traditional cable systems which economy is in question.

GoV (VALENCIANA-SPAIN)

DISTRICT A: The main goal will be the production of timber and forest biomass. Subordinated to that and under-use sustainability criteria will ensure maximum services, notably hunting uses, livestock, bee-keeping, and agricultural works for hunting fauna.

DISTRICT B: The main goal will be the protection and conservation of soil, flora, fauna and landscape. Subordinate to this is the production of wood and biomass, hunting, livestock, bee-keeping, agricultural works for hunting fauna and social use.

DISTRICT C: The main goal will be the production of timber and forest biomass. Subordinated to that and under-use sustainability criteria will ensure maximum services, notably hunting uses, livestock, bee-keeping, agricultural works for hunting fauna and social use.

DISTRICT D: The main goal will be the production of timber and forest biomass. Subordinated to that and under-use sustainability criteria will ensure maximum services, notably hunting uses, livestock, bee-keeping, and agricultural works for hunting fauna.

DISTRICT E: The aim is the conservation, with special emphasis on reducing the risk of wildfire. This is an area that is regenerating after suffering forest fires where non-adult trees densities are excessive and often impassable. Thus, silvicultural actions will aim to achieve structures that provide protection against forest fires. Subordinate to this target will also uses wood and biomass production, hunting and bee-keeping, and social use.

REGION OF WESTERN MACEDONIA (GREECE)

Actual worthwhile areas for the biomass extraction:

1. At the pilot forest area of Krania-Monachiti-Kipourio, the morphology of the soil has strong inclinations and slopes. This is also the general characteristic of the forest and forest areas in the broader area of Western Macedonia Region. Therefore, when the question comes to the energetic exploitation of the forest and biomass extraction, the following problems/issues need to be tackled:

- First, the non-mechanization of the wood cutting and processing. Due to the strong morphology and the sivicultural harvesting of the forest there is no mechanization of the process. Right now, the harvesting cooperatives responsible for the harvest and collecting the trees use exclusively animals (donkeys and mules) for the extraction of wood out of the forest. This is a costly procedure which increases the cost even more when it has to do with forest cluster with a great inclination or far away from the nearest road. Of course, until now, there was any real interest to extract also the biomass out of the forest which could give a better motive to the workers to use the mechanization also in different parts of the process.
- The biomass of the forest is actually the trimming coming from the treetop and the branches. Often and due to the strong inclination, after tree harvesting we use these residues for prevention of corrosion of the soil in most of the cases. Therefore, any general plan for energetic exploitation of biomass shall take this parameter under consideration.
- The energetic harvesting could be implemented in pilot basis in some particular regional forests. It is also believed that, in many cases, the harvesting for energetic purposes could help with fire prevention. This could be achieved by using the clear-cut method for particular parts/segments of the forest in order to prevent fires to transfer to the whole forest. It could also give very important economic benefits to the local economy by giving employment to the locals who usually abandon the rural areas because there are no working opportunities.

2. Areas where it's necessary to be very careful with conservation values, but where it's possible to realise a biomass harvesting

There are such areas which are preserved for their unique nature environment or in most of the cases because it is the habitat of a protected species like the bear, the wolf, unique birds or unique flora. In the Region of Western Macedonia there are two National Forests, the first of Pindos Mountain and the other one of Valia Kalda National Forest (warm valley) where it is protected from any burdening human activity.

3. Areas where the biomass extraction is impossible due to any reason: high protected values, high extraction costs, low growing stocks...

As referred before, in some cases where the inclination of the soil is very high the cost of extraction of biomass, or even technical timber is very costly. Such cases are quite usual in the forest of the Region and in our calculation for the presentation of wood extraction out of the forest; we always set a present which the harvesting will not be executed because of the high cost and the difficulty to extract the wood and the biomass.

ISPRA-FLA (ITALY)

Forest biomass for energy purposes is becoming a more and more important product from regional forests and a source of income for forest owners and managers. Notwithstanding this general trend, special attention shall be paid to forest multiple services and conservation needs. In general terms the plan aims to encourage active forest management in the area, in order to conserve forest ecosystems and contribute to rural development opportunities at local scale.

Although biomass production has a growing importance, the plan tries to encourage a cascading approach, where attention is paid – whenever possible – to high-value products (i.e. industrial timber) while only residues and minor products are used for energy production.

Following the general trend at national level, the plan has a precautionary approach, aiming to protect areas with outstanding ecological value, in order to avoid (or at least minimise) any potential negative impact from forest management operations. The presence and enforcement of a robust legal framework in the region represents a good starting point for this.

Apart from the presence of protected areas, additional limitations to biomass production derive from: (i) lack of infrastructures (forest roads); (ii) high extraction costs; (iii) limited production capacity for small owners; (iv) slope areas; (v) extra-mature stands.

DRAFD- REGION OF SICILY (ITALY)

As previously mentioned, the use of forest biomass for energy purposes is compatible with the safeguard and ecological improvement targets of the forest stands present in the area of the Sicani Mountains. The forest uses able to provide forest biomass mainly fall, indeed, on reforestations of Mediterranean or Mountain Conifers, in which the main objective is to facilitate the establishment of natural renovation and the subsequent renaturalization through the gradual elimination of the conifers.

However, there are some reforested areas in which no thinning interventions can be carried out, or in which the biomass yield does not justify the usage costs. These are:

- Areas with a predominant aim of natural protection;
- Forest areas with high slope and / or bumpiness in which no silvicultural interventions can be performed;
- Forest areas in which silvicultural activities are forbidden for the purpose of soil protection;
- Forest areas potentially exploitable but where thinning cannot be performed with respect to the skidding systems currently used by the managing body.

ICNF-ALGAR (PORTUGAL)

In Portugal, biomass harvesting is generally not framed by a set of specific silvicultural models. In the cases where this activity is adopted it's mainly directed to forest residues use (branches, leafs and, in some cases, roots) and, therefore, not consider as the main objective of the forest exploitation. The main silvicultural harvesting models used in the country are mainly directed to wood production (for sawing or paper pulp products), cork production (in Quercus suber areas) or cone harvesting (in Pinus pinea areas).

In the specific case of the management plan adopted (Mata Nacional da Herdade da Parra), the biomass production was exclusively adopted in the areas defines as productive. All the other areas, namely the ones with the presence of conservancy values, where excluded from the biomass exploitation model tested.

In the production areas, despite the fact that the "traditional" silvicultural model was maintained, was considered that the end use of the totality of the wood material would be directed to biomass production. This fact resulted in a direct adaptation of a traditional wood production silvicultural model, based exclusively in production areas, to include biomass production.

The remaining areas were excluded from this method for two main reasons: low intervention areas reserved to conservancy objectives not available to harvest (or afforestation) activities and dominance of species not directed to wood production (mainly Quercus suber and Arbutus unedo).

8 Final conclusions. General evaluation of action 1.7 (WP 4)

The partners involved have come to the following conclusions regarding the exchange experience and the action final results.

LM DGMA

Despite the efforts to develop a common methodology, each partner has followed its own methodology according to their specific legislation. However, this has allowed having access to many documents, which complement the development of FBMP.

The work in this pilot action has represented an improvement for Murcia Region in:

- Implementation of the development of Forest Management Plans for all types of forest ownerships for biomass uses.
- Promotion of the legislation to encourage the Forest Biomass Management Plans development and use.
- Rules and standardized documents to facilitate their review and approval.
- Development of a simple, affordable and reliable management plans for all types of forest ownership.
- Increased interest by private owner, which is aware of the need to have an FBMP to extract biomass in a sustainable way.
- Improvement of the biomass resource vision, which until now was non-existent.

CRPF-PACA (FRANCE)

For us, the exchanges with the lead partner have led to a better knowledge of the document and to make the questions we wouldn't have asked otherwise. This has been a good experience, and we could also compile more information about legal frame for example.

SFI (SLOVENIA)

The developed methodology (framework, index) was a very good guideline in preparing a forest property management plan. The final result of this action is a wood biomass forest property management plan as a pilot plan which can be now easily used also by other larger forest owners or associations of forest owners on one territory. It is a practical result, and a tool developed together with its users. Its use now depends on the property management board and the members of the agrarian common. As stressed out in the SWOT analyses, there are some factors that are going to have a crucial influence on the fulfilment of foreseen tasks of the management plan.

GoV (VALENCIANA-SPAIN)

The methodology used by each partner has provided us an extensive knowledge on the development of management plans for biomass and the different methodologies that can be applied. This will undoubtedly have a positive impact on future actions and related projects.

Although forest management planning has not been a common practice in Valencia Region, it is being promoting their fulfilment. In this sense, Sierra Negrete Management Plan is a great step forward, because is in the first plan focused in forest biomass management for energy purposes in the region.

It is expected that this plan and an interactive tool developed, will serve as an example for Valencian forest owners and managers to elaborate management plans in their territories. These actions can foster sustainable forest management in the Valencia Region.

Furthermore, the combined methodology (classical inventory + LIDAR) has allowed the reduction of a number of field plots of the forestry inventory which involves a reduction of economic costs of the field work. We have estimated in the forest studied that the cost reduction is about 3-4 euro/hectare. This reduction is effective if the LIDAR data is free accessibility with no charge.

REGION OF WESTERN MACEDONIA (GREECE)

The area relief combined with the lack of technical personnel and the necessary funds make the forest management difficult. On the other hand, GIS is a useful tool and provides the means for identifying and quantifying all the parameters that affect the available and technological biomass potential. The existence and the implementation of a rich database could lead to reducing the time and the costs of gathering information and developing an integrated biomass production, with the aim to sustainable management of forest resources, the conservation of the forest ecosystem and the production of high added value wood products that could be used for energy purposes.

ISPRA-FLA (ITALY)

Although prescribed by existing laws, forest management planning is not a common practice in Italy. Given this, the call for wood mobilisation from the European Commission and the increasing demand for energy wood are driving a stronger attention on active forest management could represent a good opportunity to promote local development. The development of forest management plans to take into consideration specific needs linked to biomass production was a good opportunity for helping local technicians, forest owners and companies to become more aware of opportunities and risks connected to renewables. The pilot action has allowed to:

- encourage a stronger attention on including biomass production within planning needs, in order to support responsible forest management in the long term;
- analyse potential demand for biomasses at local level, in order to tailor future actions;
- favour co-operation between local actors and experts operating in the renewable sector, including co-operation between the wood biomass and biogas sector;
- provide a good practice for private forest owners in the area;
- gather and develop data and figures that could also be adopted by other owners and actors.

DRAFD- REGION OF SICILY (ITALY)

The implementation of the forest management plan, aimed at the creation of a supply chain for the use of biomass for energy purposes, is for the area of the Sicani Mountains, a first concrete effort towards a policy of forests management and planning, which could reconcile economic needs with the priority of increasing the resistance and resilience of forest ecosystems. More specifically, the work carried out as part of this pilot project has produced on the territory the following positive effects:

- The creation of a model for the use of forest resources capable of triggering a process of involvement of other entrepreneurs and investors interested in taking a role in the stages of the production process (transport, storage, energy production);
- An increased awareness and information within the local communities about the importance of forest management and use of forest biomass for energy purposes.
- An increased interest of local administrators for their involvement in the supply chain as consumers of energy at lower costs;
- Show to local public and private stakeholders the economic profitability of the biomass production for energy purposes through the development of a supply chain based on the use of innovative methods and processes that are both environmentally, socially and economically sustainable;
- Addressing the Managing Body towards a policy of workers' use within the forest areas for innovative activities that can highly respond to a sustainable forest management and that require more technical expertise, but at the same time ensure the best employment opportunities.

ICNF-ALGAR (PORTUGAL)

The forest biomass represents a great opportunity to forest management in Portugal. The several constraints presented to the sustainability to rural areas (and specifically to forested ones), namely the ones related to property size, low income, fire recurrence, tend to promote their abandonment and the reduction of investment. The possibility to adopt a new productive activity, promoting the increase of the income from the

forested areas and, at the same time, granting the reduction of the fuel load in a great extension of these areas, is a major breakthrough to the sustainable management of these areas.

The adoption of this activity is, of course, mainly dependant on policy options, but steps can be made at the management level, to prepare the existent management options to include this new reality. At this point, the present action of the PROFORBIOMED project represents a great opportunity to test methodologies tending to the adoption of new management models.

The adaptation of an existent management plan, to include biomass use, permitted the testing of a new set of solutions that allow the analysis of the pros and cons of this option to a specific area and also the possibilities to adapt the current guidelines of the forest management plans to include this option.

The exercise that took place during this pilot action permitted the first approach to the inclusion of the forest biomass use in the management plan and placed the first seed to the creation of a set of specific silvicultural models directed to this forest activity. The results achieved may represent a first step in the road to develop a set of political options to promote forest biomass use in the country.

9 Annexes

9.1 SUMMARY OF METHODOLOGIES USED IN THE DIFFERENT FOREST BIOMASS MANAGEMENT PLANS.

LM DGMA

The methodology used to draft the forest biomass management plan "Sustainable Forest Management Plan: MUP nº 36 "Sierra de Burete." Cehegín Municipal District (Murcia)" was structured by the following steps:

- Previous forest review: Its objective was to make a first review of the forest and to establish general targets for the management of that forest.
- Deskwork

* Compilation of available technical information. It was consisted of compiling, summarizing and analysing all the available information existing about "Sierra de Burete" forest, considering legal, ecological, economic, social or productive aspects, in order to get a deep knowledge of its characteristics and the restrictions we can find in its management. Also, a previous management plan was consulted

* Cartographic works: stratification and management division. The final objective was to divide the forest in the previous and provisional ecological division to delimit, on the maps, the different types of vegetation so that the basic management units can be defined and, grouping them, can be obtained the upper management units. Therefore, we developed a vegetation types cartography (strata map) for the property based on different information sources (data collected in the 4th National Forestry Inventory-NFI-, orthophotos, slope and aspect maps, …) and parameters as species' composition (species, covered area and growth level), canopy cover, property (public or private), origin of the forest (natural or coming from afforestation)…

Once the strata definition was done the inventory division was carried out to obtain a basic management units map (stands, compartments, district), where the inventory works were based. This map structured the forest area for its later silvicultural management, and it allowed calculating the growing stock for each zone, according to the inventory data. The resulting management units were:

District	Compartments	Stands
3	44	132

- Sitework:

* Forest inventory: it allowed defining the forest measurement parameters of the forest, with enough accuracy, for a sustainable management. A stratified led sampling was used as inventory method, designed to provide a lowering of expenses; based on the measurement of a few inventory plots within the forest (10 plots using led sampling), and using management data of plots already measured in previous inventories (141 plots measured in 2002 using systematic sampling) or the ones contained in 4NFI (not considered in this case). The growing stocks were calculated from the union of previous inventory data and site works plots data, obtaining a sampling with a known accuracy.

- The representative site data in plots were collected in the interesting strata/compartments (stratified led sampling) in order to know their growing stock. The plots were located in the most representative places of the compartment. 10 circular plots with a variable radius were measured. Their radiuses vary according to the stand density and the forest type (containing, at least; between 15 and 25 trees in every plot). The minimum requested information measured in each plot was its area (ha); the number of the plot and of the trees that are measured in; the species of the measured trees and their normal diameter.
- In each compartment, a silvicultural report was filled, where its main characteristics were compiled.

- Deskwork:

*Inventory data processing and growing stocks: to process all the data collected and obtain the growing stocks, specific software designed for this purpose was used (it was already explained in the document "Methodology for the design of forest inventory by the use of specific software, for the elaboration of forest biomass management plans in Murcia Region" (http://proforbiomed.eu/publications/project-deliverables/deliverables-workpackage-4/pilot-action-17).

This software was based on "single-entry volume and growth equations" for the main forest tree species in Murcia Region, based on the NFI data. Thus, the growing stock and biomass was assessed.

*Definition of the cutting units (treatments): In each management unit (compartment), with the basis on the inventory data and information, it was necessary to classify and group the silvicultural management units (stands), according to the period that was necessary for each of them to start regeneration stage (regeneration, preparation and improvement). This classification is very important in the Plan, because it determines where and when applying the cuttings in each period. The main management method for "production purpose" was the floating periodic block method, practicing shelterwood cuttings in plots.

*Management Plan drafting

- Approval and validation by the Environmental authority. The environmental authority reviewed and formally approved the "Sustainable Forest Management Plan: MUP nº 36 "Sierra de Burete." Cehegín Municipal District (Murcia)," it was checked that the Plan had been designed according to the environmental limits existing in the area (wildlife, etc.) and that the resources sustainability was guaranteed in that forest.

CRPF-PACA (FRANCE)

In France, the forest management plans (FMP) are approved by the CRPF. They are different from the SAT (Schéma d'Approvisionnement Territorial) or "Local Supply Scheme" presented hereafter. The SAT is a global planning document, and a forest management plan applies only at a propriety scale.

- The FMP must contain the following information:
  a) The application for approval of a simple management plan.
  b) General information as a common situation, cadastral reference, table of land parcels…
  c) A brief analysis of economic issues.
  d) A brief analysis of environmental issues (main regulations and how the owner may adapt them).
  e) A brief analysis of social issues of woods and forests.
  f) The identification of game species subject to a hunting plan.
  g) In the case of a renewal, the FMP includes a brief analysis of the implementation of the previous plan, in particular the implementation of the program of cuts and work out in particular the cuts and scheduled jobs that have not been made.
  h) A brief description of the types of populations present in the woods and forests with reference to the categories of stands of regional pattern of forest management.
  i) The definition assigned to the woods and forests by the owner objectives.
  j) The program setting, depending on the objectives and the issues, the nature, basis, the frequency of cuts to use in the woods and forests and their percentage is surface for clear cuts, either volume or in sampling rate.
  k) The program determining the nature, attitude, size and date of creation and if necessary, the improvements work.

➢ The methodology used to draft the forest biomass management plan "Local Supply Scheme (**SAT** Schéma d'Approvisionnement Territorial)" was structured by the following steps:

- Forest inventory and zoning: A Geographic Information System analysis has been the most-used inventory type, especially through the National Forest Inventory. The forest inventory has been made by crossing several available data:

✓ Analysis of the document of management in public forest

✓ Analysis of the forest management plan in private forest when the owners gave his authorization (20 cases)

✓ OUAT for the global resource available in the private forest management plan

✓ Nation Forest Inventory, 2nd version

✓ Aerial photography of 2009

✓ Analysis of the document provided by the Cooperative Provence Forêt (resume of the woodcuts between 2000 and 2012 and foreseen cuts until 2015).

- Those analyses have been completed by field inventory and by meetings and interviews with all the main stakeholders of the area
- The result of these steps is a map with the main forest types of the CPA.
- Growing stocks. An Excel tool was developed for allowing foreseeing the volume of softwood that will be collected every year in every municipality of the CPA (the study area of "Communauté de Communes du Pays d'Aix"). This tool uses the CRPF's database that includes all the characteristics of every single Forest Management Plan in the region. By crossing the data of the database with a table of productivity, a volume per ha and a % of coniferous trees can be assign for each kind of forest stand, and a volume for the woodcut can be estimated

This tool is very interesting for a municipality, for example, because it gives them: a volume actually available, a year per year vision of the evolution of the availability of the resource, produced with a strict environmental scheme, local produces.

- But a growing stock assessment has not been made strictly; all the data are average observations on realized woodcuts and are validated by forest workers and forest managers.
- Planning. Management method. In general, the management plans for a forest are edited for 10 to 20 years. Each document treats the Management Units (a combination of a homogenous forest, with a common management purpose and a year of management operation) according to their orientation, specified by the owner (public or private) and provided that the management proposed follows the rules presented in the Regional Scheme of Forestry Silviculture (Schéma Régional de Gestion Sylvicole – SRGS). This document indicates for each forest type the rules of exploitation to certify a sustainable management of the forest stands.
- The regenerative cutting will be adapted according to the forest stand, its age, and its health state. All of this information is available in the management document of the forest.

SFI (SLOVENIA)

The Forest Management Plans, in Slovenia, are elaborated for all forest, independently of the ownership or the size of property. It is obligated to manage the forest according to the plans that are approved by ministry responsible for forestry.

- The slovenian forest management system has four different management plans:
- Regional forest management plans,

- Regional haunting-breeding plans,
- Silviculture management plans,
- Forest unit management plans (FUMP)

The Forest Biomass Management Plan "Posestni načrt Agrarne skupnosti Čezsoča" presents an extraction from the official unit forest management plan.

The "Agrarna skupnost Čezsoča" FMP is a management plant written on the basis of the Forest unit Bovec management plan (this FUMP made by Slovenian Forest Service were approved by the official government), Local energy concepts were planned for Municipality Bovec and members of the Agrarna skupnost Čezsoča. The FUMP is not covering direct issues interesting for active forest owners. The Forest Management Plan for the "Agrarna skupnost Čezsoča" is a pilot management plan with an aim to estimate wood biomass potential of known forest owners and how can they contribute to cover the local energetic needs. The developed framework of this pilot management plan can be now used for larger individual forest owners or associations of forest owners in the phases of local supply chain establishment.

The pilot forest property management plan has been created following these steps:

- Selection of a potential region
- Selection of the potential owner willing to contribute to the forest biomass use in the region
- Analyses of the forest on the property according to available information from forests GIS
- Analyses of the energy demands in the area
- Presentation of the analyses results to different participants
- Adjustment of the forest property management plan
- Forest inventory. Field work and zoning. In the 1994 method of permanent sample plot was introduced by the Slovenian Forest Service in the forest management system. In the mean time on the majority of permanent sample plots a second measurement was done. A net of sample plots is different according to needed precision: 250x500 m, 200x500m, 250x250 m. Sample plots are placed in a concentric circle. In an area of 500 m2, we measure all the trees above the 30 cm DBH on an area of 200m2 we measure all trees above 10 cm DBH.

The Forest Management Plans are divided into management units. We have chosen the forest management unit as "Bovec." Inside of that unit we have made a management plan for the property of "Agrarian common Čezsoča." From the plan for forest management unit, we can see that we have differentiated cutting works units following possible technologies: 1 chain saw + tractor skidder; 2 chain saws + cable crane; 3 chain saws + manual skidding; 4 chain saws + combination of tractor and manual skidding; 5 chain saws + combination of cable and manual skidding. About type of cutting we classified them according to silviculture guidelines in: shifting thinning, silviculture thinning in younger stands, regeneration cutting, and silviculture works in coppices.

- Growing stocks. Data as growing stock and yield for "FUMP Bovec" come from 185 permanent sample plots. Sample plots are established on 1000 x 250 m grid for more productive forests and 1000 x 1000 m grid for less productive forests. So basically we have two stratums. On those plots, trees are count and measured, and quality of timber is estimated. Additionally field work description of stands were using.

Permanent sample plots are not the only source of information about forest. Second source is the inventory of stands. In this inventory, foresters on the field are evaluating forests stands and prescribing forest management guidelines. Typical information included in this inventory are: growing stock, wood increment, tree species, harvesting possibilities and limitations, GIS information, socioeconomic information... Majority of the information is also included in Forestry Geo Information System.

The problem is that many property owners cannot directly use the information developed on different spatial levels (cadastre parcel or holding) and, mainly, they do not have their own management plan. Because of that, SFI has decided to prepare a pilot forest property management plan with a special focus on wood biomass. To achieve this goal we have used an existing Slovenian Forest Service databases, instead of field work, but we had to use GIS tools and other database programs to modify and recalculate the information on the property area.

Additionally we had meetings with owner's representatives and employees of the Slovenian Forest Service. For the energetic part of the property plan, we have used information from the local energy concept plan.

- Planning: The main three silviculture guidelines prescribe the following actions: progressive change thinning of forest stands, progressive renovation of forest stands, silviculture works in mature stands. The most common management method applied in the "FUMP Bovec" is an even-aged regeneration method that removes trees in a series of three harvests: 1) Preparatory cut; 2) Establishment cut; and 3) Removal cut. The method's objective is to establish new forest reproduction under the shelter of the retained trees (shelterwood method).

GoV (VALENCIANA-SPAIN)

The methodology used to draft the forest biomass management plan "Forest Management Plan "Sierra del Negrete" (Utiel)" was structured by the following steps:

- Diagnosis: This is the first phase to compile all the information related to the forest:
- legal, natural, socioeconomic information
- field work: Inventory division/ forestry inventory: INVENTORY+LIDAR
- Inventory of forest types. Plots and field works and zoning:

The standardizing of the inventory forest types is done by the types of vegetal covers and the silvicultural structure. The cartography of types of forestry stands and forestry inventory forest types was obtained from orthophoto, the National Forest Inventory (NFI3), MDV (Digital vegetation model).

According to our methodology, several plots were done to measure direct silvicultural parameters, by using conventional technology of forestry inventory, in different forest types. In addition, other complementary parameters related to physic, biotic and phytosanitary characteristics of plot's trees were simultaneously collected.

Circular plots have been used, with fixed surfaces, 10 meters diameter, and with systematic surface distribution for all the forest, based on the recommendations of current General Instructions for the Forestry Management 1971 (ICONA, 1971). Plots surface distribution is done by a regular quadrangular net of 500 meters long, which covers the entire forestry studied surface. So, the plot selection is hazard, eliminating those not representatives of the forest. The result was different for each forest vegetation type with a distribution of plots, and in each one it was designed a regression model for every forestry parameter.

The applied forest inventory method is based on the combined use of the LIDAR flight and forest inventory conventional techniques, using statistical sampling procedure.

- Data processing and growing stocks. For getting the estimated biomass stock and wood volume, for the main plot tree species, existing curves and equations have been used to deduce and relate the results of the field normal diameter (1,3m) data. In the same way, there have been calculated regressions that relate the tree height with normal diameter, using the information compiled of every average tree in the field work.

- LIDAR data and processing: The LIDAR data used in the methodology is from the National Plan for Aerial Orthophotography (PNOA) of 2009. The implementation of the LIDAR (Light Detection and Ranging) technology to the forestry inventory is based on the remote sensing technology, refers to a laser system of distance measuring used to make precise measurements in a massive way.

This technology is based on regression models, which relate to direct variables obtained by LIDAR data processing (explanatory variables) with information obtained by field work using conventional techniques of forestry inventory (response variables). These models are obtained from a statistical study that guarantees its mathematical consistency and accuracy, as well as the essential predictive capability. The response variables that determine the regression models are the descriptive variables of the forest tree vegetation that allow diagnosing its condition and planning the actions to be planned. In particular, they are weight stock of above-ground tree biomass, volume stock of stem, basal area, trees density, mean and stand diameter, average and stand height.

- Planning. This part belongs to the data process and results analysis:
- General Plan: focusing on model management.
- Special plans: focusing on exploitation plan and uses regulation. This is a short-period planning. In all cases stands management method has been chosen by shelterwood cuttings, generally, except in steep areas where only improvement or phytosanitary cuttings will be made.
- Document drafting. This part of the pilot action is the last one; it is the writing of the Forest Management Plan document in its last version. In this part, the final cartography and maps are produced.

REGION OF WESTERN MACEDONIA (GREECE)

For the purposes of this study, the "Forest Management Plan of Krania-Monaxiti-Kipourio Forest (Greece)" was chosen. The Management Plans in Greece have 10 year duration, in our occasion the timeframe is 2005-2014. After the end of this period, a new management plan will be issued. What we have done in this PA is the updating of the existing management plan with more accurate info and precise information about the area and the road network. Also, a GIS tool has been developed that offers all the basic information in place which will make much easier and more accurate the development of the next Management Plan for the period 2015-2024.

The forest management plans consist of 4 parts which are described below:

- Cartography and available GIS data: Digital Terrain Model (DTM), Aerial photographic coverage, orthoimages, Landsat satellite images, conservation areas map, boundaries of Forest Districts, Municipality boundaries, Forest Management Plans boundaries, and slope map.
- Forest information review: Natural status (geographic location, physiography, geology, climate characteristics, vegetation, fauna, diseases), Legal status (administrative location and property, boundaries, occupations or concessions, enclaves, environmental protection and other legal requirements, hunting status), Socio-economic status.
- Forest Inventory. Last time the inventory took place (year of data collection) was 2004, and there were no events that could significantly have altered the results in the recent years (forestation policies, fires). The main procedure followed to obtain the data was by field plots measured in a non-systematic (irregular) manner. In specific:
- 213 filed plots were measured in total in the pilot area.
- The biggest was 1ha and the smallest 0,1ha.
- The shape is rectangular and the dimensions are approximately 50mX20m=0,1ha, 50mX40m=0,2ha, etc. up to 50mX200m=1ha
- Age classification: The age is calculated by piercing a sampled number of trees. The tree diameter is measured at breast height (1,30m) above ground.
- In each plot, all the trees, with a diameter $\geq$10cm (for the species of Pinus nigra, Pinus leukodermis; Abies borisi Regis, Fagus silvatica) or a diameter $\geq$4cm (for the species of Quercus), have been measured. In each plot, typical trees were identified, cut, and their volumes were measured: with skin, skinless and skinless 10 years old.
- Growing stock: The yearly volume increase (Zv) was calculated with the volume data (V) using volume equations by each species. The calculation of V is based on the tree diameter at breast height, and on the height of the typical trunk for each diameter category.
- Current management plan. The main management method conversion is cutting aim to reach seedling forest type, if we had coppice forests, or fast growing coniferous forest. Finally, at coniferous forests we choose the appropriate method (regeneration method/cutting, silvicultural treatment, improvement cutting, cultivation cutting etc.) in order to have a healthy and productive forest.

ISPRA-FLA (ITALY)

A Forest Management Plan has been developed according to the existing regional laws. The Law distinguishes between: (i) territorial forest management plan (Piano di Indirizzo Forestale, PIF), and (ii) forest management plan (Piano di Assestamento Forestale, PAF). The first one refers to the whole territory (e.g. a park, a province, a number of owners grouped under the same Comunità Montana etc.), covering all (public and private) forests

within a given area, while the second one refers to single forest properties. The PIF defines general objectives and management references for the territory, allowing connections with planning tools and initiatives at higher (i.e. regional) level. A PIF covering the entire Valsassina forest area has been developed in 2007, and an up-to-date version is currently being developed under the responsibility of the local *Comunità Montana*.

The PAF defines general and specific objectives and management lines for single forests over a time period of (normally) 10 years. Municipalities within the *Comunità Montana* are required to develop single PAFs. For the purposes of the PROFORBIOMED Project three municipalities have been selected: Casargo, Crandola, Margno and Taceno.

Plans have been developed under the form of "ordinary plans" because forests under management are mainly productive forests. In particular the following main steps have been followed:

- review of **past and current forest management practices** in the area and definition of management goals for the future management period (10 years);
- definition of the so-called **cultural identity** as the combination of four key informing elements at compartment (or sub-compartment) level, i.e. (i) land cover (e.g. forest, other woodlands, shrubs, agriculture, etc.); (ii) tree species composition; (iii) main forest function(s) (e.g. productive - wood or non-wood forest products -, protective, recreation, conservation, etc.; (iv) suggested management solutions and techniques (e.g. coppice, high stand, natural evolution, arboriculture, etc.). Cultural identity aims at division of the forest into compartments and sub-compartments;
- division of forest into **forest compartments and sub-compartments** as basic elements units for the implementation of the plan (districts, compartments and stands or sub-compartments). Each compartment (or sub-compartment) is identified according to physical characteristics of the forest as well as management goals. Compartments and sub-compartments represent the lower scale at which (*ex-ante* and *ex-post*) data collection and information recording on management activities are performed. The management units have resulted in three compartments (Casargo, Margno, Parlasco) and 34, 8 and 7, respectively, sub-compartments or stands.
- **accurate description** of each forest compartment (or sub-compartment), including (i) age; (ii) main ecological and physical factors (e.g. slope); (iii) main human and social factors that may affect forest management; (iv) cultural identity and detailed description of all factors characterising existing plant formations;
- **aggregation of single compartments** into larger units according to their cultural identity and management purposes;
- **design and implementation of the forest inventory** and dendrometric reliefs in order to estimate growing stock. The forest inventory was performed based on the following sources:
- Data from the previous "Forest Management Plans" for the same forest areas;
- The availability of the digital cartography and other data (still being improved) at regional level on Regional Forest Types;
- The performing of a specific stratified inventory (considering the different vegetation types) to complement available data.
- The methodology proposed in the forest inventory is a stratified sampling, based on forest categories. For each plot, diameter measures were performed with the relascope at stand scale. Dendro-chrono-auxometric parameters were collected considering:
- number of trees distinguished according to diameter classes, starting from a minimum diameter (DBH) of 7.5cm;
- density (expressed on a decimal scale, where 10 means normal density), by considering the area of 100m^2 around the centre of the sampling plot;
- model tree parameters (species, DBH diameter, growth during the last ten years);
- chronological class (where relevant, e.g. for even-aged coppices in conversion to high stands);
- DBH diameter and height of the biggest tree in the case of uneven-aged/irregular stands.
- For each stand specific silvicultural and ecologic profiles have been developed, to provide *ad hoc* information on stand composition state and management orientation.

- **additional inventories, analysis and reliefs** may be needed on a case by case basis (e.g. analysis of soil and spontaneous vegetation, floristic analysis for meadows (if any), market analysis for wood and non-wood forest products, etc.). Analysis and mapping of forest roads are to be included in any case;
- **growing stocks assessment** based on data collected in the field. Total and unit volume were calculated through a simplified approach with stereometric tables according to the following steps:
- within each plot, a sample (called main sample) is identified to determine Gha – i.e. the relascopic ratio (m^2/ha);
- within a sub-sample of the main sample, volumes are determined by means of specific stereometric tables for the main species in the area (beech, fir and spruce);
- the average volume for each stand and, then, for the entire area is determined using the following: $V_{ha} = RG_{ha}$
- **Analysis of biomass demand and potential production.** The analysis includes the identification of existing forestry service enterprises as well as biomass plants in the surroundings of the forest in order to identify the current and potential demand for biomass and to determine the potential production under different scenarios.

DRAFD- REGION OF SICILY (ITALY)

- The realization of the Forest Management Plan of the public forests in the Municipality of Bivona (Agrigento Province)" represents, in the scope of forest resources planning in the Sicilian territory, the first planning experience at company level connected with the sustainable use of forest resources for energy production. This activity can be considered a "pilot action" for the definition of a methodology to replicate in other territories of the Mediterranean environment. The plan has been basically realized through the following phases carried out both on field and with computer analyses and elaborations:
- collection of information and material available for the area: regional and local regulations, historical and present forest management, dendrometric data, cartographies etc.,
- subdivision of the planning area into management units and subunits in order to achieve a distribution of surface according to administrative and territorial (forest sections and lots) and ecological - functional (forest sub-particles) criteria. In this phase of works the forest particle map is drafted using photo interpretation in a GIS environment, and provided forest maps. The subdivision of the area led to the identification of a total of 39 particles with an average surface area of 25 ha, and 436 sub-particles, on average 17 for each particle.
- On the study area also some macro areas (section) were identified, each corresponding to a body separated from the others.
- realization, in a GIS environment, of a forest types map, starting from the verification and increase of the detail of the Regional Map of Forest Types,
- on field verification of the forest types map and forest particles, sub-particles ultimate limits were identified, distinguishing what was not possible to determine by photo- interpretation (silvicultural system, differences in height, average diameter, tree density and specific composition, operations performed). Also contextual description of the station, physiognomic - structural and management attributes, of each sub-particle through an appropriate form. The acquisition of these parameters is crucial for the attribution of the predominant function and the consequent silvicultural orientation to be assigned to each sub-particle.
- acquisition, in a GIS environment, of the field data and contextual processing of the dendro-auxometric data available for different forest typologies from research conducted in the area by the Department of Agricultural and Forest Sciences of the University of Palermo (DAFS),
- estimation of the biomass. In particular, the volume of logs was determined according to the dendrometric data collected in 26 sample plots (representative of the structural and dendrometric characteristics) realized in previous experimental works carried out by the DAFS. For each tree belonging to each sampling area the diameter at 1.30 m (D) and the total height (H) were measured. The unitary volume per hectare was determined using double entry volume tables, on the basis of the average tree density/hectare values, the average height for each of the three main species and the average diameter considered representative of the entire forest stands.

- Planning. The main target in the planning is focused on the re-naturalization of the plantations with even-aged stand structure. This target will be carried out with different intensity and frequency of thinning cuts, depending on the natural evolution and tree density level of the different forest stands. The other native forest formations, having a high degree of structural degradation, low accessibility and low coverage will be destined to the free evolution.
- For each sub-particle, based on the seasonal attributes, the stand characteristics detected and the dendrometric data, specific management orientation has been assigned, to be achieved during the term of the plan through specific forest operations. The management guidelines definition was carried out through the following steps:
- definition of the prevailing function of the sub-particle,
- definition of the silvicultural orientation of the sub-particle,
- definition of the cutting series, i.e. macro categories with the same forest orientation,
- definition of the operation plan and plan of cuts.
- The prevailing use or function expresses the type of function that can be assigned to the sub-particle (naturalistic function, timber production, hydrogeological protection, recreation, etc.....), while the silvicultural orientation expresses the type of treatment for a particular stand (naturalization, free natural evolution, etc.....) to achieve their goals.
- Economical analysis linked to the possibility of a hypothetical use of residual biomass for energy production.

ICNF-ALGAR (PORTUGAL)

The management plan for the “National Forest Mara da Herdade da Parra," corresponds to a policy inventory and ordering of the forest in Algarve, required for Mediterranean forest and Plans required by the Regional Forestry.

The methodology management plan was carried away in 3 sequential phases which were legally defined:

- Characterization of the current situation. This phase permits the total characterization of the area (topographical, climatologically, edaphically and forest occupation) and the associated resources. This characterization is the basis for the planning proposals
- Definition of objectives. The management objectives depend on those included in the upper levels planning instruments (regional and national plans) and in forest spaces functions adopted for the area. These functions include production, protection, conservancy, recreation and cattle breeding and hunting. These functions are then affected to each of the management units (plots) defined for the area.
- Construction of planning proposals:
- Forest Inventory and zoning. “Herdade da Parra Management Plan” didn’t involve inventory measures when characterizing of the plots was made. It was only a qualitative assessment of the area, having been drawn to partition the property for management purposes. The various plots demarcated were characterized according to their occupation and classified by their main and secondary functions. Under this exercise were only considered the portions classified with timber production function, including parcels nº 3, 5 e 11. These plots consist of stone pine and maritime pine, with two age classes (2 and 20 years). The total area of these plots is 142 hectares (17% of the total area of the property).
- In the case of Herdade da Parra National Forest, the management unit's definition was mainly defined accordingly to the main occupation. Other factors considered, in crescent order of importance were: age classes, type of terrain preparation (important to establish future intervention options), as accessibility (the areas closer to roads will present higher priority for exploration).
- Growing stock. For this assessment, the methodology followed was the one used on the National Forest Inventory 5 (IFN5), which is based on sample plots and biomass equations. 2000 m2 circular plots in stands of cork and holm oak will be used and 500 m2 in stands of other species. Following these sampling units for homogeneous plots, and using the IFN5 biomass equations, we obtain estimates of biomass for the areas to manage. The biomass reported for different forest species, and different biomass components were dry weight estimated.

- For each species, and for each tree component, we used a mathematical growth model (based on "tables of production") to obtain the two dendrometric variables (diameter at breast height and total height) needed for the IFN biomass equations. Once the biomass estimation is made by tree component, it is possible to adapt the estimations to each parcel and to the required final use.
- The methodology for calculating the residual forest biomass (FB) coming from the bushes was based on calculating the volume occupied by each species (fitovolume), combining it with the density of each species.
- This procedure is repeated for each period to get the calendar of biomass production.
- Planning. For each of management units a set of silvicultural prescriptions was defined and coordinate among all, constituting the final management plan.
- The only specie to be used for wood is Pinus pinaster. This specie is divided into two different age-classes. The younger ones are scheduled to be cut (in non-contiguous plots) between 60 and 75 years from now. These areas will still suffer 3 thinning operations to remove 15 % of the total trees each time. The older ones (20 years old) will be conducted until the final cut without any thinning operation.

9.2 SUMMARY OF SWOT ANALYSIS

Strengths	Weaknesses
Some biomass problems detected: - Maximize the extraction of residual biomass by reducing transportation costs and improving the road network. - Vision on how to develop the timber marketing and supply chain. - Easy implementation of the proposed guidelines in new plans as well as adaptation of older documents.	**Lack of planning to date and land ownership problems**, especially in the private level, is resulting in ageing stands (no management) or rejuvenation of the stand cutting trees with larger diameter). Fragmentation of private forest problems. In a small forest it is not feasible or logical to develop plans.
High availability of forest biomass and "inexhaustible" resource.	**Biomass volume is limited** by type of forest treatments applied till now, and by environmental characteristics: - Physiography - Accessibility (road infrastructure network problems, dense forest) - Protected areas
Competitive prices, compared to fossil fuels. Biomass productivity levels able to significantly **reduce the cost**.	Low forest mechanization level
Creation of **added value and "green jobs."** Current sensibility of forest managers/owners to the use of management plans.	Lack of certification of the production process and an elevated employment of low-skilled workers
Existence of private forest owners associations and forest management organizations.	Low social acceptability of forest harvesting
Existence of educational and research institutions.	Lack of supply chain for the use of biomasses
Political push to the sustainable biomass production, planning management and renewable energies. On-going projects and feasibility studies for the creation of buildings and centres relating to biomass issues.	**Low current profitability** of forest operation and forest products means low interests of the private forest owners for the management.

Strengths	Weaknesses
Administrative incentives for drafting management plans (taxes reduction and grants) and supply chains in the forestry sector.	High cost of an on-market process and lack of marketing experiences. It has confirmed as "distances factor" raises the cost of the biomass market, besides the CO_2 emissions, so it is necessary managing and transforming the product in a closer centre. Promotion of the biomass use (district heating) depends on the public tender.
Possibility to encourage a cascading approach, with appropriate use of both industrial timber and energy-wood. High potentials for the development of short (i.e. local) biomass supply chains involving local actors.	**Lack of dissemination and confidence** of the biomass market.
Promotion of an activity based in professional management guidelines, supported by advanced knowledge and a network of European partners.	**Lack of reliable studies** and scientific knowledge regarding forest biomass use. Lack of pilot tests and field-experience to refer.
Opportunities	Threats
Profitability the biomass use and reduction the transportation cost (distribution points or other alternatives)	Lack of viability in the trees extraction: - Wood resource limited. - Under-exploitation of high-value timber in favour of energy biomass. - Hard physiography - Need to improve the road network and means in order to reduce costs in the extraction of the resources. -protected area. - Environmental threats (danger of erosion, impacts on biodiversity,)
Joint work with different sectors (industry, environmental government, forest owners…). Reduction of rural areas abandonment and creation of new industries directly or indirectly related to forest biomass use, reactivating local economies.	**Low current profitability** of forest products. Low interest from forest managers/owners due to market problems.
Increasing the average **forest area income**, promoting their sustainability and improving the personnel training in new forest management techniques.	**Low opportunities** of sale and biomass use. Local wood industry largely depending on wood materials from outside.
Social awareness to sustainable forest management by FBMP: -fitting the drafting cost to the accuracy of data and own resource -encouraging the realization of forest management plans -new standards for forest management plans -new tools for forest sustainable assessment -adopt forest biomass use guidelines easily	**Lack of funds** for investments: in road networks, district heating, rural development program, Absence of an **effective regional policy** for the use of biomass as an energy source.

Strengths	Weaknesses
Improvement of forestry infrastructures and reduction of fire risk.	**Loss actors** of the biomass supply chain. Lack of know-how required in the various steps of the production process.
Possibility of exporting the model of biomass production in the territory	An unfriendly legal framework that promotes other uses of green energy in opposition to forest biomass.
Creating social incentives to promote the FBMP implementation. Local population personal interest.	
Political interest to encourage the biomass market: - Improvement the silvicultural and environmental condition of the stands. - Reducing the forest and pest-attack risks. - Promoting the rural employment in the disadvantage areas. - Developing local energy concept based on wood biomass district heating and promoting sawmill and wood-based industry.	
New market for the valorisation of low-quality woods, improvement of forest income.	
Existence of **good practices** at regional level (energy-contracting, short supply chains, forest certification, etc.)	
Participation in projects and rural development programmes.	
National or regional programs: target of renewable energy in the national energy mix by 2020 and potential links with other renewables (e.g. biogas)	

10 Abbreviations and acronyms

3NFI= 3rd National Forest Inventory

4NFI = 4th National Forest Inventory

A=surface;

BA=Basal area per wooded hectare (m2/ha)

CC=Canopy cover

cm= centimetre

dm^3= cubic decimetres

dmt= tonne of dry mass

FMP= forest management plan

FV = fuelwood volume

ha: Hectare:

LIDAR: Light Detection and Ranging o Laser Imaging Detection and Ranging

md= Mean diameter (cm)

MH=Mean height (m)

mm= millimetres

MUP= Public utility forest (Monte de Utilidad Pública)

nd= normal diameter

NL= Normal logarithm

Nº= number

NT= Total number of trees (trees); and; N= per wooded hectare (trees/ha)

OBV = over bark volume

P (mm)= precipitation in millimetres

SE= South-East

SS= sum of squares

T (º)= temperature in Celsius grades

TB=Total biomass (dmt); and; B= per hectare (dmt/ha)

TFV=Total fuelwood volume (stere) and FV= per hectare. (stere/ha)

TH = Total height

TNST=Total number of small trees (trees); and; NST per wooded hectare (trees/ha)

TOBW=Total over-bark volume (m3); and ; OBW= per wooded hectare (m3/ha)

TUBV=Total under-bark volume (m3); and; UBV per wooded hectare (m3/ha)

TVI=Total volume increment (m3/year); and; VI= per wooded hectare (m3/ha·year)

UBV = under bark volume

WP=work package

YVI = yearly volume increment

11 Units of measure and abbreviations

Biomass= T

Current annual increment= dm^3/year.

Distance: Kilometres (km)

Length: m

Normal diameter= cm

Surface: m^2; ha

Temperature= Celsius grades (º)

Time= Minutes (min)

Volume= dm^3

12 Glossary

Canopy cover or amount of shade: part of the surface cover by the crowns of the stand (expressed as a percentage).

Compartment: management reference units. Identified on the basis of boundaries corresponding to permanent lines, such as roads, streams, etc., they include areas characterised by homogeneous characteristics in terms of forest composition, physiography, and silvicultural treatments.

Current annual increment: the growth or increment of a variable in a given year.

Dasometry: Branch of Forestry, which deal with trees measurement and forest cover. Forest mensuration.

Department: see compartment.

District: are obtained by joining different compartments according to forest management goals. Set of compartments.

Forest Management Units: minimum unit of the forest territory to consider in the management.

Normal diameter or breast diameter: the trunk diameter measured at 1,30m aprox. over the ground.

Plot: representative surface area of a larger area, which aim is to get punctual information about forest sand characteristics. Area of land chosen for forest inventory.

Stand: they represent the smallest forest management units, characterised by homogeneity in terms of forest management techniques and silvicultural management. By joining stands, compartments are obtained.