For Climadapt

Adaptation of mediterranean woodlands to climate change

Progress book n°3

State of progress of the project

after seminars 5 and 6

15 - 17 of October 2012 in Solsona (Catalonia, Spain)

Field visit in ONF pilot sites in Aude department (France) on 18 of October 2012

27 of February - 1st of March in Mitilini (Lesbos, Greece)

Med L'Europe en Méditerranée / Europe in the Mediterranean

Projet cofinancé par le Fonds Européen de Développement Régional (FEDER)

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Foreword

This is the third Progress book of FOR CLIMADAPT project. The first two Progress books are available on the website www.forclimadapt.eu (section "Publications"), and by contacting the International Association for Mediterranean Forests (AIFM www.aifm.org). You will also find contacts of each partner's official representative in the section "Presentation of the partners [...]", pages 8 to 17 of this document.

Despite many difficulties related to the general context of work for several partners, FOR CLIMADAPT project, which is coming to an end, has led to significant advances in the reflection on the theme of Mediterranean forest adaptation to climate change. Multiple exchanges incurred during the inter-partner meetings and various publications reflect the diversity of these issues and the diversity of responses experienced in the field.

Significant synergies with other initiatives have been developed. These include the recent contributions of some partners at the third Mediterranean Forest Week (Algeria, March 2013) that led to the development of strategic documents on an international scale, as well as the launching, in July, of the cooperation project MEDLAND2020, in which the project was associated among 13 MED projects addressing issues related to sustainable management of natural resources in the Mediterranean basin. This is a great opportunity to give an echo to the conclusions of FOR CLIMADAPT, both internationally and field stakeholders.

The National Park of Vesuvius, the AIFM and all the partners hope to continue their collective actions for a more sustainable and participatory management of forest ecosystems in the Mediterranean climatic, economic and social changing context.

Ugo LEONE
President of the Vesuvius Nationl Park

Mohamed Larbi CHAKROUN
President of the International Association
for Mediterranean Forests

Conception and drafting: Jean BONNIER, Louis AMANDIER, Rémi VEYRAND and Sophie VALLÉE (Association Internationale Forêts Méditerranéennes - www.aifm.org), Míriam PIQUE and Lluis COLL (CTFC), Jean LADIER (ONF), Georgios TSIOURLIS (North-Aegean Region).

General presentation of the FOR CLIMADAPT project

MED Programme

The MED Programme is a transnational programme of European territorial cooperation. It is financed by the European Union as an instrument of its regional policy and of its new programming period. It continues the tradition of the European programmes for cooperation (previously named Interreg). It takes place within the objective "European territorial cooperation" of the period 2007-2013.

With a budget of more than 250 millions euros (whose 193 millions from ERDF), the Programme launches, until exhaustion of its ERDF envelope, calls for projects to build transnational partnerships aiming at meeting the priority objectives of the Programme in the Mediterranean space.

Programme objectives:

- To improve the area's competitiveness in a way that guarantees growth and employment for the next generations (Lisbon strategy).

- To promote territorial cohesion and environmental protection, according to the logic of sustainable development (Goteborg strategy).

Four priority axis were identified:

- Axis 1: Strengthening innovation capacities.

- Axis 2: Environment protection and promotion of a sustainable territorial development.

- Axis 3: Improving mobility and territorial accessibility.

- Axis 4: Promoting a polycentric and integrated development of the MED area.

FOR CLIMADAPT is positionned on the priotrity 2 and respond to the objective 4 : "Prevention and fight against natural hazards".

Problems of the Mediterranean forests

It is essential to remind here that in each one of our interventions we consider all the natural and forest areas characterized by Mediterranean climate. It does include deforested zones or areas affected by erosion, herbaceous natural habitats, scrubland or dehesa, as well as more intensively wooded areas and ageing forests, or also man-made artificial areas (plantations). Because of their historically quite intense anthropogenic transformation, the Mediterranean ecosystems incessantly evolve between "naturality" and "artificialization". The diversity of these areas is generally included under the term of "Mediterranean forests and other wooded areas". By convenience, we shall call them "Mediterranean forests".

Although Mediterranean forests generate a reduced commercial production, they provide many amenities to the society. They are subject to traditional and new uses (production, biodiversity conservation, soil, water, carbon sequestration, recreation) that follow to the needs of society and involve an increasing stakeholders' diversity.

This sometimes leads to situations of conflict and misunderstanding, especially about the development and the management of these areas. This is particularly evident in the Mediterranean region, the scene of suburban and tourist activities in which the pressures and challenges are increased.

Shared objectives, common difficulties, coordinated action

The Meditterranean Basin is considered as one of the regions most affected by climate change, particularly by temperature increases, frequency and intensity of extreme weather phenomena and reduction of water precipitations (see 4th GIEC report, 2007).

However, consequences on ecosystems are already evi-

dent, such as displacement northwards and in altitude, species extinction, decline of forest stands, increased risk of forest fires, torrential erosion, damages caused by pest infestations, desertification... Despite their exceptionally high adaptation capacity, the forest is seriously threatened, leading to perturbations on associated economy and biodiversity.

Action is undoubtedly and urgently required to adapt to this inevitable changes. Indeed, the Mediterranean forest manager is somehow helpless and its attitude reveals nothing but a lack of tools to tackle the impacts of these changes. Three types of efforts should be made to meet this challenge:

- The transfer of new scientific knowledge to professionals in the field.

- Improving the system of observation and monitoring.

- Cooperation between stakeholders and between countries.

The overall objective is to improve the adaptive capacity of natural Mediterranean sites to the risks associated with climate change, particularly the risk of erosion, fire and decay, around four complementary approaches:

- Developing observation systems and monitoring changes in ecosystems.

- Developing an "adaptive forestry" to protect biodiversity while maintaining the economic value of populations (e.g. by promoting on mixed and irregular stands, local origin adapted species, etc.).

- Developing methods for ecological restoration and reforestation of degraded land by erosion, fire or dieback.

- Informing, raising awareness of society and improving governance.

FOR CLIMADAPT suggests an ambitious strategy for the widest spread of the benefits accruing from the project. The activities will be carried out within a framework of collaborative transnational reflection thanks to a Peer group, composed by representatives from partner's organizations along with external experts. This group has been created to capitalize the results obtained from the project's experimental activities. Having once ascertained the strengths and the weaknesses of the various activities, the peer group will contribute to the design and application of innovative mutually-shared tools for the adaptation of Mediterranean woodlands to climate change. The results of the project, validated knowledge and competence will be widely disseminated using various media throughout the partner's regions and the MED Programme area (see "Expected results").

FOR CLIMADAPT total budget, as approved by the MED Programme, is EUR 1,725,750 for an operating period of 36 months (2010 - 2013). The 75% is financed by the ERDF (European Regional Development Funds). The residual 25% is generally funded by the partner organization's own resources (self-financed) or by other parts like local authorities or other structures (French Ministry of Agriculture and forests, Italian Ministry of Economy, Greek Ministry of Economy…).

Coordination, evaluation and capitalization: a proved method

Project leader and coordination

The National Park of Vesuvius is the leader of the project. It coordinates the implementation of FOR CLIMADAPT. It means that it is responsible for the project's good execution at institutional, technical and financial levels.

A steering committee, directed by the leader, has been set up since the beginning of the project in order to take care of the respect of the commitments established with the European Union.

Capitalization and communication strategy

Capitalization is a strong element of our methodology. It is based on three elements:

- A field trip on the different pilot sites during the seminars, in order to debate and to learn together thanks to a direct confrontation with local stakeholders and field realities.

- The establishment of a group of experts (Peer group) composed by independent and competent persons responsible for the analysis of the pilot projects. It is conducted by the AIFM as an independent partner (out of local projects).

- A qualitative assessment by an independent auditor at mid-term of the project implementation.

These methodological tools should enable the project to extract good practices and to analyze the bad ones, suggest improvement solutions and identify elements that are transferable to other Mediterranean areas.

Finally, FOR CLIMADAPT also commits to the spread of the results and achievements beyond the project; like towards other cooperation projects or initiatives, international agencies and through the AIFM's Mediterranean network. For this, some communication means are dedicated to FOR CLIMADAPT (www.forclimadapt.eu, notebooks, newsletters, reports...) and are completed by means developed by each partner (posters, magazine, WebPages, press releases...).

A partner dedicated to technical animation : the International Association for Mediterranean Forest

The International Association for Mediterranean Forest (AIFM, see page 17), which played a central role in the emergence of the project and in the coordination of the phase of preparation,

handles the technical animation of FOR CLIMADAPT. It is a guarantor for the general methodology thanks to its experience in the other projects that she drove.

Besides the AIFM assures the animation and the Presidency of the peer group, as well as the secretariat in terms of capitalization. It handles in particular the drafting and publication of the Progress books and the Final report of capitalization. The AIFM facilitates the exchanges between partners, and makes the outside promotion of the project through its Mediterranean network of contacts and its communications tools. It elaborates diverse media such as the web site www.forclimadapt.eu and Newsletters. It also works to promote the information and the recommendations elaborated by the projects toward the international institutions (European Union in particular).

It also participates in the organization of certain events such as the Mediterranean forest Week (Antalya, Avignon, and the next one in Algeria, in March 2013) or the meetings of capitalization on the scale of the Programme MED (last one in November 2011 in Marseille). The AIFM also joins to initiatives on similar subjects while establishing links with other projects (RMT AFORCE, Collaboration Partnership on the Mediterranean Forests, FAO / SilvaMediterranea, GIP Ecofor...).

Expected results

Pilot activities of the partners

The pilot experiments have to allow to identify the "good practices" related to:

- Observation and follow-up of changes in ecosystems.
- Development of an "adaptative silviculture".
- Development of methods of écological restauration of degraded lands.
- Information, awareness raising and governance in terms of climate change adaptation.

Overall, FOR CLIMADAPT tries to achieve cooperative sharing among the various Mediterranean-based initiatives that focus on the forests and natural areas management and thus foster their mutualisation in order to speak to European and international organizations with one specifically identificable "shared Mediterranean voice". Through the representation and participation of different Mediterranean woodlands stakeholders, FOR CLIMADAPT aims at bringing out problematics and overall relevant solutions that need to be transmitted to decision-makers and policy-makers ("bottom-up" approach).

Deliverables

The partners will publish, in a cooperative way when it is possible, some guides and reports such as:

- Bibliographic research.
- Diagnosis and studies about processes of adaptation of the ecosystems to climate evolutions.
- Operational guidelines and technical recomendations.
- Local action plans.
- Modelization (for exemple, fire behavior model).
- Information and communication products.
- Training sessions and workshops.
- Plateforme of exchanges and networking data base .
- Written balances of pilot projects.

Eléments de capitalisation

FOR CLIMADAPT produces several documents and reports for managers of protected areas, people needing reference works and decision-makers who seek an integrated overview of their territories, additionally to the global communication tools that are mentioned below:

- Every exchange meeting and event related to the project will be written up in detailed reports available on the website www.forclimadapt.eu.

- 3 Progress books are compiled after each two seminars in order to present the visited pilot territories and scheduled activities and, above all, to summarize the main elements of discussion during the seminars.

- A Final capitalization book will round out the project. It will synthesise the acquired benefits and gains accruing from the project and its pilot activities, and indicate how transferring good practices of forest management and governance of local and regional entities to other areas in the MED Programme area. This report will be largely based on the work carried out by the Peer group.

- A quality assessment report will be made by an independent auditor. The goal will be to estimate the quality and relevance of the undertaken activities in the light of project initial objectives and, as a consequence, to suggest certain adaptation measures.

Communication tools

The main elements that allow to communicate about progression of the project and to promote it are the following ones:

- Newsletters, published every semester.
- The web site www.forclimadapt.eu.
- Some visual documents of promotion of the project (flyers, brochures, posters...).

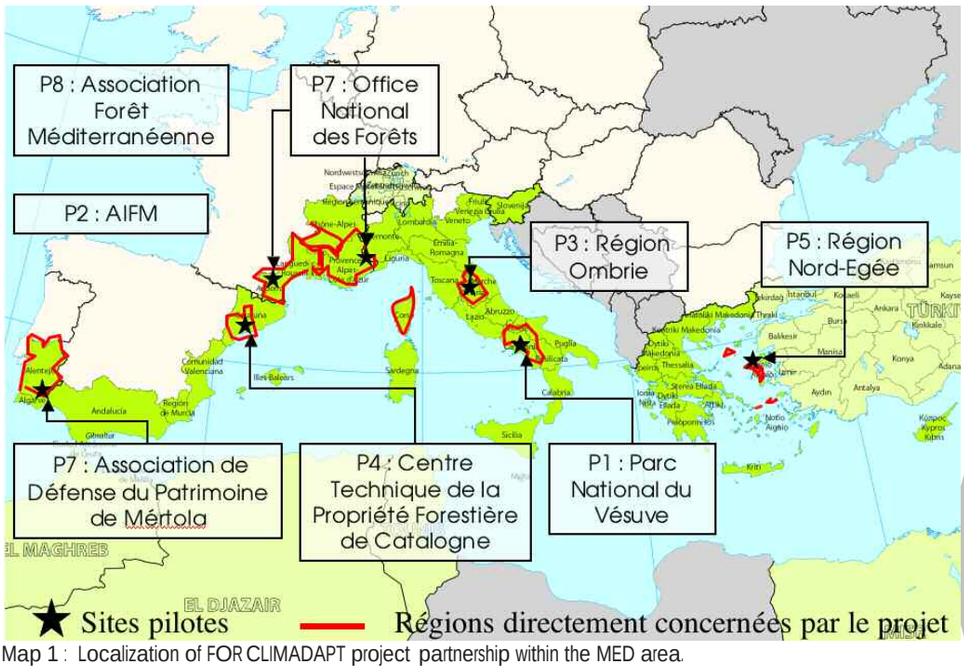
Experienced partnership

The partnership of the project is constituted of 8 organization from 5 different countries :

- National Park of Vesuvius (Italy), Project leadrer.
- Region of Umbria (Italy).
- Forest Sciences Centre of Catalonia (Spain).
- Mediterranean Direction of the French National Forests Office (France).
- North-Aegean Region (Greece).
- Association for the defense of the Heritage of Mértola, Region of Alentejo (Portugal).
- International Association for Mediterranean Forests.
- Association "Forêt Méditerranéenne" (France).

The partners' structures have an experience or are driving initiatives in connection with the problem of FOR CLIMADAPT project, within the framework of European cooperation programmes, or within the framework of specific actions.

They are recognized on their ground by the populations and by local stakeholders. There is a good complementarity between autonomous regions (Umbria Region and North-Aegean Region), national or regional forest administrations (CTFC, ONF), an organization in charge of a natural protected area (PNV) and associative actors (ADPM, AIFM, association "Forêt Méditerranéenne"). Additionally, at the level of their respective territories, each one is well coordinated with local key stakeholders.



Map 1 : Localization of FOR CLIMADAPT project partnership within the MED area.

Presentation of the partners and their position in the project

This part consists of a short presentation of each partner of the project. You will find, in particular, information about the natural and bio-climatic context and the local problems, as well as information on the general frame (ownership status, local governance, existing initiatives in terms of adaptation to climate change…), in which take place the experimental activities.

Figure 1: Emberger's Climagram of the pilot sites and of some Mediterranean cities

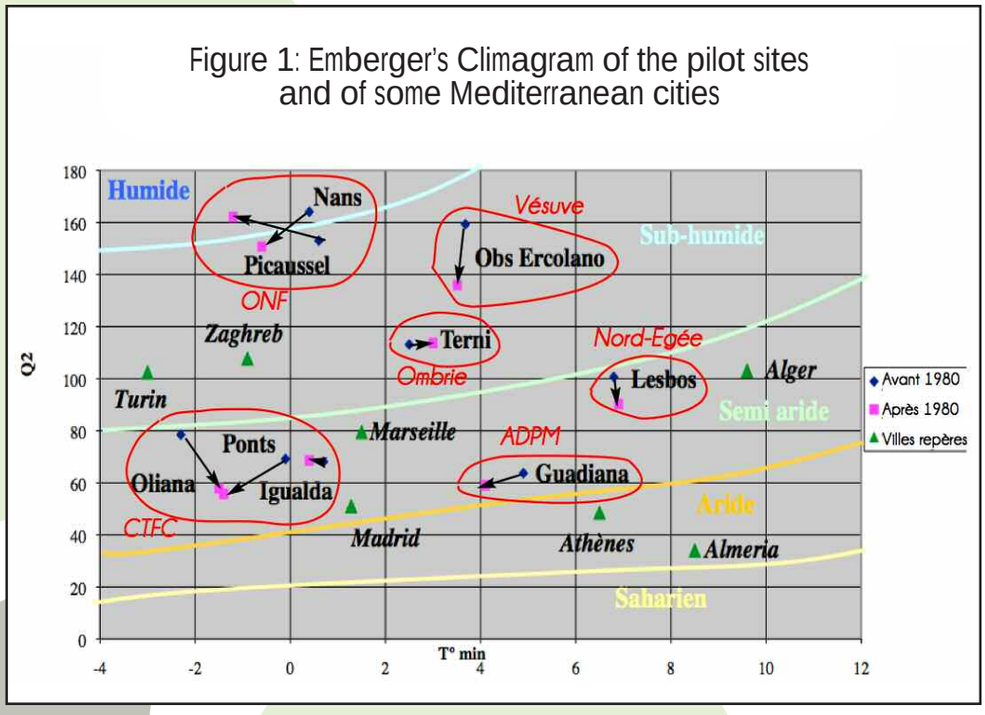


Figure 1 : Emberger's climagram identifies, at a glance, the general bioclimatic context of an area in relation to others. Abscissa, m is the average minimum temperature of the coldest month (° Kelvin). Ordinate, Q2 is an index based on annual rainfall and temperatures (including the differences between the warm season and cold season).
The combination of these two data sets the bioclimatic stage in which the site is viewed (arid, semiarid, subhumid, humid..) and allows easy comparison with other sites.
For more information, see Pierre QUEZEL's book: "Ecologie et biogéographie des forêts du bassin méditerranéens". Editions médicales et scientifiques Elsevier SAS. Paris, 2003. Plus de 500 p.

National Park of Vesuvius

Contact: Bruno DEL VITA

Web sites:
www.parks.it/parco.nazionale.vesuvio
www.vesuviopark.it/pnv/attivita/forclimadapt.asp

Partner's presentation

The Vesuvius National Park, lead partner of the project, was established in 1991 to safeguard the ecological and heritage of the territory, allowing seamless integration between man and the environment, promoting environmental education and research activities. The park covers 8 482 hectares in the Province of Napoli around the Mount Vesuvius, a typical volcano constituted of a truncated cone, still in activity. The area is rich in unique natural and historic elements, and has a quality agricultural production with great variety and originality of local flavor.

Initial state and justification of local needs

Climate change may induce a steady increase of the average temperatures, and an alteration of rainfall phenomena that result in decreasing light rainfalls, increasing heavy rainfalls, and intensified dry periods (tropicalization of the climate). These changes are accompanied by a variability of the soil's capacity to absorb rainwater, increasing alluvial phenomena and/or widespread phenomena of aridity and desertification.

These changes may also involve a change in biodiversity, particularly because the territory of Vesuvius has a volcanic lithology. Indeed, in previous centuries, many human interventions to combat erosion associated with volcanic eruptions have led to the introduction of exotic species.

The interventions against hydrogeological disasters, through eco-compatible techniques, and land development, oriented towards biodiversity conservation, can improve soil protection, while preserving the natural evolution of the ecosystems.

Fiche d'identité du territoire	
Superficie du territoire régional ou provincial	Région Campanie : 13 593,54 km² Province de Naples : 1 171 km²
Population	Région Campanie : 5 831 461 (429 / km²) Province de Naples : 3 068 604 (2620 / km²)
Situation socio-économique globale	PIB de la Région Campanie = 95 087 Millions d'euros (16 305€ par habitant)
Espaces naturels protégés	Parcs naturels = 350 083 ha Réserves biologiques = 38 279 ha Natura 2000 = 395 000 ha
Superficie forestière sur le territoire régional	445 274 ha (32,7% de la surface régionale)
Dont forêts privées	52%
Organisme national et/ou régional de gestion forestière	National
Tendances de la politique forestière appliquée à la région	Fort degré d'intervention, priorité donnée à la production et à la protection
Principaux impacts locaux du changement climatique	Érosion, désertification et aggravation des feux de forêt
Initiatives existantes en rapport avec l'adaptation au changement climatique dans la région	Aucune

Photo 1 : Overview of the National Park of Vesuvius

Fiche d'identité du site pilote	
Statuts particuliers et outils de gestion disponibles	Parc National et Natura 2000
Superficie	8 482 ha (PNV)
Population	35 2180 habitants (42 / km²)
Principales villes et communes	Napoli, Portici, Ercolano, Torre del greco, Boscoreale, San Giuseppe Vesuviano, Ottaviano, Somma Vesuviana, Sant'Anastasia, Pollena, San Sebastiano
Superficie forestière sur le site pilote	3 775 ha (44%)
Dont forêts privées	
Organisme localement en charge de la gestion forestière et de la planification	Parc National du Vesuve, Région Campania
Essences forestières dominantes	Forêts artificielles dominantes (*Pinus sp., Genista aetnensis, Robinia pseudacacia, Castanea sativa*) Peuplements purs et mixtes (*Quercus ilex, Q. pubescens*). Forêts naturelles à proximité du sommet (*Betula pendula, Alnus cordata, Populus tremula*)
Productivité des peuplements	1400 arbres / ha Volume extrait annuellement : 4 m³ / ha
Rôle principal attribué à la forêt	Conservation et usages récréatifs Pas d'usage pastoral
Autres types d'occupation des sols sur le site (espaces non forestiers)	Agriculture
Précipitations annuelles	950 mm
Moyenne des températures minimales du mois le plus froid	8.2°C
Moyenne des températures maximales du mois le plus chaud	26.5°C
Conditions géologiques dominantes	Roches volcaniques : Vitric- Eutric Leptosols, Lepti- Vitric Andosols, Vitric Andosols-Calcari-Vitric Andosols, Calcari-Vitric Cambiosols, Molli Vitric Andosols, Tephric Regosols
Principaux risques naturels auxquels est soumis le site	Feux de forêt, glissements de terrain

Programmed activities

Firstly, the Vesuvius Park tries to capitalize and to continue the work undertaken during the RECOFORME project (experimental plots and actions against invasive species were implemented), and PIT Vesevo (biological engineering interventions had been experimented).

In the framework of FOR CLIMADAPT project, priorities are:

- Carry out the data collection phase of the experimental results.

- Assess, critically, the protocol implemented by identifying any changes.

This requires the development of indicators. Indeed, the effects of forest management are difficult to assess in a short term. Therefore, the experimental measures need to be followed up in subsequent number of years in order to obtain reliable information.

A second phase will consist in:

- Determine how to move from the experimental phase to a large-scale management phase.

- Establish a projection of possible ecosystem changes taking into account the role of invasive species.

In parallel, following the experiments carried out under Interreg IIIB projects Desertnet and PIT Vesevo - S26, some naturalistic engineering works selected by a team of experts will be implemented, as well as surveys aimed at identifying the parameters that contribute to a better management.

Deliverables

- Operational workbooks, synthesizing salient characters,
- Guidelines for adapting the choices in terms of town and country planning.

Region of Umbria

Contact : Francesco GROHMANN

Web sites : www.regione.umbria.it/
www.antincendi.regione.umbria.it/

Partner's presentation

In Italy, the regions have the exclusive competence in terms of forest. As a result, the administration of the Umbria Region exercises the functions of programming, orientation and implementation of EU regulations in this sector, particularly through the Regional Plan (AIB) for forest fires regulation.

In addition, the regional government develops activities related to the knowledge of the forests and is responsible for the promotion of research, experimentation and implementation of demonstration projects in forestry.

Fiche d'identité du territoire	
Superficie du territoire régional ou provincial	8 456 km²
Population	906 486 hab (107,2 hab/km²)
Situation socio-économique globale	Taux de chômage : 6,8 % PIB / hab : 18 476
Espaces naturels protégés	Parcs naturels nationaux = 1 (17 790 ha) Parcs naturels régionaux= 7 (46 134 ha) Sites Natura 2000 = 103 (127 204 ha)
Superficie forestière sur le territoire régional	371 574 ha (44 %)
Dont forêts privées	73 %
Organisme national et/ou régional de gestion forestière	Région Ombrie, Service forêt et économie montagnarde
Tendances de la politique forestière appliquée à la région	Gestion active, application des critères de gestion forestière durable définis à l'échelle européenne
Principaux impacts locaux du changement climatique	Augmentation du nombre d'incendies, stress hydrique, dépérissement des peuplements.
Initiatives existantes en rapport avec l'adaptation au changement climatique dans la région	SECLI "*Siccità e Cambiamenti Climatici*" {http://secli.unipg.it/secli/frontend.jsp?script=intro_smb.jsp&id=56} (Sécheresse et changements climatiques) POR-FESR 2007/2013 - Axe II, Activité a1), action 4

Initial state and justification of local needs

In the Umbria Region, as well as in other Mediterranean regions, one of the most serious consequences of climate change is the increasing risk of forest fires. Indeed, the data show a significant correlation between the number of fires and increasing temperatures and droughts. Data provided by the Regional Plan AIB, show that in the period 1992-2006, the average forest area burned annually is approximately 370 hectares. The most sensitive forest formations, are the woods of Quercus ilex (Holm oak) and Mediterranean conifers.

Pilot site

The pilot area, covering an area of 13,000 ha, is located in the administrative area of the Mountain Community "Valle del Monte San Pancrazio e Nera" (municipalities of Terni, Ferentillo, Arrone and Polino). This is a chain of hills with limestone massifs in the southern area of the Umbria Region, along the lower valley of the river Nera. The territory is characterized by rugged terrain and extensive forest cover consists predominantly of coppice of Quercus ilex and Pinus halepensis stands.

Fiche d'identité du site pilote	*Bassa Valnerina – Terni*
Statuts particuliers et outils de gestion disponibles	Forêt Publique Plan de gestion forestière Site Natura 2000
Superficie	35 208 ha
Population	119 815 habitants. (340 hab/km²)
Principales villes et communes	Terni, Arrone, Ferentillo, Montefranco, Polino
Superficie forestière sur le site pilote *	18 979 ha (54%)
Dont forêts privées	10 254 ha (54%)
Organisme localement en charge de la gestion forestière et de la planification	Communauté montagnarde «Valnerina»
Essences forestières dominantes	*Quercus ilex, Pinus halepensis*
Productivité des peuplements	Taillis matures : 156 m³/ha
Rôle principal attribué à la forêt	Protection et production
Autres types d'occupation des sols sur le site (espaces non forestiers)	Zones agricoles 33%, zones urbanisées 8%, pâturages 4%, Fleuves et lacs 1%
Précipitations annuelles	963 mm
Moyenne des températures minimales du mois le plus froid (en °C.)	3,0 °C
Moyenne des températures maximales du mois le plus chaud (°C.)	32,1 °C
Conditions géologiques dominantes	Massifs calcaires
Principaux risques naturels auxquels est soumis le site	Incendies

Programmed activities

The main issue is the awareness and involvement of the population and local organizations in the defense of biodiversity and forest resources as a fundamental factor in the water cycle and wildfire prevention.

The Umbria Region conducts studies to raise awareness and actively involve the public and local agencies in the phases of systems development for the prevention of forest fires. The aim is to involve key stakeholders and implement actions to preserve forest heritage and biodiversity.

The project is structured around the following phases:

- Analysis of the territorial context (environmental, socioeconomic status...) in order to highlight the current (and potentially future) difficulties for fire prevention.

- Establishment of an initiation journey, to define a model of local organization focused towards the preven tion of wildfires in a changing context.

- Communication through leaflets, articles, website, seminars and other meetings.

- Evaluation and exchange of experiences with FOR CLIMADAPT partners.

French National Forests Office (ONF)

Contact : Jean LADIER

Web site : www.onf.fr

Fiche d'identité du territoire	*Provence-Alpes-Côte d'Azur*	*Languedoc-Roussillon*
Superficie du territoire régional ou provincial	31 400 km²	27 400 km²
Population	4,9 millions d'habitants (156/km²)	2,6 millions d'habitants (95/km²)
Situation socio-économique globale	PIB = 26000 € / habitant Chômage: 10,8%	PIB = 22000 € / habitant Chômage: 12,5%
	Budget régional 2010 : 1 800 M€	Budget régional 2011 : 1 130 M€
Gouvernance globale	Etat central fort mais important travail de décentralisation durant les 2 dernières décennies.	
Espaces naturels protégés	-3 parcs nationaux: Port-Cros, Mercantour, Ecrins -5 parcs naturels régionaux: Camargue, Alpilles, Luberon, Verdon, Queyras -3 réserves de biosphère: Ventoux, Luberon, Camargue	-1 parc national: Cévennes -3 parcs naturels régionaux: Narbonaise, Pyrénées catalanes, Haut-Languedoc -1 réserve de biosphère: Cévennes
Superficie forestière sur le territoire régional	1 500 000 ha (48% de la surface régionale totale)	1 200 000 ha (44% de la surface régionale totale)
Dont forêts privées	1 030 000 ha (68% de la surface forestière régionale)	910 000 ha (75% de la surface forestière régionale)
Organisme national et/ou régional de gestion forestière	-ONF pour la gestion des forêts publiques -CRPF pour l'appui à la gestion des forêts privées	
Tendances de la politique forestière appliquée à la région	-Défense contre l'incendie et autres aléas naturels (érosion, avalanches), -Préservation des écosystèmes... -Forêt = Composante essentielle de l'attrait touristique de ces deux régions. Les productions forestières (bois, liège...), qui étaient autrefois importantes, ne constituent aujourd'hui qu'un objectif secondaire.	
Principaux impacts locaux du changement climatique	-Sécheresses et dépérissements forestiers, principalement en moyenne montagne -Augmentation et extension des risques d'incendie	
Initiatives existantes en rapport avec l'adaptation au changement climatique dans la région	Institutions: Plan climat au niveau national (interministériel) et en Région (préfecture de Région Languedoc-Roussillon, Conseil régional PACA) Recherche: nombreux programmes et projets de recherche nationaux Gestion: adaptation des plans de gestion des forêts publique et privées	

Partner's presentation

Public institution created in 1966, the ONF main objective is to manage state forests and other public forests following the Forest Regime, and the achievement of public interest tasks entrusted by the French State. The ONF is also developing various services (management, expertise, forest works...) to the benefit of all kind of clients in the areas of natural areas management, environment, forestry wood and territorial development.

Concisely, some figures:

- Public forests correspond to 27% of the French forest in the metropolis, of which 1.8 million hectares (Mha) of state forests and 2.6 millions hectares of municipal forests.

- The ONF employs approximately 6 800 employees and nearly 3 200 forest workers.

- The ONF annually mobilizes more than 14,5 millions cubic meters of wood.

- 4,5 Mha are PEFC-certified, concerning 100% of the state forests and more than 50% of municipal forests.

The ONF is organized into nine regional branches and five regional offices. Extending from Spain to Italy, from seaside to summits of the Southern Alps (Languedoc-Roussillon and Provence-Alpes-Côte d'Azur regions), the Mediterranean office of the ONF is the regional office firstly involved in the FOR CLIMADAPT project.

The ONF intervenes in the field by integrating risk prevention (fire, erosion, pests damages...) in the forest management documents, by establishing and maintaining protective specific equipment for the defense of forests against fire and the Restoration of Mountain Lands (RTM program).

In the project, the ONF wants to improve its experimental activities in terms of adaptive sylviculture to climate change effects, including the replacement of decaying Silver fir stands by the Atlas Cedar.

Initial state and justification of local needs

The "warm" Silver fir stands, located in south-facing slope or at low altitude show, for over 30 years, signs of diebacks more or less diffuse with an alarming extent following the 2003 heat wave and drought which lasted until 2007.

Local conditions (dry climate, exposure...) drive to certain questions that cannot be resolved by considering only large Alpine and humid fir forest models:

- The homogeneity of the stands prevents managers from undertaking diversification using local species.

- The Atlas cedar has been introduced mainly in the supra-Mediterranean level and it is too early to have a feedback in terms of constraints of explotation, environmental impact and wood production.

Beyond these technical and economic constraints, it is not certain that a low density ensures a greater leaf area index, because water consumption by concurrent or accompanying vegetation can compensate effects of the reduction of the stand density.

Programmed activities

Facing diebacks, the ONF Mediterranean office works on the introduction of species, tests new silvicultural techniques, and develop a technical guide for adaptive forestry to cope with climate change effects.

The main fiels actions are spread on 3 different pilot sites as follows:

- Nans: Implementation of effective management methods aimed at reducing competition between trees for water resources, and studies on the behavior of the Atlas cedar as a potential specie for Silver fir dying back stands substitution.

- Callong: Comparative plantation of Atlas cedar from different procedings in order to replace a Silver fir stand.

- Picaussel: Testing effectiveness of a low density forestry in a mature pine forest.

The recommended silviculture for the Cedar forest on the site of Nans aims to promote the growth and the quality of the trees by reducing stand density (two plots with respectively 600 and 300 trees per hectare and one control plot with a density of 1200 trees / ha).

A monitoring system (health and growth) of a sample of 40 trees and the total production of the stand will be set up on each of the pilot sites.

Deliverables

- State of the art about adaptive forestry in France.

- Reports of initial measures (2011 and Nans Picaussel, winter 2012/2013 for Callong).

- Reports after 2 years in Nans and Picaussel (Winter 2012/2013).

Fiche d'identité des sites pilotes	*Forêt de Nans*	*Domaine de Picaussel-Callong*
Statuts particuliers et outils de gestion disponibles	Forêt Domaniale de Nans, acquise au titre de la RTM	Forêt Domaniale de Comfroide-Picaussel et Forêt Domaniale de Callong-Mirailles
Superficie	445 ha (Site pilote : 1,8 ha)	Picaussel : 657 ha (site pilote : 5 ha) Callong: 336 ha (site pilote : 2 ha)
Population	(sans objet)	
Principales villes et communes	Saint-Vallier de Thiey (3 000 habitants) Grasse (50 000 habitants)	Espezel (200 habitants), Belvis (200 habitants) Quillan (3 500 habitants)
Superficie forestière sur le site pilote *	244 ha (55%)	100%
Dont forêts privées	0%	0%
Organisme localement en charge de la gestion forestière et de la planification	ONF, agence Alpes-Maritimes, unité territoriale des Préalpes d'Azur	ONF, agence Aude-Pyrénées-Orientales, unité territoriale du plateau de Sault
Essences forestières dominantes	Pin sylvestre (32%) et Chêne pubescent (24%) Essence étudiée: Cèdre de l'Atlas (14%)	Pin sylvestre (32%) et Chêne pubescent (24%) Essence étudiée: Cèdre de l'Atlas (14%)
Productivité des peuplements	Environ 1000 arbres/ha	Environ 500 arbres/ha
	Environ 3 m^3/ha.an	Environ 5 m^3/ha.an
Rôle principal attribué à la forêt	Production ligneuse, accueil du public	Production ligneuse, accueil du public
	Pas d'activité pastorale	Pas d'activité pastorale
Autres types d'occupation des sols sur le site (espaces non forestiers)	Garrigue et rocher	(sans objet)
Précipitations annuelles	1230 mm (St-Vallier de Thiey)	950 mm (Belcaire)
Moyenne des températures minimales du mois le plus froid	-0,2 °C	2,4 °C
Moyenne des températures maximales du mois le plus chaud	26,6 °C	17,5 °C
Topographie	Altitude : 1000 à 1050 m, Exposition sud Pente : 45%	Callong : altitude 1000 m., plateau Picaussel : altitude : 850 m., fond de vallon plat et pente moyenne
Conditions géologiques dominantes	Faciès géologique: calcaire compact Matériau parental: grèze Type de sol: calcosol graveleux d'épaisseur moyenne, issus de grèze	Faciès géologique: calcaire compact Matériau parental: altérite de calcaire et colluvion
Principaux risques naturels auxquels est soumis le site	Sécheresse, incendie	Sécheresse

Photo 2 : A forest manager of the ONF presents the problem of stands die-backs in the French department of Alpes-Maritimes.

Photo 3 : Silver fir stands threaten of dieback process in the department of Alpes Maritimes (France).

North-Aegean Region

Contact : Stratos VOUGIOUKAS

Web site : www.northaegean.gr

Partner's presentation

The North-Aegean Region is composed of several islands. Each one has unique and distinct natural features. In addition, socio-economic activities of the population of the island differently affect the natural landscape.

These distinctions lead to a variety of climate change consequences that each island will have to face. For example, the island of Lesbos is under constant threat of large forest fires, while the islands of Lemnos and Ikaria undergo intensive grazing of thousands of livestock (sheep and goats in particular) highly destructive to the few remaining forest areas and preventing natural stands regeneration.

Initial state and justification of local needs

Since the experiment on reforestation applied to burned areas of the island of Lesbos, it is now clear that only artificial reforestation methods can be applied in situ to restore the area, while natural regeneration has not been successful due to problems of increased erosion and lack of post-fire reforestation programs in large scale (Map 3).

Frequent and severe fires caused over the past three decades a serious deterioration in the sector. The main tree species are Pinus brutia, Quercus infectoria and Arbutus andrachne. It is a mountainous and rough area with threathening erosion in areas affected by wildfire. Besides, the industry is under constant pressure from urban expansion, agricultural activities, illegal grazing and hunting.

Fiche d'identité du site pilote	Site 1 : Peninsule d'Amali	Site 2 : Nees Kidonies
Superficie	1 500 ha	1 ha
Population	2 500	
Principales villes et communes	Loutra, Ano Charamida, Charamida, Skala Loutron, Taxiarxai, Neapoli, Ag,. Marina, Ag. Paraskeyi, Agrilia Kratigou	Nees Kidonies, Mitilène
Superficie forestière sur le site	650 ha (43 %)	
Dont forêts privées	325 ha (50 %)	
Organisme en charge de la gestion forestière	Direction forestière de Lesbos	Commune de Nees Kidonies
Essences forestières dominantes	Pinus brutia (arbrisseaux: Quercus coccifera, Arbutus spp., Pistacia lentiscus, Cistus spp., Sarcopoterium spinosum).	
Productivité des peuplements	800/ha	
Rôle principal attribué à la forêt	protection des sols, biodiversité	
Autres types d'occupation des sols sur le site (espaces non forestiers)	horticulture (oliveraies), tourisme	
Précipitations annuelles	565 mm	566 mm
Moyenne des températures minimales du mois le plus froid	9,0 °C	9,0 °C
Moyenne des températures maxi du mois le plus chaud	26 °C	27 °C
Conditions géologiques dominantes	Calcaire dur/marneux, péridotites, schistes, phyllithes, etc. Fertilité moyenne ou basse	Roches volcaniques. Sol superficiel à faible fertilité
Principaux risques naturels auxquels est soumis le site	Incendies	Erosion

Fiche d'identité du territoire : Ile de Lesbos	
Superficie du territoire régional ou provincial	1 636 km2
Population	90 000
Situation socio-économique globale	PIB/habitant : 15 000€, taux de chômage : 20%
Espaces naturels protégés	Natura 2000: Dytiki Chersonisos - Apolithomeno Dasos (20817 ha), Kolpos Kallonis Kai Chersala Paraktia Zoni (8311 ha), Kolpos Geras, Elos Ntipi Kai Oros, Olympos (11200 ha), Voreia Lesvos 9934 ha), au total 50.262 ha soit 31% du total de la superficie de l'île de Lesbos.
Superficie forestière sur le territoire régional	31 500 ha (19 %)
Dont forêts privées	22 000 ha (70 %)
Organisme national et/ou régional de gestion forestière	Direction forestière de Lesbos
Tendances de la politique forestière appliquée à la région	Degré d'intervention moyen, priorité donnée à la protection des sols et de la biodiversité
Principaux impacts locaux du changement climatique	Aggravation des incendies, désertification

Climate change affects the fire regime in several ways:

- More intense forest fires (intensity, flame height, velocity, probability of transmission to the canopy ...), especially in natural ecosystems and in abandoned or poorly maintained areas.

- An increased risk of fire starts in areas where there is a lack of stability in terms of vegetation, poor seed bank and invasive species proliferation.

- Land degradation and erosion can cause a process of desertification.

- Changes in microclimates.

Programmed activities

The vegetation is analyzed and a projection of future vegetation is considered according to climate change, which is expected to bring drier conditions.

Action 1: Study of the evolution of vegetation, facing to climate change

The vegetation is analyzed and a projection of future vegetation is considered according to climate change, which is expected to bring drier conditions.

Action 2: Method of reducing the risk of fire

In order to deal with the future risk of frequent fire, a document was written comprising the management of forest and shrub areas to reduce the risk of fire.

Action 3: Modelling fire behaviour

Modelling of fire behaviour has been carried out for the Amali Peninsula, using the system FlamMap and also the software BehavePlus. By localizing the origin of fires, maps were produced, presenting the spread and the intensity of fire in time and space.

Action 4: Automatic weather Station

Installation of a Remote Automatic Weather Station.

Action 5: Training "prescribed burning"

Training of personnel in the technique of "prescribed burning" to reduce the risk of fire. However, this action has not been achieved because the "prescribed burning" is prohibited in Greece and the competent authorities did not give the authorisation to apply it.

Action 6: Training

Training of students and forest service's staff to the use of forest fire modelling software.

Action 7: Information – awareness raising

Organization of information/awareness raising seminars in the five major islands of North Aegean Region.

Action 8: Restoration of burnt and degraded ecosystems

Site 1: Pilot implementation in situ of different reforestation methods by planting and by direct seedling of Pinus brutia.

Site 2: Mobilization of the local population for a test of "natural" reforestation with forest and shrub species by seeds in balls of clay.

Association for the Defense of the Heritage of Mértola (ADPM)

Contact : Paulo SILVA

Web site : www.adpm.pt/adpm.html

Partner's presentation

Since its establishment in 1980, the Association for the Defense of the Heritage of Mertola (ADPM) has developed a strategic action based on the relationship between nature conservation and socio-economic development.

Priority action is ranging from sustainable local economy to the restoration of degraded lands and fight against desertification through public awareness and environmental education.

To deal with local issues, it was necessary to form an interdisciplinary team of technicians able to work together in a cross-cutting project for Mértola, in which the participation of local stakeholders was a key factor.

The ADPM is notably responsible for the establishment of the Vale do Guadiana Natural Park, contributing to its administration. It has also initiated various projects such as FAIA III on rivers ecological restoration, and implemented various training programs, in particularl a Master "Regional Economics and Local Development", in partnership with the University of the Algarve, the Polytechnic Institute of Beja and the Archaeology centre of Mértola.

Territory identity file	
Region's/province's name	Baixo Alentejo
Region or province area	8505 km^2
Population	125 066 hab (15/km^2)
Global economic and social situation	PIB/hab = 8900€ Unemployment rate = 11,5%
Institutional structure	Regional Departments that have some decison capacity.
Protected natural area	-Natural Park of Guadiana Valley (69.773ha), -SIC of Mourão Barrancos (PTCON0053) (43.309ha), -SIC of Guadiana (PTCON0036) (38.463ha), -ZPE of Castro Verde (PTZPE0046) (85.344ha), -ZPE of Guadiana (PTZPE0047) (76.546ha)
Forested area in the region/province (not urban, not agricultural)	427 524 ha (50%)
Including private forests	363 395 ha (85%)
National or regional organism for forest management	Ministério da Agricultura, Mar, Ambiente e Ordenamento do Território - Direcção-General da Conservação da Natureza e Florestas
Global tendencies of the forest policy usually implemented in the region	Low intervention degree. Priority given to protection and tourism.
Main potential climate change related impacts in the region	Die-back of *Quercus ilex* and *Suber*, increase wildfires, increase of erosion and desertification problems

Initial state and justification of local needs

The Region of Alentejo is severely affected by climate change, which, combined with increasing human pressure (including silvopastoral activites) and mismanagement of the ecosystems, is seriously exacerbating the desertification risk (increased aridity, lack of regeneration in montados, erosion and soil leaching...).

Pilot site

In 1993, ADPM has acquired a property of 200 ha with the aim of establishing a demonstrative experiment of good management practices that could be adapted by other owners and managers in their own fields. The aim is to combine agriculture, fo-

restry and nature conservation in a sustainable development approach. Various ecological slopes restoration project (reforestation, firebreaks...) and actions preventing erosion in rivers were conducted.

The pilot site is located inside of the Natural Park of Vale de Guadiana, in an ADPM property called Monte do Vento. It is located in the North of Mertola municipality, near Pulo do Lobo. It is more or less plan, with low altitude.

Pilot site identity file	*Natural Park of Vale de Guadiana*
Particular status and available regulation and planning tools	Natural Park, Natura 2000, Baixo Alentejo Forest Plan
Pilot site area	69 773 ha
Population	7500 (11/km^2)
Main cities and municipalities	Mértola.
Forested area in the pilot site*	13954ha (20%)
Including private forests	13500ha
Organism locally responsible for forest management	Ministério da Agricultura, Mar, Ambiente e Ordenamento do Território - Direcção-Geral da Conservação da Natureza e Florestas
Main forest tree species	*Quercus ilex, Quercus suber, Olea europea, Fraxinus angustifolia, Populus alba, Salix sp. Eucalyptus globulus*
Stand productivity	New projects (600 trees/há), *Montado* (90 trees/há)
	Main production is cork (2Ton/ha) and acorns for cattle (20 sheeps/ ha) or (3 cows/ha), firewood and charcoal
Main role of the forest	Protection, grazing, Tourism
	Grazing activities
Other land uses category on the pilot site (non forested area)	Agriculture, livestock, tourism, grazing
Annual amount of precipitations (millimetres)	450
Mean lower temperatures of the coldest month (°C.)	4,7
Mean higher temperatures of the warmest month (°C.)	33,8
Global geological conditions	Acid very thin schist soils with a very low productivity
Main natural risks threatening the pilot site	Drought, wildfire, desertification and high risk of erosion

Programmed activities

Action 1: Diagnosis

- Diagnosis and observation of the territory of Vale do Guadiana Natural Park in order to evaluate natural resources management (water, soils, vegetation management, agricultures practices…). This diagnosis will rely on field trips, studies, cartography and contact with local community.

- Monitoring of fauna and flora in Monte do Vento (birds, mammals and insects) and comparison with existing information before the forestry project.

- Survey on the perception of the impact of climate change and its relation to the management of natural resources in the territory of Vale do Guadiana Natural Park, focus on farmers and the local community.

Action 2 : Adaptive Silviculture

- Evaluation of techniques and species used in reforestation projects developed in the Natural Park of Vale do Guadiana, particularly in Monte do Vento, and comparison with a conventional forestry project. The following techniques will be monitored: mycorrhizal on cork and holm oaks, facilitation, intercropping between tree and shrub species, trench techniques and mound planting.

Action 3 : Ecological restoration and reforestation of damaged areas

- Lessons of ecological restoration techniques with international trainers.

- Monitoring of an ecological restoration project focused on control and reduction of torrential erosion rates.

- Projects of reforestation with firebreaks and inserted cultures carried on by the ADPM in the sylvopastoral ecosystem of Montado in the South of Portugal.

Action 4: Awareness, training and governance for social adaptation to climate change

- Realization of two Workshops to make populations aware of the restoration projects applied in Monte do Vento, and allow reflections on their success and impact.

- Realization of two workshops focused on agriculture activity and climate change scenarios in order to assess the best agriculture practices for sustainable development.

- Awareness raising campaign about the impact of climate change.

Deliverables

- Leaflets (1000 exemplary).
- Climate change game.
- Book (500 exemplary).
- Restoration workshop.

Photo 4 : Projects of reforestation with firebreaks and inserted cultures carried on by the ADPM in the sylvopastoral ecosystem of Montado in the South of Portugal.

Forest Sciences Centre of Catalonia (CTFC)

Contact : Denis BOGLIO

Web site : www.ctfc.cat

Partner's presentation

The CTFC's main action is to contribute to the modernization and competitiveness of the forestry sector, rural development and sustainable management of natural environment, resource development, education, technology and knowledge transfer to society.

In the current context of global change, the activity is focused towards solving environmental problems of ecosystem management and interactions between natural resources and society, and improving the wealth and well-being while preserving sustainability of the natural environment. Results of operations are for the benefit of the whole society.

The content of the activities of the CTFC is based on the three following lines of work:

- Functionning of agroforestry ecosystems.
- Multi-function management of natural environment.
- Governance and socio-economy of rural areas.

Fiche d'identité du territoire	*Lleida / Alt Urgell (Pré-Pyrénées)*
Superficie du territoire régional ou provincial	12,150 km² (Lleida) 1,447 km² (Alt Urgell)
Population	439,253 habitants (Lleida) 20,936 habitants (Alt Urgell)
Situation socio-économique globale	Taux de chômage (Lleida) : 12,8% PIB / habitant (Alt Urgell) : 21 150 €
Gouvernance globale	Etat fédéral. Forte autonomie des Communauté autonome, renforcée, dans le cas de la Catalogne
Espaces naturels protégés	Natura 2000: ES0000018 (Prepirineu Central català) ES5130010 (Serra de Boumort- Collegats) ES5130026 (Serra de Prada-Castellàs)
Superficie forestière sur le territoire régional	Alt Urgell: 125,438 ha (86.7 %)
Dont forêts privées	Alt Urgell: 80,651 ha (64.3 %)
Organisme national et/ou régional de gestion forestière	Ministère Catalan de l'Agriculture, de l'élevage, de la pêche, de l'alimentation, et de l'environnement ; CTFC
Tendances de la politique forestière appliquée à la région	Le degré d'intervention est relativement faible par rapport au potentiel élevé dans la Région
Principaux impacts locaux du changement climatique	Migration en altitude des espèces, stress hydrique, dépérissement des peuplements, augmentation de la magnitude et de la fréquence des perturbations (incendies, tempêtes, ravageurs, etc.)
Initiatives existantes en rapport avec l'adaptation au changement climatique dans la région	Quelques projets de recherche développés par les institutions (notamment le CTFC et le Centre de recherche en écologie et applications forestières)

Initial state and justification of local needs

As increased disturbances are expected in forests in the context of climate change, at least in Mediterranean forests, the managers must develop a forestry improving the resilience and adaptive capacity of forests.

At the regional level, the mountain and Mediterranean influences condition the formation of diverse forest ecosystems. However, some forests (conifers stands for example) have a very low diversity in terms of species and characteristics that make them particularly sensitive to disturbance such as fires, storms, or dieback, more than ever in the current climate change context.

In addition, climate change could alter the range of species, causing large migrations following the altitudinal and latitudinal gradients. However the ability of species to migrate would probably not be fast enough to cope with climate change.

Pilot site

The pilot sites are established in the heart of the Catalan Pre-Pyrenees, characterized by climate variability of mountain areas combined with a strong Mediterranean influence. Subhumid Mediterranean climate is dominant and the soils are mainly limestone.

The pilot site consists of three north-facing slopes with an altitudes from 1 000 to 1 600 meters.

Programmed activities

The actions planned by the CTFC in the project are the following ones:

- Action 1: Analysis of the subject and the experimental context (collect and analysis of existing information on the subject, research on plant material...).
- Action 2: Search for pilot sites in concertation with forest owners.
- Action 3: Application of the treatments (seeding/planting and establishment of protection barriers).
- Action 4: Monitoring and Evaluation of germination, survival and growth of plants.
- Action 5: Spreading of initial results and education (organizing field visits for researchers, technicians, students and the local population).

One of the concrete measures envisaged is the introduction of "pocket of dispersion" in low diversity forests. This involves the establishment of some plots for seedling or planting species with different features and enhancing their natural diffusion in the forest, in order to improve the resistance of forests and their capacities of adaptation on a long term.

Map 4 : Localization of the pilote territory and the autonomous Region of Catalonia in the Iberian peninsula.

Map 5 : Localization of pilot sites in the Region of Alt Urgell.

Fiche d'identité du site pilote	*Site 1: Bosc de Fontanella (Forêt de Fontanella)*	*Site 2 : Muntanya d'Alinyà (Forêt de Alinyà)*	*Site 3 : Bosc de Senyùs (Forêt de Senyùs)*
Statuts particuliers et outils de gestion disponibles	Forêt Publique ; Plan forestier ; Sites Natura 2000		
Superficie	670 ha (0,5 occupés par notre expérience)	0.5 ha	0.5 ha
Population	0	0	0
Principales villes et communes	Organya et Figols i Alinyà (plus proches villages)	Alinyà (plus proche village)	Cabó (plus proche village)
Superficie forestière sur le site pilote	100%	100%	100%
Dont forêts privées	0%	100%	100%
Organisme localement en charge de la gestion forestière et de la planification	Ministère catalan de l'Agriculture, de l'élevage, de la pêche, de l'alimentation, et de l'environnement	Privé	Privé (gestion par le Centre de la propriété forestière)
Essences forestières dominantes	*Pinus nigra* (de 800 à 1200 m) et *Pinus sylvestris* (de 1200 à 1600 m)		
Productivité des peuplements	600/ha	500/ha	750/ha
Rôle principal attribué à la forêt	Protection	Protection	Protection
Autres types d'occupation des sols sur le site (espaces non forestiers)	-	Elevage, agriculture, tourisme, éducation, conservation, etc.	Elevage, agriculture
Précipitations annuelles	920 mm	900 mm	850 mm
Moyenne des températures minimales du mois le plus froid	-4°C	-3,5°C	-3°C
Moyenne des maximales du mois le plus chaud	23°C	24°C	25°C
Conditions géologiques dominantes	Calcaire, décarbonaté dans certains cas. Sols profonds dans les secteurs peu inclinés, sol calcaires peu profonds dominants dans les secteurs plus en pente		
Principaux risques naturels auxquels est soumis le site	Incendies, sécheresse, ravageurs et maladies		

In each plot, six different species are planted, with two distinct sources for four of them. That means a total of ten different cases. To avoid damage from herbivores, protective barriers are installed around each plot. The objective is to obtain valuable information about the adaptive capacity of the main hardwood forests species accompanying sub-Mediterranean Pine stands, studying the behavior of different species and provenances.

Besides, forest management will be used to accelerate the migration of forest species and to help forest ecosystems responding to the effects of rapid changes, by planting or sowing a range of species adapted to new climatic conditions, proceeding from southern areas or from lower altitude stands.

Internationale Association for Mediterranean Forests (AIFM)

Contact : Rémi VEYRAND

Web site : www.aifm.org

ASSOCIATION INTERNATIONALE FORETS MEDITERRANEENNES

Partner's presentation

Every issues related to Mediterranean forests interest and/or concerns, more or less directly, many different social and professional groups. Therefore, to address this diversity of stakeholders and sensitivities associated to the Mediterranean forest, the International Association for Mediterranean Forests (AIFM), founded in 1996, has the mission of facilitating the exchange of knowledge, experiences or ideas about this theme, in a cross-disciplinary way between all persons concerned by Mediterranean forests.

The AIFM has developed a network of organizations and individuals made up of approximately 3 000 international contacts including experts with varied skills (foresters, environmentalists, scientists, decision-makers, civil security…) and multiple stakeholders. Among other network driging activities, it publishes a quarterly newsletter ("Latest on Mediterranean Forests") in French and in English, moderates a website (www.aifm.org), participates in, and organizes, events related to Mediterranean forests.

In addition to the FOR CLIMADAPT project, AIFM has initiated and led several cooperation projects through community programs:

- 1999-2001: "Problem of the Mediterranean forest" (Interreg II Programme).

- 2003-2006: RECOFORME "Structuring of networks and cooperation activities of the Mediterranean forest" (Interreg III Programme).

- 2009-2012: MED QUALIGOUV "Improving governance

and quality of the forest management in Mediterranean protected areas " (MED Programme).

- 2011-2014: PROFORBIOMED "Promotion of residual forestry biomass in the Mediterranean Basin" (MED Programme).

In addition, in collaboration with FAO, through its Committee Silva Mediterranea, and in connection with a group of institutions meeting within the Collaborative Partnership on Mediterranean Forests (EFIMED, Plan Bleu, GIZ, AFD...), AIFM enhanced cooperation activities, in this field, with MENA countries (Turkey, Syria, Lebanon, Tunisia, Algeria, Morocco) and participates to, or organizes, events such as the Mediterranean Forest Week, whose third edition, in Algeria in March 2013, focused on the theme of global change.

Role of the AIFM in the FOR CLIMADAPT project

The AIFM had a major role in the emergence of the project and played an active coordinating role during the preparation phase.

AIFM is responsible for leading technical exchanges and disseminating the main achievements resulting from these actions (capitalization). Throughout the implementation of the project, it is responsible for the work of technic animation. As such, in collaboration with the Lead partner and under the control of the steering committee, it guarantees the general methodology of the project (developed during the projects she has led such as RECOFORME and QUALIGOUV).

In addition, the AIFM provides the entertainment and the Presidency of the peer group and the secretariat in terms of capitalization. It is in charge of drafting the Progress books and the Final report of the project. The AIFM facilitates exchanges between partners and promotes the project through its Mediterranean network of contacts and communication tools. For this, it carries on various media such as the website www.forclimadapt.eu and Newsletters. It also works to transmit the information and recommendations to the major institutions (European Union in particular).

AIFM also participates in events such as the Mediterranean Forest Week (Antalya, Avignon...) or MED Programme events (latest one: capitalisation meeting in Marseille, November 2011). AIFM is also involved in external events to establish a link with similar initiatives (RMT AFORCE, EFIMED, FAO/SilvaMediterranea, GIP Ecofor…). Finally, it seeks to involve stakeholders in order to promote exchanges of ideas throughout the project.

Association “Forêt Mediterranéenne”

Contact : Denise AFXANTIDIS

Web site :

www.foret-mediterraneenne.org

Photo 5 : Scientist symposium in Marseille during the first seminar.

Partner’s presentation

Forêt Méditerranéenne is a French association (1901 law), created in 1978. It is a place of exchange and meeting for all people interested in the forest and natural areas of French Mediterranean regions.

Today, Forêt Méditerranéenne has a network of nearly 4 200 individuals and partner organizations, nearly 330 members and 450 subscribers to its magazine "Forêt Méditerranéenne". Its network consists of institutional stakeholders, socio-professionals, associations... of the Mediterranean forest management and protection sectors.

Role of the association “Forêt Méditerranéenne” in the FOR CLIMADAPT project

The main contributions of the Association Forêt Méditerranéenne to the project are:

- To organize an international conference as a shared initial state of knowledge in the begining of the project,

- To provide a platform for knowledge exchange validated in French Mediterranean region (institutions, communities, organizations research, associations ...) and initiate this process in other countries associative partners (the writing of a methodological guide is provided for this purpose).

Project progress and partial results

Project of the Forest Research Centre of Catalonia (CTFC)

As a research centre specialised in Mediterranean forests, the Solsona CTFC proudly hosted the 5th Seminar of the FOR CLIMADAPT project. High quality interventions and an extremely rich field trip provided the partners with an overview of local issues and the activities of the Catalan partner.

Climate change in Catalan forests

Lluís Coll, CTFC

The rise of CO_2 in the atmosphere could have a fertilizing effect for different species, but only if the level of rainfall remains stable or even increases, which does not seem to be the case. Currently, the only certainty concerning rainfall is a trend towards a longer dry season.

Moreover, Catalonia is expecting a rise in temperature of 3 °C by 2100, which will cause a significant increase in potential evapotranspiration (PET).

The combination of these two phenomena will result in:

- more severe and more frequent droughts,
- an increase in the risk of fire, driven by a growing accumulation of dry biomass due to the gradual abandonment of agro-pastoral practices and inadequate or unsuitable management of forested ecosystems,
- a likely increase in the virulence of pest attacks such as the Pine processionary caterpillar.

We also expect significant changes in the phenology and physiology of the species with, among others, an advancement of the budding period (up to 10 days earlier), a reduction in the period of growth and a shift in species altitude, as has already been found at the Montseny site by comparing vegetation types between 1970 and today.

Photo 6: Coniferous forests die-back in the Catalan Pyrenees.

The impacts will vary widely depending on the species. For example, we expect considerable sensitivity of the Strawberry tree (Arbutus unedo) to these changes, while the Phillyrea genus react much less to the forecasted changes.

With climate changes, we do not expect a decline in biodiversity, but rather changes in the composition and structure of forest stands.

In general, the whole of the Catalan forest ecosystem will be affected by climate change.

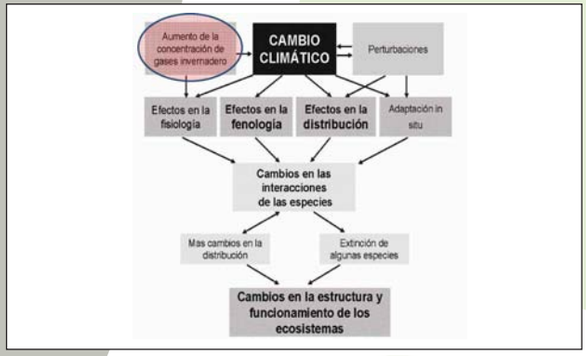


Figure 2: The system of impacts due to climate change on ecosystems. Peñuelas et al., 2004 (adapted from Hughes 2000).

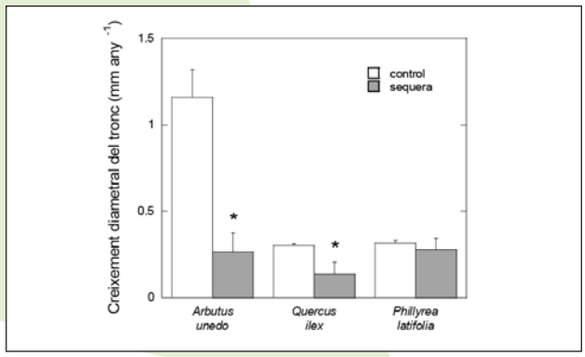


Figure 3: Growth of trunk diameter in mm per year in a population under water control (light grey) and drought conditions (dark grey). Ogaya and Peñuelas, 2007.

Forestry policies and natural resources in Catalonia: adaptation to global change

Luis Albian, Director of the Catalonia Forest Ownership Centre (CPF)

In Mexico, a study was conducted on different forest policies, realities of governance and the forest environment. The conclusion is that it would take $ 40 billion per year to effectively mitigate the problems of deforestation and climate change.

All the proposed measures must be carefully planned at the regional level : Subregional plans, management plans (property level), etc.

Currently, 40% of public funding for forests is intended to mitigate natural disasters (snow, fire, wind etc.).

However, there are doubts about the appropriateness of certain operations involving the substitution of forest species. For example, the Douglas may grow rapidly but it is more sensitive to wind. There is generally a lack of long-term planning. Harmonization with the European plan is also desirable[1]. For now, it is considered that forest management should improve the carbon footprint. But the real urgency is how to improve management with such an unstable market, i.e., to make logging viable and attractive for owners.

Recently, discussions were held on the possible need for strategic breakthroughs. For example, there is much talk of agro-forestry. Our focus, however, is to make every effort to ensure that forest areas become less dependent on public funds.

For this, it seems necessary to intensify forest management. The hope to achieve this lies not only in timber production, but also in the valuation of ecosystem services, non-timber forest products[2] etc.

Thought must be given to how to improve genetic resources. Tests are needed on large surfaces to achieve economies of scale, and should be evaluated based on expert assessment.

More risks need to be taken and more research and innovation are required, to achieve economic and social sustainability in forest management methods. For example, there are actually ongoing experiments to make grafts on the Aleppo pine for the production of edible pine cones.

It should also be accepted that some species display an invasive trend, like the cedar however, they are already established locally and are effective at adaptation and could provide solutions.

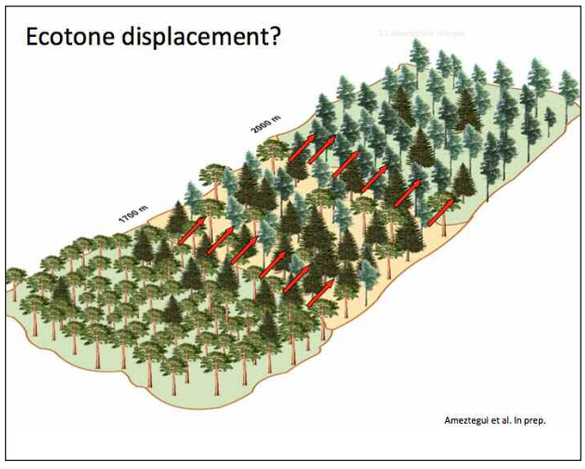


Figure 4: Diagram showing the increase in altitude of forest species due to climate change. Ameztegui et al., 2012.

Forest management and private property in the context of global change

Luis Albian, Director of the Catalonia Forest Ownership Centre (CPF)

80% of Catalan forests are privately owned, but they produce only 60% of wood supply.

The CPF is seeking participatory administration, applying the principle of subsidiarity, to work closer to the real actors on the ground, in conjunction with local decision makers.

The aim is to stimulate sustainable production of private forests, and engage the owners in the elaboration of forest policy, but also:

- to provide technical and financial support for the development of management plans, grant applications and forestry work projects,
- to oversee the restoration of disaster-affected areas, and insurance systems for forest fires and liability,
- to encourage the establishment of forestry associations,
- to spread the best forestry practices and to assist in the transfer of knowledge and technologies throughout the sector.

The CPF also acts as a technical service for the PEFC Certification[3] in Catalonia in the framework of the international system for sustainable forest management.

It is a public entity that participates in projects funded by the European Union and that is developing a network with equivalent bodies in the south of France, such as the Regional Centre of Forest Ownership (CRPF), in the regions of Aragon and Navarra, the EEIG FORESPIR[4], and ARCMED (Association of Mediterranean forest owners).

Notes:

1 - See the main themes of the Lisbon conference.

2 - Note, however, that in the region, cork and other non-timber forest products are rarely profitable.

3 - The Programme for the Endorsement of Forest Certification (PEFC) is an international non-profit, non-governmental organization dedicated to promoting Sustainable Forest Management (SFM) through independent third-party certification.

4 - Established in 1999, FORESPIR or the French and Spanish European Association for the Pyrenees, aims to contribute to the maintenance and development of the economic, ecological and social functions of forests (http://www.forespir.com/).

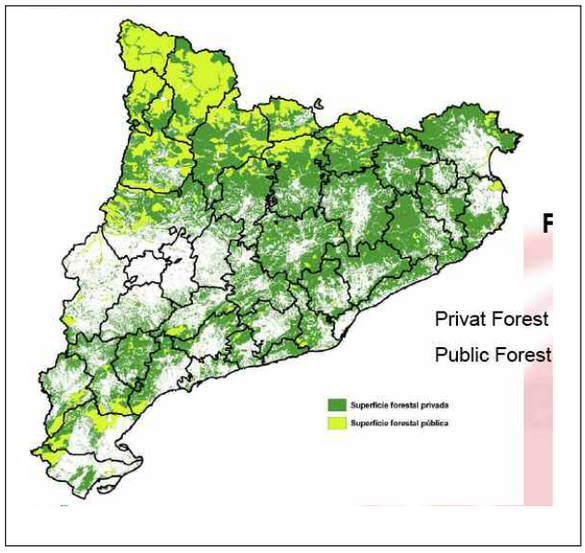


Figure 5: Map of Catalan private (dark grey) and public (light grey) forest stands.

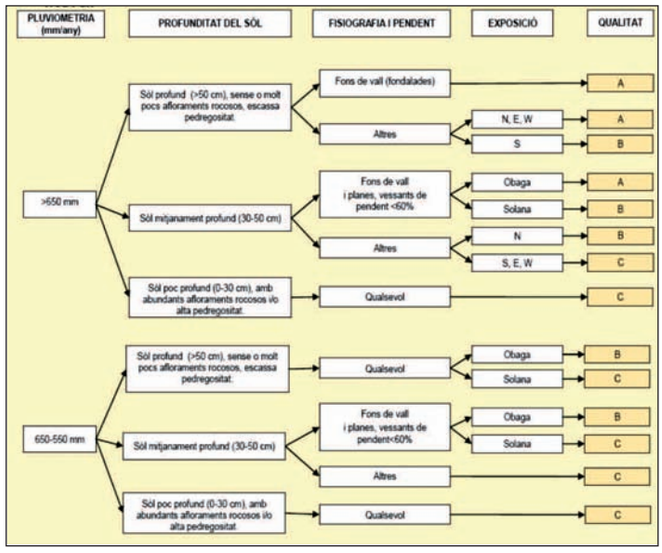


Figure 6: Orgest Classification: Four main criteria (rainfall, soil depth, topography and exposure) allow to position each site in a classification of forest stand quality.

A comprehensive and innovative tool: Guidelines for Sustainable Forest Management in Catalonia

(Orientacions de gestió forestal sostenible de Catalunya, ORGEST)

Luis Albian, Director of the Catalonia forest ownership centre (CPF)

The objective of this innovative tool is to develop guidelines for forest management adapted to local conditions, taking into account the complexity and multi-functionality of forests, as well as major disturbances (fires, drought) in the current context of global change. The aim is to provide a technical basis for forest planning, instruments (simplified management plans, etc.), while trying to harmonise at a forest level planning tools with higher levels (national, European etc.).

In particular, a typology of forest stands was developed, including information on:

- the main forest vegetation,
- the ecological characteristics of locations (soil depth and composition, micro climate etc.)
- different hazards, including the risk of fire.

The result is a classification of the stands regarding quality and vulnerability (A, B, C):

- to define the quality of sites, particularly taking into account the availability of soil water,
- to adapt management models in response to changes in rainfall patterns,
- to implement management models to reduce stand susceptibility to fires,
- to implement management models for mixed stands (allowing increased resilience).

Forest fires in Catalonia, current state and prospects

Marc Castellnou, Head of the "Fire analysis and strategy" unit of the Catalan Forest Service

Fires are increasingly violent because of climate change. During the last big fire in the Pyrenees, the town of Ionquera was surrounded in 7 minutes after the fire crossed the national road. In 2005, 25,000 ha burned in just 45 minutes!

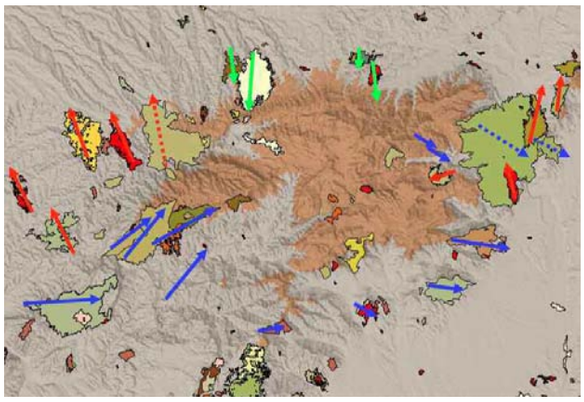
There are different types of fire (all details can be found at www.incendioforestal.es): Atlantic, Mediterranean, mountain (Alps, Pyrenees, Carpathians) etc. and also the so-called "convection" fires, which cause significant exchanges of air masses at low altitude with cold air masses at high altitude. This is called a "convection cell": a column of smoke that turns on itself, causing a "fire-storm" that moves at high speed in all directions and at very high temperatures. These are very difficult fires to fight for firemen without taking extreme risks.

Until now, they were known to occur in major forest regions like Siberia or the Urals. Yet this type of convection fire has begun to appear in Catalonia in recent years. Climate change is expected to increase the frequency of this kind of phenomena because of the increase in the frequency of heat waves from North Africa.

Aggravating factors

Atlantic disturbances and prevailing winds (north-west), which regularly sweep the north of the Iberian Peninsula, flow along two main channels from the ocean to the Mediterranean Sea. Each, on both sides of the Pyrenees, give rise to the Tramontane in the north, and Emporda winds in the south. They significantly increase the severity of fires.

Forest fires around the Ebro are increasingly similar to those of drier regions (Andalusia, southern Portugal etc.).



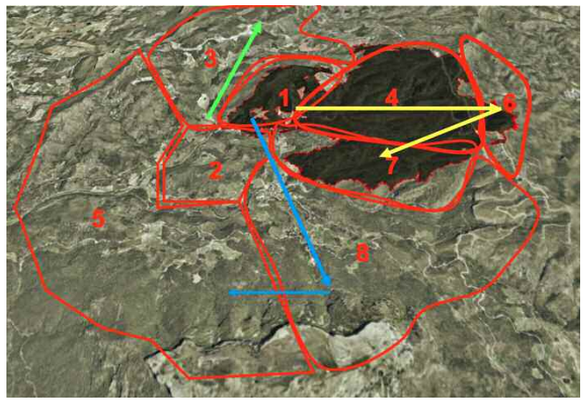


Figure 7 and 8: Multifocal and multi-axis fire propagation maps in Catalonia in 2003.

In Catalonia, fires depend on two main factors: the wind (see above) and heat coming from North Africa. In the 1950s, these rarely occurred if at all. They began around 1990, and are now increasingly regular.

Most convection fires occur when there are large continuous forests and intensive heat due to excessive accumulation of fuel (dead wood, litter) that warm up the ground over large areas, triggering thermal inversion in the athmosphere.

Insufficient preventive measures

As urbanisation progresses, the potential sources of fire outbreaks have also increased. After France, that has been the victim of this phenomenon for decades, Spain began to experience the same problems of residential sprawl and the increasing dispersion of human settlements among forested ecosystems.

For a long time, Catalonia has been a leader in international level for fighting against fires. However, it is relatively easy to stop small fires, but still difficult to handle large ones. Now we learn a lot from successes, but we do not gain enough experience from failures. This is what will have to be developed in the future for the management of fires. Indeed, there is not enough planning actions concerning the skills and responsibilities for control and prevention.

Thus, while an ordinary fire moves on average 6 or 7 km / h, good stand management can reduce this rate to 2 or 3 km / h.

The fire fighting bill in Spain is equivalent to the entire American continent! In some other countries, like Italy, we also find that responsibilities are not entirely clear: between civil security services and forestry services, who is responsible? Policy coordination at the international level would be desirable above and beyond just the focus on how to fight fires. For example, Airbus has received an order to develop giant water bombers, a project with an exorbitant cost, while there is no talk about preventive management at a European level! Yet it seems clear that the best way to reduce the bill is to increase investment in forest management.

However, we must not forget that fire is part of the ecosystem. It is not the fire itself that must be fought, but the resulting extreme and destructive events, which are not so systematic if management of the natural environment is appropriate.

Grassland fires have declined steadily since the 1970s. However, we observe that forest fires increase steadily until the late 1990s (the black year: 1994), and then stabilize. Today, fires cover less area, but are much more difficult to extinguish. Forest fires are indeed extremely difficult to control if there is no discontinuity in the landscape (fuel cuts).

Some experts make proposals such as "we will buy larger aircraft". But this is not effective against convection fires, which have multiple seats and produce a lot of smoke, making the actual fire very difficult to locate and to reach.

Photo 7: Prescribed burning carried out by farmers under the vigilance of fire-fighters, and with the observation of volunteers.

Photo 8: "Convection" fires cause large movements of air masses, making it extremely difficult and dangerous to fight.

Conclusion

Beyond a lack of fire fighting resources, it is regrettable that there is almost no forest management strategy that would significantly reduce the risk and severity of fires. It is important to develop this shared vision between countries facing the same problem.

This requires an awareness campaign among both the public and stakeholders in the field. This is what has been undertaken as part of the FIRE PARADOX project, seeking to develop a "fire culture." But it must necessarily be accompanied by the development of technical solutions to deal with an emergency situation through concrete joint actions.

For more information: Paradox - FIRESHARE (www.incendioforestal.es)

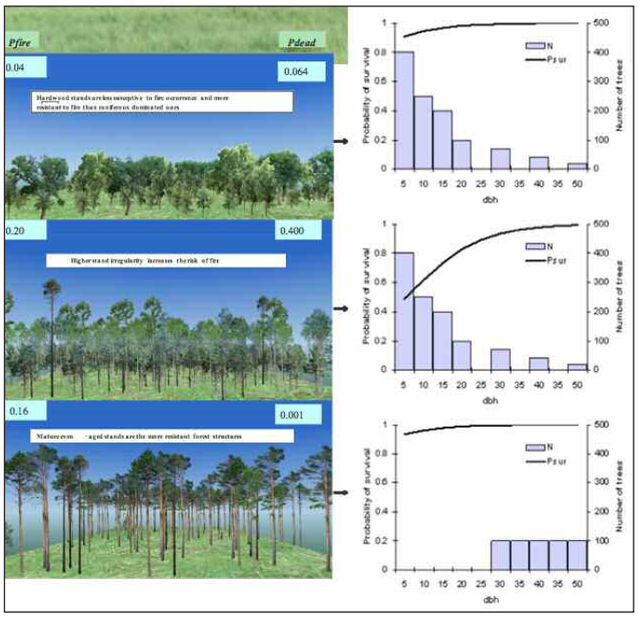


FIG 9: Example of modeling fire impacts according to stand structure. The bars represent the class of tree height (x-axis). The curves represent the probability of survivaance of the population (that is to say, the number of resilient trees / dead trees after the passage of a fire). It is observed that the conduct of irregular stands increases the risk of fire (vertical continuity). In contrast, even-aged stands are more resistant to fire.
Source : Gonzalez and al., 2007.

New tools for monitoring fire risk due to climate change

Jose Ramon Gonzales-Olabarria, "Forest dynamics" unit of the CTFC

Taking into account the risk of fire in forest management planning has been a recurrent subject of research since the 1980s. Forest fires often cause high tree mortality or significant injury to the surviving trees. However, good forest management has the capacity to change fire behaviour by changing the amount and spatial distribution of forest fuels.

This paper presents different methods to take into account the fire risk in the planning process of forest management. These methods have evolved from either non-spatial approaches, where the effect of fire is judged by determining the amount of timber loss, or from more recent approaches, in which the fire behaviour is studied in order to assess the extent of potential damage, and the impact of reducing fuel availability.

Several remote sensing (especially Airborne LiDAR based on modern techniques of aerial photography), and data processing / simulation (especially FARSITE: http://fire.org/) were presented.

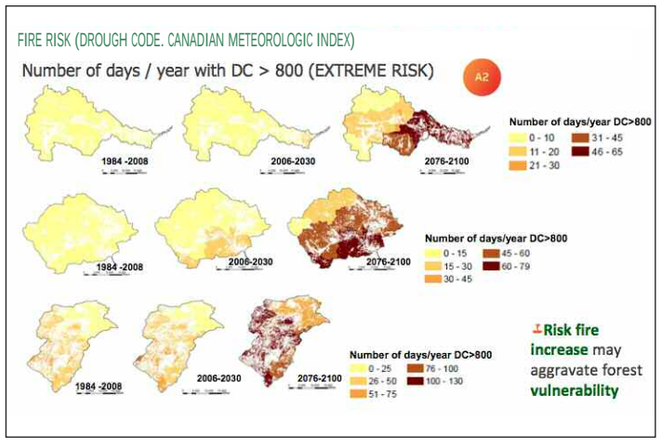


Figure 10: Fire risk according to the Canadian drought index "Drought Code" (DC). On these three Catalan watersheds, a massive increase in the number of days per year when the DC index is greater than 800 is expected (corresponding to an extreme risk).

Climate change and impacts on water resources, adaptation solutions

Eduard Pla, Centre for ecological research and forestry applications - CREAF

Mediterranean forests are significantly affected by climate change, particularly in terms of water availability. This is not apparent in quantitative terms (there is the same annual rainfall in London and Barcelona), but rather in the distribution of rainfall over the year. Indeed, in the Mediterranean region, rainfall is concentrated into brief periods of severe weather (thunderstorms, especially in the Autumn), leading to a severe drought during the rest of the year, especially in summer.

The Accua project (Adaptation of Water Use to Climate Change) http://www.creaf.uab.cat/accua/), led by CREAF, aims to assess the vulnerability of populations to fire according to scenarios integrating climate change, combined with scenarios of socio-economic change (growth or recession, adaptation response or unresponsiveness etc.).

Research on the impacts on ecosystem dynamics are being conducted, such as:

- A simulation of the potential impacts of a reduction of the forest area: the water regime becomes more extreme (excess of surface water during rainy periods, rapid drying during dry spells etc.). Yet climate change may favour brush areas less threatened by increased water deficit.

- A simulation based on forest species: Beech would be significantly reduced and replaced by conifers.

A similar analysis was performed on the Man and Biosphere Reserve of Gibraltar under the CICLO project (Intercontinental Biosphere Reserve of the Mediterranean basin).

The best-managed forests production is growing despite the increase in temperature, while those that have not been managed see a decline in terms of production.

The recommendations focus on:

- A reduction in density, while favouring large trees,
- Identification of the most resilient species,
- The establishment and maintenance of diverse agro-forest mosaics.

Experimental plots following these recommendations have been implemented in the Prades mountains, France, and results show an increased resistance of stands to drought.

For more information: www.creaf.uab.cat.

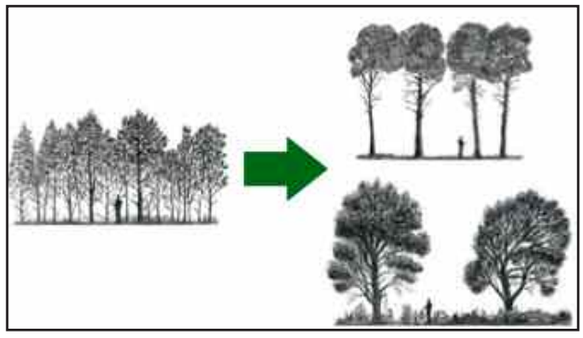


Figure 11 : Réduction de la continuité verticale (schéma du haut), et horizontale (schéma du bas) des peuplements forestiers.

Expansion and densification of forests in the context of global change, the case of the Black pine

Aitor Ameztegui, "Forest dynamics" unit of the CTFC

In the second half of the twentieth century, the Pyrenees have suffered from major changes in population and economy as well as the organisation of the territory. These changes (including agricultural abandonment) have led to an expansion of the natural vegetation, particularly forests, not only via colonization of open areas but also via the increasing density of existing forest areas. This is called "encroachment of the landscape." Comparing aerial photographs from 1956 and 2006, increasing density processes of stands of Salzmann black pine (Pinus nigra subsp. salzmannii var. salzmannii) and Mugo pine (Pinus uncinata) were quantified in the Pyrenees. In the period studied, the Black pine increased its area by 16%, while the tree cover increased by 30%. We attempted to identify the main topographical and socio-economic factors of this phenomenon. In particular, the abandonment of agricultural land has been cited as one of the determining factors of colonisation, while increasing density is more conditioned by the existence of formerly colonised masses from 1956.

Indeed, without denying the (highly publicized) reality of climate change, it is important to emphasize other factors:

- Changes in socio-economical context and land use.
- Atmospheric changes (ozone, various acids etc.).
- The arrival and spread of invasive species.
- Soil depletion.

Data on the colonisation of land areas by forest are combined with topographic data: gentle slopes and a northern exposure are conducive to maximum extensions of forest cover.

Traditionally, the expansion of cultivation and different wood uses (construction, heating...) maintained stands under pressure. Crops were grown on the gentle slopes, there are now the main areas of colonisation.

In conclusion, the region has recently experienced a significant increase of Pinus uncinata, which corresponds fairly well to the spatial changes linked to the reduction of anthropogenic activities (abandonment of agricultural land and grazing). This does not mean that climate change has no influence, but rather underlines the importance of considering changes in land use and other anthropogenic factors.

Additional information

About composition of local populations

oncerning the composition of coniferous populations threatened with decline or die-back, we find in particular Pinus uncinata, Pinus sylvestris, Pinus nigra subsp. Salzmannii var. Salzmannii, Pinus halepensis and Pinus pinea. The Swiss stone pine (Pinus cembra) is almost non-existent in the region. These are mainly "naturalised" forests, most of them dating from the last century (they were planted after the phylloxera crisis) and some are up to 300 years old. Most of stands are mixed, natural, and increasingly uneven (mixed in terms of age). Broadleaved species are reappearing.

About threats

There are a lot of discussions regarding the impacts of climate change, drought, pest attacks, fires, but relatively little on air pollution. Lluis Coll indicated that the Josep Peñuelas' team carried out studies on this subject, including ozone, which affects many Catalan forests. The results will be published soon.

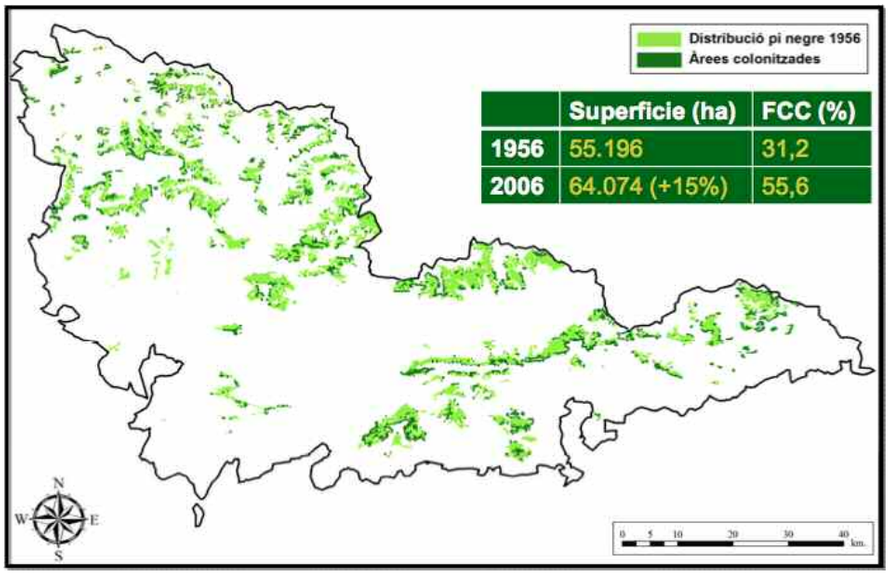


Figure 12: Black pine colonisation in 1956 (light grey) and areas colonised since by this species (dark grey) areas. Source: Http://fidbosc.ctfc.cat

Integrating environmental issues

In Catalonia, the management of protected areas is the work of a ministerial department in its own right, separated from forest issues. However, environmental concerns, in particular in the current context of climate change, are of course integrated into the work of CTFC. They work in partnership with the Ministry of environment, for example, monitoring the Black pine or in studying natural habitats.

Currently, many more people are dedicated to environmental issues rather than to forest management and this is a problem. We must go further but for now we need to continue observing. Biodiversity is a bottomless pit. However, we certainly should not neglect management.

We urgently need to better manage our forest stands. This applies across the entire Mediterranean basin. We must be able to provide recommendations for sustainable forest management so that owners can manage their plots and cope with various changes.

Forest biomass, a potential solution for in reducing human impacts on climate

On the sidelines of the seminar, partners were invited to visit the wood chip boiler recently installed for the central heating of the CTFC buildings. Ignacio Lopez, also in charge of the CTFC projects WOODE3 and PROFORBIOMED, made a brief presentation of its operation (see photos 9 to 11 below).

This type of installations can achieve neutrality of greenhouse gases emissions for the production of energy, and thus reduce the climate impact of human activities. Although they are questioned in the Mediterranean forest context, where wood productivity is quite low, energy production from forest biomass is a real opportunity for increased viability (and therefore a significant improvement) of forest management, with all that entails such as positive impacts on reducing the fire risk vulnerability of forest populations.

For more information on this type of wood-energy use, visit http://www.woode3.eu/ and http://www.proforbiomed.eu/.

Photo 10: Stock of wood chips for delivery trucks, directly supplying the burner through a feeder screw.

Photo 9: Boiler with a thermal output of 350 kilowatts.

Photo 11: Micro-cogeneration unit (biomass gasification and electric power generation).

Actions of the CTFC within FOR CLIMADAPT

Le fifth technical seminar of the For Climadapt project was an occasion for the CTFC to present, in situ, some of its field activities (16 of October).

Silvicultural models and treatments to create crown fire resistant stands and more resilient forest structures (Baronia de Rialb pilot site)

Míriam Piqué, Mario Beltrán and Teresa Valor, CTFC. Contact: miriam.pique@ctfc.cat ; ags.ctfc.cat

Study area: Rialb river basin

The technical Unit of the Catalan Fire Fighters Service (GRAF) identified the key areas that determine the development of large wildfires in the basin. These areas are called Strategic Management Areas (orange plots in the map below).

Then, a prioritization was carried out, so the most Southern Strategic Management Areas were determined as the first to be treated. The treatment experience had been developed on our pilot site.

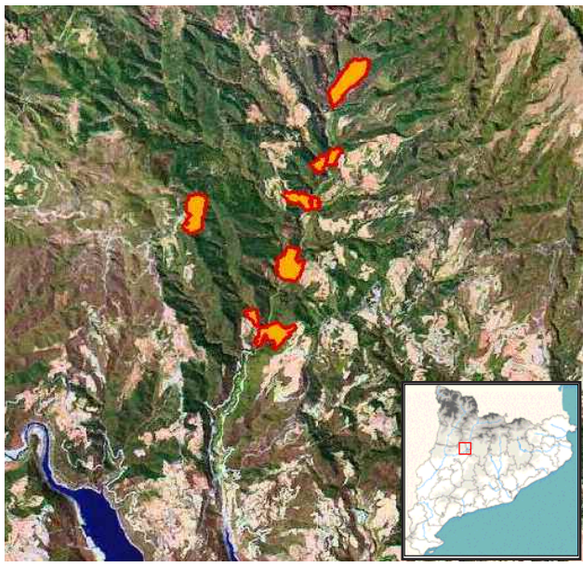


Figure 13: Maps of the Baronia de Rialb pilot sites in the Catalonia region.

Objectives

The main objective is to design and execute silvicultural models and treatments to create fire resistant crowns and more resilient forest structures.

The proposed treatments and silvicultural guidelines should reduce the risk of crown fires in the Rialb river basin. The aim is to promote forest structures with fire resistant crowns in the way that if a fire starts or comes from a neighbour area as a surface fire, it would remain on the surface and wouldn't propagate through the canopy.

The proposed guidelines should aim at improving the resilience of forests to fires, by promoting mixed forests with broadleaves, root sprouting species and fire adapted species.

Moreover, the designed treatments should be efficient in economical terms. These treatments are designed to be less expensive than traditional fire-prevention treatments, as well as more durable, with long-term effects.

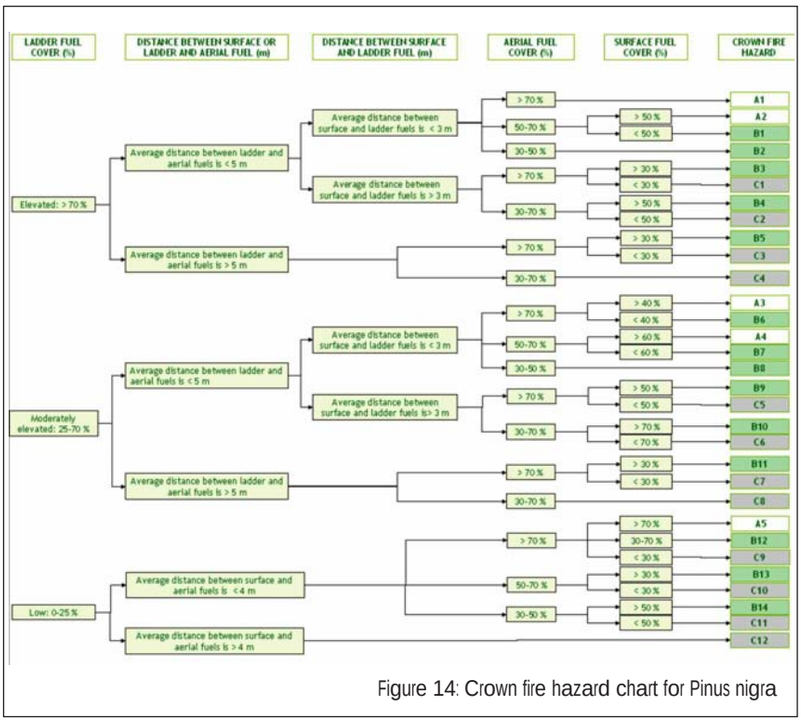


Figure 14: Crown fire hazard chart for Pinus nigra

Methodology

1. Stand characterisation and dasometric inventory: How is our stand?

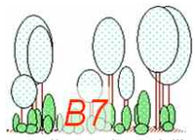
2. Identification of stand vulnerability to crown fires: parameters are responsible of stand vulnerability?

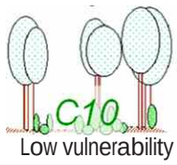
3. Definition of desired low-vulnerability structure and design of management guidelines: How should the stand be managed in order to maintain a low-vulnerability structure?

4. Designing of silvicultural treatments to achieve a low-vulnerability structure: Which parameters have to be modified in order to create a low-vulnerability structure?

5. Technical description of the treatment to be implemented: What kind of interventions have to be done and how?

6. Monitoring stand vulnerability evolution to evaluate the treatment efficiency and duration.

Initial structural parameters in relation with stand vulnerability		
Ladder fuel cover	25-70%	 Medium vulnerability
Mean distance between ladder and aerial fuels	<5 m	
Mean distance between surface and ladder fuels	<3 m	
Aerial fuel cover	50-70%	
Surface fuel cover	<60%	

Desired structural parameters in relation with stand vulnerability		
Ladder fuel cover	<25%	 Low vulnerability
Mean distance between surface and aerial fuels	<4 m	
Aerial fuel cover	50-70%	
Surface fuel cover	<30%	

Treatment to be implemented
Reduction of surface and ladder fuels to a cover ≤30 %:
Selective clearings, affecting understory and small trees (diameter < 7,5 cm) with alive crown under 1,3 m. Keep small trees (priority is given to Quercus sp.), where there is no other tree around and no problem of vertical continuity.
Elimination of broken trees (3 or 4 trees/ha, belonging to diameter < 20).
Management of slash originated in the treatments:
Cut the slash with diameter > 5 cm in pieces 0.8 to 1 m long. Distribute the slash on the floor, avoiding piles higher than 30 cm. A
Keep the slash 10 m away from the roads (Forest Fire Prevention Law).
Pruning of Quercus sp. (approximately 200 trees/ha) In the case of Stand 2:
Pruning the trees higher than 4 m, leaving the alive crown at 1.5-2 m, measured at high side slope.

Conclusions

The silvicultural treatments implemented are different from traditional treatments. Therefore, previous training of workers was needed to ensure the correct realisation.

The main change in stand conditions was the creation of vertical discontinuity between surface and aerial fuels. The aerial layer was slightly affected, so the stand maintains the main tree characteristics. Nevertheless, structural vulnerability to crown fires has decreased. The aerial layer is supposed to limit the development of shrub.

Total cost of treatments was 859 €/ha, with 5 day wages/ha (2 or 3 workers). These costs are below the normal cost of fire prevention works in this area.

Photo 12: Miriam Pique, Teresa Valor and Mario Beltran present CTFC work on fire prevention in the Barony de Rialb sector, where the frequency and intensity tend to increase due to global changes.

Photo 13: Traditionally, the Catalan forests were grazed by large herds, reducing the accumulation of dry biomass and therefore reducing the risk of devastating fires. One of the objectives of the CTFC in this area is to develop a method of clearing allowing owners to limit the vertical continuity of populations and create fuel breaks, while benefiting from their wood.

Demonstrative establishment of enrichment plantations in mono-specific Pine forests (Muntanya d'Alinyà)

Lluís Coll and Santiago Martín, "Forest dynamics" unit of the Forest Science Center of Catalonia (CTFC)

Study area

The enrichment plantations were established on 3 different sites of the Pre-Pyrenean range (figure 16).

All sites presented comparable environmental conditions (in terms of climate and soil) as well as similar stand characteristics (table 1).

Objectives

The objectives of this action were:

(1) To set up a demonstrative network of experimental enrichment plantations in monospecific Pine stands oriented to increase the resilience and the adaptive capacity of the forests in front of climate change.

(2) To evaluate the phenotypic and physiological plasticity of different broadleaved species and various provenances to different light and climatic conditions.

Methodology

On each site, two plantations were established at three different altitudes (1.000, 1.300 and 1.600 m): one in the undergrowth of a Pine stand and another in a natural gap.

Two-year-old seedlings of six broadleaved species were used. All the species were resprouters and thus increased the response-type diversity of the stands. Two regions of provenance (a local one and a Mediterranean one) were tested for four species (see Figure 17).

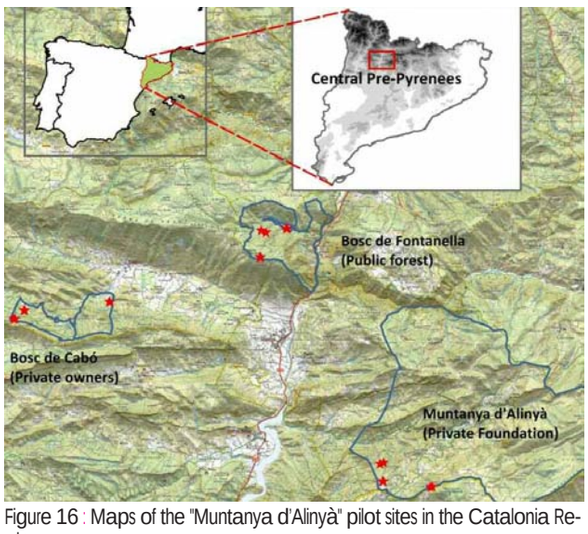


Figure 16 : Maps of the "Muntanya d'Alinyà" pilot sites in the Catalonia Region.

Species	Local provenance	Mediterranean prov.
Quercus coccifera	3	
Quercus ilex	3	3 (Castelló)
Quercus faginea	3	3 (Castelló)
Quercus humilis	3	3 (costa catalana)
Sorbus aria	3	3 (Castelló)
Fagus sylvatica	3	

Figure 17: Species and provenances used for the plantation

Measurements

The plantations were established during last autumn (2011).

The diameter and height of all plants were measured at plantation time, and destructive biomass measurements (aboveground and below ground compartments of plants) were performed in 10 plants per species (and provenances) prior to the plantation.

In 2012, survival rates (at the beginning of the summer) were computed.

The measurements to be performed in the plantations include (2012-2014):

Site description

Les éléments mesurés sont les suivants :

- Light availability (Photosynthetic Active Radiation - PAR sensor)
- Water availability (Temporal Reflectrometer - TDR probes, which calculate the electric conductivity of soils)
- Air and Soil temperature
- Precipitation
- Microsite conditions (grass cover, depth of the organic layer, distance to the nearest tree/shrub)

Plants description

- Diameter and shoot growth
- Aerial architecture
- Photosynthesis and stomatal conductance (sub-sample)
- Water potential
- Leaf nutrients
- Leaf traits (Specific Leaf Area - SLA)
- At the end of the third growing season (2014) a subsample of plants will be excavated and the biomass allocated to the above- and below-ground parts of plants assessed..

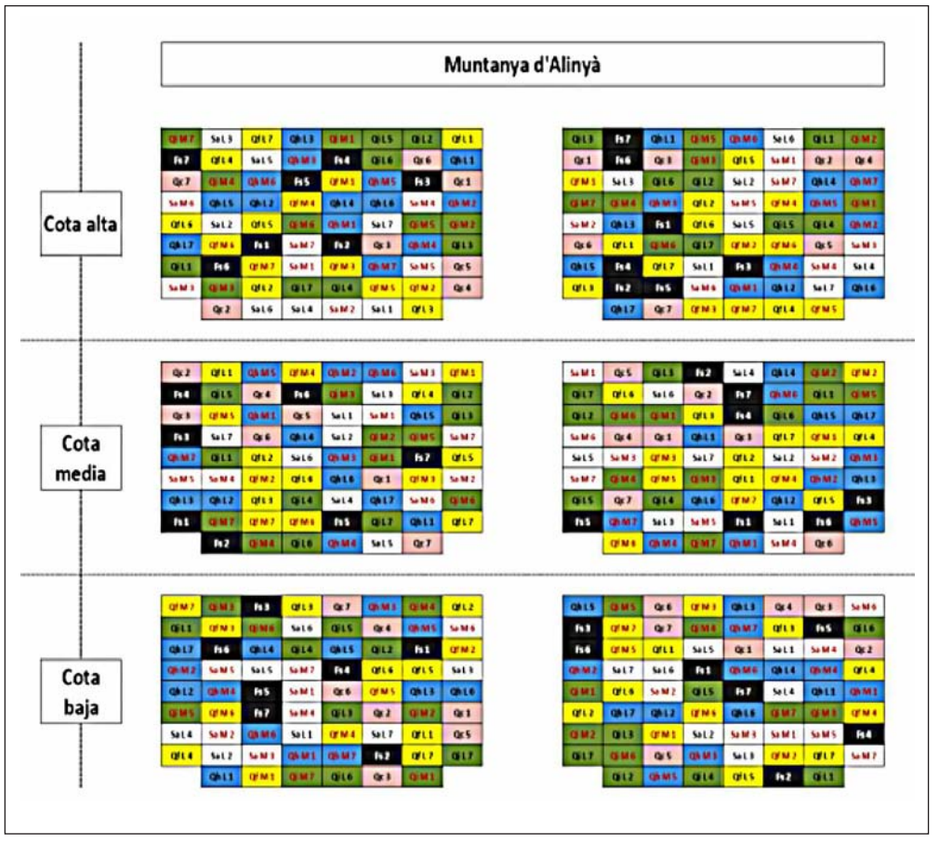


Figure 18 : Repartition of plants according to species and provenance in the enrichment plantation of Alinyà.

Photo 14: Lluis Coll describes the stand enrichment test protocol to project partners.

Photo 15: Less than a year after the initial planting, seedling mortality is high, but almost half part have survived, which will easily help conduct the experiment to the end.

Additional information on the activities of the ONF (pilot sites in the Aude Department, France)

Based on a proposal by Jean Bonnier (AIFM), partners were invited, following the seminar in Solsona (October 18, 2012), to visit the ONF pilot sites in the Aude department, near the Franco-Spanish border. This visit helped to provide more information on the ONF activities in the project, nearly two years after the visit of the pilot sites in the Alpes-Maritimes department during the first "extended" seminar of the project.

Picaussel Pilot site

Title and purpose of the test: "The relevance of low density forestry for the silver fir for stand adaptation to climate change"

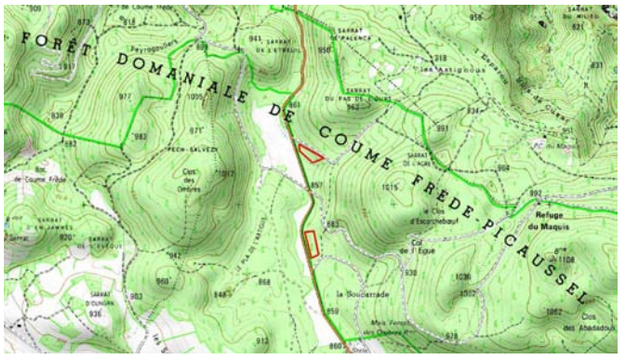


Figure 19: Location of experimental plots in the Comefroide-Picaussel State Forest

The objective of the scheme is to test the effectiveness and clarify the terms of low density forestry to reduce competition between individuals for water resources.

Experimental scheme

Climatic context

- The site is in a lower mountain climate.
- Altitude 850 m.
- Average annual rainfall: 1100 mm.
- Annual average temperature: 10 ° C.

Precise monitoring of rainfall and temperatures will be available throughout the duration of the project from an automatic weather station in the nearby Callong-Mirailles forest 5 km away.

Topographical and soil conditions

On each plot, the soil profile was observed and described in a soil pit. Local variations in the experimental units were assessed by studies using a soil auger.

Block 1

- Topographic position: lower part of a low slope.
- Local topography: mean slope (30%), regular.
- Geological stratum: compact Neocomian (n1-3) limestone. Bedrock: alterite of limestone and local colluvium.
- Soil: colluvial calcisol on compact limestone (see soil profile).

This is an earthy floor with a level of large rounded blocks of limestone seeming to form a pavement. This is visible in the ruts left by forestry operations. This level of blocks is an obstacle to the observation of deeper levels but is not a limit for root exploration.

Soil profile:

A 0-15 cm: Little humus, brown, sandy loam, dominant loam with fine sand, fairly compact, block structure, few coarse elements <5% limestone, non-carbonate fine soil, many roots.

B1 15-35 cm: Ochre brown, sandy loam, dominant loam with fine sand, fairly compact, block structure, few coarse limestone elements <5%, non-carbonated fine soil, many roots of all sizes.

B2 5-65 cm: Brown ochre (a little brighter than B1, sandy loam (clay), dominant loam with silt sand and a little clay, compact, low porosity, very structured, large earthworms, large blocks of hard rounded limestone difficult to assess (approximatively 75%), non-carbonated fine earth, quite many medium and fine roots.

The soil auger surveys reveal the variable depth of the limestone blocks level:

- 30-65 cm in the control area
- 20-65 cm in the thinned area

Photo 16: Soil auger.

Photo 17: Soil profile:

Block 2

- Topographic position: lower slope and bottom of a slight valley.
- Local topography: gentle slope, micro-relief.
- Bedrock: old alluvium.
- Soil: alluvial brunisol.

Soil profile:

NB: The pit is located in the middle of the control plot, near the vegetation plot number 3. There is moss. The litter is difficult to observe. Indeed, the "OF" topsoil (fragmented organic matter horizon) ranges around 1 cm in thickness.

A 0-5 cm: Brown, loamy, fine lumpy structure, fragile lumpy superstructure, non-carbonate fine soil.

B1 5-30 cm: Ochre brown, loam, course silt, fairly compact, almost no structure, few coarse elements <5%, pebbles, non-carbonated fine soil, many roots of all sizes.

B2 30-75 cm: Ochre brown, loamy, compact, unstructured, rounded coarse elements 10 to 20%, variable in nature, non-carbonate fine earth, quite many medium and fine roots.

Soil auger surveys stumbled on a stony level often with a gritty kind of stone. The depth of this bed of pebbles is quite variable:

- 20-65 cm in the control area
- 25-90 cm in the thinned area

Stand characteristics

Block 1 - Parcel 28

- Area: The homogeneous surface chosen for the experiment covers about 1 ha.
- Age: About 75 years at the time of the experiment set up, according to the dendrochronological analysis (counting rings on tree stumps).
- Density: 400 stems / ha; dominant diameter: 45 cm; dominant height[5]: 25 m; basal area: 40 m^2 / ha.

Block 2 - Parcel 24

- Area: The homogeneous surface chosen for the experiment covers about 1 ha.
- Age: About 55 years at the time of the experiment set up, according to the dendrochronological analysis (counting rings on tree stumps).
- Density: 420 stems / ha; dominant diameter: 42 cm; dominant height: 25 m; basal area: 38 m^2 / ha.

Note :
5 - The dominant height is the average height of the 100 largest trees per hectare.

If a reduction of 10 years is applied to obtain the age at 1.30 m (based on the number of annual rings between the bark and the pith, counted at 1.30 m in height) stands studied fall into fertility class 1 (below the average curve for block 1 and well above that of block 2).

Factor studied: Stand density

For a 25-meter dominant height Fir forest, the forestry roadmap established for fertility class 1 recommends to reduce the population to a density of 300 stems per hectare for a basal area of 30 m^2. The populations studied here are thus overdue for this kind of operation.

We test two levels of defined density (see Figure 20 and 21) obtained by thinning for the benefit of sample trees:

- High density (control) forestry: no operation during the project, with a density of 400 to 420 stems/ha. Subsequent catching up to the forestry roadmap is expected in the second stage.
- Low density forestry: considerable thinning with removal of one stem in two, i.e., half of the basal area and a density of 200 stems/ha.

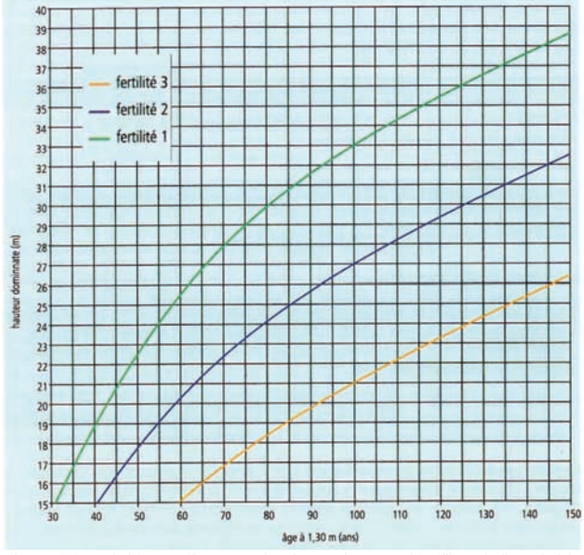


Figure 20: Height growth curves for three classes of fertility of Silver fir (Figure taken from the Silviculture guide for Pyrenees' Fir stands) and position of the stands studied.

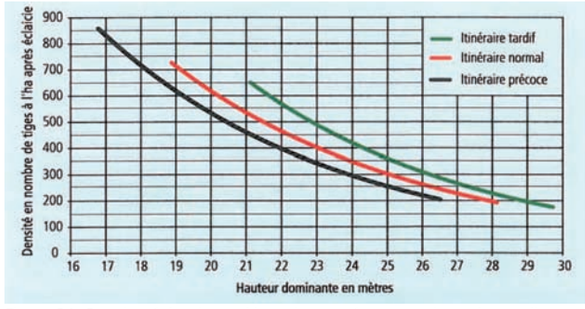


Figure 21: Graphs of density and basal area after operations, depending on the dominant height, according to the forestry roadmap for fertility class 1 (excerpts from the Silviculture guide to Pyrenees Fir stands).

Outcome measures

1. Dendrometric monitoring (at a tree sample level) for each category:

- 40 trees individually monitored for the "diameter" and "height" variables.

- A sub-sample of trees from among the 40, comparable between individual categories, is subject to health monitoring (see observation protocol below).

2. Dasometric monitoring (at the stand level) for each category:

- Basal area and quadratic mean diameter.

- Volume and composition of competing vegetation, natural regeneration of the fir.

Type of approach

Each category is located on two separate experimental units a few hundred metres apart. So this approach consists of two complete blocks with four plots.

Set-up Protocol

The set-up of the experiment includes seven steps:

1. Preliminary diagnosis: checking the homogeneity of the station and stand.

2. Topological survey and identification of categories.

3. Full inventory[6] and dominant height by category.

4. Silviculture: heavy thinning.

5. Choice of trees (sampling according to an identical method for all experimental units).

6. Final definition of the plot, labelling of sample trees.

7. Installation of vegetation monitoring plots.

Figure 22: Location of the experiments and procedures

Marking the experimental area and realisation of categories

Angle stakes marks the corners of the experimental area and categories. Both experimental plots are adjacent in each of the two blocks.

The first external trees of the experimental area are marked with a cross. The categories are distinguished by a coloured paint mark on the trees:

- Control category: blue paint

- Thinned category: red paint

Description and identification of trees

Diverse tree populations can be identified:

- Non-designated trees. They are not individually monitored. They are marked by a point of paint at 1.30 m.

- 40 sample trees of each category. These trees are selected from trees with a future in terms of operations, seeking a similar size distribution for each category. They are individually monitored. A belt of paint is marked at 1.30 m with a number on a spring and aluminium tag. They are numbered from 1 to 40 for each category.

- Couples of trees for each category (sub-population among the sample trees). These trees are selected from the sample trees and are similar from one category to another according to diameter and height criteria. They are distinguished from other sample trees by a double paint belt.

Setting up competing vegetation monitoring plots

Competing vegetation was observed on 4 m² plots, 5 in each category. These plots are evenly distributed and set up in areas less disturbed by forestry operations. Each plot is bounded by four angles stakes painted blue.

Observation protocol

1. Individual monitoring of a sample of trees for each category

The sample trees are individually monitored by their number. The following characteristics are measured:

Diameter

Circumference measurement at 1.30 m in height of sample trees with a flagging tape. To ensure that the measurements are comparable over time to each other, each measurement is made at the paint mark (see photo 18).

Height

Measuring the total height of the sample trees using a vertex (see photo 19).

Note:
6 - "Full inventory" means an inventory of ALL the trees on the plot of land, unlike the sample inventory

Health

Application of protocol from DSF observations (French Forest Health Department). The following are rated consistently for each tree monitored:

- abnormal discolouration of foliage,
- number of dead branches (estimated percentage)
- microphylla (very small leaves): no ; yes
- foliar deficit (estimated percentage)
- resin flow on the trunk (none; little; a lot).

In addition to these criteria, the fruiting, which can be an indicator of stress, is quantified by the number of cones (0, 1-10, 11-30, 31-50, over 50).

2. Monitoring of general characteristics of the population for each category

Basal area and quadratic mean diameter

These parameters are derived from a full inventory for each category measuring the circumferences at 1.30 m in height.

Competing vegetation

Competing vegetation is characterised by its phytovolume and composition. On each square of 1 m² (two squares identified on each plot) we note:

- percentage of rock or block cover,
- percentage cover of bare soil,
- percentage cover of litter,
- percentage cover of slash,
- percentage cover of the herbaceous layer,
- percentage cover, height, and the main species of the shrub layer.

Natural regeneration of fir

Counting was done of Cedar and Fir seedlings on the monitoring plots of competing vegetation.

Schedule of actions and measures

Measurements

Under the FOR CLIMADAPT project, a baseline was established in spring 2012, followed by a first measurement session after one growing season in spring 2013. The following parameters were measured:

- Circumferences of all trees at 1.30 m height.
- Heights of 40 sample trees for each category.
- Health status of the crowns of the 40 sample trees for each category.

Photo 18: Measurements (diameter, height etc.) are performed with the utmost rigour to ensure compatibility of data. Above: a demonstration by Jean Ladier during the visit.

Characterization of the low vegetation

Measurements are made every three years.

Duration of the experimental area

The total duration of the experiment is 8 years.

Initial state

Stand characteristics

Dendrometric features

The full inventory of the stand was carried out in early 2011, before the operation, to verify the homogeneity of the conditions in each block, then at the beginning of 2012, after the completion of the thinning to describe the initial state of the population in each category.

We observe:

- in block 1, a higher fertility in the control plot (dominant height is greater), with a significant forest capital base (basal area of 44 m²/ha). The difference in fertility could be linked to the limestone blocks closer to the surface than in the thinned experimental area.
- in block 2, there is a perfect similarity between the initial conditions of the two categories.

Competing vegetation

Characterization of competing vegetation was completed in spring 2012. The results are summarised in the following table:

Firstly, there are large differences between the two blocks, in the proportion of bare soil, the volume of slash and moss cover. These are the consequences of recent thinning on the Plot 28 where block 2 is located.

Then are then similar differences between the categories. This is explained in the same way by the disturbances related to the use of wood for installation of the experimental area: the thinning method, the vegetation has been partially stripped or cut, the proportion of bare soil and volume of slash are higher. This should logically be reversed in the coming years.

Dendrometric features

			population before action			Population after intervention		
			density	basal area	dominant height	density	basal area	Average diameter
BLOCK 1	control	0.55 ha	402 stems / ha	44 m² ha.	26.2 m	**402 stems / ha**	**47 m² / ha.**	**39 cm**
	thinned area	0.71 ha	263 stems / ha	36 m² ha.	25.1 m	**186 stems / ha**	**20 m² / ha.**	**37 cm**
BLOCK 2	control	0.42 ha	416 stems / ha	39 m² ha.	24.7 m	**413 stems / ha**	**42 m² / ha.**	**36 cm**
	thinned area	0.52 ha	416 t / ha	37 m² ha.	24.7 m	**207 t / ha**	**21 m² / ha.**	**36 cm**

Competing vegetation

		Proportion of litter and bare soil	Volume of slash	Moss cover	Grass cover	Volume of woody vegetation
BLOCK 1	Control	37 %	46 dm	14 %	19 %	2 dm
	Thinned area	51 %	62 dm	3 %	1 %	1 dm
BLOCK 2	Control	8 %	8 dm	66 %	17 %	3 dm
	Thinned area	15 %	48 dm	32 %	13 %	1 dm

Natural regeneration of the Silver fir

It was found that the seedlings are quite numerous in block 2 and more frequent in the control categories.

		Number of fir seedlings	Average height of seedlings
BLOCK 1	Control	1 /m²	6 cm
	Thinned area	0 /m²	11 cm
BLOCK 2	Control	8 /m²	9 cm
	Thinned area	5 /m²	8 cm

Observation of the sample trees

The sample trees are individually monitored by their number.

Diameter and height

The distribution of sample trees by diameter and height class in each category is shown. We observe (see table below):

Diameter		22.5 to 27.5 cm	27.5 to 32.5 cm	32.5 to 37.5 cm	37.5 to 42.5 cm	42.5 to 47.5 cm	47.5 to 52.5 cm	52.5 to 57.5 cm	57.5 to 62.5 cm	Total	
BLOCK 1	Control			4	8	11	5	8	3	1	40
	Thinned area	1	1	15	14	8	1				40
BLOCK 2	Control	1	4	13	13	8			1		40
	Thinned area	2	8	17	13		1				41

Height		21	22	23	24	25	26	27	28	29	Total
BLOCK 1	Control		1		4	6	11	6	4	5	40
	Thinned area		5		11	6		6	2	1	40
BLOCK 2	Control	1			11	7	11	6		1	40
	Thinned area		4	8	15	8	1	2			41

Determination of the sub-sample

To facilitate comparative monitoring, we matched pairs of trees (one per category) similar in diameter and height.

15 and 18 couples were identified, respectively, in blocks 1 and 2. Their characteristics are as follows:

Couple BLOCK 1	Diameter	Height
1-t15-e10	35/36 cm	23 m
1-t22-e12	37 cm	23 m
1-t11-e26	36 cm	24 m
1-t21-e19	37/38 cm	24 m
1-t7-e24	38 cm	26 m
1-t17-e40	39 cm	25 m
1-t9-e33	38/39 cm	27 m
1-t18-e5	40 cm	23 m
1-t26-e31	40 cm	26 m
1-t34-e25	43 cm	26 m
1-t25-e39	47/48 cm	27 m
1-t10-e35	45 cm	26 m
1-t39-e38	46/47 cm	25 m
1-t28-e17	30/31 cm	25 m
1-t6-e29	39/40 cm	25 m

Couple BLOCK 2	Diameter	Height
2-t11-e1	34/35 cm	24 m
2-t12-e37	38/39 cm	25 m
2-t14-e35	31 cm	23 m
2-t15-e26	32 cm	23 m
2-t16-e13	47/48 cm	27 m
2-t17-e3	40 cm	24 m
2-t22-e22	35/36 cm	24 m
2-t23-e30	36/37 cm	24 m
2-t24-e20	37 cm	25 m
2-t28-e24	38/39 cm	24 m
2-t29-e27	34 cm	23 m
2-t2-e34	34 cm	24 m
2-t34-e21	35/36 cm	24 m
2-t35-e38	35 cm	24 m
2-t36-e2	40/41 cm	26 m
2-t38-e28	37/38 cm	25 m
2-t3-e17	37/38 cm	24 m
2-t6-e7	38/39 cm	26 m

Health

Les observations ont été faites en mai 2012 et ont porté sur les sous-échantillons d'arbres appariés.

Leaves discolouration

The breakdown of numbers according to the rate of discolouration is as follows:

Few trees have discolouration. Only one has a high rate, with a wide distribution of anomalies in the crown.

Discolouration		0 %	10 %	40 %
BLOCK 1	Control	13	2	
	Thinned area	15		
BLOCK 2	Control	18		
	Thinned area	13	4	1

Dead branches

Of only two trees with dead branches, these were annual shoots located in the lower part of the crown..

Microphylla

The breakdown of numbers according to the presence of very small leaves is as follows:

Microphylla		no	yes
BLOCK 1	Control	15	
	Thinned area	14	1
BLOCK 2	Control	18	
	Thinned area	15	3

Leaf deficit

The breakdown of numbers according to the leaf deficit is as follows:

Leaf deficit		0 %	10 %	20 %	30 %	40 %
BLOCK 1	Control	8	5		1	
	Thinned area	7	5	3		
BLOCK 2	Control	7	5	4	2	
	Thinned area	4	9	4		1

Pine needle persistence

The breakdown of numbers according to the pine needle persistence is as follows:

It is generally believed that the normal life of Silver fir needles is 8 to 10 years. Here, only two trees have needles of less than 8 years old and the majority has needles of at least 10 years old.

Pine needle persistence		5 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years	1 years
BLOCK 1	Control	1			1	6	5	2		
	Thinned area				1	1	8	2	2	1
BLOCK 2	Control		1	3	6	6	1	1		
	Thinned area				2	7	6	2		1

Mistletoe

Mistletoe is almost absent in the experimental plot.

Fruiting

Counting cones requires a good view of the top of the tree. The count was not possible for the majority of trees, even with multiple viewing angles. In particular, it is almost impossible in the control conditions where the crowns are too tight to allow good lateral vision. This variable is thus not really relevant.

Initial results

In conclusion, there is no certainty that the decrease in population density results in an improvement of the water balance. Although an increase in photosynthetic activity is observed, it cannot be excluded that what is obtained in parallel is an increase in evapotranspiration. Only further readings for 8 to 10 years will provide certainty on this point. In addition, uncertainties remain about the potentially adverse effects of increased competition from undergrowth whose growth is favoured by light due to thinning.

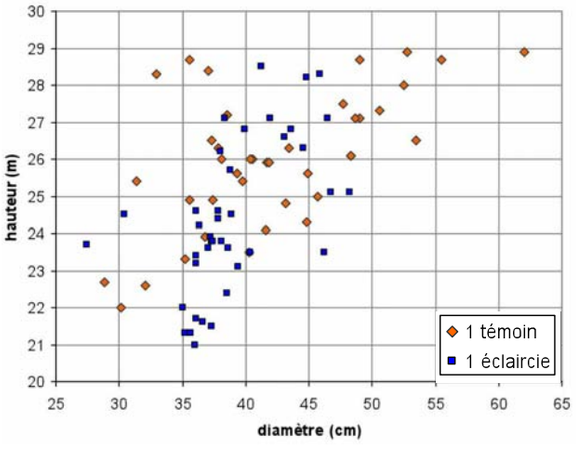


Figure 23 : Bloc1 : Graphique de répartition des arbres-échantillons en fonction de la hauteur et du diamètre.

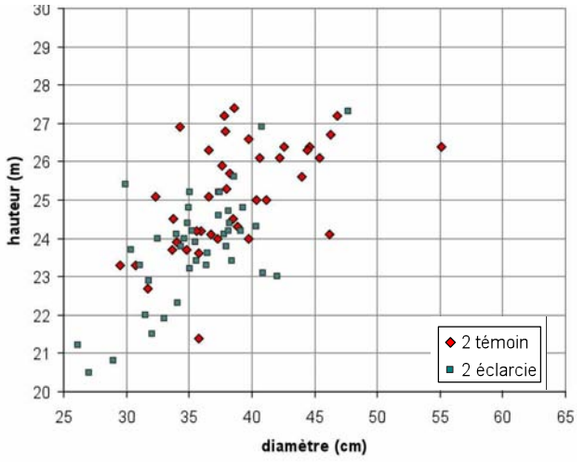


Figure 24: Bloc2: Graph of distribution of sample trees depending on the height and diameter.

Photo 19: ONF agents measure, among other parameters, the diameter and size of trees to monitor populations treated and control trees.

Photo 20: Ground surveys, thanks to delimitation of small "plots", allow to study the impact of thinning on the structure and dynamics of understorey.

Callong Pilot site

Title and purpose of the test:

"Comparison of diverse Atlas cedar origins in the context of Mediterranean Fir forests under oceanic influence"

Description of the experimental site

Stand characteristics

Plot 21 has been in a state of natural regeneration for twenty years.

- Residual seed trees, preserved during the latest cut with the hope if furthering regeneration, are in poor health (recent dieback and mortality).

- The floor is covered by competing vegetation, with bush patches and other shrubs.

- Tree regeneration is limited to a few areas.

Climatic context

The site is located in a lower mountain climate, on the sunny side (south-facing slope).

- Altitude: 1000 m.

- Average annual rainfall: 1200 mm.

- Annual average temperature: 9.3 ° C.

Monitoring of rainfall and temperatures is provided by an automatic weather station installed on a RENECOFOR Network plot (National Network for long-term monitoring of forest ecosystems[7]) in the same forest and at the same altitude 2 km away. Precipitation and average temperatures indicated above are from data collected between 1996-2004.

Topographical and soil conditions

3 kinds of stations can be identified on the plot:

- Stations on the plateau with an average thickness of soil.

- Sink-holes with thick terra rossa (red clay soil, from the hard limestone decarbonation in the Mediterranean climate).

- Ridges and slopes with shallow soil or gravel.

Only the stations on the plateau are suitable for an experimental area. The ridges and slopes have a too limited potential for planting, sink-holes are marginal situations, too small on the surface and not easily accessible for vehicles.

The characteristics of the stations on the plateau are:

- Flat topography.

- Compact fractured karst morphology limestone substrate (N_6A_1).

- Bedrock: terra rossa on alterite of compact limestone.

- Soil: fersiallitic calcisol (altered limestone, with a clear and strong clay formation and iron release, thus the red colouration in most cases).

Experimental scheme

Cedars cover a total of 7 ha, of which 5 ha will be in the experimental area.

Note:
7- RENECOFOR is the French part of a group of permanent forest ecosystem monitoring sites located in 34 European countries. This project is monitoring the forest dieback attributed to "acid rain" in the east of France and in Europe.
Since 2008, the impact of climate change and biodiversity have been added to questions about air pollution impact. (Source: www.onf.fr)

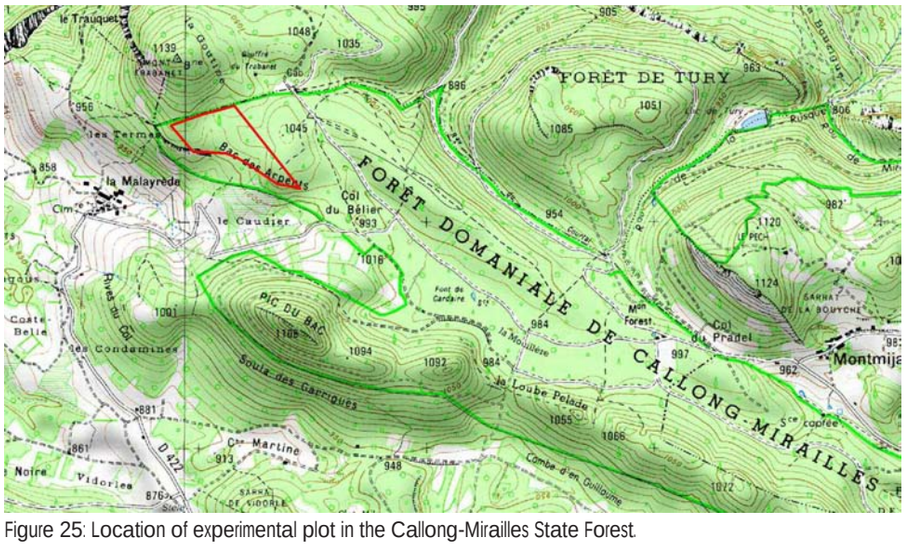


Figure 25: Location of experimental plot in the Callong-Mirailles State Forest.

Factor studied

A key factor is studied: the provenance of the Atlas cedar.

Categories tested

We planned to compare all the French origins of the Atlas cedar (Rialsesse, Marcely, Luberon, Ventoux, Issole, Saumon, Jura, Burgundy). Unfortunately, many sources, including Rialsesse were not available in 2010.

Cone harvests were conducted in the autumn of 2011 to complete the set of sources. Seed matches were prepared and dried at La Joux and the plants were produced by Les Miles nursery of Rialsesse, in the Ventoux and the Luberon (Menerbes). A too low germination rate of three batches of seeds resulted in only 4 sources for comparative planting (see table below).

Evaluation variables

The evaluation variables of the success of planting are:

- survival rate,
- health,
- average height.

Type of approach

The surface for planting and the number of plants available for each source can be considered as a complete block, with between 8 and 10 blocks, to determine the constraints of spatial distribution and planting.

Desired origin	Availability in 2010	2011 harvest	Germination 2012	Number of plants
Rialsesse (Aude)		X	X	3800
Marcely				
Ménerbes (Luberon)		X		
Ventoux		X	X	1200
Issole (Pre-Alps)	X		X	820
Saumon (Pre-Alps)		X	X	1020
Baumes-les-Dames (Jura)	X			
la Trouhaude (Bourgogne)	X			

Photo 21: The Aude pine is a subspecies with Nordic origins that has adapted to local conditions. However, faced with increasingly hotter and drier summers, the dieback is multiplying. The species has no future in the region.

Photo 22: Faced with this phenomenon, the ONF is considering various responses such as reducing rotation periods (80 years instead of 140 today), and ultimately replacing the species by a more resistant one, notably the Atlas cedar. Here, an area to be planted with cedars from different origins.

Project of the North-Aegea Region

The plenary session of the sixth and final technical seminar of FOR CLIMADAPT project took place in the Chamber of Commerce and Industry of Mitilini, on March 1st, 2013. Various scientists have first occurred to give an overview of the general situation of forests in the region, in the current context of global change.

Forests of Lesvos Island and their diachronic mapping

Prof. Kostas D. Kalabokidis

On the island of Lesvos, there are six major autonomous coniferous forests, which cover 31.500 ha, or 19% of the surface of the island. These forest stands can be divided into smaller sections based on topographic, climatic and anthropogenic conditions.

Calabrian pine (Pinus brutia) is the predominant species, whereas Black pine (Pinus nigra) occupies the highest altitudes. Some of the reforestation areas are covered by umbrella pines (Pinus pinea) and cypresses (Cupressus sempervirens).

Coniferous forests are increasingly exposed to risk of fires. There is an accumulation of fuel, either because of the abandonment of the rural environment and the reduced use of forests, but also because of the existence of mature stands of more than 100 years of age with high risk of fires. In addition, while in some parts of the island, there is an increase of grazing; other pars suffer a total abandonment of agricultural activities in the forests. In addition, it appears that climate change would lead to an increase of fires.

The above elements, combined with the utilization of fire as a means of cleaning the unnecessary biomass by farmers or as a grazing management by shepherds, increase the risk of fire occurrence.

The study site of the Amali peninsula, in the South-East of the island, is occupied in its central part by the Kratigos forest (650 ha). The peninsula has suffered frequent and severe fires over the past three decades that affected parts of the pine Pinus brutia forests. However, in the last decade, some reforestations projects in terraces were successfully achieved (cf. "Action outside the project: Plantation on terraces".

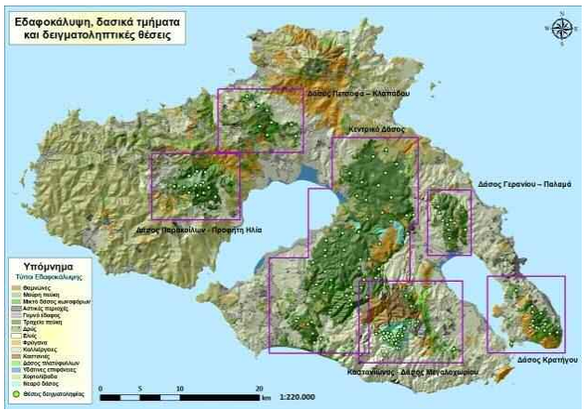


Figure 26: The six major Pine forest stands of Lesvos.
[Source: Prof. K. Kalabokidis, University of Aegean, Geography of Natural Disasters Laboratory]

The effect of climate change on the natural vegetation of Lesvos Island

Dr. Pavlos Konstantinidis

The vegetation of Lesvos Island is mainly included in the order Quercetalia ilicis (Mediterranean vegetation type, dominated by green Oak) and partially in the lower part of the order Quercetalia pubescentis (Mediterranean vegetation type, dominated by downy Oak). The Quercetalia ilicis is separated in two sub-zones: the lower and most arid Oleo-Ceratonion siliquae alliance that is mainly covered by phrygana, while the upper sub-zone Quercion ilicis alliance, is covered by maquis vegetation with evergreen sclerophyllous shrubs and Pine forests.

All species of the Quercetalia ilicis order are well adapted to high temperatures and low humidity levels. They have developed adaptation mechanisms to long drought summers and thus should be able to adapt to a small scale climate change. In contrary, the deciduous vegetation of the Quercetalia pubescentis order and Black pine forests in this zone should have difficulties to resist including to a small increase of temperature and drought. Since the summit of the mountainous region of the island is only 960 m, it is expected that these forests will firstly move up towards the higher altitudes, and eventually completely disappear of the island.

Regarding the two sub-zones of the Quercetalia ilicis, the phrygana of the Oleo-ceratonion siliquae are much better adapted to even higher temperatures and longer drought than the higher shrubs of the Quercion ilicis. Thus, the boundaries of these zones are subject to changes, at the detriment of maquis, which will occupy the actual areas of deciduous forests of the Quercetalia pubescentis.

The climate change will make all species of Lesvos more sensitive to anthropogenic activities and especially grazing. Even with the current level of grazing, it is expected that large areas of phrygana, and then of maquis, will be further degraded. The first

Photo 23: Phrygana et maquis dégradé (Photo: Région Nord-Egée).

signs of desertification are apparent in the driest part of the island, especially in the lower area.

This risk is amplified, in particular because of the large amount of accumulated fuel in unmanaged forests that provokes increased risks of fires in the near future.

Forest fire hazard modelling in Lesvos Island

Mr. Palaiologos Palaiologou

Simulations of the behaviour and spread of forest fires was performed by using the algorithm "Minimum Travel Time" (MTT) of the software FlamMap and BehavePlus. The models calculate the probabilities index of fire propagation over the entire study area with the simulation of thousands potential new fireplaces in the area (percentage of chances for each land mapping unit to be burned by a fire during the year). The combustion probability maps produced present the most vulnerable areas to a fire incident.

Larger values integrate the magnitude of fires that will potentially occur in a determinate area, which means that, under the same conditions, large fires (because they burn a greater part of the area) produce a higher index than small fires.

The models provide a framework for quantitative analysis of potential losses due to specific incidents of fires. The models provide also a method for quantifying the effectiveness of scenarios of fuel management on field, by estimating the spread scenarios, intensity and impact of forest fires.

A low index of combustion probability do not mean that the area is safe from any incident of fire, but it gives the indication that the area is less exposed to large-scale fires in normal conditions.

The simulations showed that the Kratigos forest may face frequent fires that can quickly take large proportions.

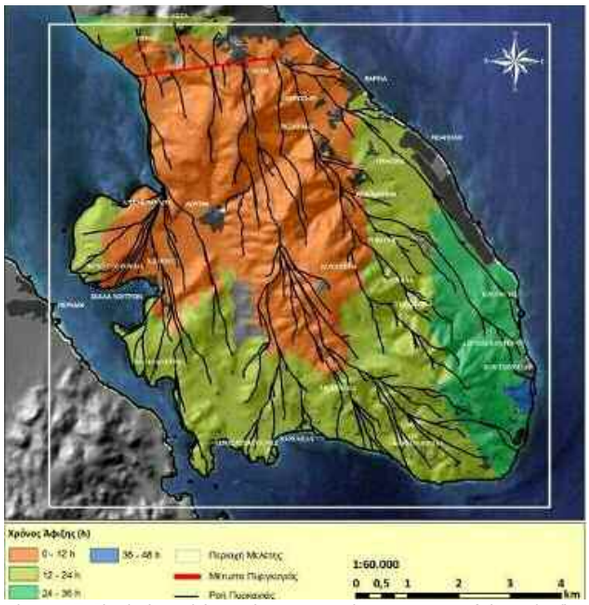


Figure 27: Simulation of the main propagation streams and time of a fire front coming from the north in the Amali peninsula.
[Source: Prof. K. Kalabokidis, University of Aegean, Geography of Natural Disasters Laboratory]

Actions of the North Aegean Region within FOR CLIMADAPT

The sixth technical seminar of the FOR CLIMADAPT project was the opportunity for the North-Aegean Region to present in situ its activities on the 1st of March.

Two pilot activities in particular were presented to partners, both integrated to Action 8 "Restoration - rehabilitation of burnt and degraded ecosystems" (see "Presentation of the partners (…)" page 12 and 13).

Site 1 - Reforestation of ecosystems degraded by fire

Place: Amali Peninsula - Lesbos

As shown on the map of fires incidents (Figure 28), almost half part of the forest in Kratigos (Amali Peninsula) was burned in recent decades. More specifically, 650 ha in 1977, 110 ha in 1999, and more recently, in 2006, 570 and 300 ha. These fires resulted in a strong deterioration of the Pinus brutia forests and loss of their intrinsic ability to regenerate naturally.

Background

Frequent and severe fires over the past three decades have led to an important degradation of forest areas of the Amali Peninsula. Today there is a lack of natural regeneration of Pinus brutia.

Objectives

The objective is the elaboration of restoration methods of burnt and degraded ecosystems, by testing in situ different reforestation modalities by planting and by direct seedling (a technique that was never applied in Greece at the date) of Pinus brutia.

Experimental protocol

The experimentation began in Autumn 2012, after the first rains.

Two ways of implantation where experimented:

Direct seedling: using of 15 to 20 seeds on small plots of about

Photo 24: Overview of the experimental site. In the centre, the fully cleared part by bulldozed is clearly visible.

0.25 m to 0.25 m, each one separated of 3 m from the others, in a very shallow depth more or less 2 cm. Half of the seeds are planted without any treatment, while the other half is made with seeds swollen by immersion in water during 48 h.

Plantation: plants are two years old with roots of about 30 cm. They are planted in the trenches or conical holes of 30 to 40 cm deep. A belt of soil of 5 to 10 cm keeps water in a sort of basin, at least for the first year.

Three different field treatments are applied for each type of planting (6 different areas in total):

1. Use of a ripper with one knife, which opens parallel trenches of about 30 cm deep, each one separated of 3 m from the other. The ripper works the ground and uproots everything on its path.

Advantage: the technique combines a relatively light mechanical intervention, and so a limited perturbation of the vegetation in place, and prepares the ground to improve roots implantation.

Disadvantage: presence of shrubs that will eventually be in competition with the young plants.

2. The second treatment includes a complete clearing of shrubs in surface thanks to a bulldozer, added to the use of a ripper in the same way as in the first case.

Advantage: the removal of shrubs in surface is comparable to the passage of fire, without the negative effect of heat. The effect of shrub competition disappears at least for the first seasons, which is crucial for the success of the reforestation.

Disadvantage: it destroys momentarily any vegetation. Although it is not a forest, this destruction will have an undeniable ecological impact.

3. The third treatment is the gentlest intervention as possible. It consists in a small clearing with manual tools only and locally around the plots where the seeds or plants are implanted.

Advantage: a minimal disturbance of the vegetation that continues to operate its ecological functions.

Disadvantage: seeds and plants have to face to a constant competition from other existent species.

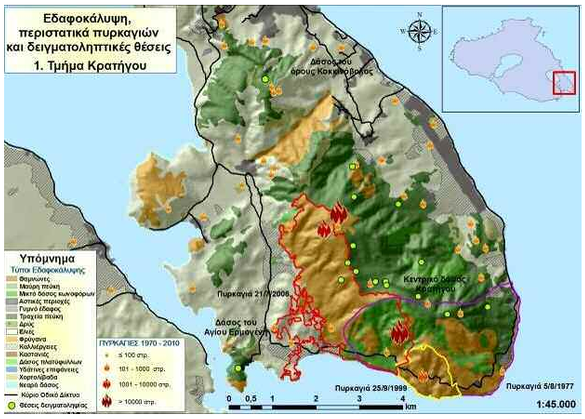


Figure 28: Land use and vegetation. Incidents of fires classified according to the burned areas between 1970 and 2010.
ΣΤΡ. = 1 ha

First results and next Steps

The comparison on the same site with similar ecological conditions of the three treatment methods on two types of implantation, will give us elements, totally unknown in Greece at the date, on the most appropriate methods for Pine forest restoration.

Obviously, if the results are equivalent or present a small difference, we will choose, for a large-scale reforestation, the method with the minor degree of intervention on the ecosystem.

Otherwise, direct seeding could reduce the cost of reforestation and their application to a larger scale.

The action was carried out in autumn 2012. The first results are very satisfactory for both applications. The new action of direct seedling has given impressive results.

It is necessary to monitor the experiment during next seasons and years and to analyse and compare the results. We must take care to help some plants to survive during the first summer by applying a few watering if necessary. The other plants will be left such as facing the natural selection and adaptation.

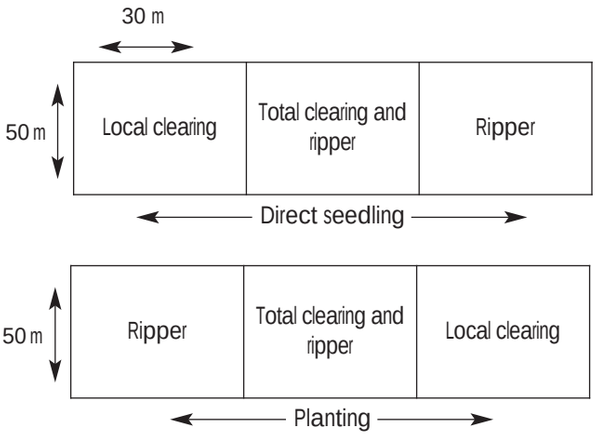


Figure 29: Diagram showing the structure of the different forms of reforestation on the Amali pilot site.

Ripper: use of a ripper in parallel lines (each 3 m.)

Total clearing and ripper: use of bulldozer for superficial clearing of shrubs and ripper.

Local clearing: manual clearing of small plots for seeding or planting.

Direct seeding: 15 to 20 seeds per plots of about 0,25 X 0,25 m (half of them immersed in water during 48 hours).

Planting: 2 years old plant in hole of at least 0,3 m depth (length of roots).

Photo 25: Young plants of Pinus Brutia.

Site 2 - Reforestation in a hostile environment

Place: North of Mytilini, in a small area near the village of Nees Kidonies.

Background

The experimental site consists of an area of 1 ha without any forest vegetation (a rocky layer, just beneath the surface prevents roots development and causes excess of water during the rainy period).

Objective

Mobilization of local population for a test of "natural" reforestation of a degraded area with forest and shrub species.

Description

Clay balls containing seeds of forest and shrub species were laid directly on bare soil. The objective was to use a technique of "natural agriculture"[8] to recover the humus layer and progressively reforest the area with the most adapted species to local environment.

But the soil and the environment were too hostile for such a method. The winter rains have dissolved the balls of clay and asphyxiated the seeds. The results were very disappointing, considering the mobilization of local populations.

To remedy this situation, we finally conducted a classic reforestation plantation of conifers (Pinus brutia, Pinuspinea and Cupressus sempervirens), with soil deep ploughing. We expect to have fairly satisfactory results.

First results

After the first winter, the plants seem to be healthy, despite the difficult conditions. There is a risk that many do not survive the next summer. A specialized assessment will be organized for the next two years at least.

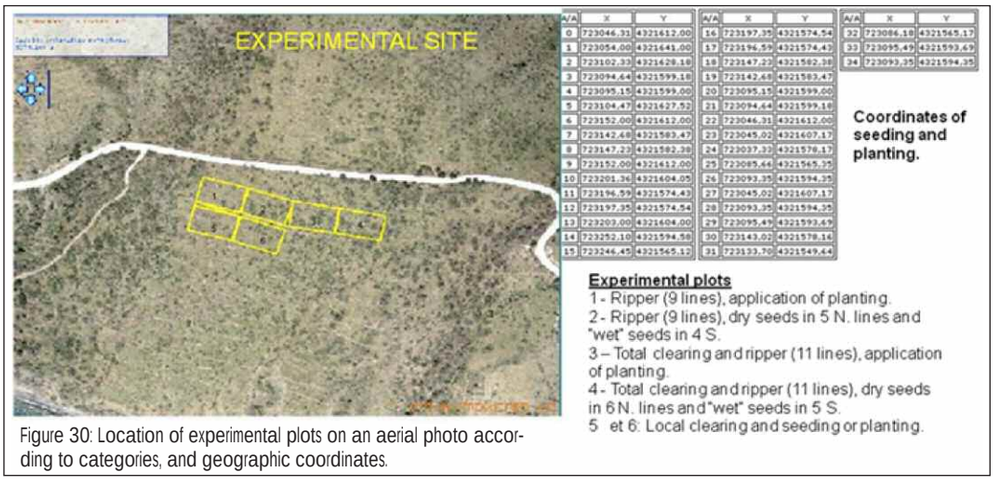
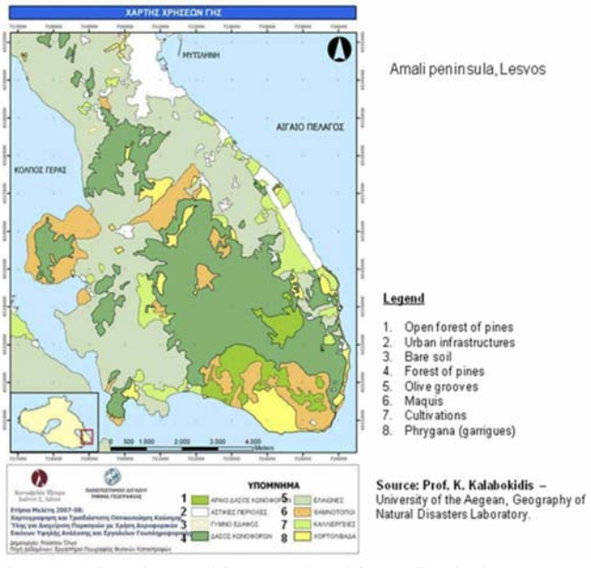


Figure 30: Location of experimental plots on an aerial photo according to categories, and geographic coordinates.



Amali peninsula, Lesvos

Legend

1. Open forest of pines
2. Urban infrastructures
3. Bare soil
4. Forest of pines
5. Olive grooves
6. Maquis
7. Cultivations
8. Phrygana (garrigues)

Source: Prof. K. Kalabokidis – University of the Aegean, Geography of Natural Disasters Laboratory.

Figure 31: Schematic map of the vegetation of the Amali Peninsula. Map of Lesbos: Source : Prof. K. Kalabokidis.

Note:
8 - Theories elaborated in Japan by M. Fukuoka at the end of the 1980's.

Elements for capitalisation

Peer group's 5th meeting

Field visits report

As mentioned above (see pages 40 to 42), climate change is expected to significantly increase the fire-associated risks (see information documents given to participants during the field trip). The two pilot actions of the Catalan partner, CTFC, within the framework of the FOR CLIMADAPT project highlight two essential and complementary aspects of fire prevention and adaptation to the context of global warming. One concerns the design and implementation of discontinuity interventions in forest stands proned to fire, and the other is more oriented towards the planting of forest species to enrich the stands in order to obtain better resilience in a context of climate change.

Action 2: Test to enrich pure coniferous stands by various deciduous trees

Lluis Coll led the group at one of the pilot sites, located at 1600 m above sea level, in a stand of pure Scots pine. Various species of hardwood have been planted in enclosures of few tens of square meters, distributed throughout the stand under a variety of cover conditions. After one growing season, it is still difficult to determine if this is a failure or a success, however the participants were able to observe the correct application of the methodology provided.

Positive aspects

- The protocol seems clear and well designed and should allow a proper statistical interpretation.

- CTFC engineers and technicians have the required skills.

- For some species, two sources were tested: one local and one native from a warmer and drier climate.

- The protocol is applied evenly, at different sites across an altitude gradient, modelling several scenarios of temperature increase. The results obtained may help to anticipate expected increases in temperature.

Areas for improvement

Among the species used, it would have been interesting to add a hardwood with some economic interest, such as for the production of timber and a rustic hardwood that could be adapted to environmental conditions, such the Norway maple (Acer platanoides) or Field maple (Acer campestre), for example, which are also good species for honey bees. This does not, however, contest the value of using native species in the context of climate change.

Implementation of an original method to support fighting against fires

Within a continuous forest, occupying an entire valley, in some determined locations of few acres or hectares delimited according to the expertise of highly experienced firemen, CTFC tries to introduce systems aimed at breaking the vertical fuel continuity, in order to remove or to significantly reduce crown fires risk. Indeed, crown fires are the most dangerous for stands of Salzmann Pine (Pinus nigra subsp. salzmannii var. salzmannii). With these systems breaking the vertical continuity of the fuel, the fire remaining on the soil is much easier to control and stop as well as being much safer for fire-fighters. Thus, the uphill part of the forest would then be protected.

The "experimental" component of the project, which makes it unique, is the search for the best efficiency / cost ratio, defining minimal intervention merely by simply removing the "fire ladder" fuel between the lower strata (<1.30 m) and the base of the tree crowns. This "fire ladder" is indeed part of the fuel that transports the fire from the surface to the treetops.

The methodology for the precise definition of work is also original, based on a dichotomous key for determining the combustibility, a very detailed key element, which was extensively explained to the participants.

The result is quite compelling with a cost of less than 900 euros/ha, considered as moderate when compared with the cost of "traditional" work of protecting forests against fire.

Failing to validate the technical efficiency of the method on the ground by setting fires (!), the CTFC has wisely chosen a less dangerous path using mathematical models of fire spread, and consulting fire-fighters. Note that the CTFC has made an effort to redefine local fuels, making divisions in various categories of diameters, biomass weights, calorimetry, etc. in order to feed the models with more relevant data.

The results support the effectiveness of the method that actually should prevent crown fires up to a wind speed of around 15 km/h. Beyond this speed, some torches would certainly form, becoming more intense as wind increases and thus fire would spread to the whole canopy.

Positive aspects

- The collaboration with firemen to define strategic pilot areas.

- The low cost of implementation.

- The intelligent use of the models proposed by researchers.

- The method for improving the resistance of treated stand in case of fire. Indeed, it is quite possible that many pines survive the passage of a simple ground fire.

To be improved

More work on the horizontal continuity

Some participants regretted that we did not take advantage of the workshop to do some clearing that would have been beneficial for the trees. Several reasons were given by the CTFC:

- To reduce costs by not complicating the work of the technicians and avoiding resort to a tree marking.

- To prevent the accumulation of residues (fuel elements) on the forest floor.

- The canopy cover limits the development of the understorey (and therefore the presence of flammable brush during very dry periods).

In addition, cross cuts or distributed cuts would have blurred the message, moreover difficult to transmit, for the training of workers who perform the work. Such a work is not intended to provide forestry results, nor to improve the sustainable management because regeneration is virtually eliminated, and it does not encourage biodiversity. The aim is the protection of the entire forest as a priority and it is the only way to allow owners to begin forest management - which is currently absent in this valley.

Pastoral care

It would be optimal, for the efficiency of the method, to revive woodland grazing in order to consume the low herbaceous layer using sheep or goats... It is also necessary that farmers be present in the area and be willing to come and graze in these remote places - suitably equipped with fences, troughs, etc. This seems difficult in this region where farming is experiencing a rapid decline.

Effective prevention, but to what extent?

One can not doubt the effectiveness of the measures adopted in the case of "normal" fires, but what would happen in a so-called "convection" fire which are becoming more frequent according to the testimonies of fire-fighters, and in the unfavourable context of climate change? (See presentation by Marc Castellnou page 20). It is unlikely that fire-fighters be willing to risk their lives in the defence of uninhabited forests. The level of safety seems insufficient in this context.

The cost is certainly lower (and locally funded), but what about the landowner who must, on this plot, cease wood production? An exchange took place within the Peer group to put forward that one of the keys to success of such operations is the pooling of risks but also benefits among the owners of these spaces. An owners' association was created by the Forest ownership centre in Catalonia, in order to obtain control over the land for this work. But are the members really willing to go further in collective management? However, this debate goes far beyond the scope of the problem of climate change.

Comments on the seminar contents

The participants appreciated the various contributions and especially the presentation of Marc Castellnou on fire types, depending in particular on the movement of large weather air masses. Climate change may manifest itself as increased drying of fuels, which increases the dangers. Moreover, and more worrisome, very warm air masses from the Sahara increasingly enter the Iberian peninsula, creating the conditions for the occurrence of a new type of fire, known as a convection fire or fire-storm, which can burn a large area very fast by multiplying the secondary outbreaks. The danger to fire fighting personnel is greatly increased and we do not yet know how this worrying phenomenon, new to our regions, works on the ground.

Examination of the 2nd Progress book

This 2nd Progress book, which describes in detail the "Vesuvius" and "Umbria" experiences was very well done and the AIFM has been praised for the quality of this work, quite unique among European programs.

A comment was made on the Emberger's climagram, which should be presented on a full page to improve its readability. It was a good idea to present the graph of bioclimatic areas of the main tree species, although they are taken from a rather dated bibliography.

General instructions from the Peer group to the partners

It is reminded that the partners must comply with the requests for information from the Peer group, particularly through the centralisation provided by the AIFM. Some partners experienced communication problems. A more request delivery of all documents will be made soon by email.

This includes the template provided by Myriam Legay about local perceptions of climate change by each partner, the table-list of species and shrubs used in the pilot actions, or in their surroundings, as well as the "ecosystem services gird" proposed by Lucio Do Rosario.

On this last point, an exercise was conducted by the Peer group to describe the various pilot projects. This trial run proved to be quite successful and the preliminary results will be sent to partners for discussion.

A summary of the national or regional policies related to climate change, is being conducted by each partner with the help of their peer, summarized into one or two pages at most.

In general, partners are asked to get closer to their peer in order to extract the essence of each project and especially the most interesting elements and transferable tools, in connection with the leitmotif of climate change in Mediterranean forests. It will be useful to carry out a veritable "distillation" of contents in order to facilitate the subsequent task of the AIFM which will be to make the final synthesis, from quite disparate projects.

The issue of climate change is very complex and we must take the opportunity for both partners and their peers to communicate by email with the AIFM as an intermediary.

Peer group's 6th meeting

The Peer Group met on Friday 1st of March in the afternoon, following the field visit on February 28 and the plenary session that was devoted to the introduction of the North Aegean Region and the island of Lesbos, and the presentation of partners' activity progress. The following is a summary of the discussion that took place that day in the Chamber of Commerce and Industry of Mytilene.

The island of Lesbos: a specific ecology

This large island in the northern Aegean Sea, not far from the coast of Turkey, has some limestone outcrops from the secondary era but is especially marked by volcanic activity. It is basically an ancient volcano that has undergone several phases, generating a variety of rocks: primary rhyolites, serpentine, Miocene cinerites.

The island can be characterized by two major landscape and ecological areas, according to geology and climate.

The eastern part of the island is a mosaic of limestone and volcanic rocks sometimes intercalated with limestone. It enjoys a Mediterranean sub humid bioclimate with annual rainfall of 900 mm (more at high altitude) favourable to the development of forests as well as thousands of hectares of olive groves, where there are multi centenarian trees still regularly exploited.

The forest is dominated by the Calabrian pine (Pinus brutia), a close cousin of Aleppo pine (Pinus halepensis). The potential shade-tolerent species is the Palestine oak (Quercus calliprinos), often likened to the Kermes oak (Quercus coccifera), but it is bigger and has greater ecological amplitude[10]. Higher ubac areas in the supra-Mediterranean level, are occupied by the Pinus brutia and Quercus calliprinos forest. This forest is gradually being enriched by Crimean pine (Pinus nigra subsp. nigra var. pallasiana), a Black pine endemic to this part of the Mediterranean basin. The landscape thus resembles the Cevennes, with oaks, some chestnut and riverine dominated by Black poplar (Populus nigra) and a spontaneous plane: the Oriental plane (Platanus orientalis), with some exceptional specimens at the foot of Mount Olympus.

The western part of the island is very different, very bare, populated by low vegetation. Its bioclimate is semi-arid with mild winters. Rainfall does not exceed 450 mm per year. The geology is very distinctive, marked by a gigantic volcanic explosion in the Miocene epoch with the formation of a caldera, pyroclastic surges, a blanket of ash and pyroclastic flows. These materials are consolidated, creating ash layers and gaps that are relatively compact, little alterable and less hospitable to vegetation. The pyroclastic flows buried the Miocene forest of Sequoia sempervirens. These trunks were then fossilised, resulting in a very original petrified forest. A nature reserve has been set up to protect this remarkable Petrified Forest site in Ticri, as well as a modern and educational geological museum.

The natural vegetation today is quite original. It is para-climax scrub dominated by chamaephytes, including a thorny bush of up to fifty centimetres in height: the Thorny burnet (Sarcopoterium spinosum). This stable plant community, not colonized by trees, is called Phygranas. It forms large areas over skeletal soils, interspersed with rocky outcrops and brightened here and there by pink coloured petals of Silene (Silene colorata).

Site 1 - Amali Peninsula

Located south of Mytilene, on the Amali peninsula, the pilot site 1 is characterised by vegetation of the thermo-Mediterranean level and a sub-humid climate with mild winters, according to Emberger's definitions. The lands are of volcanic origin: the rock is relatively altered, fairly mobile on the surface and devoid of limestone. The space is occupied by a scrub, following repeated fires (1977, 1999, 2006) that ravaged the original forest of Pinus brutia. This scrub is dominated by two Cistaceae: Pink rock rose (Cistus creticus) and Sage-leaved rock rose (Cistus salvifolius), and by Calicotome (Calycotome villosa), Spanish lavender (Lavandula stoechas) and Thorny burnet (Sarcopoterium spinosum), the characteristic bush of the Phygranas.

Pinus brutia is having difficulties in terms of regeneration; except for road embankments. It takes with some difficulty in such scrubland, differing in this respect from its cousin the more expansive Aleppo pine. This local issue perfectly justifies the implementation of the pilot project by the North Aegean partner: how to restore a Mediterranean forest on such a site, in the difficult coastal conditions, compounded by the global context of climate change? This experimental situation is particularly interesting because the technical experience that can be gained is transferable to many situations in the Mediterranean basin.

Photo 27: Sarcopoterium spinosum Bush, the Prickly burnet, typical species from the eastern Mediterranean. This shrub is common on the island of Lesbos. It is the dominant species of Phygranas, a para-climax scrubland of the semi-arid western areas of the island.

Analysis of the techniques used

Planting on a slight slope, occupied by a low dense scrub about fifty centimetres in height. Three methods of soil preparation are combined with two types of material: young plants or seedlings. The species selected is the Calabrian pine (Pinus brutia), of local origin, which seems to be a good choice in such a situation.

Note:
10 - We find it near the summit of Mount Olympus, at an altitude of 950 meters, on the ubac in the supra-Mediterranean level, while the Kermes oak does not grow out of the lower meso-Mediterranean level. This Palestine Oak would be a vicarious (that is to say, occupying the same ecological niche) of Holm oak (Quercus ilex), which it seems to replace in all situations where it might be expected.

Three different methods of soil preparation:

- Zone 1: Complete clearing of the surface by bulldozer followed by sub-soiling to about 40 cm deep using a ripper. The furrows and the seedlings are spaced at least three metres (up to 4.5 m) apart.

- Zone 2: Identical linear sub-soiling, but without clearing the scrub. Even planting density, a minimum of three meters apart.

- Zone 3: Localised work in holes of 25 x 25 x 30 cm^3, directly opened by hoe or similar in the scrubland. Same planting density, a minimum of three meters apart.

Planting according to two different methods

- Two-year old plants, from 12 to 15 cm high, raised in polyethylene bags.

- Direct sowing of some seeds (10 to 20) in each hole. Half of the seeds were soaked in water for 48 hours before planting to facilitate germination. However, shortly after planting, strong rains prevented us to demonstrate a benefit of this practice.

The holes were made every three metres in sub-soiling lines (ripper), providing a small bowl, sometimes surrounded by pebbles. This should facilitate the identification of holes when natural vegetation has grown back.

Planting and sowing was done in December 2012 and most of the plants look healthy, whatever the method used.

Photo 29: Sowing done in December 2012. Almost all Pinus brutia seeds germinated, except for mortality in the coming months, thinning will be required... unless a pseudo-coppice of softwood is the objective! However, this depends on the recovery after the end of the summer.

Photo 30: Seedlings and plantings in the sub-soiling furrows opened directly among the cistus growing after repeated fires in this part of the Amali peninsula.

Peer-group's discussions

During our visit, the plants looked healthy while seeds had already begun to germinate; it seems a success given that almost all seeds grew to seedlings of 4 to 6 cm in height. If all survive, thinning must be considered, as only single trees are required, otherwise a coppice appearance will be obtained (not necessarily negative if the aim is not to have a production forest). However, we must wait to see how these new plants survive the first summer.

The North Aegean partner's peer (Georgios Tsiourlis) highlights the objective of seeking a reforestation technique that is as respectful as possible to the environment, resulting in a panel discussion to express the supposed advantages and disadvantages of these techniques.

Method 1: Preserving existing vegetation

Advantages: maintaining the operation of the ecosystem and biodiversity could generate - in theory - greater stability, better protection of young trees against the aggressions by the climate and / or even parasites and pests, and therefore result in greater resilience.

Disadvantages: Competition of the scrubland for water and nutrients. Elevated fire risk.

Method 2: Sub-soiling to loosen the soil in the area

Advantages: promotes rapid rooting and increased resistance of small pines to the intense summer drought. In addition, contour sub-soiling can aid the penetration of rain into the soil by limiting run-off.

Disadvantages: the cost of heavy machinery operation.
If "softer" methods yield better results in terms of recovery and growth, then we can save money and avoid some damage to the local ecological balance.

Method 3: Sowing vs. plants grown in the nursery

Advantages: closer to natural colonisation of land by seedlings from seed trees. Seedlings grown from sowed seed can

Photo 28: View of the pilot site on the Amali Peninsula. Area cleared and sub-soiled using a ripper: one of the methods of the FOR CLIMADAPT pilot project on the island of Lesbos.

develop their tap-roots without the constraint of the nursery container and thus reach the deeper layers of the soil and water faster to overcome water stress in summer.

Disadvantages: a dry spring followed by a dry summer, a situation common in the Mediterranean, can destroy all hope of recovery because seedlings grown from sewed seed are very fragile for a few months.

The plants grown under controlled conditions in the nursery can safely survive this delicate stage but care is required regarding the quality of the container and growing media. Louis Amandier reminds that in France, in the 1980s, most of the failures recorded during planting came from poor quality plants. Research by the IRSTEA (French Research Institute for Science and Technology for Environment and Agriculture, former Cemagref) in Aix-en-Provence highlighted these deficiencies and especially led to experiment technical solutions that completely changed this disastrous situation. Angular shaped containers (such as the "MW" model or equivalent) prevent the roots from tangling in the bottom of the bags and from forming rings that will later strangle tap-roots. Very porous and light growing substates allow roots to explore the entire container volume more fully and facilitate the diffusion of water and nutrients. In a word, great technical progress has been made in this area to produce very strong and highly efficient plants in just a few months.

In the technical comparison of the test on the Amali peninsula, it would have been interesting to compare the seedling plants with such plants, because in our view, the plants grown in polyethylene bags during two growing seasons are far from being the safeguards required in the French Mediterranean area as precisely defined in terms of formal specifications written in the 90s. On this point, experimentation is probably not optimal; it will not be possible on this basis, to determine the possible superiority of seedlings. Indeed, in France, comparisons between seedlings and good quality plants have almost always emphasised the superiority of the plants.

After reviewing the protocol, Louis Amandier proposed that the North Aegean partner complete this test by other methods. Given the density of 160-170 of holes per plot, he proposed the following:

- Select 50 to 60 plants as a control population (initial protocol);

- On 50 plants, apply moderate watering during dry periods, once every three weeks and depending on any rainfall;

- On 50 plants, spread over a 0,25 m² circle approximately, 10 litres of compost[11] in each hole around plants and seedlings.

After a debate, the proposal was well received by the North Aegean partner because even though in economic terms, these solutions are not easy to implement on large scale plantations, they will make the most of the experience gained from experimental conditions. Indeed, what lessons can be learned if all plants and seedlings fail to survive the summer? Of course, failure is always instructive, but it would be preferable to have positive solutions.

In conclusion, this study presents great interest, which may be furthered by these proposals. We shall leave it to the partner to better adapt the continuation of the tests as indicated, then in autumn to quantify and measure the success of various methods.

One can only regret not being able to dispose of these observations before the administrative end of the FOR CLIMADAPT project, but we hope that this test will still operate beneficially, even a little later.

Site 2 - Kidonies Site

Another action of the North Aegean Region as part of the project was conducted on a small plantation behind the village of Kidonies, north of the city of Mitilini.

This is a good example of reforestation practices to avoid. Local officials, under pressure from environmentalists - as opposed to real ecologists - attempted to plant trees in a small field surrounded by a fence, close to the village. While the latter is a necessary condition in a local context where pastoralism deeply marked the landscape, it is not sufficient for successful planting. Indeed, in this case, our scientific partners were not consulted. They would have noticed that the micro climate of the location is very windy, very unfavourable to trees and, especially, there is no soil but a slab of flush rhyolite. Holes were dug into the more or less altered rock and seedlings were planted two years ago with "coated seeds" of various species (embedded in a matrix of minerals and fertilizer to optimise nutrition young seedlings). None of the plant species survived their first summer. Note that it is not the principle of the coated seed that is questionable – it is an excellent technique based on theories of "natural farming" – but rather the choice of the location which doomed any attempt of reforestation without prior work on the soil.

Last autumn, a new attempt was made with the planting of Pinus brutia seedlings and these were still alive at the time of our visit, but we do not expect them to survive the summer. In such a situation, only extremely frugal species such as the cactus pear (Opuntia ficus-

Photo 31: On a windy ridge located near the village of Kidonies, an attempt at planting was undertaken without obtaining the approval of competent ecologists or foresters. A few lines of turf highlight the gaps in the rock slab. On such a substrate, the plants would have no chance of survival.

Notes :

11 - Or better, RCW (RCW) or non-composted fresh crushed leaves, small timber, or even crushed waste from maintenance of urban green spaces. This technique is known to conserve water and promote the ecological restoration of environments.

indica) might have a small chance of survival plants. But this species is often considered invasive and its use is not recommended, sometimes even prohibited.

This scenario has some educational value, demonstrating to local decision-makers that for reforestation it is preferable to consult experienced ecologists or foresters. Here, the very small area in question has no large financial consequences, but was a very informative lesson. It remains a pity that many good-willed people invested in the plantation and that this failure is likely to demotivate them in the future.

Action outside the project: Plantation on terraces

Returning to Mitilini, near the pilot site, the bus stopped for a few moments to allow the group to observe a successful prior plantation on terraces. This consists of Pinus brutia, sometimes mixed with Cypress (Cupressus sempervirens and C. arizonica).

In the harsh climate and Mediterranean soil conditions, this intensive technique has often demonstrated, especially in North Africa, its effectiveness on slopes of between 20 to 60%. In short, the terraces are unnecessary and can be replaced by contour rip lines (see pilot site), however the abundance of rocks usually makes the operation too difficult and too dangerous for machine operators.

Photo 32: Successful planting of Pinus brutia aged around twenty years. The terraces used for soil preparation is certainly somewhat brutal for the original ecosystem, but here it demonstrates its effectiveness in difficult conditions.

Advantages: The organic components of soil, corresponding often only to a thin surface layer of humus, is gathered on a narrow strip where trees are planted. However, the embankment has a large volume of soil, loose and easy to explore for the roots, and thus conducive to recovery and growth. The back of the terrace is scraped making it more difficult to recolonise by competing vegetation and undergrowth. In addition, it serves as a catchment for rainwater on the downstream part explored by trees. In short, this terrace planting technique has many decisive advantages in difficult conditions.

Disadvantages: The main drawback is the cost, because large machinery is required to cut the terraces, usually an excavator or more often a bulldozer with blade positioned at an angle. The environmental impact is also considered to be extremely brutal by ecologists today. Indeed, Georgios Tsiourlis explains that the resulting, and almost monospecific very simplified vegetation becomes very sensitive to the vagaries of climate, diseases or pests - such as attacks by the pine processionary caterpillar (Thaumatopea pithyocampa) which we observed there.

Louis Amandier cites a slightly different and personal method for a terraced field, creating space for natural vegetation. These consist of terraces of about fifteen metres on which an excavator can move and dig individual holes uphill and downhill. Demanding species (alternating hardwood and softwood) are planted on the terraces, on a ripper furrow located a third downhill, while more hardy conifers (especially pines) are planted in individual holes opened with an excavator accompanied to the south-west side by a bush to protect the young plant from the heat of the summer sun and incidentally to enrich the soil with symbiotic nitrogen if Fabaceae such as bladder senna (Colutea arborescens) is used. These original arrangements allow colonisation by the biodiversity of the original ecosystem while involving a diversity of introduced species. The terrace technique, despite the criticism it often receives, still has some great advantages for the reforestation of difficult terrain, especially in the context of climate change.

Final evaluation of pilot projects and partnership

The progress of the activities of the various partners, on the basis of information provided during the plenary session, gives the impression that the project is now truly underway. Indeed, there were many difficulties, and the project involves slow changes. It is unfortunate that the project is already coming to an end, although the activities will be monitored beyond the administrative closure, and the results will continue to be published, including via the website www.forclimadapt.eu.

Summary of the collection of complementary information

Although many elements have recently reached the AIFM, some are still missing. It would be good to obtain a maximum in preparation for the drafting of the final capitalisation document:

a. Model of the local impacts of climate change and the responses of partners (proposed by Myriam Legay).

b. Check-list of species used within the pilot actions (proposed by Gaetano di Pasquale).

c. Geographic Information Systems (GIS files) of pilot site.s

d. Grid on pilot action's impacts on ecosystems services (proposed by Lucio do Rosario).

Preparation of the Capitalisation file

The first draft of the detailed framework for the final Capitalisation book (see table below) of the project was acceptable. Countries will participate in the writing

Recollection of deliverables: Peers are asked to support partners in achieving the deliverables as well as their communication to the AIFM who is responsible for integrating these into the capitalisation documents (final workbook, DVD etc.).

Final activities balance of each partners: Peers are responsible for the preparation of activity reports from the partners. They must also support the AIFM in the final work of gathering information from partners. A discussion took place on the form of these self-assessment reviews, of two or three pages maximum, adapted from the model used in the Med Qualigouv project.

FOR CLIMADAPT project
Final partners' "activity balance"

1. Title of project / pilot site
General objective
Description
ecogeographic
socio-political...

2. Description of undertaken actions, one by one
Actions performed
Results…
…expected
…acquired at the end of the project
…for the future (next steps, future opportunities...) ? Deadlines?

3. Box: list of "deliverables" and link towards each of them

4. Difficulties and possible improvement

5. Elements that can be transferable/replicable on a large scale

6. Benefits derived from FOR CLIMADAPT project

Total: 2 or 3 pages.
Minimum 2 images / figures with legend and author.

Synergies

a. MEDLAND 2020 capitalisation project

FOR CLIMADAPT is part of the MEDLAND 2020 capitalisation project aimed at promoting a common integrated land management scheme to protect natural resources in synergy with social and economic valorisation in the Mediterranean basin, which will begin in July 2013 for a period of 18 months. It includes around ten projects and many Mediterranean partners.

The main objective is to extract tested transferable elements in projects and to promote these internationally. This is an excellent opportunity to disseminate the project results and to ensure that the arising technical recommendations will not be buried, so that they are understood by government, regional and European institutions.

It is possible that peers may be invited to contribute as experts on issues related to the adaptation of Mediterranean forests to climate change. The CTFC (project leader) and the AIFM, who will participate in the project as partners, will endeavour to keep FOR CLIMADAPT project partners informed as developments occur under this initiative. The Association "Forêt Méditerranéenne" should also be included, in particular for the distribution of information in its review "Forêt Méditerranéennes".

b. Representation of the project at the Mediterranean Forest Week (Tlemcen, 18-21 March 2013)

The FOR CLIMADAPT project was represented at the third Mediterranean Forest Week, which took place in Tlemcen from 18 to 21st of March 2013. This event, after the success of the second edition in Avignon in 2011, was especially focused on the problems of adaptation to global changes, almost directly related to the issue of our project. The AIFM presented, among other elements, a poster on the partial results of the For Climadapt project (sent to partners in early March). Lucio do Rosario (ADPM) and Jean Bonnier (AIFM) represented the project. Subsequently, a meeting was held on March 26 at the European Parliament in Brussels, during which the achievements of the forest Week Tlemcen were presented. For more information: www.forclimadapt.eu.

Photo 33: Peer group's meeting in the Industry chamber of Mitilini.

Framework for the final capitalisation book of FOR CLIMADAPT project

0.- Préface ..... Parc national du Vésuve / Mohamed -L. CHAKROUN

1.- Introduction: project method
(pilot sites, monitoring, synthesis and capitalisation) ..... Jean BONNIER

2.- Forest and climate change: Now is the time to adapt
Climate change does not appear so obvious to the managers of Mediterranean forest and natural areas, although now all see the analyses of the IPCC as undeniable (see summary of the Marseille seminars on these issues / FM) ..... Louis AMANDIER

3.- General project framework of FOR CLIMADAPT, history and problems ..... Jean BONNIER and Louis AMANDIER

4.- Partners' final activity balance (one for each partner)
Situation, problems, activities protocol or program, status of implementation compared to forecasted, expected results and those obtained, difficulties encountered, consideration of the future, locally and / or in a cooperative framework.
Homogenisation by the AIFM ..... Each partner with peer's support

5.- Collective project knowledge and experience
"Thematic Boxes" written by members of the Peer group and / or partners. ..... Homogenisation by the AIFM

6.- Conclusions and final recommendations ..... Mohamed Larbi CHAKROUN and the PNV Representative

Coordination, homogenisation, synthesis by Remi VEYRAND and Sophie VALLEE (AIFM)
Proofreading: Jean BONNIER, Louis AMANDIER, Sophie VALLEY and Remi VEYRAND (AIFM)
Final Validation: Peer group's members.

State of progress of partners' activities after 6 semesters

Vesuvius National Park

Activities during the last six months (September 2012 - February 2013)

Action 1: Standardisation and application of bioengineering techniques (minor works) and transfer to the Forest Service

Development of an intervention protocol for bioengineering works:

- Completion of works on the ground.
- Verification of the elements in place.
- Drafting of the "modus operandi" in the Tirone Alto Vesuvio Nature Reserve.

Completion of the study on the fertility plots.

Micro-environmental characterisation: Comparative study of temperatures under the canopy of Genista aetnensis and in open area (IN versus OUT). The parameters taken into account are:

- Temperature and humidity
- Soil temperature and moisture at different depths

It was found that the canopy reduction effect on temperature is approximately -30 ° C.

A list of species used in the bioengineering works was established.

Communication and/or capitalisation activities during the period 6 (October 2012 - February 2013)

A series of meetings was organised by the forestry staff of the Campania region on the biological engineering activities carried out for the Project.

Main difficulties and state of progress comparatively to programmation

One of the main challenges has been the transfer of activities to the Park's forest technical staff. For the future, improvements need to be made in communication activities and training within the organisation. Progress is considered, on the whole, as being in line with the steps provided by the overall schedule.

Forecasted activities till the end of the project

- Preparation of the final project seminar, scheduled to take place from May 15 to 17, 2013 in the Vesuvius or Naples area.
- Project evaluation.
- Collection of final indicators.
- Final statement.
- Writing of the final administrative report and balance demand.

Region of Umbria

Activities during the last six months (September 2012 - February 2013)

During the last semester, demonstrative forestry operations have been continued. The aim is to limit the risk of wildfires and to improve resilience of forest stands facing to climate change:

- Experimental fuel cuts were finalised by the Montain Communauty of Valnerina in the communal forest of Arone.
- Cuts with bouquets reservation on the site of the Consortium Usi civici Casteldilgo, was resalised, under supervision of the National Forestry Corps. Works were subcontracted to Montain Communauty of Valnerina, as forecasted by the regional law n° 18/211.

Otherwise, the following actions were finalised:

- Drafting of a Local plan of fighting against fires on the south part of Valnerina.
- Drafting of a Wood supply plan for valorisation in energy production.

Finally were conducted:

- An evaluation of economic benefits of the Local plan of fighting against fires.
- A study of the communication tools (press and television) regarding prevention of forest fires.

Communication and/or capitalisation activities during the period 6 (October 2012 - February 2013)

Umbria Region realised some activities of promotion and information on FOR CLIMADAPT in direction of the people concerned directly or not, via the website www.antincendi.regione.umbria.it, and prepares a synthetic information guide on the role of forests in territories and on the importance to manage them smartly.

On 30th of October 2012, a third participative meeting with the population of Low Valnerina was organised in Arone, regarding to the elaboration of the Local plan of fighting against fires.

Finally, a Smartphone application for the management of the regional forest heritage ("Umbria 1515") is being elaborated. It is conceived not only for fire fighting stakeholders but also for any citizen that could launch an alert in case of fire ignition on the Umbrian's territory.

Main difficulties and state of progress comparatively to programmation

The respect of norms and procedures at national level required considerable efforts from part of the Region, and a prolongation of delays for the realisation of forecasted actions within the project.

Forecasted activities till the end of the project

By the end of the project, we foresee the following actions:

- Finalisation of forestry actions (cuts with bouquets reservation) with the aim of increasing stands' resilience to climate change (March 2013).

- Presentation of the results of the Local plan of fighting against fires to the population during a last meeting in Arone (12th of March 2013).

- Economic assessment of the Local plan of fighting against fires (April 2013).

- Drafting of the study on communication tools (press, television…) better adapted for the prevention of wildfires (April 2013).

- Realisation of a synthetic informative guide on the role of forests in the territory and on the importance of their good management (May 2013).

CTFC

Activities implemented during the last semester (Oct 2012 – Feb 2013)

- Data analysis of the growth and survival of plants established in the enrichment plantations (pilot action 1).

- Establishment of germination tests: Sowing of seeds of different species in the enrichment plantations (pilot action 1) in order to test its capacity to germinate and survive under different climatic conditions.

- Data analyses and evaluation about the effectiveness of the treatments realized to reduce fire vulnerability of pilot forest stands after a year of treatment (pilot action 2).

- Evaluation of the growth of remaining trees after prescribed burning (pilot action 3).

Communication and capitalisation activities implemented during the last semester (oct 2012 – feb 2013)

- Organization and coordination of the 5th Seminar of FOR CLIMADAPT in Solsona (Spain) from 15 to 17 of October 2012. Teresa Baiges, from the Forest Owners' Center (CPF), assisted to the 5th Peer group meeting, representing CTFC.

- An expert session was held in Solsona in February 2013 for discussing about silvicultural guidelines and forest management for adaptation of forests to climate change, in the context of the FOR CLIMADAPT project.

- Acceptance of the article of Martin S. and Coll L. (2013): "Plantaciones de enriquecimiento en pinares puros submediterráneos: capacidad adaptativa de las principales especies de frondosas rebrotadoras acompañantes", to be published in the Proceedings of the 6th Spanish National Congress (In press).

Main difficulties and state of progress comparatively to programmation

There is no particular difficulty to be mentioned. The different activities of the project are progressing as expected. We will provide before the end of the project all the deliverables and indicators that were assigned to us.

Forecasted activities till the end of the project

- Evaluation of the germination success of different species and provenances in the enrichment plantations (Pilot Action 1).

- Comparative assessment of different phenological traits between the species and provenances established under different environmental conditions (Pilot Action 1).

- Final report about the establishment of enrichment plantations to increase the diversity and resilience of monospecific forests (Pilot Action 1).

- Use of Nexus program to evaluate the effectiveness of silvicultural treatments to reduce fire vulnerability of stands one year after the treatments.

- Final report about silvicultural treatments for fire prevention: reducing forest stand vulnerability to crown fires (Pilot action 2).

- Final report about the effectiveness of prescribed burning as a silviculture tool (thinning) and its influence on post-fire growth dynamics (Pilot action 3).

- Final report about forestry guidelines for the adaptation of forests to climate change, making emphasis in the reduction of forest vulnerability to large forest fires.

- Final report about the two case-studies of evolution in Catalonia's vegetation.

International Association for Mediterranean Forests (AIFM)

ASSOCIATION INTERNATIONALE FORETS MEDITERRANEENNES

Communication activities during the last period (October 2012 - February 2013)

- Update and new publication of the project presentation leaflet (3xA5 format, double-sided, colour, 2x400 French/English copies). Distribution of the leaflet during the events in which the AIFM participated during the period (see below).

- Update and animation of the project website (www.forclimadapt.eu): news, on-line agenda, working documents (reports of seminars, Progress books, partners' deliverables...). Attendance is steadily increasing: more than 4000 visits per month in 2013. The domain name and site hosting were extended until February 2015.

- Preparation and distribution of Newsletter 4 (December 2012) and 5 (April 2013) to over 1,200 recipients.

- Promoting the FOR CLIMADAPT project at various international events, in particular:

* The final European Conference of the PROTECT project in a capitalisation workshop during the "Open Days" in Brussels (10 of October 2012).

* Symposium for the restitution of projects of the Mixt Technology Network AFORCE in Paris (December 12, 2012).

* 3rd Mediterranean Forest Week (Tlemcen, March 2013).

Capitalisation activities during the period 6 (October 2012 - February 2013)

- Publication and distribution of the second Progress book related to seminar 3 (Vesuvius, February 22-24, 2012) and 4 (Umbria, June 27-29, 2012).

- Preparation and distribution of reports on the seminar 5 (Catalonia from 15 to 17 of October 2012), the visit of the ONF pilot sites in the Aude department (Espezel, 18 of October 2012) and the seminar 6 (Mytilene, from 28 of February to 1st of March, 2012).

- Animation of the fifth and sixth meetings of the Peer group during seminars 5 and 6. Preparation and distribution of reports.

- Development of the general framework of the Final capitalisation book aiming to establish the project balance (based on the 3 Progress books), to summarise the works of partners and define reproducible elements, recommendations and transferable best practices. The plan was approved by the Peer group during the 6th meeting.

- Reactivation of peers and project partners for the implementation of the Peer group's decisions and to encourage sending of deliverables in due time (see Peer group's decisions statement in seminar reports).

- Drafting of the third Progress book concerning seminars 5 and 6 and the visit of ONF pilot sites in Aude department.

The AIFM is also developing synergies with other initiatives on similar themes. In particular, FOR CLIMADAPT was integrated into the MEDLAND 2020 capitalisation project - "Integrated and sustainable management of natural resources in the Mediterranean area" and associated with the third Mediterranean Forest Week event in Tlemcen, March 2013, whose central theme this year was precisely adaptation to global changes.

Main difficulties and state of progress comparatively to programmation

- Internal restructuring of the association.

- Cash flow difficulties.

Nevertheless, the activities are in line with forecasts.

Forecasted activities till the end of the project

- Finalisation and distribution of the third Progress book

- Support to the project leader to prepare the restitution seminar to be held in Ercolano (Italy) from 15 to 17 of May 2013. Invitation of representatives people from organisations and projects that have been associated to FOR CLIMADAPT.

- Preparation and distribution of the Newsletter No. 6 (June 2013).

- Monitoring of the implementation of Peer group's decisions.

- Grouping of deliverables and activity reports from the partners.

- Preparation and publication of the Final capitalisation book.

- Distribution of the Capitalisation file including the latest publications and a DVD containing all the partners' deliverables.

- Strengthening of links with other similar projects and initiatives, and valuation of FOR CLIMADAPT conclusions in the framework of the MEDLAND 2020 project, as well as within the component 1 of the French World Environment Found's project called "Analysis of vulnerability to climate change in five pilot sites of Algeria, Lebanon, Morocco, Tunisia and Turkey."

- Preparation and management of project closure (support to the project leader).

ONF

Activities during the last six months (September 2012 - February 2013)

Among the three pilot projects planned by the ONF, two were conducted in a timely manner, however the planting of Atlas cedars replacing the Silver fir with a comparison of French origins suffered a significant delay due to several technical problems.

The works were finally launched during the last semester. Site preparation began in early November with a view to planting in early December. Unfortunately, we have had to deal with particularly adverse weather conditions. There was a lot of snow, with snowfalls throughout the winter, as well as plentiful rains have delayed tillage, clearing and use of the last standing trees, now scheduled until the end of April.

The following actions have already been completed:

- Removal of competing vegetation using a walking excavator.

- Hauling of felled trees.

The land is now ready for planting. The nature of the terrain is quite varied in accordance with the analyses of stations made early in the project. However, the proportion of limestone blocks is greater than expected. As a result, the vegetation has not been eliminated over the entire surface as rocky areas are difficult to work and plant. The structure and surface of the experimental comparison area of origins was determined. Two homogeneous zones (one of 900 m^2, the other 1100 m^2) have been identified.

Communication and/or capitalisation activities during the period 6 (October 2012 - February 2013)

The seminar in Solsona was extended by a day, in order to organise a visit to the two experimental sites of the ONF in the Aude department.

A visit to the Callong-Mirailles state forest allow to show recent dieback of the Fir plantation and to visit the plot 21 where Atlas cedars are to be planted. Then, the experiment with a low density fir forestry plantation, in plots 24 and 28 of the Comfroide-Picaussel state forest was presented. The experimental protocol was discussed on the site.

This day was the subject of a press release. A reporter from the local press attended the beginning of the tour and published an article.

More details can be found in the section "Additional information on the activities of ONF", pages 30 to 38.

Main difficulties and state of progress comparatively to programmation

Difficulties were encountered in planting Atlas cedars on the Callong pilot site. This pilot action combines both challenges and surprises. While the plants are finally available, the very unusual and adverse weather conditions, with lots of snow and rain, prevented the preparatory work in late autumn and imposed postponement of planting until the spring.

However, progress is normal on the pilot site of Nans (Alpes-Maritimes).

Forecasted activities till the end of the project

During the last three months of the project, operations are planned on each of the three pilot sites:

- A second series of measurements on the Picaussel site (Relevance of low density forestry for the Silver fir for stand adaptation to climate change).

- Planting of cedars at the Callong site (comparison of origins of Atlas cedar in the context of a southern plantation).

- Second series of measurements at the Nans site (relevance of low density forestry for the Atlas cedar for stand adaptation to climate change).

On these three sites, information panels, the design for which is in progress, will be installed.

ADPM

Activities during the last two semesters (March 2012 - February 2013)

Action 1: Diagnosis

1. Diagnosis and observation of the territory of the Vale do Guadiana Natural Park. The publication of the report is in progress.

The main conclusions are the following:

The Vale do Guadiana Natural Park is mainly constituted of agricultural field crops (34.5%). The shrubland (22%) are also well represented in the county, with a predominance of Cistus ladanifer. Agro-forestry (Montado) areas represent 28.5% of the area, and the areas of forestry projects cover 15% of the area.

67% of farms installed afforestation projects with a base of Holm oak (pure, with Cork oak or with Pinus pinea) on areas of 75 ha average.

Dieback of Holm oak and Cork oak is observed in all farms.

Water management is a priority for agro-forestry managers. Most of them choose to make small ponds for livestock watering and irrigation has been a factor of increasing success of farms, although most of the Park soils are not mostly suitable for irrigation.

Sowing has been realised in November using cereal varieties with shorter cycles. The amount of fertilizer has remained in 200kg/hectare.

There is an emerging trend of reforestation with carob trees for being resistant to Phytophthora cinnamomi and fruit serve as fodder like the Holm oak.

ADPM is preparing a package of measures that can be taken by agro-forest managers taking into account some of the scenarios that exist in terms of climate change.

Action 2: Adaptive forestry

1. Evaluation of techniques and species used in reforestation projects developed in Vale do Guadiana Natural Park area.

Study of Mycorrhiza present in Monte do Vento stands (Holm oak and Cork oak) was ended. Mainly Cenococcum spp. and Pisolithus tinctorius (etcomycorrhizas) founded. Trees with higher number of mycorrhiza have a higher development

Main difficulties and state of progress comparatively to programmation

- Activities are progressing according to scheduled.

- Process for expenses certification was delayed for technical reasons

Forecasted activities till the end of the project

- A workshop on agriculture in a context of climate change is forecasted on 9th of May.

- Two workshops on forestry projects in the pilot site of Monte do Vento are forecasted on 22nd of May.

- An online application on forestry and climate change is being elaborated.

- An assessment of forestry projects in Monte do Vento is in course.

Association Forêt Méditerranéenne

Activities during the last semester (September 2012 - February 2013)

The database containing the details of various researchers and managers who have conducted research and experiments for adaptive management of Mediterranean forests to climate change is now available. This database has been improved and expanded.

Communication and/or capitalisation activities during the period 6 (October 2012 - February 2013)

Denise Afxantidis participated as an expert during the fifth seminar (October 15 to 18, 2012) organised by the Spanish project partner, the CTFC of Catalonia, and the sixth seminar (February 28 to 1st of March 2013) organised by the North Aegean Region in Mitilini (Greece).

On October 18, the French partners visited the second ONF pilot site in France, in the Aude department, where they visited the experiments in place (see documents distributed in the report).

This visit, in which Denise Afxantidis also participated, led to the writing of an article in the Mediterranean Forest newsletter "La feuille et l'aiguille" (The leaf and the needle) No. 89 (November 2012).

Main difficulties and state of progress comparatively to programmation

The budget has been fully absorbed, making participation in the last two project seminars difficult.

Forecasted activities till the end of the project

Participation in the closing seminar in Ercolano (Italy) May 15 to 17, 2013.

North-Aegean Region

Activities during the last semester (September 2012 - February 2013)

The following activities were completed

Action 1: Study of the evolution of the vegetation in the context of climate change

The vegetation on site was analysed and a forecast of future vegetation was considered in terms of climate change, which is expected to bring drier conditions.

Action 2: Method of reducing the risk of fire

To cope with the increased risk of fire, a document was written to guide the management of forest and shrub areas to reduce the risk of fire.

Action 3: Modelling of fire behaviour

Modelling of fire behaviour was conducted for the Amali Peninsula using the FlamMap system and the BehavePlus software. By locating the origins of fire, maps were produced, graphically representing the potential velocity and intensity of fires in time and space.

Action 4: Automatic weather station

Development of an automated weather station system installation.

Action 8: Restoration and rehabilitation of degraded or burned ecosystems

Site 1: Pilot action in-situ of different reforestation methods using plants and a novel application of direct seeding of Pinus brutia.

More details in the "The North Aegean Region project" pages 39 to 42.

Site 2: Mobilisation of the local population for a "natural" type of reforestation by planting forest and shrub species seeds in balls of clay. After disappointing results, we conducted a classic reforestation using conifer seedlings (Pinus brutia, Pinus pinea, and Cupressus sempervirens) this semester.

Communication and / or capitalisation activities during the period 6 (October 2012 - February 2013)

Organisation of the 6th seminar of the project in Mytilene (Lesbos, Greece) on February 28 and March 1st 2013.

Main difficulties and state of progress comparatively to programmation

Action 4: Automatic weather station

Development of an automated weather station system installation was delayed.

Action 5: "Prescribed burning course"

Training of staff in the technique of prescribed burning to reduce the risk of fire could not be achieved because there was no authorisation by the competent authorities as prescribed burning is completely forbidden in Greece and no exception could be obtained.

Forecasted activities till the end of the project

Action 7: Information - awareness seminars

Organisation of information and awareness campaigns in the five major islands of the North Aegean Region. Two islands have yet to be visited.

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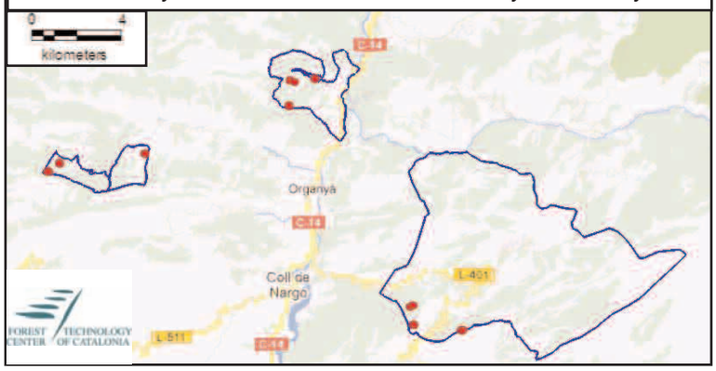
Gérard	WILLEY	CRPF		FR	1

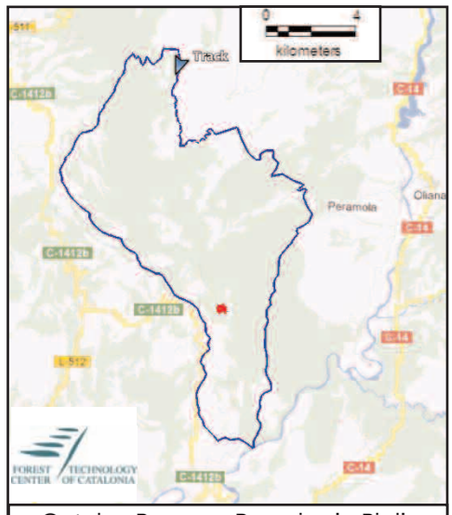
Annex 2 : Cartography of the pilot sites

Umbria Region, Municipality of Arone

Catalan Pyrenea, forests of Fontanella, Alinyà and Senyùs

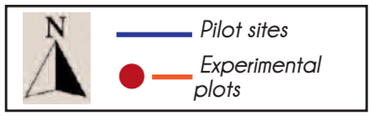


Localisation of pilot sites within the Mediterranean bassin



Catalan Pyrenea, Baronia de Rialb

Aude, Plateau de Sault



Alpes-Maritimes, Préalpes de Grasse

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Natural Park Valle do Guadiana

Projet cofinancé par le Fonds Européen de Développement Régional (FEDER)
Project cofinanced by the European Regional Development Fund (ERDF)

For Climadapt

Regione Umbria

Marseille, May 2013

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