Opinion Paper

Mitigation and adaptation potential of Mediterranean forests to climate change

MITIGATION AND ADAPTATION POTENTIAL OF MEDITERRANEAN FORESTS TO CLIMATE CHANGE

Key recommendations and financing opportunities

Forests, when sustainably managed, represent extremely valuable landuse for climate change mitigation. They also show great potential for adaptation, particularly in the case of Mediterranean forests. The phenotypic and genetic diversity of Mediterranean forests derives from natural selection processes such as adapting to environmental conditions. When atypical or extreme weather conditions arise, ecosystems can be key biodiversity hotspots. Their adaptive traits coupled with the current strengthening and implementation of sustainable management plans, highlight the potential for Mediterranean forests to respond effectively to climate change. These ecological characteristics are sources of beneficial goods and environmental services, and can be stimulated by a targeted management and orientation strategies. Nevertheless, the current situation of climate and demographic change renders these ecosystems vulnerable to several pressures, risks and threats that need to be combated with concrete management strategies. This document presents and supports several recommendations to be enacted in the Mediterranean region.

Context

This document represents a follow up to the IV Mediterranean Forest Week (IV MFW) held in Barcelona on 17 – 20 March 2015 and represents a synthesis of results and discussions presented by participants.

Summary

This document for decision makers shows the potential of Mediterranean forests regarding two strategies to combat climate change: mitigation and adaptation. The Mediterranean context and the forecast of future pressures in the region make those ecosystems vulnerable to impacts and consequences of global changes. However, the use of sustainable forest management can represent an effective and appropriate response, and can maximize all the benefits provided by Mediterranean forest ecosystems. Therefore, this document suggests global recommendations at the regional scale and promotes some precise orientations and activities that are also developed from lessons learned in different pilot sites and case studies as presented in the appendix. It also raises the question of opportunities for funding and mobilizing existing mechanisms, based mainly on carbon-related issues.

BACKGROUND AND REGIONAL ISSUES

The high ecological, economic and social value of Mediterranean forests

Goods and services provided by Mediterranean forests: diversity and impacts

The provision of goods and services is a major asset to the landscape and rural populations who depend on them. It makes forest conservation, sustainable management and their economic importance of primary interest. The current management of Mediterranean forests requires an integrated and multifunctional approach.

- **Carbon: sequestration and storage**

Well-managed forests generally hold higher carbon stocks and show greater mitigation potential than disturbed, poorly managed, overexploited or burnt forests which can represent emission sources.

- **Soil erosion control**

Protection and shielding function, limitation of natural hazards, dune stabilization and root anchorage.

- **Water quality**

Forested watersheds providing high-quality water, directly utilized by local populations

- **Biodiversity**

Strong potential for the future management and adaptation measures

- **Non Wood Forest Products (NWFP)**

Such products are of economic, social and cultural importance, promoting diversity, industry, and the generation of rural employment and income

- **Wood production**

84 million m^3 of wood produced by countries of the Mediterranean region with additional 40 million USD imported (80% from non-Mediterranean countries) to cope with the demand.

Key figures

- 85 million hectares of forests in the Mediterranean countries (including 25 million hectares of typical Mediterranean forests) or 2% of the global forest area in 2010
- 2.5 million hectares of cork oak forests, 10% of the Mediterranean forest area
- Estimated carbon stock: 5 billion tonnes of carbon (2010)
- 2 million hectares of burnt forest area in 2006-2010
- Biodiversity hotspot: 25 000 plant species, 247 woody species (trees and shrubs) including 158 endemic species or mainly found in the region.

Forests are by far the best land-use option in terms of providing natural ecosystem services, particularly carbon storage. The enhancement and production of those services can be maximized by sustainable forest management measures (i.e. measures that guarantee the sustainability of resources by planning reasonable use that encourages the forest regeneration dynamic). The enhancing and preserving of forest services is a wise choice for forest policies, one that can be achieved by promoting systematic sustainable forest management and by combating deforestation and degradation (both factors and causes). An integrated approach to land-use planning, such as providing rangelands, guarantees the multifunctionality of forests and the reduction of pressures related to competition for land use.

Factors and causes of deforestation and degradation		
Activities/events	**Impacts**	**Consequences**
Evolution of environmental conditions • increased temperatures • reduced precipitation		
Agropastoral expansion • overgrazing • expansion of agricultural activities	**Disruption of natural cycles** • water stress • reduction of natural regeneration • stand degradation • land-use changes • fragmentation and risk of fires	**Degradation** reduction of carbon stock and quality of ecosystem services **Deforestation** conversion of forests to other land uses in the long-term
Forest extraction • fuelwood • NWFP • construction timber • industrial wood		
Forest expansion • woodfuel • NWFP • construction timber • industrial wood		

Future evolutions: perspectives and challenges for the region

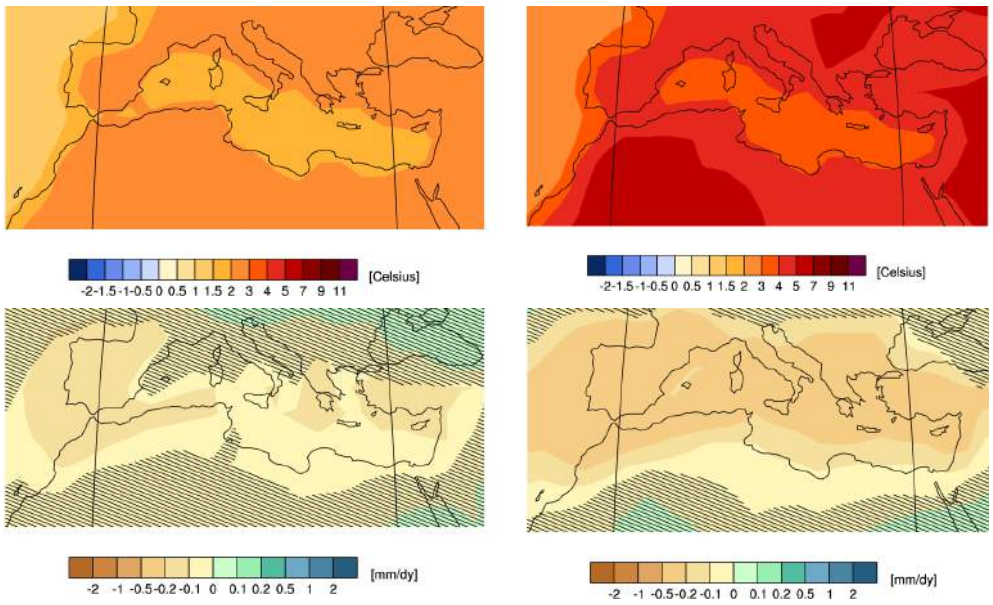
Climatic evolution

Future climate projections for the region developed by the Intergovernmental Panel on Climate Change (IPCC) in 2013 include:

- Increase in global average temperatures of 1.1 to 2.6°C, based on the moderately optimistic scenario RCP4.5, and of 2.6 to 4.8°C based on the pessimistic scenario RCP8.5
- Changes in precipitation regimes and distribution during the year, with an average reduction of up to 20% (RCP4.5)
- Increased number of extreme events.

Scenario RCP4.5 judged moderately

Sscenario RCP8.5 considered pessimistic

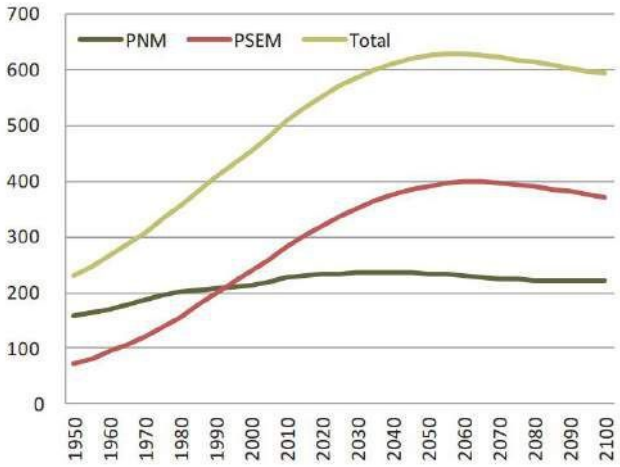


Sources: KNMI Climate explorer, simulations based on IPCC WG1 AR5 report data

Demographic evolution

Mediterranean population is predicted to grow from 507 million people in 2010 to 570 million by 2025. 95% of growth will occur in south and eastern Mediterranean countries (SEMC).

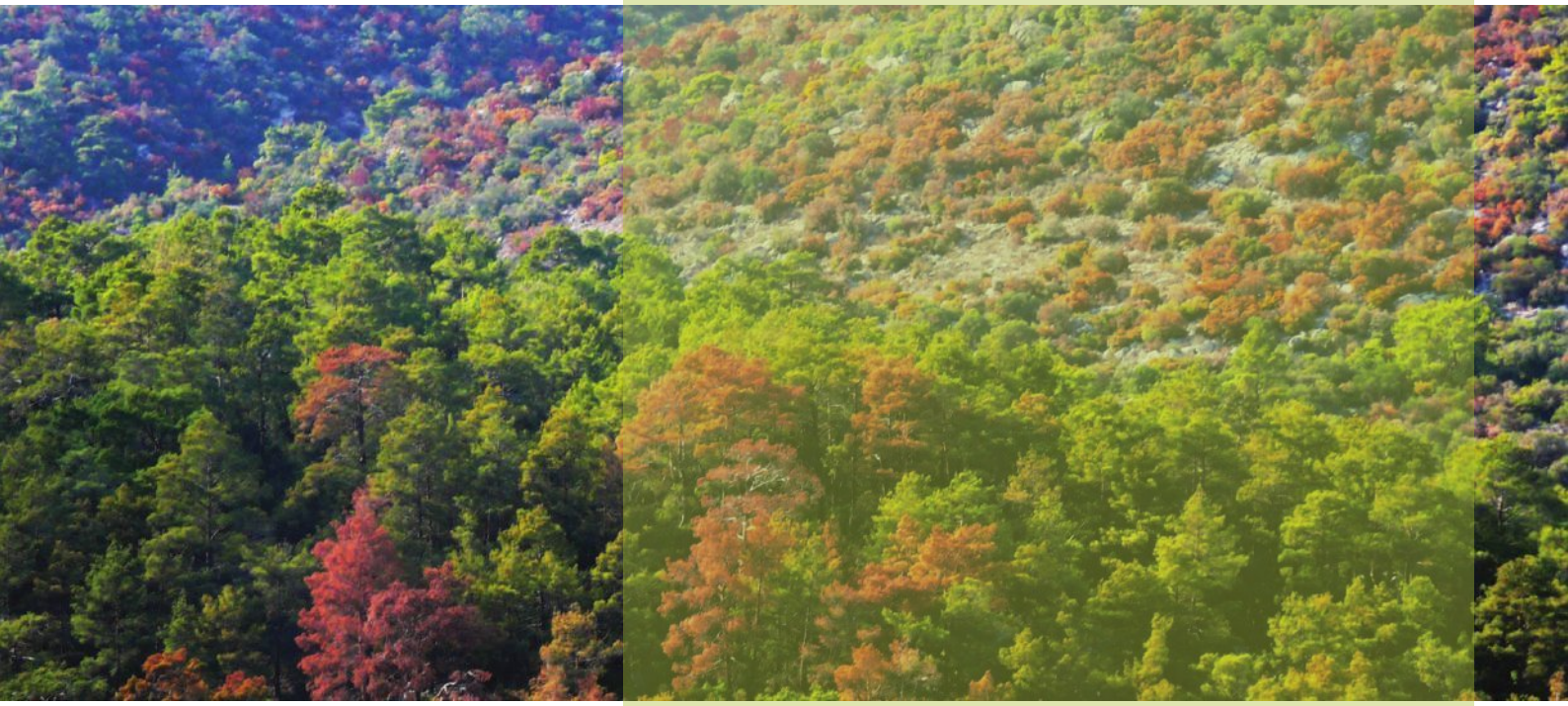
Strong expansion of urbanization: threats represented by land use changes, resource exploitation (energy, water, food, woodfuel), pressures on forests and agriculture expansion.



The risk of forest fires in the region

Resulting from natural or anthropogenic (traditional uses) dynamics, forest fires are sources of greenhouse gas emissions (removal of carbon contained in soils and biomass, emissions of CH_4 and NO_2). It is therefore necessary to manage and limit any and all fires. The risk of fires is going to increase in the current context (increased human pressure, more frequent extreme weather events). Combating and preventing forest fires in the region will mitigate the effects of climate change, implementing also cross-border fire management strategies (e.g. between Algeria and Tunisia). In 2006-2010, an average of 54 000 fires/year have been reported. They correspond to 400 000 hectares burnt in the Mediterranean region.

Mediterranean forests: ecosystems vulnerable to climate change



Impacts of climate change on the carbon balance of Mediterranean forests

The efficiency of carbon sequestration depends on:

- Environmental conditions
- The availability of water resources
- Silvicultural: stand age and aging, health conditions
- Dynamic balances in the atmosphere (gases).

All these factors, that depend on climate, influence the growth and development of organisms and thus carbon storage.

60% of all people living in water-poor countries globally is concentrated in the Mediterranean region. 80 million people will suffer from lack of water resources by 2025.

A region sensitive to climate change

Changes in climate, demography and land use will have direct and indirect consequences in the region:

- Lack of water resources
- Changes in biophysical properties of soils (e.g. soil moisture)
- Increased vulnerability to water stress and erosion (increased risk of desertification)
- Increased frequency and intensity of forest fires
- Introduction and possible altitudinal and northward migration of new pests and invasive species.

Vulnerability factors

- Biophysical: type of soils, slope
- Climatic: water deficit, extreme events, changes in the distribution of precipitations
- Silvicultural: stand age and aging, health conditions
- Anthropogenic: need of woodfuel, grazing pressure, population density.

The production of goods and services is threatened by these factors, directly affecting the downstream industry (strong economic impacts).

MITIGATION AND ADAPTATION POTENTIAL

What is the potential of Mediterranean forests?

Link between adaptation and mitigation

- Mitigation: Limiting the magnitude and rate of climate change. Two mechanisms of action can be undertaken: the reduction of greenhouse gas emissions, and carbon capture and storage.
- Adaptation: Adjustments to natural or human systems in response to effects of climate change and taking action to anticipate its consequences.

Application and special features of Mediterranean forests

- Role in mitigation: to promote carbon storage and the fight against desertification ➔ maintenance and stimulation activities
- Role in adaptation: to promote genetic resources ➔ characterization and preservation of genetic resources
- Importance of cobenefits resulting from sustainable management focused on conservation, adaptation and stimulation of forests as carbon sinks.

Key points and strategic areas

x Do not consider adaptation as justification for rejecting the need for mitigation

x Do not consider that mitigation alone will compensate for climate change: it already has consequences for which adaptation is required

√ Do implement synergistic approaches to mitigation and adaptation strategies and programs. Find compromises if strategies are competing

√ The forest sector has great potential in both fields of action.

The economic value of the additional carbon storage potential is estimated between 37 and 63 million USD for the Mediterranean forest type.

Synergies exist between mitigation and adaptation strategies to combat climate change. In the context of sustainable forest management, mitigation activities involve adaptations and vice versa. Therefore it is possible to mobilize instruments and mechanisms to promote both mitigation and adaptation strategies using carbon as a lever for promoting sustainable forest management.

How to promote the potential for mitigation and adaptation?

MITIGATION	ADAPTATION
REDUCE EMISSIONS	REDUCE RISKS
ENHANCE SEQUESTRATION	INCREASE RESISTANCE
USE WOOD AS A SUBSTITUTE FOR MORE ENERGY DEMANDING MATERIALS	IMPROVE RESILIENCE

Question

What are the funding options and how do we capture carbon financing instruments to promote and further the sustainable management of forests for adaptation and mitigation?

By adapting and strengthening governance for appropriate management of Mediterranean forests fitted to current and future issues

- Strengthen, adapt and revise national and regional forest policies to focus on the goal of preserving forest goods and services as well as forest resilience
- Consider integrated land-use planning by developing sectorial and inter-sectorial measures, as a complement to forest sector actions
- Involve stakeholders and user populations at the territorial level and set up a participatory approach to the development, implementation, and the monitoring of forest policies
- Include in national adaptation plans, measures that are adapted and specific to forests and forested lands.

By implementing concrete actions for sustainable forest management

- Implementing sustainable forest management plans
- Preventing and combating forest fires
- Promoting reforestation and forest landscape restoration
- Improving forest health
- Managing sustainable use of fuelwood resources and harvesting
- Limiting agricultural expansion
- Adapting silviculture (species, length of the felling cycle, genetic strains, etc.).

FUNDING OPPORTUNITIES FOR ADAPTATION AND MITIGATION

Cost-benefit analysis of actions and strategies to maximize mitigation and adaptation

Monetary assessments of costs and benefits are projected from a baseline scenario and account only for those additional incomes and expenses that stray from the business-as-usual situation. Benefits are sometimes computed based on the expected costs for repairing damage caused by the absence of preventive measures (avoided costs), i.e. the cost of inaction.

Methods

1 IDENTIFY PROMISING STRATEGIC ACTIONS

2 DEFINE THE REFERENCE SITUATION

3 ESTIMATE COSTS (DIRECT, TRANSACTION COSTS) AND BENEFITS (GAIN/LOSS OF EMISSIONS, COBENEFITS…) OF THE REFERENCE SCENARIO AND OF THE SITUATION WHEN THE STRATEGIC ACTIVITY IS IMPLEMENTED

Costs correspond to the financing of activities and therefore to the investment necessary for their implementation, their monitoring, and their maintenance. Costs are evaluated at the governance level as well as socio-economic costs (e.g. for restriction on use).

Benefits include all the profits, with a monetary economic value that are made from implemented actions. One element with a quantitative value is carbon, so benefits of actions taken are often given in terms of sequestration and stocks. Cobenefits also have important added values, particularly in Mediterranean forests.

Numerical examples: capturing the mitigation potential using the carbon-based REDD+ instrument	**Lebanon**	**Morocco**	**Tunisia**
Abatement costs of REDD+ actions (in USD/TCO_2e)			
Combating forest fires	31.8	49.2	494
Afforestation and reforestation	266.6	87	45.7 to 229.9
Sustainable production of fuelwood	56.9	-	-
Reducing overgrazing	-	17 to 43.6	30 to 81
Co-financing opportunities (in USD/tCO_2e)			
Economic value of non-carbon benefits	762	182	110

The value of cobenefits: a lever with a high potential beyond carbon

Maintaining cobenefits can provide leverage for reducing emissions and keeping carbon stocks, particularly in the Mediterranean context. This statement advocates for the necessity to take into account and to promote them in incentive financing mechanisms, or in payments for environmental services. Ecosystem services can also be targeted by pure adaptation programs that aim at ensuring or maximizing their sustainability over time.

Cobenefit types and examples	
Environmental	Protection, conservation, and restoration of biodiversity, ecosystems, soil fertility, and water quality
Social (including governance)	Protection and improvement of quality of life, local stakeholder participation, health, education, forest governance improvement, job generation, and land law strengthening
Economic	Preservation and stimulation of ecosystem services. Sustainable provision of forest resources, promoting sectors
Cultural	Preserving spiritual and religious practices, population welfare

Diversity of instruments

Some funding is specifically earmarked for mitigation actions (e.g. REDD+ or NAMA) while other for adaptation actions (e.g. adaptation fund). The Global Environment Facility (GEF) manages several funds like the GEF Trust Fund that supports mitigation efforts whereas the Least Developed Country Fund (LDCF) and the Special Climate Change Fund (SCCF) support adaptation measures. In regards to the Green Climate Fund (GCF), it is still not perfectly clear whether or not financing will be separately allocated to adaptation and mitigation (even though it was already decided that both strategies would be equally supported).

REDD+
- Incentive mechanism
- Performance-based payments
- Non-annex 1 countries

NAMA
- National approach
- Financing mitigation actions
- Non-annex 1 countries

ADAPTATION GRANT
- Financing actions that promote forest resilience and resistance
- Non-annex 1 countries

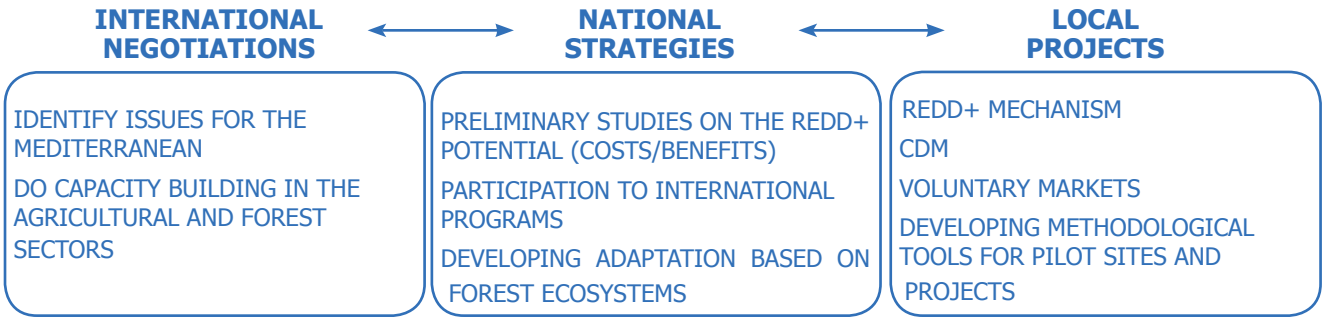
VOLUNTARY MARKETS
- Environmental sponsorship
- Sale of certified or non-certified credits
- All countries

LIFE PROGRAM
- Mitigation and adaptation practices and projects
- EU countries

CAP
- Adaptation and mitigation measures
- EU countries

NAP
- National approach
- Support to developing countries by SCCF or GCF

Strategies to follow to mobilize financing instruments



Key messages

- An important capacity for mitigation and adaptation to climate change lies in actions against deforestation and forest degradation
- Two main levers can be used in the forest sector:
  - preserving, adapting and stimulating carbon sinks (actions for preventing and combatting fires are a key activity with this respect in Mediterranean forests)
  - promoting cobenefits and other goods and services provided by forests
- It is important to identify causes and factors that are responsible for deforestation and degradation. Principle factors to address must have relevant, adapted and efficient actions that tackle current issues
- Benefits gained from these actions have to be given a monetary value and the estimation of their value requires the definition of a baseline scenario.

There is true potential in Mediterranean forests for adaptation and mitigation of climate change.

RECOMMENDATIONS, APPLICATIONS AND PERSPECTIVES

Silvicultural measures

Why sustainable forest management is important, and recommendations for management specific to Mediterranean forests

Sustainable forest management has an important potential for maximizing the production of goods and services, and specifically for having a positive impact on the carbon balance in the climatic context and its constraints.

Examples of recommendations

- Adapt stand structure to minimize water stress (depending on density and age)
- Plan regular thinning to reduce tree sensitivity to drought
- Promote connected forest stands and a length of the felling cycle that ensure that the evolutionary potential is maintained and that maximize genetic diversity
- Optimize water use
- Guide the use of forest resources and products to help local populations to adapt to climate change.

Managing forest genetic resources

Forest genetic resources and their potential

Forest genetic resources are responsible for the diversity of organisms and consist of the set of genes and alleles found in the genetic pool of forest tree species. Mediterranean forests, as biodiversity hotspots, are a living stockpile of adaptive traits that could be used for climate change adaptation as long as they are well managed. Therefore, the conservation of these resources is at stake for the ecosystems.

Why the management and conservation of forest genetic resources is important

- A diversified genetic pool, with species and varieties at the periphery of their natural range are already adapted and resilient to some extreme conditions
- Species that are threatened in their current distribution range are potential resources for other regions (assisted displacement)
- Forest managers already have knowledge of management in Mediterranean climate conditions, and could transfer that knowledge to other regions that could have a similar climate in the future.

Specific recommendations for carbon stocks

- Afforestation and reforestation activities
- Maximize natural regeneration
- Promote mixed uneven forest stands
- Restore degraded soils
- Implement specific silvicultural practices (reduce stand density using selective logging, remove dead wood, thinning)
- Combat and prevent perturbations
- Promote and use the most adapted, resilient and versatile species
- Plan sustainable grazing
- Promote wood products (stocks and substitution), develop the forest sector.

Levels of action and concrete examples

To maximize the mitigation and adaptation potential of Mediterranean forests, all levels of action and strategies should be implemented. Actions can be financed by different climate funding opportunities. Several examples are presented with further details in the appendix of this document:

- At the national level: Lebanon currently supports a reforestation program that is strategically eligible for climate-based financing through a NAMA
- At the territory level: approaches that rely on adaptation and mitigation strategies based on the forest ecosystems of different pilot sites (Lebanon, Morocco, Tunisia, Turkey) can be used to define management measures and recommendations that combat climate change and can, therefore, possibly capture carbon-based financing
- At the ecosystem level: the example of cork oak forests shows how this level of action can be important for a sector and the important potential of the sustainable use of resources for mitigation (stocks, sequestration and substitution).

Conclusion

In conclusion, Mediterranean forests are vulnerable and particularly exposed to global climate changes, but they already have adaptive traits that give them an important potential for adaptation. Mitigation and adaptation measures to ensure their resilience and the sustainability of the goods and services that they provide are likely to be eligible for many different sources of financing. To maximize mobilization opportunities, plans of action should be developed at all levels of governance and application.

SHEET 1

NATIONAL REFORESTATION PROGRAMME IN LEBANON AND FINANCING APPROACHES

INTERESTS OF A NAMA (NATIONALLY APPROPRIATE MITIGATION ACTIONS) APPROACH

Presentation of the Lebanese National Afforestation/Reforestation Programme

Ambition and objectives

In 2012, the Ministry of Agriculture (MoA) of Lebanon launched the Lebanese National Afforestation/Reforestation Programme (NARP). The Programme aims to increase the forested area from 13 to 20% of the national cover in the period 2013-2030 by planting 40 million trees in an area of about 70 000 ha.

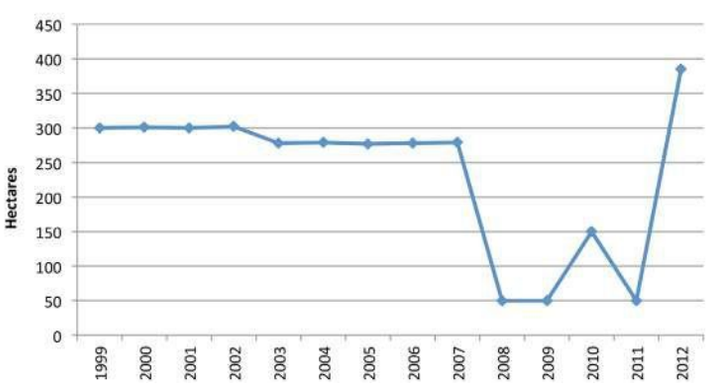
The objectives of the programme are:

1. Adaptation of forest and agricultural ecosystems to climate change (measures against soil degradation and erosion, improvement and maximization of services provided by ecosystems…)
2. Greening of the landscape for tourism promotion
3. Strengthening of growth, reforestation and the wood supply chain. Improving NWFP production
4. Increased employment opportunity in the region
5. Hunger and poverty eradication in the region, supporting local populations

Overall, actions carried out will be beneficial for boosting the regional economy and promoting the goods and services provided by forest ecosystems. These co-benefits could be put forward in the search for external financing.

Project implementation context

This situation raises the question of possibilities of existing funding and project eligibility for certain mechanisms, including carbon finance opportunities and the estimation of the mitigation potential of the programme in order to access such financing.



Reforested area in Lebanon between 1999 and 2012

The reforestation programme is already funded by national investments and its progress includes the launch of activities and contracts in collaboration with the World Bank and the French Development Agency. However, funding for completion of the project is still missing. The estimated cost of funding and maintenance is 400 million USD.

What are the NAMAs?

The NAMAs (Nationally Appropriate Mitigation Actions) are voluntary initiatives by the countries to reduce their emissions (concept developed in Cancun during the UNFCCC summit in 2010). They involve developing countries and include all the policies, programmes and projects with mitigation activities in one sector. They are not subject to undertaking the results but to an immediate realisation with monitoring emissions reductions.
Concerning their funding, the NAMAs could be unilateral (host country), supported (national and international funding) or credited (payments to results). The main donors identified are the NAMA Facility, bilateral and multilateral initiatives, the Global Environment Facility and the Green Climate Fund.

Climate change mitigation potential

A study of ONF International (ONFI) shows that the sequestration potential of the programme over a 30-year accreditation programme (2014 to 2043) could be between 11.4 and 13.6 million tCO2 . There is also the possibility of generating many cobenefits (environmental, economic, socio-political, intersectoral, etc.).

Possible sources of funding and carbon finance mechanisms			
Type of funding or mechanism	**Description and eligibility requirements**	**Characteristics**	**Financing mobilisation**
CDM	Afforestation/reforestation activities Land eligibility: afforestation of lands that have not been forested for 50 years	Very expensive standard (high transaction costs, credits for sale at very low prices)	Not recommended
Voluntary markets: Standard VCS or Gold standard	Non-permanence risk considered by VCS (guarantee that sequestered carbon is not reemitted during the project)	Certification has the potential to finance 10 to 20% of the costs of plantation and maintenance	Gold standard: best option in term of cost-efficiency
REDD+	Activities against deforestation and degradation, sustainable forest management, conservation and enhancement of forest carbon stocks	The NARP, which contributes to the enhancement of forest carbon stocks, could constitute a REDD+ strategic option	Need of developing a REDD+ national strategy

Cost/benefit analysis of REDD+: numerical example for the actions carried out in Lebanon					
Strategic action	**Reduction potential (teqCO2)**	**Unit cost (USD/ teqCO2)**	**Benefits (million USD)**	**Benefits (million USD)**	**Origin of benefits**
Prevention and fight against forest fires	70 000	2.2	32	8	Forest conservation (and therefore economic capital) and savings on the national budget spent in case of fire
Reforestation	790 000	2.1	266	218	Additional economic value of the actions (estimation of the economic value of goods and services)
Sustainable management of woodfuel	137 000	7.8	57	NA	

The NAMA approach: a relevant and promising opportunity for the Lebanese NARP

In Lebanon, the launch of a Forestry NAMA represents an excellent opportunity to capture additional funding for the NARP programme, to strengthen national capacities and to recognize at the international level the efforts in terms of reducing emissions. Funding may come from non-Annex I countries in a relatively short term and with limited transaction costs, from co-financing sources as a national patronage system or voluntary carbon markets (VCS or Gold Standard), or also from mechanisms results-based payments like REDD+.

Recommendations for the NARP

- Strongly promote the use of native species for plantations (with a small percentage of exotic fast-growing species, if needed)
- Choice of management techniques enhancing the sequestration and storage of carbon
- Consideration of the previous documented vegetation in order to respect the land eligibility criteria
- Choice of the accreditation period compatible with the requirements of funding mechanisms.

Source: report ONF International, "Quelles perspectives pour une mobilisation de la finance carbone en appui au programme de reboisement Libanais?", 2014.

THE PARTICULAR EXAMPLE OF CORK OAK LANDSCAPES

MEDITERRANEAN FOREST ECOSYSTEMS WITH STRONG CLIMATE CHANGE ADAPTATION AND MITIGATION POTENTIAL

Cork oak landscapes: ecosystems with special bioclimatic requirements

Cork oak forests are very exigent endemic ecosystems of the Mediterranean region, adapted to the climate context of their range.

- Biodiversity hotspots: 60–100 flowering plant species/tenth of a hectare
- Around 2.2 million hectares of total area at global level
- Trend in the Mediterranean region: increasing surface between 1975 and 2000 (+12.64 ha/yr), reverse trend during 2000-2011 (-2.08 ha/yr).

Cork oak landscapes: ecosystems providing many goods and services

Principal product: cork
Different uses: stoppers, automotive, military and space industry, clothing, furniture, etc.

Important economic value:

- exports of cork products: 1.3 million € (total estimated value in 2011)
- manufacture of cork products: 2 billion USD of annual sales (APCOR, 2012).

Other goods and services
Meat, cereals, NWFP (mushrooms, asparagus, honey, medicinal plants, etc.), hunting, regulation of environmental processes, maintaining of natural environmental processes, landscape and cultural or recreational services.

Physical properties and fire resistance
The physical properties of cork (impermeability, compressibility, elasticity, abrasion resistance, etc.) give cork oak forests the role of shielding and protecting against fires.

Nature of threats			
Environmental	**Economic**	**Anthropogenic**	**Demographic**
Climate change	Conversion of forest stands	Unsustainable forest management, non-respectful techniques	Increased human pressure on resources
Vulnerability to diseases	Land abandonment		Urban development
Pests	Poverty and lack of economic opportunities in the South, irregular subsidies in the North	Deforestation	
Forest fires		Overgrazing	
	Lack of integration of social issues in management practices and land use planning	Illegal logging	
	Fluctuations of the cork market		

Cork oak landscapes: ecosystems particularly affected by climate change

Climate change threatens the conservation of cork oak ecosystems, and thus the supply of all goods and services.

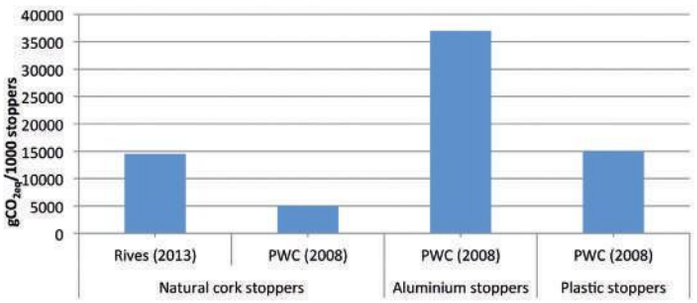
- Possible latitudinal and altitudinal shifts of the cork oak distribution area with fragmentation in the South Mediterranean region (e.g. Maghreb and Andalusia) and colonisation of new territories in the North (e.g. France, Portugal and Castile in Spain)
- Strong direct and indirect impacts on carbon stocks and biogeochemical processes
- Risks of conversion to other ecosystems, change of landscapes.

Strong mitigation potential by sequestration, storage and substitution

Afforestation of cork oak landscapes is much better option for climate change mitigation than the agriculture or grasslands.

Sequestration
Cork oak longevity and late exploitation (age > 200 years), regular bark harvest, water use minimisation.

Storage
The carbon is stored in the products at medium-term and long lifetime.



Substitution

Use of cork rather than other alternative materials: energy and emissions savings. Insulating power: significant substitution potential in construction.

Numerical example of bottle stoppers. The use of cork stoppers instead of aluminium allows the saving of 23 576 gCO2eq for every 1 000 stoppers produced.

Adaptive measures		**Financing possibilities**
Response to water stress and drought / Response to the increase of extreme events	Improve the protection of soil, stimulate organic matter (less ploughing, cover crop)	REDD+, NAMA, Common Agricultural Policy (CAP), Voluntary markets
	Identification/selection/promotion of resistant genotypes, genetic improvement	
	Stimulation of natural or assisted migration	
	Management of cork extraction adjusted to production cycles	
Response to the increased risk of fires	Preventive silvicultural measures	Special Climate Change Fund (GEF), Adaptation Fund
	Improve detection and control techniques	
	Control invasive plants	
Mitigation measures		
Increase in biomass	Identify and fight against the sources of deforestation and degradation	MDP, NAMA, REDD+, CAP, Voluntary markets
	Adapt afforestation actions for future climate conditions	
	Take preventive actions against fires	
	Monitor and take action against pest and diseases	
	Promote the regeneration and balance of age classes in the stands	
	Promote respectful practices for the extraction of cork products	
Storage in the litter and the soils	Limit ploughing	GEF, FCPF
	Fight overgrazing	
	Promote complete and permanent plant cover of soil	
	Stimulate soil productivity and accumulation of organic matter	

Specific measures for the cork industry:

- Enhancement of the substitution effect by promoting cork as energy-efficient alternative material
- Improvement of fundamental knowledge for estimating net carbon emissions due to activities, including deforestation and afforestation
- Development of management systems, silvicultural practices and more effective means of prevention, and building their capacity through research
- Mobilisation of existing funding for mitigation measures. Enhancement of the adaptation potential of cork oak landscapes and related funds.

Source: State of Mediterranean Forests 2013 and a study on "Cork Oak Landscapes, Their Products and Climate Change Policies" (2014) by P. Canaveira, S. Manso and T. Valda produced in the context of the project "Maximize the production of goods and services of Mediterranean forest ecosystems in the context of global changes" funded by the French Global Environmental Facility and coordinated by FAO-Silva Mediterranea and Plan Bleu.

SHEET 3

EXAMPLE OF ADAPTATION STRATEGY BASED ON FOREST ECOSYSTEMS

PILOT SITE OF THE TANNOURINE CEDARS FOREST NATURE RESERVE

Presentation of the pilot site

Geography

- Location: Batroun district, 75 km far from Beyrouth
- Designation: Tannourine Cedars Forest Nature Reserve (TCFNR)
- Area: 625 hectares (of which 150 hectares are forest), distributed over 1 300 to 1 850 metres a.s.l.
- Economic activities in the region: fruits production, commerce, and industries.

Climate

With annual rainfall between 1 060 and 1 650 mm, the bioclimate of the pilot site area is humid. Changes are currently being observed along the usual trends with an increase in the average temperatures during the period 2001-2010; a cause for increasingly frequent irrigation of agricultural fields to supplement natural rainfall.

Transition from humid to a semi-arid climate		
Parameters	**Scenario 2040**	**Scenario 2090**
Mean temperatures	+ 1 to 2°C	+ 3.5 to 5°C
Precipitation	- 10 to 20%	- 25 to 45%
Snow cover		- 40 to 70%
Aridity		+ 5 to 15%

Ecology

The reserve has about 300 plant species, including 23 endemic and three rare and localised species. The fauna is also very important: the site has many species of birds, mammals, amphibians, insects, including endangered species, endemic and/or vulnerable.

Production of goods and services

The Nature Reserve represents a strong tourism attraction. The Lebanese forest generates around 1% of the national GDP. The ecosystem services of the reserve include the production of honey, mushrooms, barberry shrubs, oregano, *Quercus calliprinos* (Palestine oak), *Gundelia tournefortii* (*Asteraceae* consumed as a vegetable) and *Crataegus monogyna* (hawthorn).

Main threats to the pilot site and their impacts

Climate change is one of the most important stress factors for the TCFNR:

- It is one of the most susceptible areas to the impacts of climate change resulting in a change of bio-climate (due to its northern location in Lebanon)
- The potential for adaptation of its conifer forests is low due to limited possibility for expansion in altitude
- The attacks of the endemic insect pest *Cephalsica tannourensis* are bound to increase
- The negative effects on the supply of goods and services will have impacts on the resulting benefits. The ecosystem services most affected will be those related to water (purification, flood control and erosion…) and to NWFP
- The impacts will be severe: fragmentation of ecosystems, land use changes, pest attacks, game and grazing, reduced silvicultural production, carbon sequestration, soil stabilization, potential for recreational services, etc.

Strategies

- Reinforce the adaptive potential of forests by integrating climate change adaptation into the sustainable forest management strategies
- Integrate forests and their goods and services into the development programmes and policies in order to promote the role of the forest in the sustainable management and, more specifically, in the Climate Change Adaptation of lands and their population, according to the approach of Adaptation based on the Forest Ecosystems.

Sectoral measures of adaptation strategy based on the forest ecosystems	
Sector / area	**Measures**
Natural Reserve of the Tannourine Cedars Forest	Diversification of income sources through the promotion of NWFPs Reforestation of degraded areas Introduction of integrated watershed management
Tourism	Promotion of ecotourism
Agriculture	Stimulation of soil erosion control by restoration and earthmoving activities
Intersectoral measures to strengthen the general adaptation strategy	
Spatial extension of the reserve	
Encouragement of sustainable exploitation of the forests (wood and NWFPs)	
Constructions of dikes and dams for water supply during drought periods	
Conduct training to reinforce education on the protection of the forests	
Reinforcement of the awareness of local stakeholders on climate change and pressures on forests (NGO, decision makers, managers, landowners, communities, etc.)	
Revision of the legal framework for the use and production of NWFPs	
Research on the adaptation of ecosystems in the region, forest species (trees) and crops	
Reinforcement of the communication and cooperation between stakeholders	

Probable financing opportunities to be considered

- Lebanon is a country not listed in Annex I of the UNFCCC. Funding REDD+ activities requires Lebanon to elaborate a national strategy in advance
- The proposed measures could be included in the framework of a forest NAMA under development (see sheet annex 1) and raise funds related to it
- Voluntary markets (particularly the Gold Standard and the Standard VCS), through the certification of credits for afforestation/reforestation measures or valuation of the benefits and services, represent a strong potential for the pilot site
- Actions carried out in favour of the improvement of environmental services could also be subsidised by the environmental sponsor or payment for ecosystem services
- Actions carried out for adaptation could raise specific capital funding as AF, GEF or GCF.

Sources: this sheet is derived from the activities carried out in the framework of the regional project GIZ-CPMF www.giz-cpmf.org. For further information: http://www.giz-cpmf.org/tl_files/pdf/Booklet_FEbA_Lebanon.pdf.

SHEET 4

EXAMPLE OF ADAPTATION STRATEGY BASED ON FOREST ECOSYSTEMS IN TURKEY

PILOT SITE OF THE SEYHAN WATERSHED

Presentation of the pilot site

Geography

- Location: South Turkey
- Area of the Seyhan watershed: 21 741 km^2. This size makes Seyhan one of the most important agricultural areas of Turkey, and therefore an important economic resource
- Topography: altitude steppes and mountainous areas connected to the Cukurova delta (agricultural area) by transition zones

Climate

In the lower part of the basin, winters are hot and humid, and summers very hot and dry. Higher altitude regions experience a more continental climate (cold winters and hot summers with little rainfall). A gradual climate change trend is currently being observed in the basin with an increase in temperatures over the past 40 years. Annual precipitation is also falling, while the number of forest fires is increasing. Projections for 2070 predict temperatures increasing by 2 to 3.5°C and a decrease of precipitation by 25 to 35%.

Ecology

Different types of vegetation depend on the topography and the different bio-climates of the basin. Natural areas in the southern region are mainly covered by the *maquis* while the mountains host conifer forests. In the North, the dry steppes are covered by patches of shrubs (oaks).

Use of goods and services

The natural forest areas provide important goods and services not only for the forest sector, but also for other economic sectors (control of soil erosion, oxygen production, carbon sequestration, protection of biodiversity, stabilization of water flows, feed for livestock, ecotourism, etc.). In the region, the NWFPs are important sources of income for forest services and rural populations. The main NWFPs are the pine nuts from the stone pines, laurel, resin and rosemary.

Main threats to the pilot site and their impacts

Climate change is one of the most important pressure factors in the region and directly affects the supply of goods and services, reducing the quality and quantity of the benefits they generate. The negative impacts of the climate change on the supply of goods and services have direct consequences on the economy of the region and social consequences for rural and local communities. Predicted scenarios show negative impacts on the production of wood, carbon sequestration, water quality, soil stabilization, erosion control, recreational potential of forests, ecotourism, NWFPs (in particular laurel, sage, pine cones, thyme, mushrooms, and honey) and biodiversity functions provided by the forests of the watershed. Finally, a decline in the water level would be accompanied by an increase in pollution, or even a mixing of salt and fresh water near the coast.

Strategies

The forest sector supports many downstream sectors. It is therefore important to address the problems at their root by general adaptation policies for the watershed to strengthen the adaptive capacities of other sectors. It is also necessary to reinforce the cooperation between sectors (agriculture, forest, energy, tourism, etc.). Possible strategies to implement could be the following:

- Reinforce the adaptive capacity of forests by integrating climate change adaptation into sustainable forest management strategies

- Integrate forests and their goods and services into development programmes and policies in order to promote the role of forests in sustainable management and, more specifically, in climate change adaptation of lands and their populations, according to the forest ecosystem-based adaptation approach.

Sectoral measures of forest ecosystem-based adaptation strategies	
Sector / area	**Measures**
Soils and water	Increase in programmes for afforestation and erosion control
	Restoration of degraded riparian forests and protection of existing forests
Tourism and local products	Promotion of ecotourism
	Establishing honey producing forests
Agriculture	Increase in production of NWFPs
Intersectoral measures to strengthen general adaptation strategies	
Prevention of forest fires	
Prioritisation of drought-tolerant species and promotion of specific combination of species in stands	
Prevention of forests being converted to other land uses	
Strengthening of measures for forest maintenance	

Possible financing opportunities to be considered

- Turkey is a country listed in Annex I of the UNFCCC and is therefore not eligible to the mechanisms CDM, REDD+ or NAMA approach

- Commitment to reduce the emissions under the framework of the Kyoto Protocol: possibility of selling the credits generated by the mitigation measures and actions in the voluntary markets
- Valuing goods and services provided by the pilot site: research of possible funding by payment for ecosystem services (including recreation services and provision of NWFPs)

- Request of funds for adaptation and related actions.

Sources: this sheet is derived from the activities carried out in the framework of the regional project GIZ-CPMF www.giz-cpmf.org. For further information: http://www.giz-cpmf.org/tl_files/pdf/Booklet_FEbA_Turkey.pdf.

SHEET 5

EXAMPLE OF ADAPTATION STRATEGY BASED ON FOREST ECOSYSTEMS IN MOROCCO

PILOT SITE OF THE SOUSS MASSA DRÂA REGION

Presentation of the pilot site

Geography

- Location: Souss Massa Drâa (SMD) region, covering about 10% of national territory
- Factors influencing climate: relief, proximity to the ocean, and the nearby Sahara
- The forests of the region represent more than 13% of the national forest heritage.

Climate

The site is subject to quite severe natural climate conditions and includes bioclimatic areas with arid to semi-arid climate. Climate change scenarios predict a warming and sharp decline in precipitation.

Ecology

The region hosts a particular ecosystem, the argan forest, which covers more than 800 000 ha (80% are in the SMD region). This ecosystem is important for the fight against desertification and is recognised as a Biosphere Reserve by UNESCO. Argan forests form a true green wall against the Saharan desert.

Goods and services

Thanks to its nourishing, restructuring, and antioxidant properties, argan oil is used both for food as well as in cosmetics. It is a natural product and organically produced, with high added value. The economy and development strategies of the region are mainly based on the exploitation of vulnerable natural resources (water, soil/plant systems, fisheries resources, etc.) and on recreational services for culture and tourism.

Seven percent of the national GDP is provided by the goods and services rendered related to argan forests. The role of the argan forest is therefore ecological and socio-economic at the same time.

Main threats to the pilot site and their impacts

Demographic pressures of recent decades have led to a change in land use (urban and agricultural expansion) and in the methods of exploitation of natural resources.

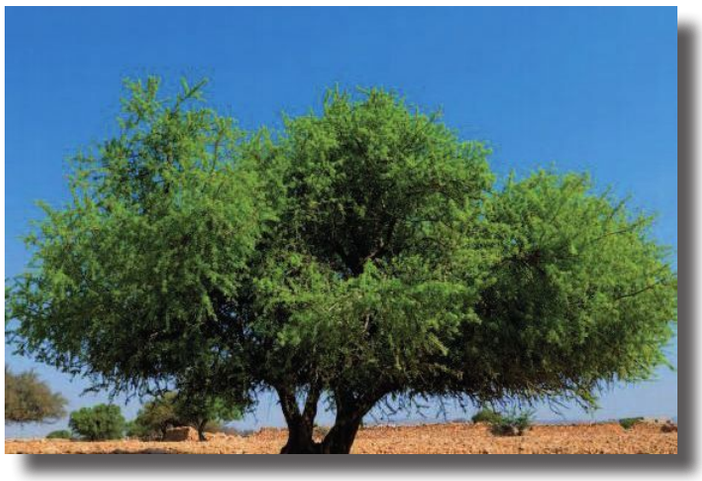
The region's ecosystems are fragile and quite vulnerable to aridity and drought. They could be strongly affected by the threat of climate change, which will accentuate these negative phenomena. The direct environmental consequences expected are:

- ecological imbalance
- physiological weakening of forest species
- early decay
- increased vulnerability to diseases and pest attacks
- disturbance of the dynamics of the natural regeneration
- impacts on biodiversity
- socio-economic consequences for the local populations.

The impacts felt across the territory will be numerous: desertification, lower groundwater levels, degradation of forest cover, degradation on rural living standards, and urban migration resulting in severe economic consequences.

Strategies

- Reinforce the adaptive capacity of forests by integrating climate change adaptation into sustainable forest management strategies
- Integrate forests and their goods and services into development programmes and policies in order to promote the role of forests in sustainable management and, more specifically, in climate change adaptation of lands and their populations, according to the forest ecosystem-based adaptation approach.



Sectoral measures of forest ecosystem-based adaptation strategies	
Sector / area	**Measures**
Water	Integrated watershed management (anti-erosion plantations, forest management) to fight the silting of dams and favour infiltration Promotion of upstream-downstream cooperation in watersheds
Agriculture and livestock	Protection of agricultural lands Sylvo-pastoral management (rangeland rotation, compensation for grazing exclusion, etc.) favouring the involvement of local populations (co-management) Development of alternative income-generating activities, such as promotion of the argan sector and regional products (*e.g.* aromatic and medicinal plants) improvement of local knowledge Development of the agroforestry (*e.g.* carob and cactus plantations)
Tourism	Creation and management of new parks and recreational areas in forests in order to diversify the regional touristic appeal Enhancement of ecotourism in existing Parks and Sites of Biological and Ecological Interest: networking of rural tourism stakeholders, training of guides and facilitators of rural tourism, reinforcement of environmental quality standards, etc.
Intersectoral measures to strengthen the general adaptation strategy	
Fight against forest fires	
Pest risk management	
Grazing exclusion in the reforestation/regeneration areas and compensation to local population	
Development and implementation of a management strategy for woodfuel	

Possible financing opportunities to be considered

- Funds that finance adaptation: Adaptation Fund (AF), Global Environmental Facility (GEF), Green Climate Fund (GCF)
- Promotion of the argan oil industry by the environmental sponsorship or voluntary markets (highlighting the multiple benefits)
- Development of systems of payments for ecosystem services for the water and tourism sectors.

Source: this sheet is derived from the activities carried out in the framework of the regional project GIZ-CPMF www.giz-cpmf.org. For further information: http://www.giz-cpmf.org/tl_files/pdf/Brochure_AbEF_Maroc.pdf.

SHEET 6

EXAMPLE OF ADAPTATION STRATEGY BASED ON FOREST ECOSYSTEMS IN TUNISIA

PILOT SITE OF THE BARBARA WATERSHED

Presentation of the pilot site

Geography

- Location: Khroumirie region, in the North-West end of Tunisia
- Watershed characteristics: water wells, it has one of the main dams in the region. Basin particularly vulnerable to climate change
- The forested area is 5 772 ha, covering 35% of the watershed.

Climate

The pilot site is located in the humid bioclimatic stage, with cool winters. Climate change scenarios predict a raise of temperatures and a slight decrease of precipitation resulting in increasing probabilities of drought.

Ecology

There are mainly natural cork oak forests and *maquis*. Ecosystems are characterized by certain fragility to water erosion, gullying and landslides.

Goods and services

The cumulative goods and services provided by the forest ecosystems in the Barbara watershed represent 1.89 million DT per year (*i.e.* approximately 900 000 €). The goods and services benefit many local rural populations: job creation potential, water and soil conservation; and at general international interest: carbon sequestration, biodiversity conservation. Five percent of the total economic value generated by the forest sector in Tunisia is provided by wood and cork industries.

Main threats to the pilot site and their impacts

Site vulnerability to change is threefold:

- *Environmental threats and impacts.* Given the fragility of the soil and the vulnerability of the site to erosion, climate change could decrease soil fertility, which is a severe problem in this region. This increased fragility is also a problem for the stability of infrastructures such as the dam. The negative impacts to look for on the cork oak population are diebacks, new or greater pest attacks, increased risk of forest fires, and expansion of invasive species such as the silverleaf nightshade (*Solanum elaeagnifolium*)
- *Economic threats and impacts*. The expected loss of agricultural land will have impacts on economic incomes. The cost attributed to the degradation of ecosystems is very high (143 000 DT/yr, *i.e.* 67 500 €/yr corresponding to 7.5% of incomes generated by the goods and services)
- *Social threats and impacts.* The economic impacts are directly transferred to the population level, which could put serious stress on local communities which are particularly vulnerable because they are dependent on silvo-pastoral resources.

Strategies

- Reinforce the adaptive capacity of forests by integrating climate change adaptation into sustainable forest management strategies
- Integrate forests and their goods and services into development programmes and policies in order to promote the role of forests in sustainable management and, more specifically, in climate change adaptation of lands and their populations, according to the forest ecosystem-based adaptation approach.

Sectoral measures of adaptation strategy based on the forest ecosystems	
Sector / area	**Measures**
Establishment of agroforest plantations	Increase in forest cover Revegetation of gullies Establishment of agroforest plantations
Tourism and environment	Investments in NWFP value chains, by supporting the creation of micro-enterprises of valuation and marketing of NWFP Support crafts based on heather stems, wicker, alder, strawberry tree, clay, etc. Design of a regional label based on the key products of the region Promotion of ecotourism in forested areas
Agriculture and livestock	Promoting the implementation of new micro-projects (snails, beekeeping, etc.) Support crafts based on heather stems, wicker, alder, strawberry tree, clay, etc. Agroforest plantation and intensification of fodder crops Technology transfer (e.g. mushroom cultivation)
Intersectoral measures to strengthen the general adaptation strategy	
Strengthening the network of monitoring and protection against forest fires and application of new fighting techniques (*e.g.* prescribed fire)	
Adaptation of silviculture taking into account the vulnerability to climate change	
Fight against pests and insects and invasive species	
Improving research on cork oak decline and rejuvenation of old stands	
Improvement of rangeland management, improvement of livestock and practice of intensive farming, rehabilitation and enhancement of permanent grasslands	
Implementation of innovative financing mechanisms for ecosystem conservation (*e.g.* compensation for grazing exclusion)	

Possible financing opportunities to be considered

- Tunisia is a country not listed in the Annex I of the UNFCCC, REDD+ financing is possible for mitigation and the promotion of cobenefits.
- Important fund raising potential from cork oak for adaptation and mitigation initiatives: based on services provided (cork production, NWFP, soil erosion and water quality control, etc.) and economic potential (local employment generation). Opportunities to search in the voluntary markets, payment for ecosystem services and funds for adaptation.

Sources: this sheet is derived from the activities carried out in the framework of the regional project GIZ-CPMF www.giz-cpmf.org. For further information: http://www.giz-cpmf.org/tl_files/pdf/Brochure_AbEF_Tunisie.pdf.

SHEET 7

EXAMPLE OF STRATEGY BASED ON THE MITIGATION POTENTIAL IN LEBANON

PILOT SITE OF JABAL MOUSSA BIOSPHERE RESERVE

Presentation of the site

Geography

The Jabal Moussa Biosphere Reserve (UNESCO) is located in the Kerserwan-Jbeil region in Lebanon. It covers 6 500 ha and it extends across altitudes ranging from 350 to 1 600 m a.s.l. Its forest has been designated as a national conservation since 2008.

Climate

The topography of the site attracts precipitation (1 350 mm/yr average). The average maximum temperature is 26.5°C in summer and the average minimum temperature is 3.5°C in winter.

Ecologie

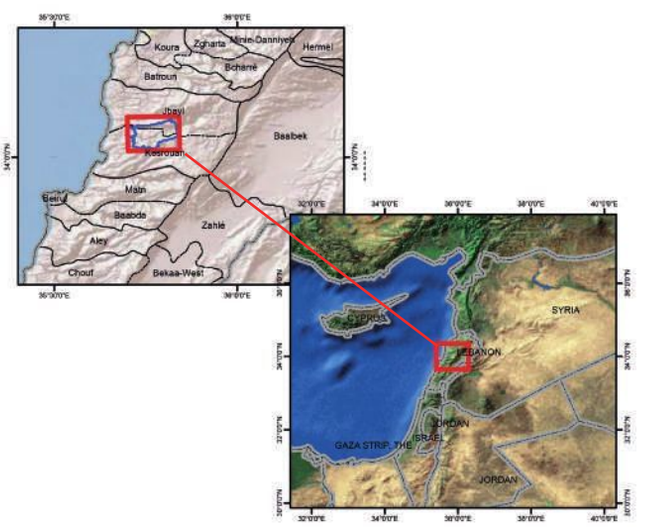
The vegetation of the site consists of sclerophyllous forests and scrublands. Populations of the species *Quercus cerris* and J*uniperus drupacea* are declining due to the effects of climate change.

Management objectives

The reserve is divided into three areas, each with different objectives: the core area (research and conservation), the buffer area (integrated conservation and sustainable ecological and socio-cultural practices) and the transition area (socio-economic development ensuring environmental protection).

Goods and services

Due to restricted practices in the core area, some goods and services are only exploitable in the transition or buffer areas (firewood, grazing, agriculture, etc.).

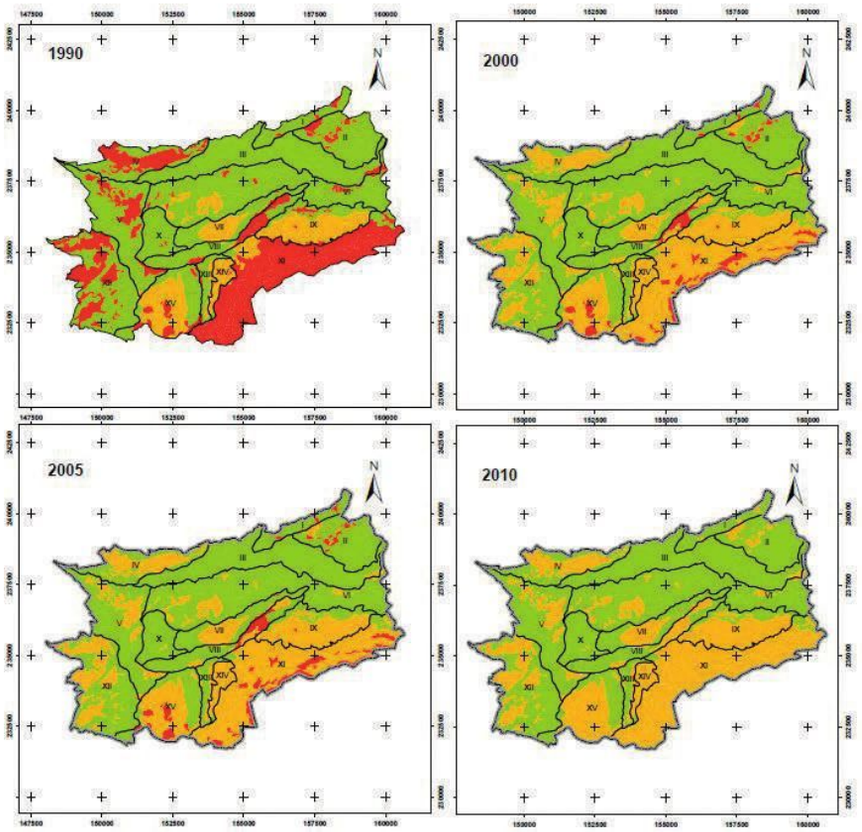


Vulnerability of the pilot site and specific drivers			
Origin	**Anthropic**	**Climatic**	**Biophysic**
Vulnerability factors	grazing	increase of extreme events	increased soil erosion in deforested areas, impacting water quality
	abusive and unregulated firewood harvesting	hotter and drier summers	

Recommendations

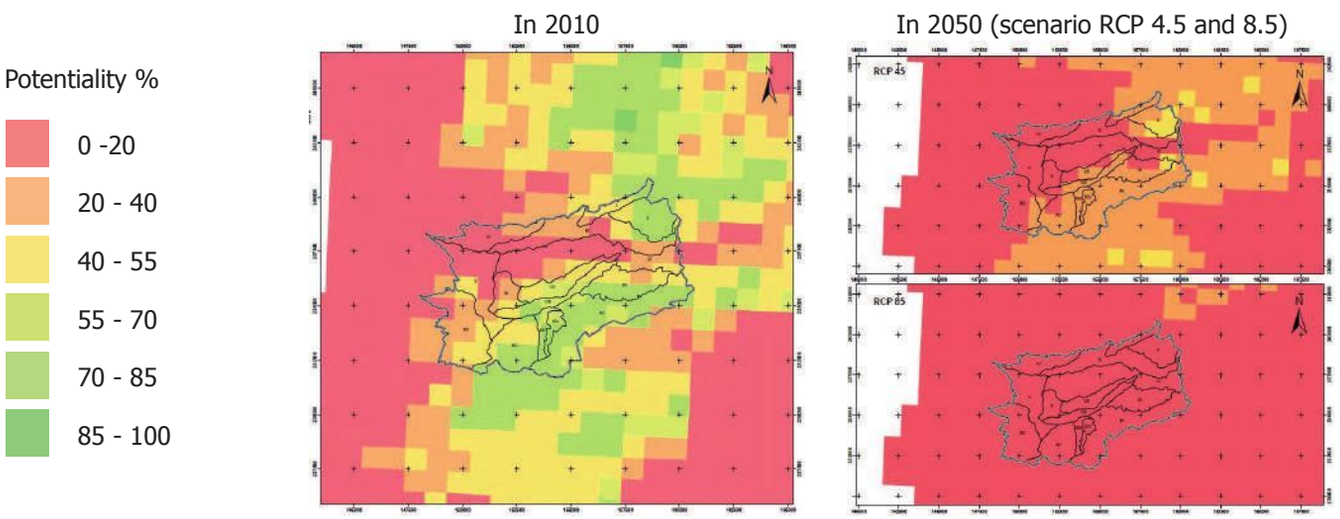
- Use adaptive silviculture taking into account the distribution of species and ecological capacities
- Improve the health of stands by planned intervention
- Promote *in situ* and *ex situ* conservation of threatened species
- Reinforce the resilience and adaptive capacity of the forests by promoting specific biodiversity (promoting the use of key species)
- Take measures to prevent fires, especially in units with steep slopes, maintaining stands at low densities, grazing in areas with shrubs susceptible to fires
- Control overgrazing
- Consider the socio-economic expectations of local populations: plan grazing access in buffer and transition areas (identify suitable areas and plan a sustainable rotation).

Historical evolution of forest cover



Evolution of vulnerability in the pilot site from 2010 to 2050

Possible distribution of *Quercus cerris*



→ Need to tailor management for adaptation of species to climate change

Perspectives

- Promotion of vulnerability assessments to other pilot sites
- Promotion of regular capacity building for assessing general and targeted vulnerability.

For further information: this sheet is derived from a study carried out in the of the project "Maximize the production of goods and services of Mediterranean forest ecosystems in the context of global changes" funded by the French Global Environmental Facility and coordinated by FAO-Silva Mediterranea and Plan Bleu.

SHEET 8

EXAMPLE OF STRATEGY BASED ON THE MITIGATION POTENTIAL IN MOROCCO

PILOT SITE OF THE MAÂMORA FOREST

Presentation of the site

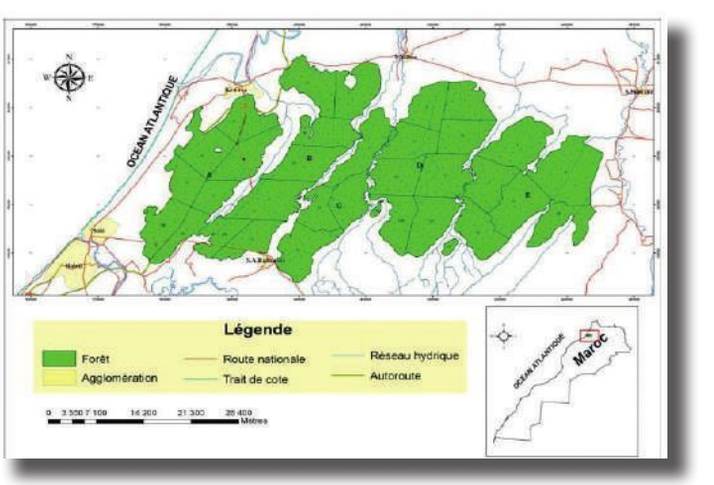
Identification
The pilot site is a forest (Maâmora) in federal legal status, surrounded by collective and private land. Collective lands have forestry (artificial plantation), pastoral or agriculture purposes. Private lands have primarily agricultural vocation.

Geography
Maâmora forest is around 132 000 ha and is located in Northwest Morocco, between Salé and Kénitra on the Atlantic coast.

Climate
The bioclimate is of the Atlantic Mediterranean type, from hot sub-humid to temperate semi-arid, with hot summers and mild winters. Precipitation is irregular, more or less depending on the geographical region, and interannual irregularities. It presents a continental gradient that grows from West to East.

Ecology and forest management
The forest is essentially a lowland cork oak (*Quercus suber*) landscape with species introduced by planting broadleaf species (*Eucalyptus* sp. and *Acacia* sp.) and conifers (*Pinus* sp.). The cork oak stands currently occupy about 50% of the total area of the forest. These stands have scattered Maâmora pear trees (*Pyrus mamorensis* L.), which is an endemic species of the region. The shrub vegetation is rich in ecological diversity, characteristic of Atlantic cork oak forests. The forest management is implemented according to a management plan whose main objectives are the preservation, rejuvenation and sustainability of the cork oak.

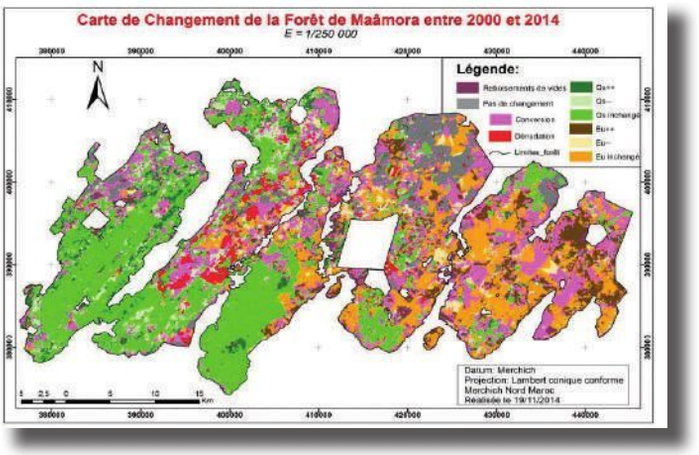
Social, economic and environmental importance
The cork oak landscape is multifunctional and its management objectives take into account social, environmental and economic factors: general utility functions (soil and water protection, conservation of biodiversity, recreation, etc.) and production. The cork industry generates 161 250 working days/yr. and 60 000 stere/an, the wood industry 370 000 m^3, woodfuel 160 000 stere/an and non-wood forest products are varied (beekeeping, truffles, fodder crops, etc.).



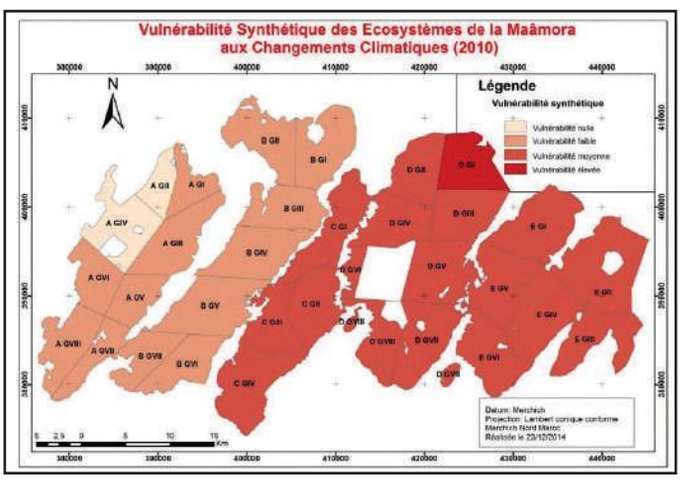
Vulnerability of pilot site and specific drivers				
Origin	**Anthropogenic**	**Climatic**	**Silvicultural**	**Biophysical**
Vulnerability factors	grazing pressure population density illegal activities (timber and NWFP extraction, fires)	water deficit pest attacks	age and health status of populations	type of soil

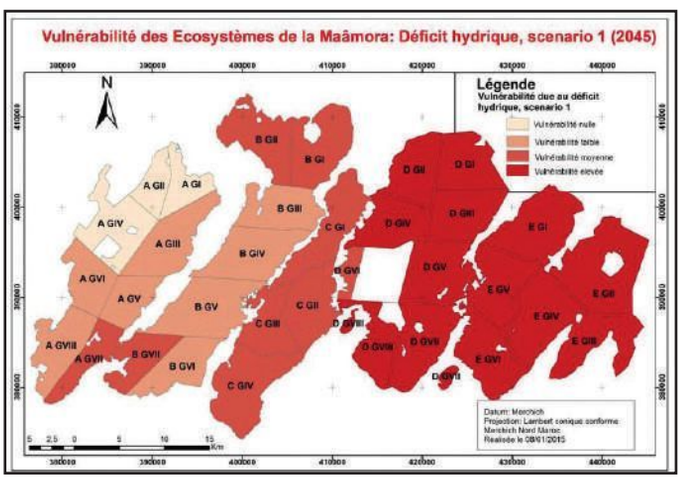
Historic land use change

The previous management plans for the site led to a strong conversion of the cork oak population into Eucalyptus, registering a loss of 20 000 ha between 1972 and 1992 *(i.e.* 1 000 ha/yr.). The subsequent forest policy in the pilot site has allowed for a reversal of this trend towards the reconstitution of the autochthonous species during the period 1992-2011 at the expense of artificially introduced ones (at a rate of 200 ha/yr on average). However, the trend scenario of forest management foresees an accentuation of degradation of forest heritage in the next 20 years, as well as recurrent ecological and social problems despite the management efforts.



Evolution of vulnerability in the pilot site from 2010 to 2045 (optimistic scenario)





Guidance provided by the management plan 2015-2034

- Preservation and acceleration of the rejuvenation of the old cork oak forests through artificial regeneration (acorns/ seedlings)
- Enhancement of the quality of cork obtained from young cork oak plantations
- Improvement of forage production to reduce the pressure on forests
- Preservation, improvement and valuing biodiversity
- Implementation of local activities on most profitable forest sectors
- Promotion of income-generating activities to improve livelihoods
- Improvement of infrastructures for public reception at recreational sites.

Recommendations

- Promotion of collaborative and participatory management, empowering different actors
- Promotion of pastoral improvement actions in marginal forest lands
- Intensification of the livestock production with higher rates of return
- Development of alternative energy sources (dissemination of improved stoves, promote village plantations, etc.)
- Promotion of new incentives for the intervention of the private sector in reforestation programs.

For further information: this sheet is derived from a study carried out in the of the project "Maximize the production of goods and services of Mediterranean forest ecosystems in the context of global changes" funded by the French Global Environmental Facility and coordinated by FAO-Silva Mediterranea and Plan Bleu.

SHEET 9

EXAMPLE OF STRATEGY BASED ON THE MITIGATION POTENTIAL IN TUNISIA

PILOT SITE OF THE SILIANA WATERSHED

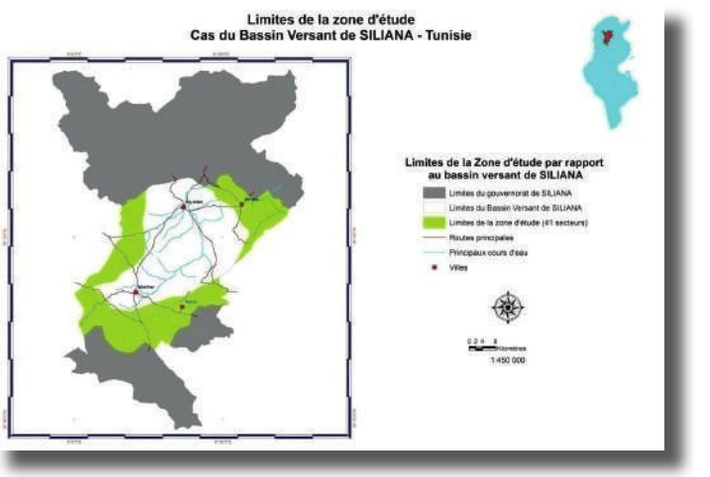
Presentation of the pilot site

Geography

The site includes the Oued Siliana watershed as well as managed forest units and adjacent forests, covering 191 500 ha.

Climate

The bioclimate of the region is semi-arid with phenomena of recurrent droughts. Climatic evolutions foresee an increase in temperatures up to 2.5°C and a decrease in rainfall up to -25% in 2046-2065 compared to the current period.

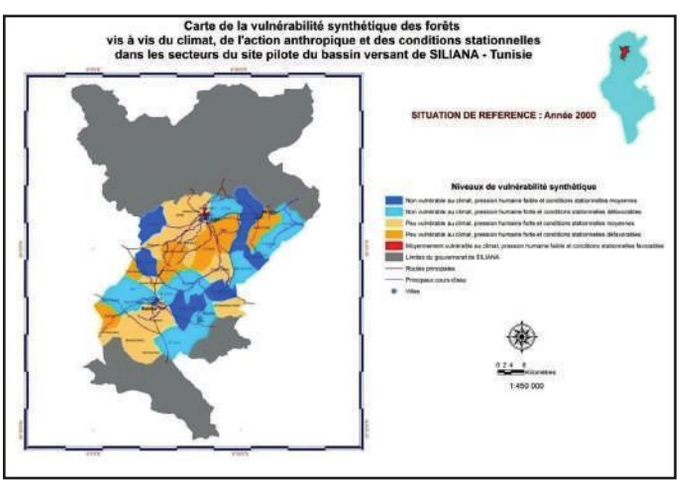


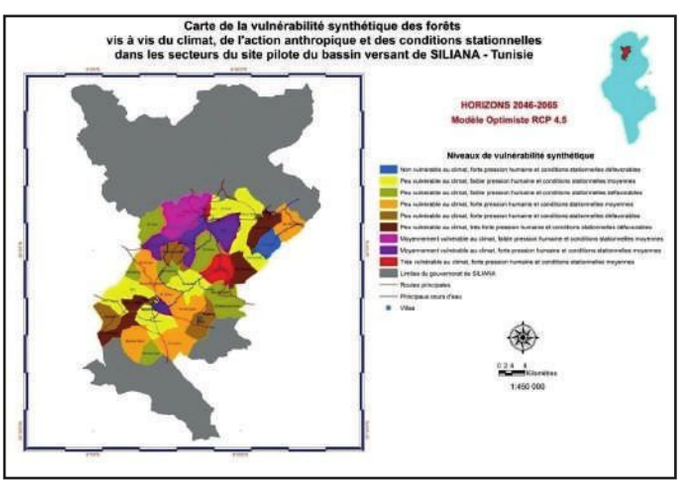
Ecology

The pilot site is covered by 66 000 ha of forests, composed in equal parts by Aleppo pine and various broadleaf species. Most of the forests in the study area have canopy density of 25-50% or higher than 75%.

Vulnerability of pilot site and specific drivers				
Origin	**Anthropic**	**Climatic**	**Silvicultural**	**Biophysical**
Vulnerability factors	grazing pressure pressure on woodfuel fires illegal cutting and clearing	water deficit	forest dynamics	edaphic stress

Evolution of vulnerability in the pilot site from 2010 to 2045 (optimistic scenario)





It is necessary to sustainably manage forests in order to (i) address the current human pressures and (ii) anticipate future changes taking into account the vulnerability of the site

Context and funding of forest management

- Proposal for the implementation of a forestry pilot project on mitigation of climate change in the context of a NAMA (2014) aiming at reducing deforestation and degradation, increasing the forest area and establishing a buffer zone (5 km around the forest domain) for activities that meet local needs
- Submission of REDD+ projects for activities that generate multiple benefits.

Activities and orientations

- Afforestation and enrichment planting: plantations to meet the demand of woodfuel (conifers), agroforestry systems with fruit trees, silvo-pastoral systems, restoration of degraded lands
- Grazing exclusion in sensitive areas to ensure assisted natural regeneration
- Improvement of energy efficiency (improved stoves)
- Promotion and development of NWFP value chain: Aleppo pine seeds and cones (human consumption and energy), rosemary (cosmetic use), carob (cooking, pharmacopeia)
- Improvement of productivity and intensification of livestock.

Recommendations and implementation strategies

- Raising the awareness of local populations about upstream projects and activities
- Maximizing the participation of local actors in the decision-making process (e.g. choice of fruit trees for agroforestry systems) and management (herding practices related to the exclusion of grazing, maintenance of plantations, etc.)
- Activities supervised by the forest administration (included in management plans)
- Soil tillage before reforestation activities
- Implementation of a monitoring process.

For further information: this sheet is derived from a study carried out in the of the project "Maximize the production of goods and services of Mediterranean forest ecosystems in the context of global changes" funded by the French Global Environmental Facility and coordinated by FAO-Silva Mediterranea and Plan Bleu and from a Project Idea Note carried out by ONF International.

SHEET 10

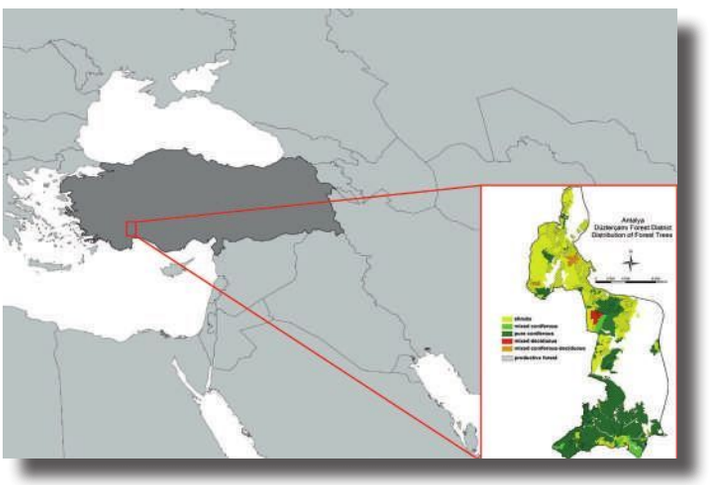
EXAMPLE OF STRATEGY BASED ON THE MITIGATION POTENTIAL IN TURKEY

PILOT SITE OF DUZLERÇAMI FOREST

Presentation of the pilot site

Geography
The pilot site is located in the Antalya region southwest Turkey.

Climate
The climate is of the subtropical Mediterranean type with hot, dry summers; mild, humid winters; and high inter-seasonal variability. Temperatures are expected to show an increase of 0.5 to 4°C in Turkey between 2020 and 2050 compared to the 1970-2000 period. The seasons are predicted to be more severe and precipitation to decline by 0.4 to 1.2 mm/day average.



Ecology

The area is 29 000 ha. 17 500 ha out of that total is covered in forests (22% of which are considered degraded), mostly consisting of maquis, where the oak *(Quercus* sp.*)* is the main species.

Context
The Duzlerçami forest is a state forest with a management plan for the period 2011-2021. The project presented for the pilot site aims to increase the mitigation potential of climate change and is in line with the national strategy, which provides for the implementation of NAMAs. Forest management is mainly focused on two areas: production (timber and firewood) and protection (especially regarding soils). Historically the site was used for both forestry and agricultural purposes.

Vulnerability and current and future threats	
Anthropogenic pressures	Constant increase of the local population density
	Lack of regulation of urban expansion
	Increase of the activities causing degradation (hunting, recreation and tourism, overgrazing, etc.)
	Illegal logging
Environmental threats	Forest fires
	Diseases and pests outbreaks

It is necessary to tailor forest management to (i) meet current human pressures and (ii) anticipate future changes taking into account the vulnerability of the site

Management objectives

- Afforestation and reduction of degradation
- Conservation and enhancement of biodiversity
- Development of wood and NWFP value chains
- Sustainable development of recreational services and tourism.

Recommendations and activities to be implemented

- Sustainable forest management aiming at increasing forest cover
- Afforestation/reforestation of indicated zones with *Pinus brutia* or other native species
- Restoration of degraded lands with native species
- Protection of sensitive areas, particularly regarding grazing by periodic grazing exclusions
- Management and planning of grazing
- Strengthening the fight against fires
- Planning recreational activities
- Planning urban development
- Development of the NWFP value chain.

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SHEET 11

EXAMPLE OF STRATEGY BASED ON THE MITIGATION POTENTIAL IN ALGERIA

PILOT SITE OF SENALBA

Presentation of the pilot site

Geography

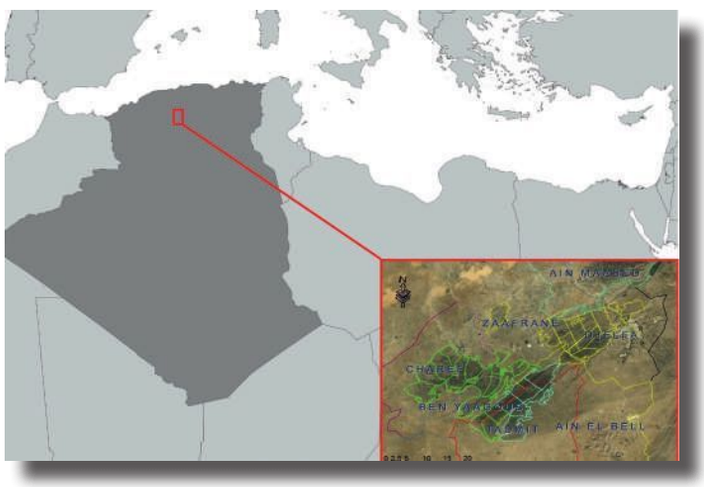
The Senalba forest is located in the wilaya of Djelfa, 350 km south of the capital Algiers in the Ouled Nail Mountains, in a semi-arid area characterised by cold, harsh winters and hot, dry summers. The pilot site of Senalba encompasses the forest areas of Senalba Chergui and Senalba Gharbi, which are under the authority of the Directorate General of Forests of Algeria.The geographic location of the area, considered as the gate of the Sahara, is strategic in the region for the fight against desertification and soil protection against wind erosion.

Ecology

The Senalba forest is composed mainly of *Pinus halepensis* with an average coverage of 50-60%. Stands are uneven-aged but currently young plants and regeneration are still lacking due to pastoral pressures and browsing. Historical reforestation actions compensate for this lack.

Management of the Senalba forest

The Senalba forest is been managed based on a management plan established in 1984 for a period of 20 years. The programme consisted of the exploitation of 25 000 m^3 of wood per yr, the restoration of 19 859 ha of degraded areas, reforestation after cuttings of 600 ha/yr, the construction of 93 km of forest roads and the opening of 130 km of new roads, silvicultural works to improve young stands and improvement of the management of pastoral resources for local populations.



Vulnerability of pilot site and specific degrading agents

The main agents of degradation and factors generating vulnerability in the site are overgrazing, water deficit and the ageing of populations. The site is slightly vulnerable to fires, since there is little understorey vegetation. The discontinuous tree layer (open forest) also gives it a good resistance to pest attacks. Only the pathogen *Thaumetopoea pityocampa* (pine processionary) represents a risk for pine stands.

Recommendations and mitigation potential of the Senalba forest

- Conservation of the forest with low density stands in order to promote forest resilience (forest management that take into account the impacts of climate change)
- Pasture rotation and control of overgrazing (temporary grazing exclusions), fence to protect young plantations
- Favouring regeneration (seedling recruitment – nurseries – and trees growth monitoring)
- Exclusion areas to test the resistance to pathogens, introduction of biological control agents if necessary
- Establishment of livestock systems to reduce pressure on the forest
- Planning and management programme: implementation of actions for a better knowledge of the forest ecosystem and its dynamics and better monitoring of management and its evolution.

Source: based on the report carried out by CTFC (Centre Tecnologic Forestal de Catalunya) and on the final report of the project "Maximize the production of goods and services of Mediterranean forest ecosystems in the context of global changes" funded by the French Global Environmental Facility and coordinated by FAO-Silva Mediterranea and Plan Bleu.

SHEET 12

NEW PERSPECTIVES FOR CLIMATE FINANCING INSTRUMENTS IN MEDITERRANEAN LANDSCAPES

Mediterranean forests are clearly part of the global effort to combat the impacts of climate change. They have been considered both in the context of adaptation measures, such as restoration of degraded landscapes, fire prevention and post-disturbance management, managing invasive species and diseases and for their potential for climate change mitigation through reforestation, afforestation, avoided deforestation and degradation initiatives.

Mitigation and adaptation are two fundamentally dissimilar approaches to climate change but they share some common features such as sustainable development, that is a common target. Exploring links between adaptation and mitigation can help understand their trade-offs and synergies and therefore implementing projects funded on integrating adaptation into mitigation projects or mitigation into adaptation projects.

Mediterranean forests are unique, dry ecosystems that provide valuable goods and services which are important for adaptation and resilience, but are characterized by relatively low carbon sequestration potential. Therefore cobenefits represent the new level beyond carbon to focus on, in order to access new opportunities for integrating adaptation–mitigation linkages into forest or climate change policies and access new financing instruments.

Mitigation needs adaptation...

Adaptation can contribute to the carbon storage and mitigation benefits by increasing project sustainability. In addition, it can maximize the cobenefits of mitigation projects and increase capacity to cope with the risks related to climate change.

...and adaptation needs mitigation

Positive results of adaptation initiatives (*e.g.* forest conservation) can integrate mitigation objectives in projects. It can facilitate access to financial instruments usually addressed to carbon funding (*e.g.* REDD+).

The importance of cobenefits and linking mitigation and adaptation was highlighted during the IV Mediterranean Forests Week (Barcelona, 17-21 March 2015) where several donors and partners confirmed that development of the Mediterranean region is a key priority for their respective organizations and expressed keen interest in more integrated approaches in the forest sector (France, The European Union, and The Centre for Mediterranean Integration which includes members such as the World Bank, the French Agency for Development, and the European Investment Bank). Existing opportunities presented by financing mechanisms to support the sustainable management of Mediterranean forests were also confirmed but a need to explore additional and new funding opportunities was also highlighted.

For more information please kindly see Forêt Méditerranéenne special issue on the IV Mediterranean Forest Week.

FAO - Silva Mediterranea

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