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ECOSYSTEM VULNERABILITY ANALYSIS (EVA) AND ITS ECONOMIC IMPACT

The case of the CORK OAK ECOSYSTEM, TUNISIA

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Projet
Appui à la mise en œuvre de la Convention Cadre des Nations Unies sur le Changement Climatique

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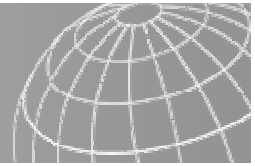

Outline

Introduction

Methodological approach

- Selection of the study areas
- Methodological framework for EVA
- Selection of Climate change scenarios
- Assessment of biophysical impacts
- Assessment of socio-economic impacts

Results

- Biophysical impacts
- Economic impacts

Conclusion

Main challenges

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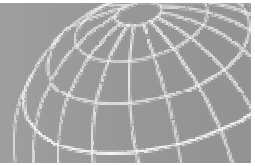


Introduction

- Need to understand climate change risks
- Effects on ecosystem functions and risks
- Effects on national economy and human welfare

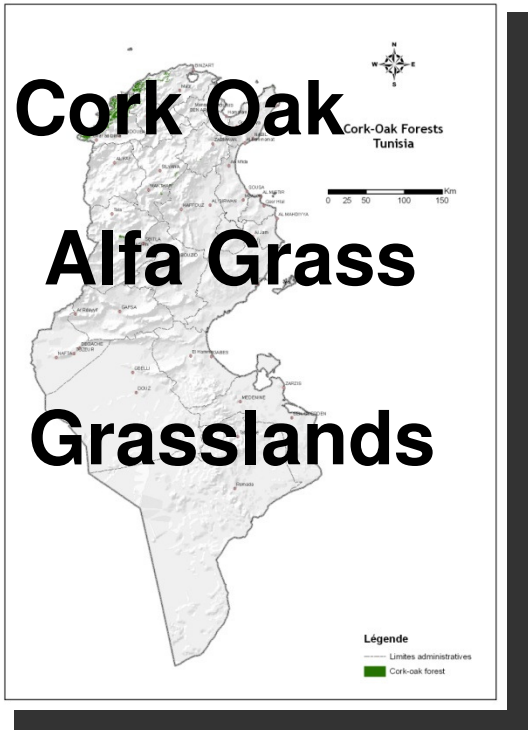
Objective : Assess the economic losses incurred by the impact of climate change in Tunisian ecosystems

- Three main ecosystems in different climate areas

North : **800 to 1000 mm / year**

Centre : **375 mm**

Medenine : **160 mm**



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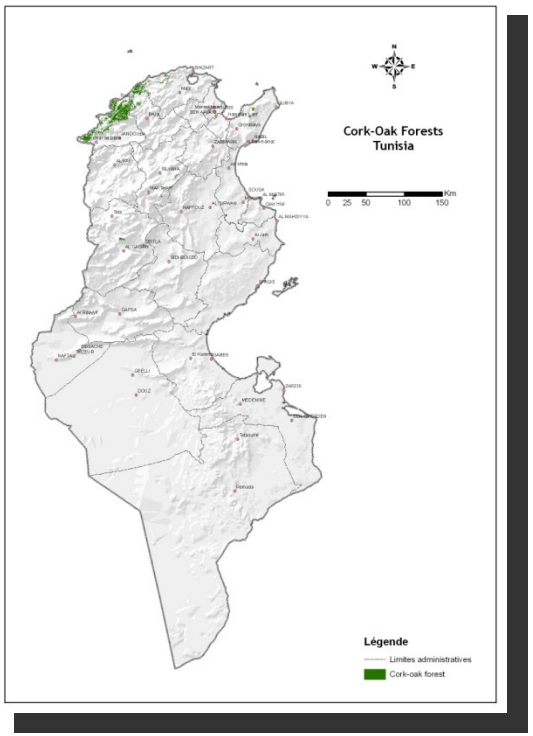
Cork Oak Ecosystem

Location : Northwest of Tunisia
Area : 90.000 Ha

Production : 7000 tons of cork
Employment : 3.000 Seasonal workers for cork harvesting and 500 for cork industry



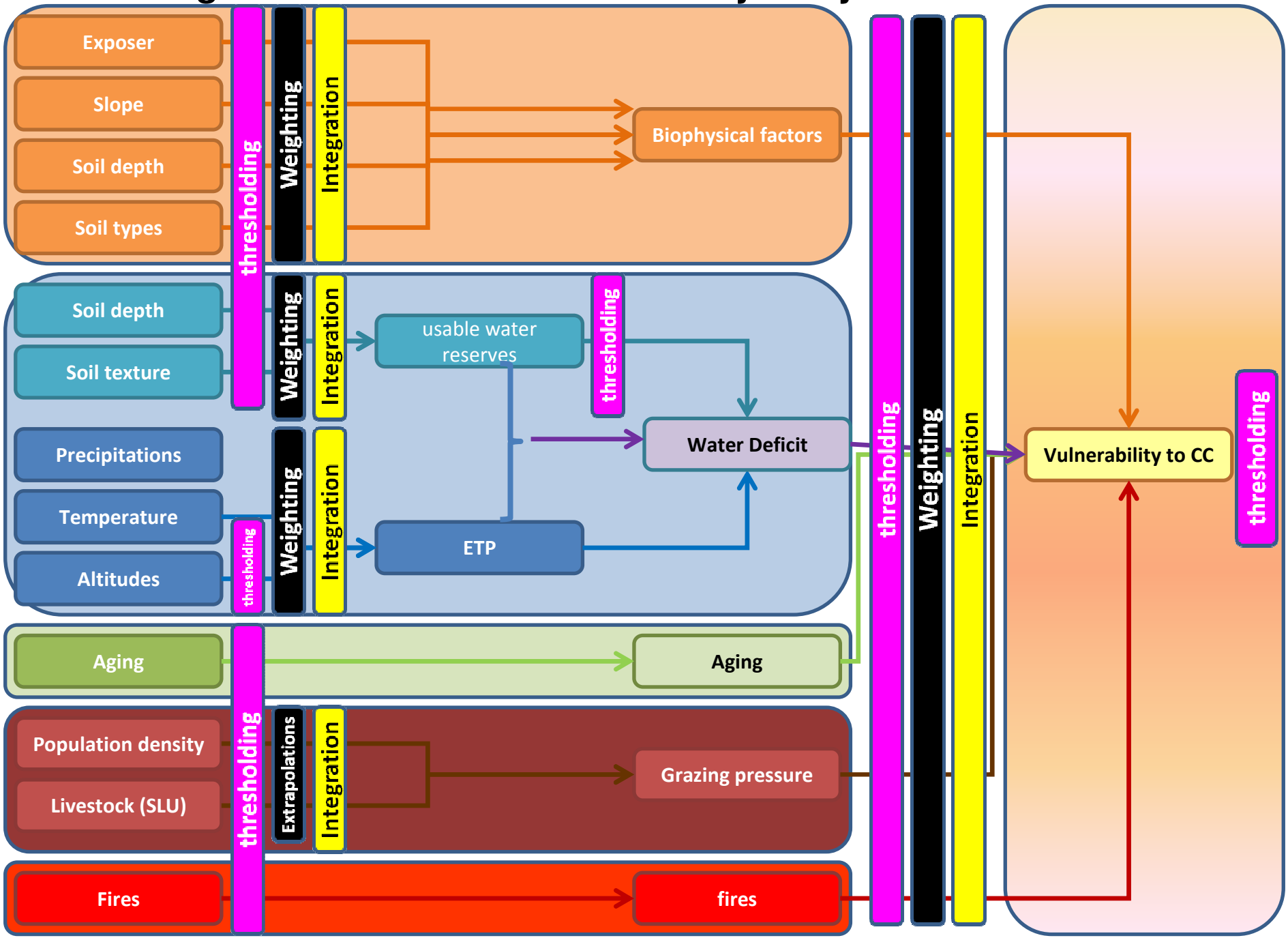
Methodological approach

- Research - Development partnership

Vulnerability analysis

I. Global analysis of major national Tunisian ecosystems **(Ecological Niche Modeling)**
II. In depth analysis of the vulnerability of **three** selected ecosystems
(Multi-Factor spatial analysis-GIS)

Methodological framework for vulnerability analysis



Risk assessment and appraisal of potential loss of cork oak forest caused by CC

- Research about impacts of serious droughts on oak forests: 1987-1990
  - According forest estimations: ~ 90 000 trees died (corresponding ~300 ha) in oak forests of Ain Draham and El Feija
- Hypothesis: Similar events in the future will cause the same effects (damages)
  - Similar stress in the future (extended raised temperature and extended reduced precipitation) will cause a forest decline

Assessment of ecosystems' goods and services and potential loss caused by CC

1. Identification of goods and services
   - Adapted approach of the *Millenium Ecosystem Assessment* using 4 categories of goods and services :
     1. **Provisioning services**
     2. **Regulating services**
     3. **Cultural services**
     4. **Supporting services**
2. Assessment of economic value of goods and services in 2010 realizing an evaluation based on
     1. **Market prices**
     2. **Prices of substitution products**
     3. **Change in production**
3. Assessment of the economic value lost due to CC according to available data concerning loss of goods and services in 2020 and 2050 using different valuation methods

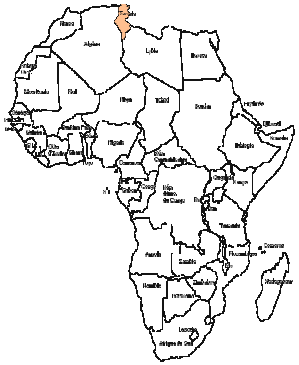
Data collection

1- Scale unit : Forest management unit

2- The reference data used are from:

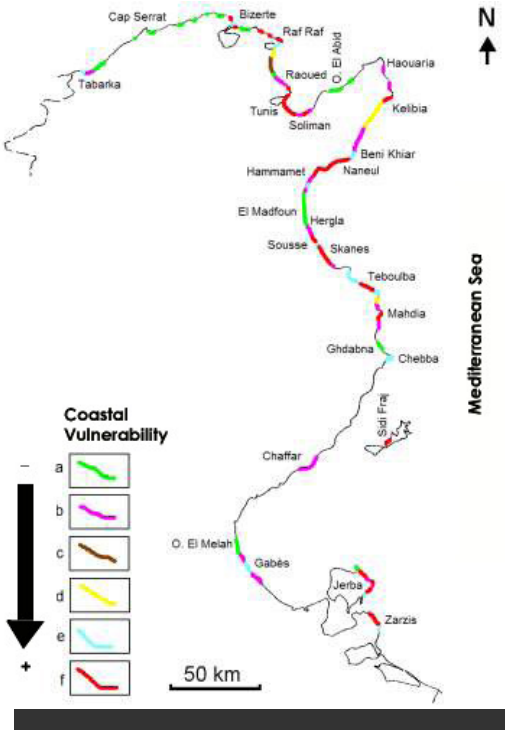
- Agricultural Database, 2001;
- National Forest Inventory and Pastoral Database, 2005 ;
- Agriculture Survey - Ministry of Agriculture, 2005 ;
- Projection of population - National Institute of Statistics, 2004 ;
- Projection of livestock - Office of Livestock and Grazing, 2011 ;
- Climate projections - HadCM3 - Scenarios A2 and B2.

Climate change in Tunisia



Tunisia :

- 164.000 Km²
- 1300 Km coast
- 10 Millions Inhab.
- Arid and semi-arid

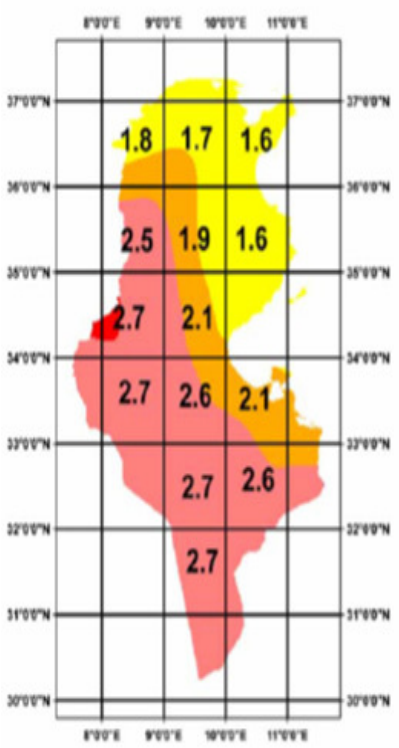


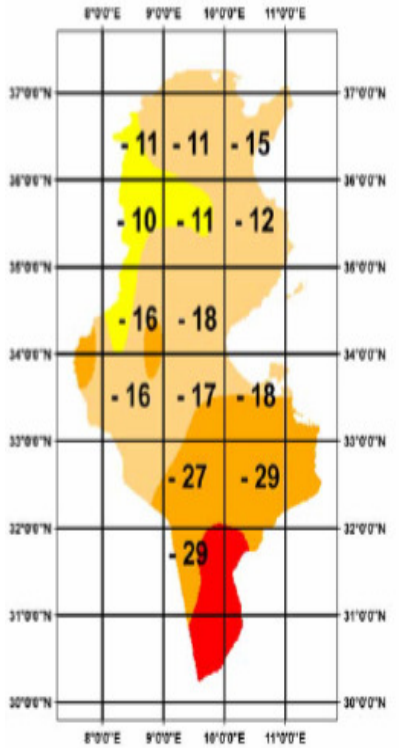
Vulnerability to sea level rise

Projections 2050

Temperature (°c) ↗

Precipitation (%) ↘





Increasing frecuency of extreme events (drought, floods)

CC scenarios

HADCM3 – Scenarios A2

2020 : Increase of temperature +1.2 ℃ & decrease of rainfall by 7%

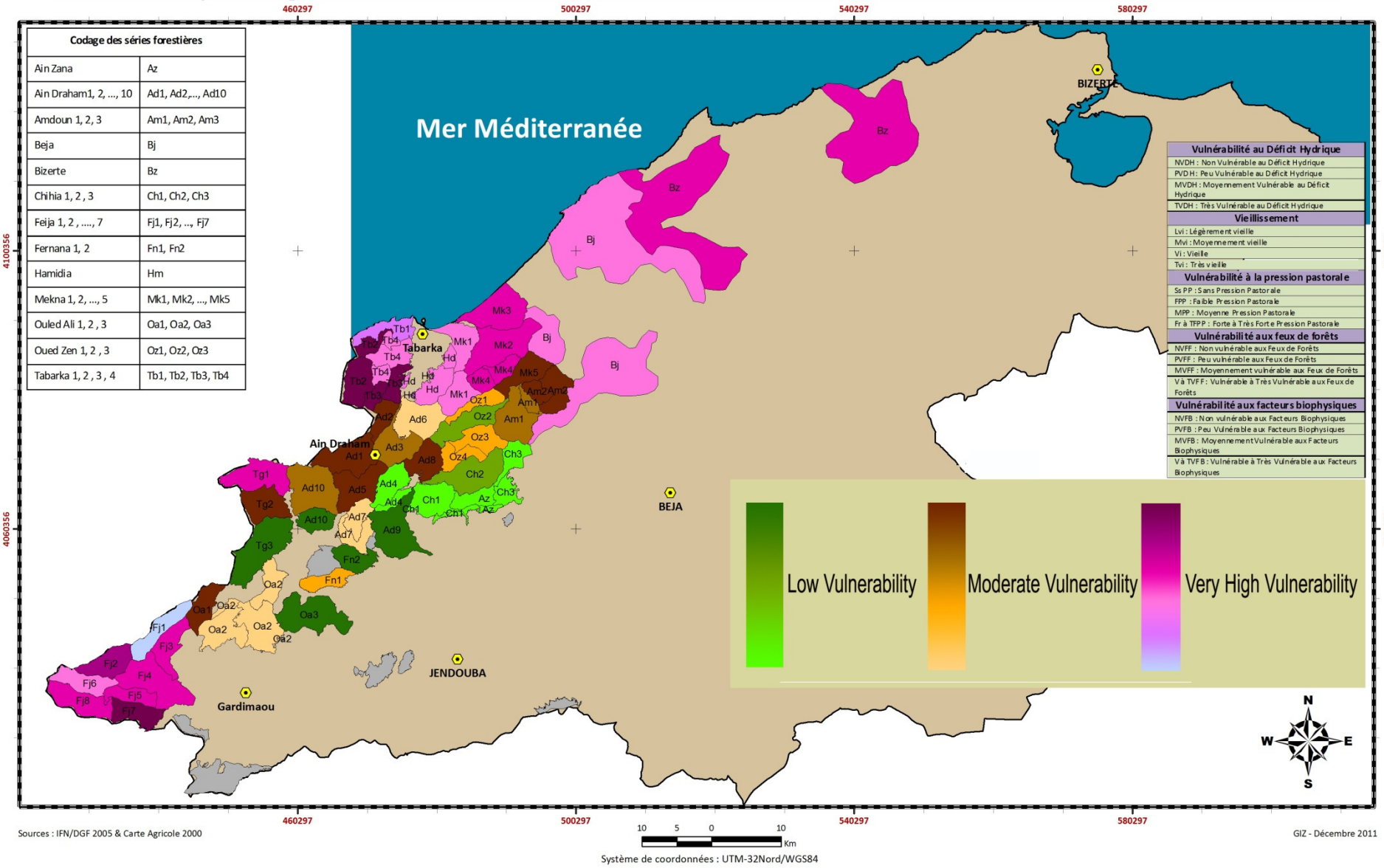
2050 : Increase of temperature +2.7 ℃ & decrease of rainfall by 16%

HADCM3 – Scenarios B2

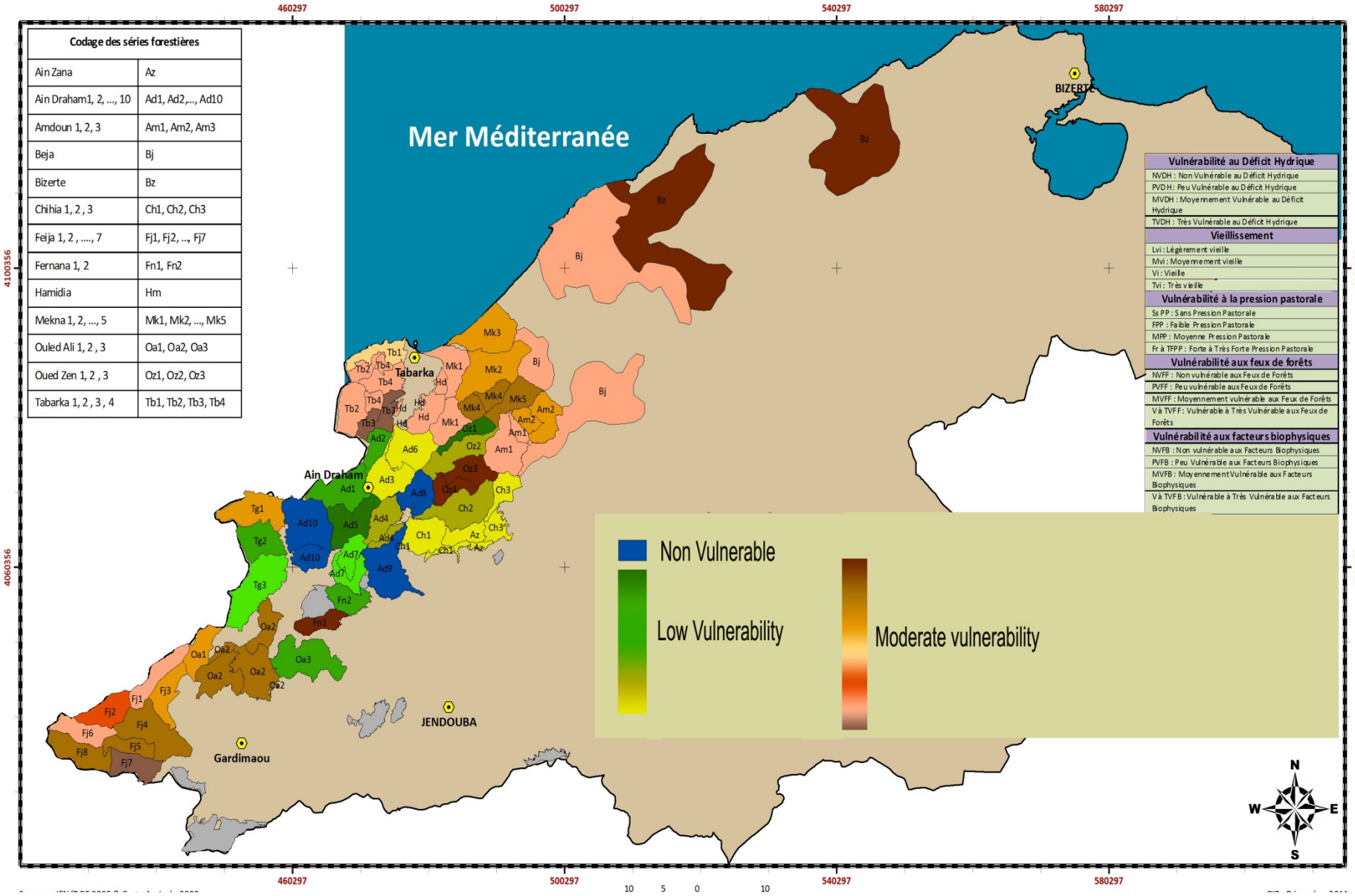
2020 : Increase of temperature +1.1 ℃ & decrease of rainfall by 4%

2050 : Increase of temperature +2.1 ℃ & decrease of rainfall by 10%

Vulnerability map (2050 – A2)



Vulnerability map (2050 – B2)



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Results

Risk assessment and appraisal of potential loss of oak forest caused by CC

- Scenario A2 (HadCM3) foresees 2 similar events to 1987-1990 : 2019-2028 and 2045-2050

Accidental situation in 1987-90 → **Normal situation in 2050**

No change in 2020
Loss in 2050 : ~ 18.500 ha (-20%) → A2
~ 1.200 ha (-1%) → B2

Results

1. Identification of actual goods and services of oak forests

Type of goods and services	Goods and services	Beneficiaries
·ovisioning services	Cork Mushrooms Myrtle Fire wood Hunting	Government
	Forage Acorns Firewood Snails Honey	Forest users
Regulating services	Water regulation Carbon sequestration	National Society Global Community
Cultural services	Recreation Landscape Cultures and traditions	Society

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Results

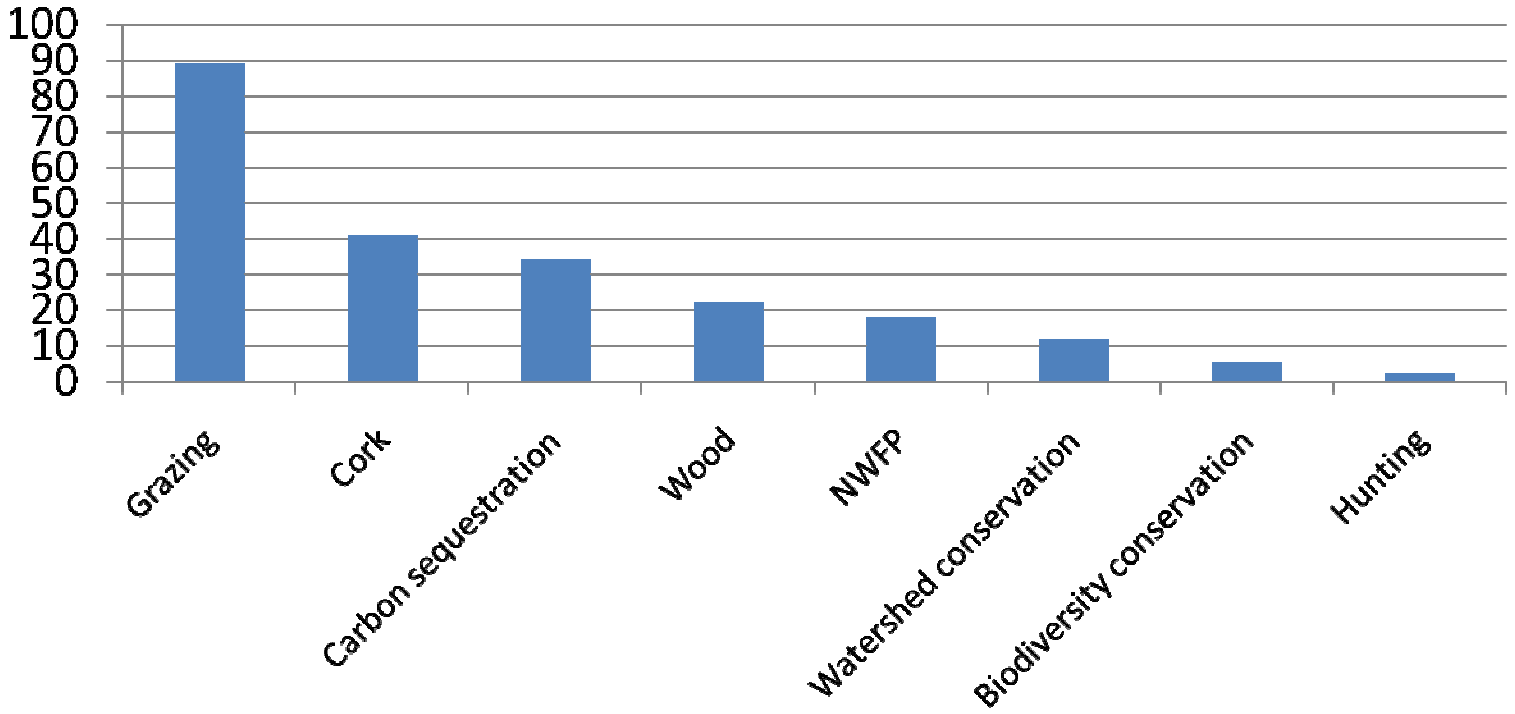
2. Assessment of economic value of goods and services - 2010

Goods and services	Approach/Methods	Value ($/ha)
Cork	Market price	40.9
Wood	Market price	22.1
mushrooms, snails, honey , myrtle, acorns	Market price	18.0
Forage resources,	Economic price of barley	88.9
Hunting	Value of game	2.1
Recreation	Methods of benefit transfer	0.1
Watershed conservation	Avoided loss of water for irrigation	12
Carbon sequestration	International market price	34.2
Biodiversity conservation	Costs of conservation measures	5.5

Results

2. Assessment of economic value of goods and services

Estimated value: ~$20 Million ($224/ha in 2010 in average)



Beneficiaries :

Local population (53%)

Global community (18%)

Government (24%)

Society (5%)

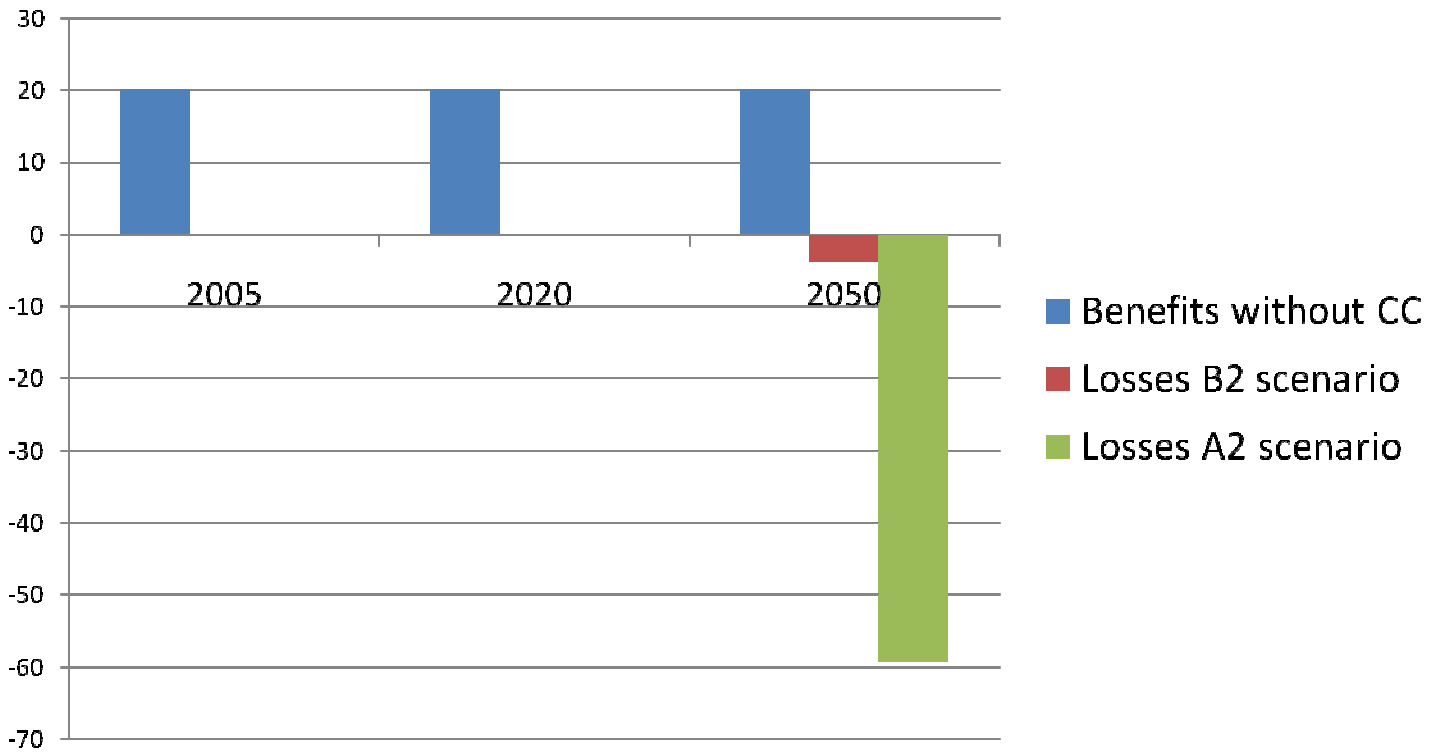
Results

3. Assessment of the economic value lost due to CC

Cork oak forest

2020 : no loss

2050 : ~ 18.500 ha → A2
~ 1.200 ha → B2



Results

3. Assessment of the economic value lost due to CC

Cork oak forest

2020 : No loss

2050 :	**~ 18.500 ha**	**→ A2**
	~ 1.200 ha	**→ B2**

Reduction for the period 2010-2050

Discount rate : 2%		
B2	0,3%	$ 2 million
A2	4.8%	$ 27 million

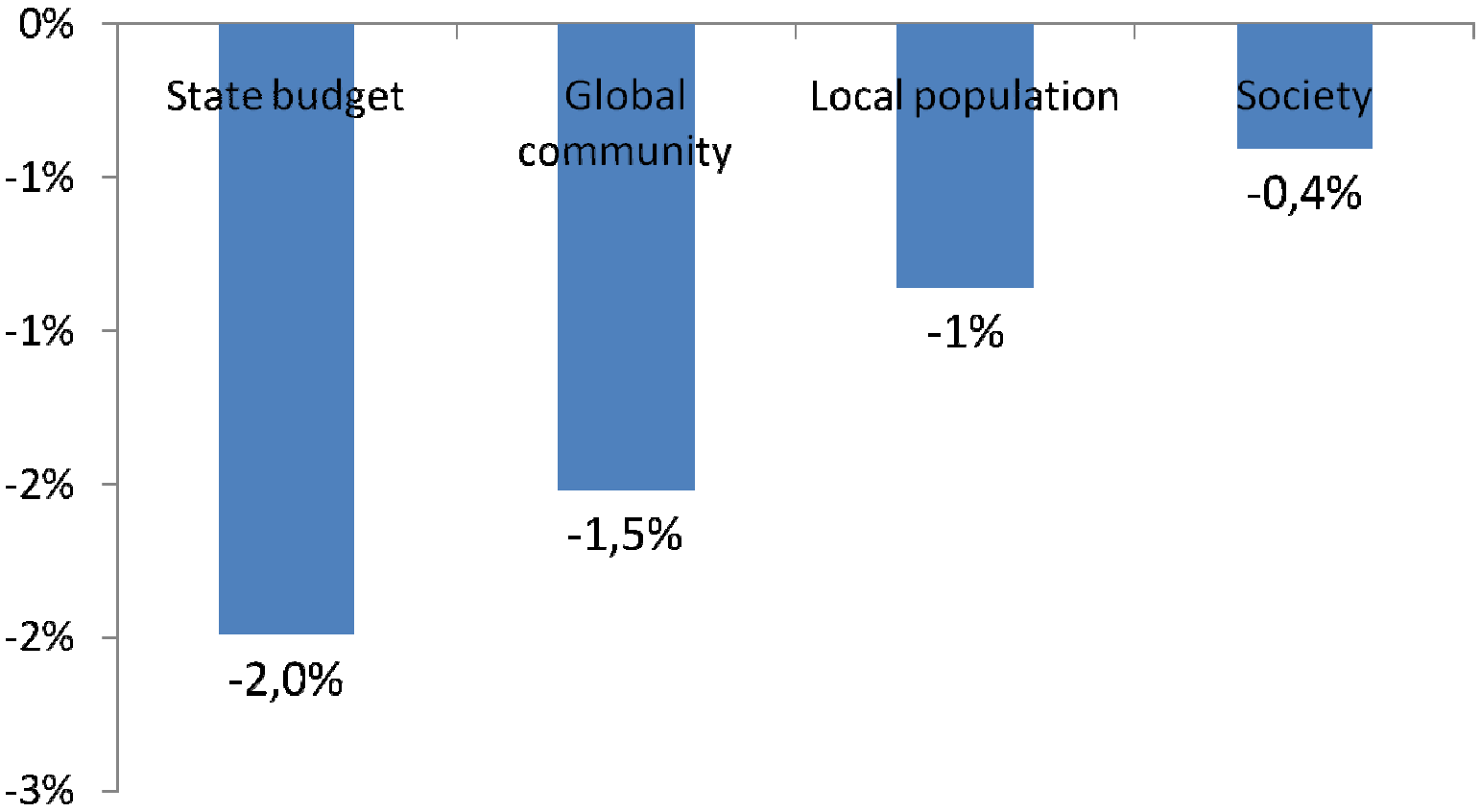
Distribution (in %) of lost values of goods and services :

Cork	**: 36%**
Wood	**: 17%**
Acorns	**: 11%**
Carbon emissions	**: 23%**
Water resources	**: 9%**

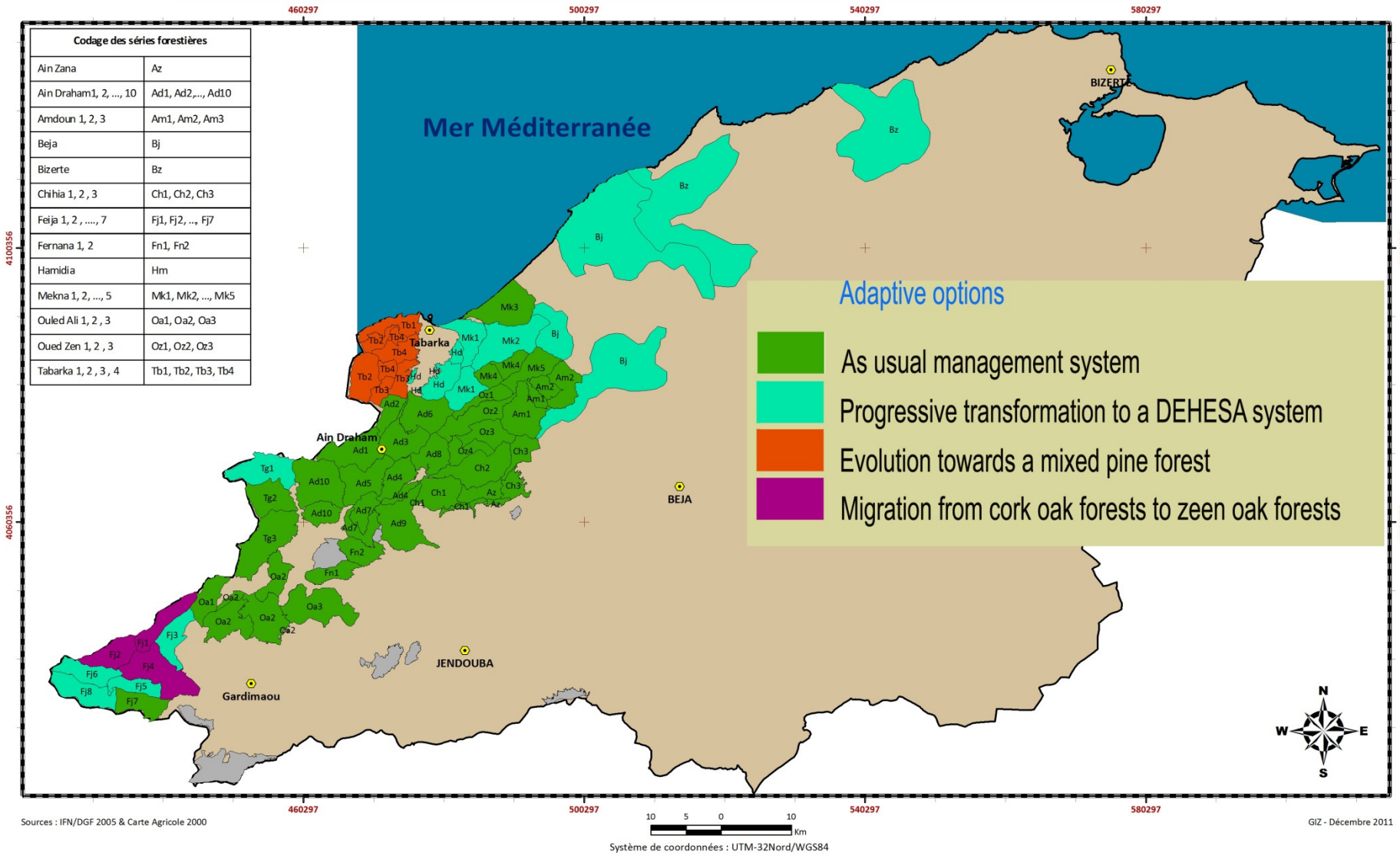
Results

3. Assessment of the economic value lost due to CC (A2 scenario)

Main losers



Options for adaptation (2050 – A2)



Conclusion

- Simple methodology, reproductible to other case studies
- GIS based tool to analyze vulnerability of forest ecosystems to CC → support for decision making

- Elaboration of an Atlas containing all maps generated in the framework of this study
- Elaboration of a Cork oak forest management model : new adaptive measures validated by decision makers
- Valuation of **economic** impacts (TEEB) of CC

Main challenges

Limits of the assessment of ecosystems' goods and services

- Difficulty to evaluate and distinguish clearly between loss due to CC and other anthropogenic factors
- Uncertainties related to climate models concerning climate predictions, for ex. about droughts
  - ✓ Which year?
  - ✓ How long?
  - ✓ How strong?
  - ⇨ Difficulty to give reliable orientations concerning time frame for adaptation measures
- Limited anthropocentric vision of the economic value, focused on the human well-being : Intrinsic value of biodiversity is ignored

Main challenges

Limits of the assessment of ecosystems' goods and services

- Incomplete assessment because of missing data, for ex.:
  - Changes of market prices due to CC
  - Costs of health impacts due to loss of air quality
  - Costs concerning raising risks of damages due to floods, uncontrolled fire, pest infestation
  - Others
- Better knowledge about CC and vulnerability of ecosystems will improve the economic assessment
- And thus, Identification of the most efficient adaptation options (CBA)

Several recommendations concerning future research

Thank you for your attention

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