WP2. SERVICES PROVIDED BY THE MEDITERRANEAN ECOSYSTEMS

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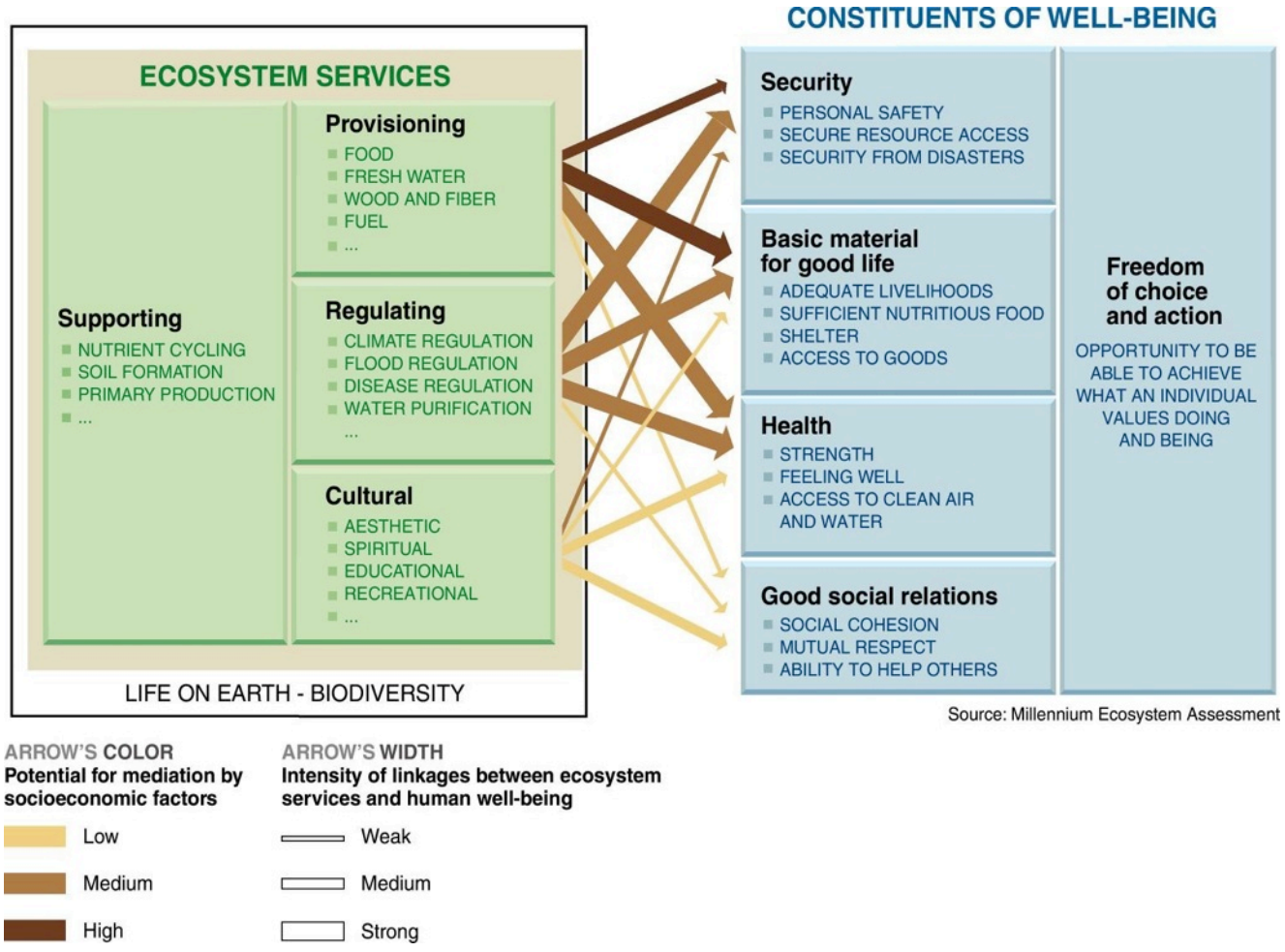
2nd OT-Med Progress Meeting 27-28 November 2014 in Carry-Le-Rouet.

Background

Ecosystem services from land and ocean are crucial for economy and human well-being in the Mediterranean.



The capacity of ecosystems to provide services is connected to biodiversity.

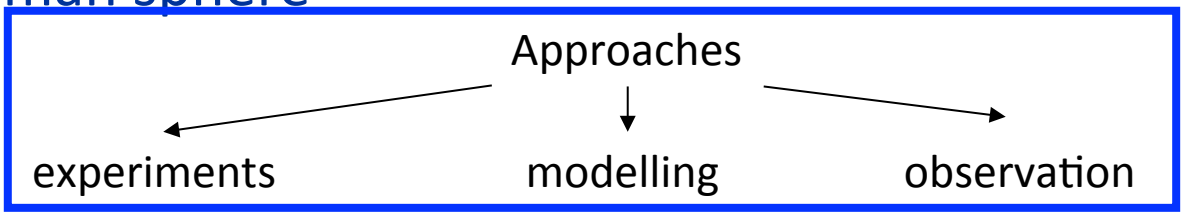
Numerical tools, based on process-based simulation models and spatial data bases, permit the assessment of past, current and future ecosystem service provisioning.

Objectives

Study biodiversity, ecosystem function, and ecosystem service provisioning in the Mediterranean region, on land and in the ocean

- at the level of local adaptive processes, by analyzing the role of environmental stresses,
- at the level of macro-ecological processes over longer/broader temporal and spatial scales,
- considering non-adaptive shorter-term dynamics (demographic fluctuations, connectivity)…

…all of this at the level of interaction between ecosystem functioning and the human sphere



Ecosystems

Focus on:

- **marine ecosystems** including the functioning of marine trophic webs;
- **agroecosystems** including the services provided by them to society;
- **forest ecosystems (including soils)**, linked to the specificity and current dynamics of Mediterranean forests;
- **urban ecosystems** and their relationships with **coastal development**, increasing human impacts and the importance of invasive species

Marine ecosystems and the functioning of marine trophic webs up to exploited resources

Activities

- responses of trophic webs in terms of community structure, functioning and adaptation with regard to climatic forcing and direct human impacts;
- long-term observations of diversity structure of the main planktonic communities in Gulf of Lions (TWP1);
- understand and forecast jellyfish blooms in coastal regions;
- artificial reefs as tools for environment rehabilitation.

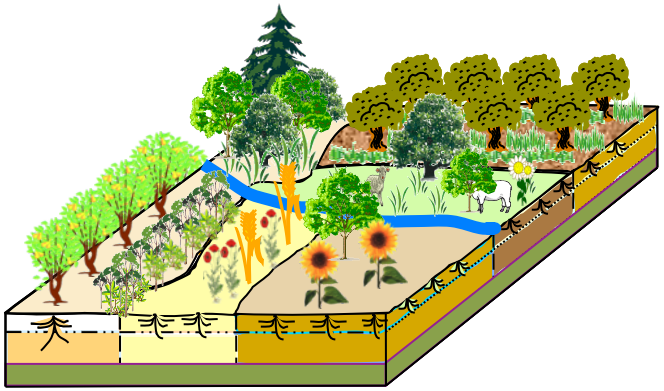
Laboratories and partners involved

MIO, IMBE, MERMEX,
BIODIVMEX, Prog Recif Prado

Agroecosystems including the services they provide to society

Activities

- analyze the role of different land management modes for agroecosystem function
- adapt the LPJmL generic ecosystem model to the Mediterranean region (TWP2)
- apply LPJmL to estimate ecosystem services (food, fibre, water), using different scenarios for land management, land use change and climate change



Laboratories and partners involved

IMBE, GSE, GREQAM

Aix*Marseille université

Implementation

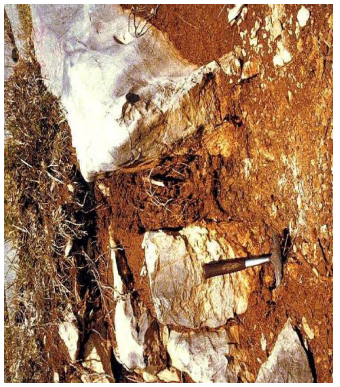
Mediterranean soils: modelling and management

Activities

- reconstruct the impacts of land use and past climate changes on soil properties during the last 50 and 2000 years, using isotopic signatures (TWP1);
- improve soil models by coupling geochemical and C-N-ecosystem models and adapting them to the Mediterranean zone;
- compare soil model to the agroecosystems model LPJmL (TWP2);
- ~~assess the role of soil degradation for agroecosystem sustainability;~~
- integrate soil quality and services into decision making and adaptation strategies (WP3).

Laboratories and partners involved

CEREGE, GSE, BIODIVMEX, IMBE, SICMED



Aix*Marseille université

Implementation

(Forest) biodiversity analysis

Activities

- compile geo-referenced information about Mediterranean ecosystems, along with existing protected areas and the major threats for them
- identify gaps in spatial patterns and ecosystem functioning
- compare biogeographic and historical data (phylogeographic) to understand the evolution of biodiversity affected by global change
- expand conceptual basis for marine biodiversity assessment

Laboratories and partners involved

IMBE, MIO, BIODIVMEX

Aix*Marseille université

Implementation

Urban biodiversity and its relationships with coastal development and human impacts

Activities

- compile all information about Mediterranean urban ecosystems (Marseille)
- estimate biodiversity-related ecosystem services for key cities, as well as across the entire Mediterranean basin
- estimate the effects of urbanisation on an individuals and populations
- estimate the impacts and the importance of invasive species in urban ecosystems
- study the mechanisms of adaptation and the origin of phenotypic variability and their effects on the selective value

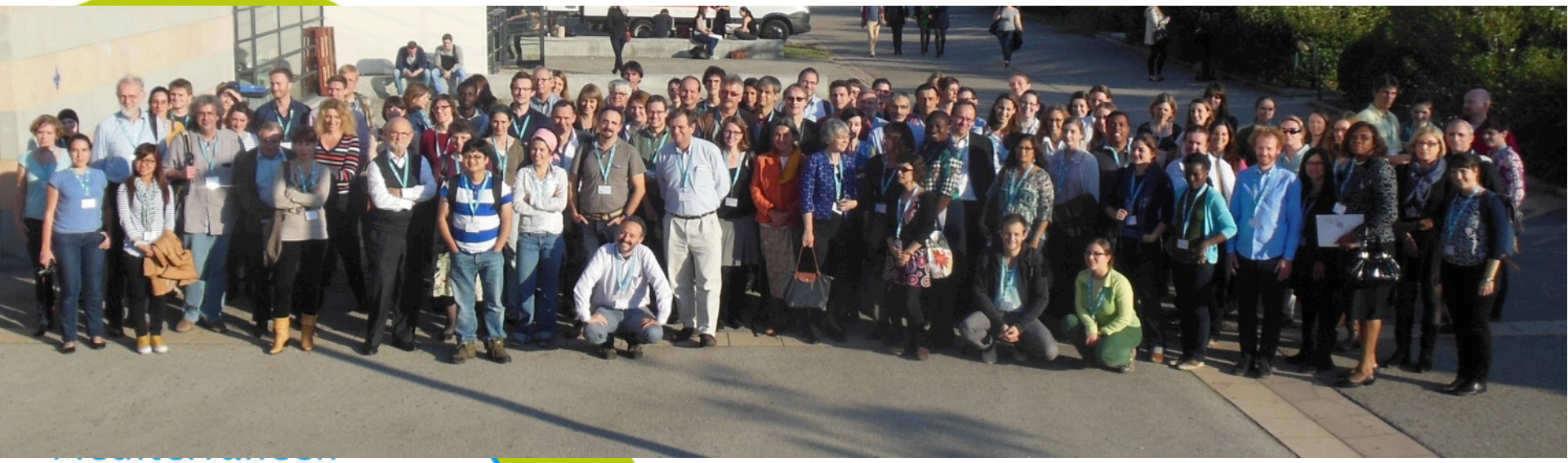
Laboratories and partners involved

IMBE, BIODIVMEX, GREQAM

Aix*Marseille université cnrs IRD Institut de recherche pour le développement UNIVERSITÉ D'AVIGNON

Institut PYTHEAS
Observatoire des Sciences de l'Univers
Aix*Marseille Université

Biodiversity and Food Security – From Trade-offs to Synergies



de Biodiversité
et d'Ecologie
marine et continentale

OSU MED LABEX

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Results

2nd OT-Med Progress Meeting 27-28 November 2014 in Carry-Le-Rouet.

Implementation WP2

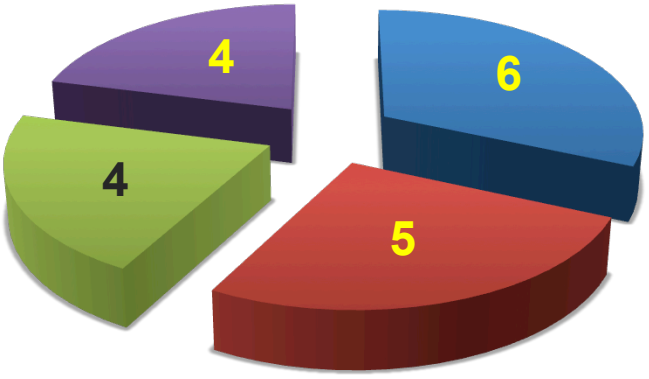
…improve understanding of:

- human-environment relationships from the perspective of ecosystem services;
- relevant processes for the prediction of change in ecosystems and service provisioning, incl. major biogeochemical cycles, agriculture, fisheries, biodiversity, and land management

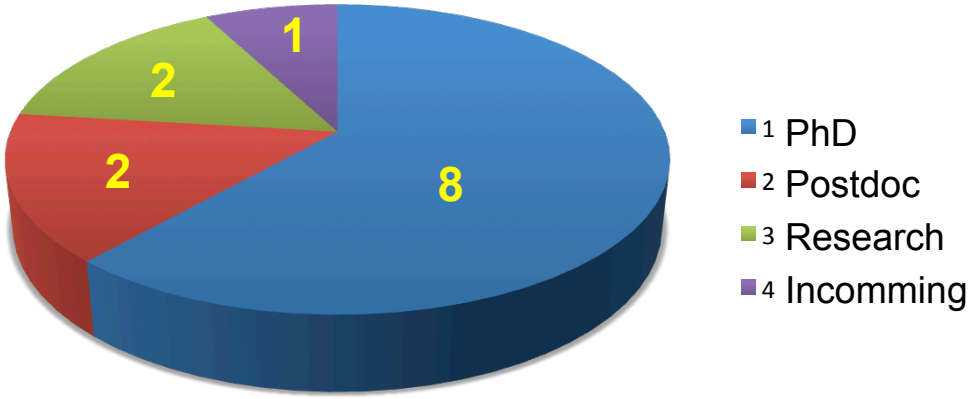
Implementation WP2

Geography of collaborations

Publication

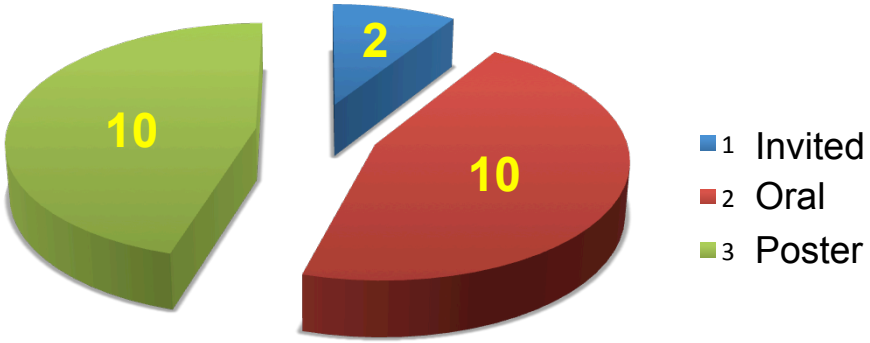


Projects

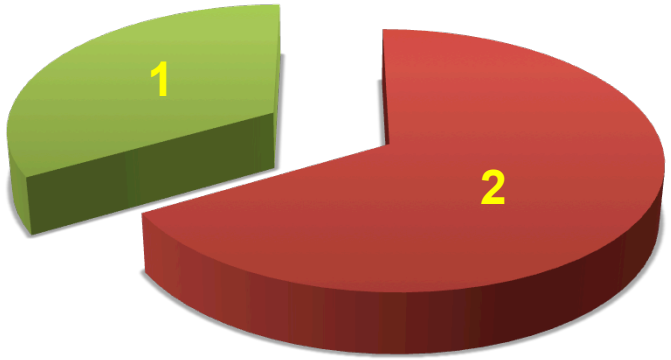


Participations in conferences

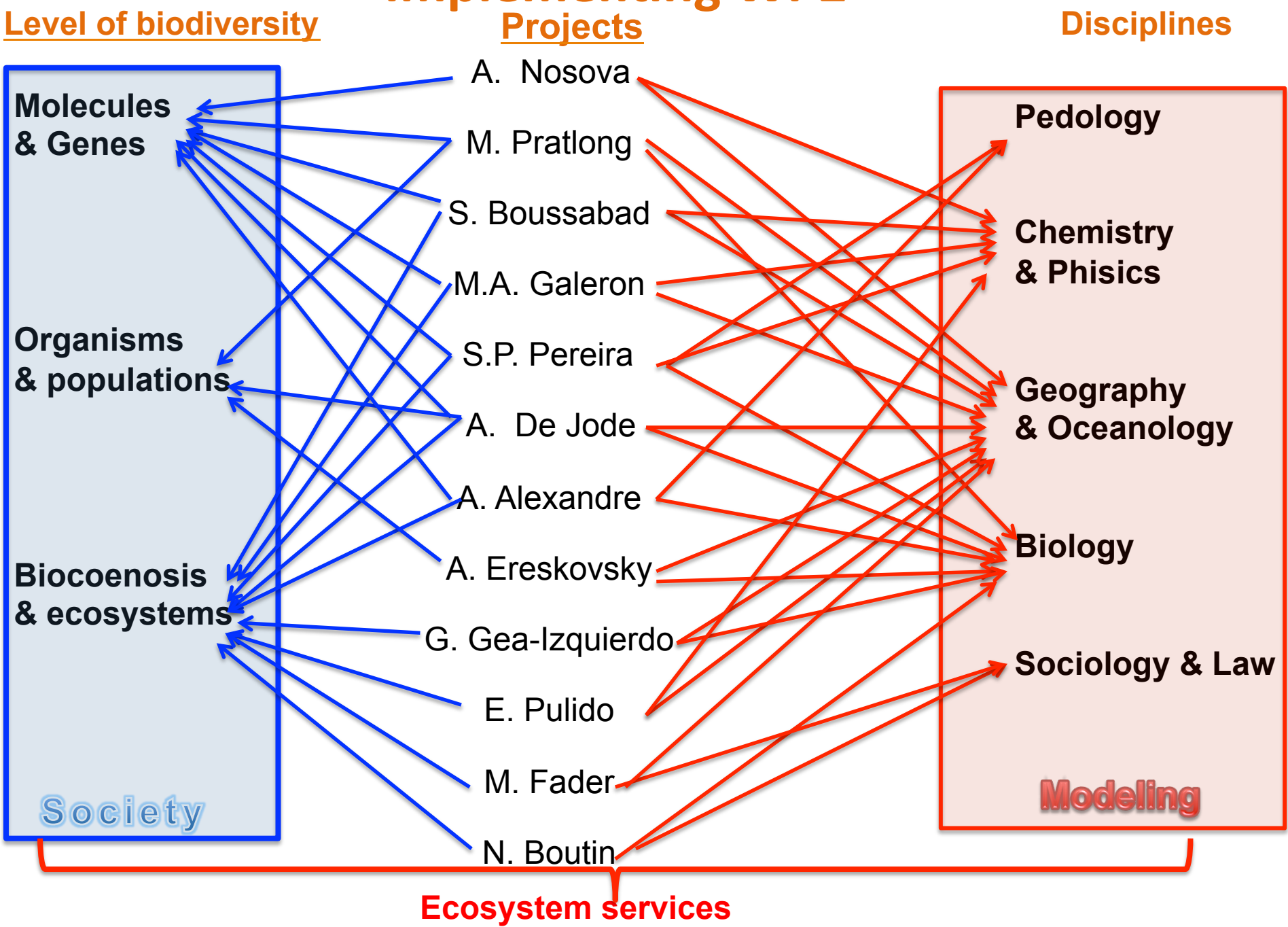
International



National



Implementing WP2



Implementation WP2

Adaptation and Evolution of marine organisms

Activities

The evolutionary challenge of climate change: adaptive processes in the Mediterranean red coral PhD student: Marine Pratlong (D. Aurelle)

Contribution of phenology to study the impact of climate change in coastal marine environment: the octocorals as models species. project leader: Alexander Ereskovsky (IMBE)

Phenology and life history of benthic Mediterranean invertebrates: viviparous bryozoans as a model mobility fellowship (2013) Andrey Ostrovsky, Vienna University

These projects study the impact of environmental fluctuations on the phenology and adaptation of metazoans in marine coastal waters of different regions of Mediterranean Sea.

- understanding of the mechanisms of organismic response to climate change at the different stages of life cycle and at genes expression level in different populations to identify the most vulnerable stages.

Implementation WP2

Marine biodiversity and the functioning of marine trophic webs

Activities

Observation of the plankton community structure in relation to the biogeochemical cycles in the Gulf of Lions and the pelagic ecosystems of North Tunisia (Bay of Bizerte and Gulf of Tunis) (started 2012) PhD student: Soumaya Boussabat (B. Quéguiner, MIO, M.N. Daly Yahia,Tunisia)

Understanding ecological functioning of coralligenous habitats, and building New Indicators based on genetic tools to assess their GES (good environmental status) (NIGESCor) (started 2014) PhD student: Aurelien de Jode (A Chenuil, IMBE)

- study the structure of **pelagic communities** in relation to the biogeochemical cycles of major elements (C, N, P and Si) in Mediterranean waters;
- understand functioning of **coralligenous communities** and resilience capacity, its biodiversity and connectivity patterns among localities and ecological profiles.

= Initial results indicate strong contrast between the east (incoming) and western (outgoing) areas of the *Golfe du Lion*, it will be possible to connect to the influence of the Rhone River inputs (nutrients, particulate matter) at the ecosystem scale.

Implementation WP2

Forest modelling and dynamics

Activities

Assessing vulnerability to global change of western Mediterranean forests using tree rings and a mechanistic approach Post-doc: Guillermo Gea-Izquierdo (J. Guiot, CEREGE)

The ecophysiological basis of carbonyl sulphide (COS) gas exchange of plants with the atmosphere (started 2012) PhD student: Alena Nosova (I Reiter, ECCOREV, J. Guiot, CEREGE)

Carbon cycle and biodiversity in Mediterranean oak forest: impact of climate change (CYCABIOCLIM) (started 2014) PhD student: Susana Patricia da Silva Pereira (V. Baldy, IMBE, C. Fernandez, IMBE)

Simulations have shown that trees have increased their intrinsic water use efficiency (iWUE) but this was not translated to an overall increase in ecosystem water use efficiency (WUE), which instead declined in the last years. **Gross primary productivity** (GPP) decreased with precipitation since the 1960s in one site. In contrast, at the other site long-term precipitation remained stable, GPP did not show an overall negative trend and the trees buffered the climatic variability observed.

Implementation WP2

Agroecosystem dynamics

Activities → TWP2

Agroecosystem management options for sustainable land use, PhD student: Simon Decock (A. Bondeau, IMBE)

Solar energy for irrigation: mitigation and adaptation option for the Mediterranean? Postdoc**:** Marianela Fader (A. Bondeau, IMBE)

In which way do different farming intensity levels affect the ability of soils to store water and maintain productivity over longer time scales?

- Literature analysis to provide suitable parameters for modelling agroecosystem sustainability

How much irrigation water will be needed in future (2080-2090) for food production in the Mediterranean region, both on the fields and as extraction from the sources?

- up to 20% increase in gross irrigation requirements, France being the country with the highest increases.
- Population growth can exacerbate the situation, especially in the Southern Mediterranean (up to 150% increases in irrigation requirements).
- Energy requirements for irrigation depend on the farm size, the cultivars planted, the irrigation technology, the geographical location (climate, soil, etc.), the sowing dates, the growing period length, etc.

Implementation WP2

Urban biodiversity and coastal development

Activities

Impact of anthropogenic particles on coastal zones in PACA Project leaders: Elvira Pulido (MIO), Richard Sempéré (MIO), Olivier Radakovitch (CEREGE)

Biotic and abiotic degradation of terrestrial organic matter discharged by Rivers (Rhône, Pô and Ebre) in Mediterranean Sea (started 2013) PhD student: Marie Aimée Galeron, (J.-F. Rontani, MIO, O. Radakovitch, CEREGE)

The high amounts of coprostanol detected clearly show that **the Rhone River is significantly affected by sewage waters**. Plant-derived organic matter appears to be mainly affected by photo-oxidation and autoxidation, while organic matter of human origin is clearly more prone to bacterial degradation.

Implementation WP2

Industrial change and biodiversity

Activities

Managing biodiversity in a context of increasing urbanization and intensified human-nature interactions PhD student: Nathalie Boutin (P. Batteau, S. Gachet, IMBE)

Stakeholder analysis of two significant environmental management problems:

- Biomass project of the Gardanne power plant
- Discharge of red mud from Gardanne to the sea

WP3

The role of WP2
for the overall objectives of OT-Med

Work in WP2 in 2013-2014 related to four main OT-MED objectives
Strengths and weaknesses

- **stimulate interdisciplinary research** on human – environment interactions in Mediterranean ecosystems, accounting for ecosystem functioning, biodiversity and human impacts, taking into account the various time scales of ecosystem development
- **identify and evaluate innovative strategies** to help decision-makers in elaborating public policies and enterprises in treating environmental questions (through data, models and technologies)
- **contribute to the meta-program MISTRALS**: Mermex (Boussabat), Biodivmex (Pereira)
- **development of connection with others WPs** of Labex: