EU –funded research on Climate Change with relevance for agriculture

past, present & future (FP7 & Horizon 2020)

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HORIZON 2020

FP6: Emphasis on Carbon and Nitrogen cycles

CARBO-EUROPE: quantified the C sources & sinks from terrestrial ecosystems (e.g. forest, soils, agriculture, peatlands) in Europe and decreased the uncertainty associated with each value through novel methodologies, new measurements and state-of-the art modelling.

CABRO-OCEAN: quantified the marine C sources and sinks in the North Atlantic and assessed their strength over the past 15 years. This was achieved through prototype observing systems and model development.

Main finding for both projects have been synthesised for policy makers and other stakeholders in an ***Integrated Assessment Report*** (published by the European Commission)

NITRO-EUROPE:

- Established a comprehensive new European Nitrogen budget
- Assessed its impact on climate
- Measured costs and benefits of Nitrogen impacts on climate, ecosystems and health
- Provided policy recommendations to reduce negative Nitrogen impacts on earth

Findings of NITROEUROPE have been already transferred to relevant UN processes/conventions

The project was a key driver of the ***European Nitrogen Assessment*** *(Cambridge University Press)* which provided, for the first time, a Europe-wide assessment of the impact of nitrogen on climate and ecosystems.

FP6: Emphasis on climate modelling

The ENSEMBLES project:
integrating climate change impacts studies into an ensemble prediction system

1. Develop an **ensemble prediction system** based on **global** and **regional Earth System Models**, **validated** against observations and analyses, at the **seasonal, decadal and longer** timescales

2. Quantify and reduce **uncertainty** in the representation of physical, chemical, biological and human-related feedbacks in the Earth System

3. Exploit the results by **linking the outputs to a range of applications**, including agriculture, health, food security, energy, water resources, insurance

Impacts on wheat yield and N leaching

Crop modelling

Water availability in big river catchments

Extremes (floods, drought)

FP7 projects: some examples

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GHG EUROPE

Greenhouse gas management in European land use systems

Quantify the annual to decadal variability of **CO_2, N_2O** and **CH_4** (GHG) budgets of terrestrial ecosystems in Europe.

Obtain a better and more comprehensive understanding of the terrestrial carbon cycle and responses of GHG fluxes to variability in natural and **anthropogenic drivers** (climate, nitrogen deposition, land use, management) and **pressures** (global markets, European climate and land use policies) for European forest, grassland, cropland, peat-land and scrubland ecosystems.

Identify the carbon pools and GHG processes most sensitive and vulnerable to changes in individual drivers and in driver combinations

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CARBO-Extreme: The Terrestrial Carbon Cycle under Climate Variability and Extremes: a Pan-European Synthesis

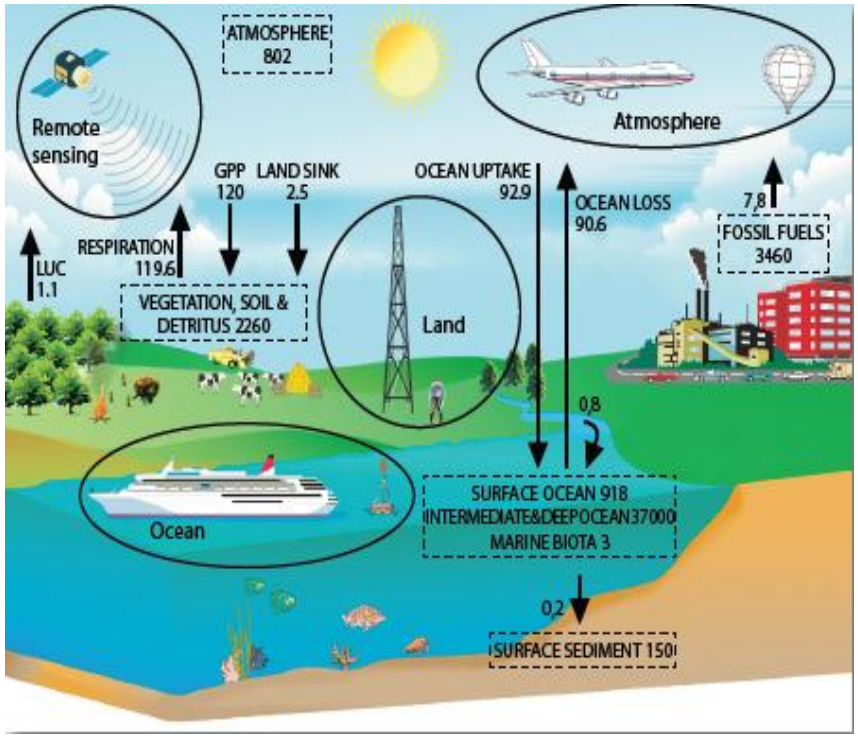
Obtain a better and more comprehensive predictive understanding of terrestrial carbon cycle responses to climate variability and extreme weather events for European forest, grass- and peat-land and arable ecosystems.

Identify the most sensitive and vulnerable carbon pools and processes to climate variability and extreme events

Map the most likely trajectory of carbon pools in Europe over the 21st century and associated uncertainties introduced by model assumptions and setup (i.e. model structure, parameters and input, e.g. scenarios)

GEOCARBON: Towards an operational Global Carbon Observing System

A coordinated effort to <u>integrate</u> and <u>analyse</u> a higher quantity and quality of CO_2 and CH_4 data, from in situ and remote sensing observations encompassing atmosphere, land and oceans.



CCTAME: Climate Change – Terrestrial Adaptation and Mitigation in Europe:

assessing the impacts of agricultural, climate, energy, forestry and other associated land-use policies considering the resulting feed-backs on the climate system in the European Union.

LUC4C: *L*and-*u*se *c*hange: assessing the net climate *for*cing, and options *for* climate change mitigation and adaptation

enhance our ability to understand the societal and environmental drivers of land use/land use change relevant to climate change

assess effects of different mitigation policies and adaptation measures within alternative socioeconomic contexts;

advance our ability to represent land use/land use change in climate models

Future climate change scenarios and impacts

IMPACT2C: *Quantifying projected impacts under 2°C warming:*

Determination of the climate in Europe and most vulnerable regions for a 1.5°C and 2°C global warming compared to pre-industrial level

Consideration of impacts from a cross-sectoral perspective, e.g. for particularly vulnerable areas that are subject to multiple impacts where cumulative effects may arise (e.g. in the Mediterranean region)

IMPRESSIONS: *Impacts & Risks from high-end scenarios: strategies for innovative solutions*

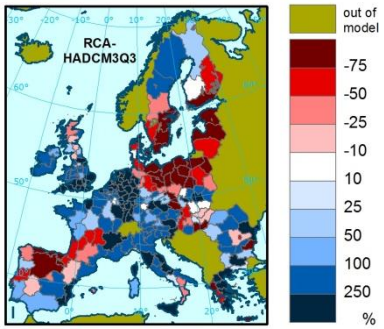
Assess the potential impacts and the ability of adaptation options to reduce vulnerability

Assess the potential synergies and trade-offs between adaptation and mitigation

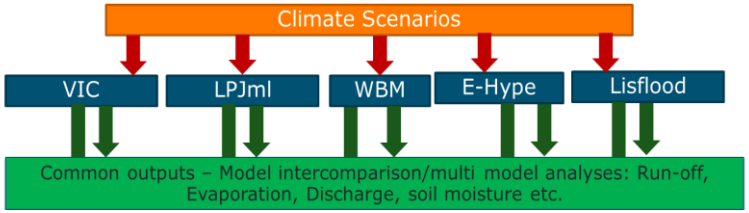
Linking to Impacts

Snow cover
(winter tourism)

River flood damage



Health and well-being from flooding



Hydro-electric Power

Power station cooling

Water availability for irrigated agriculture

Figure source : i-stock

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Societal Challenge 5

Climate action, environment, resource efficiency and raw materials

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CLIMATE CHANGE:
a cross-cutting issue under Horizon2020

- **Climate-related** expenditure should be at least **35%** of the overall Horizon 2020 budget
- At least **60%** of the overall Horizon 2020 budget should be related to **sustainable development**

1. *Fighting and adapting to climate change*

(Challenge 5 of Horizon 2020 Specific Programme)

- **Improve the understanding of climate change and the risks associated with extreme events and abrupt climate-related changes with a view to providing reliable climate projections**
- **Assess impacts (at global, regional and local level), vulnerabilities and risks and develop innovative cost-effective adaptation and risk prevention and management measures**
- **Support mitigation policies and strategies**

……special focus on a **"solution-oriented"** approach

Horizon2020, WP2014-2015 (some examples)

Advanced Earth System Models (2014)

Water cycle under future climate change, including extreme events (2014)

Integrated approaches to food security, low-carbon energy, sustainable water management and climate mitigation (2015)

Adaptation to climate change: i) assessing costs, risks and opportunities and ii) demonstration of options and practices (2014, 2015)

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Some ideas for the future: the case for Climate Services

Why:

► Increasing recognition that climate has a central role in global economic & social sectors

► Climate risk management is about *"managing the unavoidable **(adaptation)** and avoiding the unmanageable **(mitigation)**"*

► There is an increasing need for information & tools that will enable both public and private entities to minimize risks and be best positioned for continued growth.

The challenge:

Past research activities created a strong knowledge base…… but much of this knowledge is hard to access, understand and use. The challenge is to translate this (and any other relevant) knowledge into customized products & tools **('services')** that meet the needs of individual end-users (public authorities, policy makers, businesses…) and enable them to take climate-smart decisions

Our objective:

Create and implement a R&I agenda that will facilitate the co-design & co-development (suppliers and users) of a climate services ➔ extract societal & economic value out of R&I actions.

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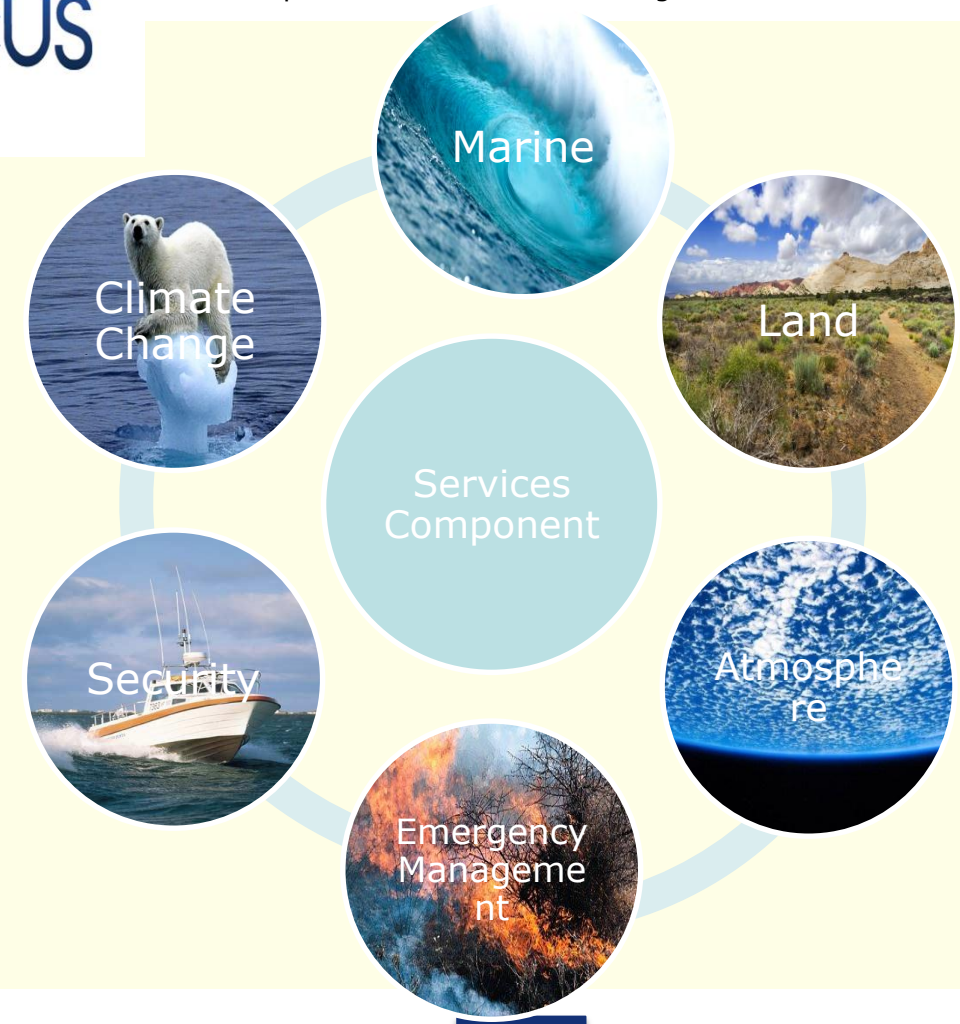
…and links with

- ***- Strategic cooperation with Member States (e.g. Joint Program Initiatives - JPIs)***
- ***- GEO***
- ***- Research Infrastructure Programme***
- ***- European Environmental Agency - Climate Adapt***
- ***- Joint Research Centre (JRC)***
- ***- European Institute of Innovation & Technology EIT (Climate-KIC)***
- ***- WMO Global Framework on Climate Services (GFCS)***

Services Component

The European Earth Observation Programme



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'Towards a European market for Climate Services'

- *Workshop held 14 March 2014 in Brussels*
- *120 participants from Climate service providers and users*
- *Launched a process leading, through the work of an* Expert Group*, to:*
  - ***the definition of a long-term Research & Innovation Roadmap***
  - ***the identification of most promising sectors on which to launch R&I actions and 'user-driven' demonstration projects***
  - ***a long-lasting partnership between providers and users of climate information for the co-design and co-production of future Climate Services***

- *The conclusions of the Expert Group will be discussed in a second European Workshop (17th March 2015, Brussels).*

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Thank you
for your attention!