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METEOROLOGISKA INSTITUTET
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LIFE Platform Meeting

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Climate change – ecosystem services approach for adaptation and mitigation

Norwich, England

Ali Nadir Arslan
(ali.nadir.arslan@fmi.fi)

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Climate Change Indicators and Vulnerability of Boreal Zone Applying Innovative Observation and Modeling Techniques

MONIMET

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PROJECT LOCATION: Helsinki

BUDGET INFO:

Total amount: 2,755,288 €

% EC Co-funding: 1,366,952 €

DURATION: Start: 02/09/13 - End: 01/09/17

PROJECT'S IMPLEMENTORS:

Coordinating Beneficiary: Ilmatieteen Laitos (FMI)

Associated Beneficiary(ies): Metsäntutkimuslaitos (METLA), Suomen Ympäristökeskus (SYKE), Helsingin Yliopisto (UHEL)

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BACKGROUND :

- The magnitude of climate change is dependent on the atmospheric load of the two most important greenhouse gases, carbon dioxide and methane. The terrestrial biosphere plays an important role in the global carbon balance, and boreal forests and peatlands are an important part of the global carbon cycle. Global carbon balance of the terrestrial ecosystems is known in an accuracy of about +-35% based on atmospheric concentration increase and versatile use of other observational and modeling methods.
  - The uncertainty increases in the regional level, and obtaining accurate figures of country based carbon balances and their future development is a challenge.

- The climate is changing rapidly in arctic and subarctic regions with projected annual mean temperature increase of about 2 – 6^{o} C from year 2000 until year 2100.
  - The northern carbon balances are thus subject to both positive and negative alterations, depending on the temporal and spatial climate variation. A regional approach is needed in order to examine these issues.

- Wetlands cover about one third of the territory of Finland. They are important for boreal greenhouse gas balances due to methane emissions.
  - The magnitude and future development of wetland emissions is not yet fully understood.

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OBJECTIVES:

- To collect information, data and expertise that is currently spread over several institutes, in order to build a comprehensive platform for analysing climate change effects on seasonal dynamics of various phenomena

- To create links and add value to existing monitoring mechanisms such as ICOS and EO systems (GMES/COPERNICUS) and make use of data acquired in previous EU Life+ funded, and other projects related to ecosystem monitoring

- To create new webcam monitoring system in order to facilitate Earth Observation systems by providing time-series of field observation for calibration and validation, as well as to improve the assessment of forest ecosystem services

- To synthesize modeling and observation approaches to identify climate change indicators
- To establish link between the climate change indicators and their effects in order to create vulnerability maps of boreal zone in connection to climate change scenarios

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MAIN EU POLICY(IES) TARGETED:

The project develops and demonstrates carbon and water cycle related monitoring systems, methodologies and vulnerability assessments for Finland and surrounding areas. As other EU countries have similar information needs, the developed system, could be useful to other EU countries. The actions to be taken in this project are applicable to support a wide variety of EU activities.

- **MONIMET supports the EU white paper Adapting to climate change: Towards a European framework for action (COM(2009) 147) that sets out a framework to reduce the EU's vulnerability to the impact of climate change. It states that in addition to mitigation we must take adaptation action to deal with the unavoidable impacts .**
- **MONIMET is linked to DG ENV: European Climate Change Programme (ECCP). Supporting the initiative of the European Commission for a policy strategy to adapt to the impacts of climate change that is aimed at assisting local, regional and national efforts. Pan-European, spatially detailed data on northern latitudes and improved models on its changes for future climate scenarios are very relevant for these efforts.**

MAIN EU POLICY(IES) TARGETED:

- **MONIMET aims are in concordance with EU Commission Communication: "Winning the battle against global climate change"** [COM(2005) 35] calling for more and better focused research to further improve knowledge on climate change and its global and regional impact. The project objectives are also related to "Limiting Global Climate Change to 2 degrees Celsius - The way ahead for 2020 and beyond" [COM(2007) 2] setting out more concrete steps to limit the effects of climate change and to "Addressing the challenges of deforestation and forest degradation to tackle climate change and biodiversity loss" [COM(2008) 645 final] calling for strengthening of forest governance and institutions at local and national level by rewarding the value of the services provided by forests and by taking account of demand and the responsibility of consumers.
- **MONIMET objectives are congruent with 'Global Monitoring for Environment and Security' (GMES/COPERNICUS) that is the European Programme for the establishment of a European capacity for Earth Observation.** GMES/COPERNICUS represents a concerted effort to bring Earth observation data and information providers together with users, so they can better understand each other and make environmental and security-related information available to the people who need it through enhanced or new services.
- **MONIMET contributes to objectives of ICOS (Integrated Carbon Observing System) Infrastructure.** ICOS is a long term (20+ years) European Research Infrastructure for quantifying and understanding the greenhouse balance of the European continent and adjacent regions.

MAIN ACTIVITIES:

The main activity of MONIMET is implementing a new innovative approach to in situ monitoring and mapping of climate change indicators that have an influence on the mitigation potential and vulnerability estimates of boreal forests and peatlands. The approach is based on a combination of different information sources describing phenology, CO_2 and CH_4 exchange, land cover, snow evolution and albedo. The information sources include in situ observations and Earth Observation (EO) (satellite) data, as well as ancillary data supporting vulnerability assessments. Dedicated high resolution regional models are applied to describe climate and land surface fluxes of carbon and water by different ecosystems.

EXPECTED RESULTS:

- ✓ **A harmonized webcam network for monitoring the seasonal cycle in boreal ecosystem carbon exchange**
- ✓ **Demonstration of the mapping of climate indicators in boreal forest zone**
- ✓ **Demonstration of the vulnerability assessment for Finnish municipalities to climate change effects**
- ✓ **Calibrated soil-vegetation-atmosphere model parametrisations for the boreal zone**
- ✓ **Estimates of the uncertainty of the results**

SOME EXPECTED RESULTS in DETAILS

Large-scale carbon and water balance estimation

- Carbon exchange modelling
- Snow monitoring
- Ground references for related remote sensing products

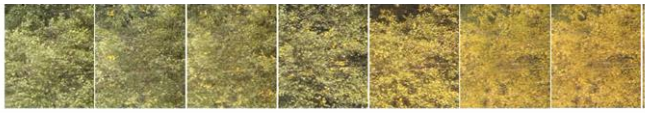
Growth model development

- Within season growth of shoots, and timing
- Interannual variation of length growth

Monitoring of phenological events:

- Emergence of new shoots
- Cone production

Data flow



AUTOMATED TRANSFER

SERVER

RS PRODUCTS

MODELS

OTHER MEASUREMENTS

DEVELOP/ COMPARE/ CALIBRATE

VALIDATE

GREEN-UP DATES

SNOW INFORMATION1

SCRIPTS

Demonstration on ecosystem services and vulnerability

- **Aim**
  - Assess vulnerability of Finnish municipalities to climate change effects on selected ecosystem services
- **Tasks**
  - Estimate ecosystem service provision potential from climate change indicators
    - Carbon sequestration by forests
    - Nitrogen retention by soils
  - Assess vulnerability
    - Risk for decrease in provision of ecosystem services

METHODS

- **Ecosystem service assessment and valuation**
  - Mass balance models
    - Carbon sequestration: JSBACH, PreLes, Yasso07
    - Nitrogen retention: INCA-N, Vemala
  - Valuation
    - Ranking and trade-off analysis
  - Scenario analysis
    - Climate, land use, forest management
- **Vulnerability**
  - Function of exposure, sensitivity and adaptive capacity
    - Estimated change in ecosystem service provision
    - Socio-economic characteristics of the region

Nature

Carbon sequestration

Nitrogen retention

Processes

C stocks, C fluxes

N stocks, N fluxes

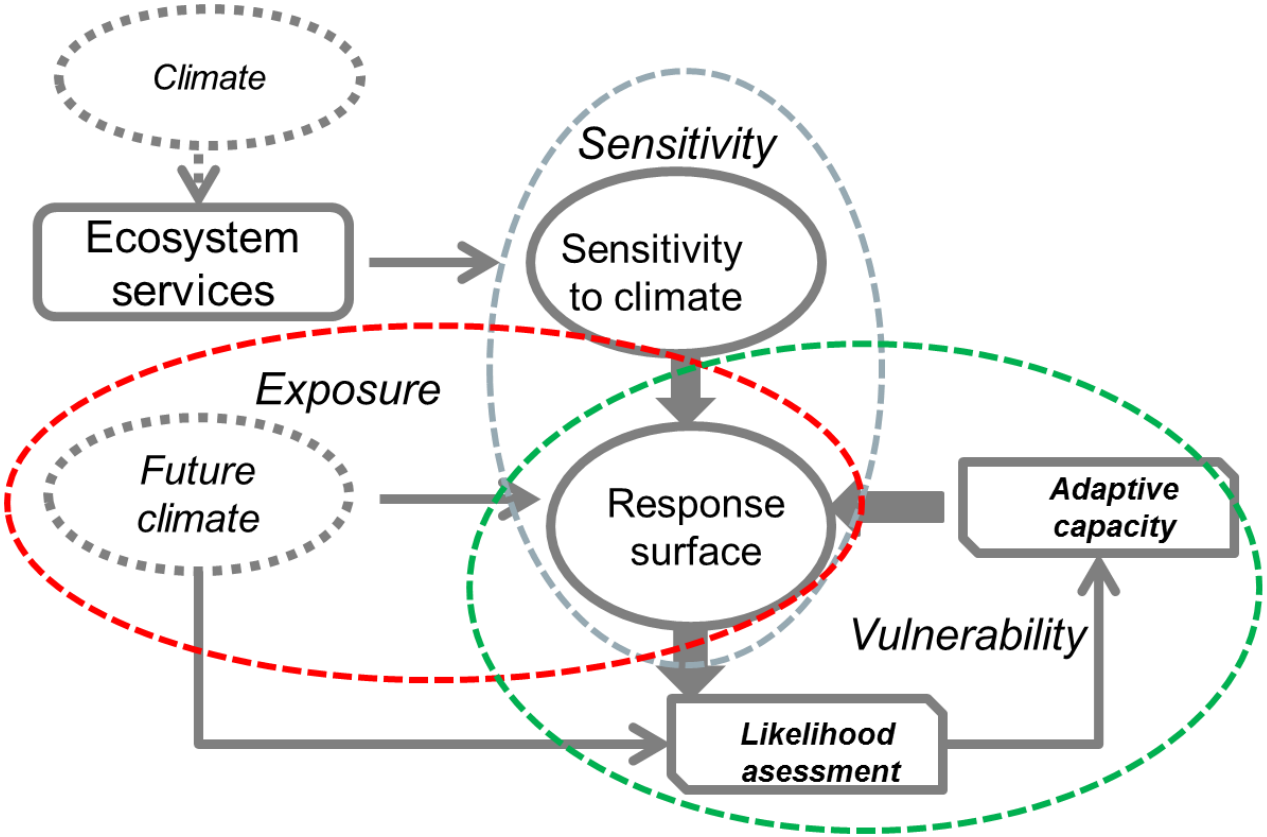
Ecosystem services

€, Ranking

€, Ranking

Economic or Other Value

Ecosystem services – the contributions that ecosystems make to human well-being



Vulnerability – combination of Exposure, Sensitivity and Adaptive Capacity