AnaEE – Infrastructure for Analysis and Experimentation on Ecosystems

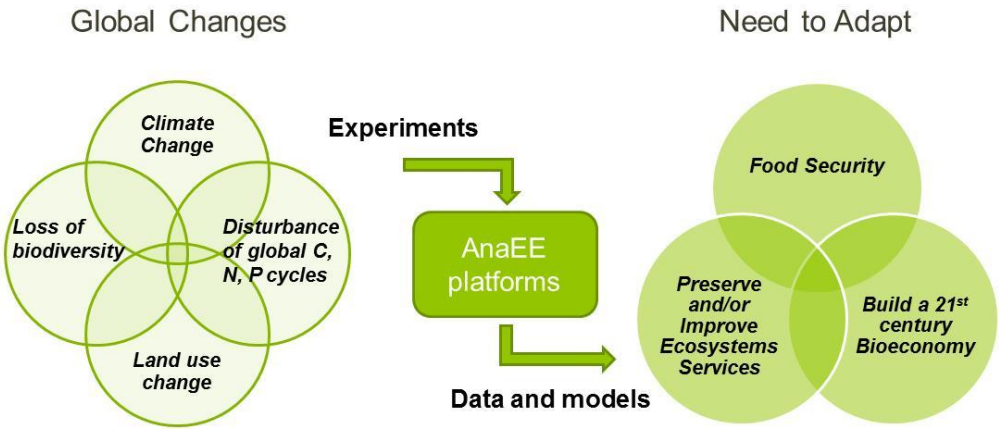
The Vision

AnaEE will be a research infrastructure for experimental manipulation of managed and unmanaged terrestrial and aquatic ecosystems. It will strongly support scientists in their analysis, assessment and forecasting of the impact of climate and other global changes on the services that ecosystems provide to society.

AnaEE will support European scientists and policymakers to develop solutions to the challenges of food security and environmental sustainability, with the aim of stimulating the growth of a vibrant bioeconomy. AnaEE will accomplish this mission by building permanent and substantial links among researchers, science managers, policy makers, public and private sector innovators, and citizens.

The context

The sustainability of agricultural, forested, freshwater and other managed and natural ecosystems is critical for the future of mankind. However, the services provided by these ecosystems are under threat due to climate change, loss of biodiversity, and land use changes. In order to meet the challenges of preserving or improving ecosystems services, securing food supply and building a 21st century bioeconomy, we need to understand and forecast how ecosystems will respond to current and future changes including new management approaches and potential environmental tipping points. Without sufficient understanding of the sensitive interdependencies between ecosystems and the environment, Europe will be unable to assess the impacts, control the risks, or potentially utilize the benefits of anticipated large changes in ecosystems structure and function. Key benefits will include greenhouse gas mitigation and climate adaptation.



The approach

To achieve this goal, AnaEE will adopt an experimental approach built around *Manipulation*, *Measurements*, *Modelling*, *Mitigation* and *Management*. At the core of AnaEE's approach are the distributed experimental facilities needed to expose ecosystems to future conditions to quantify the role of each of the drivers of change and to identify their interactions. To produce results that will inform predictive models and deliver realistic simulations, AnaEE research has to be process-oriented and will address how major biogeochemical cycles, biodiversity and the relationship between biodiversity and ecosystem functions will change under the various experimental treatments.

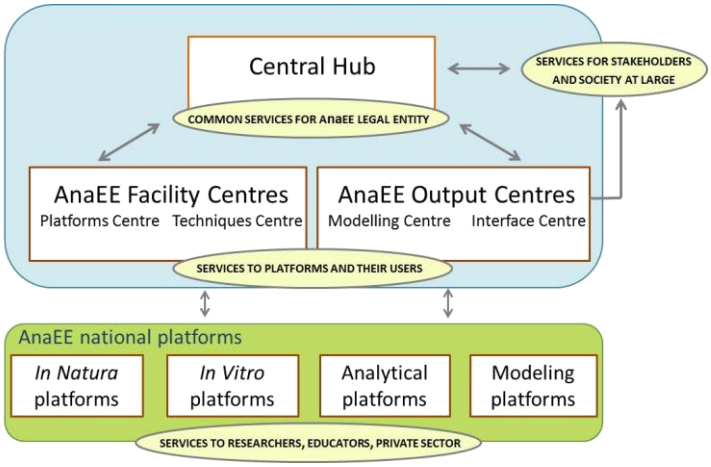
The AnaEE experimental facilities will be equipped with state-of-the-art instrumentation and Information Technology tools; and will use common standards of measurements and analysis. Facilities will be highly flexible and open to new experiments in order to be able to address the research questions of the future.

The components

AnaEE will be a unique continental scale, long term, integrated, experimental research infrastructure. It will be based on distributed (existing and new) advanced experimental platforms of four types:

- *In situ/in natura* platforms: These will comprise the predominant land use types of agriculture, forestry and nature, and the interfaces between managed and unmanaged as well as terrestrial and continental aquatic ecosystems transecting Europe's climatic zones;
- *In vitro* platforms (such as ecotrons): complement *in natura* platforms by enabling higher level of environmental control and process measurement on ecosystems;
- Analytical platforms: will offer advanced biological, physical and chemical analyses for a deeper insight into processes;
- Modelling platforms: tools to analyse and synthesise the data from experimental platforms and to make predictions of the structural and functional responses of ecosystems at a range of spatial and temporal scales.

The coordination and integration of these national platforms will be achieved through supra-national centres which will ensure international access, improved measurements and data harmonization, technology development, links between data and models, open access to raw data and syntheses. They will also allow researchers to network and provide an interface with key stakeholders.



Complementary European infrastructures

AnaEE will provide a unique, long-term and sustainable infrastructure that fills an important gap between the environmentally-oriented European research infrastructures in ecosystem sciences.

In particular, AnaEE will work alongside, and provide synergies with, ICOS (involved in long-term observations of the global carbon cycle and greenhouse gas emissions) and LifeWatch (providing access to biodiversity and ecosystem science data and data processing tools).

AnaEE will uniquely provide:

i) Experimental manipulations of natural and managed ecosystems which will improve understanding of ecosystem functioning and dynamics and make model predictions more reliable;
ii) Insight into the consequences of biodiversity loss for ecosystem vulnerability and services;
iii) Specific analysis of threats and opportunities for agricultural, forest and freshwater production.

Linking AnaEE results with data from observational sites across Europe will allow models to be scaled-up to larger geographical areas. AnaEE will also complement and add value to emerging research infrastructures in the agri-food, forestry, bioenergy, and aquaculture sectors, as well as other infrastructures that already exist or are being developed, particularly in the areas of technological development, data exchange (e.g. ELIXIR), interoperability of models, and the synthesis of summary results at a range of spatial and temporal scales.

Links with international counterparts of AnaEE such as NEON and AgMIP in the United States and TERN in Australia have already been established and participation to COOPEUS will be pursued. In addition to

these collaborations, AnaEE will work hand in hand with FACCE Joint Programming Initiative and the Group on Earth Observation (GOE).

AnaEE's strategic objectives

AnaEE aims to foster capacity building in ecosystem science by providing state of the art facilities and structuring tools for the European ecological and agricultural research community – which will, in turn, strengthen the European research area.

AnaEE will provide direct access to massive and quality controlled environmental datasets from experimental ecosystem research, as well as to data analysis and modelling tools specifically adapted to these datasets. Various stakeholders will use this information to develop policies and engineer management techniques that will allow mitigation of and adaptation to these changes.

AnaEE will help find solutions to the challenges of the bioeconomy, including food, fuel and fibre production and sustainable ecosystem services. There is a need to understand the sensitive interdependencies between ecosystem services and the changing environment if Europe is to develop a green economy centred on bio-based products and eco-technologies.

AnaEE's services and added value

Services for researchers

- Cost effective physical, virtual and remote access to key experimental ecosystem platforms across different climatic and land use regimes in Europe. Capabilities to test climatic, anthropogenic and biotic stress factors, as well as testing management options for mitigating them.;
- Cost effective access to key analytical and modelling platforms;
- Provision and support of specialist expertise in planning, constructing and maintaining ecosystem experiments;
- Improved methodologies, standardized measurements, harmonisation of metadata as well as sustained personnel training.
- Training of young researchers and students

Services for national stakeholders

- Higher international visibility of national infrastructures. Access to expertise, research programs, and data;
- Technical and organisational support to maximize the efficiency and effectiveness of data, models and scientifically solid syntheses of experimental ecosystem research for academy, education and industry users;
- Definition and standardization of criteria for cost effective procurement of the advanced equipment needed for AnaEE platforms;
- Large scale assessment of strategies aiming at adaptation and mitigation of climate change and loss of biodiversity in agro-ecosystems, forestry and freshwater ecosystems.

Services for European policy makers and industry

- Coordination of complementary competencies within the scientific community assessing mitigation and adaptation responses.
- Ability to perform experimental verification of hypotheses and to test technologies and policies aimed at mitigating unwanted effects.
- Reliable results expressed through accepted standards and comparable formats.
- Training of highly qualified personnel at the regional experimental platforms.
- Coherent guidelines and specific indicators to track, measure, and assess ecosystem services impacts and dependencies. Support to decision processes in policy and business.
- Improved networking between science, policy makers and industries, sharing knowledge of impacts and dependencies of economic activities on ecosystem services;
- Technology transfer: resulting in the growth of innovative companies at both regional and international level.