

An environment of cooperation

Dr Abad Chabbi explains the key motivations and objectives behind a brand new European project designed to bring together ecological studies throughout the continent in light of rapid environmental changes



To begin, can you reiterate the aims of the Infrastructure for analysis and Experimentation on Ecosystems (AnaEE) project?

AnaEE will provide Europe with a distributed and coordinated set of experimental, analytical and modelling platforms to analyse and predict, in a precise manner, the response of ecosystems to environmental and land use changes. In the context of the development of European bioeconomy, critical political, environmental and scientific questions related to ecosystems functioning and services will be answered.

How are you providing an integrated infrastructure for a large number of varied projects in Europe and worldwide?

AnaEE's 'grand vision' is to provide an integrated distributed infrastructure in Europe and worldwide to fulfil the needs of end-users. This will require strong interactions between the consortium partners as well as with other relevant and complementary projects. We envisage the establishment of specific tools, such as ad hoc committees of expert teams, hearings and interviews with representatives of the various AnaEE end-users, including national and international funding bodies. This will allow us to map and understand end-users' interests and service needs and to analyse the possible overlap between AnaEE and other programmes running at a national, European or worldwide level.

You are in the final stages of launching the distributed infrastructure. What are your next steps in implementing AnaEE?

We intend to use the AnaEE preparatory phase project to deliver an approved legal and governance structure, an agreed business plan with a pricing policy and detailed and realistic technical planning. In addition, strategic issues – such as how to mobilise and obtain concrete commitments from the stakeholders on the AnaEE roadmap – will be further elaborated to guarantee a successful implementation process of the infrastructure required to place Europe among the world leaders in ecological science.

What areas of ecosystem research will AnaEE encompass?

AnaEE will incorporate a diverse range of ecosystems covering forest, grassland, shrub land, agricultural land and lakes. The experimentation and development plan will be designated specifically for those ecosystems, taking into account the cascade effects on the adjacent ecosystem. A multidimensional matrix of drivers, platforms and responses will be chosen to ensure that the European infrastructure will span a necessary range in types of ecosystems, soils, land management, land use and climate as well as cross-ecosystem interactions.

Why are integrated infrastructures important in light of global changes and resulting EU and international targets such as Horizon 2020?

Existing European research infrastructures are badly fragmented, uncoordinated, lack sound integrated experimentations and are poorly linked to analytical and modelling platforms. Many research efforts require massive computing resources to tackle, for example, the environmental challenge on global warming or research in the biosciences, both of which must integrate research efforts across scientific disciplines. Indeed, the foreseen added value of the AnaEE integrated infrastructure should overcome the diagnostic deficit. The Horizon 2020 proposal recognises the urgent drivers needed for such infrastructure and this is why Member States together with European Commission have fixed the agenda to achieve the construction of 60 per cent of the priority European Research infrastructures currently identified by European Strategy Forum on Research Infrastructures (ESFRI), including AnaEE, by 2016.

What long-term impacts do you hope this work will have?

I hope that AnaEE will contribute in structuring the currently fragmented research community on terrestrial ecosystems within the European Research Area and enhance the attractiveness of the EU by offering integrated and coordinated experimental ecosystem research. I hope that AnaEE will also be developed and implemented within emerging and undeveloped countries. The present AnaEE project should serve as a springboard for such future development. On a global scale, AnaEE will help decision makers to better understand how ecological systems respond to global changes-related perturbations, to take appropriate measures for sustainable policies and test sustainable land use and innovative green technologies in order to address societal challenges.

How do you expect AnaEE to assist in managing the trade-offs between immediate human needs and maintaining the capacity of the biosphere to provide goods and services in the long term?

AnaEE's structure, with its integrated observational and experimental facilities in Europe, will offer unique opportunities for analysing simultaneously ecosystem processes, coupling this knowledge with ecosystem functions through cascades of interactions and feedback loops. The scale of these challenges is that they require not only research infrastructures, which are often beyond the resources available at national or regional levels. Furthermore, it is commonly recognised that innovation in science and technology has a crucial role to play not only in the generation of new and economically-useful knowledge for the development of new products and processes, but also for the advancement of social, political and environmental goals and quality of life.

Is AnaEE involved in shaping the direction of scientific endeavours?

No, AnaEE is solely committed to providing services and adjusts its goals according to changes of society. We are developing tools, but scientists are free to use them in whatever manner necessary. The aim of AnaEE is to reduce fragmentation and provide facilitated end services to answer the grand societal challenges facing Europe.

A framework for partnership

As ecosystems come under increasing burden from the effects of climate change, work is underway at the **Institut National de la Recherche Agronomique** in Lusignan, France – together with 12 European partners – to establish an integrated infrastructure to aid analysis of the response of these vital ecosystems to land use change

WITH THE GLOBAL human population on the verge of surpassing 7 billion, the need to rationalise and increase world food supplies is regarded as one of the most urgent challenges facing scientists and policy makers. Moreover, as the consequences of global warming become increasingly evident, it is clear that the management and preservation of the complex ecosystems in which food is produced is essential if we are to cope with the effects of a changing climate. Even in the comparably temperate conditions of Europe, in the last decade the continent has borne witness to these critical agricultural challenges. During the summer of 2003, crop yields were diminished by up to one-third in affected regions amidst rising average temperatures and precipitation deficits, translating into an estimated financial loss of a staggering €36 billion.

ADAPTING TO CHANGE

The mounting environmental crisis that we face can be observed in the smallest microbes in the soil through to large-scale deforestation. Consequently, the erosion of biodiversity in our environment through the destruction of habitats and the effects of pollution presents policy makers with the task of trading off the needs of a growing human population with the long-term sustainability of the ecosystems to provide goods and services. The necessity therefore exists for a greater scientific understanding of how living organisms are affected and adapt to the variable biotic and abiotic factors presented to them. Moreover, it is important to identify the influence of the genetic and non-genetic elements that so profoundly affect the ability of ecosystems to deal with rapid changes.

While advances in experimental science, analytic and ecosystem modelling are offering new insights and measurable predictions of biosphere changes, the global nature of the problem requires an international solution. Consequently, a project led by Dr Abad Chabbi from the Institut National de la Recherche Agronomique (INRA) in Lusignan, France has been recently approved by the European Strategy Forum on Research Infrastructures (ESFRI)

and aims to provide Europe with a distributed and coordinated set of platforms to analyse and predict the effect of environmental and land use changes on the major continental ecologies.

A QUANTUM LEAP IN UNDERSTANDING

The Infrastructure for analysis and Experimentation on Ecosystems (AnaEE) project intends to become a hub for the multitude of studies across Europe that are engaged in ecosystem functioning research and will join the disparate work being carried out under one umbrella for the benefit of everyone. "Through its integrated and experimental approach to ecosystem functioning, AnaEE will provide a quantum leap in the quality and availability of data and projections on continental ecosystem responses to global changes and management, enabling policy makers and stakeholders to sustainably manage ecosystem services for all citizens," Chabbi reveals. Moreover, the project will be the reference point for the rigorous assessment of ecosystem services, providing answers to key questions surrounding the emerging European bioeconomy alongside other important political and environmental concerns.

AnaEE will also play a crucial role in the implementation of the forthcoming European Joint Programming Initiative on Agriculture, Food Security and Climate Change (JPI FACCE), which is setting out its strategic priorities for transdisciplinary research. Chabbi outlines the synergy of the Initiative: "The JPIs will help identify the range of services to be offered by the AnaEE research infrastructure and associated access rules for different user types. There is a clear need to work with JPIs as early as possible on defining these services".

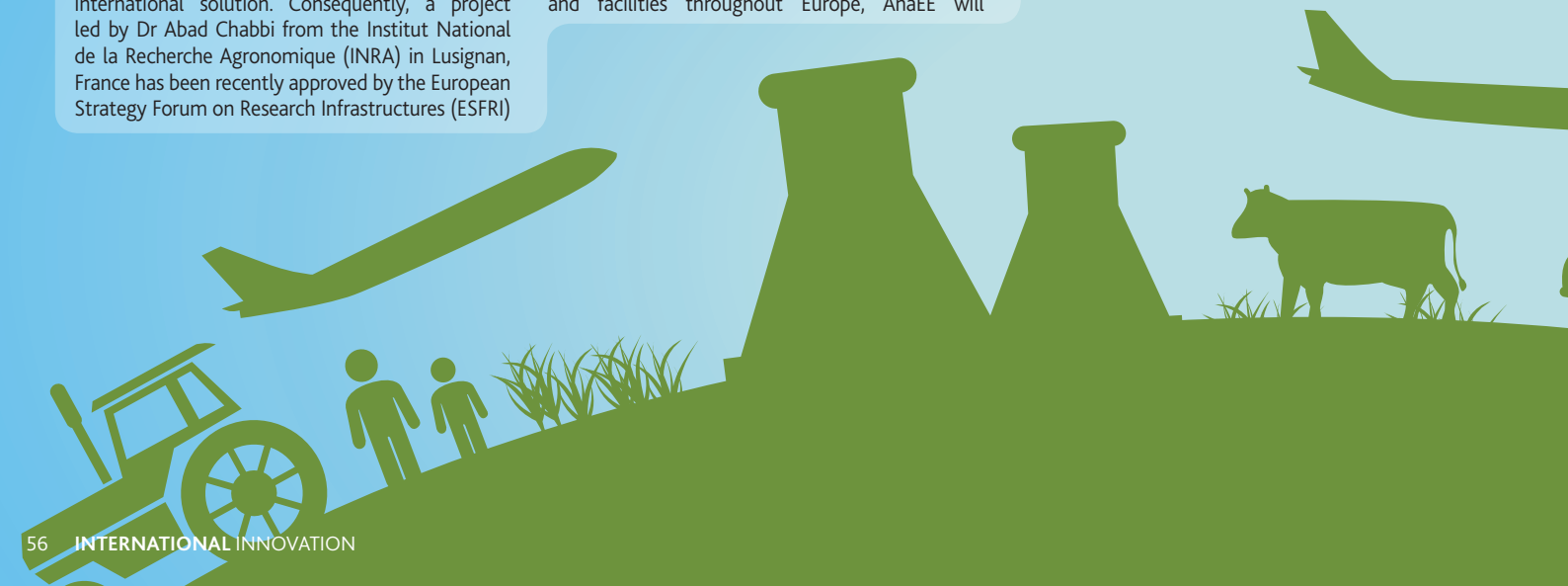
POOLING RESOURCES

By integrating the currently dispersed expertise and facilities throughout Europe, AnaEE will

become one of the world's leading authorities regarding ecological management. Utilising its integrated experimental infrastructure, the project consists of four complementary components that constitute the basis of the research. By harnessing the latest technologies, the project will bring together *in natura* and *in vitro* experiments with an association to analytical and modelling platforms. "AnaEE structure will go beyond what already exists overseas, such as the US-National Ecological Observatory Network (NEON – Boulder, Colorado) and the Variable Atmospheric Laboratory (VAL) at Arizona University. Those systems lack in fact the capacity to bridge *in natura* and *in vitro* infrastructures as well as an integrated experimental capability to complement monitoring and observational systems," explains Chabbi.

Distributed across the main types of climate and land use, including arable land, grassland, forest and wetlands, the long-term highly instrumented *in natura* experimental platform (eg. SOERE-ACBB in France, the terrestrial-aquatic interface facilities in Belgium or in Sweden, etc.) will allow for a measurement of the variables affecting the different types of ecosystems. Likewise, environmentally-controlled chambers, such as 'Ecotron' developed in Montpellier (France) planned in Belgium (Flanders) and Norway ('Bioklima'), can be used to synthesise ecosystems to provide a detailed analysis of the impact of long-term treatments and climate change.

Various laboratories will be utilised across the EU to carry out the modelling activities with the hope that AnaEE can establish its own modelling centre to act as an easily-accessible resource for collaboration. Furthermore, using analytical platforms the project will provide a better understanding of the complex interactions between the different biogeochemical cycles and ecological states. By collecting all the data



INTELLIGENCE

AnaEE

INFRASTRUCTURE FOR ANALYSIS AND EXPERIMENTATION ON ECOSYSTEMS

OBJECTIVES

To provide Europe with a distributed and coordinated set of experimental, analytical and modelling platforms to analyse and predict in a precise manner the response of the main continental ecosystems to environmental and land use changes.

PARTNERS

Institut National de la Recherche Agronomique, France • **Biotechnology and Biological Sciences Research Council**, UK • **Norwegian Institute for Agricultural and Environmental Research** • **Centre National de la Recherche Scientifique**, France • **Technical University of Denmark** • **Istanbul Technical University**, Turkey • **Fondazione Edmund Mach**, Italy • **Global Change Research Centre**, Academy of Sciences of the Czech Republic • **University of Antwerp**, Belgium • **University of Helsinki**, Finland • **Umeå University**, Sweden • **Rothamsted Research**, UK • **Inra Transfert**, France

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CONTACT

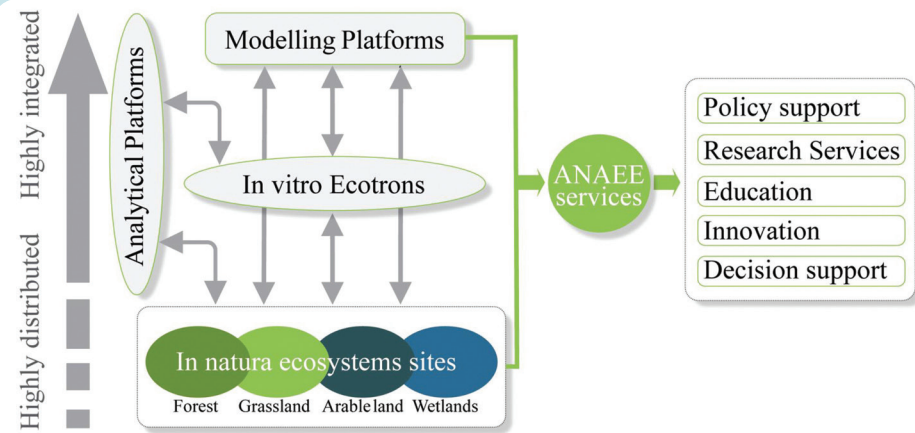
Dr Abad Chabbi
Project Coordinator

Institut National de la Recherche Agronomique
INRA-URP3F
86 600 Lusignan
France

T +33 5 49 55 61 78
E abad.chabbi@lusignan.inra.fr

www.anaee.com

DR ABAD CHABBI is a plant ecologist and soil biogeochemist. He works at the INRA research council where, since 2009, he has been leader of the national Observatory for Environmental Research-Agro-ecosystem, Biogeochemical Cycles and Biodiversity (SOERE-ACBB). His areas of expertise are ecology and soil biogeochemistry.



AnaEE architecture illustrating the functionally complementary relationships between the four components and their multiple services. The AnaEE infrastructure will provide services such as consistent methodologies to support research and education in environmental science and forecast scenarios that are of interest for stakeholders involved in nature conservation, agriculture, livestock forestry and policy makers.

in one place it will make dissemination of the predictive models and databases readily available to all the stakeholders. "With a common vision, and mutualised resources, AnaEE will be a key instrument in both structuring and improving the European research area in ecosystem science," stresses Chabbi.

THE ROADMAP

To enable effective implementation of the project, AnaEE has started its preparatory phase, laying down the first roadmap that will enable and encourage the development of a sustainable European infrastructure. To this end, Chabbi has instigated a series of workshops dedicated to the execution of the AnaEE vision alongside the installation of the necessary legal and governance policy, to underpin data sharing and technology transfer guidelines. Moreover, the workshops are an opportunity for all the stakeholders to have an input into the framework of the project and a means to forge partnerships with both the different national infrastructures and relevant commercially interested parties.

Overall, the objective of the project is to inform and influence policy makers; therefore the hope is that AnaEE will be able to help decision makers navigate through the complexities of ecosystem processes.

"AnaEE will support policy making by answering questions about the future; helping with land planning for agriculture, forestry and bioeconomy; and ecosystem services assessments at the European and regional scale for a range of scenarios and global change impacts on ecosystems and their services," expounds Chabbi. Additionally, the project hopes to provide a platform to promote the EU and its Member States' research and innovation credentials, aimed at securing European global competitiveness, in line with the objectives of the Horizon 2020 programme.

BEYOND BORDERS

So far, several European countries have provided substantial funding, constituting 41 per cent of the project's construction costs. Critically, Chabbi believes that AnaEE can serve as a springboard to greater international cooperation and infrastructure coordination: "We started building strong cooperation between AnaEE and two other big research infrastructures – NEON in the US and TERN in Australia: initiating and enhancing international cooperation with countries such as the US, Australia, Brazil, China and India, will be vital". Considering the global scale of ecological damage and the interconnected nature of world's environmental systems, the work of AnaEE may establish a precedent of cooperation that could serve millions of people for generations to come.

