Agriculture, Food Security and Climate Change
FACCEJPI

Background and objectives FACCE ERA-Net Plus

Background for the call

Climate change impacts on agriculture

Climate change has been shown to have a number of direct biophysical impacts on agriculture including changes in arable and perennial crop and pasture physiology, phenology, productivity and quality, in soil moisture and soil functioning, in water demand for irrigation, in weeds, pests and diseases, with possible heat stress effects on animal physiology, productivity and reproduction. Amongst these impacts, the risk of emergence and re-emergence of (e.g. vector borne) animal diseases associated with climate change needs to be considered. Biological adaptation to climate change is already taking place, e.g. through natural selection, biological invasions and emerging pests and diseases. However, a better understanding of the associated risks and development of both preventive and palliative strategies is required. A number of interactions have also been described with e.g. soil conditions (e.g. water status, nutrients availability), CO_2 fertilization, as well as air pollution (e.g. ozone). Potential impacts differ across crop, pasture and livestock species and may also differ across genotypes.

High seasonally averaged temperatures, changing patterns of rainfall and increasing incidence of extreme weather are likely to challenge agricultural production levels and volatility, as well as the quality of products in the future. Nevertheless, the rise in temperature and in atmospheric CO_2 may also create opportunities in some regions (e.g. at high latitudes). It is reported that crop suitability is likely to change throughout Europe, and crop productivity (all other factors remaining unchanged) is likely to increase in Northern Europe, and decrease in Southern Europe, and the eastern part of Continental Europe.

Particular attention needs to be paid to climate changes in hot-spot local areas, where the local environmental conditions are essential to maintain the added value of the particular agricultural productions.

Adaptation to climate change

European agriculture has always had to cope with variability in the weather, but climate change will likely produce more permanent shifts in temperature and precipitation that will require more robust actions. A range of strategies is available to adapt to climate change, with different levels of complexity, cost and commitment to change.

Resistance strategies (or incremental adaptation) seek to maintain the status quo over the near term through management actions that resist climate change disturbance.

Resistance strategies will likely increase in cost and difficulty over time, and may ultimately fail as climate change effects intensify. Resilience strategies (or more systemic adaptation) are typically proactive actions that increase the adaptive capacity so as to return to a healthy condition after a climate disturbance with minimal management intervention. Transformation strategies increase adaptive capacity by facilitating transition to a new system with a different structure and function that is better suited to sustained production under rapidly changing climate conditions.

Farmers across Europe are currently adapting their practices to climate change, despite less predictability in seasonal trends. Simple, no-cost adaptation options such as advancement of sowing and harvesting dates or the use of longer cycle varieties may be implemented although such options may become less successful in a more variable climate. Further adaptation options include arable agriculture changes in cultivars and in crop species, fertilization, irrigation, drainage, land allocation and diversification of farming systems.

Continued plant breeding progress aimed at increasing yield potential jointly with drought resistance and adjusted agronomic practices is required. With livestock, adaptation concerns for instance the seasonality of pasture use by grazing and cutting, changes in animal breeds and changes in farm buildings to cope with the increased likelihood of heat stress. Adaptation to increased climatic variability may also imply an increased use of genetic diversity in farming systems e.g. through balanced crop rotations and intercropping. The development of insurance products against weather-related yield variations may also be a tool to mitigate the risk aversion by farmers. In season adjustments of agricultural practices may also be based on the use of precision agriculture, remote sensing and improved local weather forecast services.

Planned adaptation aims to respond to expected impacts of climate change within the context of on-going and expected social and economic changes and is the result of a deliberate decision. Planned adaptation in agriculture will require a large coordinated research effort to develop adapted seeds and breeds and to design resilient and environmentally sound and resource efficient crop and livestock systems, while ensuring the dynamic conservation of soil, water and of biodiversity.

More productive and resilient farming systems may also lead to beneficial side effects in terms of carbon sequestration and reduction of greenhouse gas emissions per unit product and area. Minimising trade-offs and maximising synergies between adaptation and mitigation options in agriculture is needed. The technical potential, the costs and the benefits of combined adaptation and mitigation options need to be assessed in the agriculture sector, taking into account differences across regions and across production systems within Europe. Research oriented towards the development of public policies, and the potential for socio-economic innovation, is also required.

Achieving increased adaptation will necessitate integration of climate change-related issues with other factors, such as market risk, energy prices, consumers' habits, land and water availability and agricultural policies. There are critical areas outside the research to be carried out in this call that yet need to be recognised:

1. adaptation goes beyond the farm gate since changes in the processing, the transportation and the retailing of agricultural commodities will also be required;
2. climate change adaptation is not only for food crops but is also required for industrial crops and crops used for biofuels, biomaterials and for green chemistry;
3. trade and stocking policies are further options of adaptation to stabilize supply, but as with all adaptation options their costs and benefits are to be considered.

Climate smart agriculture

Climate smart agriculture has been defined as agriculture that sustainably increases productivity and resilience (adaptation), reduces greenhouse gases (mitigation), and enhances food security and development. In order to stabilize outputs and income, production systems should become more resilient, i.e. more capable of performing well in the face of disruptive climatic events.

Enhancing the capacity to manage climate risk is also a core adaptation strategy. There are many region- or situation-specific climate risk management options, e.g., crop and livestock diversification, that may also have adaptation value. There is also increasing evidence that the resilience of agricultural systems to global change depends on a wide range of ecosystem processes that provide services to agriculture, e.g. water quality and quantity, waste processing, climate protection and the regulation of pest populations.

Objectives of the call

The main objective of this call is to support interdisciplinary research and innovative approaches on the adaptation of European agriculture to:

1. incremental climate change and
2. to increased climatic variability

Transnational research projects will concern agricultural adaptation options, adaptive capacity of agriculture and resilience of agricultural systems in the European countries funding this call. Other European countries and regions, as well as overseas territories may be considered where relevant to understanding and designing adaptation systems for Europe.

It is expected that all projects will address adaptation of agriculture in the context of the environmental, social and economic factors of sustainability, therefore trans-disciplinary approaches are essential and the integration of stakeholders is important.

Projects should take into account any European regional specificity, with their own geographic and socio-economic characteristics, differing in the vulnerability of their soil and water resources, their agricultural products and local agri-food industries. Transformation strategies towards new agricultural systems should also be considered, to take into account new opportunities or increased risks of failures of existing systems.

1. Full statement of the project’s research strategy in the context of existing climate change scenarios; specification of the time horizon targeted for adaptation; specification of the production type and the agricultural system to be adapted.
2. Statement explaining how the proposed research can contribute to climate smart agriculture.
3. Statement of the added value at European scale and at country/regional scale of the research undertaken
4. Justification of the foreseen pathway to impacts of the project, regarding a) academic impact, i.e. contribution that the project’s research will make to academic advances, across and within disciplines; b) economic and societal impact, i.e. contribution that the project’s research will make to society and the economy, including e.g. the stakeholders in this area and potential for developing new policies.
5. Statement explaining the project’s specific data management policies and plans, which should be in accordance with relevant standards and community best practice. Data with acknowledged long-term value should be preserved and remain accessible and usable for future research.
6. An indication on whether the adaptation options proposed in the project will have major impacts on direct emissions of greenhouse gases (N_2O, CH_4 and CO_2) and on soil carbon stocks, as well as how it is envisaged to study such effects.
7. An indication of the possible effects of the option for agricultural production.