

Interactions between climate change & agriculture and between biodiversity & agriculture

As a result of inevitable population growth (possibly to 10 billion by 2050) and expected economic development it is clear that there will be rising demands for food and energy from the land over the coming decades. But this requirement for increased production will coincide with increasing climate change related threats to agriculture (which will probably outweigh opportunities in Europe) and therefore the need to adapt agriculture to cope with these threats. There is also the potential for agriculture to play its part in mitigating climate change by reducing its net greenhouse gas emissions. But some mitigation options may conflict with the goal of increasing agricultural production.

Furthermore, projected drivers of agricultural change suggest that biodiversity losses will continue due to the ongoing impacts of intensive agricultural practices, and especially in the EU-12 due to intensification and specialisation in some areas (and abandonment of low-intensity biodiversity-rich farming systems in others). This will undermine the EU's ability to meet its nature conservation targets (and those of the Convention on Biological Diversity), and threaten the long-term sustainability of farming in some areas as a result of, for example, soil degradation, declines in pollinators and increased outbreaks of pests and diseases. The losses of other components of biodiversity will also have significant detrimental impacts on many other related ecosystem services.

These interrelated challenges lead to the obvious conclusion that if agricultural production is to be increased through intensification then it has to be achieved sustainably, taking into account climate and biodiversity needs in the EU and elsewhere. Step changes in actions are therefore required to ensure rapid reductions in agricultural emissions of greenhouse gases, and effective agricultural adaptation and biodiversity conservation in Europe. In this respect EU policies, including the CAP and other initiatives such as the European Innovation Partnership (EIP) on agricultural productivity and sustainability, have key roles to play in increasing the scope, pace and effectiveness of actions. Such actions should include the increased use of regulations to avoid unsustainable practices and protect important ecosystems and their biodiversity, the provision of incentives to support beneficial practices and funding to stimulate research and the transfer of technological and non-technological innovation options, such as better soil and water management practices on farms. Private funded and market based measures may also contribute, but these may require an improvement in the legal basis of private or private-public payments for ecosystem services in order to increase the use of the land for the delivery of 'public goods', such as biodiversity, the storage of greenhouse gases, or water storage and retention.

The following are some recommended priority options for sustainably increasing agricultural productivity whilst supporting key actions to facilitate agriculture related climate change adaptation and mitigation, and biodiversity conservation. These are based on a review of the implications of the interrelationships between climate change and agriculture, and between agriculture and biodiversity, and take into account the potential for using a range of innovative options to increase agricultural productivity on a sustainable basis.

1. Provide incentives for climate resilient and biodiversity-friendly farmland management

Promote actions that have benefits for climate change adaptation and mitigation and avoid significant biodiversity damage, and that may be taken up by farmers as a result of the economic benefits

- Help farmers identify and take appropriate actions to use water, soil and energy resources more efficiently.
- Public funding should help overcome barriers to action by farmers, through modest support to upfront investment costs and start-up costs where needed, particularly in the livestock sector where there are fewer direct productivity benefits.

- A climate dimension needs to be integrated into a range of CAP measures, including rural development programmes.

Strengthen the protection and management of semi-natural agricultural habitats and the economic viability of the farming systems that maintain them

- This requires a combination of support and enhanced investment in traditional management alongside the development of new approaches and adaptation to changing socio-economic conditions.
- Member States can use the new CAP framework to develop measures that assist High Nature Value farming in different ways, such as supporting the appropriate management of valuable semi-natural habitats on farmland; and less direct measures such as adding value to HNV farm produce to improve economic and social sustainability.
- Increase targeted support and advice to farming systems that maintain and restore Natura 2000 habitats and species, both within Natura 2000 sites and outside, especially where they buffer or connect Natura 2000 sites.

Develop policy measures that recognise the substantial ecosystem services supplied by semi-natural farmland and farming systems

- More explicitly link public support to the provision of ecosystem services that are not supported by economic markets (including carbon storage, water flow regulation and purification, cultural and recreational value), through ecosystem assessments, strategic multifunctional land use planning and management, payment for ecosystem services schemes and improved monitoring.

Provide well-designed, targeted and monitored agri-environment schemes on farmland that provide co-benefits for biodiversity and climate change adaptation

- Some actions require adapted soil and crop management, for example use of crop rotations, integrated weed and pest management, intercropping, conservation tillage, unfarmed flower-rich buffer strips, reduced livestock densities.
- Some limited areas may be taken out of highly productive use, such as the creation of areas of flower and seed resources on intensive arable land, the rewetting of peatlands, and the extensification of grassland.
- Many of the actions needed are more beneficial if they are planned and targeted at a scale larger than the individual farm, as is occurring in some Member States. The Rural Development Regulation contains a number of important supporting measures that can help encourage and pay for the necessary planning and targeting of long-term actions at a landscape scale by funding the creation of local partnerships, facilitators and advisors.

2. Constrain unsustainable practices through policy mechanisms

Ensure compliance with the Nitrates Directive and other EU legislation that reduces nitrogen emissions

- Better management of the nitrogen cycle on farmland is beneficial for both biodiversity and reducing GHG emissions.
- The more consistent and rigorous implementation all over the EU would be helpful and would lead to more balanced fertilisation¹, combined with improved crop and manure management; low-protein animal feeding, combined with improved herd management; and ammonia emissions abatement measures, including improved manure application and storage.

Push for ambitious pesticide reduction targets and full implementation of integrated pest management

- Member States are currently failing to set ambitious pesticide reduction targets under the Sustainable Use of Pesticides Directive. Under the new CAP framework, Farm Advisory Services are now obliged to provide farmers with IPM advice.

¹ ie fertiliser use that does not lower crop yields but that decreases nitrogen leaching losses to less than 50 mg NO³-I⁻¹

Use CAP cross-compliance requirements to ensure protection and management of farmland elements that benefit biodiversity and climate change adaptation

- Ensure that Member States use the greater flexibility to set GAEC requirements in the new CAP cross-compliance regime so as to enhance protection and management of permanent grassland, riparian buffer strips, and farmland features, as well as water and nitrogen use efficiency.

3. Implement options to maximise climate resilient agriculture that benefits biodiversity through the CAP and through the new EU-level mechanisms to support innovation

Ensure that innovation investment targets areas of greatest potential and knowledge gaps, combining yield improvement with sustainability objectives

- Existing streams of yield innovation need to be better integrated with innovative practices that reduce the damaging environmental effects of high yielding agriculture. Innovation should focus on the sustainability and efficiency of contemporary systems across the spectrum in both high yielding and extensive systems..
- Other research priorities include methods to improve yields in organic farming systems; and options to refine and turn into commercial propositions novel production systems that provide the greatest co-benefits for climate change mitigation and adaptation, resource efficiency, and biodiversity conservation such as precision farming and paludiculture² on rewetted peat lands, and other beneficial approaches such as some forms of agroforestry. This includes the targeted creation of green infrastructure to restore connectivity and ecosystem services in agricultural landscapes.

Environmental safeguards, research and evaluation of the possible negative impacts of new technologies

- Innovations are not inherently more sustainable or biodiversity-friendly, and their potential impacts need careful research and evaluation, with environmental safeguards associated with any incentives for use.
- For example: the promotion of advanced biofuels from wastes and residues requires appropriate environmental safeguards to prevent harmful indirect effects, such as those related to the displacement of straw and other crop residues that are needed to retain soil carbon in fields. Certification schemes for sustainable biofuels should be encouraged, but suitable measures to modify current targets for biofuels are needed too.
- GM crops can be beneficial or detrimental to biodiversity depending on their traits and management. A relatively narrow stock of GM crops and traits is currently used globally, while a wide range of new generation traits and crops for potential future use is being developed. However, it is too early to conclude whether these crops would have beneficial or detrimental biodiversity impacts in Europe if they were to be authorised for deliberate release. It is also important to bear in mind that a suite of new plant breeding techniques is now available, most of which have the potential to produce biologically novel crops and cropping systems³; consequently their potential environmental impacts should also be carefully assessed.

Ensure Europe's genetic resources for food and agriculture are better used and conserved

- Give greater prominence in the Horizon 2020 programme to research on plant genetic resources for a more biodiverse crop base better adapted to climate change.
- Establish a more coordinated European Genebank Integrated System that provides crop breeders with greater actual or predictive characterisation and evaluation of conserved plant genetic resources, and more available online information linked with better mutual cooperation between gene banks.
- Establish a European network of *in situ* genetic reserves for crop wild relatives and on-farm conservation sites for landraces.

² ie productive use of wet peatland in a way that the peat body is preserved

³ Biological novelty that deviates substantially (genetically, biochemically, and physiologically as well as in ethical and regulatory terms, and in public perception) from what classical, selection-based breeding has achieved, and which therefore poses a new scale of potential risk.

- Stimulate the use of plant genetic resources and the marketing of a greater variety of crops by systematically analysing positive and negative implications of the EU regulatory regime upon the use of a diversity of crops and plant genetic resources.

Provide increased direct funding for research on tackling the multiple factors causing honeybee losses and wild pollinator decline

- Public funding is urgently required to address the multiple factors causing European honeybee losses. Because the interactive effects can cause greater impacts than each factor in isolation, an integrated response with concerted actions by public authorities, beekeepers, farmers, the pharmaceutical industry, and researchers is needed.

4. Reduce the external impacts of European agriculture and biofuel imports

Increase the EU's efforts to reducing global biodiversity loss through actions to reduce the environmental footprint of the EU's food, feed and biofuel imports, and to encourage consumer demand for environmentally sustainable food

- Increase the EU's active engagement in international initiatives to develop global environmental principles for food, fibre and energy production.
- Encourage and support effective voluntary and private environmental certification schemes and products.
- Encourage certification schemes with effective environmental sustainability standards for biofuel imports, but increase efforts to reduce the indirect impacts of biofuel related land use change, because these are believed to be considerably more important than direct impacts and are not monitored let alone regulated by the EU directive's sustainability scheme.
- Increase education and awareness campaigns to reduce unhealthy meat consumption levels, whilst promoting the livestock products from European High Nature Value farms.
- Take steps to increase domestic production of animal feed that also brings benefits for biodiversity and adaptation to climate change, such as legume crop systems that do not require high levels of pesticide use.
- Fund research on the potential biodiversity trade-offs of increasing or constraining (through environmental measures) agricultural production in the EU with respect to EU and global biodiversity impacts, considering also the possible impacts of land sparing versus land sharing strategies in the EU and elsewhere.

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