



Ecological intensification in EU agriculture

Policy implications of research findings from project LIBERATION

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Introduction

Recent research on “ecological intensification” has highlighted the importance of local innovation, farmer knowledge and participatory research to shift away from high-input agriculture. Designing policy instruments and providing resources to decentralize support for ecological intensification of agricultural production has challenges. The European community has designed its ‘Common Agricultural Policy’ to support social, economic and environmental approaches to farming in Europe. Yet, it also recognizes that there is no “one-size fits all” way to frame policy for all the EU’s farmers. With respect to the environmental dimensions and pathways toward “ecological intensification”, a good evidence of understanding local ecologies and dynamics is key to improved uptake and adaptation, and ensuring sustainable solutions. To avoid short term fixes and ensure long-term provisioning of multiple ecosystem services, several interventions may be proposed. As the CAP is meant to be a flexible instrument it is timely to suggest modifications drawing from implementation and research.

The LIBERATION project has generated a range of findings relevant to farmers’ field and landscape knowledge management, and implications for policy that can shape local action beyond the farm scale, to landscape level measures. These implications can be transformed into policy instruments that incentivize or regulate farm practices while at the same time appreciating the risks and benefits that exist for individual farmers, and for wider society – and being sensitive to how to manage trade-offs and synergies in both spatial and temporal terms.

Ecological intensification is an approach to agricultural production that aims to match or increase yields while minimizing negative impacts on the environment and on agricultural productivity, by integrating the management of ecosystem services delivered by biodiversity into production systems (Bommarco, Kleijn & Potts, 2013)

Key policy messages

- Policies intended to support ecological intensification must adopt a holistic ecosystem approach, rather than focus on single management practices.
- Policy initiatives should thus target the broader landscape rather than farm-level management only, and should encourage and incentivize cooperation among individual farmers.
- Further research is needed to reduce yield gaps by facilitating the uptake of groupings of different ecosystem services that are tailored to specific agricultural contexts, and to study the effectiveness of agri-environment schemes (AES) and farmers trainings and advice.
- Several implications to improve specific ecological intensification measures have emerged from LIBERATION research. Value has been documented in:
 - Preserving forest patches within 0.5 km from farms, and of semi-natural habitats;
 - Improving wildflower strips quality and tailor implementation;
 - Enhancing pollinators based on traits that match those of focal crops;
 - Tailoring biological pest control practices based on the local landscapes.



Some practices linked to harnessing ecosystem services – such as establishment and management of habitats for pollinators and ecological pest management practices – imply a need for planning and coordination at a wider spatial scale. Farms located in a certain area must coordinate their actions to implement best management practices at the landscape level, including along the boundaries of farms, along roadsides and drainage ditches, in surrounding patches of grassland, forest and woodlands. This requires farmers to interact and negotiate with other stakeholders: neighboring farmers, as well as other land managers and institutional interests – conservationists, foresters, or local water authorities, right-of-way owners and managers, among others. In order to support and encourage multi-stakeholder engagement around landscape management, **there is a need for policies that provide resources for stakeholder engagement leading to informed decision-making while incentivizing collaboration among different natural resource managers.**

Research results from the project can be extended into further applied research and tool development, and toward strengthening the models and methods needed for the monitoring at the scale of landscape-level initiatives. These in turn would be critical in providing the evidence base to inform decision-making based upon the negotiation between multiple values and competing interests. Supporting multi-objective, multi-stakeholder integration and valuation processes in spatially-explicit or targeted locations are among some of the recommendations emerging from project research.

Ultimately research results can also address the need for wider transformation of agricultural production in response to pressures for greater sustainability, resilience and adaptability. Some findings have suggested new roles for other food system actors, such as among large food retailers, possibly having a role in conveying quality and production values being sought between actors at opposite ends of the value chain.

Such visions of transformation urge that resilience in our food supply requires the restoration and expansion of ecosystem services at the landscape-scale.

Informing policy

The LIBERATION project findings can also inform EU-region wide policies and programmes. However, the opportunity to do so arises within the context of larger policy reform processes - such as the occasional Common Agriculture Policy reforms – that appear only at wide intervals (4-5 year cycles). Periodic national reviews of recommended practices, and the sub-national implementation of more regionally-appropriate strategies provide a certain degree of freedom to translate a more flexible application of the rules. Ecological intensification is not a ‘one-size-fits-all’ management framework, and accordingly policies will be needed that are structured to have appropriate sensitivity to cropping systems and other context-dependent variables, and yet that also are not so flexible such that they make oversight too difficult or costly.

Apart from EU or national level policy forum entry points, there are other sub-national platforms and entry points that hold potential for adopting LIBERATION research results to inform future policy applications at more local and landscape scaled levels. These include the signatories of the 2015 Milan Urban Food Policy Pact, a global network of cities working on transformation in local food systems, and the work on sustainable agriculture and food systems transformation of an EU policymaking body dealing with local and regional policy applications – the Committee of the Regions.

Policy messages

- I. There is a need for policies based on a holistic ecosystem approach, rather than focused on single practices or objectives. LIBERATION research shows this e.g. in relation to pollinators management:
 - a. Only a small number of common wild bee species visit crop flowers, and these can be enhanced relatively easily to increase rates of crop pollination. Most other bee species do not occur on cropland and/or do not forage on crop flowers.



Preserving them requires traditional conservation practices such as establishing protected areas and reserves. A sole focus on ecosystem services might occur at the expense of these threatened species that do not contribute much to crop pollination. There is a need for policies capable to preserve both. (Kleijn *et al.*, 2015).

- b. Management and policy measures need to focus on species beyond human dominated landscapes, to benefit wider diversity of species including those in specialized habitats. Only by adopting a holistic ecosystem approach we can ensure the conservation and sustainable use of biodiversity and ecosystem services in the long-term. (Senapathi *et al.*, 2015)
2. Policy initiatives should target the broader landscape level alongside on-farm measures. Resilience in our food supply requires the restoration and expansion of ecosystem services at the landscape-scale – including longer term interventions to improve ecosystem services, such as water purification, flood control, soil erosion prevention – and includes the establishment of new relationships with retailers in the food system (Macfayden *et al.*, 2015). The simplification of agricultural landscapes – caused by e.g. market forces, existing policies and extension practices – has also implications for the movement of insects, including natural pest enemies, between crop and non-crop habitats (Inclán, Cerretti & Marini, 2015).
3. Further research is needed to reduce yield gaps by integrating context-appropriate bundles of ecosystem services into crop production systems. Policymakers must take into account differences between ecosystem services types, particularly between functional and cultural services, when designing measures that promote this (Bommarco, Kleijn & Potts, 2013). There is also a need to look further into whether agri-environment schemes (AES) do enhance ecosystem services, by comparing outcomes in agriculturally marginal areas versus intensively farmed areas, establishing whether they are more or less cost-effective for farmland biodiversity than protected areas, and evaluating how much farmer training determines impactful results (Batary *et al.* 2015).
4. Cooperation among individual farmers should be encouraged by policy measures. A specific entry points for policies aiming to do so has been shown in relation to restoring parasitoid diversity. In this context, the promotion of organic agriculture must aim to increase both the total extent of organic farming and the connectivity of individual farms. Local and national policies should facilitate this process by e.g. establishing incentives for cooperation among farmers (Inclán *et al.*, 2015)
5. Implications for improving specific measures that promote ecological intensification through enhanced on-farm biodiversity include:
 - a. Quality of field boundaries at the local scale was shown to be an important factor in enhancing farmland biodiversity. For butterflies, AES and other policy measures should focus particular attention on preservation of forest patches in agricultural landscapes within 0.5 km, and on conservation of semi-natural habitats at a wider landscape scale (Dainese *et al.*, 2015).
 - b. Wildflower strips established in field margins may enhance aphid pest control and thereby crop yield, and are increasingly implemented as part of AES. Yet, a study in an intensively managed agricultural landscape in the Netherlands found no effect of the presence of a wildflower strip on pest control and/or yield. In addition, strips established under AES subsidies, are often of low quality in terms of flower cover and diversity. A more tailored implementation in high-potential landscapes, and the inclusion of management targets in AES may be required to improve impacts on yield (De Groot *et al.*, in preparation).
 - c. The identification and enhancement of pollinator species with traits matching those of the focal crop, as well as the enhancement of pollinator richness and evenness, will increase crop yield beyond current practices. Farmers can predict and manage agroecosystems for pollination services based on knowledge of just a few traits that are known for a wide range of flower visitor species. This has direct implications for farmers training programs design. (Garibaldi *et al.*, 2015).



d. There is potential for adapting biological pest control practices depending on land use, which has implications for policies that target specific local landscapes. An ecological model developed as part of LIBERATION research can help to adapt the economic spray threshold – the level over which it makes economic sense to use chemicals to manage pests – depending on the landscape. This can help setting the threshold higher where biological control potential is high, and lower where potential is low, to reduce overall use of agrochemicals. The model also helps to predict the best locations in the landscape to focus conservation management practices such as beetle banks or flower strips. With improved landscape management, it will be increasingly possible to restore natural balances and minimize the use of agrochemicals.

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