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Maximizing CAP impact: Advancing Climate, Biodiversity, and Farm Profitability Through Strategic Action

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Key Messages

- **Strategic de-intensification on 7% of EU agricultural land— in win-win areas—could reduce agricultural emissions by 4.9%, equivalent to a total reduction of an estimated 12 million tons of CO_2-equivalent per year.** This would represent around 3.9% of the EU's 2030 total mitigation target for agriculture, forestry and other land use, while entailing a 2% annual reduction in total agricultural production value. These figures suggest that targeted shifts in land management could contribute significantly to climate goals without jeopardising food production.

- **Biodiversity can be measurably improved.** In win-win areas, investing at least €350 per hectare is estimated to increase the variety and abundance of native species by 1%—a significant gain given Europe's slow progress on biodiversity recovery. These local gains are significant: European biodiversity intactness improved by just 1.1% between 2000 and 2018, and global studies show a decline of ~3.4% since 1970 and ~1% per decade since 1900.

- **Better targeting of CAP support remains a challenge.** Our analysis identifies three countries—Poland, Austria, and Slovenia—with above-average shares of win-win areas but below-average planned support per hectare for de-intensification. In particular, Poland and Austria also have over 50% of their agricultural land classified as intensively used, suggesting scope for environmentally beneficial transitions. Redirecting funds toward these areas could improve biodiversity and climate outcomes per euro spent. However, targeting must account for national contexts, political priorities, and the voluntary nature of farmer participation. **Result-based payments** could offer a promising way forward—enabling flexible, outcome-oriented support while encouraging uptake where environmental returns are greatest.

LAMASUS
Land Management for Sustainability

This analysis is based on new land-use management data from the Horizon Europe LAMASUS project, integrating biophysical crop and grass simulations, biodiversity models, and farm-level cost assessments. Environmental benefits are measured by biodiversity intactness (compared to pristine habitats) and CO_2-equivalent emissions from agricultural areas, including non-CO_2 greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O). While the climate benefits alone would not justify the cost, these measures are highly cost-effective for biodiversity: win-win areas are identified where a €350 per hectare annual production loss results in both a 1-ton CO_2-equivalent reduction and a 1% gain in biodiversity intactness—making this a biodiversity-driven strategy with meaningful climate co-benefits.

Identifying win-win areas matters:

The EU plans to realign the CAP with a stronger focus on competitiveness, which some fear may result in a reduced emphasis on environmental targets. It is more critical than ever to ensure that policy efforts are focused where they deliver the greatest impact and achieve climate and biodiversity goals without compromising food security.

Currently, foreseen CAP funding in member states' strategic plan allocations does not always align with regions where de-intensification would be most effective. Based on our results, some high-potential areas for biodiversity recovery and carbon sequestration receive little funding. In contrast, countries with fewer opportunities for food security-compatible de-intensification receive disproportionately high support.

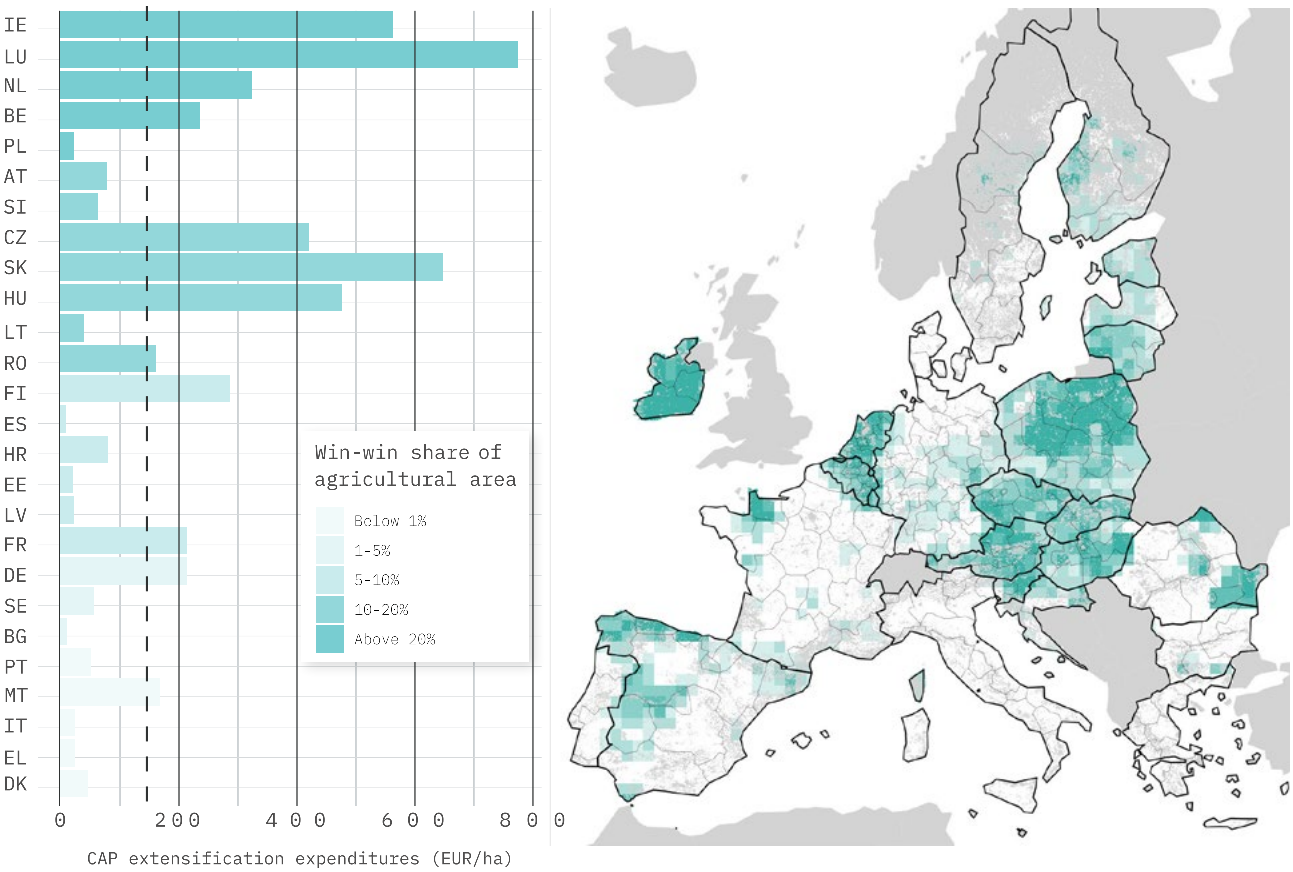
This policy brief provides spatially explicit evidence on trade-offs and opportunity costs to help policymakers target funding where it can achieve the highest environmental return. As the CAP undergoes restructuring, these insights enable smarter, more efficient policy decisions that ensure Europe's agricultural sector remains competitive and sustainable.

> *Win-win areas are regions where an annual €350 reduction in output per hectare through sustained de-intensification yields at least a one-ton annual CO_2-equivalent reduction and increases biodiversity intactness by 1% within a decade.*

Win-Win areas in Europe and current CAP Strategic Plans

Figure 1 (a) presents the spatial distribution of win-win areas across the EU (excl. Cyprus & Malta), highlighting differences between countries. Some regions, such as Ireland, Netherlands, Luxembourg, Belgium and Poland, contain large shares of agricultural land where agricultural de-intensification - based on modelled scenarios - can help achieve biodiversity and climate objectives at minimal economic trade-offs, making them candidates for policy support. It is important to stress that modelled scenarios are indicative, and real-world applicability depends on national contexts, policy settings, and farmer decisions. Policy support should also continue in areas already managed at low intensity, as they currently contribute to biodiversity and carbon goals, even if not captured by the modelled de-intensification potential.

Figure 1 Win-Win areas across EU-27 countries (excl. Cyprus)



(a) Share of agricultural area in which de-intensification of farming practices can deliver biodiversity and climate benefits with minimal cost (green). White areas have zero share, and grey areas do not contain agricultural land or are outside the EU.

(b) Aligning CAP support with win-win areas could achieve greater biodiversity gains and carbon sequestration. The dashed line is the EU average planned CAP support for de-intensification measures. Countries are sorted by their share of win-win areas. Values reflect total planned annual budgets for extensification measures divided by utilised agricultural area. Note that actual costs and measures differ by country, so these figures represent comparable but simplified averages.

A critical question is whether existing CAP strategic plans align with these win-win regions. Figure 1 (b) shows countries ordered by share of win-win area and compares planned CAP expenditures for de-intensification (from 2023 to 2029) across EU-27 countries (excl. Cyprus) with the distribution of win-win areas. The results suggest that restructuring the de-intensification-focused direct payments and eco-schemes might enable further environmentally friendly outcomes at potentially low production value losses. However, such restructuring would require context-specific analysis to avoid unintended distributional impacts.

Our analysis highlights where to target CAP support for de-intensification measures. Out of countries with above 10% of win-win areas in their agricultural land, three (Poland, Austria, and Slovenia) have planned below-EU-average CAP support for de-intensification per hectare. Of these countries, Poland and Austria have more than 50% intensively utilised agricultural area. Redirecting funds toward these areas could enhance biodiversity and climate gains per euro spent. While geographic equity is important, this recommendation reflects an efficiency perspective—prioritising support where environmental returns per unit of funding are highest. Nevertheless, Member States' decisions also reflect broader policy objectives and political priorities, which should be acknowledged. This suggests inefficiencies in Member States' current CAP Strategic Plan allocation strategies, though further national-level consultation and validation would be needed to confirm this.

Data and Methods

This study integrates high-resolution (1 km2) land-use and management data with economic and environmental modelling to identify where de-intensification of agricultural practices maximises biodiversity and climate benefits at minimal economic cost.

The **LAMASUS database** provides cropland intensity data based on energy inputs and grassland intensity based on Corine Land Cover classifications and livestock densities. Data from 2018, sourced from Corine Land Cover and Eurostat, serves as the baseline.

Environmental and economic modelling underpin the analysis. The EPIC crop model simulates yield, soil organic carbon change, and nitrogen requirements for each 1 km^2 pixel in Europe (excl. Cyprus & Malta), accounting for soil properties, altitude, slope, and climate. Modelled crops include barley, corn, potatoes, rapeseed, rice, rye, sorghum, soybeans, sunflower, wheat, and grasslands. Cropland de-intensification is defined as lower energy input, reduced tillage, improved crop rotation, and greater crop residue incorporation. Grassland de-intensification is modelled through lower livestock densities and reduced mowing frequency. Economic valuation uses five-year average crop, milk and meat prices from Eurostat and FAOSTAT. Grassland values derived from feed use coefficients for milk and meat yields (RUMINANT model). CH4 emissions from enteric fermentation are calculated using emission factors. CO_2-equivalent emissions are estimated from nitrogen inputs – due to N2O emissions being driven by the N inputs – and soil organic carbon shifts over ten years. Our biodiversity assessment overlays land-use intensity with model-derived community responses from PREDICTS-based analysis.

A trade-off analysis compares crop, milk, and meat production losses per hectare with biodiversity and CO_2 gains. Results are aggregated into regional maps to highlight areas where de-intensification delivers optimal environmental benefits with minimal economic impact. The analysis highlights potential opportunities for improving the allocation of CAP funding.

The study classifies key CAP policies supporting de-intensification into five areas. Fertilisation policies impose stricter limits on synthetic fertilisers and mandate organic alternatives. Grassland and grazing policies regulate stocking densities, grazing periods, and seasonal restrictions to enhance biodiversity and soil health. Landscape conservation measures preserve and expand hedgerows, tree groups, and non-cultivated features. Low-input farming systems promote reduced-input, self-sustaining agriculture. Plant protection policies encourage biological pest control and restrict synthetic herbicides, fungicides, and insecticides.

This analysis provides a direct link between de-intensification measures and CAP reforms. It supports evidence-based policies to maximise biodiversity and climate benefits while maintaining agricultural viability.

Further information is available in **Response functions of LUM changes and maps of climate change mitigation potentials** and **Coefficients of estimated biodiversity responses to land use** as well as the **Methodology supplement.**

About

The LAMASUS consortium is built to deliver its overall ambition, and features world-leading interdisciplinary expertise in all domains necessary for the successful delivery of the project's objectives, including expertise in integrating knowledge across disciplines. The consortium harnesses the decades of experience in policy maker support on the science policy interface and has key expertise in econometrics, social sciences, and modelling of land-use, earth and climate systems, biodiversity, sectorial economics, and land management.

The LAMASUS consortium consists of 17 partners from 9 countries in Europe (Austria, Belgium, Germany, the Netherlands, France, Spain, Norway and Switzerland).

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