BIOGEA
Testing BIOdiversity Gain of European Agriculture with CAP greening

CAP Greening: Learning from the Local Level

Case study report:

Dry Cereal Croplands in Castilla-La Mancha, Spain

2019

BIOGEA Project

BIOGEA aims to examine how the implementation of CAP greening measures introduced in the 2014-2020 period impact land use and in turn change Green and Blue Infrastructure (GBI) in the agricultural landscape. Through policy analysis on the EU and national level and biological monitoring and modelling in six case study areas in 3 Member States (Germany, Spain and Bulgaria), the impacts of policy on GBI and GBI on biodiversity are examined.

Funding

The BIOGEA project is supported by three National Research Funding Agencies (National Science Fund, Bulgaria; Federal Ministry of Education and Research, Germany; and National Research Agency, Spain) and co-funded by the European Commission within the BiodivERsA ERA-NET Co-Fund scheme.

BIOGEA Case study report: Dry cereal croplands in Castilla-La Mancha, Spain

Authors: Yanka Kazakova, Vyara Stefanova, Paula Gil, Katrina Marsden, Elena D. Concepción, Mario Díaz,

Photo on front cover: Mario Díaz

2019

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1. Introduction to BIOGEA project

The BIOGEA project investigates the impact of land use change on the Green and Blue Infrastructure (GBI) in the agricultural landscape. GBI includes landscape structures and habitats, essential for ensuring connectivity between habitats and allowing the movement of species, thus contributing to preserve biodiversity in agricultural landscapes. GBI also provides a range of ecosystem services, which are necessary for meeting environmental policy objectives. Hence, BIOGEA also aims at analysing how GBI relate to biodiversity and associated ecosystem services.

The research approach is a combination of policy analysis on the EU and national levels and local level implementation as well as biological monitoring and modelling in six case study areas in three Member States (Germany, Spain and Bulgaria). Collaborative work with stakeholders (farmers, advisors, administrators, researchers, experts and NGOs) across scales (EU, national and local) ensured that different opinions and experiences were integrated throughout the project's implementation.

Policy analysis

The policy analysis was carried out both vertically and horizontally: a top-down analysis, from an EU-wide scale to a local scale examining the EU targets for GBI and CAP Greening and their translations into national law. The policy research was based on literature reviews and document analysis at the EU and national levels. Interviews and meetings with EU and national policy experts provided additional views on relevant CAP measures.

Case studies

Targeted case studies were done in six paired intensive/extensive sites in Bulgaria (Plovdiv-Pazardzhik region and Western Stara planina), Germany (Tauber and Albstadt) and Spain (dry cereals croplands in Castilla-La Mancha and dehesas in Extremadura).

Biodiversity and GBI monitoring and modelling in case study areas

Biodiversity and habitat (GBI) field surveys were carried out in each case study area in order to evaluate how the implementation of different CAP Greening schemes impact on biodiversity. An area survey approach was used to obtain information at landscape scale on GBI as well as on specific biodiversity parameters. In plots of 500 x 500 m landscape elements were mapped, Key plant species and species groups were recorded via transect walks in arable land and grassland at up to 4 different points. Bird species were recorded at up to 5 points with a point-count method. Generalized linear models (GLM) were used to analyze the relationships between biodiversity (i.e., plant and bird species richness and Shannon's diversity index of birds) and habitat metrics across plots within each study region. Additionally, we used historical imagery to map changes on GBI occurrence in LTS from 2012 to 2018.

Analysis of CAP Greening implementation in case study areas

The local level implementation of CAP Greening scheme was analysed in participatory manner by involving farmers and local experts, farm advisors, and decision makers. Two structured questionnaires (containing both open and closed questions) were developed for

farmers and local stakeholders in each case study area. The questionnaires had similar structure and content to allow comparison between farmers' and stakeholders' results. Their experiences and views on changes in local land use practices and impacts of the CAP on green and blue infrastructure are integrated throughout this case study report.

Dry Cereal Croplands in Castilla-La Mancha is the arable farming case study area in Spain under BIOGEA project. While farming practice is mainly extensive, intensification is taking place in certain areas currently. Case study agriculture and policy data for and from the region was collected in the period March – July 2018. Biodiversity data were collected in spring 2018 (April – June).

Meetings and interviews with local farmers, administrators, advisers and NGOs' representatives in Dry Cereal Croplands in Castilla-La Mancha were organised in the period June – July 2018. A stakeholders' round-table to discuss the preliminary findings of the two Spanish case studies was organized in October 2018. The current report systemizes the findings and conclusions from these activities.

- **Interviewed stakeholders**

Six interviews with local stakeholders and three interviews with national stakeholders were carried out in the period 5 June – 13 July 2018. The local stakeholders represented local/regional agriculture authorities and a national environmental NGO. The interviewed national-level stakeholders represented national research institutions, nature conservation NGOs and one foundation.

- **Interviewed farmers**

Fifteen farmers were interviewed in the period 5 -18 June 2018. Over half of the interviewed farmers (n=8) had farms of size between 30 ha and 100 ha, three had larger farms of over 100 ha. Smaller farms of 0.1 -10 ha and 10.1-30 ha were two in each group.

All interviewed farmers had arable land, and nine of them had over 15 ha. Fourteen farmers had permanent crops. Six farmers had permanent pastures, but all of them had under 10 ha. Farmers identified their farming systems are mixed farming (n=7), arable farming (n=4) and farms with perennial crops (n=4).

2. Dry Cereal Croplands in Castilla-La Mancha case study area

The case study area is located in Castilla-La Mancha region, Central Spain. The case study area covers six LAU2 municipalities (Horcajo de Santiago, Pozorrubio de Santiago, Torrubia del Campo, El Acebrón, Cabezamesada and Corral de Almaguer) with a total area of 60,429 ha.

The landscape is characterized by flat slopes (mean 0.9 degrees), with a mean altitude of 762 meters (range 646-836 meters). Climate is Continental Mediterranean, with a mean annual temperature of 17.3 °C, and extreme temperatures. In winter, mean temperatures fall below 6 °C and in summer mean temperatures rise above 26 °C. Annual rainfall in the region amounts around 430 mm, and the aridity index ranges 0.5-0.75 (P/EPT: Annual precipitation divided by Potential Evapotranspiration), thus the area is classified as "semi-arid" by the Spanish Ministry of Agriculture, Fisheries and Food.

The population in the case study area is 10,162 inhabitants in 2017 (Table 1). The average population density is 16.8 inhabitants per km^2. The average size of towns in this region is medium to small (5,000 to 300 inhabitants).

Table 1. Area, population and population density in the case study area

Municipality	LAU2-Area (ha)	Population, 2017 (no.)	Population density (people/sq.km)
Horcajo de Santiago	9,596	3,542	36.9
Pozorrubio de Santiago	4,467	315	7.1
Torrubia del Campo	5,332	265	5.0
El Acebrón	2,209	237	10.7
Cabezamesada	5,978	360	6.0
Corral de Almaguer	32,847	5,443	16.6
TOTAL	**60,429**	**10,162**	**16.8**

Source: http://www.ies.jccm.es/estadisticas/por-municipio/fichas-por-municipio/

Population is employed mainly in agriculture and the service sector. The agriculture sector provides employment for 14.6%-69.83% of the population in the different municipalities of the case study area.

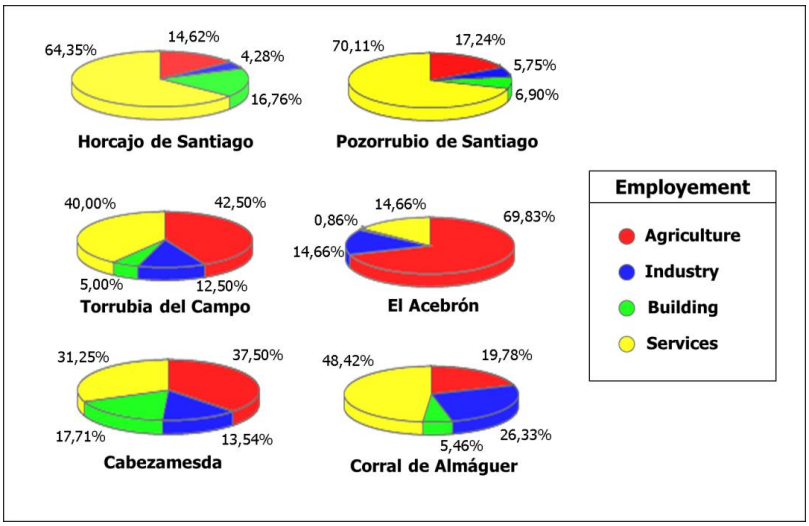

Figure 1. Affiliated workers (%) by activity sector (December 2016).

Agricultural area, including agro-forestry areas and natural grasslands, covers 96% of the land in the case study area (CORINE Land Cover 2012). Forests and scrubland have a minor share of 2.8%. Water bodies have negligible areas and are practically not recorded in CORINE Land Cover map (0%). Artificial areas cover 1.2% of the case study area territory.

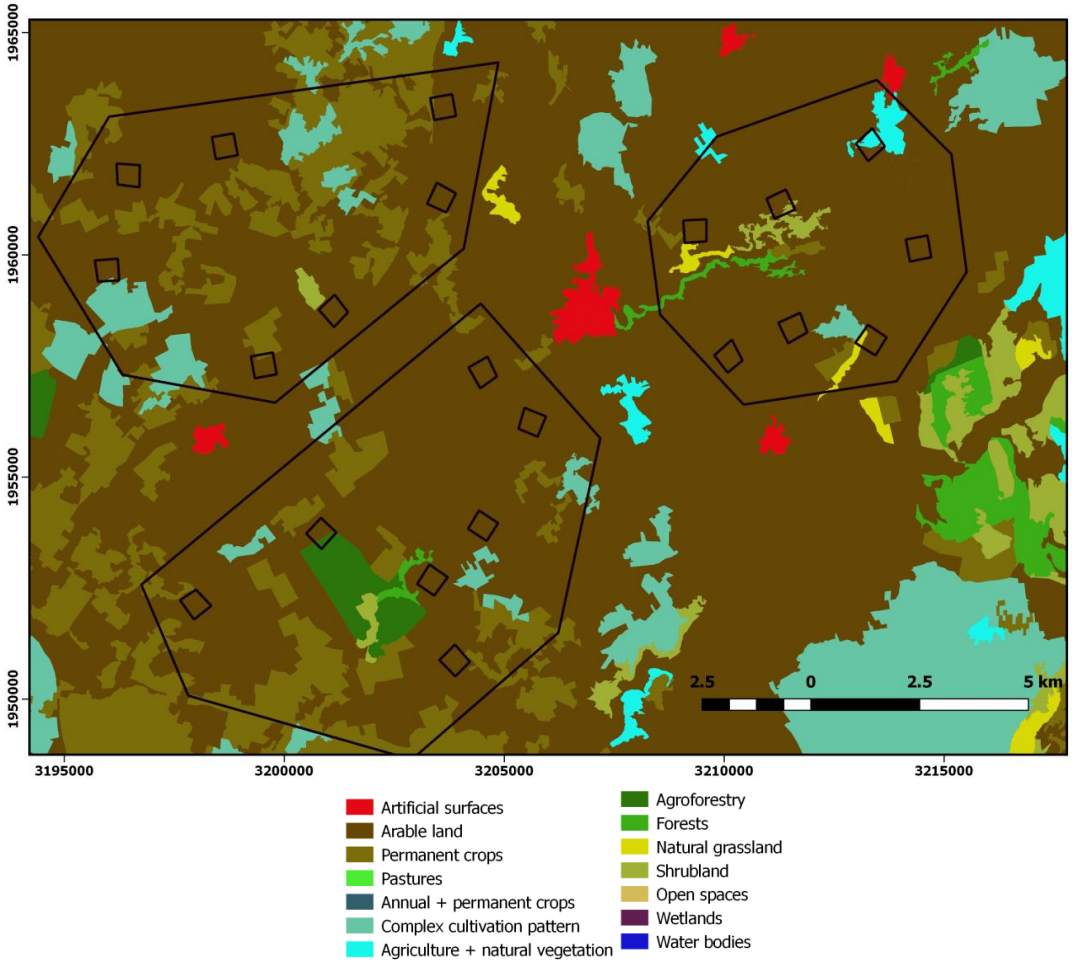

Figure 2. CORINE Land Cover categories and location of the biodiversity monitoring plots in the CS area

2.1. Agriculture land use

The landscape is characterized by an ensemble of cultivated areas, mostly dry cereal crops, vineyards and olive groves, with some areas of fallow land and pastures in between, with small enclaves of evergreen holm oaks *Quercus ilex*, kermes oaks *Q. coccifera* or diverse scrub land (species-rich mixes in the genus *Helianthemum*, *Thymus*, *Teucrium*, *Rahmnus* and many others).

The utilised agricultural area (UAA) recorded in the Agriculture Census in 2009 covers a total area of at least 51,501 ha, given that data about permanent crops is not available (Table 2). The main agricultural land use is dedicated to arable land – 91.4%, that includes both annual

and perennial crops. Permanent pastures cover a small area of 2.1%, and other agricultural land uses 6.4%.

Table 2. Agriculture land use types in the Dry Cereal Croplands case study area

Land use types	UAA (ha)	Share in total UAA (%)
Arable land	47,097.64	91.4
Permanent crops	*	
Permanent pastures	1,101.46	2.1
Other	3,302.07	6.4
Total	**51,501.17**	**100**

* Permanent crops data are not available as a separate category at the municipality level. It is included within arable land.

Source: Agriculture Census, 2009

The CORINE Land Cover data for 2012 indicates that permanent crops covers 34.1% of the study area and annual crops 53.7% (i.e., 31.2% and 49.1% of the UAA, respectively). The share of heterogenous agricultural area is 11.7%, formed by mosaic cultivation patterns and agroforestry (Table 3 and Figure 2).

Table 3. Agriculture land cover types in the Dry Cereal Croplands case study area

Land use types	Share in all agriculture land (%)
Arable land	53.7
Permanent crops	34.1
Pastures	0.5
Heterogenous agriculture areas	11.7
-- *Mosaics: complex cultivation patterns*	*6.4*
-- *Land principally occupied by agriculture*	*0.4*
-- *Agroforestry*	*4.9*
Total	**100**

Source: CORINE Land Cover, 2012

2.2.Farms and farming systems

There were 1,525 farms recorded in the Agriculture Census in 2009. One third of the farms had farmland size between 10 ha and 30 ha (Table 4). The small farms up to 5 ha were 28.1% and the largest farms of over 100 ha were 5.2% but managed 52.5% of the agriculture land.

Interpreting the data from CAP Greening scheme perspective, the farms considered green-by-definition due to their farm size (up to 10 ha) irrespective of the farming system were 44.7% but managed only 5.8% of the agriculture land.

The farms of over 30 ha were 21.2% and managed 79.3% of the agriculture land.

Table 4. Farms and agricultural land per farm size in the case study area

Farm size	Number		Area (ha)	
	(no.)	%	(ha)	(%)
Up to 5 ha	429	28.1	1,092.82	2.2
5.1 - 10 ha	253	16.6	1,777.03	3.6
10.1 - 30 ha	519	34.0	7,452.00	15.0
30.1 -100 ha	244	16.0	13,300.73	26.8
Over 100 ha	80	5.2	26,083.92	52.5
Total	**1,525**	**100.0**	**49,706.50**	**100.0**

Source: Agriculture Census, 2009

2.3.Farming systems intensity

Information about the input and use of mineral fertilizers and manure as well as livestock density index is not available at local level in the Agriculture Census 2009.

The BIOGEA team calculated the livestock systems intensity based on Agriculture Census 2009 data.

The grazing density is calculated using the livestock units of grazing animals (978.8 LU) and the area of permanent pastures (1101.46 ha). The estimated grazing density is 0.89 LU/ha.

The livestock density is calculated using the livestock units of all livestock (3936.42 LU) and the total utilised agricultural area (51501.17 ha). The estimated livestock density is 0.08 LU/ha. This is livestock intensity index is perceived as more relevant for the Dry Cereals case study area, given that sheep and goats in the region graze on stubble fields after harvest, and cattle and horses are kept indoors.

3. Characteristics of the Green and Blue infrastructure in Dry Cereals Cropland in Castilla-La Mancha

3.1. Green Infrastructure policy in Spain

The concept of Green Infrastructure (GI) is included as a new model for territorial development in the national legislation in Spain. The definition of the EU Biodiversity Strategy 2020 is adapted, specifying green infrastructure as a "network of terrestrial, aquatic and marine areas (blue infrastructure) designed, planned and managed to preserve the biodiversity and to ensure a wide range of ecosystem services".

Spain is developing a National Green Infrastructure Strategy based on article 15 of the Spanish Biodiversity Law. It considers several interrelated basic concepts about biodiversity, habitat connectivity, ecological restoration, ecosystem services and global change factors. Moreover, the future Spanish Green Infrastructure Strategy includes a set of guidelines, an economic-financial dimension, and a monitoring programme so that GI can be implemented successfully by public administrations on their territories.

The spatial planning of GI requires cartography at national, regional and local levels, which includes different GI territorial elements – core areas, buffer zones, lineal corridors, stepping stones, landscape corridors, multi-functional areas. It is under development by the Ministry of Ecological Transition.

The Land Parcel Identification System (LPIS) maintains the following GI elements as relevant from a CAP perspective – ecological focus areas (EFA), permanent pastures as well as landscape features, which are merged all together. The LPIS system maps also areas with limitations for the use of nitrates and phytochemicals. However, they do not represent all GBI elements and features on agricultural land.

3.2. Biodiversity designations and management requirements

Several plans have been developed at regional level to protect specific habitats and species, such as the Natural Environmental Conservation Plan, Wetlands Conservation Plan, Castilla-La Mancha Rural Development Program and Special Protected Sites Management Plan for Steppe habitat birds.

In the case study areas, Castilla-La Mancha Community Council implements support programmes to adopt compatible agricultural practices with steppe bird habitats conservation in Horcajo de Santiago, Pozorrubio and Corral de Almaguer (three of the six municipalities in the case study area).

Natura 2000 network

The case study area covers 37.1% of the special protected area (SPA) Área esteparia de La Mancha Norte (Steppe area of Northern La Mancha, code ES0000170) with a total area 106,414 ha. The Natura 2000 territory within the case study area is 22,373 ha. The main conservation importance of the territory is its major populations of steppe birds, particularly the great bustard (*Otis tarda*); important concentrations of little bustards (*Tetrax tetrax*), pin-tailed (*Pterocles alchata*) and black-bellied (*P. orientalis*) sandgrouses, with a small core of

Dupont's larks (*Chersophilus duponti*). Further important bird species include stone curlews (*Burhinus oedicnemus*) and hen harriers (*Circus cyaneus*).

Farming related requirements in the Natura 2000 management plans

The agricultural and livestock husbandry activities related to cultivation of extensive unirrigated herbaceous crops, unirrigated vineyards and extensive pastures (including scrub areas) formed a landscape in which the steppe birds[1] thrived.

The current transformation from the traditional cultivation of vines towards espalier vines implies the loss of a useful habitat for steppe birds like the great bustard. Similarly, the transformation from certain non-irrigated crops to irrigated ones and the construction of new infrastructures may have serious impacts on biodiversity.

Therefore, the management plan of the Natura 2000 site foresees certain management measures aiming to improve he conservation of steppe birds' populations. The SEPAs Management Plan of Steppe Birds of Castilla-La Mancha refers to the need to maintain pastures as a preservation measure, as well as to encourage the adoption of farming practices compatible with steppe bird requirements. This encouragement is mostly enforced by promoting the adoption of Agri-environment schemes funded by Castilla-La Mancha rural development programme. Prescriptions of these schemes[2] are:

- Crop rotation;
- Increase of 25% of seeds for seeding and their consumption by birds;
- Seeds should not be chemically treated;
- Use of long-cycle cereals;
- Tillage delay;
- Prohibition of mechanized work at night;
- No use of herbicides on land lying fallow;
- No cereal harvesting close to nests of groups of trees during nesting season;
- Sunflower crops limitations;
- Establishment of natural vegetation permanent strips.

3.3.Water designations and management requirements

In the framework of the future Green Infrastructure National Strategy, surface water bodies (rivers, wetlands, transitional and coastal waters) are considered as GI core areas, and fluvial spaces and flood zones as ecological corridors.

GI National Strategy also includes "nature-based green infrastructure solutions", with special relevance in urban and peri-urban areas (e.g. Sustainable Urban Drainage Systems).

[1] http://agricultura.jccm.es/inap/archivos/estepariamancha_zepa_fich.pdf

[2]http://www.castillalamancha.es/sites/default/files/documentos/pdf/20170425/decreto_29_2017_medida_12_1.pdf

- **River-basin management plans**

Tajo River Spanish Basin Management Program[3] (RBMP) indicates that agriculture and livestock pressures are affecting groundwater, which is in bad condition. The Programme of Measure includes procedures on irrigation crops and livestock holdings focused on:

- Priority criteria and compatibility of uses;
- Limitations on concessional terms for the use of irrigation (up to 40 years);
- Establishment of maximum water allocations for irrigation;
- Indication of irrigation efficiency aims;
- Establishment of water reference allocations for livestock.

Castilla-La Mancha RDP[4] supports investments to improve irrigation techniques and to promote water saving via measure 4.1 Investments in agricultural holdings. The measure is voluntary for farmers.

- **Flood-risk maps**

There is flood risk on the Riánsares River. Corral de Almaguer and Casaquemada areas (Toledo) are located in Flood Significant Potential Risk Areas. Their territories are included in the flood risk maps created by Flood Risk Basin National System. However, the case study area is not affected because it is outside the flood risk area (T=10, 100 or 500 years).

Preventive measures are applied in situ. The risk mapping does not include Natural Water Risk Measure.

- **Nitrate vulnerable zones**

The case study area is inside a wide Nitrate Vulnerable Zones (NVZ). There is no specific data about water quality and nitrate loads in the case study area.

Castilla-La Mancha Government has published a Code of Good Agriculture Practices (CoGAP) for water protection against nitrate pollution from agricultural sources, which is mandatory for agriculture and livestock holdings in NVZ.

3.4.Climate mitigation and/or adaptation measures

There are several actions[5] related to climate mitigation and adaptation at local level. The Castilla-La Mancha Sustainable Towns and Cities Network has been established as a tool to

[3]http://www.mapama.gob.es/es/agua/temas/planificacion-hidrologica/normativaphtajoanexovrd1_2016_tcm30-98540.pdf
Real Decreto Legislativo 1/2001, de 20 de julio, por el que se aprueba el texto refundido de la Ley de Aguas
[4] http://pdr.castillalamancha.es/programa-de-desarrollo-rural-2014-2020

act against climate change at local level. Action plans are included under Climate Change Mitigation and Adaptation Regional Strategy framework. Councils work together implementing sustainable development policies and Agenda 21 Local Programme. Approximately 85% of local councils are integrated into the network.

Moreover, Castilla-La Mancha Government has created the Climate Change Regional Commission to advise and coordinate the implementation of climate mitigation and adaptation actions at regional level.

Regarding agriculture, the Regional Strategy indicates that climate change mitigation and adaptation actions must be focused on:

- Promoting the improvement of soil organic content and conservation agriculture to prevent erosion processes;
- Encouraging the change towards varieties resilient to climate change, especially in olive and vineyard crops;
- Encouraging the incorporation of new technologies in irrigation systems;
- Promoting organic agriculture;
- Extensive livestock should adjust the stocking density and management criteria, as pastures will be greatly affected.

[5]http://docm.castillalamancha.es/portaldocm/descargarArchivo.do?ruta=2011/04/15/pdf/2011_6075.pdf&tipo=rutaDocm
http://www.castillalamancha.es/sites/default/files/documentos/pdf/20160126/ermacc_df.pdf
http://www.castillalamancha.es/gobierno/agrimedambydesrur/estructura/vicmedamb/actuaciones/cambio-clim%C3%A1tico

3.5.Green and Blue infrastructure assessment in BIOGEA project

The Dry Cereal Croplands case study area in Spain has a medium presence of Green and Blue Infrastructure (GBI) elements and features. The main GBI types present are isolated trees and groups of trees (small landscape elements), woody and, especially, grassy strips; and very few streams and ditches (connectivity elements). Semi-natural vegetation includes small patches of permanent pastures, shrubland and woodlots. In-fields, N-fixing crops followed by fallow are the main GBI features. Perennial crops (vineyards, olive grooves and almod trees) are also present[6].

3.5.1. Biodiversity assessment

The preliminary results of the modelling[7] of GBI-biodiversity relationships in the case study area provide the following highlights:

- Tree groups were positively related to thje abundance of overall and threatened bird species.
- Isolated trees also benefitted overall bird diversity and plant richness, but were negatively related to the abundance of threatened farmland birds.
- Permanent pasture benefitted farmland birds, including threatened farmland birds, although was marginally detrimental for secondary plant richness.
- Fallow land, both covered and ploughed, benefitted overall, farmland and threatened birds, including threatened farmland ones, though ploughed fallow was marginally detrimental for secondary plant richness.
- N-fixing crops marginally benefitted secondary plant richness and threatened farmland birds.
- Richness of herbaceous crops benefited richness of secondary plant species, but affected negatively farmland and threatened farmland birds, and marginally overall bird diversity.
- Mean size of herbaceous crops affected negatively farmland birds, including threatened farmland species.
- Vineyards benefitted overall bird species, but had no effect on plants or on farlmand or threatened birds.

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[6] Pardo, A.; Rolo, V.; Concepción, E.D.; Díaz, M.; Aneva, I.; Lukanov, S.; Oppermann, R.; Schraml, A.; Ullrich, B.; Moreno, G. 2019. Farmland biodiversity across diverse European agricultural systems: assessing the effect of Green and Blue Infrastructure. 1st Iberian Meeting on Agroecological Research, Évora, November 2018. https://www.biogea-project.eu/biogea-findings-presented-1st-iberian-meeting-agroecological-research-ibagreco

[7] Concepción, E.D.; Aneva, I.; Lukanov, S.; Moreno, G.; Oppermann, R.; Pardo, A.; Rolo, V.; Schraml, A.; Ullrich, B.; Díaz, M. 2019. Green and blue infrastructure and farmland biodiversity: Optimizing CAP greening as conservation tool. Oral presentation. 1st Meeting of the Iberian Ecological Society & XIV AEET Meeting. Ecology an integrative science in the Anthropocene. 4-7 February, Barcelona, Spain.https://www.biogea-project.eu/biogea-presentation-green-and-blue-infrastructure-and-farmland-biodiversity-optimizing-cap-greening.

- Orchards benefitted threatened bird species, but affected negatively farmland birds and marginally secondary plant richness.
- Grassy strips and marginally woody strips were detrimental for farmland birds, while woody strips benefitted overall and threatened birds.
- Streams and ditches benefited overall bird diversity, but affected negatively farmland birds, including threatened ones, and marginally threatened birds.

Thereby, the following GBI elements had demonstrated positive effects on biodiversity in the case study area: fallow land (especially covered fallow), tree groups and permanent pastures. A reduction in field sizes would also improve local biodiversity, most likely though the positive effects of grassy and woodly strips and ditches on this diversity. Effects of perennial and N-fixing crops crops were marginal or absent and effects of (herbaceous) crop diversification were negative. Promoting grassland, fallow land (especially covered fallow) and preventing field size enlargement to support more specialist farmland birds, and maintenance of tree groups, isolated trees, streams/ditches, and vineyards to enhance overall bird diversity and/or threatened (non-farmland) bird species. The maintenance of rotations including covered fallow, as well as the promotion of out-field elements such as trees, field boundaries with natural vegetation and permanent grassland, will be the best biodiversity-friendly GBI options for the area[8].

3.5.2. Assessment of stakeholders' and farmers' awareness on GBI

The BIOGEA project assessed stakeholders and farmers' awareness about the terminology "green and blue infrastructure". During the interviews, stakeholders and farmers were first asked about the term. When they stated their level of awareness, the definition was presented and examples were provided. After that respondents were asked about the recognition of the presence of GBI elements and features in the region (by stakeholders) or on farms (by farmers); as well as the knowledge about appropriate management practices for the GBI elements and features.

- **Awareness about the terminology "green and blue infrastructure"**

Stakeholders' awareness (N=9) about the terminology "green and blue infrastructure" was predominantly positive. Four stated definite awareness and three – awareness to some extent (Figure 3). Two agriculture stakeholders recognised they lacked awareness on the term.

In contrast, no farmer stated lack of awareness about the GBI terminology (Figure 4). However, the majority of them (n=12) were aware only to some extent. The farmers that felt definitely aware about GBI terminology had larger farms (over 30 ha) and were both in arable and mixed farming systems.

[8] Concepción, E.D., Aneva, I., Jay, M., Lukanov, S., Marsden, K., Moreno, G., Oppermann, R., Pardo, A., Piskol, S., Rolo, V., Schraml, A. y Díaz, M. 2019. Optimizing biodiversity gain of European agriculture through regional targeting and adaptive management of conservation tools. Biological Conservation, submitted

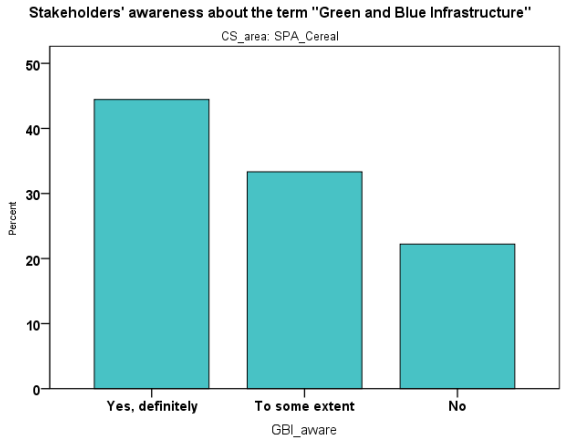

Figure 3. Stakeholders' awareness of GBI (N=9)

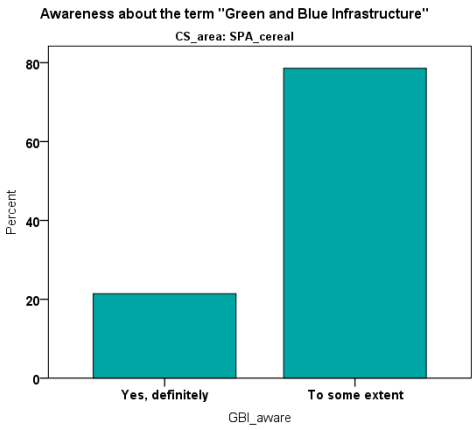

Figure 4. Farmers' awareness of GBI (N=15)

- **Recognition of the presence of GBI elements and features in the region**

The interviewed stakeholders recognised between 5 and 20 (mean value of 11) GBI elements and features in the case study area as a whole. The GBI feature identified by all stakeholders (N=9) was agroforestry/orchards. The second group of GBI features recognised by eight of the stakeholders comprised field margins, land laying fallow and isolated trees.

- **Recognition of the presence of GBI elements and features on farms**

The interviewed farmers (N=15) recognised between 3 and 10 (mean value of 7) GBI elements and features on their individual farms. The GBI feature present on most farms (n=13) was isolated trees. Twelve farmers had field margins and agroforestry/orchards. Land laying fallow was present on 11 farms. Ten farmers had ditches, trees in lines and trees in groups and nine had areas with nitrogen fixing crops and permanent pastures and grasslands. The larger arable farms seemed to have higher number of GBI elements.

- **Farmers' knowledge about appropriate management practices of GBI elements and features from environmental point of view.**

Farmers were asked to self-assess their knowledge about the appropriate management of GBI elements on their farms from environmental perspective. Stakeholders were asked to assess in general whether farmers in the case study area knew how to manage GBI elements from environmental perspective.

Farmers' perspectives. Farmers' self-assessment results indicated that only five felt certain about the environmentally appropriate management of GBI elements and features on their farms. Most farmers (n=12) could not provide examples of such practices. Only three farmers referred to "regular pruning", "respecting field margins" and "respecting field margins, streams, forest areas, nitrogen-fixing crops in rotation".

Stakeholders' perspectives. One agriculture stakeholder thought that farmers definitely knew how to manage GBI features and elements. Four respondents considered that farmers had some level of knowledge about environmentally approapriate management of GBI features. The rest were either not sure or thought that farmers lacked such knowledge.

Similarly to farmers' responses, over half of the interviewed stakeholders (n=5) could not find examples of environmentally approapriate management of GBI elements practiced by farmers in the case study area. However, the other four stakeholders provided specific explanations:

- "I consider fallow lands as a territorial element associated with productive agriculture. It is traditional to maintain at least 10% of the explotation area to "let the land rest" and breaking monoculture and endemic weeds and pests presence. Regarding isolated trees, hedges, wooded strips and stone walls, the good agricultural practices and cross compliance applied to the CAP require farmers to maintain these elements in their plots, which act as shelters of wild fauna or margins between crops."
- "Preservation of field margins, strips and pastures; maintaining green covers in permanent pastures; avoiding some phytosanitary treatments".
- "In this regard, I only know the Ecological Focus Area (EFA), for owners with fields over 15 ha, where at least 5% are dedicated to some greening options (nitrogen-fixing, fallow, afforested and forestry). I do not know whether the maintaince of this option is right, but the lands in fallow stay for 8-9 month and the nitrogen-fixing crops (legumes) are there."
- "They (farmers) make pasive maintainance of non-productive elements because they are not relevant to the crop or CAP requirements. In addition, a classical agronomic maintainance of the productive elements without taking into account biodiversity."

4. Implementation of the CAP Greening scheme in Dry Cereal Croplands in Castilla – La Mancha case study area

4.1. CAP Greening scheme in Spain

The CAP Greening scheme in EU has three main elements and respective requirements – diversifying crops and ensuring ecologically focused areas on arable land above certain size as well as maintenance of permanent pastures. The specific requirements and the implementation choices in Spain are summarized below.

- **Crop diversification**

  Crop diversification requires farmers with arable land of over 10 ha to grow at least two crops for the areas up to 30 ha, and at least three crops for the areas over 30 ha.

Spanish authorities carry out controls to check the number of crops on farmland and their respective shares between May and July each year. The different regional authorities may adapt the period taking into account the specific agro-climatic conditions in their region.

- **Ecological focus areas**

  Farmers with arable land over 15 ha must ensure that at least 5% of their land is in an ecological focus area (EFA) among which are ecologically beneficial productive land uses and landscape features. National governments define the list of EFA, from which farmers can choose what to implement on their farms.

The Spanish list of EFA is comprised of the following options: fallow land; nitrogen-fixing crops; afforested areas and agro-forestry areas under the rural development programmes; as well as *Miscanthus* areas; *Silphium perfoliatum* areas; and fallow land with melliferous plants (species, which contain pollen and nectar for bees).

Landscape features are not in the EFA list in Spain because they are included in the standards for good agriculture and environmental conditions (GAEC). The landscape elements in GAEC cover hedges, isolated trees, trees in lines and in groups, field margins, ponds and natural livestock drinking points, patches of natural vegetation or rock, terraces, dry stonewalls or other traditional structures as defined by the regional authorities.

- **Permanent pastures**

  There are two requirements for permanent pastures. The first one requires national or regional governments to maintain the ratio of permanent grasslands to the total agricultural area. The ratio may not be reduced by more than 5% compared to the reference year. The second one requires national governments to designate Environmentally Sensitive Grasslands, that include the grasslands within the Natura 2000 protected areas, and in certain cases they may also be outside Natura 2000 areas. Environmentally sensitive grasslands cannot be ploughed or converted.

In Spain, the first requirement is implemented at national level with 2012 set as a reference year and any additional area declared in 2015 (Beaufoy, 2015[9]). If the ratio is not met, then farmers that have converted permanent pastures must restore the cropland to grasslands.

The requirement for the designation of Environmentally Sensitive Grasslands (ESG) is regulated at national level. It specifies the ban on ploughing or conversion as well as that only permanent pasture within Natura 2000 areas are to be considered ESG in Spain. The identification of the specific grasslands to be designated as ESG is a competence of the regional authorities (Beaufoy, 2015).

- **Institutions and administrations**

National level. Spain had one ministry for both agriculture and environment until 2018. As of then there are two ministries – the Ministry for Agriculture, Fisheries and Food, and the Ministry of Ecological Transition, and all issues concerning agriculture and farmers are dealt with by the Ministry of Agriculture.

Regional level. The Regional government of the autonomous community Castilla-La Mancha has agriculture and environment departments.

The Rural Development, Environment and Agriculture Department of Castilla-La Mancha (regional level) is where farmers submit their applications for CAP and other support, and where regional requirements related to both agriculture and environment are defined, regulated and controlled. The Regional administration has created an information tool to facilitate the processing of CAP application.

Farm advisory services. Advisory services for farmers in Spain can be both public and private. The main public advisory services in Castilla-La Mancha comprise the Agricultural county offices. The agriculture unions are also considered a key source of information for farmers. Additionally, there are other thematic advisory bodies such as the Organic agricultural and livestock advisory network, and the Irrigation advisory services.

[9] Beaufoy, G. (2015) Country report on the implementation of the new CAP and its possible effects on permanent pastures: Spain. European Forum on Nature Conservation and Pastoralism (EFNCP)

4.2.CAP Greening scheme implementation in Dry Cereal Cropland case study area

Two of the elements of CAP Greening scheme apply to arable land over certain size (crop diversification on farms with land over 10 ha, ecologically focus area on land over 15 ha) and to permanent pastures of any size.

Arable land (91.4%) dominates the utilised agricultural area (UAA) in the Dry Cereal Croplands case study area. Close to 80% of the UAA is in farms over 30 ha suggesting high influence of the CAP Greening scheme on the management practices of arable land in the area.

Permanent pastures represent a very small share of all UAA – 2.1%, but are important for farmland birds (see point 5.3.1). The CAP Greening scheme requirement about it is to maintain the exisiting area and preserve it from ploughing or conversion.

There are no CAP Greening scheme requirements for for olive groves, vineyards and other permanent crops, which are present in the case study area.

The total number of CAP Greening scheme beneficiaries in the case study area is 694 in 2016[10], which is less than half of the farms registered in the Agriculture Census in 2009.

All farmers interviewed in the case study area under BIOGEA project had arable land (N=15); nine had over 10 ha. All but one (n=14) had permanent crops – size varied from 0.5 ha to over 80 ha. The interviewed farmers that had permanent pastures and grasslands were six.

All of them were asked to share their experience with the different elements of the CAP Greening scheme.

- **Greening scheme: Permanent pastures**

Three respondents implemented the permanent pastures element – half of those with permanent pastures on the farms (n=6). Only one of them stated that the farm's permanent pastures were designated as environmentally sensitive grasslands, indicating that they are in Natura 2000 site. All other respondents with permanent pastures (n=5) indicated that they were not environmentally sensitive grasslands – irrespective of whether the farmer implemented CAP Greening element or not.

- **Greening scheme: Crop diversification**

Twelve respondents implemented the crop diversification element. The number of crops grown on the farms was between one and seven, including permanent crops. Cereals (wheat and barley), legumes (lentils and vetch), oilseed (sunflower) and fallow land seem to be the usual crop combinations.

The motivations for the crop's choice were justified mostly by the crop rotation inside the farm (n=5) and the need to have nitrogen fixing crops (n=2), which is part of the EFA element. Two respondents indicated that these crops were best adapted to the region's characteristics (vineyard and cereals) and to the farms (cereals, legume, sunflower, and fallow land). Another farmer explained that these were traditional crops (lentils, oilseeds, olive groves and fields in fallow).

[10] Data source: Spanish Agricultural Guarantee Fund (Fondo Español de Garantía Agraria, FEGA)

- **Greening scheme: Ecological focus areas**

Eleven farmers indicated at least one choice of EFA types. Nine had chosen land laying fallow, and eight nitrogen-fixing crops. The sum of responses exceeded 11, because farmers could choose more than one EFA option to fulfil the requirement for EFA on 5% of the arable land.

The ecological focus areas were the element of the CAP Greening scheme expected to bring the highest new environmental benefits on arable land. Therefore, farmers' motivations for the EFA options choice was of particular interest for the assessment of the scheme effectiveness.

Interviewed farmers were asked to assess seven statements about their motivations for EFA choice using Likert scale, where 5 stood for strongly agree; 4 – somewhat agree; 3 – neutral; 2 – somewhat disagree; and 1 – strongly disagree.

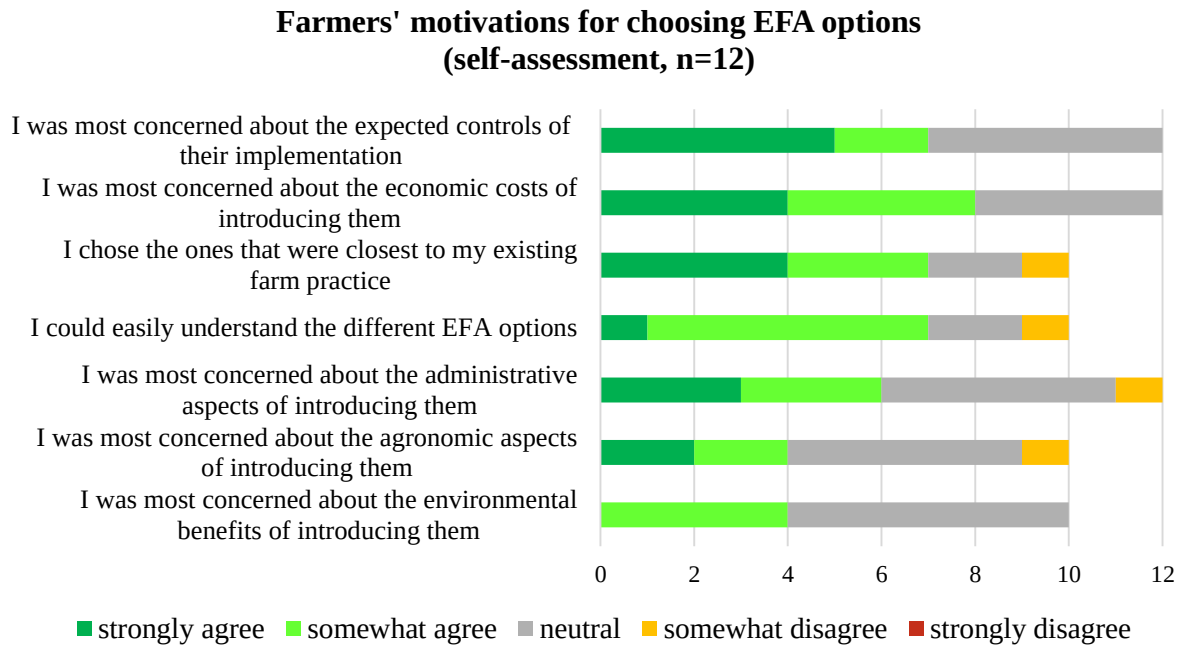

Figure 5. Farmers' self-assessment of motivations for choosing EFA options

Most EFA motivation statements received positive agreement and some had mostly neutral positions.

The top three motivations were concerns about the expected controls of implementation, the economic costs of implementation and the options closest to the existing farm practice. All of them suggested willingness to minimize the disturbance of farms' operations and business.

The motivation for environmental benefit, which was the main goal of the CAP Greening scheme and EFA element, received mostly neutral positions.

Stakeholders' perspectives on farmers' motivations for EFA choice

Interviewed stakeholders were asked to assess the same seven statements, using the same Likert scale. The difference was that stakeholders assessed the EFA choice motivations of farmers in the case study area in general.

Stakeholders believed that farmers in the case study area were mostly concerned about the expected controls of EFA implementation (Figure 6). Then, stakeholders believed that farmers chose the EFA options closest to their existing farming practices. Both statements were at the top of farmers' concerns too. Farmers' concerns about the administrative aspects of introducting EFA options were third in the stakeholders' assessment.

At the bottom of the list of seven statements, just as in the farmers' self-assessment, was the concern about the environmental benefits of the EFA options. But, unlike farmers' neutral to slight agreement, stakeholders were mostly disagreeing with it, indicating that this was farmers' least concern in the choice of EFA options.

Stakeholders' examples about farmers' motivations in the first year of choosing EFA confirmed the results of farmers' self-assessment:

- "The main concern of farmers, in the new community framework, was to receive aid similar to that received on their farm until 2014. Once they clarified that in order to collect the "ecological" payment they had to diversify the crops and comply with the EFA, the concern was if the fallow counted as a crop, what the minimum percentage of fallow was, if the legume also counted as a crop of EFA and if it counted in the same percentage as the fallow. Finally, whether they could receive some additional payment (aid to crops for protein purposes) in the case of choosing legume."
- "In the first year of implementation, farmers were concerned about different crop percentages which are needed to reach the minimum to receive payments. Furthermore, they wanted to know if they had left enough EFA fallow or EFA legume to meet the aid requirements. Farmers interests, in general, lie in collecting the aid, and not in the environmental benefits which have always seemed a hindrance to their activity."
- "Possible incidents in the basic payment for not complying with the greening requirements."

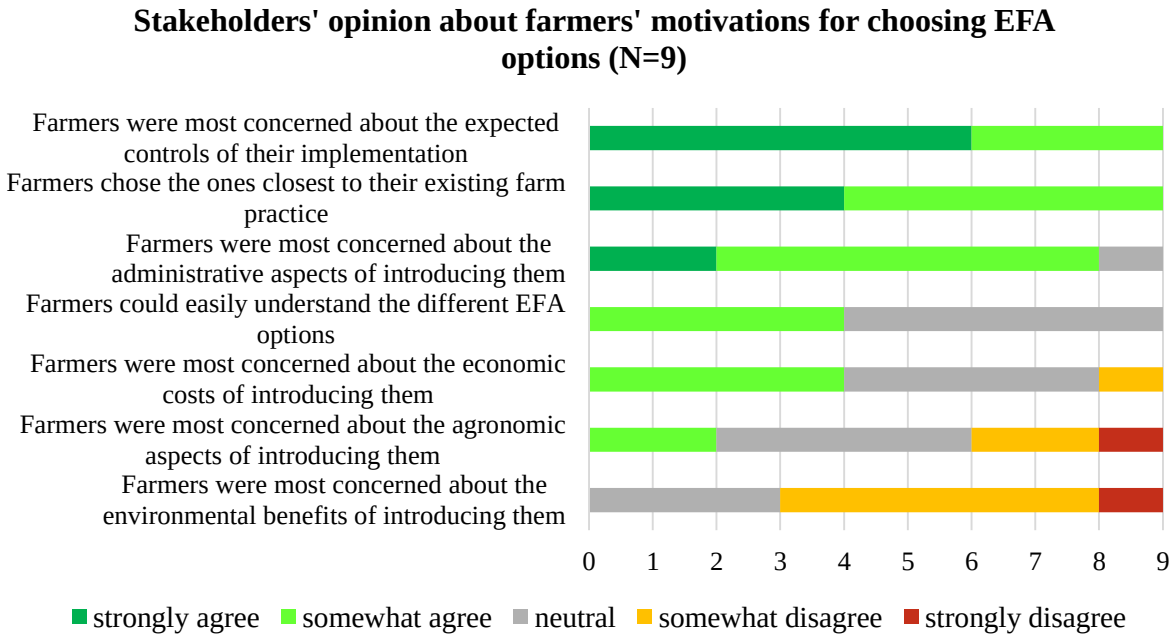

Figure 6. Stakeholders' assessment of farmers' motivations for choosing EFA options

4.3.Changes resulting from the implementation of CAP Greening scheme

Farmers and stakeholders were asked to assess the potential environmental, economic and administrative improvements resulting from CAP Greening scheme implementation based on their experiences and observations. There were seven statements, which farmers assessed for their own farms and stakeholders for the case study area. Likert assessment scale was used: 5-strongly agree, 4-somewhat agree, 3-neutral, 2-somewhat disagree, 1-strongly disagree.

- **Farmers' assessment of Greening scheme implementation on farms**

The results from farmers' assessment are presented on Figure 7. Overall, the three environmental statements received more agreements than neutral or disagreement results. The administrative and economic statements received some agreements, but also more neutral and strong disagreement statements.

Environmental perspective. The results of the environmental statements were counter-intuitive given than farmers were least concerned about the potential environmental benefits in the choice of EFA options. Furthermore, the biodiversity improvement statement received most positive assessments, while the CAP Greening scheme in Spain had no real biodiversity focus. The examples of biodiversity improvement comprised "enhanced woody and herbaceous margins", which were not EFA options in Spain but part of the cross compliance mechanism; and "observation of greater number of insects and little birds in the proximity". At the same time, there were examples of on-farm worsened conditions such as "growth of hunting fauna, which eats crops" (rabbits), and "prohibition of controlled burning implies a greater use of phytosanitary substances and the proliferation of disease". Overall, the strong agreement with environmental improvement statements was weakly supported by the examples provided by interviewed farmers.

Administrative implementation and controls. According to the results, the administrative issues and controls as well as the economic aspects, which were at the top of concerns when choosing EFA options, had not improved significantly since the first years of implementation. Most interviewed farmers agreed with the statements that controls were clear and transparent or that bureaucracy was minimal, however, there were also farmers that disagreed or were neutral about them. The examples that farmers (n=2) gave were only positive "better administrative control" and "simplified administrative procedures.

Economic perspective. The overall results about the economic returns and costs reduction were slightly positive but closer to neutral. Farmers said that the economic results "depended on the year", but overall they received "advice on profitable crops". At the same time, there were also comments that "payments were low"; there was "loss of produce, especially by rabbits"; and there were "more costs to buy chemicals".

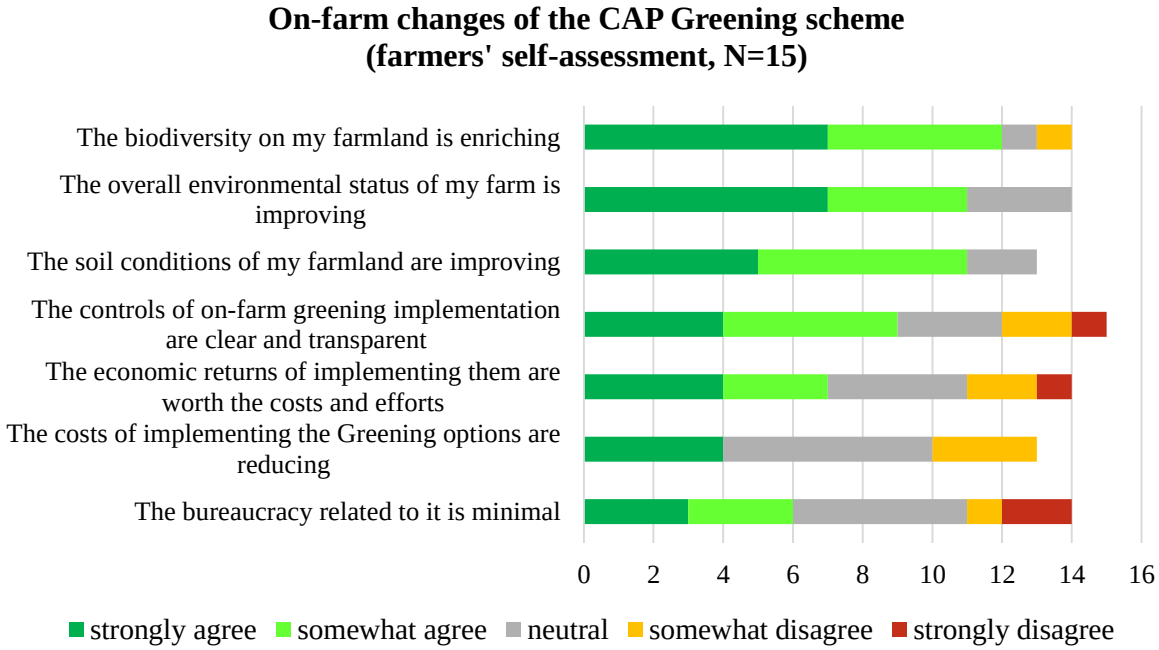

Figure 7. Farmers' assessment of on-farm changes resulting from Greening scheme

- **Stakeholders' assessment of Greening scheme implementation in the region**

The results from stakeholders' assessment are presented on Figure 8.

Administrative implementation and controls. From stakeholders perspective, the biggest improvement was about the clarity and transparency of controls. At the same time, there was disagreement about the minimal level of bureaucracy. Interestingly, stakeholders assessed it from their own perspective. They explained that there were "more controls to check the compliance with requirements" and that "management has become greatly complicated. Until 2014, CAP aid was charged based on the number of rights and not on the percentage or type of crop on farms. Now, Administration has to verify the diversification, the percentage of each crop present in farms and fields, and the chosen sample or the crops in the remote

sensing controls that coincide with those declared in the administrative request." Overall, the types of controls might be clear but they were more (in numbers) and more complicated.

Environmental perspective. The stakeholders' perception about the overall environmental improvement on farms was somewhat positive. At the same time, the improvements in soil conditions and biodiversity received more neutral assessments suggesting comparatively low positive development. Most benefits were associated with nitrogen fixing crops such as "increase of macroelements in the soil" and "certain crop improvements where legumes are cropped"; "increase in the area of legumes" and "diversification in the landscape". The neutral positions were explained as "I do not see any improved conditions" and "Honestly, I have not seen any significant change in the presence and abundance of species that are linked to this environment, such as quail, partridge and other steppe birds. But I do not have solid data either." The last example raised an important point about the (lack of) official monitoring and data of the environmental effects of CAP Greening implementation.

Economic perspective. The economic aspects – improvements in economic returns and reduction in the costs of implementation indicated a minor positive development. Stakeholders shared different aspects and reasons of little or no economic benefit:

- ✓ "The farmers who I know are gaining the same as before. They always remember that they would have to leave their farms if the CAP did not exist."
- ✓ "It has not had any influence in economic benefit, because prices of products have not changed. The most relevant benefit has been the extra payment of approximately 50% in direct subsidies."
- ✓ "Practically without (economic) effect due to the low change in usual management, although it has meant a potential damage when cereal area has decreased in good years."
- ✓ Two stakeholders considered that growing legume crops made the farm business profitable due to the "annual coupled support complementary to the basic payment and greening".

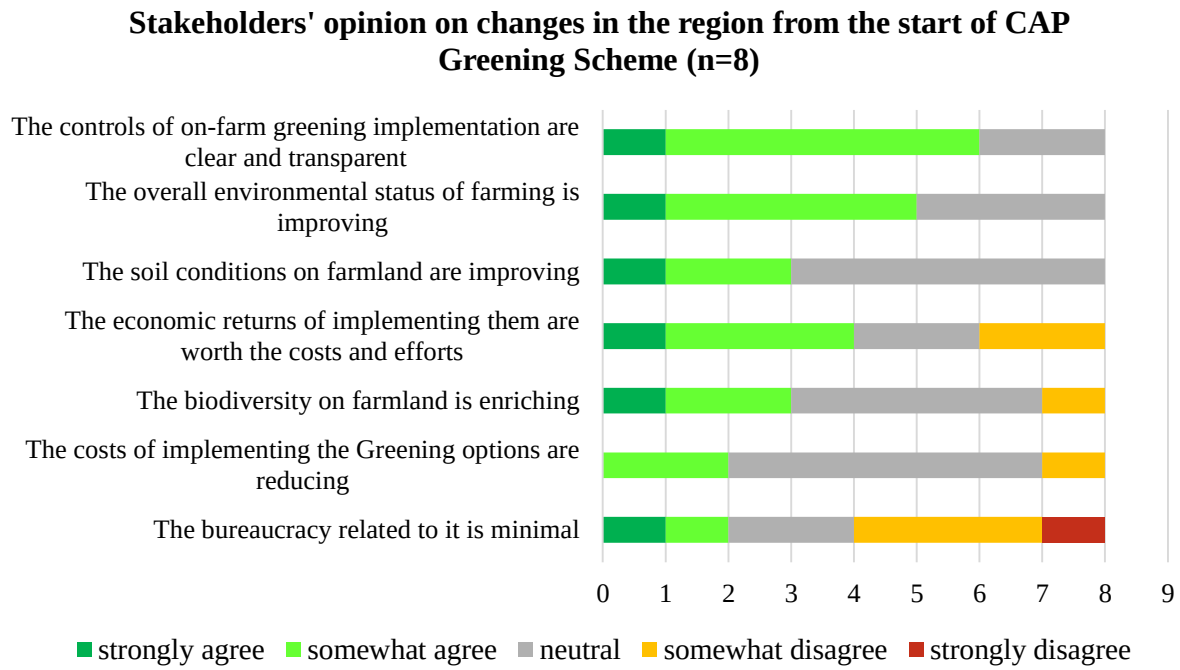

Figure 8. Stakeholders' assessment of Greening scheme implementation in the region

- **Long-term changes on farms as a result of CAP Greening scheme**

Farmers were asked if CAP Greening scheme implementation leads to long-term changes on their farms (Figure 9); stakeholders had to respond about all farms in the case study area (Figure 10).

Farmers' perspectives. Most respondents stated that the CAP Greening scheme would bring some changes in their farm management practices in the longrun. The main change from farmers' perspective was related to the sowing of nitrogen fixing crops – legumes, lentils, etc.

Stakeholders' perspective. Stakeholders' expectations about long-term changes of farm management practices due to CAP Greening scheme were modest. Stakeholders' examples related to land laying fallow and legumes. One stakeholder explained "Farmers have implemented introduction of nitrogen fixing plants in the crop rotations, when the previous practice was cereal/fallow/cereal." However, the opinion of another stakeholder was the "Mandatory introduction of fallow land in a province that traditionally did not have that requirement." The growing of legumes seemed to be there to stay: "Marketing chains may have consolidated in places where many legumes have been grown (especially fodder crops). In these cases, crops may remain without mandatory Greening."

Farmers: Long-term changes in farm management practices due to Greening

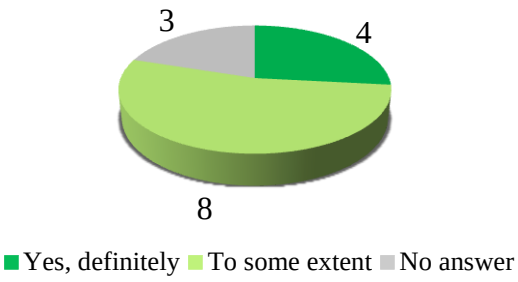

Figure 9. Farmers assessment (N=15)

Stakeholders: Long-term changes in farm management practices due to Greening

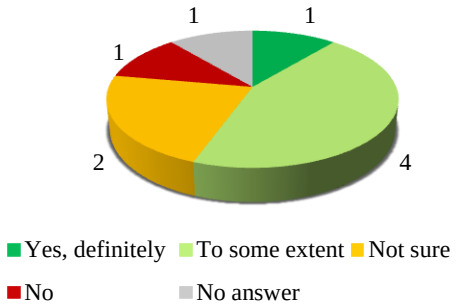

Figure 10. Stakeholders assessment (N=9)

4.4.Implementation of other CAP environmental measures

We asked farmers if they participated in other environment-related CAP measures and the similarities and/or differences they could find between CAP Greening scheme and the other measures.

- **Rural development measures**

The interviewed farmers that implemented agri-environmental measures were five. No other area-based rural development measures were implemented by the interviewed farmers.

- **Assessment of CAP schemes or measures appropriateness to address the environmental objectives on farmlands in the case study area**

Both farmers and stakeholders were asked to assess from their own perspective which CAP scheme or measure was most appropriate to address the environmental objectives on farmland in the case study area (Table 5).

Table 5. Respondents' ranking of the CAP schemes or measures that are most appropriate to meet environmental objectives on farmland.

Farmers' ranking		Stakeholders' ranking
Organic farming measure		Greening scheme
Greening scheme		Organic farming measure
Basic Payment Scheme		Cross Compliance
Agri-environment measure		Natura 2000 measure
Natura 2000 measure		Agri-environment measure
Cross Compliance		Basic Payment Scheme

The first two CAP schemes and measures appropriate for the environmental objective on farmland identified by farmers and stakeholders were the same – Organic farming and the CAP Greening scheme; only their positions are different. It has to be noted that none of the

interviewed farmers implemented the organic farming measure; therefore, they lacked practical experience on it.

Farmers placed the Basic Payment Scheme (BPS) at third place despite its lack of specific environmental objectives, which may be the reason why stakeholders placed it last. Stakeholders placed the Cross compliance instrument at third place, while farmers placed it last as the least appropriate to contribute to environmental objectives on farmland.

From GBI perspective, cross compliance is important because many of the landscape features[11] in Spain are protected only by the good agriculture and environmental conditions (GAEC).

One explanation of the ranking of these two instruments is that farmers value those intruments that provide payment/subsidy. Therefore, they comply with the Cross Compliance requirements because they need to do it in order to receive the BPS subsidy. From stakeholders' perspective the legal environmental requirement is placed in the Cross Compliance instrument, hence they place it higher.

Agri-environment and Natura 2000 measures were placed fourth and fifth in both and stakeholders' ranking.

Only two stakeholders provided explanation of their ranking:

- ✓ "Practices in organic agriculture are the ones that contribute most to environment preservation by prohibiting the use of almost all phytosanitary products to pests and diseases control. Regarding the Greening, it has introduced the obligation to diversify and incorporate more rotation crops. Conditionality is conceived as a sanction element in which farmers often do not involve or is not at fault."
- ✓ "A significant part of the lands is in ZEPA area for steppe birds, and, in this case, conservation targerts should be a priority. In any case, the current design of direct subsidies, cross compliance or even Greening payments do not contribute to these objectives. Natura 2000 payments are the most specifically designed for the targets, followed by agri-environment aid. The truth is that Greening may be contributing, at least, to maintain a basic landscape structure."

4.5.Training and advice on CAP Greening scheme

CAP Greening scheme introduced both new requirements about farmland management and new approach to claiming Pillar I subsidies. We asked farmers whether they received training on Greening or EFA options, which were their sources of information and advice about the CAP schemes and measures, and the environmental aspects of farming. Stakeholders were asked if their organisations provided training and/or advice on environmental aspects of farming and Greening to farmers.

[11] GAEC 7 covers hedges; isolated trees, trees in lines and in groups; field margins; ponds and natural livestock drinking points; patches of natural vegetation or rock; terraces; dry stonewalls or other traditional structures.

Farmers' perspectives. Over half of the interviewed farmers (n=9) responded that they had training on CAP Greening or EFA options. However, six of them did not remember the specifics of the training. The other three had training on introduction of nitrogen fixing crops in the rotation and about the fields in fallow land; one requested specific advice from farm advisors. The remaining six respondents had no training on CAP Greening or EFA options. Overall, most of the respondents (n=12), either had no training (n=6) or did not remember it (n=6)

Farmers' main sources of information and advice on CAP schemes and measures in general were the agriculture county offices (n=10), and Internet (n=5). Other sources of information were farmers' associations (n=2), other farmers (n=2), public advisory services (n=2) and training and information days.

Farmers relied mostly on the agriculture county offices "In the first place, due to qualification, knowledge and experience of technicians. In the second place, because they are like an extensive library and easy reference. And, in the third place, due to other professionals talking to you from their personal experience". In addition, "they are the sources which I can go to solve doubts or problems that arise in my farm" and "technical and bureaucratic advice and interesting news that may be unknown in the area of influence".

The sources of information on the environmental aspects of farming were not well defined. The main ones seemed to be the agriculture county offices (due to "proximity and accurate advice") (n=4), Internet (n=4) and other farmers (n=4). Other sources of information were farmers' associations (n=2), environmental authority or experts (n=2), and public advisory services (n=2). Interestingly specialised information sources as environmental authorities or public advisory services were less used than information from peers (other farmers).

More than half of the interviewed farmers (n=8) could not define the forms of advice they expected from their advisors ("I do not know"). The others preferred farm visits (n=4); direct (face-to-face) communication (n=3) and information days (n=1).

Stakeholders' perspectives. Four of the nine interviewed stakeholders stated that their organisations provided training and/or advice to farmers on CAP Greening scheme. The forms varied: telephone communication, on-farm visits, office visits, specific training activities; information hand-outs; and face-to-face discussions.

4.6.Involvement in national level decision-making about CAP Greening scheme

Two of the interviewed farmers stated they were involved in consultation or decision making about CAP Greening; however, they did not provide details on how. Ten interviewed farmers said they were not involved in any way; and three respondents provided no answer.

Two interviewed stakeholders stated they were involved in consultation or decision making about CAP Greening. One of them participated in professional meetings at the county departments. The other stakeholder explained, "It was only at the national level in several meetings with the Ministry at our request and without much success". The other seven stakeholders responded they did not participate in any consultation or decision-making.

Most farmers were not aware which organisations or institutions were involved in CAP Greening decision making in 2014 (Figure 11). Two farmers assumed that farmers associations were involved in the process. Some farmers thought that local agriculture authorities (n=1), local administrations (n=1) and known consultants (n=1) were involved. However, more farmers considered that the farmers' organisations (n=6) or local institutions (n=5) were not involved in CAP decision-making, indicating potential disconnection between the local level practitioners and national level policymaking.

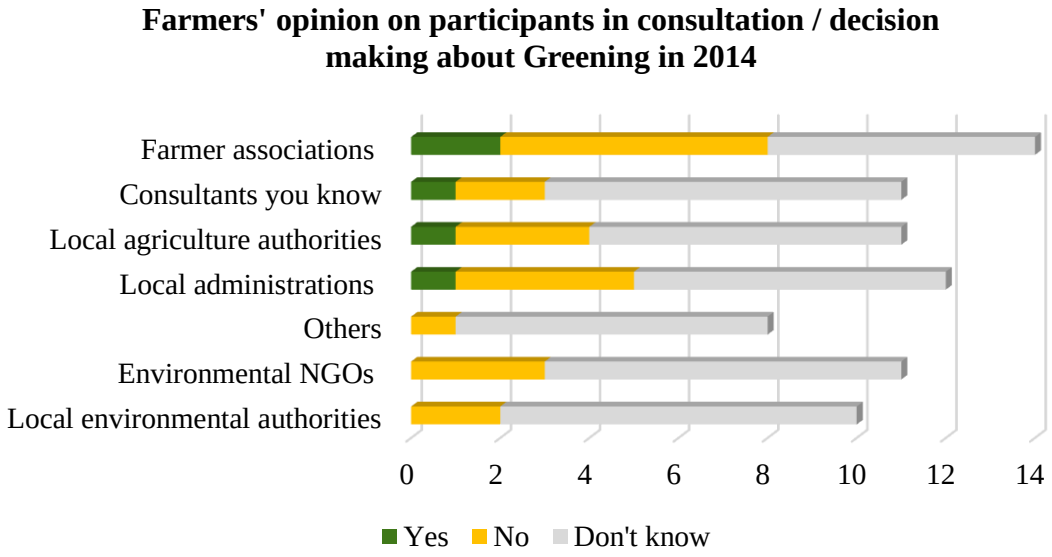

Figure 11. Farmers' knowledge about local participation in the CAP Greening decision-making in 2014

5. Conclusions from BIOGEA findings in Dry Cereal Croplands case study area

The Dry Cereals Croplands in Castilla-La Mancha is the arable land case study area in Spain; while farming practice is mainly extensive, intensification is taking place in certain areas currently. Arable land with scattered trees and perennial crops dominate the agricultural land.

GBI features and elements in the Dry Cereal Croplands in Castilla-La Mancha

- The case study area Dry Cereal Croplands in Castilla-La Mancha has a medium diversity and presence of GBI elements and features. The main GBI types present are isolated trees and groups of trees (small landscape elements); woody and, especially, grassy strips, but very few streams and ditches (connectivity features). Semi-natural vegetation includes small patches of permanent pastures, shrubland and woodlots. N-fixing crops followed by fallow are the main in-field GBI features. Perennial crops (vineyards, olive grooves and almod trees) are also present
- The preliminary results of the modelling of GBI-biodiversity relationships in the CS area indicate that fallow land (especially covered fallow), tree groups, permanent pastures and a reduction in field sizes would improve local biodiversity, whereas perennial crops and crop diversification have negative or no effects. Effects of N-fixing crops were marginal. Promoting grassland, fallow land (especially covered fallow) and preventing field size enlargement to support more specialist farmland birds, and maintenance of tree groups, isolated trees, streams/ditches, and vineyards to enhance overall bird diversity and/or threatened (non-farmland) bird species will be the best biodiversity-friendly GBI options for the area.

Farmers and stakeholders' awareness about GBI

- Most interviewed stakeholders stated high or some awareness about the GBI terminology. Stakeholders recognised between 5 and 20 (mean value of 11) GBI features or elements in the case study area. The most widely recognised were agroforestry/orchards[12], field margins, land laying fallow and isolated trees.
- The majority of farmers interviewed were partially aware about the BGI terminology, and in general found it difficult to provide practical examples of environmentally appropriate maintenance of the GBI feature and elements on farms.
- Farmers indicated between 3 and 10 (mean value of 7) GBI elements on their farms. The GBI features present on most of the respondents' farms were isolated trees, field margins and agroforestry/orchards, and fallow land.
- The average number of on-farm GBI elements and features seemed to increase with the increase of the respondents' farm size. Overall, the arable farming systems hosted the highest average number of GBI elements in our sample.

[12] In this CS area, they are mostly arable land with scattered trees and perennial crops.

CAP Greening scheme in the Dry Cereal Croplands case study area

- CAP Greening scheme in Spain supports only five GBI elements – permanent pastures and environmentally sensitive grasslands; land lying fallow; nitrogen fixing crops; agroforestry and afforested areas. This is the lowest number among the three member states included in BIOGEA project.
- The number of CAP Greening beneficiaries in the Dry Cereal Croplands CS area was 694 in 2016. This was less than half of the farms reported in the Agriculture Census in 2009.

Permanent pastures.

- The permanent grasslands in the Dry Cereal Croplands cover only a small share of the territory (2.1%) but the BIOGEA biodiversity monitoring found it important for farmland birds. Therefore, the CAP Greening scheme requirement for the maintenance of their area and prohibition of ploughing and/or conversion is a necessary mechanism that needs to be strictly controlled given the small share of permanent pastures.

Crop diversification.

- The usual arable crop combinations on the respondents' farms were cereals (wheat and barley), legumes (lentils and vetch), oilseed (sunflower) and fallow land. Diversification, although funded, had negative effects on biodiversity.
- The motivations for the crops choice were justified mostly by the crop rotation inside the farm as well as the need to have nitrogen fixing crops, which is part of the EFA element. Two respondents indicated that these crops were best adapted to the region's characteristics or were traditional crops in the area.

EFA element.

- As the other main arable option, nitrogen-fixing crops was also widely taken up. Many farmers introduced legumes, whereby they could benefit also from the annual payments for protein crops, thus, improving farms' financial in-flows. Meanwhile, markets for legumes, that can be used as animal feed, have developed around the case study area, indicating potential longer-term changes. The respondents perceived that the environmental benefit of nitrogen-fixing crops was improved soil quality, while the BIOGEA biodiversity monitoring observed only marginal benefits for plants and threatened farmland birds.
- Land laying fallow has been a traditional and voluntary farm management practice in the case study area. One stakeholder suggested it has been applied on 10% of the arable land, in a crop rotation cereal/fallow/cereal. However, it is not clear how many farmers were still applying it before the introduction of the CAP Greening scheme.

The EFA option made it semi-mandatory[13] for farmers with a maximum requested coverage of 5% of the land above 15 ha; which would be a reduction compared to the traditional practice in the area. At the same time, the BIOGEA biodiversity monitoring observed that fallow land was the most beneficial option for all bird species, especially if left covered.

- Many of the landscape features and elements in Spain are theoretically protected by the standards of the good agriculture and environmental conditions (GAEC). However, it is not known whether all of them are included in the registered agricultural area. The interviewed farmers perceived that cross compliance, including GAEC, was the CAP environmental instrument least appropriate to address environmental objectives on farmland. However, farmers are aware that they have to respect "field margins"and provide "regular pruning of woody strips", which are all elements protected by GAEC.

- Farmers' key motivations for the choice of crops or EFA options is the highest fit to their existing practices, as well as the concerns about the economic costs and the expected controls of implementation. This suggests willingness to minimize the disturbance of farms' operations and business while receiving the CAP subsidies.

- At the same time, the environmental benefits of introducing EFA were at the bottom of the list of farmers' EFA motivations.

Implementation of the CAP Greening scheme.

- Farmers perceived that the environmental benefits from the CAP Greening scheme (if any) were higher than other on-farm improvements (economic or agronomic). However, the examples they prodived indicated stronger agronomic benefits for "improved soil productivity".

- One stakeholder commented that the lack of official monitoring of the environmental effects of CAP Greening scheme prevented more detailed assessment for both farmers and local stakeholders.

Training, advice and consultation on CAP Greening scheme

- A few farmers were advised on CAP Greening scheme. Most interviewed farmers either do not remember the type of training or advice or received none at all. It indicates either a gap in provision of adequate information and training to farmers or lack of interest from farmers to search actively for it.

- The main source of information for farmers about CAP schemes and measures as well as the environmental aspects of farming are the county agriculture offices and Internet.

[13] The only other EFA option for arable land in rotation is nitrogen-fixing crops.

However, given the point above, the capacity and potential of the county agriculture offices seems to be not fully utilised about the CAP Greening scheme.

Training, advice and consultation on CAP Greening scheme

- Two interviewed farmers and two local stakeholders were involved in the national level decision-making about the CAP Greening scheme in 2014. However, the majority of farmers were not even aware which organisations or institutions are involved in the national level decision-making about the CAP, indicating potential disconnection between the local level practitioners and national level policymaking.