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Green and Blue Infrastructure and the Common Agricultural Policy (CAP) Reform: Briefing from the BIOGEA Project

Introduction

This briefing describes what Green and Blue Infrastructures (GBI) is, its importance for reaching EU environmental policy goals. It gives a brief overview of the GBI features which exist in the agricultural landscape and of current knowledge on the impact of the CAP "greening" on GBI.

There is an increasing interest in the use of natural structures (generally referred to in policy as Green Infrastructure or Nature Based Solutions) to replace hard engineering forms of intervention in nature. A significant advantage of these types of natural solution, is that they can often deliver multiple benefits for example a restored floodplain can slow water flow reducing flooding, absorb carbon dioxide and benefit wildlife. While GBI as a concept is widely accepted, implementing it in practice is proving to be more difficult. In particular, linking GBI on a regional scale across agricultural landscapes, requires many individual farmers to coordinate their management.

Agricultural practice has significant impacts on the European landscape. Almost 50% of the EU land area belongs to agricultural holdings and 40% is included in the utilised agricultural area[1]. Acknowledging the importance of ecosystem services (ES) for food production and the environment, the latest round of CAP reform aims to incentivise agri-environmental management more widely. In particular, the CAP "greening" including the introduction of Ecological Focus Areas (EFAs) (which give farmers a set of (mandatory) agri-environment measures to implement in arable farmed areas) should encourage a wider uptake of actions which benefit biodiversity, water and the climate.

BIOGEA Project

This briefing is a product of the project Testing BIOdiversity Gain of European Agriculture with CAP greening (BIOGEA) which is supported by the BiodivERsA funding programme. It researches the impact of land use change on Green and Blue Infrastructure (GBI) in the agricultural landscape. The impacts of policy on GBI and GBI on biodiversity and ES are examined 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) chosen to represent intensive and extensive landscapes in different biogeographic regions. Project outputs will include advisory tools and policy recommendations for the CAP reform.

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What is GBI?

The term Green Infrastructure (GI) or, where aquatic ecosystems are included, Green and *Blue* Infrastructures (GBI) has been rapidly adopted into policy but can have a variety of meanings. In the European Commission's GI Strategy, it is defined as follows:

[1] Based on eurostat statistics from 2013: http://ec.europa.eu/eurostat/statistics-explained/index.php/Farm_structure_statistics

*"a strategically planned **network** of natural and semi-natural areas with other environmental features designed and managed to deliver a **wide range of ES**. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings." (European Commission 2013)*

This definition includes the two key elements of GBI, its connectivity ("network") and its multifunctionality (delivery of a "wide range of ES") (Baró et al. 2016). Thus GBI can describes both physical as "features" which can for example allow migration of species between different habitat areas but also a means of delivering ES to reach particular "aims" included in policy. The diagram illustrates the links between the structural "features" which serve particular ecological functions and the "aims" i.e. the provision of ES and the related benefits to humans based on the ecosystems cascade framework (Haines-Young, Potschin 2010).

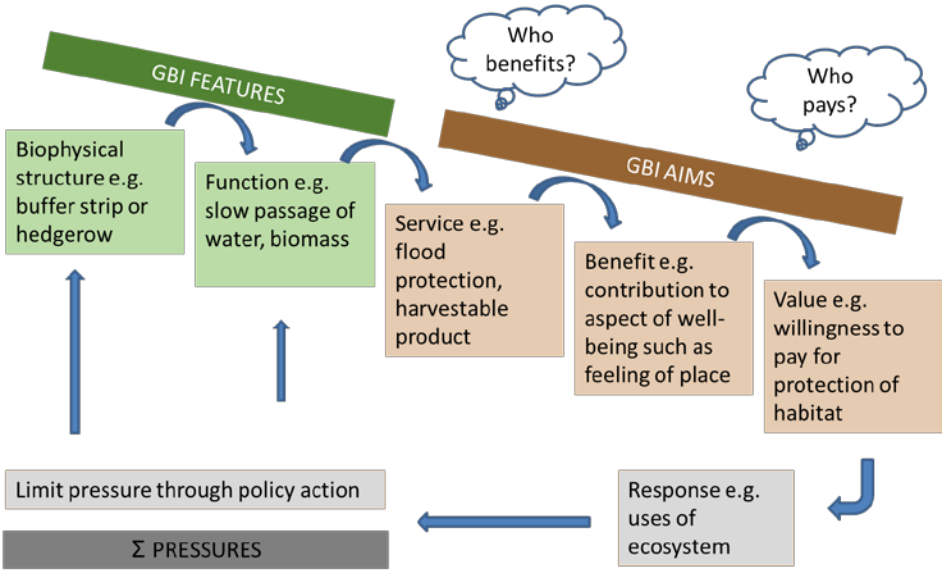

Figure 1. The conceptual framework for the BIOGEA project: The ecosystem cascade model (adapted from Haines-Yong, Potschin 2010)

GBI can be envisaged on a range of scales from small patches in an urban setting, or to break-up grey infrastructure (e.g. green bridges) to regional scale elements that give a landscape more "porosity" allowing migration of species through intensive agricultural or forest landscapes. For agricultural GBI, both scales are important: smaller-scale GBI features are managed by individual farmers e.g. at a field level but these may fulfil the desired functions and support ecosystem service delivery only when linked on a regional scale.

What is GBI made of?

The "building blocks" of GBI have been described as part of the European Commission's work on the GI Strategy[2]. The "GBI features" which are impacted by or related to agricultural activities include features which have a clear agricultural purpose and also provide additional ES (such as nitrogen fixing crops) but also features which, while commonly found in an agricultural setting, are not directly related to agricultural production (such as wetlands). In order to have a clear idea of the impacts of agricultural policy on GBI, a list of "GBI features" is needed. In the case of the BIOGEA project, GBI features were selected that are both located in agricultural landscapes and described in the CAP and environmental policy instruments.

[2] Features identified include Pasture, non-intensive woods connected with farmland, ponds, bogs, rivers and floodplains, local nature reserves, water protection areas, landscape protection areas, Natura 2000 sites High nature value farmland and multi-use forests, hedgerows, stone walls, small woodlands, ponds, wildlife strips, riparian river vegetation, transitional ecosystems between cropland, grassland and forests.

Policy instruments		CAP Pillar 1				Pilllar 2	Environmental policy		
		EFA	permanent grassland	cross-compliance	agricultural land	RD	WFD / FD	Nitrates Directive	Nature Directives
Policy aims		Enhance the competitiveness and sustainability of agriculture				Help rural areas meet challenges sustainably	Good water quality / reduced flooding	Protect water quality	Favourable Conservation Status
GBI elements (field to farm scale)	**Land use**								
Smallscale landscape elements									
Terraces	Perennial crops	x		x	x	x			x
Isolated trees	All farming systems	x		x	x	x			x
Trees in line	All farming systems	x		x	x	x			x
Trees in groups and field copses	All farming systems	x		x	x	x			x
Ponds	All farming systems	x		x	x	x	x		x
In field elements									
Maintain permanent grasslands and pastu	Livestock farming		x		x	x	x		x
Areas with short rotation coppices	Perennial crops	x			x	x			
Agroforestry / orchards	Perennial crops	x			x	x			x
Areas with catch crops or green cover	Arable farming	x			x	x	x	x	
Areas with nitrogen fixing crops	Arable farming	x			x	x	x	x	
Sowing a winter soil cover	Arable farming	x			x	x	x	x	
Land lying fallow	Arable farming	x			x	x			
Connectivity features									
Buffer strips	All farming systems	x			x	x	x		x
Hedges and wooded strips	All farming systems	x		x	x	x			x
Field margins	All farming systems	x		x	x	x			x
Ditches	All farming systems	x		x	x	x	x		x
Traditional stone walls	All farming systems	x		x	x	x			x
Strips along forest edges (no production)	All farming systems	x			x	x			x
Maintain / manage bank	All farming systems				x	x	x		x
Maintain / manage natural elements									
Wetland	Livestock farming		x		(x)	x	x		x
Floodplane	Livestock farming		x		(x)	x	x		x
Bog or moor	Livestock farming		x		(x)	x	x		x
Environmentally sensitive pastures	Livestock farming		x		x	x	x		x

Figure 2. GBI features included in the BIOGEA project and how they are included in EU policy

What is GBI good for?

Significant effort has gone into developing methods for mapping and assessing ES across Europe (the MAES[3] process). Recent literature reviews focusing on the above-mentioned GBI features (Dicks et al. 2013), and in particular those included in the EFAs (Tzilivakis et al. 2016) as part of CAP-greening, demonstrate the types of benefits for biodiversity and wider ES which can be delivered by GBI. These include maintaining and increasing biodiversity; water regulation and quantity; climate regulation; food production and cultural services[4]. The management and location of features in comparison with one another can make a significant difference to the benefits they can deliver. An additional important point is that most studies have been carried out in areas with more intensive farming systems in Northern and Western Europe. Less intensive, high nature value (HNV) systems in Southern and Eastern Europe (including BIOGEA's case study areas) are less well assessed. Initial reviews suggest that the effectiveness of introducing additional GBI features depends on how diverse the habitats within the farming system already are. In cases where there is a diverse habitat structure with significant GBI, additional features are less likely to provide significant benefits and preserving existing GBI seems to be more important (Concepción et al. 2012). This suggests that the approach to providing GBI may need to be regionally differentiated (Díaz, Concepción 2016).

[3] Mapping and Assessment of Ecosystems and their Services – MAES: http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm

[4] The Common International Classification of Ecosystem Services (CICES) https://cices.eu/ was used as a basis for examining ES. The services selected here are those most relevant to the policies examined.

How is GBI included in environmental policy?

A number of EU environmental policies rely on GBI to support particular habitats and ES to meet their targets. In the more recent policy instruments, there is often specific mention of GBI (Green Infrastructure in the Biodiversity Strategy (2011), Natural Water Retention Measures (NWRM) in the Blueprint for water (2012)). In older policy instruments, different terminology is used but the concept of connecting habitats through GBI features remains important, for example connective features in the Habitats Directive (1992) or the measures included in Good Farming Practice in the Nitrates Directive (1991). Figure 3 shows the importance of GBI for environmental policy (water, biodiversity and climate, the areas for which strong legislative frameworks exist). GBI also contributes to a number of social and economic policies including food and fibre production, health and welfare and rural development.

Legislation (directive / regulation)	Water policy
Strategy	Biodiversity policy
Action plan	Climate policy

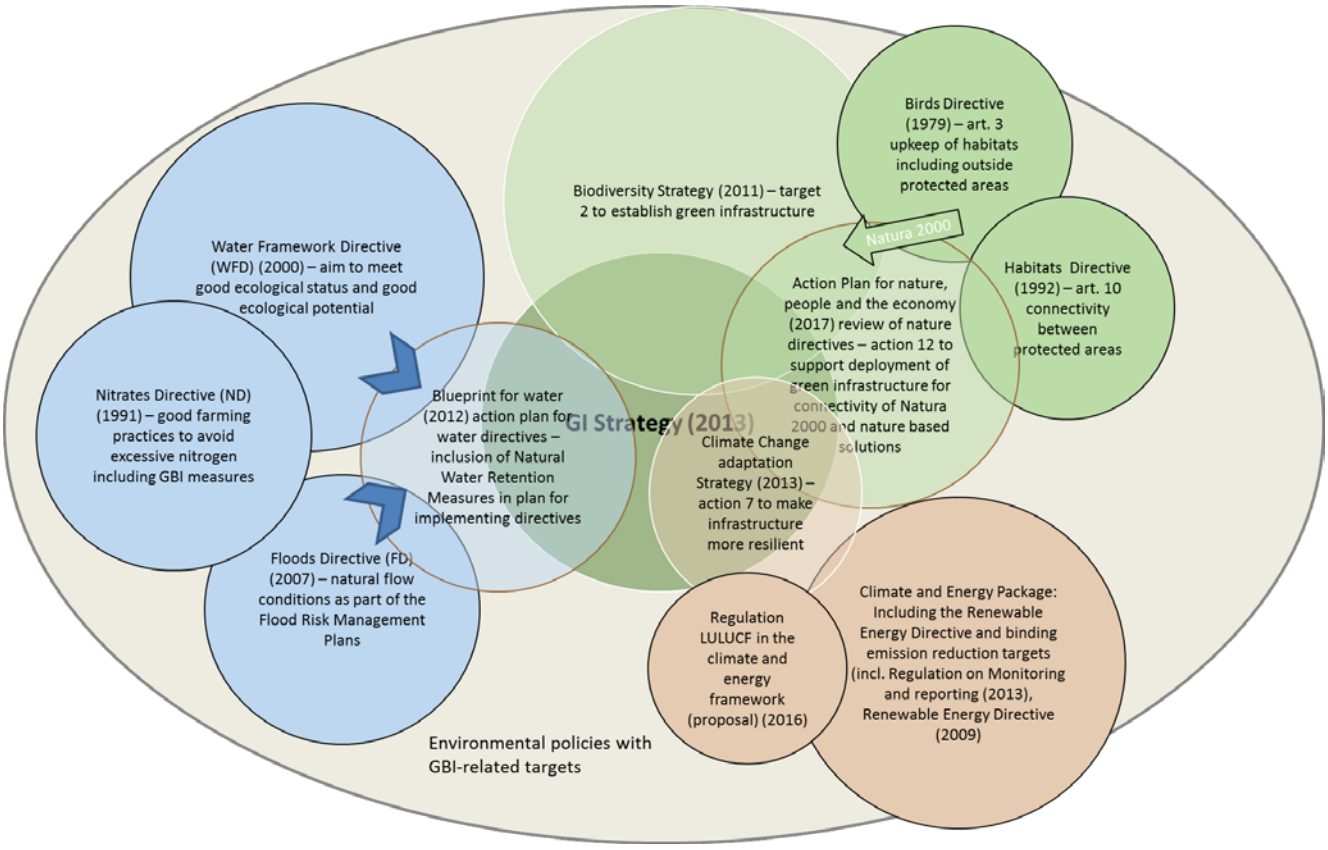

Figure 3. GBI in environmental policy, source BIOGEA project

How is GBI impacted by policy?

Agricultural policy has the greatest influence on the presence and/ or management of GBI on a regional scale. Agriculture has been a main driver for the loss of biodiversity through intensification of existing farmland and conversion of natural land into cropland during the last century. Recent reviews of biodiversity and water policies found that agricultural practices are the most significant barriers to their targets being met (European Commission 2015a), (Milieu et al. 2016), (European Commission 2015b).

CAP "Greening" requires 5% of arable land (for farms over particular size thresholds) to be managed as EFA. Many GBI features are included within the list of elements which potentially count towards a farmers' EFA, incentives to maintain GBI therefore exist under greening. Initial overviews however, suggest that many of the measures adopted are those which farmers would carry out anyway (European Commission 2016), that little new GBI is being created (Underwood, Tucker 2016) and that the most valuable measures for biodiversity are least attractive to farmers (Pe'er et al. 2016). In addition, few member states have made an attempt to encourage farmers to work together to meet regional objectives with the EFAs (European Commission 2017). While Member State have tended to focus most on the aim of food production through the CAP (Ecorys et al. 2016), most assessments focus on biodiversity and little is known about what other ES are provided (EIP-AGRI 2016). The table below gives a brief overview of the main EU level studies to the knowledge of the researchers as well as upcoming research.

Report	Assessment focus					Methods				Features covererd										Findings relevant to GBI
	Biodiv	Water	Climate	Food	Cultural	Literature review	Survey	Case studies	Field work	Permanent pasture	Crop diverse	Agro-forestry	Forest edge strips	SR coppice	Catch crops / cover	Nitrogen-fixing crops	Fallow	Terraces	Landscape features	Buffer strips	
Existing reviews																				
Review of Greening after one year (European Commission 2016a)	x	x	x	x		x				x	x	x	x	x	x	x	x	x	x	x	Few MS have reduced pesticide or herbicide input. Uptake of landscape features low but fallow positive.
Report on the implementation of the EFAs (European Commission 2017)	x	(x)	(x)			x						x	x	x	x	x	x	x	x	x	The EFA area larger than required by legislation (10%). Choices made largely based on administrative simplicity and ease of implementation. Landscape features (and fallow) best for ecosystem services but productive measures greater uptake
Mapping and Analysis of the implementation of the CAP (Ecorys et al. 2016)	x	x	x	x		x		x		x	x	x	x	x	x	x	x	x	x	x	Member States choices similar to one another. The strongest focus of measures is on food production.
Benefits of landscape features for arable crop production (EIP-AGRI 2016)				x		x	x												x		Little information available on ecosystem services beyond biodiversity. Farmers lack advice on EFA implementation.
EFA choices and their potential impacts on biodiversity (Underwood, Tucker 2016)	x					x									x	x	x		x		Non-productive measures are most valuable for biodiversity but uptake of these measures is lowest.
Adding some Green to the Greening (Pe'er et al. 2016)	x					x	x					x	x	x	x	x	x	x	x	x	The measures with the greatest benefits for biodiversity have the lowest uptake. Win-wins are possible e.g. fallow land agricultural and wildlife benefits.
Planned research (2017-18)																					
Evaluation of the payment for agricultural practices beneficial for the climate and the environment under the CAP (European Commission)	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	
Understanding Farmer Uptake: What measures are most promising to deliver on supporting biodiversity and ecosystem services in the next round of the CAP? (Eklipse)	x	x	x	x	x	x	x					x	x	x	x	x	x	x	x	x	
"Rapid evidence assessment" for the impacts of the CAP on the economy, society and the environment for BirdLife, the EEB and NABU (Pe'er, et al.)	x	x	x	x	x	x	x					x	x	x	x	x	x	x	x	x	

Figure 4. Overview of studies examining CAP greening, source BIOGEA project

What are the opportunities to deliver more GBI?

The CAP is one of the main EU funds expected to deliver environmental policy aims. It is therefore important that in its reform, the findings of the above studies as well as a range of environmental policy evaluations planned in the coming years are taken into account. In order to reach environmental policy goals, agricultural practice must be adapted and the goals of agricultural and environmental policies need to be better aligned. In particular, the uptake of the measures which support biodiversity and a range of ES should be encouraged by refocusing the incentives for choosing the most beneficial measures. Figure 5 shows the timetable for meeting targets and reform for the policies of greatest relevance to GBI.

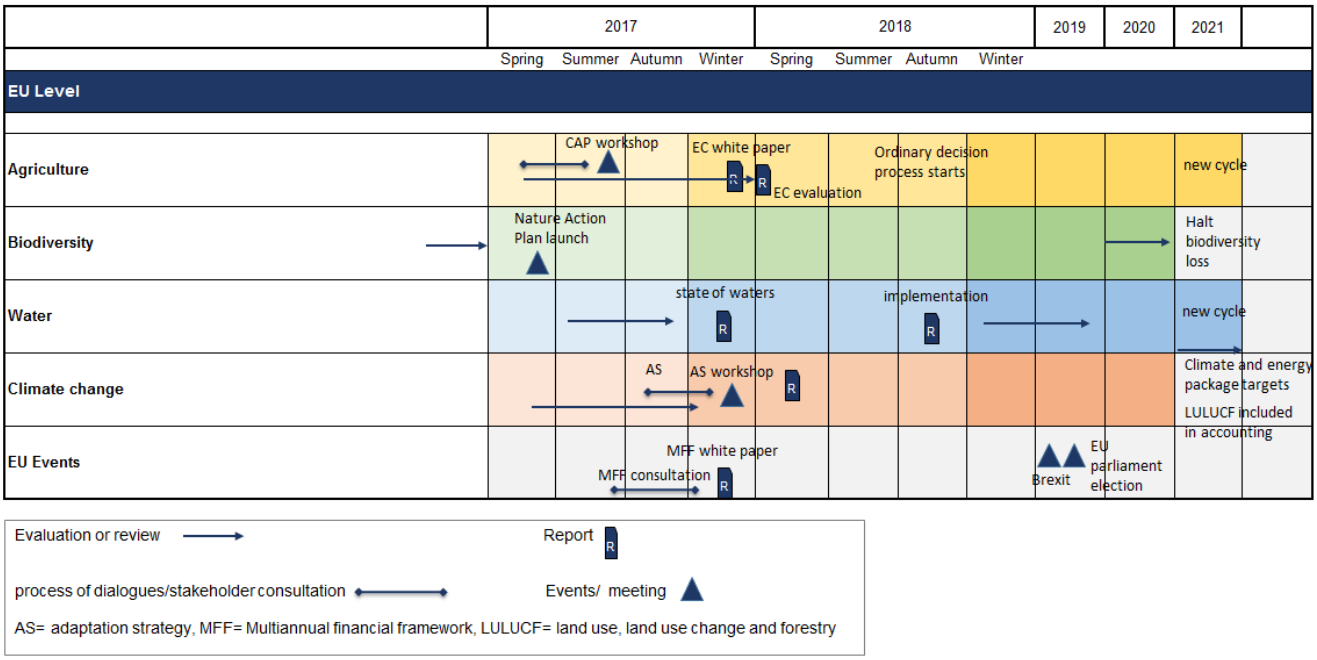

Figure 5. Timetable for policies influencing or reliant on GBI and the key opportunities for engaging with them. Source BIOGEA project.

Which topics require further exploration?

A significant amount of work has gone into examining the "greening" of the CAP and more is planned. Nonetheless, there is still further potential to explore how greening and other measures such as Agri-Environment-Climate (AEC) measures are implemented in different regions in practice, how the design and advice provision can be improved during the next CAP reform and how a wider range of ES can be delivered.

The BIOGEA project will explore these questions through the following means:

- Producing overviews for all GBI features showing how they are influenced by policy and the ES they provide (based on literature review complemented by expert views);
- Further examining the implementation of "greening" measures on the ground and their impact on GBI features through field work, interviews and modelling in Germany, Bulgaria and Spain;
- Developing indicators to measure GBI features and the benefits they deliver in the agricultural landscape;
- Developing tools to support regional advisors and help farmers with optimal placing of greening and AEC measures to support the provision of ES;
- Producing and discussing policy recommendations for the EU, national and regional levels based on the project findings.

Further reading

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