Agricultural landscapes as multi-scale public good and the role of the Common Agricultural Policy

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Abstract

During the last 50 years, the Common Agricultural Policy (CAP) has impacted the evolution of European agricultural landscapes by driving changes in land use and farming practices. We propose a typology characterizing the scales relevant for agricultural landscapes management and argue that action is required on three scales: (1) a landscape oriented management at farm level, (2) the coordination of land managers' actions at landscape level, and (3) the conservation of the diversity of agricultural landscapes in the EU. We provide evidence that the CAP has until now mainly focused on the first scale. We also illustrate how agricultural policy could encourage coordinated actions at the landscape- and EU-scales. In particular, we propose policy instruments to coordinate actions of individual land owners (e.g. collective bonus in agro-environmental contracts or support to environmental cooperatives). We also analyse how the recognition and transposition of the European Landscape Convention could promote trans-frontier landscape cooperation in order, not only to conserve high-quality rural landscapes, but also to ensure the conservation of the diversity of EU landscapes (scale 3). This article provides a knowledge base to support an integrated CAP design in the direction of improved landscape management, as an important component of the EU project towards more sustainable agriculture.

JEL code: Q15, Q18, Q24

Keywords: Landscapes, Agriculture, Common Agricultural Policy, Rural development, Collective action, European Landscape Convention

ACKNOWLEDGMENTS

We acknowledge funding from the European Commission, 7th Framework Programme through the project CLAIM (Supporting the role of the Common agricultural policy in LAndscape valorisation: Improving the knowledge base of the contribution of landscape Management to the rural economy, www.claimproject.eu).

The authors would like to thank Régis Ambroise (Ministry of agriculture and agro-industry, France), Francesca D'Angelo (European Commission, DG Agriculture and Rural Development), Robert Lifran (INRA Montpelier) for providing initial ideas and valuable inputs. We would also like to thank the partners of the CLAIM FP7 project for inspiring discussions, and Manon Lefebvre for reviewing the article and for providing suggestions that helped towards the improvement of the final version. Finally, thanks to Anna Atkinson for careful proofreading. The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

I. INTRODUCTION

European landscapes are shaped by agriculture, a millennia-old activity in Europe. In 2010, the total utilised agricultural area (UAA) still covered 160 million hectares in the EU-27, representing 42% of the whole European Union (EU) territorial area (FSS 2010). The adaptation of agricultural practices to local conditions has led to a wide variety of agricultural landscapes in Europe,[1] ranging from almost entirely man-made and intensively managed polders in the Netherlands to semi-natural extensive grazing areas in the high Alps (Paracchini et al. 2007; Cooper et al. 2009). Agriculture shapes the land primarily to derive a private good (biomass production) and at the same time provides a widely appreciated public good (landscape). Farmers' land use and agricultural production decisions in response to market demand and agricultural policies impact the provision of the landscape public good.

With technological development and the evolution of demand for food, structural changes in agriculture in the second half of the Twentieth Century have led to increased intensification, concentration and specialization of production in some areas and marginalization and abandonment in others, leading to significant changes in the farmed landscapes. Such processes were accelerated by the entry into force in 1957 of the Common Agricultural Policy (CAP), whose priority at that time was to increase agricultural productivity in order to ensure farmers a satisfactory and equitable standard of living, and to stabilize agricultural markets and farmers' incomes. Over the last two decades, the multi-functionality of agriculture and the need to integrate environmental and agricultural policies were recognized. Actions were taken to provide incentives to farmers to protect and enhance the environment (including landscape) in their farmland. Although the CAP is not a landscape policy per se it is often put forward as being the principal driver of changes in land use and farming practices in Europe, which in turn have an influence on rural landscapes. The CAP has been in place during the most widespread and rapid changes of the rural environment in the whole of European history, due to various changes in the socio-economic and technological context. It would therefore be naïve to lay all the responsibility for the transformation of rural landscape at the feet of the CAP (Brouwer and

Lowe 2000). National and regional landscape, infrastructure and land-use planning policies (including urban planning with impact on peri-urban areas with agricultural land), as well as EU environmental policy, also have potential and acknowledged impacts on rural landscapes in the EU. However, the CAP is the most important funding instrument for EU agriculture (55 billion euros per year, 41% of the EU's total budget in 2011). Given that it influences the management of the majority of agricultural land, the CAP has the potential to impact EU landscapes. Leaving national legislation, regional and local planning approaches aside, this article will focus on the Common Agricultural Policy and its impact and role in rural landscape management.

Amongst all the environmental public goods provided by farming, landscape is probably the most difficult to describe due to its multidimensional character that encompasses agronomic, environmental, social, cultural and economic dimensions. Several definitions of landscape synthesise such complexity (Wascher et al. 1999; Council of Europe 2000; Swanwick and Land Use Consultants 2002). Agricultural landscape is considered as a public good per se (for its aesthetical, recreational and cultural values) but also as an infrastructure necessary for the existence and/or provision of other public goods such as carbon sequestration, water flow maintenance, erosion prevention, pollination or habitat for biodiversity. For example, landscape configuration such as mosaics of cropland mixed with patches of native habitats and floral resources best promote pollination services (Brosi et al. 2007), and interspersing trees in croplands is a major way to provide carbon sequestration on agricultural landscapes (Nowak and Crane 2002). The article focuses on the aesthetical, recreational and cultural services provided by landscapes and the influence of the CAP on these services. Second order effects of landscape conservation on the provision of other public goods such as biodiversity or water quality are outside the scope of this article. However, many of the mechanisms described for improved agricultural landscape management can also favour the provision of these other services.

Awareness has grown that current environmental problems manifest themselves at various scales and that action should account for these scales to accurately deal with them (Cash and Moser 2000; Cash et al. 2006; Scholes et al. 2013). We defined a "scale" as any specific geographically bounded level at

which a particular phenomenon is recognizable (Cash and Moser 2000). A good understanding of the scales relevant for landscape management is a prerequisite to formulate policy recommendations for more efficient landscape management strategies in the CAP.

In this viewpoint article, we propose a typology characterizing the scales relevant for landscape management. We argue that the management of agricultural landscapes towards public good provision requires action on three scales: (1) a landscape oriented management at farm level, (2) the coordination of land managers' actions at landscape level, and finally (3) the conservation of the diversity of agricultural landscapes in the EU as a global public good (section II). We provide evidence that the Common Agricultural Policy has until now mainly focused on the first scale. We also illustrate how agricultural policy could be designed to encourage collaboration and coordinate action at the two other scales to improve rural landscape management in Europe (section III).

The target audience of this article is twofold: agricultural policy makers not familiar with beyond farm-scale approaches are invited to pay particular attention on section II; landscape planners willing to learn about EU agricultural policy and how it impacts rural landscapes may be more interested in section III.

II. AGRICULTURAL LANDSCAPE: A MULTI-SCALE PUBLIC GOOD

Agricultural landscapes are complex constructions whose management requires good understanding of, and responses to, the multi-faceted nature of the associated bio-geophysical and human systems and the interactions between them across scales (Cash et al. 2006). We propose here a typology characterizing the scales relevant for landscape management and identify the actors who hold use or control rights to the different landscape scales.

1) Farm scale: Landscape features management

Landscape features are the elementary spatial objects of agricultural landscape design. They include patches, defined as relatively homogeneous areas that differ from their surroundings (e.g. cultivated parcels, woodlots, semi-natural vegetation, groups of buildings), linear elements (e.g. hedges, non-cultivated land strips, stonewalls, terraces) and point elements (e.g. isolated trees and buildings).

Farmers decide to modify, organize, conserve or suppress these landscape features according to the private costs and benefits of such actions. Recognizing the three distinctive roles farmers can play enables us to better understand their landscape management decisions. Farmers are both producers and citizens and often owners of their land (Primdahl and Kristensen 2001). As a producer, the farmer, affects the landscape through land-use decisions (cropping patterns and crop rotation, cultivation of permanent crops, permanent pasture and forest management) and specific farming practices at the field level (tillage, fertilization, spraying, livestock density, organic farming, etc.). For example, isolated trees or hedgerows have been removed from many arable fields to enable the use of larger modern machinery.

But the farmer is not only a producer, but often a landowner. In 2010, more than 52% of agricultural land was owned by farmers, covering over 90% of all agricultural holdings across the EU-27 (FSS 2010). The farm property is a working tool, an asset and a place to live (Primdahl 1999). Along with the right to use and exploit the land and to fully control the landscape features, ownership is also subjected to numerous regulations. Water, air and soil, as well as outstanding landscape features and endangered species, are protected by legal acts and standards set and controlled by European, national and regional authorities (Water Framework Directive, Nitrate Directive or Habitat Directive). Particularly harmful interventions are forbidden by laws or are at least subject to formal approval procedures. Many decisions impacting landscapes, such as hedgerow plantings, afforestation, waterlogging, etc. are more closely related to "property management", rather than to production. Therefore it is important that the farmer's role as 'owner' is taken into account in the design and implementation of landscape management strategies (Primdahl and Kristensen 2001).

The third role concerns the farmer as a citizen, or member of a community. Farmers participate in community life and in collective actions of various kinds, including landscape restoration projects. While the major motivation of full-time farmers for landscape management is the maximisation of income from agricultural production, aesthetic and environmental functions can also be important drivers, especially for tourism-related activities (O'Connor et al. 2006), and smaller part-time and recreational farmers (Levin 2006). In the third section of the paper, more details will be given on how the CAP influences farmers' landscape and land use management decisions.

2) Landscape scale: Landscape structure and the integration of farms in rural landscape entities

Landscape scale refers to an area of coherent landscape character or a sub-unit of a natural region, above the field- and farm- scales (Prager et al. 2012). At landscape scale, the holistic image reflects the structure of the landscape, generally defined in terms of 'composition' and 'configuration' (Dunning et al. 1992). These are, respectively, the types of patches and elements present in the landscape and the amount of each, and their spatial arrangement.

At farm level, decision making on cultivation patterns and towards creation, conservation or suppression of landscape features is based on individual costs and benefits. However, these actions have an impact on structure at landscape scale. In the absence of coordinated efforts beyond the farm-level scale, the landscape value will be determined only by the value of landscape features that can be captured in an individual farm plot. Some farmers can refuse to participate in conservation because they can capitalize on the benefits of others (free riders), because it is not in their best interest (holdouts) or simply are unaware of or neglect the benefits that their conservation efforts confer on other members of the community.

Therefore, managing landscape on a farm-by-farm basis is inadequate because this spatial unit of management (the farm) is not generally commensurate with the spatial scale of the ecological process being managed (the landscape) (Cumming et al. 2006; Goldman et al. 2007). The concept of

"technology of supply" of a landscape refers to the contribution of each land manager's action to the resulting landscape status and change (Sandler 1998). There are three different landscape supply technologies: additive, threshold and best-shot. In an additive mode of supply, the actions of each contributor are perfect substitutes and the different contribution sum up. In the threshold model, a minimum surface or number of landscape elements is required in order to have a (visual) effect. If the sole action of one farmer provides increased overall landscape benefits, the best-shot model prevails. A good understanding of the technology of supply generating landscape public goods at landscape scale is crucial to design efficient coordination mechanisms.

In section III, we will discuss how landscape planning policies could account for strategic interaction in land-use decision making and foster coordination (Marshall 2004; Oueslati and Salanié 2011).

3) European (EU) scale: The existence value of the diversity of landscapes in the EU as a global public good

Due to the flow of goods, people and information, services provided by landscapes also provide benefits outside the territory where the landscape is situated (Kizos et al. 2010). They have a value beyond local population, e.g. the amenity and cultural values of well-managed landscapes attract tourists. Consumers of traditional food as well benefit from landscape when producers communicate on the specific landscape characteristics where the product is made and how they impact the quality of the product (Ministère francais de l'agriculture et de la pêche 2006). Moreover, landscapes have non-use values, such as option value (value attached to the potential use of the landscape in the future) and existence value (value of mere existence of the landscape, given that the individual has no plans ever to use it) (Hanley et al. 1997). When landscapes cover more than one country and benefit a broad spectrum of the global population, they can be characterized as a global environmental public good (Kaul et al. 1999).[2] This is particularly highlighted in the World Heritage List (UNESCO) where landscapes shaped by agricultural activities have been included as cultural landscapes for their global public good nature (Pannell 2006).

The benefits from landscape global public goods are not only determined by the quantity of landscapes preserved, but also by their diversity across the territory. The EU territory is diverse in many respects within and among individual Member States (Palmieri et al. 2011). It is assumed that citizens value positively this diversity. However, evidence of public preferences for landscape diversity is scarce, especially at EU scale. Most of the landscape evaluation studies valued specific landscape features (e.g. hedgerows, presence of buildings and presence of trees) or a specific landscape ecosystem (e.g. cultivated fields, pastures, forest, wetlands) or the landscape functions (e.g. conservation of biodiversity) (Madureira et al. 2012). Nearly all studies on landscape valuations are concerned with valuing specific a landscape. There are few studies that aim to aggregate the results for EU Member States or for the EU as a whole (Ciaian and Gomez y Paloma 2011). Evaluations of preferences towards diversity in rural landscapes are restricted to the landscape level (Arriaza et al. 2004; Marangon and Visintin 2007; Ode and Miller 2011). This gap in the literature is due to the fact that there are many challenges involved in developing a valuation framework to value preferences for EU landscape diversity. Preferences for landscape diversity beyond landscape scale are more difficult to capture because on one side this would require extensive surveys to analyse preferences across Europe, and on the other it would involve the estimate of non-use values for most of the population (those who have not visited the landscapes being evaluated). In this context, the public may have stronger preferences for a "bundle" of EU landscapes including certain locally significant landscapes or ones that display charismatic features (that they are more likely to visit or see in the media) but are less diverse at EU level, compared to a set of highly diverse landscapes. Furthermore, at methodological level, there is a trade-off between recognizing the context dependency of economic values and the need to implement the valuation EU-wide (Price 2011).

While indicators have been developed to provide quantitative evidence on the level of diversity in EU agricultural landscapes (Palmieri et al. 2011), data scarcity, missing reference frameworks and the peculiarity of change dynamics affecting traditional landscapes (e.g. disappearance of terrace cultivation and stone walls on Greek islands (Kizos and Koulouri 2006) or bocage landscapes in

Brittany (Thenail 2002)) do not allow to draw, from local case studies, general conclusions on the evolution of landscapes diversity at the European level. Several authors have nevertheless expressed their concerns about the vanishing regional distinctiveness and diversity of European agricultural landscapes in the last decades (Meeus et al. 1990; Jongman 2002). Among the driving forces of uniformization and polarization of EU landscapes, there are the Common Agricultural Policy (Meeus et al. 1990), farming modernization leading to land uniformization in more productive areas (Jongman 2002), and the changes in land use due to urbanization (Antrop 2000; Zasada 2011).

In this context of risk of uniformization and polarization of EU landscapes, and despite the lack of evidence of public preferences for landscape diversity, scholars call for stronger integrated landscape planning and policy at European level to maintain the diversity and coherence of the European landscapes (Meeus 1993; Piorr et al. 2011). The argument is that diversity of landscapes is worth conserving, in the same way as ecological biodiversity or linguistic and cultural diversity (Crystal 2000).[3] However, there is until now limited action at EU level in terms of preserving the diversity of landscapes. This may be due to the lack of agreement on the type of public good landscapes are, and therefore the right level of governance to provide this public good (OECD 2001). On one hand, one can argue in favour of essentially local governance because landscapes are local public goods: most of the use value of diverse, traditional, well-kept landscapes will be reaped within the country, as an advantage to attract qualified human resources and tourists. However, since landscapes also have non-use values (including an existence value) for a broader population, they can be qualified as pure/global public goods. We propose a reconciliation approach, where each individual landscape is considered a local public good but diversity of landscape a global public good that should be managed at EU level. The underlying argument is that effective landscape management in each individual Member State creates support for the overall quality of EU landscapes, but ensuring the conservation of the diversity of landscapes in the EU requires specific action at the global scale. No single country can take effective action to contribute to the diversity of EU landscapes on its own. The diversity of EU landscapes is a complex global public good akin to a weighted sum public good, where the

contribution of each hectare of land depends on its distinctiveness, i.e. whether a similar landscape exists somewhere else in the EU or not. Beyond this concept, there is the idea that some landscapes can be complementary, or on the contrary substitutes from the point of view of diversity conservation at EU level. In section III 3, we will discuss how the conservation of the diversity of landscapes in the EU should be integrated as an objective into landscape planning and policies, as a further requirement beyond landscape conservation.

We have identified in this section different actors holding use or control rights to different landscape scales: landowners and farmers control landscape features; landscape structure depends on the decision of various land managers and the local socio-ecological context in which these decisions are taken; diversity of landscapes depends upon a number of regions and country governance processes. Given this multiplicity of scales and actors, how to insure that landscape is managed at all relevant scales? Interestingly, given that the CAP influences the management of the majority of agricultural land, it has the potential to encourage the delivery of landscape public goods on a European scale. Moreover, since CAP is supporting individual farmers, it has the potential to influence landscape management at the farm scale. In the following section, we analyse the role and potential impact of the Common Agricultural Policy in landscape management within such a multi-scale framework.

III. AGRICULTURAL POLICY INSTRUMENTS FOR MULTI-SCALE MANAGEMENT OF AGRICULTURAL LANDSCAPES

In the first 20 years of its history the CAP included extremely limited environmental considerations (Vanslembrouck and VanHuylenbroeck 2005). The priority at that time was to increase agricultural productivity in order to ensure farmers satisfactory and equitable living standards, and to stabilize agricultural markets and farmers' incomes. With the 1992 MacSharry reform, environmental protection became a concern of the CAP. Under the agri-environmental regulation 2078/92, aid was made available to farmers to support production methods that protect the environment and maintain

the countryside. The multi-functionality of agriculture was recognized by the Agenda 2000 reform and the establishment of the Rural Development Policy (RDP). Since then, the CAP is divided into two pillars. Pillar I includes direct payments to farmers and market management measures while pillar II measures are related to the RDP. Pillar I dominates the CAP budget, with a budget close to three times the size that of pillar II in the last programming period 2007-2013. The EU expenditures for Rural Development, having risen from 4% of the total CAP budget in the 1990s to 25% in the beginning of the 2010s, reflect the growing strategic and societal value attached to this policy in addressing the new global challenges for rural areas in the enlarged EU.

Within the multi-functionality orientation of the agricultural policy, there is a growing concern for landscape issues. One illustration of the concern for landscape in the CAP is the fact that "landscape state and diversity" is one of the indicators retained in the set of 28 agri-environmental indicators (AEI) that have been adopted in order to portray agricultural production systems, farm management practices, pressures and risks to the environment and the state of natural resources, as well as to track the integration of environmental concerns in the CAP.[4]

In this section we show that, while concern for rural landscape management has been introduced into the Common Agricultural Policy, the focus remains on management at the farm scale, with limited attention given to the two other scales. We also show how policy instruments could be refined for the CAP to better integrate the two other scales in order to facilitate the coordination of farm actions and avoid the risk of homogenization and consequently maintaining diversity of agricultural landscapes at EU level.

1) CAP impacts on landscape features at farm scale

Although the CAP is not a landscape policy per se it is often put forward as being the principal driver of changes in land use and farming practices in Europe, which in turn have an influence on rural landscapes. We review here the wide range of CAP measures with a direct or indirect impact on landscapes.

CAP pillar I measures are disconnected from any landscape provision objective but do nevertheless influence agricultural landscapes through their impact on land use and production systems. Coupled payments and market support schemes have given incentives to farmers to grow the supported crops, therefore contributing to the reduction in crop diversity, already encouraged by the intensification of agriculture (Centre d'Analyse Stratégique 2011). Since the decoupling reform in 2003, direct payments are not anymore linked to production (however member states can continue to couple a small amount of payments to specific products). Production decisions made by profit-maximizing farmers are therefore in theory no longer impacted by direct payments. But, by contributing to farm income, CAP decoupled payments indirectly contribute to farm maintenance and to the preservation of agriculturally managed landscapes. One reason is that, in order to be eligible to receive the payment, farmers have to meet certain cross-compliance requirements: compliance with Statutory Minimum Requirements (SMRs) in relation to 19 European Union regulations and directives, and the maintenance of 'Good Agricultural and Environmental Conditions' (GAECs), as defined by individual Member States. Among these requirements, many impact landscape management at farm level. For example, the maintenance of landscape features like terraces, stone walls, field margins, hedges, ponds, ditches and trees contribute directly to the aesthetic value of landscapes. The requirements for minimum soil cover and minimum land management impede the deterioration of the visual aspect of agricultural land generally associated with soil erosion, the overgrowth of vegetation and the closure of landscapes. Establishment of buffer strips along water courses also influences the landscape mosaic when plots are along water courses, even if the first aim is to protect water against pollution and run-off. Bans on the conversion of permanent grassland to arable land at farm level contribute to the diversity of cropping patterns.

But differentiated effects can be observed according to the regions, depending on the patterns of the on-going structural change in these regions. If decoupled payments are in theory more neutral on production decisions than the old direct payments set according to production, the decoupling reform still cannot stop the trend of landscape homogenization in productive areas due to the reduction of

cropping diversity, increase in parcel size, and disappearance of animals from the open landscape. Animals' function in the modern mono-cropping system is extremely reduced, due to the substitution of (i) draft animal power with machinery, and (ii) animal manure (resulting from animal waste and recycling of crop residues) with mineral fertilizer (Piorr et al. 2007; Piorr et al. 2009). Such trends are due to the modernization of farming and are rather independent from the CAP (they have also occurred in countries with no agricultural subsidies). Moreover, several studies have found that decoupling can influence land abandonment in marginal agricultural regions characterized by poor soils, steep terrain, or water deficit or excess. Land abandonment is the result of various demographic processes, usually consisting of the movement of the rural population to urban areas, as well as land taken out of production because of the land being unsuited to the development of profitable farming and because, since the decoupling reform, farmers can receive payments without producing (complying with cross-compliance requirements is sufficient) (Miettinen et al. 2004; Council of Europe 2007; Brady et al. 2009).

To counteract such trends, measures with a direct focus on enhancing the conservation of rural landscapes have been included in the rural development policy. Restoring and preserving the state of European landscapes is included within one of the six rural development priorities in the CAP post-2013 (restoring, preserving and enhancing ecosystems dependent on agriculture and forestry) (EU 2013b). Agri-environmental measures (AEM) are the primary policy instrument used to encourage farmers to protect and enhance landscape features on their farmland (axis 2 in the CAP pre 2014 and substituted by agri-environment-climate measures in the CAP post-2013). On a contractual basis, they provide payments to farmers in return for a service related to reducing environmental risks associated with modern farming and/or related to preserving natural resources, soil and cultivated landscapes. These incentives are the compensation/reward for farmers for protecting resources which they only partially benefit from and in some case may not benefit from at all. Those actions encompass the conservation of historical features (e.g. stone walls, terraces, small woodlands), management of pastures (including limits on livestock stocking rates, low-intensity measures,

mowing), creation of pastures or the management of other High Nature Value farmland areas, like traditional orchards. In 2009, the agricultural area enrolled in AEM amounted to nearly 38.5 million ha and represented 20.9% of the UAA in the EU-27 (EC 2011b). According to the typology set by the European Commission, the most important types of agri-environmental commitments in terms of area enrolled were related to the management of landscape, pastures and High Nature Value areas (13.5 million hectares and represented 39% of the total area committed across the EU-27 in the year 2009). However, there is also some evidence that many landscape actions are undertaken by farmers without any support, either because they are not aware of the existing schemes, or because the costs and constraints associated with signing such contracts are perceived as higher than the payments received (Primdahl et al. 2004).

RDP regulations specify that support to landscape conservation action can also be granted through the measures for the diversification of farm activities and the maintenance and development of services and actions in rural areas (axis 3 in the CAP pre 2014). The measures targeting the maintenance, restoration and upgrade of cultural heritage, such as the cultural features of villages and the rural landscape, play a crucial role in landscape management (Torreggiani and Tassinari 2012). Traditional farms and buildings create aesthetic value for rural landscapes (Tempesta 2010; EC 2011a) and make a fundamental contribution to rural economies, though their impact on tourism. Many other Rural Development measures not targeting landscape management may also have potential indirect effects on landscapes (EC 2011a). Examples can be found in Table 1.

Rural development and in particular agri-environmental measures reward individual farmer behaviour with little, if any, inducement for coordinated action across property boundaries. Landscape-scale management remains the exception rather than the rule (Selman 2006). The fact that coordination of landscape management actions between farms is merely taken into account can be viewed as a consequence of the conceptual framework underlying the Common Agricultural Policy implementation. The design of agri-environmental policies is mainly based on the microeconomics of production, where public good provision in general and landscape management in particular are

perceived as a by-product or a joint production of agricultural activity (Delvaux et al. 1999; Dupraz et al. 2003). According to the theory of joint production, agriculture produces multiple and interconnected (joint) outputs or effects (OECD 2001). These effects or outputs may be positive or negative, intended or unintended, complementary or conflicting, valued in existing markets or not. There may be market failure in the production of joint non-commodity outputs by agriculture, i.e. under- or overprovision of certain commodities, making corrective actions necessary, for example through the compensation of the extra cost associated with the delivery of public goods by farmers. But relying exclusively on the theory of joint production to design the landscape measures of agricultural policy limits the focus on farm scale and avoids delving deeper into the difficult issue of the spatial aggregation of actions taken by different farmers at the landscape scale (Piorr et al. 2007; Lifran 2009). Moreover, it fails to address the question of the provision of diversity of landscapes as a global public good at the European scale. In the following section, we propose an alternative conceptual framework and review possible instruments that could be integrated into European Policy to overcome these limits and better account for the multi-scale nature of landscapes.

2) The coordination of land managers'actions for landscape management

In this section we present instruments likely to create a better integration of farm and landscape scales by favouring the coordination of land managers' actions to obtain a landscape effect. Most of the CAP measures focusing on landscape management target and provide incentives for the provision of landscape public goods by individual farmers. But to ensure that the farmers' efforts in landscape management deliver the maximum aesthetic value and environmental benefits, landscape management requires integrative instruments to coordinate the scattered actions of multiple landowners. The scale at which these instruments should operate should reflect the costs and benefits of alternative landscape management decisions (Hodge 2007). We refer to this scale as the landscape scale.

Collective management of landscapes will be particularly advantageous in cases where (1) different farmers possess specific assets which need to be pooled in order to make landscape provision possible

at a geographical scale beyond the farm scale, and which could not be provided or protected by a single farmer, and where (2) providing landscape requires highly specific investments whose scale goes beyond the individual stakeholder (e.g. highly specialised machines for maintenance of hedges which are too costly for individual farmers and where cooperatives or other structures may be the ideal intermediary) (Van Huylenbroeck and Mettepenningen 2011).

The theory of collective action provides an interesting conceptual framework to deal with these issues (OECD 2013). Collective action can be defined as action taken by a group in pursuit of members' perceived shared interests (Scott and Marshall 2005). The theory of collective action was first discussed by Olson (1965) and Hardin (1968). Both authors have argued that it is not sufficient that every member of a group share common interests for them to act collectively to achieve them. There will always be 'free riders' who cause the collapse of the collective system. However, Ostrom (1990) has identified many examples in the world where groups of people are able to manage common resources in a sustainable way, even in the absence of individual property rights, or management by public agencies. Possible coordination mechanisms – in increasing order of authority and integration – are i) regulatory interventions, ii) information systems, iii) voluntary agreements and iv) formal organisation (Primdahl et al. 2004; Van Huylenbroeck et al. 2009). Examples of such institutional arrangements and mechanisms are represented in table 2.

Regulatory interventions

Consideration for scale issues has been included in the CAP post 2013, in particular in the "greening" conditions that farmers will have to respect to receive full direct payments (see table 2). Member States are given flexibility on whether the obligation applies at farm-level, group of farmers or regional level, therefore making it possible to adapt the requirement to the scale where the environmental benefits are highest. Despite the existence of a regulation/mandatory approach, it is recognized that other instruments are necessary (described below) to assist farmers with the coordination of their actions at landscape-scale.

Information devices

Agri-environmental advisory and extension services represent influential tools for providing farmers with knowledge and skills relating to environmental agricultural practices as well as for promoting the coordinated- implementation of landscape management measures. Beyond the content, training creates occasions for farmers to meet each other and this can promote good communication and mutual understanding between farmers, two necessary conditions for coordinated actions. Learning and innovation networks, including farmers, non-governmental organisations (as advocates of sustainability), extension and research, have also proven to be an adequate vehicle for empowering groups of farmers to investigate new options to make their business more sustainable (EU SCAR 2012). EU Member States have the obligation to offer their farmers advice under a Farm Advisory Service (FAS). In the CAP 32014-2020, landscape issues are covered by advisory services only through advice on the requirements and standards forming the scope of cross-compliance at farm-level (EU 2013c).

Voluntary agreements

Even if agri-environmental contracts are usually signed by individuals, a certain level of coordination can be reached by setting the eligibility criteria (e.g. target area) and the payment design (e.g. collective or agglomeration bonus). Some examples of potential contractual arrangements are presented in Table 2. These ideas have to some extent been taken into account in the CAP 2014-2020 (EU 2013b), since when the Agri-environmental-climate commitments are undertaken by a group of farmers, payments can be increased due to transaction costs by 30% when applied by a group of farmers (20% when applied by an individual farmer). Such contracts are certainly an improvement compared to agri-environmental schemes in the CAP pre 2014, which rarely include any incentives for coordination at landscape scale.[5] However, taking into account all behaviour that we would want to encourage to improve landscape management with a single instrument/incentive can be complex (Goldman et al. 2007). Moreover, such coordination mechanisms remain rather weak since the

environmental outcome is dependent on the voluntary decisions of individual farmers to engage in the environmental contract.

Formal organisation

Environmental cooperatives or land-care associations can regulate, coordinate and monitor the actions of its members. Membership can be compulsory or voluntary, or the implementation of the organization is submitted to a vote, but cooperation of all landowners is compulsory once it is formed (Goldman et al. 2007). While organisation of farmers in cooperatives has for long empowered farmers with regards to purchasing inputs and selling production on the market, the possibilities of cooperative organisations to supply non-commodity outputs have not yet been fully exploited (Van Huylenbroeck 2002). There is nevertheless evidence that environmental cooperatives represent an instrument to foster collective action in landscape management (Falconer 1999; Falconer 2000; Polman and Slangen 2002; Slangen and Polman 2002). First, the environmental goal can be set for the area under the management of cooperative members. Assuming that the farms involved in the environmental cooperative are sufficiently spatially distributed, the management scale would reach the landscape scale (Van Huylenbroeck 2002). Secondly, farmer participation is increased since the environmental cooperative members are involved in both the design, implementation and evaluation stages of the actions (Goldman et al. 2007). Thirdly, the administrative, implementation, monitoring and enforcement costs would be reduced as the asymmetric information between the farmer and the policy maker is reduced, as well as saving on transaction costs compared to multiple individual agreement negotiations (OECD 2010). Communication, mutual understanding between the members of such groups and commitment are necessary to reach those benefits (Emery and Franks 2012; Prager et al. 2012). Action at the institutional level is also necessary to create adapted institutional forms, for example recognizing collective ownership of a particular good (Van Huylenbroeck 2002). Formal organization and contractual agreements are not excludable tools since agri-environmental contracts could be designed for groups. The group receives the payment from the member state, according to the overall objectives set for the group, and then redistributes it among individual contributors,

according to their respective roles (Van Huylenbroeck 2002). In the CAP 2014-2020, there is support to fund the cost of co-operation involving at least two entities and aiming at joint approaches to environmental projects and ongoing environmental practices, including the preservation of agricultural landscapes (article 36) (EU 2013b).

3) The management of diversity of landscapes at EU level

In this section we present instruments likely to create a better integration of the landscape at European scale by ensuring the conservation and management of the diversity of EU landscapes. Regional agricultural peculiarities across the EU and the associated landscapes will be maintained only if the diversity dimension is integrated as an objective of landscape planning and policies. Currently, although restoring and preserving the state of European landscapes is included within the priorities for rural development, preserving the diversity of agricultural landscape in the EU is not a stated objective.

As argued by Meeus, Wijermans et al. (1990) , "If we value landscape variety as such, and if we want to promote a continuous existence of different landscapes instead of *"One European Landscape"*, then the very first step is an international exchange of ideas, objectives and plans for the different European landscapes". The EU experience in managing other global public goods, such as climate or biodiversity, could serve as a basis for the management of the diversity of EU landscapes. One interesting example of international collective action is the participation of the EU in the Convention of Biological Biodiversity (CBD) aiming to ensure the conservation and sustainable use of the diversity of species. The participation of the EU in the CBD has fostered the EU Biodiversity Strategy 2020, adopted by the European Parliament in April 2012 with the aim of reversing the loss of biodiversity, and speeding up the transition to a green economy. This same approach could be considered for landscape as it can be deemed a global public good and therefore it could benefit from management beyond the EU scale. Thus, the approach will be to start with a convention applying at

the global scale, transposing it onto EU legislation (including the CAP) and finally for Member States to integrate the strategy into their plans, programmes and/or national schemes.

Currently, in the absence of a real policy instrument to manage the diversity of landscapes, the solution chosen is indeed to rely on international conventions, in order to promote a common approach to the conservation of European landscapes and coordinated actions. At the European level, there are two major conventions dealing with the diversity of landscapes: the Pan-European Biological and Landscape Diversity Strategy (PEBLDS) and the European Landscape Convention (ELC), both managed by the Council of Europe (international organization aiming to foster cooperation in the European continent).

The PEBLDS was created in 1995 to promote a consistent approach and common objectives for national and regional action in Europe for the implementation of the Convention on Biological Diversity (1992). It has been signed by 55 European countries, which, in doing so, recognised the special need for international cooperation in efforts to conserve biodiversity and landscapes of European importance. Interestingly, both biological and landscape diversity were targeted in the PEBLDS. A specific pan-European convention dealing with landscape issues has been created since then: the European Landscape Convention.

The European Landscape Convention (ELC) promotes the protection, management and planning of European landscapes. The ELC requires the recognition of "landscapes in law as an essential component of people's surroundings, an expression of the diversity of their shared cultural and natural heritage, and a foundation of their identity". The ELC acknowledges not only that the quality of European landscapes constitutes a common resource, but that their diversity does also. Furthermore, compared to the PEBLDS, it does not focus on landscapes of European importance, but on all landscapes. The ELC aims to encourage the public to formulate policies to preserve, manage and plan the landscape at local, regional, national and international levels and organises European cooperation on landscape issues. Although the ELC is a weak policy document in terms of legal obligations and power, it represents a substantial appeal for the Member States to establish an active landscape policy

(Landscape Europe website). The convention was adopted on 20 October 2000 and came into force in 2004. It has been signed by 37 of the 47 Member States of the Council of Europe. It is open to all European countries (EU Member States and others), as well as the European Community itself (article 14 of the ELC), but none of the EU institutions has signed it yet.

One of the general measures of the ELC is: "the Integration of landscape into regional and town planning policies, and in its cultural, environmental, agricultural, social and economic policies, as well as in any other policies with possible direct or indirect impact on landscape". If taken up the ELC recommendations could provide an impetus towards a better integration of landscape protection, management and planning into European policies, including the CAP. The effects could be enhanced by the coordination of farm landscape management through collective action (as promoted by the ELC) such as the participation of the general public, local and regional authorities and other parties in the definition and implementation of landscape policies. Landscape observatories, centres and institutes at the local, regional, national or international level are one of the main instruments for the implementation of landscape policies according to the guidelines for the implementation of the ELC.

IV. CONCLUSIONS

In this article, we have focused on the role of the CAP in shaping EU agricultural landscapes, and how this role could be improved with a better coordination of action beyond the farm scale. We have identified that optimal management of agricultural landscapes requires action on three scales: (1) the management of landscape features at farm level, (2) the management of landscape structure and the integration of farms into rural landscape management entities at landscape level, and finally (3) the conservation of the diversity of agricultural landscapes in the EU as a global public good. We have reviewed the influence of the different CAP measures on landscape and how landscape management has been included within rural development policy. We concluded that the focus of the CAP is mostly limited to landscape management at the farm scale. We have described how alternative conceptual

frameworks can support the design of policy instruments to contribute to a better integration of the landscape and EU scales in the CAP. Table 3 summarizes the findings.

This article provides a knowledge base to support an effective CAP policy design in the direction of improved landscape management, an important component of the EU project towards more sustainable agriculture. Two main recommendations have emerged. First, in order to reconcile the farm and landscape scales, rural development policy should further develop integrative instruments to coordinate the scattered actions of multiple landowners. Examples include AEM with coordination requirements triggering a collective payment, or support to environmental cooperatives engaging in collective action for landscape management. Second, in order to ensure the provision of the global public good "diversity of landscapes", coordination and management should occur not only at regional and national level, but also at European level. In this sense the recent establishment of the Coordination of the European Landscape Observatories may give new impetus to a common approach to the landscape question (UNISCAPE 2013). International conventions enable the promotion of a common approach to the conservation of European landscapes and coordinated action. Experience from the management of other global public goods such as biodiversity show the added value of such coordinated action.

The need for further research is manifold:

First, the integration of these three landscape scales will depend on the costs and benefits of a multi-scale approach to landscape management. This assessment has been left outside the scope of this article. Therefore, further research is needed in order to address: (1) the evaluation of preferences (benefits) for the landscape public good at farm and landscape level, as well as the evaluation of preferences for the global public good "landscape diversity" at EU level; (2) an assessment of the costs of the integration of these three landscape scales in the policy framework. In addition of usual limitations associated with landscape valuation (Price 1993), there are many challenges involved in developing such framework (e.g.: context dependency of economic values vs. need to obtain value at EU level and appraisal of non-use values of landscapes).

Here, in the absence of evidence in the literature on these two aspects, we have assumed that the benefit-cost ratio of policy intervention for multi-scale management of agricultural landscapes is positive and we have focused on how this could be implemented within the Common Agricultural Policy.

Second, beyond the analysis and valuation of landscape as a standalone, ecological knowledge is needed on the added value of an improved landscape management in the multiple provision of ecosystem services and particularly those that support agriculture (i.e. pollination, pest control). Economic valuation of such services, coupled to the valuation of landscape, would further support the cost-benefit assessment of public support to landscape management at different scales.

Third, analysis of farmers' attitudes towards landscape management could suggest which actions are more likely to be undertaken without external incentives, and which policies could be effective in reinforcing the incentives to contribute to the landscape public good.

Last, while the article has focused on the importance of considering multiple spatial scales for landscape management, time scales and the chronology embodied in landscapes should not be underestimated (Widgren 2012). Each landscape is a result of the superposition of different layers of changes that have occurred at very different points in time, and they tend to survive in different social and political contexts. As a consequence, it is often impossible to immediately streamline the evolving society preferences towards landscape with the current state of the landscape (Lifran 2009). In the CAP, as well as in other policies, landscape planning objectives tend to be defined in terms of the conservation of the existing landscape, more than in terms of considering/developing new forms. A management action is considered as contributing towards landscape if "it maintains or protects individual landscape elements or the characteristic structure of a more traditional agricultural landscape as a whole" (Institute for European Environmental Policy 2011). However, one difficulty with landscape policies intended to conserve historically dated landscape relates to the fact that in the

meantime economic and social conditions prevalent at the time of reference have changed (Von Haaren 2007). Under the new conditions, there is a risk that conservation policies will not achieve their objectives and/or that they will result in reducing the landscape to a museum, i.e. to de-link its aesthetic elements from the social and economic ones. It is useful to remember the experiences of important periods of history, e.g. the Renaissance, during which the issue of landscape was central to society's thinking on the "agricultural project" (Ambroise 2004). The same logic could apply now: the EU project towards more sustainable agriculture may face the challenge of setting up a new landscape scheme.

Table 1: Indirect effects of non-landscape-targeted Rural Development measures on agricultural landscapes

CAP measure	Influence on agricultural landscapes
Support to Less Favoured Areas/ Areas with Natural Constraints (RDP axis 2) and the maintenance of farmed landscapes	The Less Favoured Areas (LFA) policy was conceived as a structural policy to reduce the differences in farm income due to differences in productivity across regions within the EU, and to prevent land abandonment by maintaining agricultural activities and rural population. In the EU-27, 54% of the total UAA has been classified as LFA. The continuity of farming systems, despite the natural handicaps in Less Favoured Areas, is seen as central to the preservation of cultural landscapes. When farming declines, land is abandoned or under-used, scrub and forest encroach and the open landscape disappears (Vanslembrouck and VanHuylenbroeck 2005). CAP support to LFA contributes to mitigate the risk of land abandonment. However, LFA payments are not restricted to the areas of greatest landscape value or where the risk of land abandonment is greatest, leading therefore to uncertain effects on landscape (Cooper et al. 2006).
Afforestation and agro-forestry measures (RDP axis 2): influence on land use change	In the Rural Development Policy 2007-2013, three measures are related to afforestation and agroforestry (221, 222 and 223). The promotion of afforestation has a drastic influence on landscape due to the land use change from field/permanent crops to tree plantations. Nowadays, the development of the practice of forest landscape design has enabled a better integration of tree plantations into the landscape (Halldorsson et al. 2005). One example is the coexistence in the same plot of trees and crops, i.e. agroforestry. On top of the wide range of environmental, agronomic and economic benefits associated to agroforestry, it also has the potential to create high value landscapes (Palma et al. 2007; McAdam et al. 2009). Despite this evidence, some of the initial policies developed under the CAP (before the 1992 reform) included measures against its development, such as direct support for the removal of trees from fields (Herzog 1998), or exclusion of agroforestry parcels from CAP direct payments (Lawson et al. 2002; Liagre and Dupraz 2008). The benefits of integrating trees with agricultural systems are now recognised in most countries and agroforestry plots are generally eligible for direct payments (Angeniol and Liagre 2010). Moreover, since 2003, national governments have been allowed to include the planting of agroforestry systems within their Rural Development Programmes (measure 222) (EC 2005).
Food quality schemes and the promotion of cultural landscapes	The EU food quality policy promotes and protects the names of quality agricultural products and foodstuffs with three different schemes: PDO (protected designation of origin), PGI (protected geographical indication), TSG (traditional speciality guaranteed). On top of the certification schemes, CAP support is available to farmers who participate in food quality schemes (measure 132) and producers' groups for information and promotion activities of these products (measure 133). PDO and PGI schemes have the potential to influence landscape when product specification must include not only a description of the agricultural product, but must also specify and justify the link between the landscape and the product, and show how the specific characteristics of a particular region influence the product (Ministère francais de l'agriculture et de la pêche 2006). For example, for vineyards and fruit trees, the specification of

	authorized variety, density and pruning rules influences the visual aspect of landscapes. Including these landscape characteristics in the product specification can therefore encourage farmers to take action in favour of landscape conservation, so that they conserve the benefits associated with product certification. Of all PDO and PGI products registered by 2005 (671), 80% (532) had a link to landscape management (Paracchini and Capitani 2011).
CAP support to the modernisation of farm activities (RDP axis 1) and potential impacts on landscapes	Axis 1 of the Rural Development Policy concerns the improvement of the competitiveness of the agricultural and forestry sector. When the support is directed towards investment in machinery, it can potentially have a detrimental influence on landscapes: farmers may increase plot size, rectify their geometry, and reduce the number of fixed elements in order to enable the use of machinery and increase the economic efficiency of the farm. Greenhouse parks, where several large greenhouses are clustered on the same site, are another good example of conflict between innovation –that can be supported by Axis 1 measures– and aesthetic influence on landscapes. These parks enable producers to reduce production costs by sharing infrastructure such as energy, water and gas facilities but they severely impact the aesthetic of the surrounding landscapes (Rogge et al. 2008).

Table 2: Overview of institutional arrangements and mechanisms to promote landscape management at the landscape-scale

Regulatory interventions
Example of greening conditions in CAP post 2013 (EU 2013a) • The ratio of the land under permanent grassland in relation to the total agricultural area declared by the farmers should not decrease by more than 5% compare to 2015 reference. But, Member States will be free to decide to apply the permanent grassland-retention-ratio at national, regional or farm level. • Where the arable land of a holding covers more than 15 hectares, farmers shall ensure that as from 1 January 2015, an area corresponding to at least 5% of the arable land is ecological focus area (EFA) (including land lying fallow, terraces, landscape features, buffer strips, afforested areas). Member States may decide to implement up to 50% of the percentage points of the ecological focus area at regional level in order to obtain adjacent ecological focus areas. Member States shall designate the areas and the obligations for farmers or groups of farmers participating. Moreover, Member States may decide to permit farmers whose holdings are in close proximity to fulfil the obligation on the basis of collective implementation provided that the ecological focus areas concerned are contiguous. The EU has recognized that EFA can provide higher environmental benefits and further contribute to landscapes if they are rationalized at the landscape scale (Allen et al. 2012; Westhoek et al. 2012).
Information devices
• Farm Advisory Services on landscape feature management (cross compliance) • Learning and innovation networks focused on collective landscape management action
Voluntary agreements
• Spatially targeted AEM: Coordination is obtained indirectly through the definition of a target areas. Parcels are eligible only if they are within the target area (Wünscher et al. 2008; Uthes et al. 2010; Schouten et al. 2011). This foster the possibility to obtain an impact at landscape-scale if the target area is restricted enough • Agri-environmental contract accounting for threshold effects: the payment to each individual farmer is conditional upon the area intended to be covered by the contracts being greater than the area needed to pass the threshold (Dupraz et al. (2009), Kuhfuss, Préget et al. (2013)) • Agglomeration payment: the basic payment is given for the change in land use, while an additional payment is conditional to the proposed plot being contiguous to another with a similar or distinct land use (Parkhust et al. (2002), Lifran (2009), USDA (1998)))
Formal organisation
• Environmental cooperatives are organisations of farmers who work in close collaboration with local administration to integrate environmental management into farming practices (Franks and Mc Gloin 2007). • Land-care associations, such as the German *Landschaftspflegeverbände*, consist of a broad range of stakeholders from agriculture, nature conservation and regional authorities involved in the implementation of municipal landscape planning and environment protection. Their scale of intervention is the landscape and watershed level (for the implementation of the water framework directive) (DVL 2010).

Table 3: Summary of the multiples scales of agricultural landscapes and the role of the Common Agricultural Policy

	Farm scale	Landscape scale	European scale
Landscape feature to be provided	Landscape features, including patches (e.g. cultivated parcels, woodlots, semi-natural vegetation, groups of buildings), linear elements (e.g. hedges, non-cultivated land strips, stonewalls, terraces) and point elements (e.g. isolated trees and buildings).	Landscape structure (Composition and configuration of the landscape elements and patches) in an area of coherent character	Diversity of agricultural landscapes across Europe
Actors	Land owners and managers	Decision of various land managers, often requiring a coordinating body/institution/policy	Multiple regions and countries
Conceptual framework	Joint production of food and agricultural landscapes	Collective action	Governance of global public goods
Current CAP and agricultural landscapes	Impact of CAP payments on land use and farming practices. Existence of rural development measures targeting the conservation of landscape features, as well as non-landscape-targeted measures with indirect effects on agricultural landscapes	Impact on landscape scale through the impact on the farm scale	Impact on the majority of agricultural land in Europe through the impact on the field and farm scale
Possible improvement of the CAP towards better agricultural landscape management		Potential role in encouraging coordinated actions of various farmers, accounting for the importance of the spatial dimension	Promoting a common approach to the conservation of European landscapes and coordinated actions for the conservation of the diversity of EU landscapes

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NOTES

[1] For the purpose of the present article Europe and EU are used as synonyms (authors apologise for this simplification).

[2] Other examples of global public goods usually found in the literature include the conservation of genetic diversity, the mitigation of climate change, the control of emerging infectious diseases or the management of sea areas beyond national jurisdiction (Arriagada and Perrings 2011).

[3] Moreover a synergistic effect can be obtained by treating diversity of landscape and biological diversity in similar conceptual terms, as landscape structure is a key element for the understanding of species diversity (Walz 2011): diverse landscapes can provide habitats for a larger pool of genetic resources (e.g. tree varieties (Granke et al. 2009), cattle breeds have adapted to specific landscapes (Hiemstra et al. 2010) etc.)

[4] The "landscape state and diversity" indicator (AEI28) is based on three sub-indicators: 1- the dominance and internal structure of the rural-agrarian landscape in the context of the wider landscape matrix; 2- the hemeroby state (or degree of naturalness) which shows the distance from the natural state due to human (agricultural) activities; 3- the interest and perception that society has for the rural-agrarian landscape (tourism, local products) (Paracchini and Capitani 2011; Paracchini et al. 2012)

[5] The only rural development measures with collective dimension we have identified in CAP pre 2014 are measures for which municipalities or groups of actors from the non-farming sector are also eligible (similar measures are considered in the CAP post 2013). In particular, measures 322 and 323 focused on the renewal and improvement of the overall appearance of the rural settlement and natural environment (main elements of the cultural landscape and touristic attractiveness). With the LEADER approach of measure 412 the establishment of partnerships at the sub-regional level to co-ordinate investments to enhance the cultural landscape, rural heritage and cultivation in High Nature Value areas were supported.