

THE PROVISION OF PUBLIC GOODS THROUGH AGRICULTURE AND FORESTRY IN SOUTH CENTRAL REGION IN BULGARIA

Dimitre NIKOLOV ¹, Ivan BOEVSKY ², Petar BORISOV ³, Teodor RADEV ⁴

¹ Prof. Dr., Director, Institute of Agricultural Economics, Sofia, Bulgaria,
email: dnik_sp@yahoo.com,

² Assoc. Prof. Dr., Institute of Agricultural Economics, Sofia, Bulgaria,
email: ivan.boevsky@gmail.com,

³ Assoc. Prof. Dr., Vice Dean, Agricultural University, Plovdiv, Bulgaria,
email: peterborisov@gmail.com,

⁴ Assoc. Prof. Dr., Agricultural University, Plovdiv, Bulgaria, email: radev1974@abv.bg

Abstract

The main result of agriculture is the production of raw materials for the processing industry and food but it also forms public goods as a secondary effect. The most important public goods which are linked to agriculture are: agricultural landscapes, biodiversity, water availability and water quality, functionality of soil, climate change, air quality, resilience to flooding, fires and erosion, vitality of territory, security food. The aim of the study is to identify the main public goods in the region and trends in their developments. The most important public goods in the region are: Climate change mitigation, Water Quality, Air Quality, Rural vitality. The public goods Landscape, Food Security and Pollination are increasing in the region. Air Quality, Water Quality, Water availability are stable. But most of the identified public goods: Climate change mitigation; Soil Conservation and soil functionality; Rural vitality; Biodiversity; Resilience to Flooding; Resilience to Fire are under decline. Another main point from discussion on public goods is that the concept of public goods is not popular and almost all stakeholders are unaware of it.

Keywords:

Agriculture, public goods, climate change mitigation, water quality, air quality, rural vitality

Introduction

Agriculture is indispensable part of the economic activity in the South Central Region, Bulgaria which half territory is used for agricultural production. Though the main result of this activity is production of raw materials for the processing industry and foods, the secondary effects are impact on the environment and landscape formation. This impact could be positive or negative. For instance, the technologic changes in the last decade give opportunity to produce more, but the intensive use of natural resources leads frequently to their wasting and deterioration. On the other hand, the agriculture could create attractive landscapes and to preserve the local culture and traditions. Thus, the agriculture insures public goods, which bring social and ecological profits.

The most significant public goods having relation to agriculture as economic activity are: agricultural landscapes, biodiversity, water availability and water quality, functionality of soil, climate change, air quality, resilience to flooding, fires and erosion, vitality of territory, security food.

This analysis purpose is to identify the main public goods in the South Central Region, their location and development trends.

1. Literature review of public goods related to EU agriculture

These goods are related predominantly to the natural environment and include agricultural landscapes, biodiversity, water availability and quality, soil functionality, climate stability in terms of carbon emissions, air quality, resistance to flooding and fire, different social goods as rural areas vitality, food safety, animal health and welfare.

Lots of these public goods have complex character and combine in a different degree elements with public and private character. The food safety is an example for a public good received in result of private goods use – production factors as land and labour resources. Their offer and demand are regulated from existing markets, thus the external intervention from the public bodies is rarely necessary. This way, through the established market conditions, is formed the production of definite foods, in such degree insuring their availability, i.e. there is a security of supply.

Public goods are described as such for which consumption people do not compete and their consumption from one person or group of persons does not exclude consumption from other persons. These two characteristics are in the base of the non-efficiency of the market as a mechanism stimulating the offer, which suppose the undertaking of interventions from the public bodies.

Often agricultural goods, associated with EU agriculture, are not result from the agricultural production itself. For instance, the presence of specific crops or habitats is related to the realized agricultural activity, but the opportunities for alternative use are limited. This relation exists due to the landscape evolution and to the adaptation of some species to the agriculture as a human activity and it is an indication for the interdependence between the valuable natural public goods and characteristics of agricultural system. (Havlik и др., 2005; Hodge, 2008).

Other goods as climate stability, fire resistance, water availability and quality, air quality etc. do not exist by themselves; they are influenced in some degree by agricultural activity in its various forms. Fire resistance, for example, could be enhanced by the recovery of marshes and wetlands. Although these actions can insure higher degree of fire resistance and positive effect on the local environment, they will restrict agricultural production. This means that is necessary to look approaches to ensure society with food, through the implementation of agricultural activities which have a gentle impact on the environment and minimization of unfavourable effects on agricultural production.

1.1. Agricultural landscapes

From millenaries the agriculture forms various landscapes, identified frequently as typical for different regions and giving profit for the local societies. Agricultural landscapes are an entity of topography and physical environment, including cultural, archaeological, domestic heritage and ecological infrastructure (European Landscape Convention, 2008; Swanwick et al., 2007). In some places the cultural elements dominate in the landscape, but they are also result from the way of land and forest use. Such landscapes were formed in the time as a result from the complex interaction between the local natural and cultural factors, driven by social-economic and ecologic powers (Wascher, 2004).

EU agricultural landscapes are characterized by heterogeneity and differ locally by specific elements, forming the respective social parameters of the communities from a given area. They have high degree of publicity giving access to everyone who can use this public good. Though, the national legislation should be taken in consideration, regulating the access to private properties and respectively, agricultural lands. Generally the rivalry in this good's use is restricted, but there are cases of landscape change, due to the big interest to some region and big number of visitors

Not all agricultural landscapes could be assessed as attractive and desirable public goods. Some activities as the monocrop agriculture, greenhouse production, non-typical for the region new crops, form landscapes breaking the ecological, esthetical and social-cultural character of the landscape. Such activities should be organized and managed in a way to keep the typical for the region landscape. Despite the above-mentioned, when the landscape features are endangered by degradation, the necessity of public intervention is high, having in view the requirement for coordinated actions of the different interested countries. This is especially important for the maintaining of relict functions, ensuring clean environment or cultural profits, but this could turn to economic hindrance for the farming business, due to the production function limitation

1.2. Biodiversity

The biodiversity is a public good adding value to the territory. It could be examined as a diversity of species and habitats or as an entity of useful functions for the society (Fisher и Turner, 2008). Independently of the definition approach, this good could be used by all persons, as its specific character defines the high degree of exclusion of some consumers, i.e. there is a competition between consumers. For example, after hunting and gathering wild herbs on some territory, the opportunities for such activities could be depleted and recovered after a new reproduction cycle. This is the reason imposing the necessity of protection of definite zones, aiming to guaranty the availability of the public good.

The biodiversity depends strongly on the implemented technology for crops growing. Generally the extensive agricultural practices create opportunities for natural resources preservation, in a high degree, and this way they generate ecological niches, maintaining the species varieties (Grime, 1973; Beaufoy et al., 1994; Kleijn et al., 2008). For this reason the relation between agricultural production and biodiversity in agricultural lands is direct, as the agricultural activity increases the richness of kinds up to some level of production intensity. As a result of economic conditions and stimuli development, traditional agricultural practices had been drop off, thus the biodiversity maintaining has been violated (Tucker и Evans, 1997; Pain и Pienkowski, 1997). This fact requires stronger intervention by the society for the recovery of distinctive natural environment of the given territory.

1.3. Water quality and availability

Agricultural activity has strong impact both on the quality and availability of water resources. Agriculture is among the main consumers of water resources and their excessive use can lead to their moment exhausting (generally in summer). River waters quality, passing through agricultural lands, is influenced by the lands pollution levels with chemicals in result of fertilization and pesticides and herbicides use. These impacts are spread in the nature along the river, beyond the limits of agricultural farms. Thus it is indispensable to implement production practices for sustainable water use. For example: the creation of buffer massive along river valleys to improve the water quality, to convert the arable land in pastures, to terrace of land and less use of groundwater.

Both quality and water resources availability in Europe possess private and public features. There is a public control of water use, as the rules for water production are regulated from the legislation. There are also defined standards for water resources preservation in order to conserve their quality and use for drinking and other needs. It could be also a private interest if, for example, the pollution of water basins is reduced to minimum and they could be used for fish or for watering of animals. Taking in consideration that the water is limited natural resource, there is a considerable risk of excessive exploitation leading to this resource exhaustion. This risk can be sharpening in the future, especially in some EU regions, where the rainfall diminishes and there are more intensive drought periods.

In long-term perspective the advantages related to the maintaining of water quality and of the water resources availability would be guaranteed by the two characteristics, inherent for the public goods – non-exclusion and lack of competitiveness for their use. For this aim the government should implement a policy for encouragement of sustainable water use, oriented to pollution restriction of groundwater and surface water, to guaranty non only the clean drinking water, but to preserve ecosystems and their services.

1.4. Soil functionality

The agricultural soils quality is estimated through a set of parameters, including the organic matter ratio, the level of sensibility to wind and water erosion, the soil structure and the infiltration capacity, the flora and fauna health and the pollution degree (JRC, 2009a). Agriculture impacts on most of these parameters, having in view that the soil is used as an environment for growing, source of food substances and place for conservation of materials and wastes. Thus, the implementation of convenient practices for soil use could preserve their functionality for the future

The soil has characteristics both of private and public good. As a production factor, it is object of private control and property, so its use from a definite person excludes the rest of users. Despite the interest of the owner to preserve this resource, there is a short-time stimulus to maximize the productivity using more pesticides, fertilizers and inappropriate methods of harvesting, which deteriorate the soil quality. The society has interest in the keeping of soil functionality, in a long-term aspect, to guaranty the food production and to insure ecosystems functions.

1.5. Climate stability (carbon emissions and greenhouse gases)

It is of public profit to slow the pace of global warming through speed reduction of the release of anthropogenic greenhouse gas emissions or through improvement of carbon conservation (IPCC, 2002). The stable climate is one of the purest public goods, having universal profits. The carbon storage and the reduction of greenhouse gas emissions – key elements for the mitigation of climate changes – have strong characteristics of public goods; no one could be excluded from their advantages and there is not competitiveness in their consumption. Though the agricultural sector has the main contribution for the greenhouse and carbon emissions generation, agricultural practices encouraging the storage of carbon dioxide and the use of agricultural production as renewable energy sources, could reduce the use of fossil fuels and thus, to reduce greenhouse gases emissions for all the economic and public activity.

The soils could be source of carbon and place for its storage. To keep their role as a storage place, the pace of carbon depletion from the soil should be minimized and the absorption capacity should be kept or even increased. The carbon content in the soil depends on the ratio between the speed of carbon adding from the plants' growing and the speed of its removal through organic matter degradation, extraction and other soil processes as the erosion. The degree of carbon conservation depends on factors as soil kind, humidity, planted crops and production practices (UNEP, 2009). The conservation potential is highest at minimal levels of soil cultivation and low level of organic matter degradation, although there are big differences according the regions (Freibauer et al., 2004).

Big part of the potential for mitigation of climate change results has derived from the carbon capture from the soil (IPCC, 2007a) and the realization of this potential depends on the implemented agricultural practices. Some forms of agricultural activity encourage the carbon conservation up to some point of saturation, which often leads to improvement of soil structure and diminution of the risk of floods in the same time (Watson et al., 2000; Smith, 2005). The absorbed carbon from the soil does not stored permanently and for

definite agricultural activities could be released quickly. Actually the carbon could be lost easily, faster than its accumulation, which lead to fast and considerable diminution of the effect of activities, leading to carbon capture.

In the process of agricultural production the greenhouse gases, including ammonia, nitric oxide, methane and carbon dioxide are released by the use of inorganic fertilizers, machines and from the livestock breeding. In practice, these emissions cannot be reduced to zero, but there is a wide range of practices capable to reduce the emissions through manure management; timely and effective use of fertilizers; modification of livestock alimentation; change of water use; soil cultivation and diminution of the dependence on fossil fuels

1.6. Air quality

The human health depends strongly on air quality and the lack of polluters has useful impact on the whole society. This fact determines the air quality as one of the most significant public goods, which could be used by everyone, when available.

Agriculture is a source of greenhouse emissions and of burnt gases from the diesel engines of machines, smoke from straw and waste, smells from the livestock, pollution from sprayers and all this leads to air quality diminution. Some of these emissions are local, small and relatively rare, but others are widely spread in some production forms. The minimization of these pollutions from different sources could be attained through the admission of concrete management practices.

1.7. Floods resistance

There are forecast saying that the global warming will strength the hydrologic cycle and will increase the frequency of floods in big parts of Europe (ЕИП, 2008). Such extreme meteorological events will have impact on agricultural productions, located in floodplains and at low waterfronts, which are often the most productive agricultural areas. The risks are increased in areas where the rivers and other water flows have been straighten, which increases the water flow speed or where the costal vegetation plants have been removed or in highly compacted soils that quickly become marshy after rainfall. (LUC, 2009). Agriculture could have contribution for such results, applying some forms of land management for the improvement of its capacity for water conservation.

The number of people threatened by a risk of floods has increased from 1,5 millions to 3,5 millions in the last 60 years in Great Britain (Evans и др., 2004), as the danger is not only for farmers. Every person leaving and working in the endangered areas has an interest in applying activities for risk prevention. Due to the local character of the floods, this public good could be determined as a local.

It must be taken in consideration that the decisions of farmers to reduce the risk of floods in their areas influence and help the diminution of floods' risk of areas and of its neighbours. The improvement of floods resistance can be realized through agricultural practices improving the soil structure and this way to increase its infiltration degree. This effect could be attained by creation of grass buffers, hedges or forest stripes, slowing the water passing or pastures keeping (LUPG, 2004; Defra, 2008). To be efficient these practices should be implemented by sufficient number of farmers.

1.8. Fire resistance

In the past the fire, caused by natural or anthropogenic reasons, played important role for the formation of the ecology of the Mediterranean Sea area. Although the local fires are a part of the natural ecosystems dynamics, forest fires for example have negative social-economic impact and lead to some effects in the environment as loss of biological diversity, diminution of ecosystems capacity for natural recovery and increased risk of soil erosion (WWF, 2003). With the climate change, the fire danger is likely to increase in the time, due to the probable temperatures raisings and rainfall diminution, thus – longer summer draughts.

Often the reasons for the fires are result from the complex interaction of social-economic factors and the desire for fast change of the land designation. The changes in human activity and land use practices could create not only fire conditions, but can change the composition and the configuration of land coverage as an element of the landscape. For example the increase of the forest coverage in the Northern part of the Mediterranean sea is due to the abandonment of traditional agricultural practices in Spain, Italy and Greece, which leads to loss of open areas of arable land and this way, the created landscape is dominated by bushes and forests (Mazzoleni и др., 2004). This way there is a lack of natural barricade for the fire and the risk of fire spreading on big areas is considerable.

Having in view the degree of these fires and the destruction, caused by them, the landscape improvement related to the fire resistance, is of wide public interest. Actually no one could be excluded from the advantages of fire avoidance, because almost all interested would be influenced by such phenomenon. Because of the fact that fires usually affect definite areas, the fire resistance shows characteristics of regional or local public good. The maintenance of convenient agricultural forms in these regions contributes to improvement of the environment fire resistance and to generate a set of supplementary profits, as keeping of open landscape and biodiversity (Moreno et al., 1998).

1.9. Viability of rural areas

Similar to the landscape, “rural areas’ viability” is a complex concept – including social, cultural and economic assessments, but often the social viability of rural population is examined as a core of this public good. This is due to the necessity of critic social masse to maintain the services and the infrastructure and also the conservation of local traditions and culture of population in rural areas.

Rural areas viability depends strongly on agriculture, but this relation weakens because the sector contribution for the economy of rural areas diminishes at the expense of other sectors. The relation of agriculture is the most significant in some regions of Spain, Italy, and Greece and in the new member-states, having more population in rural areas. In these countries the agriculture remains one of the main forms of permanent employment and has multiplication effect on the supply chain. Agriculture keeps its important social and cultural role; traditional foods and customs are related to agriculture. They are highly assessed both from the local people, because they support to keep the social capital and consolidate the “filling for a location” and from the society as a whole, due to the conservation of the relation with the pastoral past. In addition, the tourism and the relaxation depend in a big degree on the presence of cultural heritage and of the biodiversity in agricultural lands, which is a result from agricultural activity.

The viability maintenance in rural areas, through preservation of supporting agricultural practices and communities, is a big advantage for the society, keeping the agricultural traditions and cultures is a counterpoint of the urban life and helps the territorial balance encouragement. Its social and cultural components have the characteristics of the typical public good, because everyone could estimate the offered profits and the rivalry in consumption is barely expressed.

1.10. Food safety

"Consumption safety for the individual, the household, on a regional, national and global level, could be reached when all people have physical and economic access to sufficient as a quantity, safe and nutritive food to satisfy their food needs and preferences, to have an active and healthy way of life"(FAO, 1996). The access to safe and desired foods is an important public good. Though the markets are the best offer regulators, there are dangers, resulting from the economic expedience of management decisions and could lead to a deficit of foods necessary for the human wellbeing. Indeed, the primary problem is to eliminate the hunger and the malnutrition, i.e. food is insufficient as a quantity or to remove the consumption competitiveness. But the offer should also respond to consumers' expectations to eat non-harming for the health, natural foods, creating personal satisfaction after consumption. In the food security context, we should examine the functioning and the management of the supply chains. They must be realized in a way insuring for the population an access to traditional, local foods, which are a part of agricultural culture and conserving it in the time. Although, having in view the climatic changes, it is necessary to preview preventive actions for their mitigation and overcoming, so to avoid the risk for the agrosystems' production potential.

2. Research method

The necessary data is collected through the leading of focus groups with deep examination of the analyzed thematic scope, using the advantages of the group dynamics and impact. During the discussions, through detailed analysis of pre-defined circle of questions, have been formulated clear categories and definitions, which helped the better explication and understanding of the phenomena qualitative researches. Discussions were led by a moderator, posing the questions for discussion, controlling the equal participation of each person, accentuating new interesting directions, expressed by participants. The moderator has used the following projective techniques for the leading of discussions: Associative techniques and Technique of completion. The participants were 14 persons – farmers, representatives of agricultural associations, local public bodies and advisors. The participants were divided in two groups of 7 persons. Every group has received natural-geographic map of the region and list of 10 potential public goods. Each participant has had a task to identify the location of public goods in the region using 3 colors of adhesive stickers (red = available; white = neutral; blue = lack).

3. Results

Participants in the focus-group, through a discussion related to public goods in the South Central Region, Bulgaria have determined 10 (of 11 possible) public goods in the region (see Table 1). It has turned out that the region was characterized by a high degree of public goods availability, because all of them are present within its borders. The richness of public goods shows that the potential of the region for their creation has been used. Important contribution for this has the agriculture as an economic activity, as well as the forestry. The public goods distribution, in relation to their origin, is almost equal, as one of them has relation to both activities. Rural areas viability has a complex character and for its formation should be reported the influence of the entire economic environment, taking in consideration that agriculture and forestry are typically economic activities for the region, having leading significance. Apart the public goods it was determined the presence of one public problem – the air pollution with pollens (pollination). It is caused mainly by agriculture and forestry and has been interpreted in the framework of plants pollination. Despite the profit of the pollination for the plants, it has a private character and is necessary from the point of view of the society to search opportunities for the mitigation of the pollution with pollens in the region.

Table 1 List of public goods and bads provided by agriculture and forestry in the region

Public goods and bads	Agriculture	Forestry
Public Goods	Landscape	Air Quality
	Water availability	Water Quality
	Food Security	Climate change mitigation
	Rural vitality	Rural vitality
	Biodiversity	Resilience to Fire
	Soil functionality	
Public Bads	Pollination	Pollination

The state of public goods in the South Central Region has changed in the time. Improvement has been outlined for 3 public goods, for other 3 there is no change, for the rest 6 there is deterioration (see Table 2). The maintaining of agriculture in the region and the investments in the sector have been defined as important factors for the formation of attractive landscapes and the ensuring of food safety, where is result from the introduction of new crops and production enlargement. Important contribution for that has the Rural Development Policy (RDP), which stimulates as a whole the activity in agriculture and forestry. There is an improvement related to the pollution, resulting from the restriction of industrial productions and maintaining of forest resources, whilst more intensive agricultural works create conditions for environment pollution. All mentioned factors have impact for the deterioration of climatic changes mitigation, soil functionality, rural areas viability, biodiversity and fire sustainability.

Table 2 Trends of public goods development in the region

Public goods and bads	Increase	Stable	Under decline
Air Quality		X	
Water Quality		X	
Climate change mitigation			X
Soil functionality			X
Pollination	X		
Landscape	X		
Rural vitality			X
Biodiversity			X
Food Security	X		
Resilience to Fire			X
Water availability		X	

Public goods in the South Central Region have been ranked, according their significance degree. The participants in the focus group gave priority to four public goods, compared to the rest, grouped by their importance degree for the region and their availability determines the region appearance (see Table 3). Unfortunately the state of two of them – climatic changes mitigation and rural areas viability – has been deteriorated, which imposes the necessity of undertaking actions for their outlook improvement. The implementation of purposeful policy, related to agriculture, is one of the tools to use. Water and air quality are in stable condition, but for them are necessary a permanent monitoring and stimulation of preserving activities to improve their state and the region characteristics.

Table 3 Rank of public goods in the region

Public goods and bads	Rank
Climate change mitigation	4
Water Quality	4
Air Quality	4
Rural vitality	4
Soil functionality	2
Landscape	2
Biodiversity	2
Food Security	2
Pollination -	1
Water availability	1
Resilience to Fire	1

Public goods own inherent features, which give them different character depending on their use – only within the region limits (predominantly local goods) or they are used out the region limits (more global goods); in terms of the use from a group of persons for their own purposes (more private goods) or no one could have profit for for himself (more public goods). The bigger part of identified in the South Central region public goods have predominantly global character and at the same time they are predominantly public, which put them in the upper left corner of the matrix (see Fig. 1). This defines the region’s characteristics as important both in national and in local aspect. The region has potential to render positive impact on neighbouring regions and to realize synergic effects from their interaction.

<p><i>MORE GLOBAL / MORE PUBLIC</i></p> <p>Water Quality Water availability Climate change mitigation Air Quality Rural vitality Food Security</p>	<p><i>MORE GLOBAL / MORE PRIVATE</i></p> <p>Biodiversity</p>
<p><i>MORE LOCAL / MORE PUBLIC</i></p> <p>Landscape Resilience to Fire Pollination</p>	<p><i>MORE LOCAL / MORE PRIVATE</i></p> <p>Soil functionality</p>

Fig. 1 Distribution of public goods according to their features as local/global and private/public

The four most significant public goods form the hot points in the South Central region. Their location has been defined as concentrated within the Rhodope Mountain, which territory has a potential for various economic activities and famous by its cultural and historic heritage. Rhodope are the main supplier of public goods not only for the South Central Region, but for the entire South Bulgaria, which defines them as a place for purposeful support for the keeping and development of public goods. The region possess its own particularities (see Table 4), which should be taken in consideration at the elaboration and implementation of a targeted development support.

Table 4 Allocation of the most important public goods and their specifications

Public Good	Locations	Characteristics of this locations	Degree of availability (low, medium, high)	Factors influencing availability	Comments
Climate change mitigation	Rhodope mountain	Mountain relief, forestry area, lakes, low population density, agroecology area	Medium	Agroecological payments	
Air quality	Rhodope mountain	Mountain relief, forestry area, lakes, low population density, agroecology area	High	Low rate of intensification and industry development, low population density, preserved habitats	It correlates to the water quality
Water quality	Rhodope mountain	Mountain relief, forestry area, lakes, low population density, agroecology area	High	Low rate of intensification and industry development, preserved habitats, availability of artificial lakes	Richness of mineral springs, opportunity for water treatment
Rural vitality	Rhodope mountain	Mountain relief, forestry area, lakes, low population density, agroecology area	Low	Low rate of economic activities, urban migration, aging of population	Historical artefacts and local culture, opportunities for tourism

Conclusions

On the base of the achieved research the following main conclusions for the creation and development of public goods in South Central Region, Bulgaria. The region is rich of public goods and this way it has national importance. The agriculture and the forestry have a key role for public goods formation. The implementation of intensive production practices creates premises for negative trends for public goods development. The mountain agriculture has been identified as more attractive from the point of view of the potential consumer. The potential of available public goods has not been used in a sufficient degree to guaranty the rural areas viability in the Rhodope Mountain and to stimulate their development.

Within the led discussion it has been established that the conception for the public goods is not popular among Bulgarian society. That's why it is necessary to elaborate a strategy for promotion of public goods advantages and in the same time, to implement a policy for preservation and development of public goods. Thus, beneficial effect can have not only the Rural Development Policy but other EU sector policies. It is obvious that the national and local contributions should not be ignored in order to have higher degree of empathy and interest for the development of public goods in the region.

Acknowledgement

The research reported in this paper was funded by the European Commission within the project "PROVIDing smart DELivery of public goods by EU agriculture and forestry" Grant Agreement Number 633838" (PROVIDE), HORIZON 2020 Programme, (<http://www.provide-project.eu/>).

References

1. Beaufoy, G., Baldock, D. and Clark, J. (1994) *The nature of farming – Low intensity farming systems in nine European countries*, Institute of European Environmental Policy with support from WWF and the JNCC: London.
2. Defra (2008) *Analysis of historical data sets to look for impacts of land use and management change on flood generation*, FD2120, Department for Environment, Food and Rural Affairs: London.
3. European Landscape Convention (2008) *The European landscape convention: Information Resource*, [Online], Available at: <http://www.landscapecharacter.org.uk/files/pdfs/ELC-LCN.pdf>
4. Evans, E., Ashley, R., Hall, J., Penning-Rowsell, E., Saul, A., Sayers, P., Thorne, C. and Watkinson, A. (2004) *Foresight future flooding: Scientific summary, volume I future risks and their drivers*, Office of Science and Technology: London.
5. FAO (Food and Agriculture Organisation) (1996) Rome declaration on world food security and world food summit plan of action, *Conference Paper*, World Food Summit, Rome, Italy.
6. Fisher, B. and Turner, R.K. (2008) Ecosystem services: Classification for valuation, *Biological Conservation*, vol. 141 pp. 1167-1169.
7. Freibauer, A., Rounsevell, M., Smith, P. and Verhagen, A. (2004) Carbon sequestration in the agricultural soils of Europe, *Geoderma*, vol. 122 pp. 1-23.
8. Grime, J.P. (1973) Competitive exclusion in herbaceous vegetation, *Nature*, vol. 242 pp. 344-347.
9. Havlik, P., Veysset, P., Boisson, J. M., Lherm, M. and Jacquet, F. (2005) Joint analysis under uncertainty and multifunctionality of agriculture: Policy considerations and applied analysis, *European Review of Agricultural Economics*, vol. 32 no. 4 pp. 489-515.

10. Hodge, I. (2008) To what extent are environmental externalities a joint product of agriculture? Overview and policy implications, in: *Multifunctionality in agriculture: evaluating the degree of jointness, policy implications*, OECD Publications: Paris.
11. IPCC (2002) *Climate change and biodiversity: Technical Paper V*, Intergovernmental Panel on Climate Change, [Online], Available at: <http://www.ipcc.ch/pdf/technical-papers/climate-changes-biodiversity-en.pdf>
12. JRC (2009a) *Final report on the project 'sustainable agriculture and soil conservation (SoCo)'*, European Commission Joint Research Centre: Brussels www.ec.europa.eu/dgs/jrc/downloads/jrc_biofuels_report.pdf
13. Kleijn, D., Kohler, F., Báldi, A., Batáry, P., Concepción, E.D., Clough, Y., Díaz, M., Gabriel, D., Holzschuh, A., Knop, E., Kovács, A., Marshall, E.J.P., Tschamntke, T. and Verhulst, J. (2008) On the relationship between farmland biodiversity and land-use intensity in Europe, *Proceedings of the Rural Society B*, vo. 276 no. 1658 pp. 903-90.
14. LUC (Land Use Consultants) (2009) *Adapting agricultural policy to increased flood risk*, Land Use Policy Group: UK.
15. LUPG (Land Use Policy Group) (2004) *The integration of agricultural, forestry and biodiversity conservation policies with flood management in England and Wales*. Royal Haskoning: Peterborough.
16. Mazzoleni, S., di Pasquale, G., Mulligan, M., di Martino, R. and Rego, F.C. (eds.) (2004) *Recent dynamics of the Mediterranean vegetation and landscape*, John Wiley and Sons: Chichester.
17. Moreno, J. M., Vazquez, A. and Velez R. (1998) *Recent history of forest fires in Spain*, in: Moreno, J.M. (ed.) *Large forest fires*, Backhuys Publishers: Leiden.
18. Pain, D.J. and Pienkowski, M.W. (eds.) (1997) *Farming and birds in Europe*, Academic Press for RSPB: London.
19. Smith, P. (2005) An overview of the permanence of soil organic carbon stocks: influence of direct human-induced, indirect and natural effects, *European Journal of Soil Science*, vol. 56 pp. 673-680.
20. Swanwick, C., Hanley, N. and Termansen, M. (2007) *Scoping Study on Agricultural Landscape Valuation*, Department for Environment, Food and Rural Affairs: London.
21. Tucker, G.M. and Evans, M.I. (1997) *Habitats for birds in Europe: A conservation strategy for the wider environment*, BirdLife International: Brussels.
22. UNEP (2009) *The natural fix? The role of ecosystems in climate mitigation*, United Nations Environment Programme: Nairobi.
23. Wascher, D.M. (2004) Landscape Indicator Development: Steps towards a European approach, in: Jongman, R. (ed.) *The New Dimensions of the European Landscape: Frontis Series No. 4*, Kluwer Academic Publishers: Dordrecht.
24. Watson, R.T., Noble, I.R., Bolin, B., Ravindranth, N.H., Verardo, D.J. and Dokken, D.J. (eds.) (2000) *Land use, land use change and forestry*, Cambridge University Press: Cambridge.
25. WWF (2003) *Forest fires in the Mediterranean: a burning issue*, [Online], <http://www.envedu.gr/Documents/Forest%20fires%20in%20the%20Mediterranean.doc>