Bulletin UASVM Horticulture, 69(1)/2012
Print ISSN 1843-5254; Electronic ISSN 1843-5394

Agricultural Landscapes and Biodiversity Conservation in Italy

Carlo BLASI[1)], Raffaella FRONDONI[1)], Laura ZAVATTERO[1)]

[1)]Department of Environmental Biology, Sapienza University of Rome, P.le Aldo Moro 5, 00185 Rome, Italy; carlo.blasi@uniroma1.it.

Abstract. In the last decades, agricultural areas have been acknowledged as important areas for biodiversity conservation and provision of ecosystem services. Several international and national Conventions have promoted the development of multifunctional agriculture and the maintenance of traditional cultural landscapes. In this general context, this paper presents some relevant research experiences carried out in Italy at different spatial scales, from national to local (Province and Municipality of Rome). The results of these studies confirm that traditional agricultural areas support the conservation of habitats and species of national and European interest and represent important elements for environmental quality at the landscape scale. Moreover, they highlight the importance of taking into account the biophysical environment, together with historical and cultural features, for mapping and charactering traditional agricultural landscapes, as well as the need to focus on the dynamics of agricultural land, which is threatened by land cover change.

Keywords: biodiversity conservation, traditional agricultural landscapes, land ecological network, land cover change

INTRODUCTION

In the last decades, agricultural land triggered increasing interest and attention from landscape ecologists and conservation biologists, in parallel with the development of the concept of multifunctional agriculture and the alarm for the decline of traditional cultural landscapes (Billeter *et al*., 2008; Plieninger *et al*., 2006; Vos and Meekes, 1999). The idea that agriculture can produce several outputs in addition to food and fibre made agricultural land a valuable cover type in terms of socio-economic viability of rural areas, sustainable use of resources and environmental protection (de Groot *et al*., 2002; Renting *et al*., 2009; Scherr and McNeely, 2008). The Millennium Ecosystem Assessment has acknowledged the critical importance of agricultural landscapes in providing products for human sustenance, in supporting wild species biodiversity and in maintaining ecosystem services such as climate control, erosion control, control of invasive alien species, water retention, and soil fertility (MA, 2005). Likewise, recent proposals for the Common Agricultural Policy (CAP) introduced four new environmental challenges to be pursued through policies of rural development, namely climate change, promotion of renewable energies, water management and conservation of biodiversity (MIPAF, 2010).

In this context, traditional landscapes have emerged as particularly important areas. These systems result from the long lasting interaction between humans and their environment and are usually associated with the use of low-impact agricultural practices, significant habitat diversity, and presence of seminatural vegetation (Antrop, 1997; Harrop, 2007). All these characteristics have a positive influence on the preservation of soil resources and autochthonous species, on species richness and abundance, and on the occurrence of species and habitats of particular conservation interest (Bennett *et al*., 2006; Fahrig *et al*., 2011; Tscharntke *et al*., 2005).

Agricultural land is still the most common land use type in the European Union (http://epp.eurostat.ec.europa.eu), but traditional landscapes are seriously threatened by land cover change. Intensive agriculture is leading to increasing landscape homogenisation, whilst urbanisation and land abandonment have caused an overall loss of agricultural areas since the Second World War (Antrop, 2004; Jongman, 2002; Zomeni *et al*., 2008). As a consequence, the natural value of traditional cultural landscapes and the need for their sustainable management have been taken into account in policies at regional, national and European levels (Rural Development Programmes, National Biodiversity Strategy of Italy, National Plan for Agricultural Biodiversity of Italy, European Common Agricultural Policy), and in international conventions and strategies (European Landscape Convention, Convention on Biological Diversity, Pan-European Biological and Landscape Diversity Strategy, Global Strategy for Plant Conservation –Target 6). All these conventions emphasise the protection of human practices that contribute to the creation and maintenance of biological diversity in terms of species, communities and landscape.

Within this general background, this paper presents the outputs of some research projects carried out in Italy, which have highlighted the positive role of agricultural land for biodiversity conservation and sustainable management at different spatial scales, from national to local.

RESEARCH EXPERIENCES AT THE NATIONAL SCALE

Italy is one of the richest countries in Europe in terms of biodiversity, because of its geographic position and of the high heterogeneity of physical attributes, vegetation cover, and historical and cultural features (Blasi *et al*., 2005).

The macro classification of Italian landscapes by Barbati *et al.* (2004) shows that landscapes with agricultural matrix cover 55% of the national territory, and landscapes with natural matrix of forests and semi natural habitats cover 40%. However, based on measures of matrix porosity (which refers to patch density in a landscape), the agricultural matrix is semi-continuous and rich in natural patches in 16% of agricultural landscapes, whereas 10% of natural landscapes are rich in agricultural patches. Moreover, 3% of the national territory is covered by true agro-natural landscapes with mixed matrix, which are located in the transition zone between lowlands and hills (dominated by agriculture) and mountains (dominated by natural and semi natural vegetation), where no sharp variations in altitude and/or landform occur. These results indicate a close relationship between agriculture and nature and provide a spatially-explicit reference for highlighting heterogeneous areas that could have high richness in biodiversity and particular interest for landscape dynamics.

Traditional agricultural areas in Italy sustain valuable semi-natural grasslands that are maintained by grazing and hay-making and are enclosed in the list of the Habitats Directive 92/43/EEC (Biondi *et al.*, 2009). Four are priority habitats and four are habitats of Community interest (Tab. 1). Moreover, agricultural areas are relevant for the conservation of vascular plants: the "Important Plant Areas of Italy" project (Blasi *et al*., 2009; Blasi *et al.,* 2011) shows that about 40% of the 1393 species of conservation interest fall within agricultural land. Their importance is probably even underestimated, due to the lack of botanical studies in agricultural areas.

A promising tool for ecological studies on cultural landscapes at the national scale is the Map of Vegetation Series of Italy, which was realised by a large team of regional experts from several Universities (Blasi ed, 2010; Blasi and Frondoni, 2011). The map delimits land units that are relatively homogenous in terms of physical features and vegetation potential, and that correspond to specific land capability and vocation. Therefore, it represents the best

reference spatial framework for evaluating consistency of agricultural use with the biophysical environment, and for assessing the role of agricultural cover types for environmental quality at the landscape scale.

Tab. 1

Approximate total cover (in hectares) of semi natural grasslands of priority (*) or Community interest that fall within the Sites of Community Importance (SCI) of Italy (source: Database Natura2000, Italian Ministry of the Environment, http://www.minambiente.it)

Habitat type	**Total hectares**
6210*Semi-natural dry grasslands and scrubland facies on calcareous substrates of the *Festuco-Brometea*,* important orchid sites	253233,31
6220*Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*	187790,95
6230*Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas	45656,95
6240*Sub-pannonic steppic grasslands	1024,51
62A0 Eastern sub-mediterranean dry grasslands of the *Scorzoneretalia villosae*	8241,95
6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils	7552,22
6510 Lowland hay meadows with *Alopecurus pratensis* and *Sanguisorba officinalis*	28238,23
6520 Mountain hay meadows	17145,72

RESEARCH EXPERIENCES AT THE LOCAL SCALE

Province of Rome

The Province of Rome is located in central Italy (Fig. 1) and occupies 5352 km², with a population density of 747 people/square km (about 4 million people). More than 50% of the total area is covered by agricultural land, the majority of which is non-irrigated arable land. Artificial areas (which include the city of Rome and its hinterland) cover 14% of the overall area, whereas natural and semi-natural areas cover 34%.

The application of an ecoregional process based on relative homogeneity of biophysical features (climate, lithology, landform) and of cultural and socio-economic characteristics (land cover/land use patterns, historical geography) helped to map and define different landscape units and in particular to highlight the agricultural landscapes that are consistent with specific vegetation potential and with the underlying physical features (Blasi *et al*., 2010*a*, 2010*b*). These areas can be considered as traditional cultural landscapes, and are indeed characterised by specific crops and fruit trees and by definite types of potential natural vegetation (Fig. 2).

Studies aimed at designing the land ecological network of the Province (Blasi *et al.*, 2008*b*, 2010*b*) considered agricultural areas as valuable elements for functional connectivity, diffuse naturalness and good state of landscape conservation when agricultural use was traditional and therefore consistent with the natural setting. In these cases agricultural areas have been included among the primary and secondary connections in the network (Tab. 2). The assumption on the value of these areas for environmental quality and biodiversity conservation was confirmed by the fact that 258 out of 639 species of priority conservation interest (which include vascular plants, mammals, amphibians, reptiles and birds) are recorded in agricultural areas.

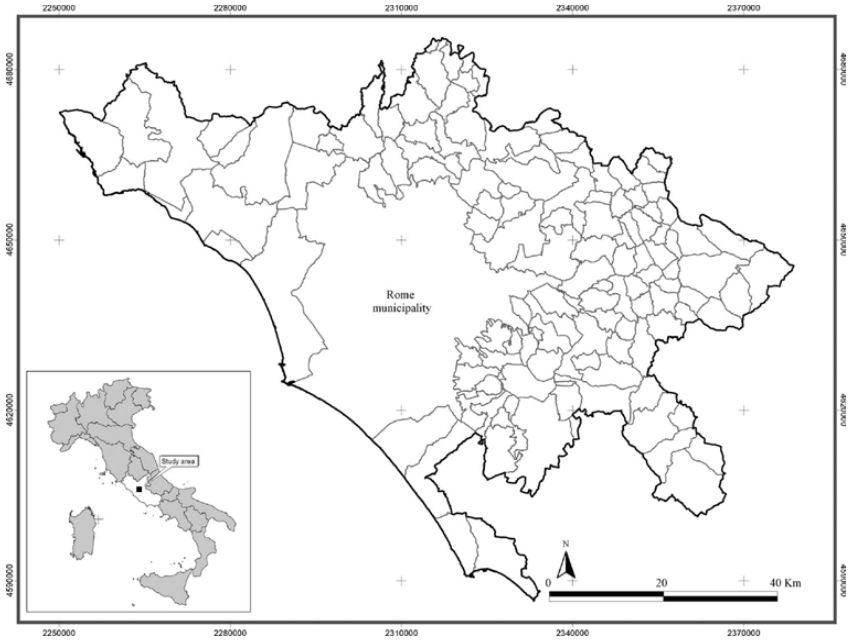

Fig. 1. Location of the Province of Rome, which encloses the Municipality of Rome.

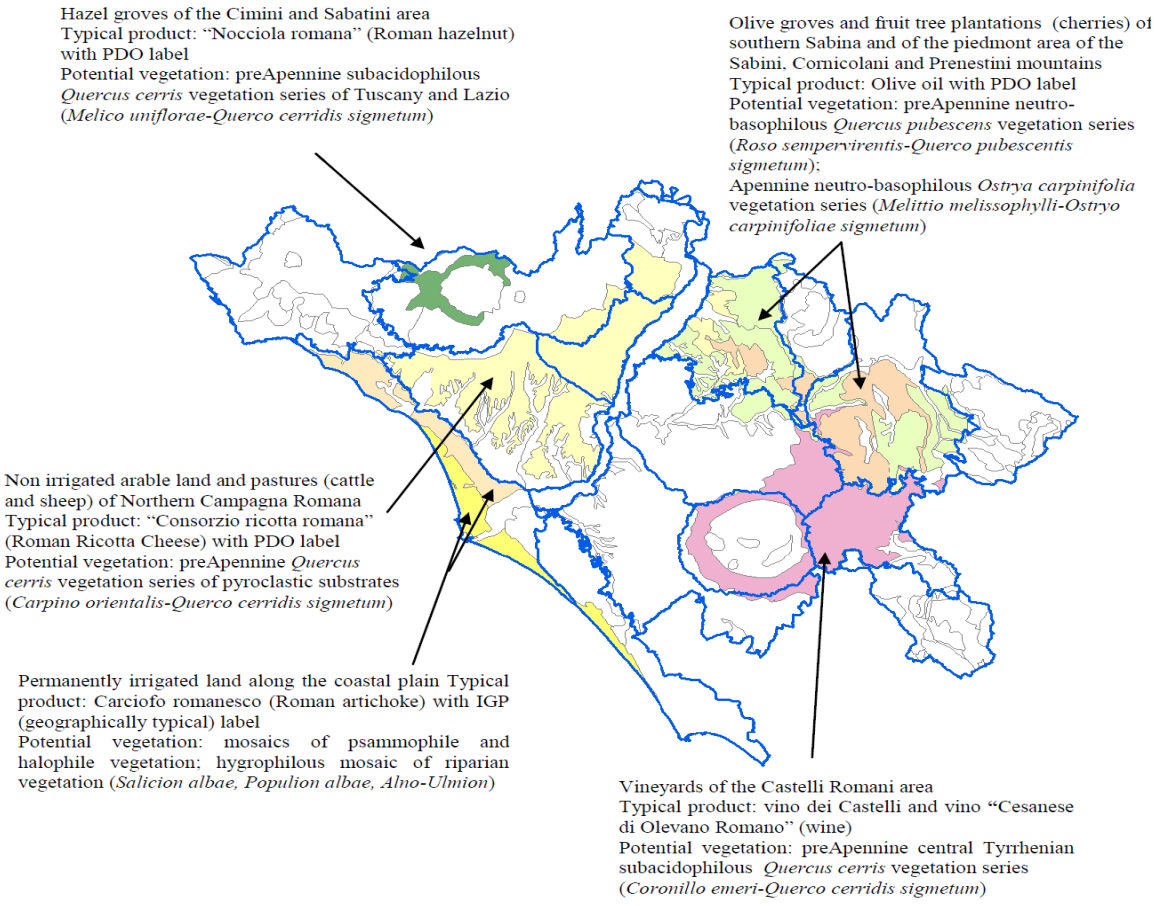

Fig. 2 Relationship between distribution area of vegetation series and certified typical agricultural products within the landscape units of the Province of Rome. Blue lines indicate the limits of landscape units. Grey lines shoe the distribution pattern of all vegetation series occurring in the Province, whereas colour patches represent the vegetation series that relate to typical crops and products within specific units.

Tab. 2

Land cover composition (percentage) of the elements of the Land Ecological Network (LEN), overall area (hectares) and percentage relative to the total LEN

	Node		**Landscape connections**	
Land cover %	Core Areas	Buffer zones	in natural and seminatural landscapes	in agricultural landscapes
Artificial surfaces	3,8	4	13,4	12,1
Agricultural areas	**13,7**	**31,9**	**51,6**	**84,9**
Forest and semi-natural areas	64,5	63,9	34,3	3,0
Wetlands	0,5	0,1	0,2	0
Water bodies	17,5	0,1	0,5	0
Area (in ha)	44,6	147,0	145,7	68,9
% LEN	11	36	36	17

Municipality of Rome

The Municipality of Rome, which covers an area of 1286 square kilometres, is the largest agricultural Municipality in Italy and one of the widest in Europe (ISTAT, 2009). It hosts a specific ensemble of natural, agricultural, and cultural features of international importance as well as considerable biological diversity, which includes 60 plant community types and 5 priority habitats under the EU Habitats Directive (Blasi *et al*., 2008*a*).

Recent analysis of land cover change from 1954 to 2001 (Frondoni *et al*., 2011) showed that urbanisation has been by far the most important change process and caused important reduction in the extent of agricultural land (the most available and suitable cover type for building) as well as increasing fragmentation (Fig. 3). Urban sprawl has been particularly attracted by the occurrence of roads and by pre-existing heterogeneous agricultural areas, which represent mosaics of cultivations, scattered houses, and areas of natural vegetation. Heterogeneous agricultural areas overall lost 56% of their initial extent, most to urban areas. This marked decline represent a relevant loss in ecological terms as they contribute to the distinctive character of the "Campagna Romana" landscape and could provide stepping stones and corridors for species movement.

Despite the strong urbanisation process, agricultural land continued to dominate land composition in 2001 and showed a high persistence, especially arable land and pastures (65% of their 1954 extent underwent no subsequent change). The maintenance and relatively low dynamics of agricultural land are mainly due to a waiting strategy for land sale (owners prefer to expect plans and policies that allow building on agricultural land) and to the occurrence of large traditional, sometimes historical, farms.

Since agricultural land is principally used for extensive cultivation and grazing, its dominance in extent helps preserve soil resources and recovery potential of vegetation and thus can be considered positive in ecological terms. Local policies should carefully take into account the threat of reduction and fragmentation of the suburban agricultural matrix, and enhance the role of agricultural land for biodiversity conservation, in line with the regional Rural Development Programme.

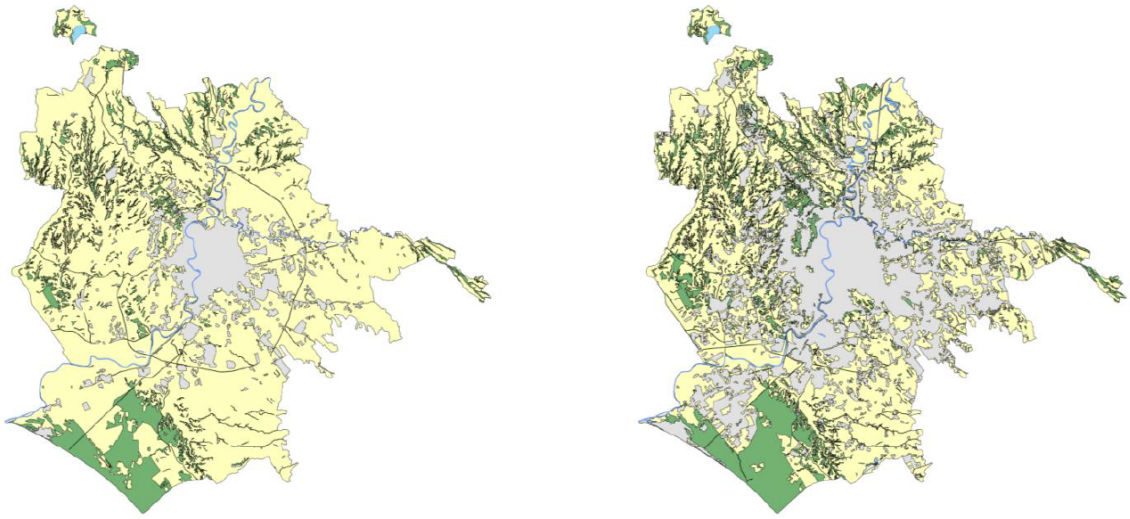

Fig. 3. Land cover map of the Municipality of Rome, in 1954 (left) and 2001 (right). Agricultural areas are shown in yellow. Grey means artificial surfaces, green indicates natural and semi-natural vegetation. Land cover classification refers to Level 1 of the CORINE Land Cover legend.

CONCLUSIONS

The landscape perspective, with its focus on ecological function and connectivity, and the ecosystem approach promoted by the Millennium Ecosystem Assessment and by the latest CAP all consider traditional agricultural use as a positive element for biodiversity conservation and maintenance of ecosystem services. This is owed to the fact that traditional agricultural landscapes are strictly connected to potential environmental heterogeneity, that is to spatial heterogeneity created by natural biophysical characteristics. This close relationships ensures stability over time and appraisal of historical and cultural aspects.

With this awareness in mind, the Italian Society of Vegetation Science (SISV) and the Department of Environmental Biology of Sapienza University of Rome are working together on a project on the rural landscapes of Italy, which aims to highlight the coevolution among nature and traditional agriculture through the classification of landscape units with specific ecological, vegetation and functional potential at the national scale.

REFERENCES

1. Antrop, M. (1997). The concept of traditional landscapes as a base for landscape evaluation and planning. The example of Flanders Region. Landscape Urban Plan. 38:105-117.
2. Antrop, M. (2004). Landscape change and the urbanization process in Europe. Landscape Urban Plan. 67:9-26.
3. Barbati, A., C. Blasi, P. Corona, D. Travaglini and G. Chirici (2004). Applicazione della cartografia land cover per la macrocaratterizzazione dei paesaggi italiani. Atti della 8ª Conferenza Nazionale Asita (Roma, 14-17 dicembre) : 265-270.
4. Bennett, A.F., J.Q. Radford and A. Halsem (2006). Properties of land mosaics: implications for nature conservation in agricultural environments. Biol. Conserv. 133:250-264.
5. Billeter, R., J. Liira, D. Bailey, R. Bugter, P. Arens, I. Augenstein, S. Aviron, J. Baudry, R. Bukacek, F. Burel. et al. (2008). Indicators for biodiversity in agricultural landscapes: a pan-European study. Journal of Applied Ecology 45:141-150.

6. Biondi, E. C. Blasi, S. Burrascano, S. Casavecchia, R. Copiz, E. Del Vico, D. Galdenzi, D. Gigante, C. Lasen, V. Spampinato, R. Venanzoni and L. Zivkovic (2009). Italian Interpretation Manual of the Habitats (92/43/EEC Directive). Available on-line at http://vnr.unipg.it:8080/habitat/index.jsp).

7. Blasi, C. (2010). La Vegetazione d'Italia con Carta delle Serie di Vegetazione in scala 1:500.000. Palombi &Partner S.r.L., Roma.

8. Blasi, C., R. Copiz, E. del Vico, S. Ercole, E. Lattanzi, M. Marchese, M. Marignani L. Michetti, Barbara Mollo, L. Rosati, D. Smiraglia, A. Tilia and L. Zavattero (2010b). Il sistema ambientale: ecologia del paesaggio e rete ecologica. Chapter 4. In: Nucci, C. (Ed.). Piano Territoriale Provinciale Generale_ PTGP. Provincia di Roma.

9. Blasi, C., L. Boitani, S. La Posta, F. Manes and M. Marchetti (Eds.) (2005). Biodiversity in Italy. Contribution to the National Biodiversity Strategy. Palombi Editori, Rome.

10. Blasi, C., G. Capotorti, R. Copiz, R. Frondoni, D. Guida, B. Mollo, D. Smiraglia and L. Zavattero (2010a). The ecoregional approach for landscape classification: an Italian example. Living Landscape, The European Landscape Convention in research perspective (Florence, 18-19 October 2010), Conference Materials, Volume I:178-193.

11. Blasi, C., G. Capotorti, M. Marchese, M. Marta, M.A. Bologna, P. Bombi *et al.* (2008a). Interdisciplinary research for the proposal of the Urban Biosphere Reserve of Rome Municipality. Plant Biosyst. 142:305-312.

12. Blasi, C. and R. Frondoni (2011). Modern perspectives for plant sociology: the case of ecological land classification and the ecoregions of Italy. Plant Biosyst. 145(suppl):30-37.

13. Blasi, C., M. Marignani, R. Copiz, M. Fipaldini, S. Bonacquisti, E. Del Vico, L. Rosati and L. Zavattero (2009). Map of the Important Plant Area (IPAs) in Italy. CD-Rom In: Blasi, C., M. Marignani, R. Copiz and M. Fipaldini (Eds.). Mapping the Important Plant Area in Italy. Ministry of Environment, Land and Sea Protection. Palombi & Partner S.r.l., Roma.

14. Blasi, C., M. Marignani, R. Copiz, M. Fipaldini, S. Bonacquisti, E. Del Vico, L. Rosati and L. Zavattero (2011). Important Plant Areas in Italy: From data to mapping. Biol. Conserv. 144 (1):220-226.

15. Blasi, C., L. Zavattero, M. Marignani, D. Smiraglia, R. Copiz, L. Rosati and E. Del Vico (2008). The concept of land ecological network and its design using a land unit approach. Plant Biosyst. 142 (3):540-549.

16. De Groot, R.S., M.A.Wilson and R.M.J. Boumans (2002). A typology for the classification, description and valuation of ecosystems functions, goods and services. Ecological Economics 41:393-408.

17. Fahrig, L., J. Baudry, L. Brotons, F.G. Burel, T.O. Crist, R.J. Fuller, C. Sirami, G.M. Siriwardena and J.L. Martin (2011). Functional landscape heterogeneity and animal biodiversity in agricultural landscapes. Ecol. Lett. 14:101-112.

18. Frondoni, R., B. Mollo and G. Capotorti (2011). A landscape analysis of land cover change in the Municipality of Rome (Italy): spatio-temporal characteristics and ecological implications of land cover transitions from 1954 to 2001. Landscape Urban Plan. 100:117-128.

19. Harrop, S. R. (2007). Traditional agricultural landscapes as protected areas in international law and policy. Agr. Ecosyst. Environ. 121:296-307.

20. Jongman, R.H.G. (2002). Homogenisation and fragmentation of the European landscape: ecological consequences and solutions. Landscape Urban Plan. 5:211-221.

21. ISTAT (2009). Tabella generale "Territorio e Superficie" in Data Warehouse 5° Censimento dell'agricoltura, 2000. http://www.istat.it/censimenti/agricoltura/

22. MA_ Millenium Ecosystem Assessment (2005). Ecosystems and Human Well-Being: Current State and Trends. Island Press, Washington DC.

23. MIPAF (2010). Quale futuro per le politiche di sviluppo rurale dopo il 2013? Position Paper, Roma. Italian Ministry of Agriculture and Forest.

24. Plieninger, T., F. Hochtl and T. Spek (2006). Traditional land-use and nature conservation in European rural landscapes. Environ. Sci. Policy 9:317-321.

25. Renting, H., W.A.H. Rossing, J.C.J. Groot, J.D. Van der Ploeg, C. Laurent, D. Perraud, D.J. Stobbelaar and M.K. Van Ittersum (2009). Exploring multifunctional agriculture. A review of

conceptual approaches and prospects for an integrative transitional framework. J. Environ. Manage. 90:112–123.

26. Scherr, S.J. and J.A. McNeely (2008). Biodiversity conservation and agricultural sustainability: towards a new paradigm of "ecoagriculture" landscapes. Phil. Trans. R. Soc. B 363:477-494.

27. Tscharntke, T., A.M. Klein, A. Kruess, I. Steffan-Dewenter and C. Thies (2005). Landscape perspectives on agricultural intensification and biodiversity-ecosystem service management. Ecol. Lett. 8:857-874.

28. Vos, W. and H. Meekes (1999). Trends in European cultural landscape development: perspectives for a sustainable future. Landscape Urban Plan. 46:3-14.

29. Zomeni, M., J. Tzanopoulos and J.D. Pantis (2008). Historical analysis of landscape change using remote sensing techniques: An explanatory tool for agricultural transformation in Greek rural areas. Landscape Urban Plan. 86:38-46.