



Review

Mapping and monitoring High Nature Value farmlands: Challenges in European landscapes



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ABSTRACT

The importance of low intensity farming for the conservation of biodiversity throughout Europe was acknowledged early in the 1990s when the concept of 'High Nature Value farmlands' (HNVf) was devised. HNVf has subsequently been given high priority within the EU Rural Development Programme. This puts a requirement on each EU Member State not only to identify the extent and condition of HNVf within their borders but also to track trends in HNVf over time. However, the diversity of rural landscapes across the EU, the scarcity of (adequate) datasets on biodiversity, land cover and land use, and the lack of a common methodology for HNVf mapping currently represent obstacles to the implementation of the HNVf concept across Europe. This manuscript provides an overview of the characteristics of HNVf across Europe together with a description of the development of the HNVf concept. Current methodological approaches for the identification and mapping of HNVf across EU-27 and Switzerland are then reviewed, the main limitations of these approaches highlighted and recommendations made as to how the identification, mapping and reporting of HNVf state and trends across Europe can potentially be improved and harmonised. In particular, we propose a new framework that is built on the need for strategic HNVf monitoring based on a hierarchical, bottom-up structure of assessment units, coincident with the EU levels of political decision and devised indicators, and which is linked strongly to a collaborative European network that can provide the integration and exchange of data from different sources and scales under common standards. Such an approach is essential if the scale of the issues facing HNVf landscapes are to be identified and monitored properly at the European level. This would then allow relevant agri-environmental measures to be developed, implemented and evaluated at the scale(s) required to maintain the habitats and species of high nature conservation value that are intimately associated with those landscapes.

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1. Introduction

Agriculture is a dominant form of land management, accounting for almost 40% of the world's terrestrial surface (Balmford et al., 2005; Donald and Evans, 2006; Dudley et al., 2005; Gordon et al.,

2010; Millennium Ecosystem Assessment, 2005; Power, 2010). Over the second half of the 20th century, regular food shortages in many parts of the world and rapid population growth, underpinned a worldwide expansion of agricultural production (Benton et al., 2003; Signal and McCracken, 2000; Evenson and Gollin, 2003; FAO, 2011; Firbank, 2005; Gordon et al., 2010; Tilman et al., 2002), but often at high costs for biodiversity (Aavik and Liira, 2009; FAO, 2011; Stoate et al., 2009; Tilman et al., 2001). Agriculture is a major driver of contemporary global environmental change and of unprecedented rate of biodiversity loss (Amano et al., 2011; Foley et al., 2005; Plöner and Bieling, 2013; Tilman et al., 2001; Wade et al., 2008). In recent years, broad-scale polarisation

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has been observed in agricultural landscapes, with increasing intensification of already intensively managed land being accompanied by the abandonment of less productive, more extensively managed land (Bignal and McCracken, 1996, 2000; Bratli et al., 2006; Caraveli, 2000; Dietschi et al., 2007). Intensification of agricultural practices has involved a marked increase in the use of external inputs (e.g. agrochemicals) and resulted in a massive homogenization of agricultural landscapes and loss and fragmentation of natural and semi-natural habitats (Bratli et al., 2006; Halada et al., 2011; Jongman, 2002). A similar decrease in habitat diversity and simplification of landscape mosaics through spontaneous forest encroachment has also been described as a consequence of abandonment of less productive or remote agricultural landscapes (Lomba et al., 2012; Pedrolí et al., 2007; Plieninger and Bieling, 2013; Plieninger et al., 2006). The impacts on biodiversity of such changes to agricultural practices and related patterns of landscape heterogeneity have been widely described, and the role of low-intensity agriculture for agro-biodiversity conservation acknowledged (Aavik and Liira, 2009; Albrecht et al., 2007; Altieri, 1999; Amano et al., 2011; Bartel, 2009; Bignal and McCracken, 2000).

Agriculture is also the dominant land-use in Europe (EEA, 2006; Halada et al., 2011; Henle et al., 2008; Stoate et al., 2009) and it has been estimated that 50% of all species in Europe depend on agricultural habitats (Benton et al., 2003; EEA, 2009; Halada et al., 2011; Kristensen, 2003; Stoate et al., 2009; Tscharrntke et al., 2005). Over past centuries, traditional agricultural systems shaped European landscapes, enhancing environmental conditions to the benefit of a wide range of wild species and habitat types, many of which are of particular nature conservation concern, e.g. listed as of conservation priority in the European Union (EU) Species and Habitats Directives (EEA, 2004, 2009a; European Commission, 2011; Halada et al., 2011; IEEP, 2007a; Plieninger and Bieling, 2013). Such inherently biodiversity-rich farming systems, including livestock, arable, permanent crop or mixed farming systems, usually rely on traditional low intensity practices (Andersen et al., 2003; Beaufoy et al., 1994; EEA, 2004; Pedrolí et al., 2007; Van Doorn and Elbersen, 2012). Characterised by low livestock grazing densities, the use of fallow between arable crops and low inputs per unit of area of nutrients, agrochemicals and irrigation in arable and permanent crop systems (Beaufoy et al., 1994; Van Doorn and Elbersen, 2012), such farming systems are referred to as 'High Nature Value farmlands' (hereafter HNVf), since they contribute to maintain natural habitats and viable populations of wild species of highest conservation value (Beaufoy et al., 1994; Bignal and McCracken, 1996, 2000; Henle et al., 2008; Plieninger and Bieling, 2013).

As recent losses for ecological value in many European rural landscapes have been attributed to changing agricultural practices, nature conservation and rural development priorities have progressively converged within EU agricultural and environmental policies, thus contributing to an increased efficiency and progress towards conservation goals and targets (Jongman, 2013). In particular, there is a growing interest in maintaining traditional, extensive practices and preserving (semi-)natural habitats and other structural/functional features of rural landscapes (Bartel, 2009; Doxa et al., 2012; EEA, 2004, 2009a; EENRD, 2009; Stoate et al., 2009). To achieve such policy challenge, improved knowledge of ongoing changes in the extent, distribution and condition of HNV farmlands is essential (EEA, 2012). Even if HNVf overlap, to a large extent, with traditional agricultural landscapes, as they both often rely on low input farming systems, a spatial and typological quantification of such overlap still remains a challenge. Further, no comprehensive data exists regarding European traditional landscapes and the currently available descriptions of farming systems maintaining HNV farmlands lack the required detail or such detail

is only locally available (EEA, 2004, 2012; IEEP, 2007b; Paracchini et al., 2008).

This manuscript provides an overview of the characteristics of farmlands with high value for nature conservation across Europe, together with an indication of their importance to the conservation of biodiversity across the EU and the rationale for the development of the HNVf concept. Current mainstream methodological approaches for the identification and mapping of HNVf across EU-27 and Switzerland are reviewed, the main limitations of these approaches highlighted and recommendations made as to how the identification, mapping and reporting on HNVf extent, state and trends across Europe can potentially be improved and harmonised under these constraints.

2. Defining farmlands with high value for conservation

2.1. High Nature Value farmlands and support for biodiversity

The importance of low intensity farming for the conservation of wildlife and biodiversity in general throughout Europe was acknowledged early in the 1990s when the concept of 'High Nature Value farmlands' was devised (Andersen et al., 2003; Baldock et al., 1993; Bartel, 2009; Beaufoy et al., 1994; Henle et al., 2008). HNV farmlands comprise 'areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports, or is associated with, either a high species and habitat diversity or the presence of species of European conservation concern, or both' (Andersen et al., 2003; Beaufoy et al., 1994; EEA, 2004; Pedrolí et al., 2007). HNV farmlands relate to low external input farming systems under traditional practices which support European habitats and species of high importance for nature conservation (Plieninger and Bieling, 2013). Overall, HNVf concept relies on the assumption that many of the European habitats and landscapes considered of high nature conservation value depend on the continuation of specific low-intensity farming systems (Doxa et al., 2012; Henle et al., 2008; Peppiette, 2011), as they were often found to be positively related to high levels of biodiversity (Andersen et al., 2003; Beaufoy et al., 1994; Bignal and McCracken, 1996; EEA, 2009; Pedrolí et al., 2007; Weissteiner et al., 2011). Even so, this concept does not imply a causal relation between farming practices and the existence of High Nature Value on farmlands (Andersen et al., 2003). In fact, high species and/or habitat diversity may exist alongside, or despite, current farming systems, although for most categories of HNVf there would have been a positive link at least historically (Andersen et al., 2003).

HNV farming areas still remaining in Europe are currently estimated as ca. 30% of the European Utilised Agricultural Area (UAA; EEA, 2004, 2009a; Van Doorn and Elbersen, 2012). The largest areas of traditional agricultural landscapes are found in eastern and southern Europe and contain habitat types such as semi-natural grasslands, *dehesas* and *montados* (the terms used for open, wooded pastures in Spain and Portugal, respectively), steppe grasslands, permanent crops (such as fruit and nut orchards and olive groves), and arable crops in dryland areas where naturally regeneration through one to three year fallow is used to help rebuild soil nutrients before the next non-irrigated crop is planted. HNVf are also relatively abundant in mountainous regions across Europe and contain upland grassland and heathland habitats in association with pastures, hay meadows and small areas of crops from which additional winter fodder for the livestock is produced (Andersen et al., 2003; Beaufoy et al., 1994; Calvo-Iglesias et al., 2009; EEA, 2004, 2012; IEEP, 2007b; Paracchini et al., 2008). Some of the most critical nature conservation issues in Europe relate to changes to traditional farming practices on these habitats. Many of these habitats can only be maintained by farming practices, since

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