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## Changing year-round habitat use of extensively grazing cattle, sheep and pigs in East-Central Europe between 1940 and 2014: Consequences for conservation and policy

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### ABSTRACT

Many habitats in Europe have been managed by grazing for thousands of years. However, extensive grazing systems are becoming increasingly rare in the region, and there is a lack of understanding of the functioning of these systems.

We carried out 147 structured interviews in 38 landscapes throughout the Carpathian Basin, with 3–5 informants/landscape. The number of actively grazing cattle, sheep and pigs, their year-round habitat use and the proportion of herds actively tended were documented for four characteristic historical periods (before, during and after socialist cooperatives and after EU Accession).

The numbers of grazing cattle and sheep had decreased substantially by 2010 (by 71% and 49%, respectively), while pig grazing almost disappeared by the 1970s. Cattle primarily grazed habitats with taller vegetation. Sheep grazed dry pastures and stubbles, while pigs were driven into marshes and forests. In general, the importance of dry and wet grasslands increased, while the significance of marshes, stubble fields, vegetation along linear elements, second growth on hay meadows, wood-pastures and forests decreased over time. Approximately half of the grazed habitats were not typical pasture grasslands, and functioned as supplementary pastures during droughts, autumn and winter. The number of habitat types grazed per month per site dropped, and herding decreased substantially, in particular in the case of cattle and pigs.

Contributing factors of the economic and social changes of the examined period included the collapse of the communist-era legal framework, the intensification of livestock husbandry, EU Common Agricultural Policy (CAP) regulations, and the rise of a nature conservation ethic.

We conclude that agricultural policies should take into account the full spectrum of habitat types necessary for the effective operation of extensive grazing systems. We argue that conservation-oriented extensive grazing should use the traditional wisdom of herders but adapted to the present situations.

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### 1. Introduction

Extensive grazing systems (also called large-scale grazing, Plachter and Hampicke, 2010) are predominantly based on natural and semi-natural habitat types and non-intensively managed

livestock breeds, kept usually at relatively low stocking densities. The system is often fine-tuned to local environmental and socio-economic conditions (Meuret and Provenza, 2014; Molnár, 2014; Reid et al., 2008). Extensive grazing systems have played and still play an important role in maintaining biological, and also cultural diversity (Halada et al., 2011; Oppermann, 2014; Plachter and Hampicke, 2010; Rodríguez-Ortega et al., 2014; Vera, 2000). Additionally, extensive grazing systems are important tools for

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resilient and sustainable agroecosystem management, and for ensuring food security. In addition, they contribute to the maintenance of several ecosystem services of biodiversity such as biomass production, control of pests and disease, and pollination (Baumgärtner, 2007; Bruun and Fritzboeger, 2002; Frison et al., 2011; Heikkinen et al., 2012; Poschlod et al., 2002; Rodríguez-Ortega et al., 2014). Extensive grazing is often beneficial for conservation purposes as well (Báldi et al., 2013; Plachter and Hampicke, 2010; Török et al., 2014; WallisDe Vries et al., 2004). A high number of high nature-value habitats require extensive or transhumant grazing management in Europe (Bunce et al., 2004; Halada et al., 2011; Hartel et al., 2013; Poschlod and WallisDe Vries, 2002; van Uytvanck and Verheyen, 2014; Vera, 2000).

In connection with the resilient maintenance of extensive land-use systems, several authors emphasize the importance of landscape scale and historical time scale (Agnoletti, 2014; Fischer et al., 2012; Loos et al., 2015; Plachter and Hampicke, 2010; Vera, 2000), as well as of traditional ecological knowledge (Agnoletti, 2014; Berkes et al., 2000; Cevalco et al., 2015; Molnár et al., 2008; Plieninger and Bieling, 2013).

Extensive grazing in Europe is decreasing in many places; the associated traditional ecological knowledge also is disappearing (Hernández-Morcillo et al., 2014; Oteros-Rozas et al., 2013; Varga and Molnár, 2014). The main role of traditional ecological knowledge in the case of extensive grazing is to optimise extensive exploitation of the biomass produced in the landscape. This is a kind of workmanship in landscape ecology (cf. Johnson and Hunn, 2010). It comprises knowledge of which biomass in the landscape is best for grazing, where, when, how and by which livestock (Molnár, 2012; Molnár et al., 2015; Vera et al., 2007). In landscapes where biomass production has a high inter- and intra-annual variability, e.g. steppe and alpine areas, extensive grazing systems must adapt to these heterogeneities (Gugič, 2009; Meuret and Provenza, 2014; Molnár, 2012; Plieninger et al., 2015). Beside typical pasture grassland habitat types (dry and wet grasslands, wood-pastures) a number of different other habitat types (such as stubble fields, second growth hay, marshlands, forests, and vegetation along linear elements) were and are still also taken advantage of (Barrantes et al., 2009; Vera, 2000).

Much agricultural, ecological and conservation biological work has focused on the role of grazing on dedicated pasture grasslands, but less research is available on grazing other habitats (e.g., marshes, forests, and stubbles) (but see e.g. Andresen et al., 1990; Middleton et al., 2006; Plachter and Hampicke, 2010; Poschlod et al., 2002; Roturier and Roué, 2009; Vera, 2000). Very little is known about the role of reserve pastures (e.g. grazing on arable lands) in extensive grazing systems based predominantly on (semi-)natural habitats (but see, e.g., Barrantes et al., 2009; Molnár et al., 2015; Toro-Mujica et al., 2015; Vera et al., 2007). Current European agricultural policy also exacerbates this divide by separating subsidies to grasslands, forests and croplands (Olmeda et al., 2014).

The continuously present herder managed herd behaviour and daily grazing circuits, often ensuring grazing optimised to the forage offered by the landscape (Meuret and Provenza, 2014; Molnár, 2014; Oteros-Rozas et al., 2013). However, as a result of the socio-economic changes of the past decades, the number of knowledgeable herders declined, throughout Europe and in the post-Soviet countries alike (Varga and Molnár, 2014). Though pastoral grazing declined, it is still a living practice in many marginal regions (Molnár, 2014; Roturier and Roué, 2009; Oteros-Rozas et al., 2013).

In most European countries a rich historical and ethnographic literature is available on extensive grazing systems (see e.g. Bellon, 1996; Gunda, 1940; Jacobeit, 1961; Wealleans, 2013). These, however, rarely document landscape ecological and habitat

aspects of extensive grazing systems (but see in Hungary, e.g., Andrásfalvy, 2007; Gunda, 1968; Tálasi, 1936). Missing landscape ecological research is sometimes impeded by the explicit partial or total prohibition of grazing on certain habitats by some national or European Community rules and legislation (for instance the forest law, occasionally EU CAP; Barrantes et al., 2009; Haraszthy, 2014; Varga and Molnár, 2014).

The main objective of this article is to document landscape ecological features of extensive grazing and their respective changes over the past few decades in the post-communist countries of the Carpathian Basin. The actual research questions were raised as follows:

1. How many total head of cattle, sheep or pigs were and are grazed extensively in the areas of the communities under investigation?
2. In which month on which habitat types did/does the livestock graze throughout the year and how has the importance and number of habitat types grazed varied over the past 60–70 years?
3. How has the use of non-typical pasture habitat types (e.g. stubbles, marshes, forests) varied across the year and over the past 60–70 years?
4. How was and is grazing accomplished (via herding or fencing)?

Research was carried out at 38 locations across the Carpathian Basin, studying four historical periods between 1940 and 2014.

## 2. Study area and methods

### 2.1. Study area

Changes in the grazing system were studied in 38 landscapes of the Carpathian Basin in Central Europe. Research was conducted in six post-communist countries, predominantly in Hungary, and in Croatia, Serbia, Romania, Ukraine and Slovakia (Fig. 1, for name, total area of municipalities and the cover and change of grasslands see Appendix 1).

The climate of the study areas is typically continental with Atlantic, sub-Mediterranean and, to a lesser extent, alpine influences. Annual average temperature varies around 11 °C; annual average precipitation ranges up to 500–1200 mm (Condé et al., 2002). Study sites were selected to represent the most typical vegetation zones and thus grazing systems in the Carpathian Basin (the zone of *Picea abies* forests in the higher mountains (800–1200 ma.s.l.), *Fagus sylvatica* and *Quercus petraea*, *Q. cerris* forest regions in the mountain and hill ranges (200–800 ma.s.l.), and loess, sand and salty forest steppe landscapes in the lowlands (50–200 ma.s.l.)).

Over the past several centuries, small-scale peasant and allodial land-use systems typically shaped wildlife and landscape in the Carpathian Basin. Extensive livestock management played a primary role in transforming the vegetation, for instance by creating wood-pastures and pastures in the place of former forests, changing the species composition of primary steppes, and developing hay meadows (Andrásfalvy, 2007; Babai and Molnár, 2014; Bellon, 1996; Varga et al., 2015).

Social and economic changes in the 20th century (for instance, socialist transformation of agriculture, post-communist transformations after 1989, and then the accession to the EU) brought about significant changes in the rules of grazing, number of grazing livestock and breed composition (Beaufoy and Marsden, 2010; Bodó, 2001). Correspondingly, the number of jobs in agriculture diminished gradually, and barely reaches 4.9% in Hungary at present (Hungarian Central Statistical Office, 2014).

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