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Botanical surveys as a base for the assessment of ecosystem services provided by semi-natural habitats in Hungary

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Abstract: Farming systems, particularly organic farming, are often depending on ecosystem services, such as pollination and biocontrol. These essential services are partly provided by semi-natural habitats. In order to explore their contribution to ecosystem services we investigated different types of semi-natural habitats in an agricultural landscape in Central-Hungary. Four types of semi-natural habitats were studied: woody areal, woody linear, herbaceous areal and herbaceous linear elements. The vegetation of these types was compared using different indicator values such as Simon's nature conservation categories of the Hungarian vascular plants, Borhidi's phytosociological classification of the Hungarian vascular plants and Borhidi's relative ecological indicator values. We found differences in the vegetation composition between the internal and external part of the elements. More weeds were recorded in the external plots, which may indicate the degradation of these habitats. The abundance of the flowering species was also higher in the external plots.

Key words: ecosystem services, semi-natural habitat, vegetation sampling

Introduction

Many former studies proved that the semi-natural habitats (SNHs) of the agricultural landscape provide ecosystem services (ESs) that are important for farming systems. These habitats provide more types of services at the same time (Millennium Ecosystem Assessment, 2005).

We consider SNHs (e.g. shelter forest belts, pastures, meadows) those habitats where anthropogenic impacts can be detected, but where species diversity and species interrelation complexity are still comparable with a natural habitat. Sustainable agricultural production relies on ESs provided by natural and semi-natural habitats. The ESs and the biodiversity also depend on many local and landscape factors e.g. farm management, chemical usage. The agri-environment schemes are playing a key role in the maintenance and increase of biodiversity and ESs of SNHs (Bullock *et al*., 2011).

The basis of the ESs is often the vegetation; thus, the vegetation composition, i.e. the proportion of the herbaceous, woody and flowering species, may determine the ES potential of the SNHs (Wratten *et al*., 2012). For instance, the SNHs provide overwintering sites, hiding places, pollen, nectar and alternative nutrition for pollinator species, pests and their natural enemies (Balzan & Moonen, 2014; Kiss *et al*., 1993, 1997; Kádár *et al*., 2004).

The basic purpose of this study is to describe the vegetation of SNHs in order to relate the vegetation parameters later to the presence of beneficial species and pollinators for ES and then to create a scoring system for SNH's potential to provide ES. In addition, our aim is to conduct a general assessment of the vegetation of these elements and to compare the SNH types based on the vegetation data. In the basic project (QuESSA: **Qu**antification of **E**cological **S**ervices for **S**ustainable **A**griculture, EU-7 Framework *KBBE.2012.1.2-02*) ESs of the SNHs and the interactions between crop fields and SNHs are examined in relation to farm management.

Material and methods

We selected 18 landscape sectors with 1 km radius, which didn't overlap, on the outskirts of Jászárokszállás and Jászdózsa villages, Central-Hungary in 2013. In these sectors we selected and sampled 72 SNHs. Four SNH categories were created: woody areal (WA), woody linear (WL), herbaceous areal (HA) and herbaceous linear (HL) elements. These are the most typical habitats in this area. In each sector 4 SNHs were sampled, one from each of the above categories with a minimum distance of 200 m between each element. For botanical surveys 18 WA, 18 WL, 17 HA and 19 HL elements were selected and from these SNHs. 14 WA, 15 WL, 13 HA and 14 HL elements were selected for flower abundance estimations.

Each element was sampled at two sites: one internal (12.5 m from the edge of the SNH) and one external (on the edge of the SNH) transect (50 x 1.5 m). At each site the vegetation was sampled in two scales: (1) the attributes of the herbaceous layer as species composition, % cover of the species and phenological stage were measured in 2 plots of 1 x 5 m in the transects once; (2) the flowering abundance of insect-pollinated plant species was measured within the transects by estimating the number of flower units of each flowering species in 10 plots of 1 x 1 m that was sampled three times: in June, July and September (Figure 1). Furthermore, the adjacent land use was recorded.

Based on these data, the number of species, dominant species, rare and protected species, invasive species and the proportion of monocots and dicots were analysed in the assessed plots. External and internal parts of the elements were compared (Figure 1). The vegetation data was also evaluated by Simon's nature conservation categories (NCC) of the Hungarian vascular plants (Simon, 2000), Borhidi's phytosociological classification of the Hungarian vascular plants ('social behaviour types', SBT) (Borhidi, 1995) and the relative ecological indicator values by Borhidi (1995).

Results and discussion

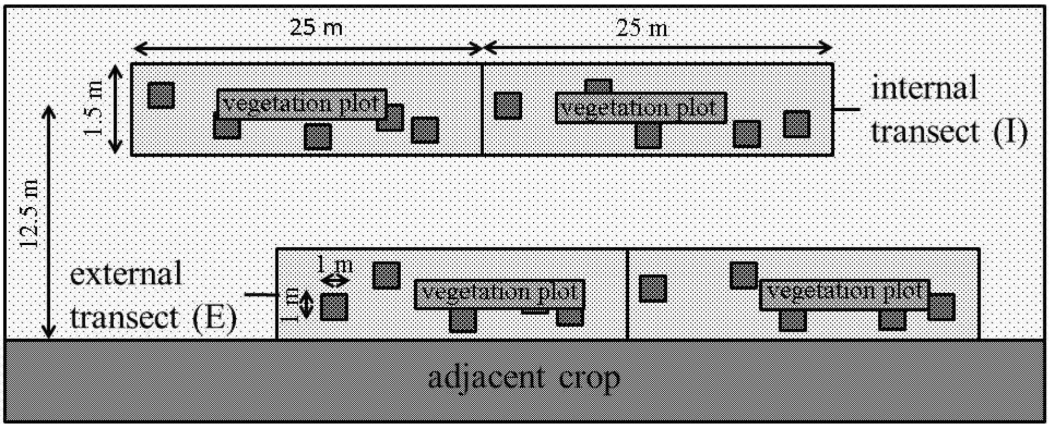

Figure 1. The sampled internal (I) and external (E) transects in the SNHs adjacent to a crop field. The 50 x 1.5 m transects includes two 1 x 5 m vegetation plots and ten 1 x 1 m flowering abundance plot.

The most common species in the investigated SHNs was *Elymus repens*, as it was found in 69 of 72 SNHs. The mean cover of *E. repens* was higher in the external plots than the internal part in each SNH types (Figure 2.). This species is considered as a weed in NCC (Simon, 2000) and ruderal competitor in SBT (Borhidi, 1995) which may indicate the degradation of the SNHs. Based on the relative ecological indicator values (Borhidi, 1995) this species is considered as a semi-humid habitat indicator in relative water demand (WB) and a nutrient-rich habitat indicator in relative nitrogen demand (NB).

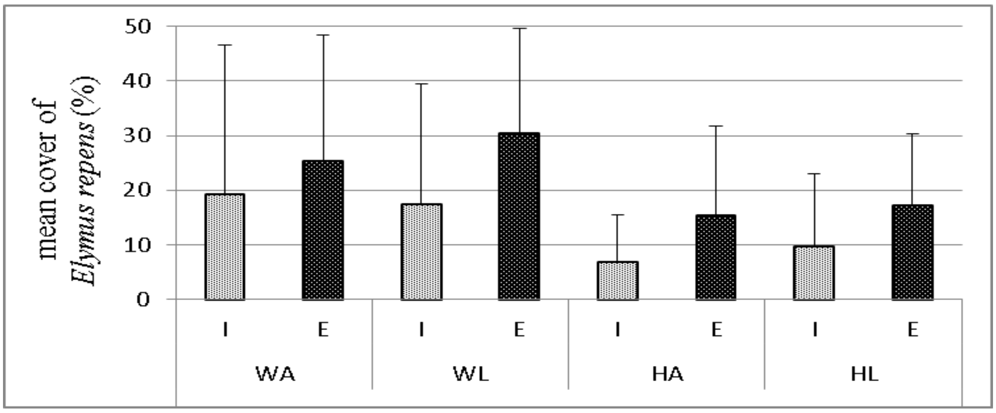

Figure 2. Mean cover of *E. repens* in the internal (I) and external (E) plots of the SNH types. Semi-natural habitat types: WA: woody areal element, WL: woody linear element, HA: herbaceous areal element, HL: herbaceous linear element.

In all SNH types the mean cover of the weeds (NCC) (Simon, 2000) in the herbaceous layer was always higher in the external plots (adjacent to the crop) than in the internal part of the elements. The coverage of the weeds decreases towards the inside of the SNHs (Figure 3).

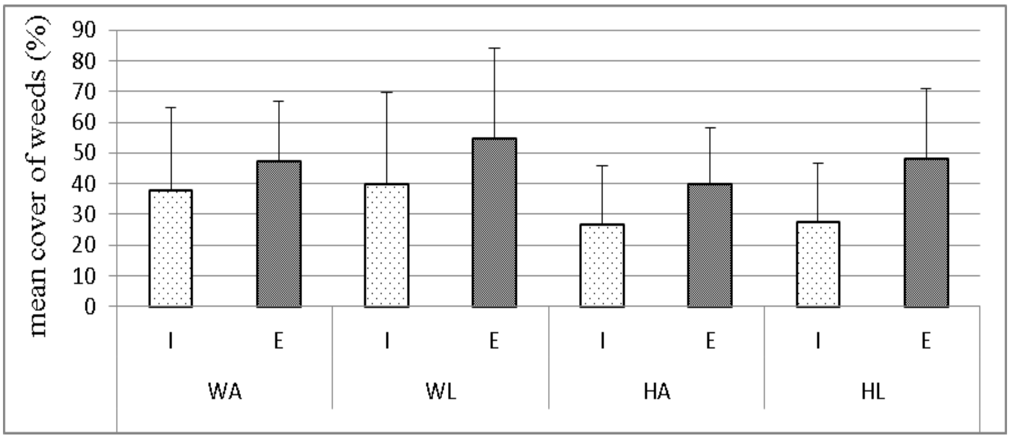

Figure 3. Mean cover of weeds (in according with natural conservation ranks (Simon, 2000) in the internal (I) and external (E) plots of the SNH types. For codes for semi-natural habitat types, see Figure 2.

The most abundant insect-pollinated flowering species was *Tripleurospermum inodorum*. In this case differences were found between external and internal plot data as well. The flowering abundance of these species was twice as high in the external transects as in the internal transects (Figure 4). Probably the proportion of the external part of an element could be important also for the pollination as an ecosystem service.

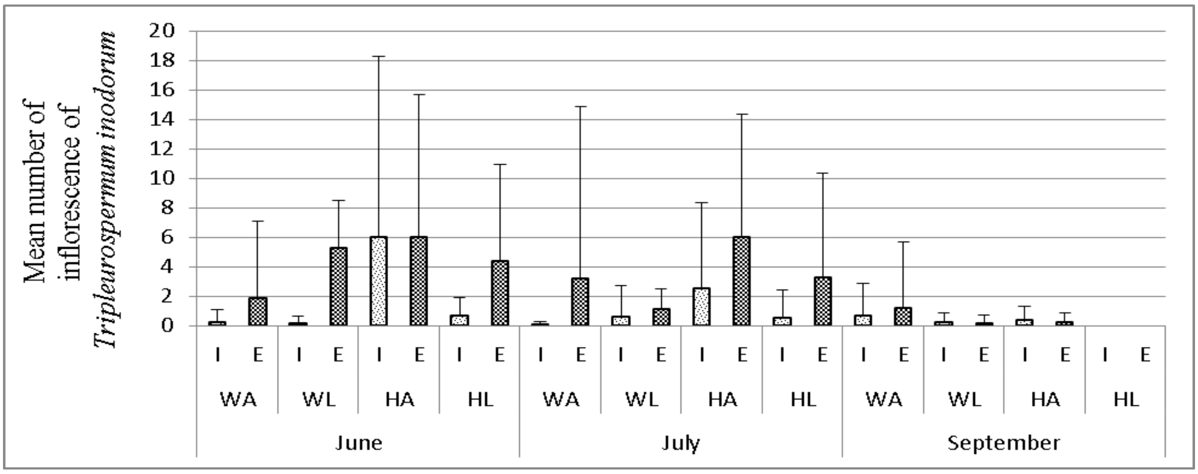

Figure 4. Mean number of inflorescences of *T. inodorum* in the internal (I) and external (E) transects of SNH types (10 plots of 1 x 1 m) in June, July and September in 2013. For codes for semi-natural habitat types, see Figure 2.

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