HABITAT PROVISION ECOSYSTEM SERVICE EVALUATION OF EXTENSIVE PRODUCTION SYSTEM

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Abstract: Sustainability is a key challenge for humanity in the 21st century. Ecosystem services, the benefits that people derive from nature and natural capital is a concept often used to help explain human reliance on nature and frame the decisions we make in terms of the ongoing value of nature to human wellbeing. The key to sustainable development is achieving a balance between the exploitation of natural resources for socio-economic development, and conserving ecosystem services that are critical to everyone's wellbeing and livelihoods. In case of ecosystem services, it is about the primary production of natural resources (food, wood, water ...), but especially to protect against erosion, water natural disasters and protection of cultural and aesthetic values of the country. In this context, the biodiversity of ecosystems is indispensable, because has an important role in creating and regulating ecosystem processes, functions, and services. The contribution presents the role of biodiversity for the sustainability of ecosystem services and the possibilities of its evaluation. The research was conducted on permanent grasslands (PG) at study site Kečovo. At the study site, seven plastic traps were placed in spring 2015 for one month in line with 3 m distance. The habitat provision was identified by Biotope Valuation Method (BVM). The calculated value of the study sites was 41.67. According to the Catalogue of habitats in Slovakia this study site belongs to lowlands and sub-mountain mowed grasslands. In Kečovo, a total of 547 individuals of soil arthropods were captured, of them two eurytopic species (*Poecilus Cupreus*, *Calathus fuscipes*) and one relict species (*Lebia Cyanocephala*).

Key words: biodiversity, sustainability, permanent grasslands, Biotope Valuation Method

Introduction

Grasslands are the most intensively studied habitat types as regards carabids. One reason is that ground beetles are seen as important predators of agricultural pests. Ground beetles are affected by several grassland management practices, including grazing, fertilizing, cutting and other pasture improvement measures. A general principle seems to be that management practices and increasing disturbance decrease the numbers of species and individuals. In grasslands, ground beetles have also been used for assessment of environmental quality and classification of grasslands. It is possible to assess site quality by comparing abundances of rare and generalist species and giving rarity scores to different habitats provision (Eyre et al. 1996).

Nonetheless, the available data indicate that a higher level of species diversity in an ecosystem tends to increase the likelihood that particular ecosystem services will be maintained in the face of changing ecological or climatic conditions (National Research Council Committee on Noneconomic and Economic Value of Biodiversity, 1999). The services include the provision of clean water, regulation of water flows, modification of local and regional climate and rainfall, maintenance of soil fertility, flood control, pest control, and the protection of coastal zones from storm damage. All those are "products" of ecosystems and thus a product of biodiversity. The value of various ecosystem services can also be seen in the costs that must be incurred to replace them (Laurila-Dant, et al. 2015). For example, natural soil ecosystems help to maintain high crop productivity, and the productivity that is lost if soil is degraded through erosion or through changes in species composition can sometimes be restored through the introduction of relatively expensive fertilizers or irrigation.

The contribution presents the role of biodiversity for the sustainability of ecosystem services and the possibilities of its evaluation. For the economic evaluation we used the Biotope Valuation Method (BVM), which ranks national biotopes by point values according to their capacity as specific environments for living plant and animal species (including NATURA 2000). Each biotope type has been valued by an interdisciplinary team of ecologists and economists from different scientific backgrounds using points according to eight ecological characteristics (matureness, naturalness, diversity of plant species, diversity of animal species, rareness of biotope, rareness of species, vulnerability, and threat to existence), each of them with a potential point value ranging from one to six points (Trögl, et al., 2016)

Materials and methods

We analyzed permanent grasslands at study site Kečovo. Study site Kečovo belongs to the geographical location Slovak Karst, and it is located in 354 m a s.l. with a long-term average temperature of 8.6°C. The soil type is Cambisol and permanent grasslands are mowing.

The biotic parameters (arthropod number and arthropod fresh body biomass) were measured. In the randomly placed transect, 7 plastic traps were placed in spring 2015 (April – May) for one month in line with 3 m distance. The captured individuals were preserved in formalin solution, their taxonomic level of order and family was identified. *Carabidae* were categorized into groups according to the ecological valence (Tab 1).

Tab 1 The distribution of species by the ecological valence

Ecological valence	Habitat
R1 (relict species first class)	climax habitat
R2 (relict species second class)	climax habitat and close to climax habitat
SN	semi-natural habitat
D	destroyed habitat
A	artificial habitat

It was used a Biotope Value Method modified according to Cudlin taken into account *Carabidae*. Cudlin used coefficients ranged from 0.6 (minimum) – 1.4 (maximum) that were adjusted to our conditions.

Results and discussion

Biodiversity have an important role in the creation and regulation of ecosystem processes. Carabids are frequently used to indicate habitat alteration. They have been used in grasslands where species number and/or abundances have been noted to change along a habitat disturbance gradient. A biodiversity indicator is a taxon or a functional group the diversity of which (character richness, species richness, level of endemism) reflects diversity of other taxa to detect and monitor changes in the environment. Selecting the most suitable indicator depends on the goal of the survey and the characteristics of the indicator (Raino, Niemelä, 2003). In carabid beetles there are several species or species groups that have been used as indicators.

Five classes (*Arachnida*, *Isopoda*, *Diploda*, *Chilopoda*, *Insecta*) at the study sites were determined in total. The class Insect was represented by five orders: *Coleoptera*, *Hymenoptera*, *Diptera*, *Orthoptera*, *Dermaptera*. In this study site, were collected 550 individuals of arthropods with total body biomass of 30.69 g.

The order *Coleoptera* was evaluated with emphasis on family Carabidae as a bioindicator group. Carabids depend on several abiotic and biotic factors, these include: temperature or humidity, food conditions, presence and distribution of competitors and life history and season, including migration between hibernation and reproduction habitat (Raino, Niemelä, 2003). Carabids were classified by the ecological valence. We determined one relict species (R2) – *Lebia cyanocephala* (1 individual total), which preferably the limestone soils. The study site Kečovo is situated in the karst area. Then we determined semi-natural species (SN) and artificial species (A) (Tab 2).

Tab 2 *Carabidae* distribution into groups by the ecological valence (number of individuals)

Staphylinus caesareus (1)	R2 **SN** D
Poecilus cupreus (45)	SN D
Calathus fuscipes (10)	SN D
Silpha obscura (6)	SN D
Cryptocephalus pini (2)	SN
Chaetocnema concinna (2)	SN D
Sciaphilus asperatus (1)	R2 **SN** D
Alophus triguttatus (1)	R2 **SN**
Lebia cyanocephala (1)	**R2** SN
Chrysolina coerulans (2)	R2 **SN**

In PG Kečovo, eudominant species was represented by *Poecilus cupreus* (63.38 %), which is characterized as heliophilous species typical for fields, permanent grasslands and ruins. *P. cupreus* indicates degradation processes in ecosystems by Hůrka et al. (1996). Jaďuďová et al. (2016) determined these species as eudominant species in another PG in Central Slovakia, near Banská Bystrica. Next eudominant species in PG Kečovo was *Calathus fuscipes* (14.08 %). *C. fuscipes* is an openland species. It can tolerate perturbations resulting from intensive agricultural management practicesand thus can colonize a wide range of open habitats extending from unmanaged (heathland, wetlands, peatlands) to intensively managed (grazelands, mesophilous grasslands, abandoned lands) *Calathus fuscipes* is known as dominant

in meadow assembly. The PG Kečovo is characterized by these conditions. Aleksandrowicz et al. (2009) determined *Calathus fuscipes* (17.49 %) as eudominant species on permanent polish grasslands.

Habitat provision was identified by BVM. The calculated value of the study sites was 41.67. To distinguish the habitats, BVM method modified according to Cudlín (2012) stressed on *Carabidae* was applied. Cudlin used coefficients ranged from 0.6 (minimum) to 1.4 (maximum). Because of low numbers of relict and adaptable species in the locality, coefficient of 0.15 was used for recalculation of biotope value. Modified biotope value was 6.25. We agree with the statement, that the management practices in grasslands affect soil arthropods and carabids respond quickly to habitat fragmentation, grazing, fertilization (Raino, Niemelä, 2003).

Conclusion

A common trend is that large, poorly dispersing specialist species decrease with increased disturbance while small generalist species with good dispersal ability increase. Some species are not affected by moderate disturbance. But some of them including *Carabidae* are sensitive to environmental factors. Our results demonstrated the usefulness of *Carabidae* as bioindicator of biotope quality and increased biotope value.

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