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Effect of active conservation management on biodiversity: Multi-taxa survey in oak woodlands of Podyji National Park, Czech Republic

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Abstract

European woodland used to be managed by livestock grazing, coppicing and fire that kept the forests open and favourable for fauna associated with open woodland habitats. However, these practices have been discontinued during the last two centuries in most of Europe. It has lead to increased canopy closure, loss of precious habitats and subsequent decrease in biodiversity. This is also the case of oak woodlands that cover most of Podyji (Thayatal) National Park, Czech Republic. Numerous endangered open woodland specialists, including such emblematic species as the aesculapian snake (*Zamenis longissimus*), the clouded apollo (*Parnassius mnemosyne*), *Purpuricenus kaehleri* longhorn beetle or the great capricorn beetle (*Cerambyx cerdo*) are restricted to forest edges or to remnants of the former forest steppes. As a part of a restoration management, small clearings with retention trees (each 40x40 m) were created. Using multi-taxa survey approach, we observe the recolonisation dynamics. We search for origin of species associated with clearings in matrix of other, locally available habitats. Preliminary results show that creating gaps in forest canopy is favourable for forest biodiversity. In comparison to closed canopy forest, the treatment plots generally harbour richer assemblages of most taxa investigated (e.g. plants, butterflies, saproxylic beetles and reptiles). However, hands off approach prevails in management of protected oak woodlands putting emphasis on maintaining natural processes rather than conservation of biodiversity. Our results based on response of the numerous taxa demonstrate that it is crucial to adopt active approaches in conservation management of protected forests in order to avoid further loss of biodiversity.

Keywords

endangered species, active conservation, open forest, forest steppe, traditional silviculture

Introduction

Open forests are biodiversity hotspots (Hunter et al. 2001; Peterken 2001; Sutherland 2002; Nilsson et al. 2005; Konvička et al. 2006; Spitzer et al. 2008). In ancient European landscape, forests were used for e.g. livestock grazing (as pasture forests) and as a source of firewood (as coppices) (Warren & Key 1991; Rackham 2003; Thomas & Packham 2007). These traditional silvicultural practices kept the forest structure open by mimicking historical natural disturbances (e.g forest fires and grazing by large herbivores) (Vera 2000; Bakker et al. 2004; Lindbladh et al. 2003). They have thus helped to maintain the forest biodiversity that has been accumulating since the end of the last ice age (Harding & Rose 1986; Brown & Boutin 2009). However, during last two centuries the traditional practices have largely been abandoned. Open forest habitats, former pasture forests and coppices have been afforested or gradually become overgrown by secondary succession and transformed into shady, closed-canopy forests. Reduced disturbance (both natural and human-induced) (Bouget 2005; Eriksson et al. 2006) has lead to lack of early-successional habitats and to subsequent decrease in biodiversity (Litvaitis 1993; Hunter et al. 2001; Nilsson et al. 2005). Active disturbance is therefore required to preserve the species associated with these successional habitats.

Disturbed forest habitats often harbour specific plant and animal species that are rare or absent in closed canopy forests because these species require sunny habitats or tend to be less competitive (Bouget 2005). Species associated with early successional stages and disturbances tended to be considered generalists associated with forest edges that do not need any kind of specific management. Many species exploiting disturbed areas are, however, specialists associated with specific site conditions (DeGraaf & Yamasaki 2003).

For effective management planning in protected areas, it is important to have knowledge about the principles of biodiversity dynamics of disturbed habitats. In 2011 and 2012, we investigated the effect of small scale disturbances on biodiversity of forest habitats in Podyji National Park. Also, we wanted to know what is the difference between gaps isolated in the forest and disturbed plots connected to open habitat (meadow or forest edge). To answer this question we performed a multi-taxa survey based on different groups of organisms, including butterflies, moths, epigeic beetles, saproxylic beetles, reptiles, birds, and plants. Here, we present the preliminary results of the study.

Methods

Study area

Podyji National Park (South Moravia, Czech Republic) protects an area of 63 km² covering the deep Dyje (Thaya) River canyon, mostly covered by oak dominated forests. Large part of the area used to be managed by livestock grazing and coppicing until the Second World War. The traditional management has been abandoned afterwards, and secondary succession has lead to increase in the canopy closure. Numerous endangered open woodland specialists still can be found here, including such emblematic species as the aesculapian snake (*Zamenis longissimus*), the clouded apollo (*Parnassius mnemosyne*), *Purpuricenus kaehleri* longhorn beetle or the great capricorn beetle (*Cerambyx cerdo*), are now restricted to forest edges or remnants of the open forests or forest-steppes on shallow soils of steep, rocky parts of the canyon (Picture 1).

Picture 1: An open forest stand in Podyji National Park. © P. Sebek

Study design

At six sites within the national park, pairs of experimental clearings (40x40 m) with retention trees have been created in dense forests near the bottom of the river canyon close to the alluvial meadow (Picture 2). One clearing always adjoined the meadow, while the other clearing has been isolated from the meadow by at least 20 m wide forest belt. Further, four control study plots of 40x40 m representing four types of habitats were established at each of the six sites. The habitat types sampled include closed-canopy forest, forest edge, open forest (i.e. forest steppe), and alluvial meadow. Hence, the sampling was carried out on six localities with 12 experimental clearings and 24 control plots.

Model taxa observed include: butterflies (studied by walking transects carried out four times during the season - May, June, July, August), moths (captured by ultra-violet light traps; one trap per plot, four times throughout the season), epigeic beetles (captured using pitfall traps; five traps per plot was installed from end of April to end of July), saproxylic beetles (sampled using two flight interception traps installed at 1.5m height on each study plot from end of April to end of July), reptiles (sampled using artificial shelters of 1x1m size; four shelters were placed at each plot), and birds (sampled by direct observation). Finally, census of flowering plants has been carried out at each of the plots.

Picture 2: An experimental clearing with retention trees near Hardegg. © P. Sebek

Results and Conclusions

Preliminary results of the study indicate that creating experimental clearings had a positive effect on diversity and abundance of most model taxa. Different groups, however, responded to the management in different ways. The clearings were species rich for plants, saproxylic beetles, reptiles and butterflies (among them the critically endangered clouded apollo). For moths and epigeic beetles, the clearings were less species rich than the control habitats, however, the species composition was different, with no or few species of conservation interest found in closed-canopy forest. The clearings were an important habitat for many endangered species, and might thus play an important role in streghtening their populations.

The results also show the differences between the two types of clearings. Diversity and abundance of most model taxa was higher in the clearings connected to the meadow than in the isolated clearings. Connection between the clearing and the meadow or connection to a flight corridor (forest edge) was also found to have an important effect on the species composition, the composition of the clearings connected to the meadow being more close to the composition of the open habitats or the forest edges. For future conservation planning, it is thus important to ensure the connection between clearings and other open habitats, such as open forest, meadows or forest edges.

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