

# Keep Your Eyes on the Fire: Prescribed burning as an old-new opportunity for grassland management

Orsolya Valkó<sup>1,2</sup>, Péter Török<sup>2</sup>, Balázs Deák<sup>1</sup>, Béla Tóthmérész<sup>2</sup>

1) MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, P.O. Box 71, H-4010 Hungary, E-mail: valkoorsi@gmail.com

2) University of Debrecen, Department of Ecology, Debrecen, P.O. Box 71, H-4010 Hungary

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**Abstract and motivation:** *We noted the burning interest concerning the application of prescribed burning as an alternative grassland management technique at the EDGG co-organized Open Landscapes conference in Hildesheim during and after our presentation about the possible application of prescribed burning in European grasslands (Deák, B., Valkó, O., Török, P., Tóthmérész, B.: Fire as an alternative management tool – adaptation of North-American grassland burning practices to European grassland conservation. Open Landscapes – Ecology, Management and Nature conservation. Hildesheim, Germany, 29 Sept - 03 Oct 2013). Some conservationists highly welcome prescribed fires, while others are against it. These contrasting attitudes are because we (i) lack of proper scientific information on both short- and long-term effects of fires on grassland biodiversity, (ii) because of the generally negative attitude generated also by the international and national media reporting catastrophic damages in nature, human life and property caused by wildfires and arson, and because of (iii) the confusion of wildfires and arson with controlled and carefully designed prescribed fires. With the following forum paper we would like to stimulate discussion and generate further research activity in this topic, strongly referring to our recent paper published in Basic and Applied Ecology (Valkó et al. 2013) indicating the most important conclusions based on this carefully conducted systematic review.*

**Keywords:** wildfire; arson; biodiversity conservation; species richness; prairie; endangered species

## Introduction

Wildfires and human-induced burnings are present in most European grassland types. In historical times, traditional burning played an important role in land-use and was applied in a sustainable way based on traditional ecological knowledge. Due to socio-economical changes, traditional fire use has been ceased in many parts of Europe, and/or replaced by frequent technical fires and arson. Despite of the considerable extension and frequency of grassland burning and its impacts on grassland species, published European studies focusing on these topics are rather scarce. To provide a qualitative analysis of fire effects on grassland species, prescribed burning experiments offer the most appropriate sources of information. Furthermore, prescribed burning could also offer an alternative cost-effective way of grassland biodiversity management.

Our goal was to evaluate the results of European attempts to use prescribed burning in grassland management and assess whether or not the targeted objectives were achieved. We collected prescribed burning studies from North-America as a reference system to identify which elements of fire management can be adapted to the European grassland conservation and management strategy. To assess the current European attitude on burning, we contacted grassland specialists across Europe to gain information concerning (i) the legislative regulation of burning, (ii) the occurrence and frequency of wildfires, technical fires and arson in grasslands and (iii) the possibilities and limitations of the use of prescribed burning in their countries. We distributed questionnaires via direct e-mailing, through the 13th Bulletin

of European Dry Grassland Group (December 2011) and via the mailing lists of EDGG and the European Vegetation Survey (1,600 people). We gained information from 49 colleagues from 19 countries.

## Current situation of burning in European grasslands

Although fire is an important factor in European grasslands, the effects of fire on flora, fauna and habitat structure is poorly studied and rarely documented; we found only 11 publications in English about prescribed fires in European grasslands. In most of the studies, dormant-season burning was carried out on an annual basis with valuable long-term monitoring. Most of these studies concluded that annual burning solely is not appropriate to maintain the targeted structure and species composition of grasslands (e.g. Kahmen et al. 2002, Köhler et al. 2005). Based on the experiences from North-America we suppose that the reason for this was the too frequent burning, which did not allow the vegetation to recover between the burns.

Based on our questionnaire survey, fire was used as a part of the traditional grassland management to improve forage quality, reduce accumulated litter or woody encroachment in many countries (Austria, Czech Republic, Estonia, Greece, Hungary, Poland, Russia, Slovakia). Recently, traditional burning practices have disappeared from most of the countries because of socio-economic changes, agricultural intensification and legislative issues. We argue that traditional ecological knowledge on grassland burning holds a great potential for planning and evaluating grassland management measures, but the ethnographic and historical evidence

should be elaborated more in detail to provide vital suggestions for its implementation.

Illegal uncontrolled burning is practiced nowadays in extensive areas of Central-, Southern- and Eastern-European countries, causing serious conservation problems (Romania, Hungary, Bulgaria and Ukraine). There are several motives for setting fires illegally like (i) the improvement of pastures, especially in mountain areas (Greece, France or Romania); (ii) to gain Natura 2000 subsidies without labour-intensive management actions, typically in lowland hay-meadows (Romania) or (iii) fires are set just for “fun” or vandalism (Hungary, Romania and Ukraine). Because of the unpredictable and often negative experiences from uncontrolled fires, even prescribed burning is prohibited in most of the European countries, to protect human life and property (Greece) or to mitigate air pollution (Austria or Hungary). There are some countries where prescribed burning is permitted with restrictions regarding the timing and extension of prescribed fires and the fuel and weather conditions for burning (Germany, France, Spain, Portugal, the United Kingdom, the Netherlands and Slovenia). There are detailed codes and training for professional teams who apply prescribed burning mainly for shrubland and heathland management and fire hazard reduction. In a few countries, prescribed burning is included in the management of protected areas (e.g. in France or Portugal), but only a few case studies are available from grasslands.

### What can we learn from European and North-American case studies?

In North-America prescribed burning is frequently used for nature conservation purposes in grasslands, which is also indicated by the huge number of studies on this topic. The overall aim of burning is often the reintroduction of natural disturbance regimes (MacDougall & Turkington 2007). Prescribed burning is often combined with other management tools (grazing or seed sowing). Although the application of the North-American methodology offers viable perspectives for the European management practice we stress that there is a need for focused case studies to test whether the well-developed North-American burning regimes can be adapted to the European grassland conservation strategy. Given the differences in history, climate and composition of grasslands in the two continents, the elements of North-American burning practice can only partly be applied in Europe. As a first step, North-American burning regimes should be evaluated to determine in which European grasslands prescribed burning can be an appropriate management option. Based on the questionnaire survey and the reviewed studies, the most promising management objectives of prescribed burning experiments could be the following.

*Reducing accumulated biomass.* Both European and North-American studies found that burning in winter or early spring can effectively eliminate accumulated

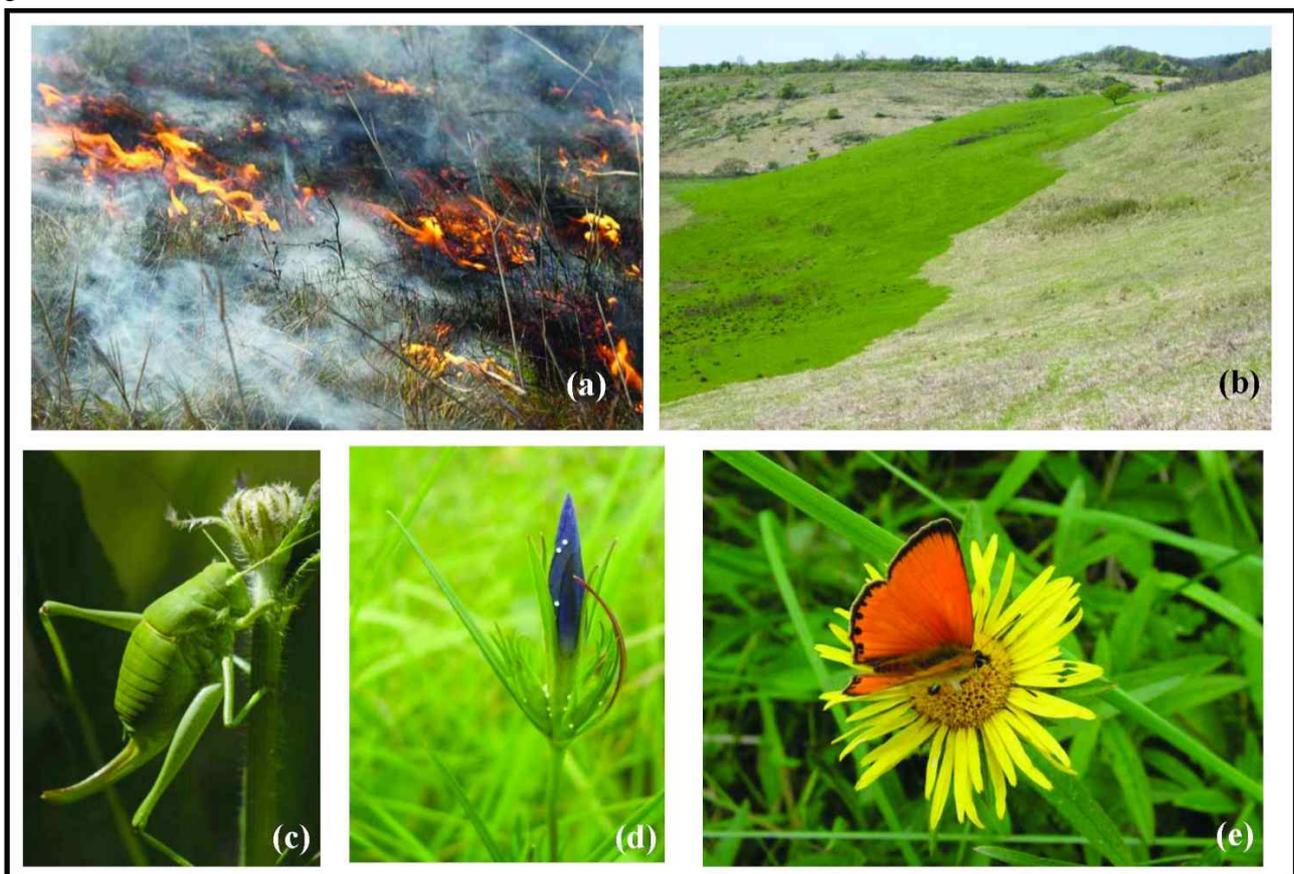


Figure 1. Burning in a mesic grassland in Hungary (a). On the burned patch, vegetation recovered rapidly, providing forage for herbivores several weeks before the unburned patches did (b). For the conservation of endangered species, the appropriate timing of burning is crucial. For flightless species, like the endemic grasshopper *Isophya costata* (c), summer burning can be detrimental. In summer, immobile life stages, like eggs of the endangered *Maculinea alcon* (d) are also vulnerable to fire, while adult butterflies, like the endangered *Lycaena dispar* (e) can easily escape (Photos: T. Miglécz, a; A. Kelemen, b and d; B. Deák, c and e).

biomass but it has only minor effects on the flora and fauna (Ryser et al. 1995, Rowe 2010). Based on these findings, prescribed burning should be tested on sites where management by grazing or mowing is not feasible, like in grasslands located far from farms or settlements. Besides effective biomass removal, burning can result in untargeted species composition in abandoned grasslands if applied too frequently (Kahmen et al. 2002, Wahlman & Milberg 2002). Thus, proper fire return periods should be tested in various grassland types and also fine-tuned to site characteristics (e.g. the amount of living and dead biomass or the presence of noxious competitor species in the vegetation). Fire return periods (2-3 years; Fuhlendorf et al. 2009) applied in tall-grass prairies suggest that at least three years may be appropriate in European grasslands because they are evolutionary less adapted to fire than North-American ones.

*Supporting target species by burning.* Some European studies mentioned positive effects of burning on several rare or protected species by creating suitable germination microsites or warmer and drier microclimate. Focused case studies on certain target species could be integrated in future conservation actions. However, based on North-American experiences, burning is not recommended at sites where remnant populations of endangered species are present.

*Management of open landscapes.* Some European studies found that prescribed burning can help in the management of open landscapes by the prevention of woody encroachment (Page & Goldammer 2004, Rietze 2009). Based on North-American experiences, combination of fire and grazing (patch-burning management) can increase structural and functional diversity which can support the coexistence of species with different habitat requirements (Fuhlendorf et al. 2009). In extended grassland areas, prescribed burning can also be a proper tool for preventing huge and uncontrolled wildfires and accordingly it can contribute to the protection of personal safety and private property. We suggest that in extended open landscapes, like Central- and Eastern European steppes introduction of patch-burning management can increase landscape-level heterogeneity.

*Invasion control.* Despite the serious conservation problems caused by invasive species, application of fire against them has not been studied yet in Europe. In North-America, carefully designed prescribed burning is effectively used against several invasive species (Keeley 2006). Based on North-American studies, summer fires are the most effective in the suppression of invasives. Timing should be fine-tuned to the most susceptible period of the given invasive species (Pyke et al. 2010). Since summer fire can have detrimental effects on several grassland species, invasion control by prescribed burning should be first tested in highly infested areas without outstanding nature conservation values to avoid damaging populations of rare species.

### Proposals and future perspectives

We suggest that prescribed burning of grasslands should be integrated into European nature conservation practice in the near future. However, given the limited number of published studies from Europe; further habitat-specific prescribed burning experiments are needed to find

specific application circumstances and management objectives. We also stress that a database of grassland fires should be established, to accumulate the traditional ecological knowledge, the practical knowledge and field experience of conservation managers concerning effects of fire on grassland habitats and species.

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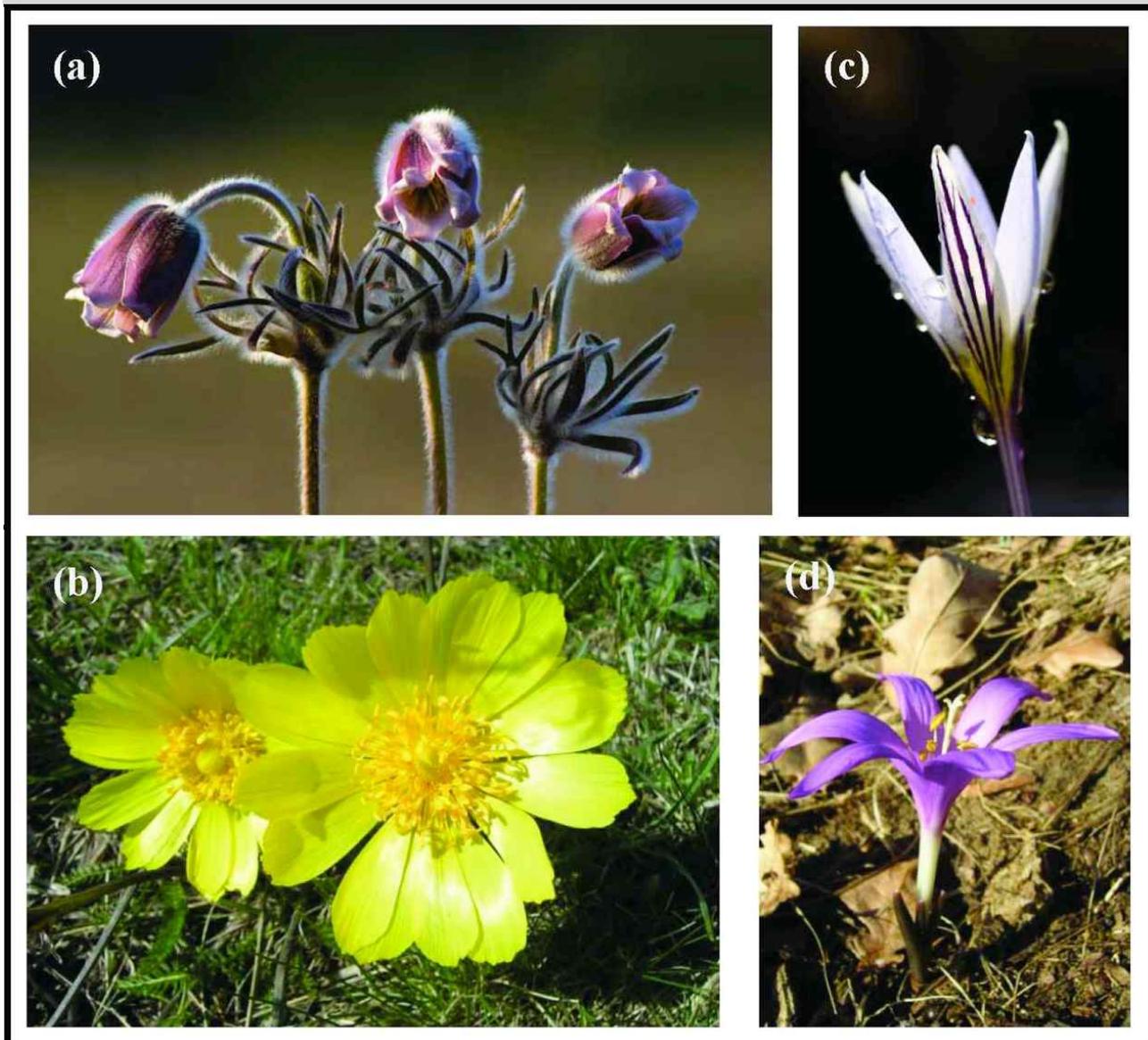


Figure 2. Fire can promote some endangered species by increasing microsite availability through the reduction of litter layer. Seed germination of *Pulsatilla pratensis* ssp. *hungarica* (a) and *Adonis vernalis* (b) is promoted by fire. *Crocus reticulatus* (c) and *Bulbocodium vernum* (d) can successfully regenerate from below-ground storage organs. (Photos: B. Deák, a,c; and A. Kelemen, b,d).

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