Characterization and conservation of xeric grasslands in the Târnava Mare area of Transylvania (Romania)

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Abstract

The Târnava Mare EU Site of Community Interest (SCI), Romania, is a landscape of high grassland biodiversity, which includes small areas of xeric grasslands. These forest-steppe associations have some unique habitat species compositions and contain small populations of EU Habitats Directive and Romanian red-listed plant species. The grasslands are in need of a conservation strategy that will fully describe their legal conservation status, identify threats and deliver their management requirements. The conservation programme is discussed with regard to a newly discovered and exceptional stand of xeric grassland allied to 'stony steppe' formations, which is presented as an example of the factors involved in the protection of such sites.

Zusammenfassung: Kennzeichnung und Erhaltung von Trockenrasen im Gebiet Târnava Mare in Siebenbürgen (Rumänien)

Das Târnava Mare-Gebiet (EU *Site of Community Interest*, SCI) in Siebenbürgen, Rumänien, ist eine Landschaft mit hoher Biodiversität an Grasländern, darunter auch Trockenrasen, und hohem Naturschutzwert. Die Waldsteppen-Komplexe stellen eine besondere Vegetation dar und beherbergen Pflanzenarten, die nach der FFH-Richtlinie der Europäischen Union geschützt sind und/oder auf der Roten Liste der gefährdeten Pflanzenarten Rumäniens stehen. Es bedarf einer Schutzstrategie für das Târnava Mare-Gebiet, die die Grasländer beschreibt, mögliche Gefährdungen aufzeigt und Angaben zum notwendigen Management der Flächen macht. In diesem Beitrag wird eine solche Schutzstrategie am Beispiel eines kürzlich entdeckten und wertvollen Bestandes einer xerophytischen Felssteppe entworfen.

Keywords: grassland conservation, *Stipa*, stony steppe, xeric grassland

1. Introduction

This paper provides a summary of xeric grassland conservation activities conducted by the Romania-UK Târnava Mare Natura 2000 project, Fundatia Adept. This project, combining biodiversity conservation and help for farming communities, is based within the Târnava Mare Site of Community Interest (SCI) in the Saxon Villages district of central-southern Transylvania. In December 2008 this 85,000-ha area, which straddles the boundaries of Braşov, Mureş and Sibiu counties, was approved by the EU Council of Ministers to be included in the Natura 2000 network, as the largest such site in Romania outside the Carpathian Mountains. The SCI, situated south of the west-flowing Târnava Mare river, is exceptional not only for its large size but also in having a significant level of agriculture and a sizeable human population.

The project has been initiated partly to develop a conservation strategy for the important grasslands in the area and look for opportunities to protect the grasslands under an integrated framework encompassing Habitats Directive but also considering policy opportunities under Rural Development, e.g. EUROPEAN ENVIRONMENT AGENCY (2004), particularly with respect to High Nature Value. This is a categorisation of grasslands (ANDERSEN 2003) that have been incorporated into the Romanian Rural Development Plan in terms of the targeting of agri-environment resources towards parcels of land with a minimum content of wildflower indicator species (ROMANIAN GOVERNMENT 2007). Using these opportunities, valuable grasslands can be retained because of the financial incentive the agri-environment scheme provides to the farmer. It is a clearly important part of the project to counter the main threats of abandonment or of intensification common to grasslands across Europe

(KLEIN et al. 2008), with the need to maintain low input management with light stocking levels and cutting where necessary, the key goals of grassland management. For these goals the project needs to collect information on the characteristics and location of the most important grasslands in the project area. HANSEN et al. (2001) identifies the main concerns for Romanian biodiversity.

The dry grasslands in the area are very much on the edge of range of dry grasslands in the country away from larger concentrations towards the Pannonian plain of Hungary or the Pontic steppes of the Black sea coast (SARBU et al. 2004). There are few attempts yet to describe the dry grasslands of Romania within a European context (e.g. following SCHAMINÉE et al. 2009), and ILLYÉS et al. (2007) does not cover this area, but it may be possible to describe the grasslands in terms of their analysis as continental *Brachypodium* grassland. Reference to their work would also suggest the partial origin of the grasslands of Târnava Mare from dry woodland. Phytosociological studies of Romania as a whole include DONIȚĂ et al. (2005) and SARBU et al. (2004) with red lists of plant species provided by the latter and by OLTEAN (1994) and by OPREA (2005). There have been several local studies of the phytosociology and species of the general vegetation of the neighbouring parts of Transylvania including SĂMĂRGHITAN (2005), DRĂGULESCU (2003), and SANDA et al. (1983). RUPRECHT et al. (2009) have examined some of the dry grasslands further west in a drier zone.

This paper describes the preliminary surveying methods used in this large area and the dry grasslands that have been discovered and includes the local species that are typical to the different habitats, particularly red-listed species. It also describes an example of such grassland that has been discovered recently and is a typical site in terms of the questions it poses for implementing a conservation management and protection plan.

2. Material and methods

The area was chosen for protection as it contains extensive areas of EU priority habitats, including woodlands, grasslands – including lowland xeric grassland communities of varying characteristics – and scrub, as well as highly significant zoological interest in a European context. The topography consists of a deeply dissected plateau at an almost constant maximum altitude of 700 m and valley bottoms at about 300 m, with abundant steep slopes, occasional cliffs of hardened marls, and land-slips with intricate mosaics of drier and wetter areas.

The area of plateau is situated between the rivers Olt and the Târnava Mare, a tributary of the Mureş (Fig. 1). Its highest point is Pietriş at 839 m a.s.l. Soils are varied but predominantly brown clays, pseudo-rendzinas and brown earths with some local formation of podsols and generally the climate is too wet for chernozem (DRĂGULESCU 2003). Climate is classified as moderate continental. Precipitation total is approximately 650 mm per year, mean annual temperature is 8 °C with mean monthly temperature of –4 °C in January and 19 °C in July and with absolute low of –31 °C and high of 39 °C (DRĂGULESCU 2003).

The grasslands and arable land occur within a matrix of high woodland cover, with woodland areas situated along the tops of ridges and plateaus (Fig. 1), with grassland in valleys and valley sides. These woodlands, modified by plantations of *Pinus sylvestris* and *Fagus sylvatica* (with very occasional native stands of the latter) are mainly *Tilio-Acerion* of slopes, Dacian *Quercus robur-Carpinus betulus* woodland, Pannonian woods with *Quercus pubescens*, and alluvial forest of *Alnus glutinosa* and *Fraxinus excelsior* (DONIȚĂ et al. 2005). There are also wild populations of *Juniperus communis* but its ecological status hasn't been resolved and may be a relict of a *Pinus sylvestris* forest. There are extensive wet grasslands with some peaty soils in flat valley bottoms but they have mainly been drained during the 1970's, and only occasional stands of *Sanguisorba-Alopecurus* grassland survive.

The open and unfenced grasslands are currently managed by sheep and cattle grazing in extensive systems and by hay cutting and occasional burning to control scrub.

Across this area, xeric steppic plant communities are present in what can be considered the edge of their distribution in the forest steppe zone, due to climatic conditions, including

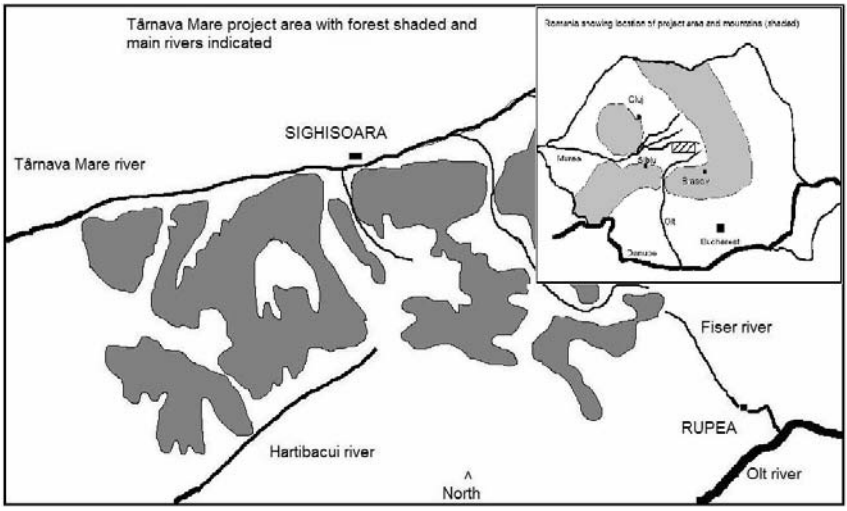

Fig. 1: Map showing location of the Târnava Mare project area in Romania (centre outlined) (small map) and project area survey with forests shaded.

Abb. 1: Lage des Târnava Mare-Gebiets in Rumänien (Schraffur, Bildmitte) (kleine Karte) und Gebietsübersicht mit grau hinterlegten Wäldern (große Karte).

higher rainfall as one approaches the periphery of the Carpathians, and more montane grassland communities (DONIȚĂ et al. 2005). Many of the xeric grasslands areas that hold EU priority habitats and species exist as small areas, often under one hectare in size, within a mosaic of mesic and hygrophilous grassland, including wet meadow and in some cases even in a mosaic with reed bed communities (*Phragmites australis*, nomenclature follows TUTIN et al. 1968–1993). However, these xeric plant communities contain some rare assemblages of plant species, and rare and threatened plant species that are just being discovered and require conservation protection based upon EU priority habitat or species status.

The xeric grassland surveying strategy was based on visits to south-facing slopes and geological land-slips, also small slumping hills, which are termed *movile* in Romanian (Fig. 2). Past experience has shown that within the project area the xeric communities are confined to these locations. These locations were identified using a combination of aerial photographs, Google Earth, and botanical literature (e.g. CSŰRÖS & KOVÁCS 1962). They are occasionally encountered by chance as part of our general surveying of all grassland habitats in the project area. Surveys have been conducted on an increasing scale over the years 2003–2009. Sites were visited primarily in the summer months but some sites have also been visited from late March until late October because of the potential for the presence of plant species with phenological peaks in the vernal or autumnal period. Vegetation analysis has been carried out by compiling species and habitat lists for each site.

3. Results

3.1. Site surveys

In some cases we have found subsequently that we are revisiting locations of important xeric communities known for several decades from the work of local botanists, especially CSŰRÖS & KOVÁCS (1962) and SCHNEIDER-BINDER (1971, 1972, 1975, 1977). In other cases we appear to be discovering significant new sites where there is no information in the literature or recollection of sites by local botanist.

From our landscape level surveying we have identified 11 sites 0.5–3 ha in size that are considered to have high conservation status (which have been sampled, Table 1), including the presence of at least one EU priority plant species. However, we expect there to be others, as over the period 2000–2009, we have surveyed only approximately 50% of potential sites. There is a concern from our discoveries so far that other important botanical sites

Table 1: The most important xeric sites in the Târnava Mare SCI in terms of conservation priority.
Tabelle 1: Liste der wertvollsten Trockenrasenflächen im SCI-Gebiet Târnava Mare.

Locality, area and whether situated on *movile*	**Xeric grassland habitats, EU Habitats Directive (Annex I) habitats**	**Examples of xerophilous species present – EU Habitats Directive (Annex II) species, Red-listed, rare, or endemic to Romania**
Buneşti 1 ha *movile*	62C0* Ponto-Sarmatic steppe 40A0* Subcontinental peri-Pannonic scrub	*Adonis vernalis*, *Cephalaria radiata*, *C. uralensis*, *Crambe tataria*, *Crepis pannonicus*, *Dictamnus albus*, *Hierochloe australis*, *Iris aphylla*, *Orchis militaris*, *Prunus tenella*, *Salvia nutans*, *Seseli peucedanoides*
Buneşti-Viscri 3 ha	62C0* Ponto-Sarmatic steppe 40A0* Subcontinental peri-Pannonic scrub 6240* Sub-Pannonic steppic grasslands	*Adonis vernalis*, *Astragalus austriacus*, *Crambe tataria*, *Dictamnus albus*, *Echium russicum*, *Iris aphylla*, *Omphalodes scorpioides*, *Prunus tenella*, *Salvia nutans*, *Salvia transsylvanica*
Saschiz 3 ha *movile*	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) with important orchid sites 40A0* Subcontinental peri-Pannonic scrub 6240* Sub-Pannonic steppic grasslands	*Adenophora lilifolia*, *Cephalaria radiata*, *Crambe tataria*, *Daphne cneorum*, *Iris aphylla*, *Mercurialis ovata*, *Orchis militaris*, *O. ustulata*, *Prunus tenella*, *Sesleria heuflerana*
Apold 1 ha *movile*	6240* Sub-Pannonic steppic grasslands	*Adenophora lilifolia*, *Cephalaria radiata*, *Iris aphylla*, *Orchis ustulata*, *Salvia nutans*, *Seseli peucedenoides*, *Sesleria heuflerana*
Movile 3 ha *movile*	6210* Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) with important orchid sites 6240* Sub-Pannonic steppic grasslands	*Adonis vernalis*, *Cephalaria radiata*
Mihai Viteazu 0.5 ha	6240* Sub-Pannonic steppic grasslands	*Astragalus austriacus*, *Cephalaria radiata*, *Crambe tataria*, *Dictamnus albus*
Bradeni 1 ha, *movile*	6240* Sub-Pannonic steppic grasslands	*Adonis vernalis*, *Cephalaria radiata*, *Salvia nutans*
Malâncrav 1 ha	6210* Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) with important orchid sites	*Adonis vernalis*, *Astragalus austriacus*, *Dictamnus albus*, *Gymnadenia conopsea*, *Orchis militaris*, *O. tridentata*, *Silene chlorantha*
Roadeş 0.5 ha	6210* Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) with important orchid sites	*Adonis vernalis*, *Astragalus austriacus*, *Cephalaria radiata*, *Echium russicum*, *Orchis ustulata*, *Salvia nutans*
Archita 0.5 ha	6240* Sub-Pannonic steppic grassland	*Cephalaria radiata*
Dacia 3 ha	6240* Sub-Pannonic steppic grassland 6190 Rupicolous Pannonic grassland	*Adonis vernalis*, *Cephalaria radiata*, *C. uralensis*, *Hyacinthella leucophaea*, *Lappula deflexa*, *Polycnemum majus* var. *mediterranea*, *Scorzonera austriaca*, *Scorzonera purpurea* ssp. *rosea*

remain unrecorded and potentially under threat, despite their location within the Site of Community Interest and it is known that several *movile* were removed during the 1970's.

Three plant species present in dry grassland in the area, *Crambe tartaria*, *Iris aphylla* and *Echium russicum*, together with *Adenophora lilifolia* (Fig. 3) in more mesic grassland, are listed on Annex II of the EU Habitats Directive. These species occur singly or in combination at these sites and are convenient indicators that we can use tentatively in conservation valuation or prioritization of the top rank of xeric sites. We also used Romanian red-listed plant species (OLTEAN et al. 1994, NEGREAN 2001, SARBU 2004, OPREA 2005) to record the presence of species on the basis of rarity status, particularly Romanian endemic species such as *Cephalaria radiata* and *Salvia transsylvanica*. We noted the species' presence and vegetation composition of all sites visited so that the sites can be ranked within a conservation priority action list, which will determine issues such as potential purchase or other protection. However, many sites have some ecological status even as High Nature Value grassland, having the presence of indicators from the National Rural Development Programme species list (ROMANIAN GOVERNMENT 2007). Information on exact site location is restricted because of current concern about issues of threat to site integrity, planning of development or collection by visitors of rare plant species and/or medicinal plants.

Some of the best xeric grassland sites in this area are on the small slumping hills or *movile* (JONES 2009). These sites are a focus for our research, being very important for the facies of xeric species on their southern slopes but having rich assemblages of montane, mesophilous, and hygrophilous species on their northern slopes, including most notably *Adenophora lilifolia*, *Angelica palustris* and Romanian red-listed species such as *Daphne cneorum*, *Hierochloe australis* and *Peucedanum rochelianum*. They are considered a unique botanical treasure of the project area, on a par with some of the best botanical sites in Europe, for their exceptional botanical diversity at both habitat and species level, which is packed into small areas, often 30 m or less across.

At a European level, many species that are not mentioned in Table 1 but are becoming rarer across Europe through habitat loss are still relatively abundant in Transylvania at the sites described. This includes such plant species as *Allium ericetorum*, *A. flavum*, *Artemisia pontica*, *Aster amellus*, *A. linosyris*, *Brassica elongata*, *Clematis recta*, *Eryngium planum*, *Euphorbia epithymoides*, *Gentiana cruciata*, *Gentianella ciliata*, *Inula hirta*, *Jurinea mollis*, *Linum flavum*, *L. hirsutum*, *L. tenuifolium*, *Nonea pulla*, *Odontites lutea*, *Polygala major*, *Pulsatilla montana*, *Senecio integrifolius*, *Silene otites*, *Thymelaea passerina*, and *Vinca herbacea*. These species are typically found in the project area on agriculturally unimproved pasture and hay meadow but only occasionally on areas of arable land which have been ploughed and are reverting to pasture.

For all 11 sites, there was an average of 6.2 red-listed species per site and a total of 29 red-listed species, with the Buneşti site being the richest (Table 1). This site on the edge of woodland is represented by two discrete *movile* which have been burnt at least once in the last 5 years to control invaded scrub. The site is an area that is mainly woodland, however, most other woodland edges in an immediate 1 km radius of the site are unremarkable for their grassland species and so it represents a 'hotspot' of diversity.

3.2. An example of a remarkable 'stony steppic' grassland site in the Târnava Mare area

This grassland site is situated near Dacia to the west of Rupea in Braşov county. It is on a ridge of conglomerate rock containing quartzite pebbles which is 500 m long with steep sides facing south and south-east and with slopes of >45° in places. The vegetation is of a very open steppic type (Fig. 4) along the top of the ridge, dominated by *Teucrium montanum* (c. 50% cover), *Carex humilis* and *Thymus* species, and represents a community type intermediate between two EU priority habitat types, 6190 Rupicolous Pannonic grassland and 6240 sub-Pannonic steppic grassland (DONIŢĂ et al. 2005) and is totally unique within the project area. *Teucrium montanum*, for example, occurs in only a few other places in the area but always at low frequency. The vegetation requires more detailed analysis, but is con-

Fig. 2: *Movile* or slumping hill near Apold, site of *Cephalaria radiata* and *Adenophora lilifolia.*
Abb. 2: Rutschhügel (*Movile*) nahe Apold. Wuchsort von *Cephalaria radiata* und *Adenophora lilifolia.*

sidered to have some relationship with an association of Daco-Sarmatian pastures with *Carex humilis, Stipa joannis* and *Brachypodium pinnatum* (Adrian Oprea, pers. comm.). The site becomes more mesic lower down the slope, which is dominated by *Brachypodium pinnatum* with a very large and extensive population of *Adonis vernalis*. The north face of the ridge is mesic grassland notable for *Campanula rotundifolia*, which is rare in the area and is a somewhat montane floristic element (Adrian Oprea, pers. comm.). The locality is grazed by sheep, and the open stony steppic vegetation covers some 3 ha.

The site was discovered in July 2008 when the vegetation was very dried-up and open, and the areas of bare rock raised the possibility that a range of geophytes and therophytes might also occur. Over its long history, the site would be difficult for colonization by shrub and tree species, because of the difficulty of rooting and severe desiccation stress, exacerbated by grazing. The land slopes downwards to the south for several kilometres and therefore the ridge receives the full effect of exposure of sun and wind, which in combination with the hard rocky substrate represents a potential refuge for plant species of a range of open habitats.

When visited at the beginning of May 2009, *Arenaria procera* was in flower and *Hyacinthella leucophaea* was at capsule stage, having finished flowering. Later, species were encountered that included rarities not known elsewhere in the Târnava Mare area, for example *Scorzonera austriaca* flowering in late May, and notably an annual *Chenopodiaceae* taxon, *Polycnemum majus* var. *mediterranea* Beck (found by Dan Turtureanu), at possibly its third recorded site in Romania (SĂVULESCU 1952–1976). Several other annual or paucienial species occur at the site, including *Alyssum desertorum*, *Arenaria serpyllifolia*, *Erophila verna*, *Lappula depressa*, *Medicago minima*, *Scleranthus annuus* and *Trifolium arvense*. No other steppic site is known in the Târnava Mare area with such a high number of winter annuals. The site also has both *Cephalaria radiata* and *C. uralensis.*

It is evident that fine-scale vegetational analysis is needed to describe the subtle patterning of sub-community and clinal variation in these rather open communities in relation to edaphic and micro-climatic features of the site.

Fig. 3: *Adenophora lilifolia*, one of our rarest species and a plant of the mesic-xeric ecotone.

Abb. 3: *Adenophora lilifolia*, eine der seltensten Pflanzenarten im Untersuchungsgebiet, die im Übergang von halbtrockenen zu trockenen Bereichen wächst.

4. Discussion

The majority of our xeric grasslands containing rare species and habitats occur in small areas of up to 3 ha, within a matrix of mesic grassland and often also arable or fallow arable land. On the small slumping hills or *movile*, the xeric communities may occur within 30 m of equally rare hygrophilous species, making management and monitoring plan development especially detailed. Therefore, we need to give special consideration to their management and protection because of the small areas concerned and their remote occurrence as islands of forest steppe habitat. Major threats in the future include lack of management and subsequent scrub invasion (CREMENE et al. 2005) and the ecologically opposite threat of overgrazing and nutrient enrichment as a result of increasing stock numbers and agricultural intensification. Other threats include the use of the site for aggregate (sands and gravels) or rubble extraction (as in the stony steppe, already being quarried at one end of the site), unplanned development e.g. mobile telephone masts, flattening to increase arable area, track and road construction or recreational use such as motocross. With the growth in eco- or agri-tourism comes also the threat of collection of some of the rarer and attractive species, several of which are already esteemed by the horticultural trade and as rare medicinal plants, e.g. *Daphne cneorum* and *Adonis vernalis*. Certainly, access to some sites needs management in the case of large parties of botanists, especially sites on the steeper and less stable slopes, which have soils which are easily eroded.

All sites lie within the designated Târnava Mare SCI. However, there is concern that this status will not confer protection for some time to come (and indeed the 'stony steppic' site

Fig. 4: Stony steppe showing open vegetation and frequent *Teucrium montanum*.
Abb. 4: Offene Felssteppe mit *Teucrium montanum*.

described above lies at the very periphery of the SCI). Various possibilities for protected area organization in response to these threats include a system of 'micro-reserves' such as those successfully designated and managed in Spain's Valencia province (LAGUNA 2001). In terms of active conservation, firstly, these sites might possibly fall under the ownership of the local commune, which can engage in conservation, especially if an ecotourism incentive exists. Secondly, protected areas might be bought and resourced by conservation charities or trusts and reserves created. Thirdly, these areas might be administered under a financial agreement between the owner and a conservation body which delivers a simple but effective management plan, with the body also providing advice in terms of further funding through EU rural development agri-environment schemes. In all cases there is a need to deliver conservation management via regimes of cutting, grazing, and occasional burning, as well as the need to monitor site grassland condition status. It is likely that these needs will become increasingly difficult in future, particularly under changes in agriculture and land-use regulations. A consequence of agricultural intensification is the possibility that conservation grazing of less productive but ecologically rich grasslands will become increasingly difficult to obtain unless it is paid for, following land-use and conservation trends in Western Europe. Also, cutting by hand at these sites will become increasingly expensive, and burning may become illegal or difficult to implement. Moreover, burning has a poor image as a management tool (e.g. KAHMEN et al. 2002 for calcareous grassland and YALLOP et al. 2006 for upland vegetation), though it appears to be traditionally used in the area to control scrub of *Prunus spinosa* and *Carpinus betulus* which can quickly invade xeric grassland (paradoxically, there is often conflict between conservation aims with for example conservation of avi-fauna requiring scrub retention). There is the possibility that the xeric grasslands have been maintained in this forest zone by a very long history of livestock management (PÄRTEL et al. 2007). Without human intervention much of the dry grasslands habitat found would possibly not survive and would through vegetation successional processes become woodland. Work on grasslands survival following succession to woody vegetation (e.g. REJMANEK & ROSÉN 1992, KALAMEES & ZOBEL 1998) shows for many European grassland species that the grass-

lands must have been kept open in significant areas to maintain diversity in the long term. Hence it is important to control scrub and provide appropriate levels of grazing/cutting as grassland soil seed banks under long-term scrub cover may not be long-lived.

Furthermore, the autecology, including population dynamics, of some of the rarest species needs to be evaluated, given their very isolated occurrence and small population sizes, with species conservation action plans created for the rarest and most threatened species. Beyond, the finer ecological detail of a management plan (so-called micro-management), it is possible that only a landscape approach to all these factors, i.e. retaining a large, contiguous area of traditionally farmed landscape will ultimately provide the conditions and associated ecological processes within which these xeric patches will survive and their respective species, as suggested by ERIKSSON et al. (2002), including seed dispersal. Fragmentation of habitat and shifts in grazing management may have an adverse effect on the grassland matrix in which our xeric grasslands survive and BUTAYE et al. (2005) have examined the factors involved in survival of discrete isolated grassland plant populations. Further studies are needed on the ecology of these grasslands, including the effects of small mammal and insect grazing, pollination and seed-dispersal, and species population dynamics. Populations of some of the rare species are very small and they are very isolated from any other populations. For example, another population of *Daphne cneorum* in addition to that on a *movile* near Saschiz is not known at any locality in the area for 20 km in any direction, although there are one or two old records. Its population is currently very small, consisting of less than 20 individuals, and over 4 years of study no seed has been formed. Certainly some of these species need *ex situ* propagation of plant material and seed banking as an insurance against any further decline in population, and collaboration with a University Botanic Garden to highlight the status and importance of xeric/steppic species in a national context.

Monitoring will require specialist staff to visit the sites several times a year to check delivery of conservation management and, less frequently, to assess priority habitat and species status, such as by the use of permanent quadrats to evaluate condition of habitats and population assessments for species, including annual counts of individuals for rare annual species, e.g. *Echium russicum*.

The xeric grassland sites are all unique in terms of habitats and species composition and so loss of some of the sites will not necessarily be mitigated for by the retention and expansion of others. Restoration of these sites would be virtually impossible given the special conditions of these dry banks and *movile*, especially in terms of their specific edaphic conditions. Also, within some of the individual sites, the distribution of species can be very restricted and they can be quite easily overlooked, particularly if phenological peaks (e.g. flowering) are missed very early or late in the season.

The stony steppe is an example of the diversity, isolation, and uniqueness of our grassland sites. This locality, on the edge of the SCI, could easily be destroyed by continue quarrying along the ridge so our project needs to have contact with owners and quarrying companies. In terms of its management, it has the typical functional ecology of our sites with constituent slow-growing stress tolerant species that are sensitive to plant competition, requiring low intensity grazing in combination with dry soils to maintain the very open nature of the vegetation. Agricultural intensification of neighbouring lands either for livestock farming or arable crops will bring nutrients, particularly nitrates, on to the site. This could cause an increase in competitive ruderal grass species such as *Setaria viridis*, already present around the quarry, at the expense of sensitive relict taxa such as *Polycnemum majus* var. *mediterranea*. Hence a buffer zone of low intensity, backup grazing land will be needed around the site for its special open xeric grassland characteristics to survive.

In terms of future conservation within Romania and perception of these grasslands in other countries, there is a focus on wilderness, especially the Carpathian Mountains (which have many endemics) and Danube Delta when ascribing Important Plant Area status (ANDERSEN et al. 2005). Farmed landscapes have largely been overlooked (MOUNTFORD & AKEROYD 2009), which makes it difficult to highlight the value of these steppic plant communities within their essentially agricultural setting in a lowland landscape.

We are continuing to discover new sites, and we need to train the next generation of botanists and field officers to manage the area. In terms of outputs we need to summarize and classify the grasslands and produce guides for field officers, landowners, and farmers, particularly highlighting grassland management requirements, conservation threats, and sensitivity in relation to farming practices. One aspect of our work is the identification of a list of conservation value grassland plant indicator species which can be used to evaluate and rank new sites and monitor existing sites. They are a resource that can help conservation projects and land-owners take advantage of opportunities under agri-environmental aspect of rural development to maintain so-called High Nature Value grassland. Another aspect of research is the history of land use in the area and an understanding of traditional methods used in grassland farming, their contribution to the grassland ecology and to its local richness. Some of these traditional methods, which have largely disappeared across Europe, have wide significance for grassland conservation managers elsewhere in reconstructing and reintroducing models of traditional grassland utilisation and in grassland habitat restoration.

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