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CAN QUARRIES SUPPLEMENT RARE XERIC HABITATS IN A PIEDMONT REGION? SPIDERS OF THE BLANSKY LES MTS, CZECH REPUBLIC

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ABSTRACT

Although there is growing evidence that post-industrial barrens such as quarries can harbour a substantial proportion of species diversity formerly associated with traditional rural landscapes, most of the evidence originated from limestone quarries in relatively warm areas, while minimum studies exist for cool regions and acidic substrates. We used pitfall trapping to study spiders colonising three quarries in a piedmont region of southwestern Czech Republic. We compare samples from the quarries with adjoining seminatural localities using both univariate and multivariate analyses. Samples from the quarries contained less species per trap, but endangered species occurred both in the quarries and outside of them, and some were sampled in the quarries only. Compared to the seminatural localities, quarries were colonised by species preferring lighter and more open vegetation. These species had, in average, more restricted distribution in the Czech Republic, suggesting that the quarries indeed attracted specialists of early successional habitats that are increasingly rare in modern landscapes. Prospects of such species depend on future restoration policy in existing quarries. To safeguard them, spontaneous succession should be preferred over engineered reclamation.

KEY WORDS: anthropogenous sites; spiders; quarries; restoration; biodiversity conservation; primary succession

INTRODUCTION

European landscapes have been long modelled by human activity. Impacts of traditional farming led to development of a vast diversity of unforested early successional biotopes such as grasslands, field embankments, grazed commons, fallow and various disturbed sites. These were colonised by a remarkable diversity of specialised species and communities. Decline of these biotopes is a relatively recent phenomenon, brought about by agricultural intensification, accompanied by local abandonment of marginal, unproductive lands. Unproductive biotopes have shrunk to tiny and highly fragmented remnants of their original area (Thomas, 1993; Bruun, 2000; Van Swaay, 2002). As a result, species depending on habitats of traditionally used landscapes are rapidly declining across Europe (Thomas *et al*., 1994; Fischer and Stocklin, 1997; Lindborg and Eriksson, 2004).

It is increasingly recognised that quarries, mined sites and other types of post-industrial barrens can provide refuge for considerable numbers of plants and animals species that are gradually declining in rural landscapes (quarries: Benes *et al*., 2003; road verges: Munguira and Thomas, 1992; post-mining heaps: Holec and Frouz, 2005; sand and gravel pits: Rehounkova and Prach, 2006; industrial brownfields: Eyre *et al*., 2003). Quarrying, in particular, represents a dramatic form of land degradation with multiple impacts on natural environments (e.g.

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destruction of original biotopes, dust, noise, increased traffic density; cf. Berhe, 2007). However, once it is terminated, it initiates successional developments of highly diverse habitat mosaics that can supplement or mimic habitats that are rare or missing in surrounding landscapes (Novak and Konvicka, 2006). Successional changes are particularly slow at walls, bottoms and barren terraces, creating xeric conditions and providing for associated xerophilous biota (Schulz and Wiegleb, 2000; Wiegleb and Felinks, 2001; Novak and Prach, 2003). The conservation value of long-abandoned and spontaneously vegetated quarries is widely recognised and numerous reserves exist in abandoned post-industrial sites across Europe (Warren, 1993; Key, 1994; Cilek, 2002). However, all these newly emerging habitats are being threatened by technical reclamations, often composed of covering the sites with fertile topsoils and subsequent afforestation. In the Czech Republic, this still applies for most newly excavated sites (Stys and Branis, 1999), despite clear demonstrations that spontaneous succession, perhaps accompanied by minor adjustments such as suppression of invasive weeds, offers a cheaper and biodiversity-friendlier alternative to technical restoration (Holl and Howarth, 2000; Prach and Pysek, 2001; Wang *et al*., 2001; Prach, 2003).

Most of the evidence that quarries can supplement or mimic declining xeric habitats originated from regions with relatively warm climates, often on calcareous (Cullen *et al*., 1998; Majoor and Lever, 1999; Benes *et al*., 2003) or volcanic (Novak and Konvicka, 2006) substrates. Such regions usually comprise substantial remnants of xeric grasslands, which provide a pool of species colonising the quarried sites. In contrast, there is minimum evidence from cooler regions, higher altitudes and acidic substrates, although quarrying affects such regions as well. Even descriptive accounts on vegetation succession in quarries in cold regions and on acidic substrates are scarce (cf. Prach *et al*., 2001).

To partially fill this gap in knowledge, we studied spider fauna inhabiting both acidic-rock (granulite) and calcareous-rock (limestone) quarries in a piedmont area in the southwest of the Czech Republic. We selected spiders, a moderately studied and sufficiently species-rich group, which has been proposed as an indicator of environmental quality (Marc *et al*., 1999; Pearce and Venier, 2006) and for which there is a recent synthesis of distribution and ecological requirements for the country (Buchar and Ruzicka, 2002). As reference points, we compared the quarries with adjoining islets of seminatural xerophilous vegetation, presumably providing sources of colonisers. We discuss the consequences of our results for species and habitat conservation and give recommendations for future management of the mining sites.

MATERIALS AND METHODS

Study Area

The study was carried out in the Blansky les Mts (southwestern Czech Republic), a part of the Sumava Mts chain. It is a submountain area (max. altitude: Klet Mt., 1084 m) formed by rolling slopes and shallow valleys. It is mainly covered by beech forests and spruce plantations, interspersed by fields, pastures and small villages. Prevailing substrate is granulite, but there are a few limestone outcrops in the south. The climate is cold to moderately warm (range of average temperatures is 4·7–7°C), but relatively mild for the altitude owing to shielding by higher parts of the Sumava Mts. The precipitation is 560–720 mm (Albrecht, 2003).

Spiders were sampled at six localities, three quarries and three adjoining seminatural xerothermic localities (herein ‘seminatural’), paired with the quarries. In the list below, each quarry is followed by its adjoining seminatural locality.

Vysny (quarry, excavation terminated in 1993; 48° 50′ N, 14° 18′ E; 570 m a.s.l.; limestone substrate; area 5 ha).

Vysenske kopce (seminatural, a nature reserve of former pastures; 48° 49′ N, 14° 18′ E; 570 m a.s.l.; limestone; 5 ha).

Plesovice (quarry, operating; 48° 52′ N, 14° 21′ E; granulite substrate; 520 m a.s.l.; 21 ha).

Trisov (seminatural, a warm sheltered plateau; 48° 53′ N, 14° 21′ E; 520 m a.s.l.; granulite; 0·5 ha).

Zrcadlova hut (quarry, excavation discontinued in 2000; 48° 53′ N, 14° 14′ E; 650 m a.s.l.; granulite; 12 ha).

Na Strazi (seminatural, a nature reserve of former pastures; 48° 56′ N, 14° 14′ E; 570 m a.s.l.; granulite; 3 ha).

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Sampling

Three distinct successional habitats were studied in each quarry: rocky walls, herbaceous stage and scrub. This design was chosen assuming that succession in the quarries would eventually lead either to herbaceous or woody stages, depending on local topography (Wheater and Cullen, 1997; Wiegleb and Felinks, 2001). Only herbaceous and scrubby habitats were sampled in seminatural localities, as there were no walls present. Four pitfall traps were exposed in each of the habitats from May to September; to obtain comparable size of samples, we used eight instead of four traps in the herbaceous habitats outside of the quarries. Special hanging desk traps (Ruzicka, 2000) were used on the rocky walls, whereas plastic cups (9 cm in diameter and 15 cm deep, containing a killing and preserving solution of 5 per cent formaldehyde) were used for grasslands and scrub.

Nomenclature and the conservation status of individual species follow Buchar and Ruzicka (2002).

Species Richness

We used ANOVA to compare numbers of species between localities, as well as with respect to locality *character* (quarry vs. seminatural), *substrate* (granulite vs. limestone) and *habitat* (herbaceous vs. scrubby vs. rocky wall). *Post-hoc* multiple comparisons were performed using the Spjotvoll–Stoline test (i.e. HSD test for unequal *N*). Numbers of endangered species were compared using the non-parametric Kruskal–Wallis test. All tests were conducted using Statistica 6·0.

Life History Traits

Life history traits of individual species, as summarised for Czech spiders in the atlas by Buchar and Ruzicka (2002), were used to compare samples from different conditions. We considered species *mean altitude* (i.e. average of all records in the country), their *distribution extent* (sum of occupied grid squares in the country), *disturbance level* of habitat (increasing from artificial to disturbed, seminatural and climax), *humidity* (very dry, dry, semihumid, humid, very humid) and *light* (dark, shaded, partly shaded, semiopen, open) requirements. Average values of these traits were computed per (i) trap and species and (ii) trap and individual and then ran ANOVAs comparing these traits with respect to locality *character* (quarry vs. seminatural), *substrate* (granulite vs. limestone) and *habitat* (three categories: herbaceous, scrubby, rocky walls). While mean altitude and distribution extent are numeric variables, the others were treated as ranked variables in analyses; we used middle value of the ranks for species classified to >1 category in the Atlas.

Ordination of Species Composition

Species composition was analysed using Canonical correspondence analysis (CCA), a technique that relates species composition of samples to external 'environmental' predictors, and tests for significance of ordinations using the Monte Carlo permutation (999 permutations per analysis), in CANOCO for Windows 4·5 (ter Braak and Smilauer, 1998). The permutation tests were run with reflecting temporal and spatial distribution of catches: five catches per trap were treated as a time series, using split-plot permutation design for repeated sampling. In all analyses, we used log-transformed species data and used the downweighting of rare species option. Empty cells in the data matrix (zero catches) would preclude a use of the split-plot design, we added a small value (0·0001) to each data matrix cell.

RESULTS

We captured and identified 3029 adult individuals of 132 species. Five species (*Lasiargus hirsutus* (Menge, 1869), *Micaria formicaria* (Sundevall, 1831), *Phrurolithus minimus* (C. L. Koch, 1839), *Panamomops affinis* (Miller and Kratochvíl, 1939), *Sitticus distinguendus* (Simon, 1868)) are considered endangered in the Czech Republic; all of them are species of xerotermic open and/or scrubby habitats. Complete species lists were published separately in Tropek (2007).

Table I. Dependence of spider life history traits on environmental factors. 'Direction' stands for categories that are significantly different (assessed by Spjotvoll–Stoline tests for unequal N)

	df	Individuals			Species		
		F	p	Direction	F	p	Direction
Character							
Disturbance level	1	1·69	n.s.	—	11·09	**	sn > q
Altitude	1	3·84	n.s.	—	5·02	*	sn > q
Light	1	26·61	**	q > sn	22·94	**	q > sn
Distribution extent	1	42·93	**	sn > q	7·55	*	sn > q
Humidity	1	0·01	n.s.	—	0·10	n.s.	—
Substrate							
Disturbance level	1	6·58	*	g < l	2·32	n.s.	—
Altitude	1	0·19	n.s.	—	1·40	n.s.	—
Humidity	1	1·06	n.s.	—	0·07	n.s.	—
Light	1	0·18	n.s.	—	0·01	n.s.	—
Distribution extent	1	1·35	n.s.	—	0·37	n.s.	—
Habitat							
Disturbance level	2	4·19	*	h > w > sc	0·42	n.s.	—
Altitude	2	4·24	*	sc > w = h	2·48	n.s.	—
Humidity	2	3·24	*	sc = h > w	0·51	n.s.	—
Light	2	13·56	**	h = w > sc	13·44	**	w = h > sc
Distribution extent	2	2·51	n.s.	–	1·58	n.s.	—

Character: q, quarry; sn, seminatural; Substrate: g, granulite; l, limestone; Habitat: sc, scrubby; h, herbaceous; w, rocky wall. Statistical tests: n.s. $p > 0{\cdot}05$; $^{*}p \leq 0{\cdot}05$; $^{**}p \leq 0{\cdot}001$.

Species Richness

Fewer species ($F = 51{\cdot}96$, 1 df, $p < 0{\cdot}001$) and fewer endangered species ($H = 3{\cdot}84$, $p < 0{\cdot}05$) were found in the quarries than in the seminatural localities (Table I). Individual localities differed in richness per trap ($F = 19{\cdot}63$, 5 df, $p < 0{\cdot}001$, endangered: $H = 16{\cdot}05$, $p < 0{\cdot}05$). The lowest richness occurred in the two granulite quarries, while the highest for the seminatural locality Trisov; the richness of the Vysny limestone quarry was similar to the seminatural localities (Figure 1). The seminatural locality Trisov contained considerably more endangered species than the remaining localities. Substrate had no significant effect (all: $F = 0{\cdot}13$, 1 df, $p > 0{\cdot}1$; endangered: $H = 1{\cdot}92$, $p > 0{\cdot}1$). The richest habitats were the herbaceous stages, followed by scrubby and rocky walls ($F = 19{\cdot}15$, 2 df, $p > 0{\cdot}1$). No habitat pattern was applied for endangered species ($H = 0{\cdot}84$, $p > 0{\cdot}1$).

Life History Traits

Table II summarises tests comparing average life history traits of species found in the samples. Patterns for analyses with species and individuals were similar. Samples from the quarries contained more species characteristic of disturbed and open habitats and more species with limited distribution extent. Captures from scrubby habitats contained more species characteristic of undisturbed, cold (=higher altitude) and dark conditions, whereas species characteristic of more open habitats prevailed in samples from herbaceous habitats and rocky walls. Substrate had no effect on average species traits.

Ordinations

The ordination of all samples localities (Figure 2) separated quarries from seminatural localities; a practically identical pattern occurred in an ordination distinguishing between quarries and seminatural localities (not shown).

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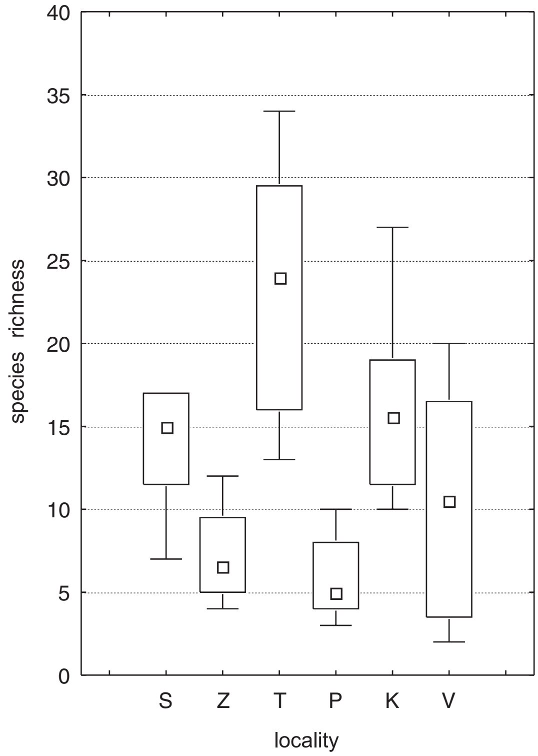

Figure 1. Species richness of spiders sampled in three quarries and three adjoining seminatural localities in the Blansky les Mts area, southwestern Czech Republic. Median numbers per trap and whole season plus 25–75 per cent quartiles and ranges are shown. The letters denote names of the localities: S, Na Strazi, seminatural; Zrcadlova hut, quarry; T, Trisov, seminatural; P, Plesovice, quarry; K, Vysenske kopce, seminatural; V, Vysny, quarry.

The gradient on the second ordination axis was shorter for the quarries than for the seminatural localities, suggesting that spider assemblages inhabiting quarries were more homogeneous. Spiders associated with quarries consisted of species of disturbed and/or early successional habitats (e.g. *Hahnia nava, Meioneta rurestis, Oedothorax apicatus*), while those associated with seminatural localities consisted of some xerophilous species (e.g. *Xysticus robustus, Zelotes electus, Zodarion germanicum*), some woodland species (e.g. *Coelotes terrestris,*

Table II. Results of the canonical correspondence analyses (CCA) of the composition of spider assemblages inhabiting quarries and adjoining seminatural localities in the Blansky les Mts area, southwestern Czech Republic

Explanatory variable	Total variation	Explained variation	Eigenvalues		F	p
			1st axis	2nd axis		
All samples						
Character	16·74	0·37	0·37	0·81	8·16	**
Locality	16·74	1·06	0·38	0·33	8·24	**
Quarries only						
Habitat	19·57	0·40	0·25	0·15	1·87	**
Substrate	19·57	0·32	0·32	0·93	2·95	**
Locality	19·57	0·46	0·33	0·13	3·01	**

See 'Materials and Methods' for descriptions of explanatory variables. P: Monte-Carlo permutation test (999 permutations): ** $p = 0{\cdot}001$.

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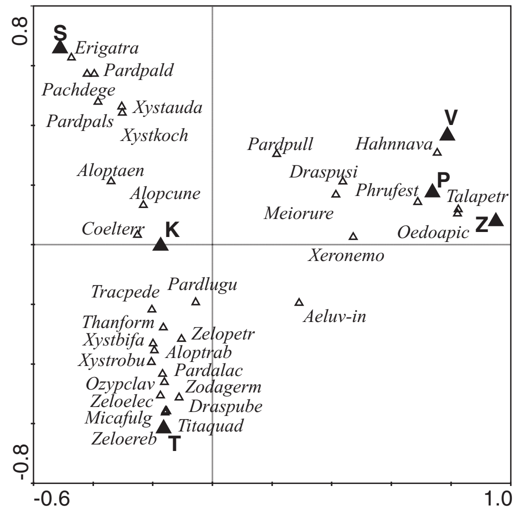

Figure 2. Results of canonical correspondence analysis (CCA) showing distribution of spider species in individual study localities, all samples analysis. Only species having the highest fit to the ordination model (more than four per cent) are shown. The letters denote names of the localities: S, Na Strazi, seminatural; Zrcadlova hut, quarry; T, Trisov, seminatural; P, Plesovice, quarry; K, Vysenske kopce, seminatural; V, Vysny, quarry. See Appendix for abbreviations of spider species names.

Haplodrassus silvestris, Histopona torpida) and some widespread generalists (e.g. *Leptyphantes flavipes, Pachygnatha degeeri, Xysticus kochi*).

If only habitats within the quarries were considered in the ordination (Figure 3), samples from herbaceous habitats consisted of both xerophilous (*Alopecosa aculeata, Tricca lutetiana, Trochosa robusta*) and generalist (e.g. *O. apicatus, Pardosa palustris, Xysticus cristatus*) species, those from walls consisted of a few rocky habitats specialists (e.g. *Pholcus opilionoides, Salticus* scenicus, *S. distinguendus*) and those from scrub contained a few forest species (*Haplodrassus umbratilis, Pardosa lugubris, Tegenaria silvestris*) and species of open habitats

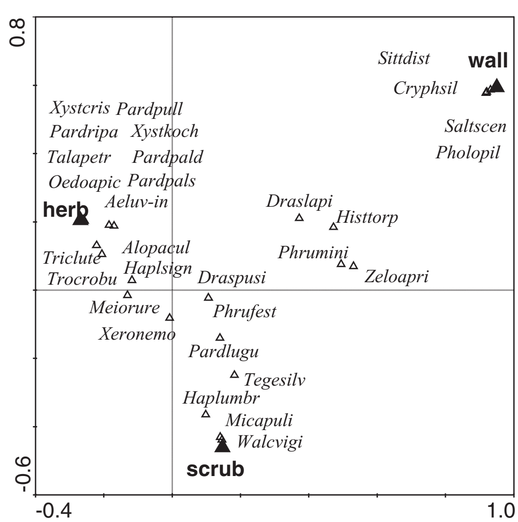

Figure 3. Results of CCA showing distribution of spider species in individual habitats, quarries only analysis. Only species having the highest fit to the ordination model (more than 2 per cent) are shown. The letters denote habitats: H, herbaceous stage, S, scrub, W, rocky wall. See Appendix for abbreviations of spider species names.

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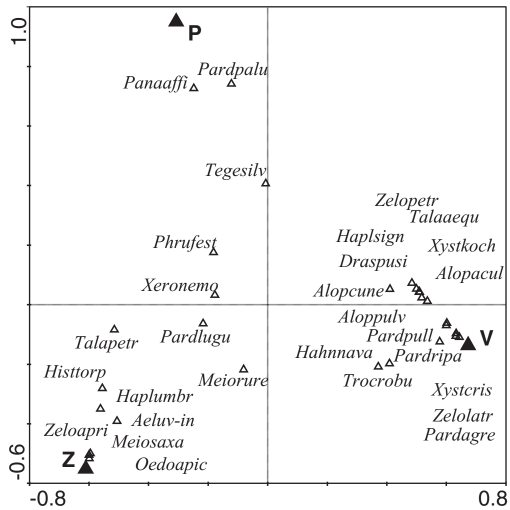

Figure 4. Results of CCA showing distribution of spider species in individual quarries, quarries only analysis. Only species having the highest fit to the ordination model (more than two per cent) are shown. The letters denote habitats: H, herbaceous stages; S, scrub; W, rocky wall. See Appendix for abbreviations of spider species names.

(*Micaria pulicaria, Walckenaeria vigilax*). In the ordination of quarries (Figure 4), the first axis distinguished between the substrates, granulite and limestone. Two groups of species were visible; (i) acidophilic (e.g. *P. affinis, Phrurolithus festivus, Talavera petrensis*) and (ii) basophilic (e.g. *Pardosa riparia, Talavera aequipes, T. robusta*).

DISCUSSION

Our results suggest that species richness of spiders inhabiting excavated quarries becomes similar to that of adjoining undisturbed seminatural habitats within a decade. The operating Plesovice quarry hosted the lowest number of species, whereas Vysny quarry, abandoned for 11 years, was even close to the richness of the Na Strazi grasslands. Although the latter quarry differed from the remaining two quarries in substrate, substrate did not influence species richness at all. This rapid colonisation agrees with results of other authors studying successional patterns in spiders (Simmonds *et al*., 1994; Ruzicka and Hejkal, 1997; Mrzljak and Wiegleb, 2000) and other animal groups (Nichols and Burrows, 1985; Wanner and Dunger, 2002; Nichols and Nichols, 2003; Broring and Wiegleb, 2005). The pattern of colonisation seems to be related to the successional development of vegetation (Bell *et al*., 1998; Mrzljak and Wiegleb, 2000; Wheater *et al*., 2000): the highest spider richness was found in scrubby habitats, whereas rocky walls exhibited the lowest richness. The importance of vegetation seemingly contradicts the observation that spider richness was not affected by substrate, because substrate obviously affects plant species composition (Cattelino *et al*., 1979; Glennlewin, 1980). However, spiders as predatory animals do not depend directly on the presence of particular plant species, but rather on such structural features as vegetation height, cover of vertical layers or presence of open ground (Scheidler, 1990; Mrzljak and Wiegleb, 2000). These features may be quite similar at sites of similar successional age, despite differences in bedrock. Still, we detected some differences attributable to substrate, but these were manifested at the level of species composition (i.e. in ordinations) rather than on the level of species richness.

The quarries contained, on average, fewer species than the seminatural localities. Additionally, the ordination analyses revealed that the assemblages inhabiting the quarries were more homogeneous than those found in seminatural localities, perhaps due to a limited pool of regionally occurring species able to exploit early successional conditions (Leps and Rejmanek, 1991; Prach *et al*., 1997). Species associated with woodlands were completely absent from the quarries, although all three quarries directly adjoined some forest. Still, the quarries hosted three endangered species, two of which were exclusive for the quarries. Additionally, several species

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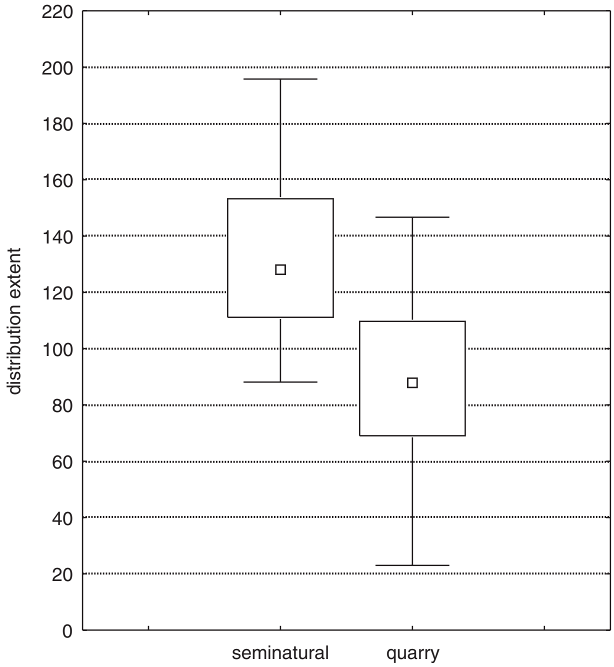

Figure 5. Mean distribution (number of grid atlas cells) of spiders captured in quarries and in adjoining seminatural habitats (ANOVA, $F = 42{\cdot}93$, $p < 0{\cdot}001$). The values are distribution extents of individual species computed per individual captured. Median numbers per trap and whole season plus 25–75 per cent quartiles and ranges are shown.

sampled in the quarries are regionally rare, or comprised first records for a wide region (Tropek, 2007). However, both endangered and regionally remarkable species were sampled outside of the quarries as well and two endangered species were exclusively found for seminatural localities.

Comparisons of ecological traits between species inhabiting quarries and seminatural localities revealed that the species from the quarries displayed traits expected in animals colonising early successional biotopes, such as preference for more open space and sparse vegetation. They also displayed, on average, a more restricted distribution in the Czech Republic (Figure 5). This is consistent with the decline of open, sparsely vegetated biotopes, increasingly lost from both rural and wooded landscapes (Thomas *et al*., 1994; Van Swaay, 2002). As a result, species depending on such conditions are rare in distribution atlases. This trend is apparent throughout Europe and has been demonstrated in such groups as butterflies (Benes *et al*., 2003; Wenzel *et al*., 2006), birds (Vickery *et al*., 2001; Atkinson *et al*., 2005) and higher plants (Fischer and Stocklin, 1997; Adriaens *et al*., 2006), but less so on such groups as spiders due to a lack of historical distributional data. It follows that the quarries indeed benefit a particular guild of early successional species.

The beneficial effects depend on the methods used for post-excavation quarry restoration. There are two contrasting options: traditional engineered reclamation and relying on spontaneous succession (Prach and Pysek, 2001; Elmasdottir *et al*., 2003). Several authors have shown that, immediately after abandonment, succession proceeds via colonisation by pioneer species independent of the restoration method used (Ruzicka and Hejkal, 1997; Mrzljak and Wiegleb, 2000; Prach *et al*., 2001). As succession proceeds, the fates of technically reclaimed and naturally restored quarries diverge. Engineered schemes traditionally used in the Czech Republic aim on creating biotopes similar to those dominant in the surrounding landscapes (e.g. woodland, meadow, crop field). As such, they are likely to be colonised by regionally common species (Haigh, 1992; Holl and Cairns, 1994; Holl, 1996; Kielhorn *et al*., 1999). In contrast, sites left to spontaneous succession attract species depending on more specific, regionally rare habitats, including such blocked successional stages as rock, scree or xerophilous grasslands (Schulz and Wiegleb, 2000; Hodacova and Prach, 2003; Holec and Frouz, 2005; Ottonetti *et al*., 2006).

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A third possibility is a combination of the options by directing natural processes towards development of habitats with a high conservation potential (e.g. Mattoni *et al*., 2000; Longcore, 2003). This approach seems as particularly suitable for situations where it is not acceptable to wait for long-lasting natural succession (e.g. areas disturbed by mining around cities) and for areas that lack remnant natural habitats that would provide propagule sources for spontaneous colonisation of restoration sites (cf. Novak and Konvicka, 2006). If selected, this strategy should avoid creating regionally common habitats and should focus on regionally rare or declining ones instead. In doing so, it should learn from patterns of spontaneous succession (Prach, 2003). In particular, spontaneously established vegetation tends to be highly heterogeneous, containing structures absent from intensively used landscapes. Unfortunately, this third option remains little used in the Czech Republic and elsewhere in Central Europe.

In the studied case, the quarries diversify the supply of early successsional open-ground habitats and hence provide habitats for specialised fauna, including some endangered species. Despite being situated in the cool piedmont and on acidic rock, they perform similarly to calcareous quarries in warm lowlands (e.g. Cullen *et al*., 1998; Benes *et al*., 2003). In contrast, agricultural or forestry reclamation, as well as other high-intensity uses (establishing damp fields, golf courses, etc.) would likely support only widespread species of regionally common biotopes. Far from advocating opening new quarries, this biodiversity potential of already existing sites should be pragmatically exploited, either by allowing spontaneous succession after closure of quarrying (a cheapest option), or by directing restoration operations towards habitats that are regionally rare. However, because the seminatural localities outside of quarries hosted a higher species richness, including some endangered species, and because the course of succession critically depends on rich sources of colonists (Novak and Konvicka, 2006; Rehounkova and Prach, 2006), preserving remnants of seminatural open habitats remains a high conservation priority.

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APPENDIX

Abbreviations of Scientific Names Used in Ordination Diagrams (Figures 2–4).

Aeluv-in, *Aelurillus v-insignitus* (Clerck, 1757); Alopacul, *A. aculeata* (Clerck, 1757); Alopcune, *Alopecosa cuneata* (Clerck, 1757); Aloppulv, *Alopecosa pulverulenta* (Clerck, 1757); Aloptaen, *Alopecosa taeniata* (C. L. Koch, 1835); Aloptrab, *Alopecosa trabalis* (Clerck, 1757); Coelterr, *C. terrestris* (Wider, 1834); Cryphsil, *Cryphoeca silvicola* (C. L. Koch, 1834); Draslapi, *Drassodes lapidosus* (Walckenaer, 1802); Draspube, *Drassodes pubescens* (Thorell, 1856); Draspusiv, *Drassyllus pusillus* (C. L. Koch, 1833); Erigatra, *Erigone atra* (Blackwall, 1833); Hahnnava, *H. nava* (Blackwall, 1841); Haplsign, *Haplodrassus signifer* (C. L. Koch, 1839); Haplumbr, *H. umbratilis* (L. Koch, 1866); Histtorp, *H. torpida* (C. L. Koch, 1834); Meiorure, *Meioneta rurestris* (C. L. Koch, 1836); Meiosaxa, *Meioneta saxatilis* (Blackwall, 1844); Micafulg, *Micaria fulgens* (Walckenaer, 1802); Micapuli, *M. pulicaria* (Sundevall, 1831); Oedoapic, *O. apicatus* (Blackwall, 1850); Ozypclav, *Ozyptila claveata* (Walckenaer, 1837); Pachdege, *P. degeeri* (Sundevall, 1830); Panaaffi, *P. affinis* (Miller et Kratochvíl, 1939); Pardagre, *Pardosa agrestis* (Westring, 1861); Pardalac, *Pardosa alacris* (C. L. Koch, 1833); Pardlugu, *P. lugubris* (Walckenaer, 1802); Pardpald, *Pardosa paludicola* (Clerck, 1757); Pardpals, *Pardosa palustris* (Linné, 1758); Pardpull, *Pardosa pullata* (Clerck, 1757); Pardripa, *P. riparia* (C. L. Koch, 1833); Pholopil, *P. opilionoides* (Schrank, 1781); Phrufest, *P. festivus* (C. L. Koch, 1835); Phrumini, *P. minimus* (C. L. Koch, 1839); Saltscen, *S. scenicus* (Clerck, 1757); Sittdist, *S. distinguendus* (Simon, 1868); Talaaequ, *T. aequipes* (O. P.-Cambridge, 1871); Talapetr, *T. petrensis* (C. L. Koch, 1837); Tegesilv, *T. silvestris* (L. Koch, 1872); Thanform, *Thanatus formicinus* (Clerck, 1757); Titaquad, *Titanoeca quadriguttata* (Hahn, 1833); Tracpede, *Trachyzelotes pedestris* (C. L. Koch, 1837); Triclute, *T. lutetiana* (Simon, 1876); Trocrobu, *T. robusta* (Simon, 1876); Walcvigi, *W. vigilax* (Blackwall, 1853); Xeronemo, *Xerolycosa nemoralis* (Westring, 1861); Xystauda, *Xysticus audax* (Schrank, 1803); Xystbifa, *Xysticus bifasciatus* (C. L. Koch, 1837); Xystcrist, *X. cristatus* (Clerck, 1757); Xystkoch, *X. kochi* (Thorell, 1872); Xystrobu, *X. robustus* (Hahn, 1832); Zeloapri, *Zelotes apricorum* (L. Koch, 1876); Zeloelec, *Z. electus* (C. L. Koch, 1839); Zeloereb, *Zelotes erebeus* (Thorell, 1871); Zelolatr, *Zelotes latreillei* (Simon, 1878); Zelopetr, *Zelotes petrensis* (C. L. Koch, 1839); Zodagerm, *Z. germanicum* (C. L. Koch, 1837).