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Dynamic processes as a key factor for biodiversity? A zoological case study in the largest rockslip area of the Eastern Alps

(Dobratsch, Austria; Arachnida: Araneae, Opiliones, Scorpiones; Insecta: Coleoptera)

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Abstract

The calcareous, protected rockslip area "Schütt" at the Dobratsch mountain impresses with its remarkable landscape, marks a striking zoogeographical borderline and is one of the most important biodiversity hot-spots in Austria. Beside its geographical position inside the endemic-rich Southern Alps it is the dynamic processes which provide this long-term-habitat to enhance the richness of invertebrate fauna in this area.

Taking the long view, the southern part of the Dobratsch mountain in the Eastern Gailtal Alps in Carinthia, Austria was formed by two great rockslip events: a prehistoric one at the end of the last glaciation period and later by the greatest historical landslip of the Eastern Alps in January 1348.

The Schütt-area features the only Austrian locality with two scorpion species occurring sympatrically, *Euscorpius germanus* and *E. tergestinus*. The rare harvestmen species *Carinostoma carinatum* and *Leiobunum roseum* can there be found in what are probably the biggest national populations. Selected examples of a remarkable heliophilic and thermophilic spider fauna of the vegetation free rock debris include the salticid *Philaeus chrysops*. Piny, open screes of the Natura-2000-sites "Schütt-Graschelitzen" and "Villacher Alpe (Dobratsch)" are further characterised by large-dimensioned, sunlit deadwood structures. They promote the occurrence of rare and endangered Urwald-relict buprestids like *Buprestis novemmaculata* and *Dicerca moesta*, a xerothermophilic, Southeast European faunal element. The present national distribution of the very rare *Buprestis splendens* – protected by the Habitats Directive – is restricted to a single site in the screes of this rockslide area.

The key to this zoological diversity and the aggregation of remarkable, rare and endangered species is the high dynamics – on the one hand in the giant rock debris reaching downhill to the valley bottom and on the other hand creating plenty of deadwood inside the natural forests of the Dobratsch. Future nature protection activities should be based on the knowledge of the positive impact of natural dynamics in contrast to the degradation effects of timber harvest in this unique area.

Key-Words

screes, deadwood, succession, protected area, FFH-directive, Urwald relict species, xylobiotic insects, arachnids, Buprestidae, *Buprestis splendens*, Carinthia, Schütt

Introduction

„The role of dynamics and stochasticity in ecological systems has long been neglected.“
PLACHTER & REICH (1998)

In Central Europe, and especially in the Alps, dynamic processes are quite diverse: landslides, inundations, avalanches, fires and windfall occur at very low frequencies and are spatially unpredictable. Humans see them as catastrophes, particularly as the cultural landscape spreads rampantly into free natural space. They are being combated and much money and energy is spent for their prevention. The last refuges of unhindered dynamic processes are found inside some restricted areas such as nature reserves and national parks. Despite several categories of nature protection, and decades of effort by the Natura-2000 network of the European Union, unspoiled near-natural river landscapes with dynamic gravel banks and flood-plain forests – reaching from the glaciers down to the large rivers – avalanche tracks, and other erosion areas including rockslip areas, screes and windthrow areas are deficiency habitat types. This lack of understanding of uncontrollable processes in our tamed landscapes is mirrored in the states of endangerment in these habitat types in Austria and Carinthia; the above mentioned biotope types are all regarded either as threatened by complete destruction or as endangered (PETUTSCHNIG 1998, ESSL & EGGER 2010, KEUSCH et al. 2010). However, even nature conservation strategies still seek to protect and "freeze" conditions in an "optimal" state (PLACHTER 1996).

Which Carinthian Natura-2000 sites now offers generous possibilities for dynamic processes? These are the Hohe Tauern National Park, the Wolayersee and its surroundings, the Inner Pöllatal, the Vellacher Kotschna, the Upper Drau, the Gail in the Lesachtal, the Lower Lavant, the Reifnitzbach and particularly our investigation area the Schütt-Graschelitzen and Villacher Alpe (Dobratsch) – altogether making up about 4.6 % of the country's territory (cf. GUTLEB et al. 2000, PETUTSCHNIG et al. 2002). Even Natura-2000-sites offer no guaranteed protection of dynamic processes, as the protection depends on the presence of listed animal- or plant species, or habitat types.

In particular dealpine dynamic processes, at lower altitudinal zones, are barely tolerated. Rare exceptions are small parts of the Lower Vellach near its entry into the Drau river (EGGER et al. 2002, KOMPOSCH 2009a) and the Gail in the Lesachtal.

Figure 1: The Dobratsch (Villacher Alpe, 2166 m) south face provides a mosaic of different habitat types including numerous heat islands. View of the screes northeast of Nötsch. (Photo: S. Aurenhammer/ ÖKOTEAM)

The Schütt, which is located on the southern slope of the Dobratsch (Villacher Alpe), is the largest dealpine rockslide area featuring unhindered dynamic processes (fig. 1). It is characterized by massive rock faces and steep screes. Two Natura-2000-sites, namely "Schütt-Graschelitzen" (AT2120000) and "Villacher Alpe (Dobratsch)" (AT2112000) extend over the rockslide area.

The present survey aims at a description of the dynamic processes affecting the Schütt, and relates their impact to the rockslide area's habitat structure and qualities. From this perspective, the occurrence of notable, rare or endangered arthropod taxa, including arachnids and xylobiotics, is discussed with particular focus on their habitat requirements and dependency on dynamic processes. This approach should promote the study of dynamics in terms of generating biodiversity and addresses the issue from the perspective of nature conservation.

Description of the study area and reflections on the zoological research

Formation

The rockslip area Schütt (fig. 1) is located on the southern slope of the Dobratsch (Villacher Alpe, 2166 m) in the Gailtal Alps; part of the Southern Alps. Geomorphologically the Schütt consists of fragmented limestone that covers an area of 13 km x 1.5 km. It extends from Saak in the west to Unterschütt in the east. Two rockslip events were essentially involved in the geomorphologic formation of this region, which is located directly on the Periadriatic Seam.

A prehistoric rockslip event most likely resulted from the destabilization of the mountain's southern face caused by the regression of the Gail-glacier after the last (i.e. Würm) ice-age. Hence the Gailtal was filled with 170 million m^3 of crashed down rocks which lifted its altitudinal level for about 100 meters. The old parts of the Schütt (Alte Schütt) are characterized by huge rocks of limestone and debris of various grain sizes filling the rock holes. A vegetated, water-holding humus layer now covers larger parts the weathered boulders.
Both geological and meteorological conditions were responsible for the second rockslip event in 1348 AD. Periods of heavy precipitation (1000 mm) and temperature extremes promoted further destabilization of the rock faces. On the 25^{th} of January a strong earthquake triggered the largest historical rock slide in the Eastern Alps. 30 million m^3 of rock crashed down, covered an area of 2 km^2 and raised the young parts of the Schütt (Junge Schütt) (TILL 1907, NEUMANN D. 1988, NEUMANN W. 1988, KRAINER 1998). The greyish limestone rubble fans out over the Alte Schütt and features a structure with numerous gaps and spaces. Large parts of the rockslide area are devoid of humus and vegetation (fig. 2).

Succession

Botanically, the Schütt can be characterized as a remarkably patchy biotope, as a complex of numerous small plant communities forming a mosaic of different habitats. The knowledge of dynamic processes in phytosociology is based on the observations of AICHINGER (1951). Referring to the harsh environmental conditions, he pointed out that under such circumstances competition phenomena get suppressed by the individual struggle for survival. He defined this biotope as a "complete mix-up" ("völliges Durcheinander") of different plant species and described the succession of different plant communities in the Schütt.

Figure 2: Rock habitats of the southern slope of the Dobratsch: Urwald SE Rote Wand (top left), "Paradies"/ Kanzel NE Nötsch (top right), Tscheltschnigkogel, slope near Egger Loch-cave (bottom left) and S Geklobene Wand (bottom right). (Photos: Ch. Komposch/ ÖKOTEAM)

The pioneer species *Dryas octopetala* is one of the first species rooting in what little soil is available on the screes without vegetation. Once it covers the harsh bedrock, it gradually gets replaced by *Erica carnea*. Thick covers of *E. carnea* then promote an accumulation of humus and enhance the water absorption capacity of the ground. This is the basis for the first trees to take root in the rocky, dynamic substrate. *Pinus sylvestris* and *P. nigra* are the dominant tree species of the rockslide area's screes. As discussed below, this habitat type has a key role in the occurrence of rare and endangered arthropod taxa. *Picea abies* colonizes the piny biotopes under the condition of sufficient water supply. This again increases the water-absorbing humus layer and allows deciduous tree species to succeed. The southern slope of the Dobratsch is characterised by various Mediterranean-Illyrian floral elements like *Fraxinus ornus, Ostrya carpinifolia* and *Pinus nigra* (PICHORNER 1998).

Zoological research on the Schütt has a long tradition. Already in the second half of the 19th century zoologists began to investigate its fauna (REUTER 1875, HOLDHAUS & PROSSEN 1900, SCHATZMAYR 1908). In 1935, a new species of Palpigradi, *Eukoenenia austriaca stinyi*, was described from the Eggerloch; which is part of the mountain's distinctive cave system (STROUHAL 1936). Fifty years later came the description of two new species of theridiid spiders, living in the screes of the Tscheltschnigkogel (THALER & STEINBERGER 1988). Until today, various zoological investigations have been made in the dynamic habitats of the rockslide area. These include, for example, the study of a subterranean trap in the rock fields of the Steinernes Meer (SCHLICK-STEINER & STEINER 2000), a long-term population study on the troglophilous carabid beetle *Laemostenus schreibersii* (Rusdea 1992) as well as numerous zoological investigations by the ÖKOTEAM (e.g. KOMPOSCH 1997, 2004, KOMPOSCH et al. 1998, HOLZINGER 2002, FRIEß 2001).

Figure 3: Methods: sweep netting with a 6 m stick (left) and an air eclector on a dead pine at the site Urwald SE Rote Wand (right). (Photos: Ch. Komposch/ ÖKOTEAM)

Material and Methods

The current zoological investigations are based on two projects: (1) a masters thesis dealing with coenoses of xylobiotic beetles, and (2) a broader zoological monitoring project in the Natura-2000 sites "Schütt-

Graschelitzen" and "Villacher Alpe (Dobratsch)", carried out by the ÖKOTEAM – Institute for Animal Ecology and Landscape Planning. The fieldwork extended – beside dozens of visits within the last 15 years at least – over 24 days (75 person-days) in 2012, spread over a 4 month period from May till mid-September. In total, 64 sample sites were investigated so far – mostly during daytime, partially at night – including the following methods: hand collecting (hc), beating of vegetation (bt), air eclectors (ecl) (15 qty., mid-July till mid-September, fig. 3), sweep net (sn, fig. 3), sieve (sv) and collecting deadwood (co) marked with exit holes. Spiders, scorpions, harvestmen, true bugs, leaf and plant hoppers and beetles were collected and transferred into ethanol or ethyl acetate.

Results

The biotopes of the rockslip area Schütt are affected by two types of dynamic processes. First, it needs to be mentioned that, up to now, two heavy rockslide events were responsible for the formation of the area and its rigorous modern characteristics. Second, we find that current dynamics permanently and continuously impinge on the steep and rocky biotopes. To these belong rockfall and the constant movement of fine debris. The Schütt now provides habitats for highly specialised arthropod coenoses that managed to adapt to the permanent dynamics and their impacts on the biotope. Initially, spider and scorpion species depending either on rock faces or the gap-rich structure of the screes are presented. Thereafter the focus shifts on xylobiotic coenoses depending on the presence of deadwood in the area's open pine stands.

Figure 4: Arachnids I: *Euscorpius germanus* (top left), *Carinostoma carinatum* (top right), *Leiobunum roseum* (bottom left) and *Megabunus armatus* (bottom right).
(Photos: Ch. Komposch/ ÖKOTEAM)

<u>Rock and scree species</u>

The rocky habitats of the Dobratsch and Schütt area are considered to be the most interesting for the arachnid fauna. Therefore our investigations over the years concentrated on the calcareous rocks, *Pinus*- and *Erica*-covered tali, moved tali, caves and gravel banks from the Alpine zone down to the Gail River.

On the rock faces of the Dobratsch summit (46°36'N, 13°40'E, 2150 m, 19.7.2011, H. Komposch & E. Hoffmann leg.) we successfully recorded the harvestman *Megabunus armatus* (fig. 4), which is endemic to the Southern Calcareous Alps. Quite high abundances could be documented for the long-legged sclerosomatid *Leiobunum roseum* (fig. 4). Frequent occurrences include the sites Tscheltschnigkogel (Egger Loch), S Storfhöhe, S Geklobene Wand, Schütter Wald, Urwald SE Rote Wand, NE Nötsch and Kanzel NE Nötsch. Remarkable is the presence of the very rare nemastomatid *Carinostoma carinatum* (fig. 4), found for example at the site S Geklobene Wand.

It is beyond the scope of this paper to mention the dozens of records of *Euscorpius germanus* (fig. 4) all over the investigated area; however unique was the discovery of *Euscorpius tergestinus* at the entrance of the Egger Loch cave at the Tscheltschnigkogel (46°35'N, 13°49'E, 550 m, 16.8.2012).

Selected examples of some remarkable spider species of the rock debris include the rare wolf spider *Pardosa pseudostrigillata* (fig. 6) at S Geklobene Wand. It shares the vegetation free rock debris and fine screes with the salticid *Philaeus chrysops* (fig. 6, e.g. Tscheltschnigkogel, S Geklobene Wand, NE Nötsch). Large calcareous blocks with some old pine trees in between are the habitat of the rare orb weaving spider *Araneus grossus* (fig. 6, NE Nötsch-dead-tree-line; 46°35'N, 13°38'E, 1050 m, 13.8.2012). Coming closer to the habitat's deadwood structures, the liocranid spider *Liocranum rutilans* (fig. 6) was found several times under the bark of dead trees (e. g. Schütter Wald, Urwald SE Rote Wand, NE Nötsch).

<u>Xylobiotic species</u>

During our zoological investigations in 2012, the occurrence of various rare and threatened jewel beetles (Buprestidae) was proven. These include *Dicerca moesta*, *Buprestis haemorrhoidalis*, *B. novemmaculata*, *B. octoguttata*, and *B. splendens* (figs. 5, 8).

Specimens were allocated as follows: *Dicerca moesta* (*n*=1; sites: S Geklobene Wand, 46°34'N, 13°46'E, 690 m; method: bt), *B. haemorrhoidalis* (*n*=11; S Geklobene Wand; N Nötsch, 46°35'N, 13°37'E, 670 m; NE Nötsch, 46°35'N, 13°38'E, 940 m; Storfhöhe S, 46°34'N, 13°47'E, 930 m; hc, ecl), *B. novemmaculata* (*n*=2; S Geklobene Wand; NE Nötsch; ecl.), *B. octoguttata* (*n*=10; S Geklobene Wand; NE Nötsch, Storfhöhe S; Schütter Wald, 46°34'N, 13°44'E, 600 m; hc).

The current occurrence of *Buprestis splendens* can be demonstrated by sightings and recent records (G. GAILBERGER, C. HOLZSCHUH, Ch. KOMPOSCH leg. et vid.). At least 6 individuals were recorded in the years 2008 to 2012 (fide C. HOLZSCHUH). The maximum number of individuals that could be observed during one day was 17 (G. GAILBERGER in litt.). All findings of *B. splendens* are, however, restricted to only one localised spot (1.5 ha) northeast of Nötsch (46°35'N, 13°38'E, 940 m).

All sites feature piny, open screes that are characterised by large-dimensioned, sunlit, and partly vertical deadwood structures (fig. 7).

Figure 5: Urwald relict buprestids *Dicerca moesta* (top left), *Buprestis haemorrhoidalis* (top right), *Buprestis octoguttata* (bottom left) and *Buprestis novemmaculata* (bottom right). (Photos: S. Aurenhammer & Ch. Komposch/ ÖKOTEAM)

Discussion

High biodiversity and faunistic and zoogeographic peculiarities caused by mosaic-like habitat complexes

The large rockslide events, followed by dynamic processes and the differentiation of various states of succession create rich structured habitat mosaics in theses extreme biotopes. The most conspicuous ones are the treeless rock debris and screes (fig. 2). These erosion areas offer unique environmental conditions for stenotopic, rare and endangered taxa with both thermophilic and cold-stenothermic ecological demands. Determining factors of these rockslip areas are, due to the dynamic processes over thousands of years, the presence of biotope complexes, a partly consistent lack of trees as well as the dominance of rocks and scree slopes. Further characteristics are structures like old deadwood, a high insolation, extremes of temperature on the surface, a stable temperature and humidity regime below, a lack of competition and the deficiency factor food supply.

The Schütt rockslip area provides heat islands, with suitable environmental conditions for thermophilic, heliophilous species that are normally considered to have more southern distributions. Examples among spiders include *Dysdera adriatica*, *Eresus moravicus*, *Steatoda phalerata*, *Theonoe sola*, *Araneus angulatus*, *Pardosa bifasciata*, *Tegenaria tridentina*, *Cheiracanthium punctorium*, *Zelotes exiguus*, *Xysticus bifasciatus* and *Pellenes tripunctatus*. At the same time, sometimes just a few metres away, different stages of succession and different strata offer quite contrasting environmental conditions for cold-stenothermic and hygrobiotic species or even glacial relicts.

The high species diversity is clearly based on the indicators mentioned above. The following example should emphasize the importance of this rockslip area as a hot-spot of biodiversity: up to now we know more than 300 spider species from the Schütt and Dobratsch area (KOMPOSCH 2013)! This represents 45 % of the recorded species for Carinthia (KOMPOSCH & STEINBERGER 1999, KOMPOSCH 2000, KOMPOSCH unpublished).

Similar findings are true for the rockslide area's fauna of xylobiotic beetles. The contiguous presence of different types of forest habitats, which results from the mosaic-like habitat structure of the area, allows the occurrence of species having different environmental requirements. On one side, the Schütt is characterized by xerothermophilic species like *Dicerca moesta*; a Southeast European faunal element (KAHLEN & PEEZ 1977). In Northern and Central Europe *Dicerca moesta* is only found rarely and sporadically (FREUDE et al. 1979). In Austria the buprestid was found more frequently near Vienna in the middle of the last century (POCHON 1964). HEISS (1971) mentions two records from 1954 and 1952 from Northern Tyrol. In Germany's Red List of Threatened Species it is rated as "critically endangered" (GEISER 1998); for South Tyrol (e.g. KAHLEN & PEEZ 1977) it is classified as "rare" (KAHLEN & HELLRIGL 1996).

On the other hand, the adjacent moist, near-natural forests are home to rare and endangered montane species. Not far from the open screes, the lucanid beetle *Sinodendron cylindricum* develops in the rotten wood of mixed-beech forests (e.g. BRECHTEL & KOSTENBADER 2002).

Figure 6: Arachnids II: *Araneus grossus* (top left), *Philaeus chrysops* (top right), *Liocranum rutilans* (bottom left) and *Pardosa pseudostrigillata* (bottom right). (Photos: Ch. Komposch/ ÖKOTEAM)

Helio- and Thermophily

On the ground surface, the treeless rocky habitat types with their high heat capacity lead to higher temperature sums and therefore provide suitable conditions for heliophilic and thermophilous arthropods. The presence of several southern, Mediterranean and Submediterranean species reflects these special microclimatic conditions.

The jewel beetle family generally includes many thermophilic species (BRECHTEL 2002). Buprestid taxa occurring in Central Europe are further known to be exceedingly heliophilic. Their larvae develop only in (at least partially) sunlit deadwood; adults don't oviposit on shaded deadwood structures (ZABRANSKY 1998). The major parts of the Schütt are located in a southern or south-western aspect. The steep, open, piny screes (*Pinus sylvestris, P. nigra*) are warm and sunny habitats – rarely found elsewhere in Austria – and provide ideal breeding conditions for helio- and thermophilic taxa (fig. 7).

The heliophilic and thermophilic jumping spider *Philaeus chrysops* (fig. 6), recently investigated by NATMESSNIG (2005), probably finds its largest nationwide population in the Schütt area. The current exclusive records of *Araneus grossus* (fig. 6) across all of Austria are three sites in Southern Carinthia, including the Dobratsch area and the nearby Kanzianiberg S Finkenstein (KOMPOSCH 2000, THALER & KNOFLACH 2003). Several species like the small soil inhabiting spider *Protoleptoneta italica* (STEINBERGER 1987, 1988, personal observations), the litter inhabiting nemastomatid *Carinostoma carinatum* (fig. 4), critically endangered in Austria (KOMPOSCH 2009b) or the thermophilic rock inhabiting harvestman *Leiobunum roseum* (fig. 4), subendemic to Austria (KOMPOSCH & GRUBER 2004, KOMPOSCH 2009c), reach their northern distribution limits in this part of the Gailtal Alps.

Examples for the insufficiently investigated cold-stenothermic fauna and cave fauna include the giant-eyed harvestman *Megabunus armatus* (fig. 4) and *Gyas annulatus*.

Deadwood

The recorded buprestid guild depends on the presence of deadwood. All species of the documented guild breed in conifers and need – as far as is known – several years of development, and are fastidious in the selection of the deadwood structures they inhabit. Adult beetles feed on the green needles of their host plants (preferably *Pinus* spp.), which is part of their gestation period. For their development they depend on large-dimensioned, sunlit deadwood structures (POCHON 1964, MÜHLE et al. 2000, BRECHTEL & KOSTENBADER 2002, HELLRIGL 2010). All buprestids of this guild count as so-called "Urwald relict species". They depend on a sufficient amount and certain quality of deadwood structures and hence indicate the habitat tradition and structural quality of forest habitats (SCHMIDL & BUßLER 2004, MÜLLER et al. 2005).

For example, *Buprestis splendens* preferably develops in decorticated, solid, large-dimensioned, vertical deadwood (ZABRANSKY 2004, PAILL & ZABRANSKY 2005, own observations). Over the past decades *Buprestis splendens* was considered extinct in Austria. The latest finding reached back to 1954 and came to a single individual from Styria (HORION 1955). However, in 2001 the species was rediscovered in the Schütt (ZABRANSKY 2004) and could be found there repeatedly since. *B. splendens* is under the protection of the Habitats Directive; its present nationwide distribution is restricted to a single site in the screes of the rockslide area (PAILL & ZABRANSKY 2005). In Germany's Red List of Threatened Species it is classified as "extinct". The other species of *Buprestis* included in this guild are either classified as "endangered" or "vulnerable" (GEISER 1998).

Figure 7: Pine trees die back from rock fall, remain at the fringes of the screes and turn into large-dimensioned, sunlit deadwood structures. Sample sites: NE Nötsch (left), "Paradies"/ Kanzel NE Nötsch (top right), Urwald SE Rote Wand (bottom right). (Photos: S. Aurenhammer/ ÖKOTEA)

Due to forestry use of most Central European woodlands, large-dimensioned deadwood structures have become restricted to very few patches of near-natural biotopes. However, a few steep, rocky screes of this rockslide area feature a remarkably high density of such structures. Damaged by rock fall, pine trees die back at the fringes of the screes and turn into ecologically important microhabitats, being of high value for nature conservation (fig 7). They are most significant for rare, xerothermophilic beetle species and provide the basis for zoological biodiversity (KLAUSNITZER 1996). Additionally, these steep, rocky pine stands are very difficult to access. So far they remained untapped by forestry which again allows the accumulation of deadwood.

The recorded guild of Urwald relict buprestids must be considered as representative of a rare, endangered, stenoecious fauna (cf. KLAUSNITZER 1996, SCHMIDL & BUßLER 2004, MÜLLER et al. 2005) that directly benefits from the dynamic processes in the rockslide area.

A tight habitat selection of arachnids to deadwood is rather rare. An example is the wolf spider *Acantholycosa lignaria*, recently discovered in the Gesäuse National Park (KOMPOSCH & HORAK 2011). However, a quite large spectrum of scorpions and spiders shows a significant preference for deadwood; especially for the crevices under bark. Examples mentioned are the two thermophilic spider species *Segestria bavarica* and *Liocranum rutilans*. Even after many years of collecting scorpions in the field, the high abundances of *Euscorpius germanus* observed were surprising. Spread all over the Schütt area, we could observe several hundred individuals during the day using the efficient method of pulling bark form dead trees.

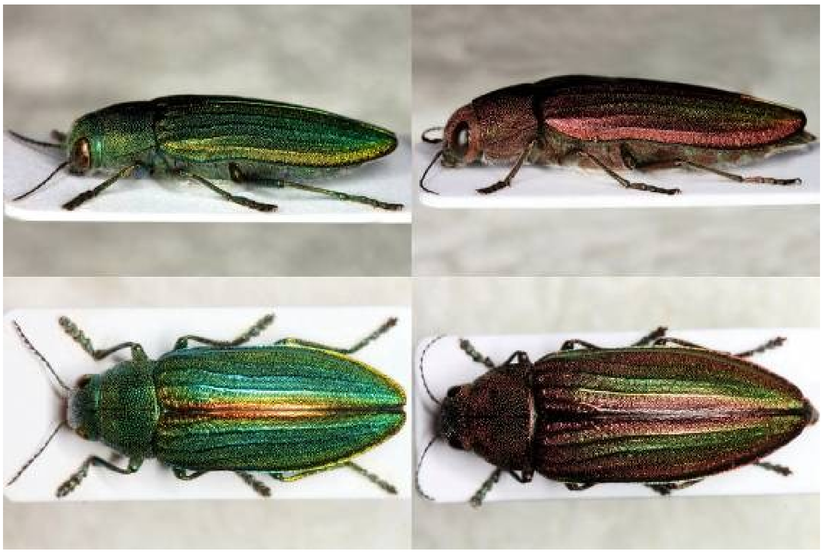

Figure 8: Lateral and dorsal view of two colour variants of *Buprestis splendens* belonging to the same population located northeast of Nötsch (Carinthia). (Photos: S. Aurenhammer/ ÖKOTEAM)

Conclusions

Recent results confirm that the rockslide area Schütt must be considered a national hot-spot of biodiversity. It is characterized by a mosaic of different habitat types and various threatened species and coenoses. Rare Urwald relict species develop in sunlit, large-dimensioned deadwood structures of the steep, piny screes. Although this habitat type widely remains unused by forestry and generally extends over considerable parts of the protected areas, large-dimensioned old and dead trees only occur locally and are generally sparse. The main parts of the Schütt are, however, either intensively or extensively cultivated by forestry. Protection concepts and management plans are necessary to sustainably protect the microhabitats of rare and endangered species in the Natura-2000-sites. In this context, dynamic processes are considered key factors of biodiversity and must be allowed to continue without hindrance to guarantee the maintenance of rare habitat types. Forestry use or the intensification of it is considered to be a threat to the region's forest habitats and sensitive coenosis living in there (compare KÖSTL et al. 2011). Continuous, scientific basic research and monitoring projects are strongly recommended for acquiring reliable information about the population dynamics of rare and endangered species and thus for the effective implementation of management plans. On the one hand, special attention should be paid to the crevice- and cave inhabitants by using pitfall traps – subterranean traps that should be located in the rock debris of all altitudinal zones, from the summit down to the Gail valley, in undercooled scree slopes or so called "ice-cellars" or "cold spots" – and hand collecting in caves. On the other hand, focus should be placed on xylobiotic Urwald relict species for their representation of a rare, endangered, stenoecious fauna and their dependence on scarce deadwood structures.

Figure 9: Negative impacts on the Schütt-area caused by forestry: clear-cut near Federaun (IX. 2012, top left), spruce plantation near Oberschütt (IX. 2012, top right), devastated karst source near Unterschütt (VI. 2012, bottom left) and timber-foresting near Nötsch/ Wasserleonburg (IX. 2012, bottom right). (Photos: Ch. Komposch/ ÖKOTEAM)

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