Ants (Hymenoptera, Formicidae) in alpine floodplains – ecological notes and conservation aspects

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Abstract

Ants (Hymenoptera, Formicidae) show a striking species richness in floodplain habitats of the Eastern Alps. The 87 ant species occurring in floodplain habitats represent 51 – 82% of the regional ant faunas. The percentage of threatened ant species, listed in regional red lists is high: 66 (76,7%) species are classified as threatened in at least one regional red list. These endangered species especially depend on dead wood and old trees, dynamic river banks, open xerothermic habitats and wetlands like bogs, fens and reeds. The number of ant species, which is restricted to riparian habitats is relatively low. The regional conservation status of these typical floodplain species in the Eastern Alps (Leptothorax gredleri, Manica rubida, Myrmica hellenica, Myrmica gallienii, Formica selysi, Formica cinerea, Formica fuscocinerea) is presented. The role of primary and secondary habitats in floodplains for ant conservation is discussed. Patterns and gradients of nest densities and species numbers in riparian habitats are summarized. In Central Europe maximal densities and species richness even of typical ripicolous ants are observed in elevated sites, and decrease in more frequently flooded, highly dynamic shore lines. Inundation risk, vegetation structure and the presence of open, sunny areas without or with scarce vegetation, dead wood and old trees are regarded as main factors determining species composition and densities of ants in floodplains. Implications for future river restoration activities are discussed.

Keywords: ants, Eastern Alps, river restoration, species richness, conservation, floodplain

Introduction

Semiterrestrial floodplain biotopes like shorelines, gravel banks and riverine forests generally represent important and diverse habitats for wildlife. Also ants (Hymenoptera, Formicidae) reach high densities and diversity in riverine habitats. In this paper I want to summarize results regarding species richness, distribution, densities and conservation efforts concerning ants in floodplains of the Eastern Alps.

The following aspects will be discussed:

1) The general importance of riverine habitats for the species richness and conservation of ant species in alpine regions. 2) Important environmental factors which influence the species composition of ant communities in riparian habitats and are crucial for the conservation of species richness and endangered ants species in floodplains. 3) Practical implications towards the management of alpine rivers, especially regarding restoration measures.

Methods

Faunistic information is predominantly based on own studies in North Tyrol (Austria) Inn and Lech (Glaser 2001, unpubl.), in SouthTyrol (Italy) Etsch (Glaser 2003, 2004, 2005a) and in Vorarlberg - Alfenz, Rhine (mouth into Lake Konstanz), Bregenzer Ache, river Ill (Glaser 2000, 2002, unpubl., Glaser et. al. 2003). Additional data from Dietrich & Ölzant (1998) for the river Ill (Vorarlberg), Weber (2003) for the Taugel (Salzburg), Ambach (1999) for Danube and Traun (Linz, Upper Austria), Schlick-Steiner & Steiner (1999, 2002) for Danube und Wien (Vienna, Lower Austria) and Lude et al. (1996, 1999) for the Isar (Bavaria, Germany) were evaluated. The influence of environmental factors was investigated in detail on the river Etsch (Glaser 2004, 2005b).

The Cluster Analysis was calculated using the program MVSP 3.0 (distance unit Sorensen´s Coefficient, clustering method UPGMA). Because of expectable changes in the taxonomy of *Tetramorium* in Central Europe (Steiner at al. 2002, Neumeyer & Seifert 2005, Schlick-Steiner & Steiner, pers. com.), *Tetramorium caespitum* and *T. impurum* are not distinguished and summarized as *Tetramorium* – Agg.. Also *Ponera corarctata* and *P. testacea* were not separated to evaluate even studies done before the revalidation by Czosh & Seifert (2003). The actual synonymization of *Myrmica microrubra* with its host species *M. rubra* by Steiner et al. (2005) is not yet considered for pragmatic reasons.

The role of riparian habitats in the conservation of endangered ant species is analysed in view of the data base for the Red list of the ants of Vorarlberg (Glaser 2005b).

Results

Species richness

87 ant species have been recorded in floodplain habitats of Austria and Southern Tyrol (Glaser 2004, Glaser 2005a). The percentage of the regional ant fauna occurring (also) in floodplain habitats ranges from 51 and 82% (Fig. 1). Differences between regions are mainly due to variation in investigation

intensity. The Austrian federal country Vorarlberg shows the highest number of ant species recorded in floodplains - 57 spp. (82% of the total fauna).

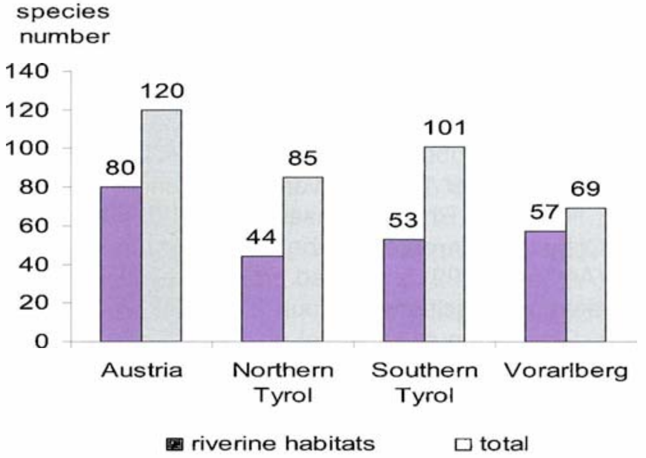

Fig. 1: Species numbers of ants (Hymenoptera, Formicidae) recorded in floodplain habitats in comparison with the species numbers of the total ant fauna of Austria, Northern Tyrol, Southern Tyrol and Vorarlberg

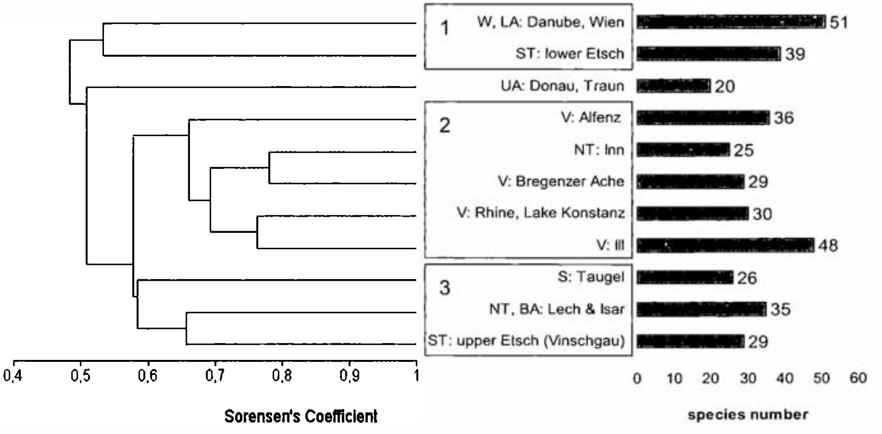

Fig. 2: Faunal similarity of the ant faunas of floodplains in the Eastern Alps on a qualitative level (Cluster analysis, distance unit Sorensen´s Coefficient, clustering method UPGMA) and total number of recorded ant species in different floodplains. Segregated groups 1, 2 and 3 in red rectangled frames. VI = Vienna, LA = Lower Austria, ST = Southern Tyrol (Italy), NT = Northern Tyrol, VO = Vorarlberg, SB = Salzburg, BA = Bavaria (Gemany). References in the text.

The highest numbers of species at a single river resp. river section were 48 spp. (Ill river and adjacent wetlands (Glaser et al. 2003 and unpubl.) and 52 spp. (Donau and Wien River in the surroundings of Vienna, calculated from Schlick-Steiner & Steiner (1999, 2002) (Fig. 2).

A cluster analysis of the species composition on a qualitative level by the Sorensen Coefficient allows the segregation into three types of ant communities (Fig. 2, Glaser 2004): Group 1 contains the lower course of the Etsch river (Glaser 2004) and the Danube river in the surroundings of Vienna (Schlick-Steiner & Steiner 1999, 2002). The Inn river in Tyrol and the rivers in Vorarlberg (Bregenzer Ache, Ill, Alfenz, Rhine - Glaser 2000, 2002, unpubl.; Glaser et. al. 2003. Dietrich & Ölzant 1998) represent the second group 2. Danube and Traun in Upper Austria (Ambach 1999) is isolated probably by its relatively low species number, but shares most species with group 2. Taugel (Weber 2003), Lech and Isar (Glaser 2001, Glaser unpubl., Lude et al. 1996, 1999) and the upper Etsch (Glaser 2003, 2006, in press) form the last group.

Table 1 shows an actualized list of the ants occurring in flood plain habitats of the Eastern Alps (Glaser 2005, modified).

Endangered species

66 (77%) of the 87 ant species occurring in floodplain biotopes of the Eastern Alps are listed as threatened at least in one regional Red list (see table 1). The situation in Vorarlberg (Glaser 2005b) illustrates the role of riparian habitats for endangered ant species. In this region 27 spp. (50%) of the 57 ant species living in riparian habitats are endangered in different threat categories (Fig. 3). In comparison 37 spp. (54%) of the 69 ant species recorded in Vorarlberg are endangered. The threatened ant species in floodplains mainly depend on dead wood and old trees, dynamic river banks, open xerothermic habitats and wetlands like bogs, fens and reeds (Fig. 4). Not threatened species are typically unspecific woodland species or generalists.

Relatively few ant species are closely associated to riparian habitats (see also Glaser 2004). All these species (see below) are listed in the regional red data books (if available).

The small myrmicine ant *Leptothorax gredleri* seems to be restricted to riverine decidous forests and their ecotones in Austria and Southern Tyrol (Italy). This species is classified as vulnerable in Vorarlberg (Glaser 2005b), in Upper Austria (Ambach, in Vorb.) and Bavaria (Sturm & Distler 2003). In Lower Austria the species is considered as near threatened (Schlick-Steiner et al. 2003) and as threatened (without further classifications) in Carinthia (Rabitsch et al. 1999).

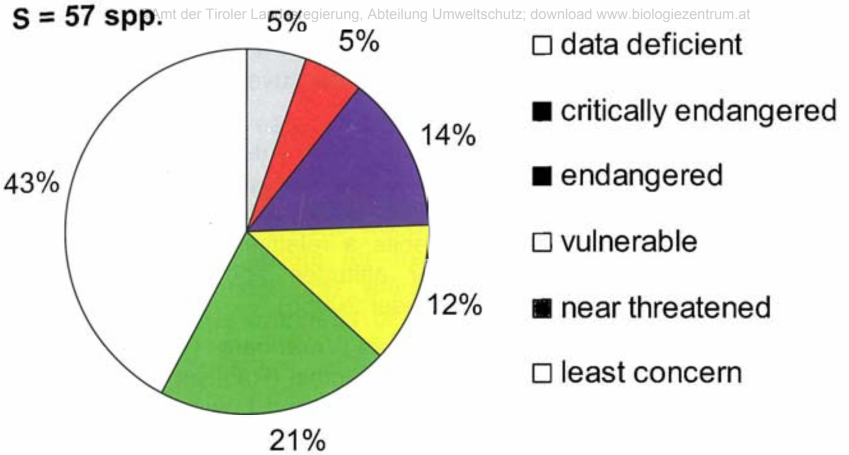

Fig. 3: Percentages of threatened species in floodplain habitats according to the Red list of the ants of Vorarlberg (Glaser 2005)

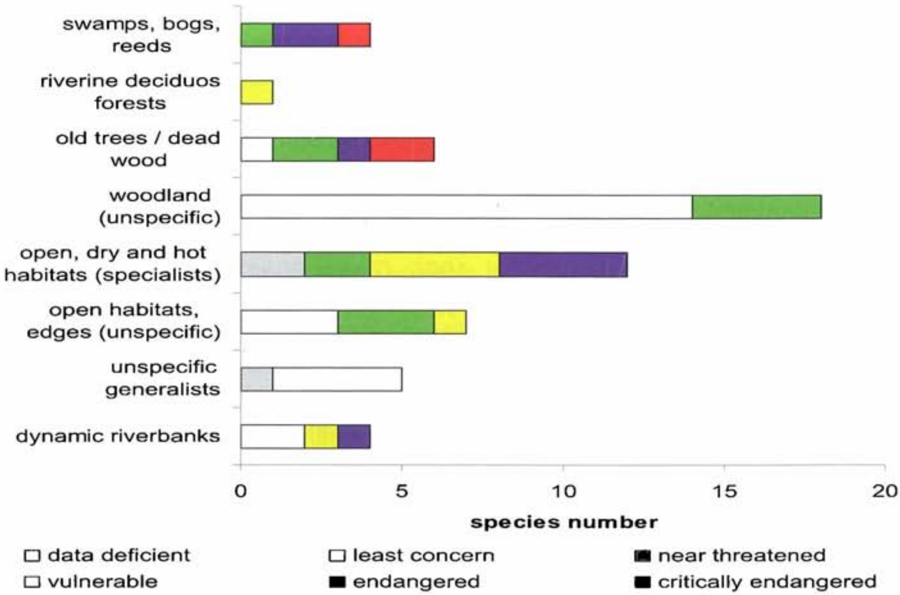

Fig. 4: Habitat preferences and threat status of ants in floodplain habitats of Vorarlberg (S = 57) from the upper Etsch (Glaser 2005, in press, modified)

Myrmica hellenica, Manica rubida and the species belonging to the Formica cinerea – group prefer open dynamic sand and gravel banks and their early succession steps. But there exist show significant interspecific differences regarding preferred substrate types and vegetation coverage (see below, Lude et al. 1999, Glaser 2006, in press.)

Manica rubida is considered as vulnerable in Lower Austria (Schlick-Steiner et al. 2003) and Bavaria (Sturm & Distler 2003). The species is a typical species of dynamic shore lines and banks along rivers, but at least in the Austrian and Southern Tyrolean Alps the species inhabits a relatively broad range of not threatened habitats especially at higher altitudes and seems not to be endangered (Glaser 2001, Glaser 2004, Glaser 2005b).

Myrmica hellenica is listed as vulnerable in Vorarlberg (Glaser 2005), as threatened (without further classifications) in Carinthia (Rabitsch et al. 1999) and as endangered in Bavaria (Sturm & Distler 2003) and Lower Austria (Schlick-Steiner et al. 2003). For Upper Austria only one historical record exists from the Danube (Ambach, pers. com.).

The ant *Myrmica gallienii* lives in regularly inundated swamps, reeds and grassland and their colonies can survive floods by forming floats (Münch 1991). The species is highly endangered in the Eastern Alps. In Vorarlberg this ant is classified as endangered (Glaser 2005b). For Tyrol the status, with only one recorded population (Glaser 2001) must be considered as even more critical. The threat status in Upper Austria (Ambach, in Vorb.) and in Lower Austria (Schlick-Steiner et al. 2003) is critically endangered. In Bavaria the species is listed as threatened without further classification (Sturm & Distler 2003).

Among the 3 spp. of the *F. cinerea*-group especially *Formica selysi* shows a higher threat status. *F. selysi* is especially found in dynamic shore lines and river banks, but sometimes also inhabits rocky slopes and even secondary sites like gravel pits and quarries (Lude et al. 1996, Glaser 2001). In Austria this ant has been only recorded in Vorarlberg, Tyrol and Carinthia (Glaser 2001, 2005b, Rabitsch et al. 1999). The species is listed as endangered in Vorarlberg (Glaser 2005b), threatened (without further classifications) in Carinthia (Rabitsch et al. 1999) and critically endangered in Bavaria (Sturm & Distler 2003).

F. fuscocinerea very successfully colonizes cultivated and urban areas (see below) and does not appear to be threatened in Western Austria and Upper Austria (Glaser 2000, Glaser 2001, 2005b, Ambach, in Vorb,). On the other hand the species is classified as endangered in Bavaria (Sturm & Distler 2003) and in Lower Austria (Schlick-Steiner et al. 2003). *Formica cinerea*, which is widespread in Central Europe, is not common in the Eastern Alps and only recorded from their northern (Lech, Isar) (Glaser 2001, Lude et al. 1996) and southern margin (Southern Tyrol, Eastern Tyrol, Carinthia) (Glaser 2004). The biogeographically interesting form "*balcanina*" occurs syntopically with typical *F. cinerea* in South Tyrol (Glaser 2004). This eastern "form" described as species by Petrov & Collingwood (1993) from the Balkan, has been synonymisized by Seifert (2003) with *F. cinerea*. This ant is classified as endangered in Bavaria (Sturm & Distler 2003) and threatened (without further classifications) in Carinthia (Rabitsch et al. 1999).

The greater part of threatened ant species in floodplains is not restricted to riparian habitats.

In alpine valleys especially mature riparian woodlands often offer a high amount of standing and decaying dead wood and old trees. Therefore riparian forests are very important habitats for tree living ant species like *Dolichoderus quadripunctatus*, *Temnothorax affinis*, *T. corticalis*, *Camponotus fallax*, *C. truncatus* and *Lasius brunneus* or species which prefer dead wood on the ground as nesting sites like *Leptothorax gredleri*, *Temnothorax parvulus* or *Camponotus vagus*.

Elevated, not regularly flooded sand and gravel banks often develop a steppe like vegetation ("Heißländen"). The growth of bushes and trees is prevented or at least slown down by extremely dry and hot conditions and / or by extensive grazing by livestock. Reminants of such "Heißländen" have survived for instance in the floodplain of the Danube near Vienna (Schlick-Steiner 2002) but also in the upper Etsch valley (Italy, Southern Tyrol, Vinschgau: Schludernser Au, Prader Sand (Glaser 2005). These habitats show an extremely diverse ant fauna containing many xerothermophilic species. Sometimes secondary dam meadows along canalized rivers can represent surrogate habitats for these ant communities (Glaser 2004).

The primary and natural habitats of many ant species, showing high densities and frequencies in the cultivated landscape today, are originally situated in flood plains. *Lasius niger* and *Myrmica rubra* the probably most frequent ants in cultivated and often heavily modified urban habitats in Central Europe reach very high densities in seminatural habitats at river sides. *Lasius brunneus* a typical "house ant" at least in western Austria is the most frequent tree dwelling ant in riparian deciduos forests. The pioneer *Formica fuscocinerea*, which is very abundant in ruderal and urban habitats like road sides and asphalted areas in Austria is originally adapted to open, dynamic banks and shorelines.

Many ant species, which are typical for a traditional cultivated landscape and nowadays decline by changes of agriculture. Natural riparian habitats but also the small corridors along heavily modified rivers with narrow strips of woodland, shorelines and even secondary, ruderal habitats can represent important refuges for them (see Glaser 2004). The local and regional conservation value of these secondary habitats in modified river sections is often underestimated. For example at the lower Etsch the single large population of *Formica cinerea* has been recorded in a dry meadow on sandy soil, which was formerly used as hobby airfield and therefore offers bare patches without vegetation (Glaser 2004). Especially in alpine regions such secondary habitats are essential for species with restricted vertical distribution, occurring only in the intensively utilized and densely populated bottoms of the valleys and therefore showing a high threat status (Glaser 2005b).

Patterns of nest densities and species numbers

Information about nest densities in riparian habitats of the Eastern Alps is relatively scarce. Lude et al. (1999) found an average nest density of 11.5 / 100 m^2 in floodplain habitats of the upper Isar (Bavaria). At the Tauglgries (Salzburg) Weber (2003) observed a mean density of 79 nests per 100 m^2. In floodplain habitats of the upper Etsch (Southern Tyrol, Italy) Glaser (2005a) calculated a mean density of 31.3 nests / 100 m^2. Generally nest densities are lowest in highly dynamic and often flooded shore lines, and increase in elevated sites with scarce to closed "steppe" vegetation. The succession towards woodland generally causes a decrease of densities. Species numbers show similar patterns (Grossenrieder & Zettel 1999, Lude et al. 1999, Weber 2003, Glaser 2006, in press). However, this decrease of species richness in riparian woodland habitats versus open habitats without trees and bushes cannot be observed in suprameditteranean climates (Glaser 2004). In this study, mature riverine forests with trees > 30 cm diameter possess maximum species numbers (S = 20), and outnumber even the values of dry dam meadows (S = 14). Figure 5 and 6 show patterns of species numbers and nest densities in riparian habitats from two seminatural sites on the upper Etsch (see also Glaser 2006, in press). Maximum species richness and nest densities are found in elevated banks with steppe vegetation. Both decrease in woodland and dynamic shorelines. In comparison with shore lines, nest densities show a slight increase even in elevated banks with scarce vegetation.

Figure 7 presents nest densities of the typical riparian ant species (Seifert 1996) *Formica cinerea, Formica selysi, Myrmica hellenica* and *Manica rubida* in different floodplain habitats from the upper Etsch. Only *Manica rubida* shows maximum densities at dynamic shorelines. *Formica selysi* can be found in all habitat types, but densities in riparian forests are extremely low, and the centre of distribution is clearly observed at elevated sites. *Formica cinerea* and *Myrmica hellenica* only occur at elevated sites and even seem to avoid the often inundated shorelines.

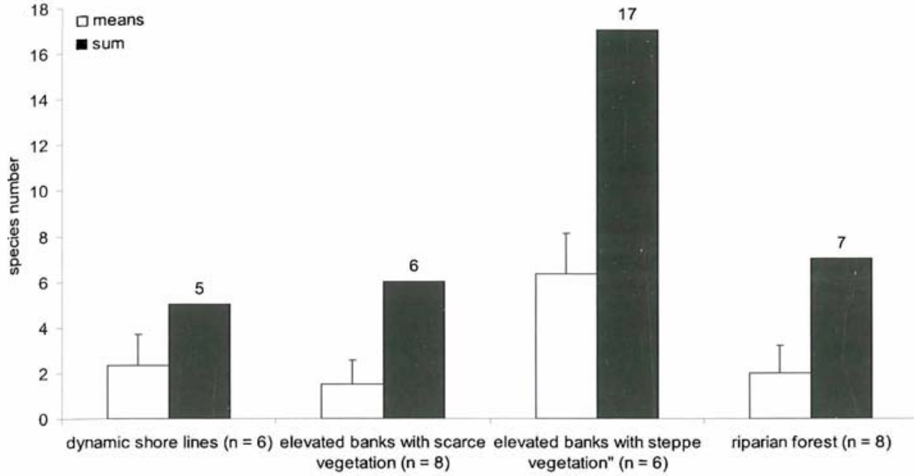

Fig. 5: Mean (with standard deviation) and total species number of ants in floodplain habitats from the upper Etsch (Glaser 2005, in press, modified)

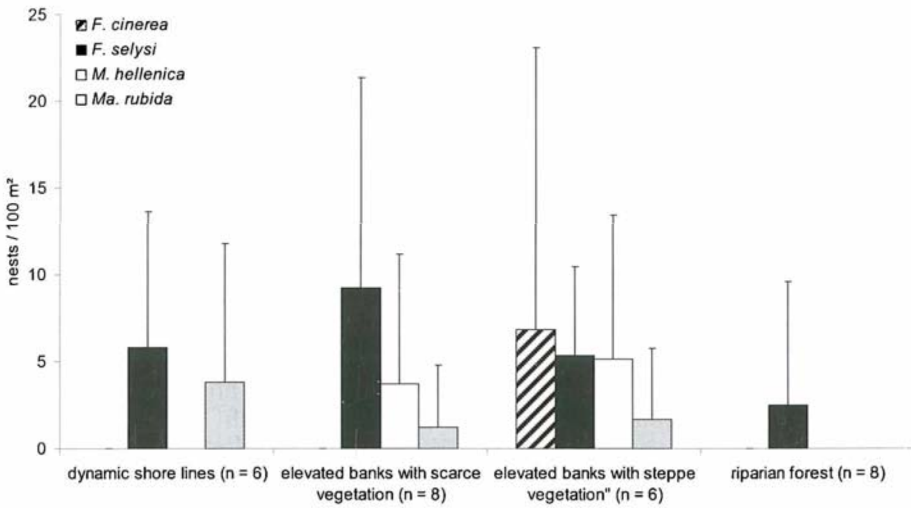

Fig. 6: Mean (with standard deviation) and maximal densties of ant nests in floodplain habitats from the upper Etsch (Glaser 2005, in press, modified)

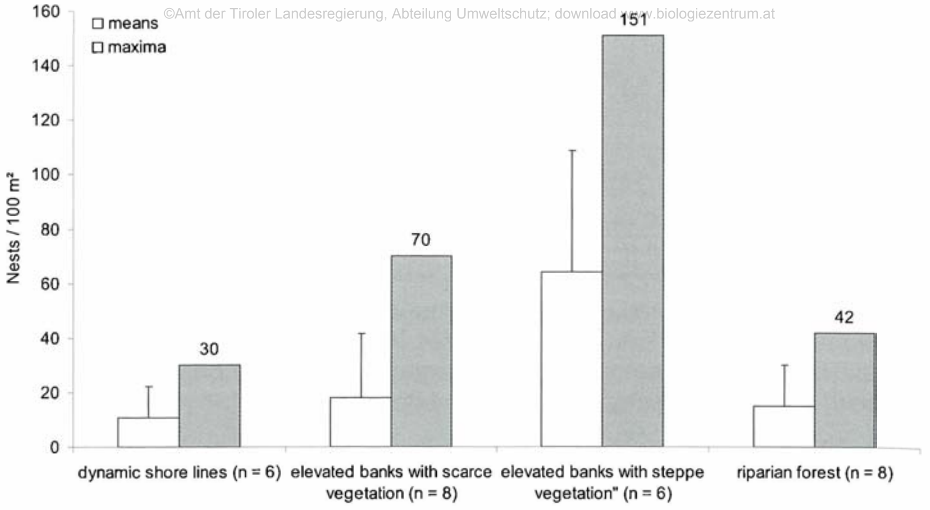

Fig. 7: Mean nest densities (with standard deviation) of the typical ripicolous ant species *Formica cinerea, Formica selysi, Myrmica hellenica* and *Manica rubida* in floodplain habitats from the upper Etsch (Glaser 2005, in press, modified)

Importance of environmental parameters

A canonical correspondence analysis of the data from the upper Etsch (nest densities, relative coverage of different substrate types and vegetations layers, shore line vs. elevated sites (for details see Glaser (2005) shows two gradients. One gradient can be interpreted as succession from open habitats towards woodland. The second illustrates the differences between dynamic shorelines and banks with scarce or no vegetation. This study gives also some indication of habitat preferences. *Lasius psammophilus*, *Formica cinerea*, *Tetramorium* cf. *impurum* and *Temnoththorax interruptus* prefer areas with well developed coverage of herbs and grasses. *Manica rubida* and *Lasius niger* were found more frequently in areas with higher coverage of sandy and fine sediments. *Myrmica rubra* and *Leptothorax gredleri* avoid areas with high coverage of stones. The former is also recorded more rarely at higher coverage of gravel (only *M. rubra*). *Leptothorax gredleri* needs areas with sufficient coverage of debris and dead wood. *Formica selysi* is not found in sites with high coverage of trees, shrubs, debris and dead wood and prefers a high coverage of stones and gravel.

In a further study on the lower course of the Etsch (Glaser 2004) frequencies of ants and presence / absence of environmental parameters (dynamic shore lines, elevated banks, disturbance by forest management or dredging, shrubs, bushes, young and old trees, mowing of meadows and sun exposed areas without or with no or only scattered vegetation (for details see Glaser (2004)) are calculated in a canonical correspondence analysis. Two main gradients could be demonstrated. The first presents a gradient from shore lines towards mature woodland. The second gradient is characterized by the ant community of regularly mown grassland.

Strategies vs. floods

Behavioural mechanisms against floods like forming air bubbles in the nest, floating across the water surface or climbing up trees (refs in Glaser 2004) represent important adaptations for ants to survive in riverine habitats. On the other hand the ability of ants to penetrate thick layers of sediments deposited by floods can be very important. At least *Myrmica hellenica*, *M. rubra* and *F. fuscocinerea* can dig out their nest entrances after heavy floods, even through sand layers up to a height of 1 m (personal observations)

Discussion and conclusions

The occurrence of endangered, highly specialized species and high diversity of the ant fauna of floodplain habitats demonstrate their importance for the conservation of ants.

The main factors, which influence species composition, distribution and densities of ants in floodplain habitats, are inundation risk (which is especially demonstrated by the importance of elevated sites versus dynamic shorelines), vegetation structure and the presence of open, sunny areas without or with scarce vegetation, dead wood and old trees. Habitat succession and diversity are predominantly caused by regular dynamic floods creating a rich mosaic of different biotope types at least in (semi)natural floodplains. Unfortunately most alpine floodplains are more or less modified by human impact and the natural creation of floodplain habitats by flood dynamics is heavily impaired. Nevertheless different secondary habitats within the remaining riparian corridors can represent surrogates for natural flood plain habitats, where some typical and endangered ant species can survive.

The protection of the last wild rivers in the Alps is extremely urgent and important. On the other hand restoration activities on canalized rivers are welcome and necessary to maintain the diversity of riverine ant communities (and other biota).

The restoration of flood dynamics to re-establish and favour the creation of natural floodplain habitats is a main target of these efforts. However, re-established dynamics are not a conservation success in itself. The first step towards success would be the creation of suitable habitats by flood dynamics. The evidence for a real restoration success would be the recolonization by endangered and typical species or communities (comp. Bond & Lake 2003)

The implications for future river restorations are:

1) Elevated sites with a lower inundation risk are crucial even for ant species possessing special adaptations in case of floodings like *Formica selysi*. They can represent important population sources for recolonization after heavy flood events. Highly dynamic and often inundated shore lines show lower nest densities and species richness than slightly elevated banks. If during restoration activities elevated banks are dredged off, the risk of (local) extinction of species arises.

2) In some cases breakwaters can favour a mosaic of different successions on relatively small areas by a moderated flood impact, whereas similar biotopes in the floodplain hinterland have already been consumed by agriculture, settlements and infrastructure. The displacement of such embankments can produce sterile, highly dynamic areas and homogenize a mosaic with essential habitats for endangered species by increased flood dynamics.

3) Secondary floodplain habitats play a role as shelters and retreats for threatened ant species. Restoration activities should incorporate and use these habitats as recolonization centres and migration corridors.

4) Transport of sediments, drifting wood and debris is restricted in most rivers by artificial obstacles. But floating driftwood and debris form an important downstream transport for invertebrates (Tockner et al. 2005). Also fertilized ant queens or whole colonies can be assumed to use this way for colonization and migration.

5) Most river restorations focus on aquatic life (fish, benthos), while (semi)terrestrial biota especially invertebrates are usually neglected. The aims of restoration activities should integrate the requirements of aquatic and terrestrial biota to maintain the biodiversity of alpine floodplains. Monitoring programs to control the success of river restoration must therefore involve also (semi)terrestrial invertebrates.

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Tab. 1: List of ant species recorded in floodplains of the Eastern Alps (i.a.o.). Regional threat status in Vorarlberg (Glaser 2005), Carinthia (Rabitsch et al. 1999), Lower Austria (Schlick-Steiner et al. 2002) and Bavaria (Sturm & Distler 2003).
Abbreviations: V = red list Vorarlberg, K = red list Carinthia, L = red list Lower Austria, B = red list Bavaria. 0 = regionally extinct, 1 = critically endangered, 2 = endangered, 3 = vulnerable, 4 = near threatened, G = threatened without further classifications, DD = data deficient, LC = least concern / not endangered, - = no record. Gr. 1, 2, 3 = groups of faunal similarity (see text), ST = Southern Tyrol, V = Vienna, LA = Lower Austria, UA = Upper Austria, V = Vorarlberg, S = Salzburg, NT = Northern Tyrol, BA = Bavaria. For references see text.

	Regional threat status				Gr. 1			Gr. 2					Gr. 3		
					ST: lower Etsch	V, LA: Danube, Wien	UA: Donau, Traun	V: Alfenz	NT: Inn	V: Bregenzer Ache	V: Rhine, Lake Konstanz	V: Ill	S: Taugel	NT, BA: Lech & Isar	ST: upper Etsch (Vinschgau)
	V	K	L	B											
Anergates atratulus (Schenck, 1852)			G	1	x										
Aphaenogaster subterranea (Latreille, 1798)	2	G	G	2	x	x									
Camponotus fallax (Nylander, 1356)	2	G	4	2	x	x						x			
Camponotus herculaneus (Linnaeus, 1758)	LC	LC	LC	LC				x							x
Camponotus ligniperda (Latreille, 1802)	LC	LC	LC	LC	x			x				x	x		
Camponotus piceus (Leach, 1825)		G	2	1		x									
Camponotus truncatus (Spinola, 1808)	1	G	4	1	x		x								
Camponotus vagus (Latreille, 1802)	0	DD	2	1		x									
Cryptopone ochraceum (Mayr, 1855)					x										
Dolichoderus quadripunctatus (Linnaeus, 1771)	4	DD	4	2		x	x					x			
Formica aquilonia Yarrow, 1955	DD	DD	5	3											
Formica cinerea Mayr, 1853		G		3	x										x
Formica cunicularia Latreille, 1798	LC	LC	LC	4	x	x		x				x	x		x
Formica fusca Linnaeus, 1758	LC	LC	LC	LC		x	x	x				x	x		x
Formica fuscocinerea Forel, 1874	LC	LC	3	3			x	x				x	x		
Formica lemani Bondroit, 1917	LC	LC	LC	LC				x				x			
Formica lugubris Zetterstedt, 1838	LC	DD	LC	3								x			
Formica lusatica Seifert, 1997			LC	G		x									
Formica polyctena Förster, 1850	LC	DD	DD	4		x		x				x	x		
Formica pratensis Retzius, 1783	4	LC	LC	3		x		x				x			
Formica rufa Linnaeus, 1761	4	DD	DD	3		x		x				x			x
Formica rufibarbis Fabricius, 1793	2	DD	LC	3	x	x						x			
Formica sangiunea Latreille, 1798	4	LC	LC	4		x									
Formica selysi Bondroit, 1918	2	G		1	x			x				x			x
Formica picea Nylander, 1846	2	G	1	2								x			
Formica truncorum Fabricius, 1804	4	G	2	2		x		x					x		
Formicoxenus nitidulus (Nylander, 1846)	LC	LC	G	2									x		

Tab. 1 (Fortsetzung)

	Regional threat status				Gr. 1			Gr. 2					Gr. 3		
	V	K	L	B	ST: lower Etsch	V, LA: Danube, Wien	UA: Donau, Traun	V: Alfenz	NT: Inn	V: Bregenzer Ache	V: Rhine, Lake Konstanz	V: Ill	S: Taugel	NT, BA: Lech & Isar	ST: upper Etsch (Vinschgau)
Lasius alienus (Förster, 1850)		DD	LC	G		x									
Lasius brunneus (Latreille, 1798)	LC	LC	LC	LC	x	x	x	x				x			
Lasius distinguendus (Emery, 1916)	DD		G		x	x		x							
Lasius emarginatus (Olivier, 1792)	3	LC	LC	4	x	x									
Lasius flavus (Fabricius, 1782)	LC	LC	LC	LC	x	x		x				x	x		x
Lasius fuliginosus (Nylander, 1846)	LC	LC	LC	LC	x	x	x	x				x			x
Lasius jensi Seifert, 1982			G	DD		x									
Lasius meridionalis (Bondroit, 1920)		G	G	3											x
Lasius mixtus (Nylander, 1846)	LC	LC	3	DD		x		x				x	x		
Lasius myops Forel, 1894		G	G	2	x										
Lasius niger (Linnaeus, 1758)	LC	LC	LC	LC	x	x	x	x				x	x		x
Lasius paralienus Seifert, 1992	2	DD	LC	G	x	x		x				x	x		
Lasius platythorax Seifert, 1991	LC	LC	LC	LC	x	x	x	x				x	x		x
Lasius psammophilus Seifert, 1992		DD	DD	G											x
Lasius sabularum (Bondroit, 1918)	DD							x				x			
Lasius umbratus (Nylander, 1846)	LC	LC	G	LC	x		x	x				x			x
Leptothorax acervorum (Fabricius, 1793)	LC	LC	LC	LC			x	x				x	x		x
Temnothorax affinis (Mayr, 1855)	4	G	LC	G	x	x	x	x				x			
Temnothorax albipennis (Curtis, 1854)	3		2	3		x							x		
Temnothorax clypeatus (Mayr, 1853)		G	1			x									
Temnothorax corticalis (Schenck, 1852)	1	G	3	2	x	x	x								
Leptothorax gredleri Mayr, 1855	3	G	4	3		x	x					x			x
Temnothorax interruptus (Schenck, 1852)		DD	3	3		x							x		x
Leptothorax muscorum (Nylander, 1846)		LC	3	LC											
Temnothorax nigriceps (Mayr, 1855)	2	DD	3	3								x	x		
Temnothorax nylanderi (Förster, 1850)	LC			LC	x							x			x
Temnothorax parvulus (Schenck, 1852)		G	2	3	x	x									
Temnothorax crassispinus (Karawajew, 1926)		LC	LC	DD		x	x								
Temnothorax tuberum (Fabricius, 1775)	4	DD	2	3				x							
Temnothorax unifasciatus (Latreille, 1798)	3	DD	LC	4	x							x	x		x
Manica rubida (Latreille, 1802)	LC	LC	4	3	x		x	x				x	x		x
Myrmecina graminicola (Latreille, 1802)	LC	DD	DD	3	x	x		x				x	x		
Myrmica microrubra Seifert, 1993	4		G	DD				x				x			x
Myrmica gallienii Bondroit, 1920	2		1	G											
Myrmica hellenica Finzi, 1926	3	G	2	2	x			x				x	x		x
Myrmica lobicornis Nylander, 1846	LC	LC	G	3			x								
Myrmica lonae Finzi, 1926	4	DD	2	3	x							x			x

Tab. 1 (Fortsetzung)

	Regional threat status				Gr. 1			Gr. 2					Gr. 3		
	V	K	L	B	ST: lower Etsch	V, LA: Danube, Wien	UA: Donau, Traun	V: Alfenz	NT: Inn	V: Bregenzer Ache	V: Rhine, Lake Konstanz	V: Ill	S: Taugel	NT, BA: Lech & Isar	ST: upper Etsch (Vinschgau)
Myrmica rubra (Linnaeus, 1758)	LC	LC	LC	LC	x	x	x	x	x	x	x	x	x	x	x
Myrmica ruginodis Nylander, 1846	LC	LC	LC	LC	x	x	x	x	x	x	x	x	x	x	
Myrmica rugulosa Nylander, 1849	3	?	G	3		x	x	x	x		x	x		x	x
Myrmica sabuleti Meinert, 1861	4	LC	LC	4	x	x		x			x	x	x	x	x
Myrmica salina Ruzsky, 1905		DD	1			x									
Myrmica scabrinodis Nylander, 1846	4	LC	LC	4		x		x				x			x
Myrmica schencki Viereck, 1903	2	DD	LC	3		x						x	x		x
Myrmica specioides Bondroit, 1918	DD		3	3		x		x				x			
Myrmica sulcinodis Nylander, 1846	LC	LC	G	3											
Myrmica vandeli Bondroit, 1919	1		2	1								x			
Plagiolepis pygmaea (Latreille, 1798)		G	2			x									
Plagiolepis vindobonensis Lomnicki, 1925		G	3	2	x	x									
Polyergus rufescens Latreille, 1798		G	G	1	x	x									
Ponera coarctata (Latreille, 1802)	4	DD	G	3	x							x	x		
Ponera testacea Emery, 1895			G												x
Solenopsis fugax (Latreille, 1798)	3	DD	DD	3	x	x						x			
Stenamma debile (Förster, 1850)	4	DD	G	DD	x	x		x				x			
Tapinoma ambiguum Emery, 1925	3	DD	4	G		x						x			
Tapinoma erraticum (Latreille, 1798)	3	DD	4	3		x						x			
Tetramorium-Agg.	LC*	LC	LC	LC*	x	x	x	x				x	x		x
Tetramorium ferox (Ruzsky, 1903)	-	-	G	-	-	x	-	-	-	-	-	-	-	-	-
				Artenzahl:	**38**	**51**	**20**	**36**	**25**	**29**	**30**	**48**	**26**	**35**	**29**