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A New Alnion incanae-Association of the Inner Italian Alps: Hedero helicis-Alnetum glutinosae

By

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With 2 Figures

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Summary

WALLNÖFER S. 2009. A new Alnion incanae-association of the inner Italian Alps: Hedero helicis-Alnetum glutinosae. – Phyton (Horn, Austria) 49 (1): 9–23, with 2 figures.

In this study, the Hedero helicis-Alnetum glutinosae (Alnenion glutinoso-incanae, Alnion incanae) is newly described on the basis of phytosociological relevés. The forest type dominated by black alder is found in the colline and submontane belt on south-facing slopes in the inneralpic, precipitation-poor Vinschgau Valley (South Tyrol, Northern Italy). It colonizes banks of rivulets with shallow to intermediate soil depth. In the understory widespread species of deciduous forests and species of nutrient-rich sites dominate. A tabular comparison with Central European alluvial forest types rich in *Alnus glutinosa* (Pruno-Fraxinetum, Stellario nemorum-Alnetum glutinosae, Carici remotae-Fraxinetum) shows clear floristic differences. Differential species of the Hedero helicis-Alnetum glutinosae include thermophilous species; it is also negatively differentiated by the absence of species indicating wet soil and of the trees *Fraxinus excelsior* and *Prunus padus*. Also from the association of alluvial black alder forests in Northern and Central Italy (Aro italici-Alnetum glutinosae) the Hedero helicis-Alnetum glutinosae is clearly distinguished, inter alia by the absence of species preferring wet soils. However, by the dominance of *Hedera helix* it resembles generally the South European alluvial forests. Besides, floristic affinity to Carpinion-communities of Insubria exists. Because of the restricted distribution area

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and the smallness of the stands the Hedero helicis-Alnetum glutinosae must be considered as an endangered plant community.

Zusammenfassung

WALLNÖFER S. 2009. A new Alnion incanae-association of the inner Italian Alps: Hedero helicis-Alnetum glutinosae. [Eine neue Alnion incanae-Assoziation der inneren italienischen Alpen: Hedero helicis-Alnetum glutinosae]. – Phyton (Horn, Austria) 49 (1): 9–23, mit 2 Abbildungen.

In dieser Arbeit wird das Hedero helicis-Alnetum glutinosae (Alnenion glutinoso-incanae, Alnion incanae) auf der Grundlage von pflanzensoziologischen Aufnahmen neu beschrieben. Der von Schwarzerle dominierte, collin-submontane Waldtyp ist auf flach- bis mittelgründigen Bachufern im Bereich südexponierter Hänge im inneralpischen niederschlagsarmen Vinschgau (Südtirol, Norditalien) ausgebildet. Im Unterwuchs herrschen weit verbreitete Laubwaldarten und Arten nährstoffreicher Standorte vor. Der tabellarische Vergleich mit mitteleuropäischen schwarzerlereichen Auwaldgesellschaften (Pruno-Fraxinetum, Stellario nemorum-Alnetum glutinosae, Carici remotae-Fraxinetum) zeigt große floristische Unterschiede auf. Trennarten des Hedero helicis-Alnetum glutinosae sind u. a. thermophile Arten, während Pflanzen nasser Böden, aber auch die Baumarten *Fraxinus excelsior* und *Prunus padus* fast vollständig fehlen. Von der Assoziation nord- und mittelitalienischer Schwarzerlenauwälder (Aro italici-Alnetum glutinosae) ist das Hedero helicis-Alnetum glutinosae ebenfalls deutlich differenziert, u.a. durch den Ausfall von Feuchte- und Nässezeigern. Es ist aber aufgrund der Dominanz von *Hedera helix* generell den südeuropäischen Auwäldern ähnlich. Weiters bestehen floristische Ähnlichkeiten mit insubrischen Carpinion-Gesellschaften. Das Hedero helicis-Alnetum glutinosae ist wegen des eng begrenzten Areals und der Kleinflächigkeit der Bestände als gefährdete Waldgesellschaft einzustufen.

1. Introduction

Like other azonal vegetation types, floodplain forests are mainly determined by extreme soil factors and are to a lesser extent influenced by the overall climate. Thus, they usually appear in approximately the same form in several different climatic zones (ELLENBERG 1996). A broad floristic homogeneity was, for example, observed in alluvial *Alnus incana* communities of Northern and Central Europe (SCHWABE 1985).

Alnus glutinosa dominates riparian forest communities throughout its large European range reaching from the Mediterranean to the boreal zone (TCHOU 1948, HORVAT & al. 1974, DIERSCHKE 1980, DIEKMANN 1994, PRIEDITIS 1997, AMIGO & al. 2004). Associations in Central Europe and also in Northern and Central Italy are included in the alliance Alnion incanae (Syn. Alno-Ulmion) and suballiance Alnenion glutinoso-incanae (POTT 1992, PEDROTTI & GAFTA 1996, WILLNER & KARNER 2007). In Central Europe, black alder mainly occurs in the three associations Pruno-Fraxinetum OBERD. 1953, Stellario nemorum-Alnetum glutinosae LOHMEYER 1957 and Carici remotae-Fraxinetum KOCH ex FABER 1936 (NOIRFALISE & DETHIOUX

1980, OBERDORFER 1992, POTT 1992, RENNWALD 2000, WILLNER & KARNER 2007, DOUDA 2008). In Italy, the Aro italici-Alnetum glutinosae GAFTA & PEDROTTI 1995 (Syn. "Alno-Fraxinetum oxycarpae" sensu auct.) was described within the Alnion incanae (FRANCALANCIA & ORSOMANDO 1980, CASINI & al. 1995, PEDROTTI & GAFTA 1996, CESCHIN & SALERNO 2008). All these associations exhibit a widespread distribution which is typical for azonal plant communities.

In the present paper, a new association of riparian *Alnus glutinosa* forest, the Hedero helicis-Alnetum glutinosae, is described from the inneralpic Vinschgau Valley in northernmost Italy. It differs remarkably from hitherto known Alnion incanae units. It also displays, unlike the above mentioned associations, a very restricted distribution. Floristic composition and habitat of the association are described. Furthermore, issues concerning syntaxonomy, site ecology, distribution and endangerment of the Hedero helicis-Alnetum glutinosae are discussed.

2. Study Area

The Vinschgau Valley (= Valle Venosta, South Tyrol) in northernmost Italy is an over 75 km long, west-east directed valley running parallel to the Ötztal Alps in the north and the Ortler Alps in the south. The broad U-shaped main valley has very steep slopes. The study area comprises the south facing slope of the Vinschgau Valley, called Sonnenberg (46° 36'–46° 42' N, 10° 33'–11° 03' E; Fig. 1). Most relevés were made in the eastern part of the valley. The studied sites lie mainly in the colline and submontane altitudinal belt (600–1280 m a.s.l.).

Geologically the study area is situated in the so-called "schistic zone" of the Vinschgau Valley, a part of the Ötztal-Stubai complex. The bedrock consists mainly of gneisses and phyllites. The dominating soil types are mostly base-rich pararendzina, brunificated pararendzina and brunificated ranker (STAFFLER & al. 2003).

The study area has a Central European climate with mean annual temperatures of 9–10° C (FLIRI 1975). Due to the inner-alpic position characterized by orographic seclusion, the Vinschgau Valley is the driest and most continental region of the Eastern Alps (FREI & SCHÄR 1998). Annual precipitation rates in the colline and submontane belt are about 490–550 mm with a peak in July and August. Air humidity is low. Frequent winds from West or North additionally contribute to the dryness. On the south-facing slope of the valley, the microclimate is characterized by exceptional drought and summer heat. The sample plots, however, are situated in narrow and deep valleys with a clearly more shaded and humid microclimate compared to the surrounding slopes. Microclimate data are not available.

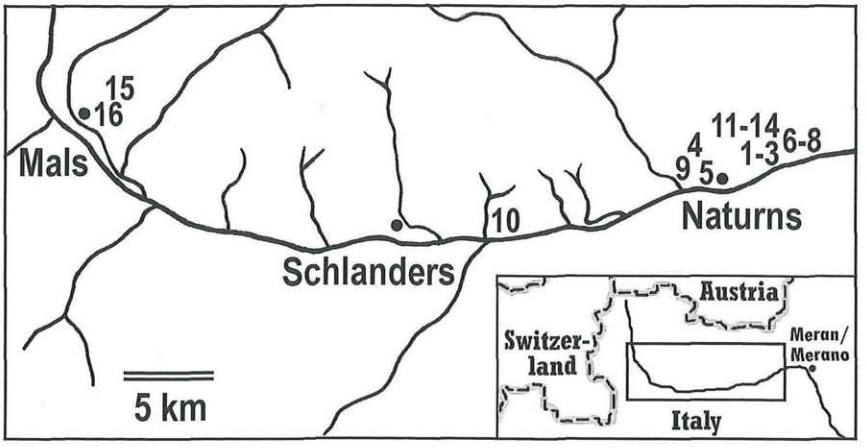

Fig. 1. Map of the study area showing the approximate location of relevé sites. Relevé numbers correspond with numbers in Tab. 1.

Characteristic vegetation in the colline and submontane belt of the Sonnenberg consists of open *Quercus pubescens* woodland with *Fraxinus ornus, Pinus sylvestris* and *Larix decidua* admixed (BRAUN-BLANQUET 1961, STAFFLER & KARRER 2001). The forests are intermingled with patches of shrub communities and dry grassland. In part they are occurring naturally, in part they result from pasture (STRIMMER 1974, SCHWABE & KRATOCHWIL 2004). Large areas are covered by plantations of *Pinus nigra*. In general, the area has been subjected to a long-lasting human influence, especially from pasture. The studied sites, however, are only influenced by infrequent coppicing and grazing.

3. Methods

Vegetation was recorded from 2003 till 2007 according to the Braun-Blanquet method (WESTHOFF & VAN DER MAAREL 1978). Sampling areas were adapted to the narrow strip-formed stands. Plot size ranges from 80 to 150 sqm. Fieldwork was done in early summer in order to record also geophytes. The cover-abundance scale follows REICHELT & WILMANNS 1973. The vegetation table was sorted manually. Nomenclature of phanerogams follows WILHALM & al. 2006; the nomenclature of mosses follows FREY & al. 2006. Information on ecological and sociological behaviour of species derives from OBERDORFER 2001 and MUCINA & al. 1993. The association concept applied is in accordance with WILLNER 2006 and WILLNER 2007; it admits the description of associations based on good differential species. The denomination of syntaxa is in accordance with WEBER & al. 2000. Syntaxonomy follows WILLNER & KARNER 2007 and PEDROTTI & GAFTA 1996.

Tab. 1 displays the original relevés and, in addition, a comparison with published tables of four similar associations of the suballiance Alnenion glutinoso-incanae: (i) Pruno-Fraxinetum developed in depressions and valley bottoms on deep,

moist soils with high water table. This widespread Central European community was also recorded on the bottom of Vinschgau Valley (PEER 1977, MÜLLER 1997). (ii) Stellario nemorum-Alnetum glutinosae found on temporarily flooded banks of rapidly flowing streams on siliceous rock up to the montane belt. It was recorded in Northeastern Austria and in Northern Bavaria (WALENTOWSKI & al. 2004, WILLNER & KARNER 2007). (iii) Carici remotae-Fraxinetum, growing on constantly percolated soils next to springs and rivulets. The association is widespread in Austria, Bavaria and Switzerland (ELLENBERG & KLÖTZLI 1974, WALENTOWSKI & al. 2004, WILLNER & KARNER 2007). (iv) Aro italici-Alnetum glutinosae, comprising riparian forests on wet soils in Northern and Central Italy (GAFTA & PEDROTTI 1995, PEDROTTI & GAFTA 1996).

The average ecological indicator value of soil moisture was calculated for the here discussed units except for the Aro italici-Alnetum glutinosae. Values were taken from ELLENBERG & al. 1991. As they were defined for Central Europe north of the Alps, the results should be interpreted with caution. In addition, some of the species lists used for the calculation are incomplete.

4. Results

The Hedero helicis-Alnetum glutinosae is here newly described and recorded in Tab. 1. Holotypus of the association is relevé no. 6 in Tab. 1. The UTM coordinates of this relevé are 32T 655060 E 5170140 N.

4.1. Structure and Floristic Composition

The forest stands form narrow stripes along the rivulets. The 15–20 m high canopy is mostly gappy. Also the shrub layer is moderately developed. The herb layer cover is variable, amounting from 25 to 70 %. Mosses cover up to 20 % of the plot area.

The tree layer is clearly dominated by *Alnus glutinosa. Fraxinus ornus* is admixed throughout, but grows only in rarely flooded, relatively dry zones of the plots. Less frequent are *Prunus avium, Alnus incana, Juglans regia, Populus nigra and Castanea sativa.* The shrub layer is mainly built up by *Sambucus nigra, Corylus avellana* and juvenile trees. In addition, climbing *Hedera helix* is often present in shrub and tree layers. In the herb layer the most important species are *Brachypodium sylvaticum, Hedera helix, Salvia glutinosa, Parietaria officinalis, Stachys sylvatica, Equisetum arvense, Athyrium filix-femina* and *Oxalis acetosella.* Most of them are character species of the units Fagetalia sylvaticae or Querco-Fagetea. They typically occur on sites with good water supply, but not on wet soils (OBERDORFER 2001). Besides, some species typical for floodplain forest indicate moist to wet, nutrient-rich soils (e.g., *Stachys sylvatica, Circaea lutetiana*). Some of the species such as *Parietaria officinalis, Geranium robertianum* and *Urtica dioica* are principally characteristic for nutrient-rich ruderal communities. The most frequent bryophytes are *Plagiomnium undulatum, Conocephalum conicum* and *Brachythecium rivulare.*

Table 1. Hedero helicis-Alnetum glutinosae ass. nova hoc loco (columns 1–16) and comparison with Central European and Italian alder-ash-forests on the basis of frequency values (columns 17–25). Differential species indicated by frames refer only to the comparison between Hedero helicis-Alnetum glutinosae and the other units. Listings of frequency values are incomplete. Bryophytes are cited only for Hedero helicis-Alnetum glutinosae. Abbreviation: juv. = occurrence of tree species in shrub and herb layer.

Data sources: PF1: Pruno-Fraxinetum. MÜLLER 1997, table I, columns 21–67. Vinschgau, South Tyrol. – PF2: Pruno-Fraxinetum, colline Form, pannonische Gebietsausprägung. WILLNER & KARNER 2007, table 16, column 2. Austria. – PF3: Pruno-Fraxinetum, colline Form, mitteleuropäische Gebietsausprägung. WILLNER & KARNER 2007, table 16, column 1. Austria. – SA1: Stellario nemorum-Alnetum glutinosae, colline Form. WILLNER & KARNER 2007, table 16, column 7. Austria. – SA2: Stellario nemori-Alnetum glutinosae, Tieflagenform. OBERDORFER 1992, table 305, column 1. Southern Germany. – CF1: Carici remotae-Fraxinetum. WILLNER & KARNER 2007, table 16, column 5. Austria. – CF2: Carici remotae-Fraxinetum calthetosum, reine Ausbildung. PFADENHAUER 1969, table 6, columns 9–27. Southern Bavaria. – AA1: Aro italici-Alnetum glutinosae, nomenclatural type of the association. GAFTA & PEDROTTI 1995. Marche, Italy. – AA2: "Alno-Fraxinetum oxycarpae". FRANCALANCIA & MARCONI 1994, table 1. Marche, Italy.

Column no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Vegetation unit	**Hedero helicis-Alnetum glutinosae**																**PF1**	**PF2**	**PF3**	**SA1**	**SA2**	**CF1**	**CF2**	**AA1**	**AA2**
Relevé no. / Number of relevés	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	47	54	77	26	99	140	19	1	17
Altitude [m a.s.l.]	680	600	725	800	660	800	880	860	690	810	1020	760	830	810	1280	1220									
Exposition [gon]	150	110	190	190	110	150	150	170	140	230	220	210	170	160	230	240									
Inklination [%]	50	40	30	30	45	30	35	30	55	25	60	40	60	65	70	25									
Cover tree layer [%]	70	55	50	80	70	70	75	75	85	80	80	85	75	50	25	75									
Cover shrub layer [%]	15	20	15	2	15	10	5	5	7	10	10	20	20	7	10	10									
Cover herb layer [%]	30	35	50	35	55	70	25	60	25	35	60	70	70	60	25	30									
Cover moss layer [%]	1	5	3	15	7	2	10	10	20	10	3	2	2	5	3	5									
Average indicator value of soil moisture									5.45								6.37	6.0	6.11	6.25	6.23	6.24	6.97		
Differential species of Hedero helicis-Alnetum glutinosae																									
Woody plants																									
Fraxinus ornus	1	2a	1	+	1	1	1	1	+	1	1	1	2a	1	.	.	.	.	.	.	.	.	.	.	.
Fraxinus ornus juv.	2a	1	1	1	2a	+	1	1	1	2a	+	1	1	1	r	.	.	.	.	.	.	.	.	.	.
Juglans regia	1	2a	2a	.	.	.	1	2a	1	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	6
Juglans regia juv.	+	1	+	.	+	+	1	.	+	+	+	1	1	1	.	+	.	.	.	.	.	.	.	.	.
Castanea sativa	.	1	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Castanea sativa juv.	+	1	+	.	+	1	.	.	.	.	1	.	r	1	.	.	.	.	.	.	.	.	.	.	.
Hedera helix (upper layers)	1	.	+	+	1	2a	+	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Hedera helix (herb layer)	2a	2a	2a	2a	2b	1	2a	2a	2a	2a	1	2a	2a	2a	.	1	2	6	18	.	1	26	.	.	47
Prunus avium	.	2a	.	.	.	2a	.	.	1	2a	.	.	.	.	.	.	2	.	.	.	2	.	.	.	12
Prunus avium juv.	2a	1	+	+	1	1	1	.	1	+	.	r	r	+	.	.	4	.	.	.	.	.	.	.	.
Prunus mahaleb	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Herbaceous plants																									
Asplenium trichomanes	.	+	+	+	.	.	+	+	.	.	r	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Cystopteris fragilis	.	.	.	.	+	+	+	.	.	.	.	r	.	r	+	+	.	.	.	.	.	.	.	.	.
Festuca heterophylla	.	.	.	1	.	.	1	+	.	1	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Brachypodium rupestre	.	.	.	1	.	.	1	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula trachelium	.	.	.	.	+	.	+	+	.	.	+	r	+	+	.	+	.	.	.	.	2	.	.	.	6
Campanula rapunculoides	+	+	+	+	+	+	+	.	.	.	+	.	.	.	.	.	4	.	.	.	.	.	.	.	.
Cardamine impatiens	+	+	+	.	.	+	+	1	.	1	+	+	+	+	.	+	17	.	.	.	1	.	.	.	.
Tussilago farfara	.	.	.	+	.	+	.	.	+	.	1	.	.	1	1	.	2	.	.	.	.	.	.	.	.
Arctium minus agg.	+	+	.	.	.	+	+	.	.	.	.	+	+	+	r	+	.	.	.	.	1	.	.	.	6
Agrostis capillaris	.	.	.	1	+	+	+	.	+	.	.	.	.	+	+	.	.	.	.	.	3	.	.	.	.
Asplenium adiantum-nigrum	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex flacca	+	.	.	1	1	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
Lapsana communis	.	.	.	.	.	+	.	+	.	.	+	.	+	+	.	+	4	.	.	.	12	.	.	.	17
Veronica urticifolia	.	.	.	+	.	.	+	+	+	.	+	.	.	.	.	.	4	.	.	.	.	.	.	.	.
Salvia glutinosa	+	+	.	+	.	2a	+	2a	.	.	2a	2a	.	2a	.	.	.	.	25	15	.	19	.	.	12
Differential species of the other units																									
Woody plants																									
Fraxinus excelsior	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	2a	2	98	70	62	35	80	37	.	.
Fraxinus excelsior juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	15	74	49	42	.	62	53	.	.
Prunus padus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	46	8	31	29	1	.	.	.
Prunus padus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	25	91	47	19	.	21	21	.	.
Acer pseudoplatanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	23	19	21	39	.	.	12
Acer pseudoplatanus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	33	34	12	.	49	16	.	.
Quercus robur	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	16	35	26	9	.	.	.
Quercus robur juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28	7	4	.	6	.	.	.
Euonymus europaeus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	76
Acer campestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	65
Lonicera caprifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	35
Prunus spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
Populus alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23
Herbaceous plants																									
Aegopodium podagraria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	17	65	77	85	40	16	.	65
Adoxa moschatellina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	11	14	19	14	6	.	.	17
Filipendula ulmaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	61	2	25	54	51	19	37	.	.
Impatiens noli-tangere	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	68	44	17	54	38	40	26	.	.
Caltha palustris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	45	.	13	35	14	53	79	.	.

Table 1 (continued)

Column no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Primula elatior	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	6	.	30	23	12	42	84	.	.
Paris quadrifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	2	26	.	8	28	10	.	.
Lysimachia vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	85	.	4	23	7	14	31	.	.
Chrysosplenium alternifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	36	.	4	23	8	23	10	.	.
Scirpus sylvaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	.	1	8	3	12	10	.	.
Stellaria nemorum s.str.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	.	5	89	81	9	.	.	.
Anthriscus sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21	.	5	23	18	1	.	.	.
Asarum europaeum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	39	35	10	44	5	.	23
Lamium maculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	52	16	69	49	9	.	+	12
Carex sylvatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	46	16	4	6	54	37	+	.
Ranunculus ficaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80	40	35	33	19	5	.	.
Galeobdolon luteum agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	70	65	26	59	16	.	.
Pulmonaria officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	51	54	5	41	.	.	.
Allium ursinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	36	4	3	20	.	.	.
Phalaris arundinacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	4	54	42	4	.	.	.
Stellaria holostea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	20	54	30	4	.	.	.
Symphytum tuberosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	34	39	.	21	.	1	53
Chaerophyllum hirsutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	35	8	28	21	+	23
Anemone nemorosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57	50	27	32	.	.	.
Silene dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	42	27	8	5	.	.
Carex brizoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	46	24	28	5	.	.
Equisetum palustre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	12	.	4	47	.	.
Carex remota	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	54	99	.	.
Ranunculus lanuginosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	76
Petasites hybridus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	47
Festuca gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	41
Arum italicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	59
Bryonia dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	47
Carduus personata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	47
Elymus caninus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	41
Carex pendula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	23
Salix alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	35
Euphorbia amygdaloides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	35
Cardamine bulbifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	23
Silene latifolia ssp. alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	12
Chaerophyllum temulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	35
Heracleum sphondylium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	35
Bromus ramosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	23
Poa trivialis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	12
Viola alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	12
Dactylorhiza maculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	12
Stellaria media	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	76
Saponaria officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
Myosoton aquaticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
Rubia peregrina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
Equisetum telmateia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
Other species																									
Alnus glutinosa	3	2b	3	3	4	3	4	3	4	2b	5	5	4	3	2b	3	98	82	83	96	87	69	63	4	100
Alnus glutinosa juv.	+	+	+	1	.	+	.	.	+	.	+	+	r	1	.	.	.	6	7	19	.	25	31	.	.
Alnus incana	.	.	.	2b	.	.	.	2b	.	3	.	.	2a	.	.	.	47	19	3	19	2	9	.	.	.
Populus nigra	2b	.	.	.	.	.	2a	.	.	.	.	.	.	.	.	.	2	6	.	8	7	.	.	.	6
Sambucus nigra	+	+	2a	.	+	2a	1	.	+	.	1	2a	2a	+	1	+	47	74	39	58	39	35	5	+	100
Ligustrum vulgare	.	.	.	+	1	.	+	+	1	+	.	1	+	.	.	+	32	20	12	8	1	11	.	+	65
Cornus sanguinea	+	+	.	.	1	.	.	.	1	+	.	.	.	.	.	.	2	82	22	12	9	19	.	2	82
Corylus avellana	.	2a	.	.	+	.	.	.	+	+	2a	.	.	+	.	.	.	19	40	46	16	47	.	.	65
Crataegus monogyna	.	+	.	.	+	+	.	.	+	.	.	+	+	.	.	.	23	20	20	19	5	14	.	.	65
Lonicera xylosteum	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	1	13	32	14	12	3	19	16	.	41
Clematis vitalba	+	+	+	1	1	.	+	+	+	+	1	1	+	1	.	.	.	32	8	19	1	19	.	.	41
Brachypodium sylvaticum	2m	2m	1	2a	2a	2m	1	2a	1	2b	2a	2a	2m	2a	.	.	70	80	43	42	28	52	53	1	53
Geranium robertianum	+	.	1	+	.	2a	+	1	.	2m	2a	1	1	1	1	1	85	54	23	35	27	38	21	2	88
Stachys sylvatica	+	1	1	.	.	1	+	1	+	1	2a	2a	2a	+	+	1	61	61	23	62	45	46	10	2	94
Athyrium filix-femina	+	+	.	+	.	1	1	1	1	1	2a	1	2a	2a	1	.	70	.	22	42	9	41	5	.	.
Oxalis acetosella	.	.	.	+	+	.	2a	2a	1	2a	+	2a	2b	1	.	.	80	.	40	27	22	65	26	.	.
Equisetum arvense	1	+	+	+	1	2m	+	+	2a	1	2m	+	1	2a	+	+	55	4	17	27	14	24	.	+	30
Parietaria officinalis	+	2b	3	.	.	2b	.	1	.	.	.	2b	2a	+	.	.	.	46	1	.	.	.	.	.	6
Viola riviniana/reichenbachiana	+	1	+	+	2m	2a	1	.	+	1	.	1	.	1	.	.	19	57	17	15	8	32	31	+	35
Lactuca muralis	+	+	+	+	+	1	1	1	+	1	2a	+	2a	1	1	1	40	.	.	.	1	.	.	.	17
Eupatorium cannabinum	+	+	.	.	+	1	+	+	+	1	+	+	+	1	.	.	40	22	4	.	2	21	21	+	12
Fragaria vesca	.	r	.	+	+	+	+	+	.	+	+	+	+	+	+	1	55	.	16	15	5	19	26	.	.
Rubus fruticosus agg.	+	+	.	+	1	1	+	1	+	.	.	.	r	.	.	.	.	.	25	39	14	40	.	+	47
Alliaria petiolata	r	+	1	.	.	1	.	.	.	.	+	1	2a	1	.	.	2	44	14	35	37	4	.	+	70
Dryopteris filix-mas	.	.	.	.	.	1	.	1	.	+	1	+	.	+	+	.	.	.	18	31	16	34	5	.	.
Galium mollugo agg.	+	+	.	+	.	+	.	+	+	+	+	.	.	+	+	+	47	.	4	19	9	6	.	.	.
Urtica dioica	r	.	+	+	.	+	.	+	.	+	1	1	+	+	+	+	80	72	44	89	83	36	10	1	82
Ranunculus repens	+	.	+	+	+	1	+	+	+	+	.	.	+	+	1	+	72	.	13	31	13	20	58	+	.
Taraxacum officinale	+	.	r	.	+	+	r	.	+	+	.	.	r	+	.	+	51	.	.	.	1	.	10	.	.
Moehringia trinervia	.	+	+	.	+	+	.	+	.	.	+	1	1	+	+	+	23	.	1	15	.	6	5	.	.
Glechoma hederacea	.	+	1	.	.	.	+	1	.	+	.	2a	2b	.	.	.	51	74	22	31	46	21	5	.	.
Solanum dulcamara	.	+	.	.	.	.	.	.	+	.	1	.	+	+	1	+	59	2	.	12	19	13	16	.	30
Humulus lupulus	r	.	.	.	+	+	.	.	+	.	1	+	+	.	+	.	79	41	16	46	39	6	.	.	23
Circaea lutetiana	.	.	+	.	.	+	.	.	.	.	.	2a	1	.	.	.	.	89	18	12	11	46	10	+	6
Mentha longifolia	.	.	.	.	.	+	.	+	+	.	.	.	.	+	+	1	11	.	.	.	5	.	.	+	6
Galium aparine	.	.	+	.	.	+	.	.	.	.	.	.	+	1	+	.	25	61	29	73	63	14	.	1	41
Geum urbanum	.	.	+	.	+	1	.	.	+	.	.	+	+	.	+	1	98	78	44	65	42	29	16	+	70

Table 1 (continued)

Column no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Hieracium murorum	.	.	.	+	.	.	+	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.
Deschampsia cespitosa	.	.	.	.	+	.	.	.	1	+	.	+	.	.	+	1	98	6	21	23	20	52	68	.	.
Rubus caesius	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	1	91	83	13	23	34	16	.	3	59
Angelica sylvestris	.	.	.	.	.	.	+	1	.	1	.	.	+	.	.	1	82	.	8	12	11	18	10	+	41
Aethusa cynapium	r	.	+	.	.	+	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	17
Poa nemoralis	.	.	.	.	.	.	.	+	.	+	+	+	.	.	+	+	2	.	8	35	9	6	.	+	12
Rosa canina	.	+	.	.	.	+	+	+	.	+	.	.	+	.	.	.	51	.	.	.	3	.	.	+	.
Myosotis sylvatica agg.	.	.	+	+	.	.	.	.	.	.	.	1	+	+	.	.	.	.	.	.	1	.	.	.	12
Carex pallescens	+	+	.	.	.	+	.	.	+	.	.	+	.	+	.	.	61	.	.	.	1	.	.	.	.
Bryophytes																									
Plagiomnium undulatum	.	+	+	2a	+	.	1	1	.	.	+	+	.	1	+	+									
Conocephalum conicum	+	.	.	1	.	+	1	1	+	.	.	+	.	.	.	.									
Brachythecium rivulare	.	+	1	.	1	+	.	.	.	1	.	+	+	.	+	1									
Atrichum undulatum	.	+	.	.	+	.	.	.	1	.	+	.	.	+	1	.									
Eurhynchium angustirete	.	.	.	+	.	+	.	.	1	.	.	.	.	.	.	.									
Plagiomnium rostratum	.	.	.	.	.	.	.	.	+	1	.	.	+	.	.	.									

Rare species: Agrostis sp. 8, 13:+, A. stolonifera 4:+, Ajuga reptans 13:+, Allium sp. 2, 3, 4, 7, 9:+, Alnus incana juv. 10:1, Arctium sp. 8:+; 3:r, Artemisia absinthium 14:r, Artemisia vulgaris 16:r, Aruncus dioicus 9, 12:+, Astragalus glycyphyllos 11:r, Betula pendula 7:1, B. pendula juv. 3, 4, 10:+, Bromus ramosus 12:+, Bryonia dioica 15:r, Bryum bimum 9:1, Cardamine amara 4, 9, 16:+, Carex digitata 12:+, C. hirta 1, 14:+, C. humilis 11:r, C. spicata 7:+, Celtis australis 5:+; 2, 13:r, Cerastium holosteoides 6:r, Chaerophyllum aureum 16:+, Chelidonium majus 6:+, Cirsium oleraceum 1, 13, 14:+; 5:r, C. palustre 15:+, C. vulgare 15:+; 8:r, Clinopodium vulgare 13:+, Crepis paludosa 4:+, Dactylis glomerata 4, 13:+, Dactylorhiza maculata agg. 14:+; 13:r, Dryopteris affinis 7:+, Dryopteris carthusiana 10:+, Epilobium montanum 15:+, Epipactis helleborine 7:+, E. sp. 11:r, Equisetum variegatum 10:+, Erigeron annuus 9:+, Euonymus europaeus 5, 9, 13:+; 12:r, Fallopia convolvulus 6, 12, 13:+; 8:r, Festuca arundinacea 4, 7, 8:+, F. gigantea 14:+, F. nigricans 4:2a; 7:+, F. sp. 8:+, Galeopsis sp. 3, 6:+, G. tetrahit 11:+, Gymnocarpium dryopteris 14:+, Heracleum sphondylium 7:+, Hieracium bifidum 14:+, H. laevigatum 8:+, H. sp. 11, 13:+, Hippocrepis emerus 8:+, Holcus lanatus 4, 7:+, Hypericum tetrapterum 7, 9:+, Juncus compressus 1:+, J. effusus 9:+, Juniperus communis 4, 10:+, Larix decidua 11:+, Listera ovata 5, 9:+, Lycopus europaeus 2:+, Lythrum salicaria 4, 5:+; 9:1, Melica nutans 10:1, Mentha sp. 1, 2, 4, 5, 9, 11:+, Ophioglossum vulgatum 8:+, Palustriella commutata 10:+, Peucedanum oreoselinum 4:+, Phegopteris connectilis 14:r, Phyteuma betonicifolium 4, 8, 14, 15:+, Picea abies 7, 15:1, P. abies juv. 10, 16:+, Pimpinella major 5:+; 11:r, Plagiomnium affine 9:+, Plagiomnium medium 5:+; 9:1, Plagiothecium succulentum 9:+, Poa angustifolia 5:+, P. sp. 4:1, P. trivialis 6, 8, 9:+, Polypodium vulgare 7:+, Populus tremula 4:1; 12:+, P. tremula juv. 4, 12:+, Primula veris 1, 11:+; 5:r, Prunella vulgaris 11:+; 4:r, Pteridium aquilinum 6:1; 12:+, Rhamnus cathartica 15, 16:+; 13:r, Rosa sp. 4, 9, 11:+, Rubus corylifolius agg. 11:1, R. idaeus 15, 16:+; 11:1, Sambucus racemosa 10:1, Scrophularia nodosa 11:+, Silene latifolia 16:+, Solidago virgaurea 15:+, Sorbus aucuparia juv. 15, 16:+, Stellaria media 14:+, Tilia cordata: 10:1, T. cordata juv. 10:+, Torilis japonica 7, 8, 13, 14:+; 5, 6:r, Ulmus glabra 16:2b; 10:2a, U. glabra juv. 16:1; 2, 10, 15:+, U. minor 6:1, U. minor juv. 5, 6, 9, 13:+, Valeriana officinalis s.l. 10, 15, 16:+, V. tripteris 15:+, Veronica beccabunga 15:+, V. chamaedrys 12, 13:1; 4:+, V. hederifolia agg. 12:+, Viburnum opulus 5:+, Vincetoxicum hirundinaria 4:+, Viola odorata 5:+.

The species composition of the relevés is homogenous, a division into subassociations is not apparent. Relevés no. 15 and 16, however, were made on the margins of the study area in the western Vinschgau Valley at a rather high altitude. Accordingly they show some divergences, e.g. the minor importance of *Hedera helix* and the presence of *Fraxinus excelsior.*

The syntaxonomical comparison with similar associations described in the literature yields a clear differentiation of the Hedero helicis-Alnetum glutinosae (Tab. 1). The most resembling units are the South Tyrolean and Pannonian form of Pruno-Fraxinetum (PF1, PF2) and Aro italici-Alnetum glutinosae (AA1, AA2). The differential species of the Hedero helicis-Alnetum glutinosae include:

1) Thermophilous, partially frost-susceptible species, many of them with submediterranean distribution. These are woody plants (*Fraxinus ornus, Juglans regia, Castanea sativa, Prunus mahaleb, Hedera helix*) as well as herbaceous species (*Festuca heterophylla, Brachypodium rupestre*).

2) Fern species typically growing in rock crevices (*Asplenium trichomanes, Cystopteris fragilis, Asplenium adiantum-nigrum*).

3) Pioneer or ruderal species (*Arctium minus agg., Tussilago farfara*).

In addition, the Hedero helicis-Alnetum glutinosae is negatively differentiated by the absence of many species. These are mainly character species of the order Fagetalia (e.g., *Fraxinus excelsior, Impatiens noli-tangere, Ficaria verna, Galeobdolon luteum* agg.), of wet meadows (e.g., *Filipendula ulmaria, Caltha palustris, Lysimachia vulgaris*) and of wet forest communities (e.g., *Festuca gigantea, Carduus personata, Carex pendula*). The comparison of average indicator values of soil moisture in Tab. 1 shows that the value of the Hedero helicis-Alnetum glutinosae is the lowest.

4.2. Syntaxonomical Status

We assign the Hedero helicis-Alnetum glutinosae to the class Querco-Fagetea Br.-Bl. & Vlieger 1937, order Fagetalia sylvaticae Pawł. 1928, alliance Alnion incanae Pawł. 1928 and suballiance Alnenion glutinoso-incanae Oberd. 1953 (Willner & Karner 2007). The attribution to Fagetalia is well-founded as species of Central European deciduous forests make up the largest part of species. The affinity to the alliance and suballiance of riparian alder forests is above all based on the dominance of *Alnus glutinosa* and habitat characteristics. In the herb layer, however, character species of Alnion incanae are of little importance (e.g., *Stachys sylvatica, Circaea lutetiana*).

4.3. Habitat

The sample plots are situated in 5–15 m wide, often deeply indented brook valleys (Fig. 2). The microclimate of the forested, shady valleys is relatively cool and humid compared to the surrounding area. However, the southerly exposure on a large scale leads to generally high temperatures.

The streams are mostly small and, due to the strong inclination, rapidly flowing. The forest stands grow in areas from 0 to 1.5 m above the stream level. The incline of the banks is varying, but often quite steep. Accordingly, the action of running water and the water supply in the upper soil layers are considerably varying within a sample plot. The banks of the streamlets are strongly affected by the eroding action of the rapidly flowing water. In contrast, areas further away from the stream are only rarely flooded. The main soil type is brown soil. Soils are skeleton-rich and exhibit high loam

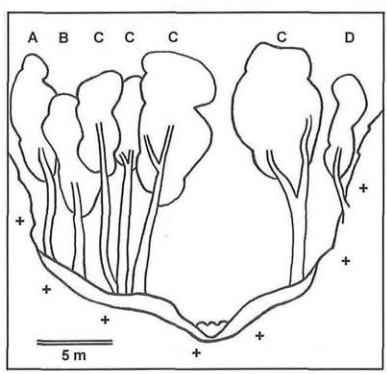

Fig. 2. View of a typical stand of Hedero helicis-Alnetum glutinosae. The crosses mark solid rock. Symbols for tree species: A – *Fraxinus ornus*, B – *Juglans regia*, C – *Alnus glutinosa*, D – *Quercus pubescens*.

contents. Nitrogen content of the soil is presumably high owing to the impact of the symbiosis of alder with bacteria of the genus *Frankia (Actinomycetes)*. Soil depth is low to moderate and varying within the sites. In general it doesn't exceed 60 cm. In this depth usually solid rock is reached. Consequently, also the waterlogged soil zone beneath and lateral to the streambed, belonging to the hyporheic zone and/or the groundwater zone, is very narrow.

5. Discussion

5.1. Syntaxonomy and Site Ecology

The Hedero helicis-Alnetum glutinosae exhibits substantial floristic differences from the most similar Central European units, although these were recorded not far from the study area, in the Vinschgau valley and in adjacent Austria. The following features are evident:

1. The Hedero helicis-Alnetum glutinosae comprises only few species indicating moist and wet soils. This is also shown by the low ecological indicator value of soil moisture. Obvious reasons for this are the limited influence of surface water and groundwater within the stands. Presumably also climate, i.e. high temperatures and drought, could be relevant. Owing to its rather dry character the Hedero helicis-Alnetum glutinosae shows a certain resemblance to stands of no longer flooded, former alluvial forest. This applies for example to dry floodplain forests in Eastern Switzerland ("Ulmo-Fraxinetum impatientetosum", Frey 1995); dominating species of that unit are *Alnus glutinosa* and *Fraxinus excelsior* in the tree layer and *Impatiens parviflora, Glechoma hederacea, Circaea lutetiana, Geum urbanum* and *Brachypodium sylvaticum* in the herb layer.

2. Remarkable is the almost complete absence of *Fraxinus excelsior* and *Prunus padus*, which do occur in the Vinschgau Valley (Wilhalm & al. 2006). Both are constant and diagnostic species of the Alnion incanae (Oberdorfer 1992, Chytrý & Tichý 2003, Willner & Karner 2007). Also in this case a probable explanation is the rather dry soil character and the lacking contact to a larger groundwater body. However, the absence of *Fraxinus excelsior* is striking as this species tolerates also strong water deficit (Marigo & al. 2000).

3. The Hedero helicis-Alnetum glutinosae contains a very small number of geophytes, whereas this life form occurs frequently in the Pruno-Fraxinetum, Stellario nemorum-Alnetum and Carici remotae-Fraxinetum (e.g., *Ficaria verna, Anemone nemorosa, Allium ursinum;* Tab. 1). High frequency and dominance of geophytes are generally characteristic for Central European floodplain forests (Ellenberg 1996). This is also the case in warm regions in Central Europe (e.g. South-eastern pannonian Austria; see unit PF2 in Tab. 1; Karrer & Kilian 1990).

The distinction from the Aro italici-Alnetum glutinosae is mainly based on other differential species (Tab. 1). Essential is the comparison with the nomenclatural type of the association by GAFTA & PEDROTTI 1995 (unit AA1 in Tab. 1). In addition, Tab. 1 contains data of anthropogenically altered, coppiced stands of the association from a regional study (FRANCALANCIA & MARCONI 1994; unit AA2).

The above mentioned points apply in part to the comparison between Hedero helicis-Alnetum glutinosae and Aro italici-Alnetum glutinosae. Firstly, also the Aro italci-Alnetum glutinosae has several differential species which indicate soil moisture (e.g., *Festuca gigantea, Carex pendula, Ranunculus lanuginosus, Carduus personata*). As to the above mentioned point 2, in the here displayed data of the Aro italici-Alnetum glutinosae *Fraxinus excelsior* and *Prunus padus* do not occur, but they can be found in other Alnion incanae units in Northern and Central Italy (PEDROTTI & GAFTA 1996). Finally, geophytes are frequent also in the Aro italici-Alnetum glutinosae (e.g., *Arum italicum, Cardamine bulbifera*).

Altogether, the data by FRANCALANCIA & MARCONI 1994 show a moderate resemblance with the Hedero helicis-Alnetum glutinosae (Tab. 1). They include some of its differential species, e.g., *Hedera helix, Prunus avium, Lapsana communis* and *Salvia glutinosa*. A broad syntaxonomical overview on South European riparian forests by DIERSCHKE 1980 reveals that *Hedera helix*, a dominant species in the Hedero helicis-Alnetum glutinosae, is a constant species in many of these forests types. There exists also a study on *Alnus incana* forests of Europe showing an increased occurrence of *Hedera helix* in communities of the Southern and South-western Alps (SCHWABE 1985).

Thus, a floristical affinity of the Hedero helicis-Alnetum glutinosae with South European floodplain forests can be stated. Considering possible reasons for the formation of this association, this resemblance may point out the relevance of the dry and warm climatic conditions in the study area. Temperature has also been shown to be the most important factor for the variability of Alnion incanae communities in the Czech Republic (DOUDA 2008). Besides, a decisive factor for the development of the Hedero helicis-Alnetum glutinosae could also be the regional absence of competing tree species: In adjacent, less continental parts of South Tyrol *Ostrya carpinifolia* dominates forests in small valleys and ravines in the colline and submontane belt, whereas in the study area it is absent for climatical reasons (PEER 1982).

Aside from that, the Hedero helicis-Alnetum glutinosae shows certain floristical and ecological relations to Carpinion betuli units. An example is a submontane forest community dominated by *Castanea sativa, Fraxinus excelsior* and *Alnus glutinosa*, which is developed in insubrian, precipitation-rich Southern Switzerland (ANTONIETTI 1968: "Querco-Fraxinetum prov.", ELLENBERG & KLÖTZLI 1974: "Arunco-Fraxinetum castanosum").

Those sites are slopes on base-rich silicate bedrock with moist, nutrient-rich soils. Floristic similarity with the Hedero helicis-Alnetum glutinosae is expressed by the frequent occurrence of *Alnus glutinosa, Castanea sativa, Rubus fruticosus* agg., *Athyrium filix-femina, Salvia glutinosa, Hedera helix* and *Festuca heterophylla* (ELLENBERG & KLÖTZLI 1974). However, the Swiss stands are clearly differentiated by species revealing a higher water supply and a lower pH-value of the soil (e.g., *Fraxinus excelsior, Frangula alnus, Aruncus dioicus, Molinia arundinacea, Pteridium aquilinum, Vaccinium myrtillus*). In view of the huge climatic difference of the two regions, the floristic resemblance of both forest types seems striking and points out the relatively humid and cool microclimate of the Hedero helicis-Alnetum glutinosae stands.

5.2. Endangerment and Conservation

Generally the Hedero helicis-Alnetum glutinosae can be considered as a very rare community, as only few streamlets are found in the study area. This forest type is of high conservation value. It corresponds to the priority natural habitat type "91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)" according to Annex I of the flora-fauna-habitat directive of EU (LASEN & WILHALM 2004). The community considerably contributes to the floristic diversity of the region, as it is rich in species with suboceanic distribution and contains several regionally rare taxa (e.g., *Ophioglossum vulgatum*).

However, the stands are threatened by a potential reduction of the streams' water flow, as black alder relies on a continuous, good water supply (WALENTOWSKI & EWALD 2003). In contrast to other alluvial sites, the trees do not reach a groundwater body that is independent of the stream water. In dry stream beds within the study area, dead individuals of black alder can be found. A reduction of water flow can be expected in the course of upcoming climate change, among others because of increasing water demand by agriculture.

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