Annual report of the Geobotanical Institute ETH (2000)

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P. J. EDWARDS

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1 Introduction

The year 2000 was again a very busy year for the Geobotanical Institute. In addition to the ongoing teaching and research activities, a number of new research projects were started, and grant applications for further projects were submitted. In particular, the institute has become involved in several European Union projects where it collaborates with institutes from other European countries.

Two developments at ETH will affect the Geobotanical Institute: the move of the Department of Environmental Sciences into the former chemistry building in 2004, and the reorganisation of the so-called *"Grüner Bereich"* of ETH, which consists of the Departments of Forest Sciences, Agriculture and Food Science, and Environmental Sciences. At present there are intensive discussions about merging these disciplines, possibly in a School of Environmental Sciences and Natural Resources.

In April 2000 the institute took over the management of the *Swiss Botanical Society* for a period of three years. A very successful excursion to the English Lake District was organised by P. Jewell and attended by 18 institute members in September 2000. Several excursions and a symposium were held together with visitors from the University of Utrecht.

The homepage of the institute (http://www.geobot.umnw.ethz.ch) was completely redesigned and greatly expanded by H. Dietz, K. Rohweder and H. Vogel. It now provides continually updated information over institute members, teaching, research projects and publications.

2 Staff of the Institute

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Alexander BURKARDT
René FÜCHTER
Irène GALINANES
Beatrix KÜTTEL
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Andreas NAEF
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Scientific visitors
Prof. Dr. Frank KLÖTZLI, Geobotanisches Institut ETHZ (1.1.–31.12.00)
Prof. Dr. Elias LANDOLT, Geobotanisches Institut ETHZ (1.1.–31.12.00)
Drs. Andrea LEONARDI, University of Pavia, Italy (15.5.–15.6.00)
Alexandra FRASER, Kansas University, USA (20.9.–31.12.00)
Almut SCHERER, University of Utrecht (23.7.–15.8.00)
Prof. Dr. Krystyna M. URBANSKA, Geobotanisches Institut ETHZ (1.1.–31.12.00)
Pille URBAS, University of Tartu, Estland (1.8.–31.12.00)

2.3 RETIREMENTS

Several people left the Geobotanical Institute after many years of valuable collaboration, due to new developments in their private or professional life. They are gratefully acknowledged here. The institute secretary Karin Lee was replaced by Erika Aeschbach, formerly secretary of the Geological Institute. Dr. Johannes Kollmann was appointed as associate Professor in Copenhagen, and Dr. Hansjörg Dietz from the University of Würzburg took over his position. Finally, Roger Stupf was replaced by Hans-Heini Vogel in his function as system administrator.

The institute members deeply regret having lost Anita Hegi on 16 April 2000 after almost one year of serious illness. The following lines remember the enormous contribution she made to institute.

Anita Hegi (1942–2000)
Anita Hegi was appointed by the Geobotanical Institute in 1974 and served the institute for more than 25 years as technical assistant

in the field and in the laboratory. She looked after the Lemnaceae collection for more than 20 years, which involved the cultivation of up to thousand or more lines for experimental studies. She took care of these inconspicuous plants with greatest carefulness and full dedication. She also carried out a great diversity of other tasks, helping with chemical analyses, morphological measurements, chromosome studies and preparations for microscopy. In addition, Anita Hegi contributed enormously to the safe and smooth functioning of the institute through her continuous presence and attention. She knew each institute member personally, was always generous and ready to help, and assisted in times of personal difficulties or conflicts. With Anita Hegi, the institute has lost an exceptionally cheerful, kind and careful collaborator (*E. Landolt*).

3 Research

3.1 Overview

The research of the Geobotanical Institute is focused on four main directions: plant ecology, plant evolution and systematics, mycology, and archaeobotany; the main interests of the research groups are described in detail below.

3.2 Research fields

Section Plant Ecology

Group 1: Community and Ecosystem Ecology
(Prof. Dr. P.J. Edwards, Dr. C. Abivardi, Dr. H. Dietz, Dr. P. Ryser, Dr. S. Güsewell, Dr. E. Weber)

- Ecosystem processes: nutrient budgets, herbivory and other biotic interactions
- Ecosystems on a landscape level and GIS
- Agroecology
- Physiological and ecological characters of plants; plasticity in response to light and nutrients
- Herb-chronology and its application to population ecology
- Ecology of invasive plants

Group 2: Plant Ecology and Conservation Biology
(Prof. Dr. A. Gigon, Dr. D. Ramseier)

- Ecological stability: concepts and case studies
- Competition, positive biotic interactions, and coexistence of plants
- Restoration ecology
- Assessment of biodiversity
- Conservation of rare ecosystems and species

Section Evolution and Systematics

Group 1: Evolutionary Ecology
(Prof. Dr. B.A. Roy, Dr. D. Siemens)

- Role of pathogens in structuring plant populations and communities
- Relation between resistance to pathogens and tolerance to physical stress
- Co-evolution between pathogens and hosts: the roles of host species, their distribution and ecology

Group 2: Plant Systematics and Evolution
(Dr. M. Baltisberger, Prof. Dr. E. Landolt, Dr. A. Widmer)

- Speciation and population genetics in *Draba, Ranunculus, Ophrys* and *Viscum*
- Microevolution and genetic adaptation in a changing environment
- Plant–pollinator interactions
- Taxonomic revision of the Lemnaceae
- Survey of the flora of Zürich

Section Mycology

(Prof. E. Horak, PD Dr. A. Leuchtmann)

- Plants and fungi (ectomycorrhiza, saprophytes) in various habitats of the northern and southern hemisphere

- Monographic revision of several genera of the Agaricales (*Crepidotus, Galerina*) and Boletales (*Boletellus*)
- Evolution and ecology of symbiotic interactions between grasses and endophytes
- Dispersal and infection strategies of the endophyte *Epichloë*

SECTION ARCHAEOBOTANY

(Dr. C. Jacquat, Dr. O. Mermod)

- Diversity and evolution of agricultural and adventitious plants
- Agricultural systems and human influence on the natural vegetation of Switzerland from the Neolithic period to the Middle Age
- Transition from nomadic to resident life in Jordan (Petra)

3.3 NEW RESEARCH PROJECTS 2000

(Title. Source of funding. Research assistant(s); project leader)

- "Competition of wetland plants as affected by shade". ETHZ. K. Edelkraut; S. Güsewell.
- "Consequences of crop to wild plant transgene flow for biodiversity of associated organisms and implications for hybrid invasiveness". ETHZ. M. Meier; A. Hilbeck, P. Edwards & B. Roy.
- "Effects and mechanisms of BT transgenes on biodiversity of non-target insects: pollinators, herbivores and their natural enemies". EU. J. Schmidt; P. Edwards & A. Hilbeck.
- "Effects of elevated CO_2 on diversity and community structure of arbuscular mycorrhizal fungi in a grassland ecosystem. ETHZ. H. Gamper; A. Leuchtmann.
- "Study of the extracts of several medicinal plants and their active ingredients, as Methyl Bromide alternatives for control of insect pests, plant-parasitic nematodes and soil-borne plant pathogens". CIMBRIA Stiftung Zürich & ETHZ. C. Abivardi.

4 Excursion to the English Lake District 2000 - a travel report

PETER JEWELL & DIETER RAMSEIER

From September 17th to 23rd 2000, 18 members of the Geobotanical Institute ETH joined an excursion to the English Lake District. It was our intention to look at the wide habitat diversity and flora of this beautiful region and to meet local scientists to exchange ideas and learn about their research activities. For one week we would be based at Ambleside in accommodation belonging to Charlotte Mason College. This chronological report serves as an account and record of our activities.

The Lake District was interesting to us for a number of reasons. The proximity of the Irish Sea coast and relatively high mountains (Scafell Pike: 984 m a.s.l.) mean that steep meteorological gradients occur across the whole region. Within 20 km the annual precipitation rises from about 900 mm a^{-1} up to about 4500 mm a^{-1} (Pearsall & Pennington 1989). Habitats in the Lake District are further divided by differences in geology and land use history. For a group from Switzerland, the area is of particular interest because of the large number of arctic-alpine relicts that still survive there.

Monday. To consider influences of moisture and geology across the region, we visited three contrasting locations (Fig. 1, Table 1). First we travelled west across Hardnott and Wrynose pass, from where we saw splendid views of the Isle of Man and Ireland, into Eskdale to visit a very humid Milkingstead wood (Fig. 2). Eskdale is at the western edge of the Lake District, where the winter climate is warm and humid enough to allow various

Table 1. *Elevation and rainfall at six sites in The Lake District (UK) visited during the excursion. Elevation was approximated from the 1:50'000 OS map for West Cumbria (No. 89). Rainfall values are means of 1941-1970, from Halliday (1997). Site numbers are as in Fig. 1*

Nr.	Location	Elevation (m a.s.l.)	Rainfall (mm a^{-1})	Dominant geology
1	Mikingstead Wood	± 50	3200-4000	Eskdale granite
2	Wastwater	50-100	2400	Borrowdale volcanic series
3	Helton Fell	± 300	1200-1600	Borrowdale volcanics (Eastern limit)
4	Grange-over-Sands	0	1000	Carboniferous limestone
5	Sandscale Haws	±10	1200	Carboniferous limestone
6	Helvellyn (summit)	950	3200	Borrowdale volcanic series

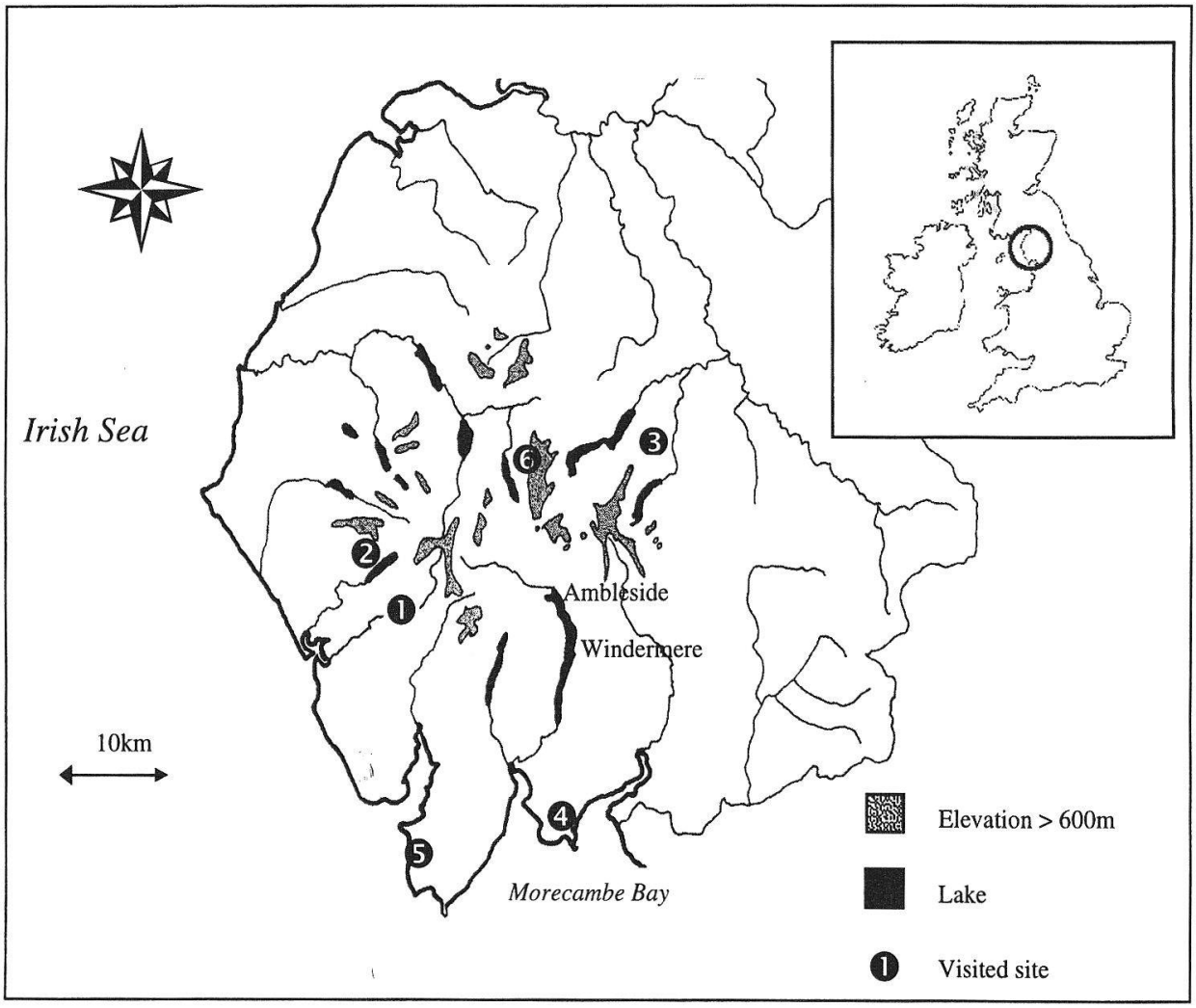

Fig. 1. Map of Cumbria, The Lake District, with sites visited during the excursion, lakes, and areas above 600 m elevation. For numbers of sites see Table 1. Redrawn from Halliday (1997)

filmy ferns to grow. We saw three species: *H. tunbrigense, H. wilsonii* and *Trichomanes speciosum*. We also saw *Dryopteris aemula,* another fern with an atlantic distribution, and at a nearby Mitredale wood on less acidic geology we saw a fine stand of the Royal fern (*Osmunda regalis*). An interesting story surrounds recent discoveries of *Trichomanes speciosum*. Plant hunters have overlooked the gametophyte form in favour of the sporophyte. However, more widespread discoveries of the gametophyte suggest that the distribution of *T. speciosum* is not as restricted as once thought. In Switzerland *Hymenophyllum* species only occur in the more oceanic climatic conditions of Tessine, but they are unable to survive the cold montane winters. We were to find other similarities between Switzerland and the Lake District throughout the week.

En route to our next site we saw, in the steep scree slopes above Wastwater, the rare shrubby cinquefoil (*Potentilla fruticosa*), an arctic relict that is now widely planted as an ornamental species. Wastwater is the deepest lake in the region at 76 m and is set in an impressive glacial landscape. The water is very base-poor, which results from the volcanic, acid geology which dominates the mountainous central Lake Disitrict. The landscape surrounding Wastwater is absolutely typical of this volcanic geology. On the edge of the lake we looked at an oligotrophic mire and our species lists grew. After watching what may be considered "an entertainment" in the Lake District (a farmer moving his sheep), we travelled 30 km inland to Helton Fell on the Eastern side of the region (Table 1, Fig. 1). Although overlying similar geology, Helton Fell provided a contrast to the wet woods and

Fig. 2. *Milkingstead wood, Eskdale. A typical "wet woodland" rich in ferns and bryophytes.*

mire we saw earlier. We saw more arctic-alpine or circumpolar species, e.g. *Nardus stricta* and the deer sedge (*Trichophorum caespitosum*), Butterwort (*Pinguicula vulgaris*), the grass of Parnassus (*Parnassia palustris*) and the starry saxifrage (*Saxifraga stellaris*).

One feature of interest, which was on everybody's mind by the end of our first day, was the low tree line. If we had investigated a transect from west to east across the region we would have witnessed a steady rising of the tree line as oceanic effects were reduced. For the sake of the record we can quote from Halliday and Malloch (1981) that the tree line is reduced with oceanicity, because of increased cloud and precipitation and lower summer temperatures. As a result, increased altitude produces a greater reduction in the growing season in oceanic uplands, which in turn reduces the upper limit at which trees can grow.

Tuesday was spent with Dr. Robert BUNCE from Merlewood, which is a research station of the Centre for Ecology and Hydrology (CEH, formerly the Institute of Terrestrial Ecology). We received an excellent overview of the work done at Merlewood and then we hiked through some agricultural landscapes. Dr Bunce talked and we listened, sometimes agog at the conversation to which we were privy.

On **Wednesday** we spent a day appreciating the work and facilities at Ferry House on Lake Windermere, which is a Freshwater ecology arm to the CEH. In the evening a party set off for "That famous seaside town" Blackpool in search of some human behavioural ecology and maybe a fish.

The Western coastal fringe of the Lake District is dominated by salt marsh and dune systems, (although oak woodland does run to the sea in some locations). **Thursday** was spent looking at some of these coastal features with the National Trust's warden for Sandscale Haws Nature reserve. We began the day at Grange-over-Sands which is on the northern side of Morecambe Bay (Table 1, Fig. 1). At Grange-over-Sands we saw a coastal landscape dominated by swathes of *Spartina anglica,* where 30 years past there had been sand to play in (according to Peter Jewell).

In 1937 *S. anglica* was introduced into the outer bay in order to trap sediment (P. Burton, pers. comm.), and from the 1940's it has appeared in vegetation records. Throughout the 1980's and 1990's due to the speed and extent of its spread and its perceived blighting of landscape, *S. anglica* has been increasingly regarded as menace in the area. In conservation terms *S. anglica* can also be a problem since it grows so vigorously that it excludes other species. Halliday (1997) notes that the local declines of *Limonium* spp. and *Aster tripolium* are hastened by the growth of the *Spartina.* There is almost no food value in seeds for birds but enough for certain arthropods (e.g. *Hydrobia*). Attempts to eradicate *S. anglica* with herbicides, stonebreakers or digging out have not been successful. But as we go to press local newspapers are reporting a new million pound attempt at eradication.

Next we moved on to Barrow in Furness to visit Tummer Hill Marsh, which might be described as maritime ecology against a backdrop of severe anthropogenic disturbance. The site is a UK designated Site of Special Scientific Interest: that is a protection order for areas of particular ecological importance. In this case an area of species rich salt-marsh situated among the hangars and homes of Vickers Shipbuilding Co. We finished the day at the Sandscale Haws National Nature Reserve, where our guide was able to show us

some active demonstrations of restoration ecology. At Sandscale Haws we visited a wide range of habitats including dunes and dune slacks as well as some impressive long-term grazing exclosures (Table 1, Fig. 1).

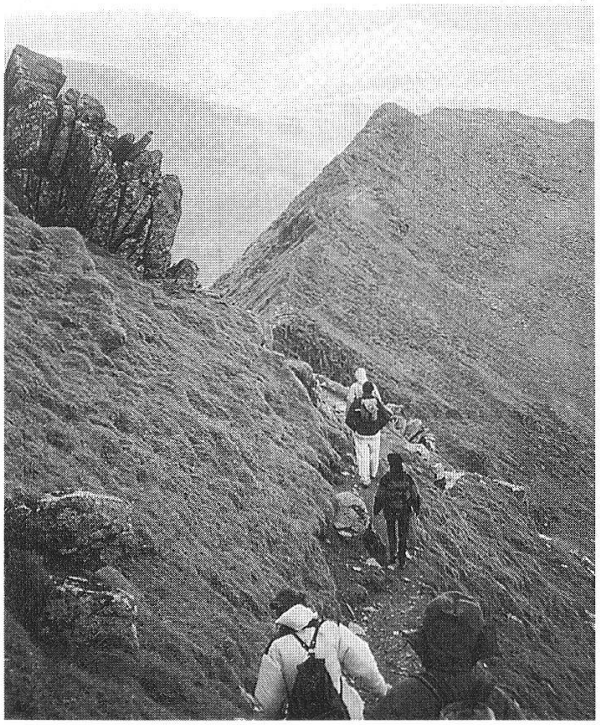

Fig. 3. Descending Helvellyn mountain (950 m a.s.l.) along Striding Edge.

On **Friday** most of the party climbed to the top of the second highest peak in the Lake District, Helvellyn (950 m a.s.l.; Table 1, Fig. 3). As the name of the mountain may suggest, the landscape was reminiscent of the Swiss Alps. Similar to the Alps this was largely the result of the area's land use history. Quarrying, mining, peat cutting and grazing having been the most important factors and quarrying is still going on, whereas peat cutting has stopped and grazing has been reduced. We found many plant species well known from the Alps, like *Oxyria digyna, Cerastium alpinum, Antennaria dioeca, Saxifraga oppositifolia, Silene acaulis, Minuartia verna, Salix herbacea,* and *Dryas octopetala.* But these arctic-alpine elements occur in the Lake District only on the few places with neutral or rather base-rich soils (Pearsall & Pennington 1989), whereas their occurrence in Switzerland is on places rather poor in bases (first three), indifferent, or base-rich as well (last one). One species, *Valeriana officinalis,* which is only found below the tree line in Switzerland, we found here well above the tree line.

Peat deposits looked to be much deeper uphill than downhill. We assumed the steep gradient in temperature and precipitation to be the reason. In some places the heaviest rains had caused sub-surface soil pipes to burst, but we saw only the aftermath of these events: black rips in the soil and sometimes a visible washout zone below. It is interesting that this phenomenon was not recognised by any of our Swiss contingent. Our last day was a suitable end to an interesting week. We had great weather all week (which is a rather endangered species in the Lake District) and we had humorous and intelligent guides throughout.

We wish to thank, for their help with the planning and execution of our excursion: Mr. Jeremy Roberts, Dr. Rod Corner, Dr. Robert Bunce, Prof. Alan Pickering and all at Ferry House, Mr. Peter Burton, Dr. Geoffrey Halliday and Mr. Robinson from Blackpool, as well as the Rübel foundation for financial support.

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Pearsall, W.H. & Pennington, W. (1989) *The Lake District.* Collins New Naturalist Series. Bloomsbury Books London.

5 List of publications 2000

5.1 *PERSPECTIVES IN PLANT ECOLOGY, EVOLUTION AND SYSTEMATICS,* 3 (2000)

The third volume of the journal *Perspectives in Plant Ecology, Evolution and Systematics* appeared in two issues in 2000 with a total length of 164 pages. This volume contains 9 monographic contributions and reviews. The aims and scope of the journal are given under http://www.urbanfischer.de/journals/ppees/. Dr. Karl Fleischmann serves as Managing Editor, and Prof. Peter J. Edwards is Editor-in-Chief. The Editorial Board consists of six scientists from the ETH Zurich and the Universities of Zurich and Bern, and the editors are supported by an international Advisory Board of about 20 ecologists and systematists. All contributions are peer-reviewed.

Issue 1/00

Wells, C.L. & Pigliucci M. Adaptive phenotypic plasticity: the case of heterophylly in aquatic plants. 1–18.
Zotz, G. Size-related intraspecific variability in physiological traits of vascular epiphytes and its importance for plant physiological ecology. 19–28.
Kollmann, J. Dispersal of fleshy-fruited species: a matter of spatial scale? 29–51.
Alpert, P., Bone, E. & Holzapfel, C. Invasiveness, invasibility and the role of environmental stress in the spread of non-native plants. 52–66.
Schütz, W. Ecology of seed dormancy and germination in sedges (*Carex*). 67–89.

Issue 2/00

Nybom, H. & Bartish, I.V. Effects of life history traits and sampling strategies on genetic diversity estimates obtained with RAPD markers in plants. 93–114.
Müller, I., Schmid, B. & Weiner, J. The effect of nutrient availability on biomass allocation patterns in 27 species of herbaceous plants. 115–127.
Van Wijnen, H.J. & Bakker, J.P. Annual nitrogen budget of a temperate coastal barrier salt-marsh system along a productivity gradient at low and high marsh elevation. 128–141.
Mitchell, R.J., Auld, M.H.D., Le Duc, M. G. & Marrs, R.H. Ecosystem stability and resilience: a review of their relevance for the conservation management of lowland heaths. 142–160.

5.2 *BULLETIN OF THE GEOBOTANICAL INSTITUTE ETH,* **66** (2000)

Articles

Holderegger, R. Changes in rosette size distribution of *Saxifraga mutata* in a successional sere. 3–10.
Güsewell, S., Zorzi, A. & Gigon A. Mowing in early summer as a remedy to eutrophication in Swiss fen meadows: are really more nutrients removed? 11–24.
Ramseier, D. Why remove the topsoil for fen restoration? Influence of water table, nutrients and competitors on the establishment of four selected plant species. 25–36.
Billeter, R. & Diemer, M. Effects of abandonment on *Tofieldia calyculata* (Liliaceae), a common, subdominant wetland species. 37–46.

Research Projects

Stehlik, I., Holderegger, R., Schneller, J.J., Abbott, R.J. & Bachmann, K. Molecular biogeography and population genetics of alpine plant species. 47–60.
Edelkraut, K., Ramseier, D. & Güsewell, S. Competition of wetland plants as affected by shade and nutrient supply. 61–70.

5.3 FURTHER PUBLICATIONS

A Publications in refereed journals or books

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Gautschi, B., Widmer, A. & Koella, J. (2000) Isolation and characterization of microsatellite loci in the Dice Snake (*Natrix tessellata*). *Molecular Ecology,* **9,** 2191–2193.

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Güsewell, S. & Klötzli, F. (2000) Assessment of aquatic and terrestrial reed stands. *Wetlands Ecology and Management,* **8,** 367–373.

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Gurnell, A.M., Petts, G.E., Harris, N., Ward, J.V., Tockner, K., Edwards, P.J. & Kollmann, J. (2000) Large wood retention in river channels: the case of the Fiume Tagliamento, Italy. *Earth Surface Processes and Landforms,* **25,** 255–275.

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Kahl J., Siemens, D.H., Aerts, R.J., Gäbler, R., Kühnemann, F. Preston, C.A. & Baldwin, I.T. (2000) Herbivore-induced ethylene suppresses a direct defense but not an indirect defense against an adapted herbivore. *Planta,* **210,** 336–342.

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Landolt, E. (2000) Some results of a floristic inventory within the city of Zürich (1984–1998). *Preslia, Praha,* **72,** 441–455.

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Petts, G.E., Gurnell, A.M., Gerrard, A.J., Hannah, D.M., Hansford, B., Morrissey, I., Edwards, P.J., Kollmann, J., Ward, J.V., Tockner, K. & Smith, B.P.G. (2000) Longitudinal variations in exposed riverine sediments: a context for the ecology of the Fiume Tagliamento, Italy. *Aquatic Conservation: Marine and Freshwater Ecosystems,* **10,** 249–266.

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