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## 6. ENGLISCHE ZUSAMMENFASSUNGEN DER IM BERICHTS- JAHR 1989 ABGESCHLOSSENEN DISSERTATIONEN UND DIPLOMARBEITEN (Summaries of Ph D and Diploma Theses)

### 6.1. Dissertationen (Ph D Theses)

RYSER Peter. Influence of gaps and neighbouring plants on seedling establishment in limestone grassland. Experimental field studies in northern Switzerland. Veröff. Geobot. Inst. ETH, Stiftung Rübel, Zürich 105, 71 S.

*Einfluss der Kahlstellen und benachbarten Pflanzen auf das Wachstum der Jungpflanzen in Wiesen auf Kalkstein.*

The influence of vegetation on the establishment of new seedlings was studied experimentally in a limestone grassland (*Mesobrometum*) in northern Switzerland. Seeds of six dicotyledonous species (*Arabis hirsuta*, *Linum catharticum*, *Medicago lupulina*, *Plantago lanceolata*, *Primula veris* s.l. and *Sanguisorba minor*) were collected at the study site and sown in artificially created microsites, which were differentially influenced by adult plants of three species common in the meadow (*Bromus erectus*, *Onobrychis viciifolia* and *Salvia pratensis*). The microsites were tufts of the adult plants, the edges around them and gaps beside them. The influence of moss cover on the establishment was studied on separate plots. Seeds were sown in August of 1986 and 1987. Emergence, fate of emerged seedlings and their growth was followed during one or two years. As the emergence after the first sowing was poor, the quantitative data presented in the summary is based on results of the second sowing.

1. Germination occurred in all microsites. Moderate vegetation cover increased the number of seedlings of all species, although it often delayed the emergence. Most seedlings emerged in spring. The only species with mainly autumn germination was *Arabis*.
2. Three major patterns of establishment in relation to the influence of neighbouring plants could be distinguished:
  - *Plantago* and *Sanguisorba* established well in all microsites. Their mortality was slightly higher in dense vegetation than in gaps, but in all microsites 50-90% of the emerged seedlings survived the first growth period.
  - *Linum* was extinguished by a fungal disease in spring 1988 regardless of the microsite. Thus the analysis of establishment is based only on the small number of seedlings, whose fate could be followed during 1987. The results indicate a good establishment in gaps and a detrimental effect of dense vegetation cover.
  - *Arabis* and *Primula* were hardly at all able to establish in gaps. They suffered a high mortality because of abiotic factors such as frost heave in winter (*Arabis*) and desiccation after the mowing of the meadow. The vegetation enhanced the establishment by stabilizing the soil and preventing the desiccation. Less than 5% of the *Arabis*-seedlings survived one year in the gaps, while the survival was 21-43% in edges and 25-52% in tufts. Moss cover enhanced the establishment of *Arabis* significantly. *Primula* survived to less than 25% in gaps, the figures for edges and tufts being 35-93% and 42-57%, respectively. Late emerging *Primula*-seedlings had a significantly higher mortality in summer than the early emerging ones.

*Medicago* differed in its establishment in the two years of study. Survival in 1987 was high, 56-100% in the different microsites after one growth period. In 1988 survival was low. It was better in the shelter of *Onobrychis* (47-51%) than in the other microsites (0-42%).

3. The growth of the seedlings was very slow, and the seedlings remained small until the end of the study. Species with the best survival, *Plantago* and *Sanguisorba*, had the largest plants in autumn 1988. The growth of these species was reduced by vegetation cover.
4. The species of the neighbouring plant influenced the establishment and growth of *Ara-bis*, *Medicago* and *Plantago*. Seedlings of these species established better and were larger in *Onobrychis*-plots than in *Bromus*-plots.
5. Vegetation cover did not prevent the establishment of seedlings. Climatic factors were more decisive for their survival than competition. Neighbouring plants had a positive effect on establishment of species vulnerable to climatic hazards. On the whole, species differed more in their ability to establish in gaps than in dense vegetation. The observed slow growth and the survival of the seedlings over long periods in undisturbed turf are important factors for the maintenance of the high species density in nutrient-poor lime-stone grasslands.

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## 6.2. Diplomarbeiten (Diploma Theses)

HATT Marcel. Samenvorrat von zwei alpinen Böden. 64 S. (Polykopie). (s. Beitrag in diesem Band).

*Seed pool of two alpine soils. (See contribution in this volume).*

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JUTZ Xaver. Vegetationskartierung und Standortuntersuchungen in Feuchtgebieten auf der Ricken-Passhöhe. 66 S. + Anhang. (Polykopie).

*Vegetation mapping and site investigations in wetlands around Ricken-pass.*

In the last few years, considerable effort has been put into investigation and protection of the remaining wetlands. Many are endangered and there are still numerous areas that demand investigation. The mapping of all minerotrophic peatlands ("fen inventory" = Flachmoorkartierung) showed that the landscape between Rapperswil and Ricken-pass is rich in wetlands and that some have subalpine character even at 500 m a.s.l.

In this report plant communities of the area of the Ricken-pass were investigated. The different associations were recorded on a map. At two sites the nutrient conditions were assessed by establishing transects from the farmland to the wetland. Suggestions and recommendations were made for the protection of the area.

The phytosociological investigations highlighted the combined presence of acidophilous and calcicolous plant communities. Observations and results suggest that the communities are related to topographical and hydrological conditions. Whilst the top soil is acid base-rich groundwater and/or surface water flushes one site such that calcicolous plants are able

to compete successfully with acidophilous plants and even dominate.

Along both transects a soil chemical gradient was found from fertilized agricultural meadow to the oligotrophic mire. At one site high nutrient levels were correlated with the dominance of plants typical of eutrophic conditions. At the other site these high forbs were absent, most probably because of the very acid conditions.

It is recommended that the whole area should be protected for its flora and its fauna. In this context the existing protection order has to be modified and enforced.

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KERST Roeland. Vegetationskartierung und Standortsuntersuchungen in Feuchtgebieten in der Umgebung von Eschenbach und Wangen (SG). 66 S. + 4 Karten + 2 Tabellen. (Polykopie).

*Vegetation mapping and site investigationss in wet meadows in the surroundings of Eschenbach and Wangen (SG).*

Structure and distribution of most plant communities on wet sites are well known. However, even near Zuerich, some areas are rather insufficiently analysed. The "fen inventory" between Rapperswil and Ricken has shown that many wet meadows contain peculiar sub-alpine characteristics down to the lowlands. This combination of species is nowhere known at such a low elevation in the northern Midlands.

In this study the vegetation of different areas near the villages of Jona and Eschenbach has been investigated. In one field the base and nutrient concentrations have been analysed along a transect.

A new vegetation map has confirmed this peculiar occurrence of species. The frequent and common coexistence of base-rich and acid soil indicating values is remarkable. The base rich soil indicating species like *Carex davalliana*, *Epipactis palustris*, *Tofieldia calyculata* and *Eriophorum latifolium* are growing very frequently together with the acidity indicators *Carex stellulata*, *C. fusca*, *C. pallescens* and *Luzula multiflora*.

The pH-values of the soil measured along the transect in this vegetation complex are between 5.0 and 5.2 (pH CaCl<sub>2</sub>). This soil can clearly be described as acid. The influence of base-rich groundwater might be the cause for the growth of alkali indicators. pH values of groundwater were on average 1-1.5 pH-unities higher than those of the soil. This accentuates the effect of alkaline groundwater, which allows calciphilous species to occur on these acid soils.

The survey of the nutrients shows declining values from the edge of the forest to the middle of the wet meadows. The higher nutrient values on the edge of the forest might be due to the influx of nutrients imported by decaying leaves and needles.

In the immediate surroundings of these wet meadows a new motorway is planned. Changes in groundwater levels due to the constructions of the new road could change the special vegetation in the affected areas. Because of the obviously negative consequences on this nature reserve the construction of the road near these areas should be rejected.

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PAZELLER Ladina. Reproduktives Angebot, Effizienz und Erfolg bei *Chrysanthemum alpinum* und *Chrysanthemum atratum*. 66 S. (Polykopie).

Reproductive offer, efficiency and success of *Chrysanthemum alpinum* and *Chrysanthemum atratum*.

The paper deals with reproductive strategies of the alpine species *Chrysanthemum alpinum* and *Chrysanthemum atratum*. Two populations of each species were investigated. The approach to this problem follows the concept of URBANSKA (1989) whereby strategic units are counted at different reproductive stages. Reproductive offer, efficiency and effort are calculated for both female and male structures in this concept. This paper treats all three female parameters but only the male reproductive offer and efficiency.

Female reproductive offer is determined by the number of developed ovules, whereas female reproductive efficiency is expressed by the number of fertile seeds relative to the total number of ovules. The female reproductive efficiency turned out to be relatively small and seems to be dependent on the male reproductive efficiency, at least in sexual species.

Male reproductive offer corresponds to the number of pollen grains. The fact that it was very large in all four populations suggests that both *Chrysanthemum*-species are allogamous. Male reproductive efficiency is expressed by the number of viable pollen grains relative to the total number of pollen grains. With greater than 90% fertility the pollen grains of all populations proved to be extremely fertile and highly efficient.

Female reproductive success is determined by the number of new individuals which is calculated by the product of the germination percentage and the reproductive efficiency. Germination percentage was studied under controlled and natural conditions. In trials carried out under controlled climatic conditions the seeds of *Chrysanthemum atratum* germinated better than those of *Chrysanthemum alpinum*. In the field trials almost no seedlings emerged. The resulting reproductive success was larger in *Chrysanthemum atratum* than in *Chrysanthemum alpinum*.

Generally reproductive behaviour of *Chrysanthemum atratum* showed larger differences among populations whereas the corresponding parameters of *Chrysanthemum alpinum* behaved more homogeneously. Within populations all parameters varied greatly.

The suitability of the seeds of *Chrysanthemum alpinum* and *Chrysanthemum atratum* for biological erosion control above timberline is briefly discussed.

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SCHÄPPI Bernd Kleinräumiger Bodenchemismus und die Verteilung ausgewählter Pflanzenarten in Trespen-Halbtrockenrasen. 77 S. (Polykopie)

*Small scale soil nutrient supply and the distribution pattern of selected plant species in Bromus erectus grassland.*

The distribution pattern of the limiting nutrients nitrogen, phosphorus and potassium was analysed in relation to the diversity of niches for seedlings and young plants. The purpose was to reveal the heterogeneity, from the seedlings' point of view, of the soil surface layer. Moreover, it was investigated to what extent local nutrient availability is moulded biogenically or phytogenically by the physiological activity of different plant species and by the digging activity of common voles (*Microtus arvalis* Pall.). The central point of the investigation was an analysis of the nutrient conditions of microsites influenced by *Bromus*



*erectus* and *Onobrychis viciifolia*. These two species differ greatly in their morphological and physiological characteristics and therefore one should expect them to influence the chemistry of their microenvironment in different ways. These species are abundant in the grassland under investigation and it could be assumed that a different influence on the microsite nutrient status - provided it could be proved - would also bring about consequences for the ecosystem as a whole.

Nutrient analyses along randomly chosen 2.5 cm and 10 cm soil transects revealed that the availability of the limiting nutrients K, N and P in the surface soil layer (0-4 cm) varies on a very small scale. The diversity of niches for seedlings or young plants was high.

Effects of biogenic activity were strongest in case of the vole hills which showed a significantly poorer nutrient supply than any of the investigated microsites within the surrounding vegetation.

Analyses of leaf material from *Onobrychis* and *Bromus* in summer and autumn for C/N-ratio showed that both species lose high amounts of their nitrogen as a result of litterfall in autumn, and that the C/N ratio of the litter differs significantly between the two species. This clearly reveals that the two species potentially alter the chemical status of their local environments. However, no statistically significant difference regarding the availability of N, K and P could be detected in the microsites influenced by *Bromus* and *Onobrychis*. These are at least two possible explanations for this.

First, species richness and heterogeneity of chalk grasslands lead to considerable microsite or habitat overlap of different species. Second, the living conditions for the soil fauna which are optimal in the investigated soils support the biogenical mixture of the surface soil layer. This in turn leads to a neutralization of the pedogenic effects caused by plant physiological activity.

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TONASCIA Nils. Biosystematische Untersuchungen an *Heracleum sphondylium* s.l. in der Schweiz. 44 S. (Polykopie)

*Biosystematic investigations on Heracleum sphondylium s. l. in Switzerland.*

To clarify the systematics within the *Heracleum sphondylium* group different natural populations were investigated morphologically, cytologically and ecologically. Individual plants were collected and measured, their chromosomes were counted in somatic cells and the vegetation of the different sites was analysed.

*H. alpinum* clearly differs morphologically from the other taxa in the group. *H. sphondylium* s.str. and *H. montanum* are different in their typical forms. The distinction between these two taxa by means of hairiness and division of leaf is only possible in a limited way because these characteristics are very variable. This is considered in Flora Europaea by uniting *H. granatense*, *H. setosum* and *H. montanum* to one single subspecies. Sites of *H. pollinianum* mentioned in literature and in the herbarium ZT were checked but no individuals of this species could be found in Switzerland.

The number of chromosomes of the species investigated was always  $2n=22$  in accordance with the literature.

The habitats of *H. sphondylium* s.str. and *H. montanum* are hardly distinguishable by their vegetation types or their indicator values.

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WIESNER Michael und CHRISTEN Markus. Erarbeitung und Darstellung eines Naturschutzkonzeptes am Beispiel der Allmend Zürich. 1. Teil. Erhebung der wissenschaftlichen Daten. (WIESNER M.). 2. Teil. Didaktische Umsetzung für die Ausstellung Heureka. (CHRISTEN M.). 86 S. (Polykopie).

*Working out and presentation of a proposition to conserve natural beauty and wild life on the "Allmend" of Zuerich. Part I. Scientific base (by M. WIESNER). Part II. Didactic transposition for the exhibition Heureka (by M. CHRISTEN).*

### Part I

The "Allmend" of Zuerich is an important place for recovery for the inhabitants of Zuerich. Until 1986 the meadows were used as a drill-ground for the army. Since the army left different users as a farmer with sheep (2000 sheep in spring 1990), walkers with dogs (about 400 dogs in one day), footballers, playing children, glider pilots or picnickers can be seen on the meadows.

To make propositions for the future using and cultivation we studied the soil, the vegetation, the influence of dogs, sheep and human walkers on the "Allmend".

The soils at both sides of the river "Sihl" are Cambisols over a slope of Gleysols, not homogeneous concerning water economy.

The vegetation is influenced by nutrients (agriculture, sheep and dogs) and by the stress of the treads of men, dogs and sheep. Therefore we found two typical types of vegetation:

1. The meadows intensively used. Typical plants are: *Lolium perenne*, *Dactylis glomerata* and *Poa* sp. A speciality of this vegetation is *Trifolium fragiferum*.
2. On certain dry places plants of the *Mesobrometum* like *Bromus erectus*, *Salvia pratensis*, *Centaurea angustifolia* could survive. These parts of the meadow we are called up to conserve.

The input of nutrients from excrements of the dogs is much higher than an intensive fertilizing in agriculture. There could even be an influence on the ground water.

To conserve the richness of the "Allmend" the following points should be realized:

- Less dogs on *Mesobrometum* meadows.
- Less sheep on *Mesobrometum* meadows.
- Happenings (like football-meetings or the exhibition Heureka) should be allowed only on one meadow.
- No more sport-grounds, roads and buildings.
- More wet sites for water organisms.

### Part II

In 1991 there will be a national exhibition about science in Switzerland called Heureka on 5 ha of the "Allmend". We worked out a project for this exhibition. Vegetation, fauna and soils of the "Allmend" as well as the human influences are presented. Four different vegetation types with their typical species, planted into pots, will be in the centre of our exhibition: *Mesobrometum*, a vegetation with *Urtica dioica*, *Lolio-Plantaginetum*, and a sport-ground lawn. The relations between soil, fauna and human influences are pointed out. The visitor can walk on different paths through our exhibition. Every path represents an other relation in the ecosystem of the meadow.

The visitors should be informed about the richness of life in the meadows and some important relations in the ecosystem. During the exhibition an excursions on the "Allmend" will be held once a week.

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