Englische Zusammenfassungen der im Berichtsjahr 1987 abgeschlossenen Dissertationen und Diplomarbeiten

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Summaries of Ph D and Diploma Theses

Dissertationen (Ph D Theses)

BRUNNER Ivano. Pilzökologische Untersuchungen in Wiesen und Brachland in der Nordschweiz (Schaffhauser Jura). Veröff.Geobot.Inst.ETH, Stiftung Rübel, Zürich *92*, 241 S.

Myco-ecological investigations in meadows and fallow land in northern Switzerland (Jurassic mountains near Schaffhausen).

In Merishausen ("Schaffhauser Randen") differently managed semi-dry meadows (*Mesobrometum*; 3700 m^2) a fertilized mown meadow (200 m^2), pine forests (*Brachypodio-Pinetum*; 400 m^2), and beech woods (*Carici-Fagetum*; 400 m^2), each divided into 50 m^2 plots, were investigated in terms of fungus- and plant-sociology, fungus- and plant-phenology, pedology and microclimate. All stands were visited regularly at one or two week intervals on more than 100 excursions during the vegetation periods in 1983-1985.
In addition, the natural regeneration of pine (*Pinus silvestris*) was recorded and ectomycorrhizae of one-year-old pine seedlings were investigated and classified. Simulatenously, ectomycorrhizal fungi were cultivated in pure culture from fruitbodies and used to inoculate seedlings grown under sterile conditions. The ectomycorrhizae which resulted in vitro were examined and classified, and their morphology and anatomy compared with naturally occurring ectomycorrhizae.

1. Altogether, 195 species of fungi were recorded in 15 research areas (4700 m^2). The majority of these taxa are macromycetes of the classes Basidiomycetes (83%) and Ascomycetes (13%). The species *Clavaria incanata, Entoloma costatum, Psathyrella phaseolispora* and *Agrocybe gibberosa* were very rare findings.
2. The fungus communities of meadows, pine forests, and beech woods differ distinctly from each other.
3. The fungus communities of pine forest and beech woods are astonishing in their large number of characteristic saprobic fungi, as well as in their relative poverty of species of ectomycorrhizal fungi. Possible causes for this are discussed.
4. Many fungal taxa found in *Mesobrometum* were established by other authors in dry meadows of Switzerland and Germany as well as in meadows on inland dunes in Germany; a few species also have an arctic-subantarctic-alpine distribution.
5. Investigations of the fungus community of the *Mesobrometum* (3700 m^2) showed:
   - Following the results of three years of investigations under the most favourable conditions

the "minimum area" of the taxa found is 1750 m^2.
- The number of species-area curve increases continuously and still has a rise of over 50% at 3700 m^2 investigated research area).
- After at least 8 years fallow the number and density of the species of fungi increases.
- Contrary to managed unfertilized mown meadows the C/N-ratio increases in fallows from 10.5-12.9 to 11.7-13.3 by about 1.0; a negative influence on soil-inhabiting saprobic fungal flora cannot be observed.
- Yearly burning of the vegetation in spring results in an increase of certain nitrophilic macromycetes.
- Intensive management and fertilization suppresses nearly all the fungal flora in a habitat (only a few fructifications could be observed).
- Physical and chemical data of soil can complete autecological data of certain macromycetes already available.

6. The fungus season in 1983 was middling, in 1984 good, and in 1985 bad. With detailed microclimatic data, the influnce of precipitations, dry periods, and temperatures on the fungus aspects are discussed.
7. Meteorological factors play an important role in growth of fruit bodies:
   - Amount of precipitation: As a rule, one week before first finds of most of the macromycetes, precipitation is over 10 mm per week.
   - Frost: In spite of frosts in spring and autumn a large number of saprobic fungi fructify. A possible induction of fruitbodies by frost is considered.
8. Naturally regenerating one-year-old pine seedlings are to be found with a frequency of 5-10 m^2 on plots which are cut every year, with a frequency of 2-4 m^2 in plots which are cut every second year and in plots which are burnt yearly. Seedlings are relatively rare with a frequency of 0-1 m^2 in plots which are cut every fifth year and in those that are not managed.
9. In 8-year-old fallows 4-7-year-old pine could be found frequently, 1-3-year-old pine were rare. Possibly, increase of cover by *Brachypodium pinnatum* is responsible for accumulation of poorly decomposing litter and reducing of favourable microstands for seed germination, so-called "regeneration niches".
10. 29% of one-year-old pine seedlings from a meadow stand "Uf der Gräte" were ectomycorrhizal, of all investigated short roots only 4% had ectomycorrhizae of type Ba. From the border of a wood in the "Grätental", all one-year-old pine seedlings were ectomycorrhizal and in 69% the short roots were ectotrophic. In addition to the three types of ectomycorrhiza (Ga, Ic, Hb), one "Pseudomycorrhiza" was ascertained. Only the type Ga could be identified as *Cenococcum graniforme*.
11. Four ectomycorrhizal fungi (*Suillus collinitus, Hebeloma* cf. *circinans, Tricholoma terreum, Rhizopogon luteolus*) of pine, collected from local meadows and pine forest stands, were isolated and used to inoculate pine seedlings grown under sterile conditions. All species of fungi (with exception of *Rhizopogon luteolus*; no infection) formed ectomycorrhizae of type Aa.
12. Comparisons of morphology and anatomy of ectomycorrhizae of naturally regenerated one-year-old pine seedlings did not result, in any case, in agreement with ectomycorrhizae synthesized in vitro.

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HUBER Walter. Natürliche Bastardierungen zwischen weissblühenden *Ranunculus*-Arten in den Alpen. Veröff.Geobot.Inst.ETH, Stiftung Rübel, Zürich *100*, 160 S.

Natural hybridizations between white-flowered species of Ranunculus in the Alps.

In the present work, the hybrid character of strange *Ranunculus*-taxa, controversial up to now, is demonstrated by means of extensive material.

1. As prerequisite for clarifying these hybrids the *Ranunculus aconitifolius* L. s.l. - complex was investigated in detail: It comprises two resembling species which were mostly not distinguished formerly, *R. aconitifolius* L. s.str. and *R. platanifolius* L. Both species are diploid (2n = 16), sexual, and quite frequently hybridize, resulting in diploid progeny with reduced fertility.
2. The following astonishing hybrid combinations were investigated in detail:
   - *Ranunculus kuepferi* Greuter & Burdet x *R. aconitifolius* L. s.l.
   - *Ranunculus kuepferi* Greuter & Burdet x *R. seguieri* Vill.
   - *Ranunculus parnassifolius* L. x *R. seguieri* Vill.

a. The three combinations are surprising because the parents are extremely different in their morphological characteristics: *R. kuepferi* has narrowly lanceolate, entire leaves and is mostly 5-25 cm high, unbranched and 1flowered; *R. aconitifolius* s.l. has 5-7angular in outline, palmately divided leaves with entire or coarsely divided segments, is mostly 15-120 cm high and multiple branched; *R. seguieri*, also with 5-7angular in outline, palmately divided leaves but with finely divided segments, is only 3-15 cm high and 1-10flowered, whereas *R. parnassifolius* has ovally lanceolate or roundish but, like *R. kuepferi,* entire leaves and looks in other characteristics like this species too. The hybrids show various intermediate forms of leaves dependent on their ploidy level. The morphological characteristics of all parent and hybrid taxa are presented in the diagnoses as well as in a dichotomous key which includes other white flowered *Ranunculus* species.

b. The phytosociological and ecological behaviour of the hybrids was compared with that of the parents by means of vegetation surveys, ecological indicator values, and observations at the habitat.

c. The astonishing hybrids occur in some natural localities. The geographical distribution of the taxa is given and pointed out in comparing maps.

d. Special attention was applied to the cytological investigations. The somatic chromosome number was determined for all parent species and hybrid combinations from numerous localities: While *R. aconitifolius* s.l. and *R. seguieri* are constantly diploid (2n = 16), *R. kuepferi, R. parnassifolius* and the various hybrids with these two species are found in several ploidy levels (2n = 16, 24, 32, 40); only the diploid taxa are sexual, whereas the polyploid are apomictic. The occurrence of the polyploid chromosome numbers coupled with apomictic reproduction is of particular interest and has decisive consequences to the morphology of the hybrids.
   Aneuploid numbers were found in 4 plants. Endomitoses were observed, too. Chromosome banding patterns proved to be unsuitable for taxonomy.

e. Pollen investigations and extensive pollination experiments showed that all hybrids studied have reduced fertility or were almost completely sterile. It was possible to produce experimentally several hybrid taxa corresponding to those existing in nature. The characterization of progeny is still incomplete because the germination could not be accelerated, although various artificial methods were tried, and because the development of the juvenile plants usually takes several years.

3. The existence of some doubtful hybrids from literature was investigated and additional

possibilities for hybridisation between white-flowered *Ranunculus* species were tested: crosses of *R. aconitifolius* L. s.l. with *R. pyrenaeus* L. and with *R. angustifolius* DC., with *R. seguieri* Vill., with *R. alpestris* L., with *R. glacialis* L. and with *R. gramineus* L. as well as *R. alpestris* L. x *R. glacialis* L. and *Callianthemum coriandrifolium* Rchb. x *R. glacialis* L. Only the combination *R. aconitifolius* x *R. angustifolius* was successfully accomplished; it was not found, however, in nature.

4. Nomenclature of the taxa was clarified; synonyms are added to the correct names. Five hybrid taxa are described:

- *Ranunculus* x *intermediifolius* Huber, hybr. nov. (= *R. aconitifolius* L. x *R. platanifolius* L.)
- *Ranunculus* x *scissus* Huber, hybr. nov. (= *R. kuepferi* Greuter & Burdet x *R. platanifolius* L.)
- *Ranunculus* x *scissus* Huber nothosubsp. *disjunctus* Huber, nsubsp. nov. (= *R. kuepferi* Greuter & Burdet x *R. platanifolius* L.; 2n = 32, 40)
- *Ranunculus* x *digeneus* Kerner ex Huber nothosubsp. *latemarensis* Huber, nsubsp. nov. (= *R. parnassifolius* L. x *R. seguieri* Vill.; 2n = 40).

In addition two nomenclatural changes were made:

- *Ranunculus* x *lacerus* Bell. nothosubsp. *valesiacus* (Suter) Huber, comb. et stat. nov. (= *R. kuepferi* Greuter & Burdet x *R. aconitifolius* L.; 2n = 40)
- *Ranunculus kuepferi* Greuter & Burdet subsp. *orientalis* Huber, nom. nov.

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SCHAFFNER Ruth. Vegetation of stabilizing and eroding slopes in eastern Nepal. Veröff.Geobot.Inst.ETH, Stiftung Rübel, Zürich *93*, 98 S. + Anhang.
Die Vegetation stabilisierender und erodierender Hänge in Ostnepal.

The study presented here, carried out from August 1983 till November 1985 along Lamosangu-Jiri Road in the eastern part of the central midlands of Nepal, deals with plant regeneration and succession on unstable slopes (natural or man-induced) and their possible stabilization. Special attention is paid to the erosion problem of this region.

1. In order to get ideas about regeneration and development of the plant cover, 45 transects were laid through 35 landslides and slopes along the road, at altitudes ranging from 100 to 2600 m a.s.l. The transects were divided into sections according to the different phytosociological conditions. Data were recorded after the monsoon in 1983/1984/1985, at the end of the dry season in 1984/1985, and at the beginning of the monsoon in 1984/1985. The post-monsoon data were usually the richest in species, so they are used for the evaluations of development and possible stabilization in the first place. The records from the dry season and early monsoon give additional information on the findings. Due to the wide altitudinal range and their other different environmental factors, the plots are divided into four groups. There is a positive development trend, best expressed in the strongly increasing plant frequencies, especially in the protected plots, and in the noticeable number of shrubs and trees invading the slide- and transition-sections. Although it is difficult to state a succession after only three years of observation (not accounting for the different age of the slides), the invasion by perennial plants can be interpreted as a sign of succession. And this can be judged as a first indication of a stabilization, since succession presumably occurs only after a certain consolidation of a slide.
2. In order to know more about the composition of a possible climax or, at least, of a "stabilized vegetation" comparatively immun to human influences, 13 relatively stable areas were recorded too. They are related to the four groups of the landslides and slopes and help to interpret the development trends.

3. Research on erosion was carried out at Dandapakhar and Bonch, the locations of the two meteorological stations of the Integrated Hill Development Project (IHDP) of the region. At both sites two plots were established, one bare, one covered with plants. The differences between the two plots in runoff and soil loss were evaluated. The data for the uncovered plots proved to be clearly higher than those of the covered plots. The findings are discussed and compared with the data of other erosion research groups in Nepal.
   Landslides and slopes usually carry a relatively undeveloped soil. Development of a climax, or in steep slopes rather of a subclimax, can obviously take place only on mature soil. Maturing of the soil, a long process, is additionally slowed down by erosion.

The slopes of the hills of Nepal are, due to the natural conditions, very unstable and exposed to erosion. Since it is evident that erosion is reduced by plant cover, every step should be taken to protect, maintain, or induce a vegetation cover on unstable sites. This could be achieved by:

- Protection of the existing or growing vegetation by fencing or employmet of watchmen.
- Planting or sowing of adapted *Gramineae* like *Chrysopogon aciculatus, Cynodon dactylon, Pogonatherum* at lower altitudes; *Arundinella hookeri, Hemarthria compressa, Pennisetum clandestinum* (African) at higher altitudes.
- Planting or sowing of unpretentious and at least temporary preferably unpalatable shrubs or perennial herbs like *Eupatorium adenophorum, Hypericum cordifolium, Osbeckia nepalensis, Phyllanthus parvifolius, Gonostegia hirta, Polygonum* spp. at lower altitudes; *Artemisia* spp., *Centella asiatica, Eupatorium adenophorum, Hemiphragma heterophyllum, Lycopodium clavatum* at higher altitudes.
- Planting or sowing of pioneer trees like *Alnus nepalensis* or *Pinus roxburghii* with the aim of inducing the subclimax of forest communities via the state of grassland or shrubland.
- Technical stabilization which promotes the re-settlement by plants and in interaction with them helps shorten the unstable stages of a slope.

With these measures much could be done to reduce erosion and to smooth the way for a possible stabilization of a region.

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MEISTERHANS Edwin. Vegetationsentwicklung auf Skipistenplanierungen in der alpinen Stufe bei Davos. Veröff.Geobot.Inst.ETH, Stiftung Rübel, Zürich *97*, 169 S.

Development of vegetation on levelled ski runs in the alpine zone near Davos.

In the region of Davos (eastern Swiss Alps) investigations were made on the phytosociological and ecological effects of machine-levelling of ski runs situated above 2200 m realized between 1963 and 1978. In 1978 the vegetation and sites of 241 sown and unsown plots on acidic silicate and dolomite were described. Of these 92 permanent plots were studied in 1979 and 1980. The investigations were completed by comparisons of ski runs with adjacent alpine meadows and scree slopes as well as with glacier forefields in the Val Roseg (Upper Engadine) and levelled ski runs in the Corvatsch area (Upper Engadine).

Results

1. The machine levelling of ski runs destroys most of the original plant cover. Accordingly the mean vegetation cover of the relevés with natural revegetation on solicate comes only to 4% and on dolomite to 5%. On 33% of the relevés the cover is even less than 0.05%. Deep

bulldozing destroys the stratification of the soil and the humus, and fine material found in the topsoil of undisturbed areas is lost.

2. The first colonisation of levelled ski runs on silicate and dolomite is made by a random mixture of species of surrounding alpine meadows, snowbeds, and scree slopes. The mean plant cover of levelled ski runs (5%) corresponds rather to that of the natural scree slopes (11%) than to that of the alpine meadows (80%).
   Some of the species that grow on levelled ski runs are found exclusively on silicate, others only on dolomite, and yet others on both substrates.
   Species of snow beds amongst others grow on areas with relatively long lasting snow cover. Other site factors such as altitude, slope, and exposure do not clearly influence the vegetation.
3. During the three years of investigation some considerable differences in the change of vegetation on the plots with natural revegetation of the silicate and the dolomite were found. The mean total plant cover on both rock types was most dense in 1979, and in 1980 (the last year of investigation) the least dense. This decrease of the vegetation is partly due to the unfavourable weather conditions.
   From 1978 to 1980 the proportion of fine earth on the surface decreased noticeably on unsown permanent plots of recently levelled ski runs, but only slightly on those that were levelled five years before, while the proportion of stones (>2 mm) increased accordingly. Thus the mean proportion of the fine earth on the surface of a one-year-old levelling (47%) was considerably higher than that of a six-year-old one with similar site factors (21%) because some of the humus and fine earth had already shifted deeper.
   First only the native plants, which grew from still existing rhizomes on the recently levelled areas appeared. In these rather rare favourable microsites with partly unspoilt top soil a comparatively dense plant cover may develop after some time. The species spread by diaspores such as *Cardamine resedifolia, Chrysanthemum alpinum* or *Hutchinsia alpina* appear only later.
4. The mean total plant cover comes to 30% on plots with artificial revegetation. Great variation in the density of some sown species (0.2-90%) influences the classification.
   With increasing altitude the sown species generally become stunted. The other site factors do not noticeably influence the some times poor growth of the sown species.
5. On the permanent plots with artificial revegetation the mean total plant cover decreased clearly from 1978 to 1980 especially on plots with a cover of more than 10% of sown plants in 1978.
   The proportion of stones on the soil surface generally increased from 1978 to 1980 whereas the fine soil decreased slightly. There is no obvious relationship between the changes of vegetation and the site factors.
6. The mean total plant cover was far greater on plots on siliceous substrate with artificial revegetation (30%) than on unsown ones (4%). The reason for this is also that environmentally disadvantageous levelled ski runs were not sown. On areas with artificial revegetation a few grasses such as *Festuca rubra* or *Deschampsia flexuosa* often dominate and therefore the diversity of species is smaller than on areas with revegetation by indigenous plants. Here the indigenous species generally grow slightly more densely, whereas the mosses on the soil appear less dense than on sown areas with similar site factors.
   Permanent plots were found with vegetation decreasing at least twice as much on levelled ski runs with artificial revegetation as on those with natural revegetation.
7. The levelled ski runs at Piz Corvatsch usually show soils rich in fine earth and clay particles. Therefore these soils are more prone to erosion than those in the region of Davos. Due to the higher average altitude there are more snow bed species than near Davos.
8. The small changes of vegetation on the plots from 1978 to 1980 and the development of the plant cover on glacier forefields also indicate that it will probably take many decades, if not more than a century, until a closed plant cover (most likely originating from species of adja-

cent alpine meadows and scree slopes) can develop. Nor will there be a stable closed vegetation on areas with artificial revegetation for several decades, as the cover very often severely decreases again after relatively dense growth.

9. Because of the slow and unstable development of the vegetation, the large scale destruction of many alpine plants, some of which even protected species, and because of the damage to the scenery there should not be levelling of ski runs in the alpine zone except for small adaptations absolutely necessary for the safety of the skiers and for which an environmental impact assessment with positive result has been made.

Based on the results of the present work and of the literature, suggestions are made and discussed concerning the artificial revegetation with native species according to the site factors.

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MEISTERHANS-KRONENBERG Hanna. Auswirkungen des Skibetriebes auf subalpine Heuwiesen bei Davos. Veröff.Geobot.Inst.ETH, Stiftung Rübel, Zürich *96*, 79 S.

Effects of skiing on subalpine hayfields near Davos.

On the Clavadeler Alp near Davos (GR) the effects of downhill skiing were investigated on a subalpine fertilized meadow (*Trisetion*) situated about 2040 m a.s.l.
Three transects of 100-140 m length and 10, 11, and 25 1 m^2 plots were established. The influences of the compressed snow cover, of the ice formation, and the delayed thaw on the phenological development and the yield of the subalpine fertilized meadows were investigated.
Two segments of the investigated parts of the ski runs were unexpectedly sooner free of snow than the rest of the meadow. This is presumably the result of a thinner snow cover due to a slightly humped site and intensive skiing around a marking of the ski run.
In spring an ice layer of 1-6 cm thickness was always measured on the ski runs, partly still under a snow cover. Only one third of the measurements outside the ski runs showed layers of ice only 1-3 cm thick.
Underneath the layer of ice on the ski run the soil was frozen everywhere to at least 5 cm depth. Outside the ski run the soil was mostly not frozen or only to a depth of 2 cm at the most.
After the melting of the layer of ice it took about two weeks for the soil to thaw completely. The living organisms in the frozen soil are little or not at all active. Therefore the ski run areas are still brown without evident growth two weeks after the melting of the snow. The areas that were free of snow earlier showed the same state.
One week after the thawing of the soil, that is three weeks after the melting of snow and ice, the plants on the ski run area had grown about as far as the ones that broke straight through the last snow on areas outside the ski run. The phenological development of *Crocus albiflorus, Taraxacum officinale* s.l., *Ligusticum mutellina* and *Silene dioeca* is described. The development was delayed from ten days to two weeks. In the early flowering species *Crocus albiflorus* and *Taraxacum officinale* this delay was far more noticeable, probably due to the greater difference in the temperature of the soil within and outside the ski run at this particular time. The delay was somewhat less in the later flowering species *Ligusticum mutellina* and *Silene dioeca.*
Apart from the development of the flowers the average height of the plant cover was also used as a measure for the delay. Shortly before the hay harvest the average height within the ski run came only to 70% of that outside the ski run at two transects out of the three. A slower growth on the ski run areas during the first 30 days increased the delay caused by the late beginning of growth.

Slightly more than half the species occurred more frequently outside the ski run than on the ski run, and only 20% more frequently on the ski run than outside the ski run. In all three transects the species *Ligusticum mutellina, Trifolium badium* and *Ranunculus montanus* were found more frequently, with at least 10% of cover difference, on the areas outside the ski run than on those within the ski run. Within the ski run *Alchemilla* sp. and *Trifolium repens* appeared more frequently, also with a difference of at least 10% of cover.
Small differences in the topography of the site influenced the combinations of species. Therefore each transect was partly characterized by an individual combination of species.
"Sensitive" forage plants such as *Festuca pratensis* and *Dactylis glomerata* repressed on lower altitude ski runs (up to about 1500 m) cannot be found at all at higher altitudes.
The consequence of the delay in the development of the vegetation was a smaller yield. The average loss of yield on the three transects in the ski run area came to 16.2% in the year 1982, to 18,8% in the year 1983, and to 17.2% average. These losses of yield were smaller than those at lower altitudes (up to 1500 m). This is the result of a deeper snow cover that remains longer in the subalpine zone and guarantees better protection, as well as for the fact that only more robust species, adapted to extreme climatic conditions, are distributed.
Unexpectedly there were no differences in the nutritive value of the older vegetation outside the ski run and the younger one within the ski run.
As it would cause very much work and expense to establish the damage to each plot of land, the payment of generous, regional, lump-sum compensations is recommended.

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SCHÜTZ Martin. Genetisch-ökologische Untersuchungen an alpinen Pflanzenarten auf verschiedenen Gesteinsunterlagen: Keimungs- und Aussaatversuche. Veröff.Geobot.Inst.ETH, Stiftung Rübel, Zürich *99*, 153 S.
Genetic-ecological studies in alpine plants from various substrata: germination trials and sowing experiments.

Germinating behaviour and early development phases were investigated in numerous alpine taxa. The study comprises trials carried out under controlled conditions, observations in greenhouse and experimental garden, and also seeding experiments in semi-stabilized scree slopes and in machine-graded ski runs within the alpine vegetation belt. The field plots were partially protected with biologically degradable CURLEX blankets.
The behaviour of the plants studied was charaterized by a pronounced ***diversity*** and ***variability***. Some taxa manifested virtually no dormancy whereas seeds of the other ones germinated badly or not at all. Three types of seed dormancy were recognized:
Innate dormancy, mostly long-lasting, was frequently influenced by an impermeable seed coat. Scarification of such seeds often stimulated germination. In many cases, the innate dormancy was caused by an underdeveloped or physiologically inactive embryo; treatment with the gibberellic acid led then frequently to germination, but affected negatively the development of seedlings and young plants. A short-lasting innate dormancy was often observed in freshly harvested seeds.
Induced dormancy, occurring in seeds stocked under apparently unfavourable conditions, was revealed in comparative studies dealing with seed samples of various age.
Enforced dormancy was observed in the field trials. This type of dormancy seems to be mostly related to the temperature decrease occurring towards the end of the growing season.
The field trials demonstrated that safe-site conditions favourable to germination are not necessarily identical with those necessary to the seedling establishment and a successful development of young plants.

The ***diversity*** of behaviour of the plants studied is clearly related, on the one hand, to general ecological factors and, on the other hand, to microniche conditions. The genetical component (evolution of diverse species, racial differentiation) plays an important role, too.
The ***variability*** in behaviour could have been influenced by several different factors, e.g. climatic conditions during seed development, fitness of the mother plant and/or a flexible allocation of resources indispensable to the successful reproduction by seed.
The study contributes to a better assessment of the biological erosion control within the alpine vegetation belt. The behaviour types described could be used as criteria for an optimal choice of the material foreseen for the seeding at high altitude. Such material should consist of native plants which are well adapted to the extreme alpine environment.
Are discussed, too, various biotechnical treatments helpful for the preparation of the seed material, a possibly best time for the seeding in the Alps, as well as advantages and disadvantages of the CURLEX blanket.

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Diplomarbeiten (Diploma Thesis)

TSCHURR Reto Floris. Regenerationsverhalten und vegetative Fortpflanzung bei einigen Alpenpflanzen. 70 S. (Polykopie). Siehe Beitrag in diesem Band.
Regeneration and vegetational reproduction in some alpine plants. See contribution in this volume.

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POST-Diplomarbeit von ANDRES Franziska, BOSSHARD Andreas, STROHMEYER Susanna und WOHLGEMUTH Thomas.
Der Einfluss einer kurzzeitigen Brache in einem anthropogenen Kleinseggenried auf Aspekte von Boden, Mikroklima, Vegetation und Fauna. Gedanken über den naturschützerisch optimalen Zustand. 375 S. (Polykopie). Siehe Beitrag in diesem Band.
Effects of a short-term fallow in an anthropogenous wetland site (Primulo-Schoenetum ferruginei) on soil, microclimate, vegetation and fauna. Reflections on the optimal state from the view point of the preservation of nature. See contribution in this volume.

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WILHELM Markus. Tendenzen zur Veränderung der Vegetation im Urner Reusstal nach der Dammöffnung. 76 S. (Polykopie)
Tendencies of changes of the vegetation on the delta of the Reuss after the opening of the embankment.

Recent stockings of wetland communities in Swiss lowlands show that their dimensions as well as their numbers have decreased. Therefore, fens should not only be put under protection, but the preservation of neglected or endangered associations should be promoted. In this connection the government of the canton Uri supports an alteration of the water movement by shortening the embankment of the Reuss and closing the stuary. These proceedings make hope for a re-naturation of the delta. Since this project is unique, the development of the delta is studied thoroughly. Under this scope the present vegetation structure and their habitat has been registered as a basis for a trend forecast.
The vegetation map realized thereby confirms the tendency presumed according to the ANL-report (1983) that the waterlevel on the left side of the Reuss has risen 15 cm and on the right side 25 cm at least. The differences have been taken for the hypothesis of the partial sagging of the delta as the waterlevel oscillates since 1973 around 433.58 m a.s.l.
The six groundwater tubes revealed most interesting values concerning the problematic nature of eutrophication. The closer the sample point was to the motorway, the higher were the concentrations of ortho-phosphate, total-phosphate, ammonium, nitrate and nitrite. It is evident that the motorway with an approx. height of 2 m fertilizes the environmental fens. The low-sedge swamps dominated by *Carex davalliana* north of the motorway show a very high nutrient content; the moist formations of *Filipenduletum* spread out at the cost of tall-sedge swamps.
The direct influence of the Reuss on litter meadows of Seedorf seems to be extraordinarily low as most parts were only strongly influenced by the lake during the inundation period. The opening of the embankment will probably not much influence the vegetation mosaic.

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SINDELAR Karin. Vegetationskartierung und Standortuntersuchungen im Urner Reussdelta. 69 S. + Anhang. (Polykopie).
Vegetation relevés and habitat investigations in the delta of the Reuss.

The actual situation of the "Flüeler Riet" and the relict of flood plain forests is shown by a vegetation map and relevés. The hydrological and hydrochemical site conditions of the vegetation point out the basis for the projected embankment with its formation of a new delta. The investigations further showed the increase of wet regions and the influence of the fertilized surroundings. *Molinietum* decrease and *Filipenduletum* increase. The borders between the associations change in favour of those in wet eutrophic stands.

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VON GUNTEN Beat. Experimentelle Untersuchungen zu Mikroklima und Keimlingsentwicklung in Trespen-Halbtrockenrasen (bei Merishausen SH). 97 S. (Polykopie).
Microclimate and development of seedlings in semi-dry Bromus erectus grasslands (near Merishausen SH).

In semi-dry *Bromus erectus* grasslands near Merishausen (Schaffhauser Randen) the microclimate and the development of seedlings of *Arabis hirsuta* (L.) Scop. and *Linum catharticum* were investigated in the relatively moist summer 1987. The aim was to assess the impor-

tance of gaps and of the kind of relationships between the different plant species for the coexistence of these species. Bare gaps of 10x10 cm were made in autumn 1986 in the vegetation on the south and on the north sides of large tussocks of *Bromus erectus* Hudson. This led to the following types of microhabitats: unchanged vegetation, gap, "south site" south of the tussock, tussock site, "north site" north of the tussock. In these microhabitats daily courses of irradiance, temperatures of top soil (to -2 cm) and air as well as relative humidity (rH air) were measured. In the frame of a larger investigation by RYSER (in prep.) the germination and establishment of the plants mentioned above was compared with the data on microclimate.

Results

1. In the "**south sites**", the highest temperatures and the lowest rH-values were measured (especially after the mowing in mid-July). The intensity of irradiance depended on the height of the vegetation. The water content of the top soil was relatively high. The microclimate showed "continental" characteristics.
2. In the **tussock sites** the temperatures in soil and air were relatively low and well-balanced. The rH-values were high in comparison with other microhabitats and the irradiance was very low. The microclimate showed "oceanic" characteristics.
3. In the "**north sites**" the "oceanic" character of the microhabitat was less pronounced than in the tussock site due to the influence of the neighbouring gap. The intensity of irradiance was higher. In spring frosts were frequent.
4. In the center of the **gaps** the fluctuations of temperature and rH were high due to wind and cloudiness. The absolute values of temperature and rH had less extreme maxima and minima than in the south site. irradiance was highest and water content of the top soil lowest. The center of the gap showed "continental" characteristics.
5. *Arabis hirsuta* survived best in the protected "south sites". The (low) mortality was due to dry soil, mechanical destruction and frost.
6. *Linum catharticum,* which requires much light, developed best in gaps and its borders; however, many seedlings are killed by drought, especially after mowing.
8. All this shows that *Bromus erectus* in a positive way influences the establishment of seedling and young plantlets. In this context it is postulated that positive interactions are a necessary factor for coexistence of different plant species and their coevolution.

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