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8. ENGLISCHE ZUSAMMENFASSUNGEN DER IM BERICHTS- JAHR 1994 ABGESCHLOSSENEN DIPLOMARBEITEN

(Summaries of Diploma Theses)

FATTORINI Marzio. Demographische Untersuchungen auf standortgerecht renaturierten Skipisten bei Davos. 68 S. (Polykopie).

Demographic Studies in Ecologically Restored Ski Runs in the Surroundings of Davos.

The paper deals with development of plant populations in ecologically restored ski run plots at Jakobshorn near Davos (2450 m. a. s. l.). The study focused on demographic assessment, with special attention being given to age-state structure. Data are presented as age-state classes and in three gross categories (all young newcomers ([TYN], all adult newcomers [TAN] and all transplants [TT]).

Transplant survival after 8 and 9 years in all plots was very good (more than 85%). All planted *species* survived and their population sizes increased as a result of reproduction by seed. Amongst reintroduced species was *Trisetum spicatum*, previously rare in the area.

All grasses used as transplants proved to be suited for ecological restoration above the timberline. Performance of *Deschampsia flexuosa* was particularly good (high survival rates, copious production of flowers).

The number of species in the plots increased strongly within eight or nine years following restoration; it varied between eight species in plot 4 and fifteen species in plots 1 and 2. The increase resulted from immigration of diaspores originating either from nearby intact vegetation, or from neighbouring trial plots installed in earlier studies. Alpine grassland (*Caricetum curvulae*) and snowbeds are the most important natural sites from which immigrant species originated. Species which may have arrived from other plots were *Hieracium alpinum*, *Senecio carniolicus*, *Chrysanthemum alpinum*, *Luzula lutea* and *Doronicum clusii*. In total, 15 species immigrated spontaneously into the studied plots; particularly successful in this respect were *Cardamine resedifolia* and *Chrysanthemum alpinum*.

Not all immigrants were pioneer species: the results of the study confirm in this respect some earlier observations from the Swiss Alps and the Rocky Mts.

The reproduction of transplants and immigrants with the subsequent production of diaspores increased considerably the range of age-state classes. The dynamics of mixed stands at the time of demographic study corresponded to a phase in which young individuals (seedlings and/or juveniles) were very numerous but all age-state classes were present. The plant communities in the studied plots may thus be assessed as *young normal phase* of development *sensu* Rabotnov (1945). The general tendency in development of mixed stands was even more distinct when data from two consecutive years were compared.

Use of Curlex® mats clearly influenced the success of restoration. The differences observed between restored and non-restored ski run were very distinct: vegetation in the restored plots was much better developed. These findings thus confirm earlier results of our group.

Developmental patterns in the restored plots were generally comparable but some differences amongst plots were noted, too. It is conceivable that these differences may be partly due to restoration timing, partly to the use of transplants which were of different age, and also to differences in species composition. Strong site heterogeneity and differences in degree of damage of whole plots or plot sectors caused by ski run maintenance machines

and/or herbivores should be also considered. Transplants were often found to represent significant components of safe-sites; this aspect should be further studied.

The results of the study indicate very good prospects for further plant development in restored sites. As expected, this development is determined on the one hand by survival and reproduction of transplants and on the other hand by intensive immigration with the subsequent founding of new populations. This optimistic prognosis should not, however, serve as an excuse for future large-scale damage to alpine environment caused by construction of more downhill ski runs.

RECKINGER Claude. Untersuchung der Vegetation des Panzerübungsgeländes Kloten-Bülach. 51 S. (Polykopie).

Study of the Vegetation in an Area Used for Tank Manoeuvres.

The vegetation of an area used for driving exercises with tanks was investigated ecologically and phytosociologically between August 93 and August 94.

Because of the military manoeuvres the soil in the area has been compressed, the pH is high (7 to 7.6), and the humus content low (1.2 to 4.5 %).

The phytosociological relevés describe a gradient from dry to wet. The wet tank tracks are colonized year after year mainly by species of the *Potamogetonion*, *Phragmition*, *Bidentetalia tripartitae*, *Elatini-Eleocharition ovatae*, *Juncion bufonii* and *Plantagine-talia*. The spatial pattern of the mud colonizers changes depending on the water level in the tank tracks. The tanks shorten the vegetation period for many relevé areas to 3 to 4 months.

The rarest plant found was *Heleocharis ovata*, a species characteristic of the *Elatini-Eleocharition ovatae*. It forms lush stands (height >40 cm) with only a small percentage of therophytes, unlike in other sites which have been described. This may be due to the fact that the tank tracks may be flooded several times during the vegetation period.

The military area serves an important ecological function in providing a secondary riverine biotope in which threatened species can survive. 17 species were found which are endangered in the canton of Zürich. Many of these plants can also be found in the military areas in the Brugger Schachen, in Thun and in Frauenfeld, in particular the species characteristic of *Nanocyperion*. These similarities are partly a result of similar environmental factors, but they are also due to distributional and historical factors.

BIERI Simon. Genetisch-ökologisches Verhalten von *Ranunculus aconitifolius* L. und *Ranunculus platanifolius* an Kontaktstandorten. 60 S.+ 8 S. Anh. (Polykopie).

Genetical and Ecological Characteristics of Ranunculus aconitifolius L. and Ranunculus platanifolius L. at Contact Sites.

Two contact sites of *Ranunculus aconitifolius* L. and *R. platanifolius* L. in Switzerland were studied genetically, ecologically, morphologically and phenologically. One site was the alpine Weisstannental (Canton St. Gallen), the other the Jura Mountains of Solothurn

(Canton Solothurn). The two species and also hybrids were collected from each site. The techniques used included gel electrophoresis, morphological studies, studies of flowering phenology and analysis of surrounding vegetation. The main findings were:

1. *R. aconitifolius* and *R. platanifolius* hybridise with each other and generate a hybrid species *R. x intermediifolius* Huber.
2. The hybrid is intermediate between its parental species in terms of ecology, morphology and genetic markers, but more closely related to *R. platanifolius*.
3. Ecological and morphological considerations as well as the iso- and allozymatic results, clearly indicate that the hybrid species backcrosses exclusively with *R. platanifolius*. Hence, genes may move from *R. aconitifolius* to *R. platanifolius*; gene introgression does occur as HUBER (1988) postulated.

MERMOD Olivier. Bestäuberspektrum und Phänologie als Mechanismen zur genetisch-ökologischen Isolierung alpiner *Erigeron*-Arten (Asteraceae). 52 S. + 5 S. Anh. (Polykopie)

Spectrum of Pollinator and Phenology as Mechanisms of Genetical and Ecological Isolation of Erigeron-Species of the Alps (Asteraceae).

There exist practically no genetic barriers between the *Erigeron*-species in the Alps. Nevertheless, they do not hybridize with each other in habitats of different sympatric taxa. The mechanisms of species demarcation were examined in four *Erigeron*-species (*E. alpinus*, *E. glabratus*, *E. neglectus* and *E. uniflorus*) of three regions (Gemmi VS; Melchsee-Frutt OW; Pizol SG) of the Swiss Alps in terms of their phytosociology, ecological indicators, phenology, colours of ligulate flowers and spectrum of pollinators.

The four *Erigeron*-species investigated use a combination of the following strategies: ecological differentiation, different flowering times and colours of ligulate flowers, synchronization of flowering time within a population, synchronization of flowering time of species with similar optical characteristics, spatial separation and different strategies of reproduction (cross-pollination against self-pollination).

SCHLÄPFER Barbara. Unter- und oberirdischer Biomasseturnover von drei ökologisch unterschiedlichen Grasarten. 35 S. (Polykopie)

Above- and Below-ground Biomass Turnover of Three Ecologically Contrasting Grass Species.

Plant species with a low maximal growth rate dominate vegetation on nutrient poor habitats even though species with an inherently high relative growth rate are able to grow faster also under nutrient poor conditions. A possible cause for this dominance is low nutrient losses due to longevity of the organs. This hypothesis was tested by studying biomass turnover of three ecologically contrasting grass species.

Growth and life-span of the organs of the three grass species, *Bromus erectus*, *Arrhenatherum elatius* and *Dactylis glomerata*, were investigated on three differently fertilized meadows during one year. The fresh weight to dry weight ratio, which reflects composition and anatomy of the organs, was also determined.

Seedlings of the three species were planted in polyester-bags with 50 µm mesh in July 1993, enabling harvesting of the entire root system. The plants were harvested 3, 7, 9.5 and 11 months after planting. Total biomass and the percentage of dead and living organs were determined. The percentage of dead roots was determined after staining with tetrazolium.

On the nutrient poor site all grass species showed the same development of their biomass, but on the more fertilized meadows *Arrhenatherum* and *Dactylis* grew significantly faster than *Bromus*. *Bromus* also responded more slowly to nutrient enrichment and showed no effect in the first growing season.

Bromus had a lower percentage of dead leaf material than *Arrhenatherum* and *Dactylis*. The percentage of dead roots showed the same results, except that during the summer the values for *Arrhenatherum* decreased sharply, probably because of decomposition of the dead roots.

On all sites, *Bromus* had a higher percentage of dry weight in its leaves, stems and roots than *Arrhenatherum* and *Dactylis*.

Arrhenatherum and *Dactylis* invest a larger part of their biomass in flowering stems, i.e. reproduction, than *Bromus*.

The results indicate a longer life span of leaves and roots of *Bromus* which in combination with its slow growth can be interpreted as a slow turnover. *Arrhenatherum* and *Dactylis* are able to grow faster when nutrients are available, but have a shorter life span of their organs. These species thus have a fast turnover. Tissue density correlates positively with life span of the organs but negatively with growth rate.

The larger investment in reproduction indicates that *Arrhenatherum* and *Dactylis* also have a faster turnover of individuals than *Bromus*.

There is a trade-off between growth rate and life span of the organs. This is determined by tissue quality. Low tissue density enables fast resource acquisition and fast growth, but has negative consequences for life span. High tissue density results in a slower growth but a longer life span. Fast growth is important under nutrient rich conditions, in spite of the high losses due to the short life span. Under nutrient poor conditions long life span is important due to minimizing losses, regardless of the slower growth.
