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Summaries of Ph D. and Diploma Thesis

Dissertationen (Ph D. thesis)

FOSSATI Alessandro. Keimverhalten und frühe Entwicklungsphasen einiger Alpenpflanzen. Veröff.Geobot.Inst.ETH, Stiftung Rübel 73, 193 S.

Germinating behaviour and early developmental phases in
some Alpine plants

Germinating behaviour and early developmental phases in some Alpine species were studied under natural as well as controlled conditions. In laboratory, germination tests with pre-treated or not pre-treated seeds sown onto blotting paper, sterile garden soil as well as silicate and carbonate Alpine soils, were carried out in various series. In the wild, control plots established above timberline comprised silicate and carbonate soils, surfaces with various reliefs being chosen; sowings within these plots were made upon naked as well as vegetation-covered soil. Germination and the development of seedlings and young plants were examined in regular intervals.

The following taxa were studied: a) from silicate: *Sesleria disticha*, *Hieracium alpinum*, *Senecio carniolicus*, *Cardamine alpina*, *Salix herbacea*, *Gnaphalium supinum*, *Soldanella pusilla*, *Geum montanum*, *Ranunculus Grenierianus*, *Nardus stricta*, *Carex sempervirens*, *Gentiana Kochiana*, *Helictotrichon versicolor*, *Luzula multiflora*, *Antennaria dioeca*, *Pulsatilla sulphurea*. b) from carbonate: *Sagina Linnaei*, *Veronica alpina*, *Arabis coerulea*, *Ranunculus alpestris*, *Salix retusa*, *Hutchinsia alpina*, *Saxifraga caesia*, *Dryas octopetala*, *Carex firma*, *Gentiana Clusii*, *Helianthemum alpestre*, *Anthyllis alpestris*, *Sesleria coerulea*, *Leontopodium alpinum*, *Carex sempervirens*, *Scabiosa lucida*.

Germinating behaviour. - Germination rates in seeds from niches with a short vegetation period were frequently rather high. Taxa depending upon a long vegetation period were greatly variable in this respect, their germinating behaviour being influenced by seed-dormancy. The most successful methods for breaking the dormancy proved to be mechanical scarification with a razor-blade as well as treatment with the gibberellic acid; stratification trials

were less effective. Some dormancy mechanisms apparently were very complex.

Seeds of most studied species remained partly viable for several years, but the germinating behaviour varied from one taxon to another with the increasing seed age.

Influence of the substratum upon the germination was mostly not demonstrable in laboratory conditions. In the field, taxa from carbonate germinated rather poorly in siliceous soil, whereas taxa from silicate behaved comparably both in silicate as well as carbonate plots. Germination rates were generally much higher in naked soils than in vegetation-covered surfaces.

Development of young plants. - Most of the taxa originating from niches with a short vegetation period developed rapidly in controlled conditions, whereas the development of taxa depending upon a longer vegetation period was rather variable.

Influence of the substratum upon the development of young plants was obvious in most taxa studied in laboratory conditions, plants from silicate and those from carbonate growing best in their respective soils. In the field, however, the plants at the end of the observation period were too small for getting any conclusive information.

The development of young plants in *Pulsatilla sulphurea* was particularly interesting, leaves not growing from the plumula between the cotyledons, but from a knob situated at the base of the hypocotyl.

Mortality. - Mortality was much more pronounced in the field than in laboratory conditions. Taxa from silicate survived much better in silicate than in carbonate, mortality rates being higher in naked surfaces than in vegetation-covered ones. Taxa from carbonate suffered more losses in silicate than in carbonate, no particular differences being observed between naked and vegetation-covered surfaces.

Mortality in naked soil was generally higher in summer than in winter. In vegetation-covered surfaces mortality varied in function of the substratum: maximal summer losses were observed in rather sparse vegetation upon carbonate, whereas in winter the rather closed vegetation upon silicate proved to be more affected.

KLEIN Andres. Die Vegetation an Nationastrassenböschungen der Nordschweiz und ihre Eignung für den Naturschutz. Veröff.Geobot.Inst.ETH, Stiftung Rübel 73, 75 S.

The vegetation on motorway verges in northern Switzerland and its suitability for nature protection purposes.

1. The vegetation on motorway verges in northern Switzerland can be characterised by the following particular features:

- variability, marked differences in the composition of the vegetation cover occurring between particular verges

- instability, vegetation cover greatly varying from year to year in its composition
 - species diversity, an average species number per relevé being about 40
 - large proportion of weeds and ruderal plants; high level of coverage by some of the sown species (*Festuca rubra*, *F. ovina* s.l., *Poa pratensis* and to some extent also *Agrostis gigantea*, *Bromus erectus* and *B. inermis*).
3. In spite of favourable edaphic conditions, the development of vegetation towards a dry mager grassland is hindered by the present management, in particular by a frequent mulching.
 4. The management trials (moving and raking once a year) as well as experimental planting of species typical of mager grassland indicate the south-facing verges are suitable for introduction of this type.
 5. The formation of protection worthy plant communities on motorway verges could be promoted by the use of a suitable seed material comprising local races, seed mixtures consisting a great variety of species as well as by change of the management.

LEUTHOLD Christoph. Die ökologische und pflanzensoziologische Stellung der Eibe (*Taxus baccata*) in der Schweiz. Veröff. Geobot. Inst. ETH, Stiftung Rübel 67, 217 S.

The ecological and phytosociological situation of yew-tree (*Taxus baccata*) in Switzerland.

A survey made in 1970 on the distribution of the yew-tree (*Taxus baccata*) in Switzerland shows that this species has decreased considerably since 1904 when a similar survey was made, and that the next tree generation is practically non-existent. The yew-tree maintains a peculiar "in-between" position, i.e. between deciduous tree and evergreen conifer as well as between pioneer and climax tree. Owing to this position and the genetically controlled small height growth the species in question could grow in a large number of ecological niches of our forests as a secondary stand tree.

From a climatic point of view the potential range of yew-tree covers half of Switzerland. The species can be found in all regions with oceanic to subcontinental climate and which are not subject to heavy winter frosts. Compared to beech with a similar distribution, yew-trees tolerate drier air and do not suffer from late frost. Their range therefore extends further into the continental zones.

At present, however, yew-trees occur in only half of their potential area. Site factors such as local climate, water properties, skeletal and nutrient content of the soil as well as the influence of man were investigated as potential limiting factors within the climatic zone. It was found that the parent material of soils and configuration of ground were the only natural limiting factors: marly and unstabilized soils discourage beech. This, together with better light conditions on steep slopes promote the growth of yew-trees.

The 260 vegetation surveys reveal the wide phytosociological and accordingly ecological range of this species. Although the survey confirmed *Taxo-Fagetum* as the association for the area investigated, its range proved to be smaller than previously thought. Many stands containing yew-trees had to be attributed to other associations.

An ecogram has been made as a synthesis of the ecological and phytosociological results, integrating edaphic factors as well as competitive influence of beech and pine. The ecogram shows that the ecological niche of yew-trees is determined by extreme site factors which act physiologically as barriers (mainly hydrological factors) and by ecological conditions (mainly light competition).

However, all these ecological and botanical aspects do not fully explain why the yew-tree is missing from large parts of its potential range. This is in fact due to human influence. The yew-tree has been connected with human civilization for thousands of years. The investigation showed that already early civilizations have caused severe damage to this species. In addition, differences in local forest management systems over the last two centuries have further contributed to the existing pattern of distribution.

The present decline of yew-trees is based mainly on two factors: the conversion of coppice with standards into much darker high forests and the excessive game population density (also due to human influence). Nearly all young yew-trees suffer severely from browsing damage.

In conclusion, we can say that the present yew-tree stands should be considered as relicts. Without active measures of protection and promotion in the near future this peculiar tree species will almost certainly disappear completely from Swiss forests with the death of the present tree generation - which would be yet another step towards the growing depletion of nature in our technical civilization.

SPIRIG Amadeus. Zum Wasserhaushalt verschiedener Strassenbaumarten unter dem Einfluss der winterlichen Salzanwendung. Veröff.Geobot.Inst. ETH, Stiftung Rübel 74, 68 S.

Water regime of several roadside tree species as influenced by the use of de-icing salt in winter.

The effects of de-icing salt on the water-balance of four roadside tree species (*Quercus robur*, *Aesculus hippocastanum*, *Tilia x euchlora* and *Platanus acerifolia*) were investigated. Transpiration, water saturation deficit, osmotic potential and water-potential were measured in two vegetation periods; other variables were deduced from them. The results are characteristic for salt-stressed trees of the respective species on the dividing strip of a road.

The soil types were comparable for all sites, the salt-stressed sites had to be classified as drier. Atmospheric water-stress was greater (*Aesculus*, *Quercus*), equal (*Tilia*) or smaller (*Platanus*) than measured for controls.

Salinity, climatic and edaphic conditions produced different reaction in

each species. *Quercus* increased its water-turnover at the salt-stressed site without disadvantageous consequences for its water-balance. This could be explained by the ecophysiological possibilities and anatomical-morphological adaptations of the species. *Quercus* has an efficient stomata-regulation system, and its low osmotic potential allows for a low water-potential, which in turn provides sufficient water supply. Salts ions were excluded.

The relatively balanced water relations of *Aesculus* at the salt-stressed site were interpreted as a consequence of a decreasing transpiration rate that was veiled by the so-called Iwanoff-shock. An improved water supply caused by a decreasing water-potential could not be found, although the uptake of salt ions seemed to indicate osmotic adaptation and resulted in an apparently low osmotic potential and a surprisingly high turgor.

Tilia reduced drastically its transpirational water loss at the salt-stressed site. It was concluded that the incorporated salt ions changed the stomatal and intercellular diffusion resistance to water vapour. The other measured parameters indicated small if any variation in water-balance.

The unfavourable environmental conditions at the control site of *Platanus* together with the increased diffusion resistance - probably also due to incorporated chloride - at the salt-stressed site caused a more balanced water regime of the specimen at the salt-stressed site.

In this paper it was found that the tree species unable to exclude salt ions selectively and taking up chloride - eventually sodium - ions showed an increased resistance and a decreased transpiration rate. This led to an improved water-balance at the salt-stressed sites. Due to the increasing concentration of salt ions more negative osmotic potentials were measured at the salt-stressed sites what seemed to indicate somotic adaptation. It however must be considered that this probably does not reflect the cytoplasmatic reality, since the water-potential did not decrease correspondingly.

As a consequence of the in general negligible changes in overall water-balance the hypothesis that the use of de-icing salt would cause a "physiological dryness" in the sense of SCHIMPER (1898) had to be abandoned. Conclusively, de-icing salt seems to affect the investigated roadside trees rather by the toxicity of its components than by their osmotic effects.

Diplomarbeiten (Diploma thesis)

NäF Ernst. Zur Entstehung und Erhaltung von Mooren und Streuwiesen im Reusstal. 134 S. (Manuskript).

Development and conservation of wetlands in the Reuss valley.

Straw meadows and other wetlands including a quaking mire were investigated in an old river bed of the Schorenschachen near Mühlau in the Argovian Reuss valley.

The area was mapped with the aid of aerial photos. Basiphilous *Molinia* meadows build up the main part of the area and macrophorbe meadows of differing composition. Apart of that, the *Ranunculus-Carex hostiana* small sedge community in flooded depressions are present to a great extent.

In these different straw meadows twenty-seven control plots were put up to observe fluctuation in vegetation and groundwater conditions (weekly readings of water table in tubes). Evaluation of these measurements gave the characteristic ground water values for these vegetation units. The same time, it became clear that river water is percolating into the area through the dam.

Three transects containing twenty-one plots were laid out through the quaking mire. Analysis of nutrients in ground- and inundation water coupled with relevés on the same plots has proven, that nutrients from the surrounding intensively cultivated fields penetrating into the old river bed are not completely absorbed anymore by the marginal macrophorbe meadow belts: Nutrient indicators are spreading from this belt into the neighbouring parts of that quaking mire, reacting very sensitively on inflowing nutrients. In the other parts of that quaking mire these nutrients, mineralizing in situ in minor quantities, are not available to plants, because other factors, especially excessive humidity, are preventing the installation of such indicators.

To conserve this unique quaking mire, it is important in the long run to install a larger circular buffering zone, which is not fertilized. The boundary line of the proposed conservation area should guarantee its future existence.

WEILENMANN Katharine. Bedeutung der Keim- und Jungpflanzenphase für alpine Taxa verschiedener Standorte. 133 S. (Manuskript).
(Gekürzte Fassung s. S. 68 dieses Bandes).

Importance of germination and first developmental phases for alpine taxa from various habitats. (See p. 68 short-version).

ZIMMERMANN Maria-Astrid. Einfluss von Calcium und Magnesium auf das Wachstum von mitteleuropäischen Lemnaceen-Arten. 92 S.
(Manuskript). (Gekürzte Fassung s. S. 120 dieses Bandes).

Influence of calcium and magnesium upon the growth of duckweeds (*Lemnaceae*) from Central Europe.
(See p. 120 short version).
