

## THE DEVELOPMENT OF PIONEER – COMMUNITIES ON RAW SOIL ABOVE ALPINE TIMBERLINE (ABRIDGED VERSION)

M. JOCHIMSEN

Approximately since 1850 the glaciers are retreating their snouts towards higher elevations. This process was interrupted only by slight advances about 1890 and 1920. The areas now being ice-free offer excellent opportunities for studying plant settlement under the conditions of the alpine belt. To a certain extent the state of vegetation in this region is relevant to the origin of mud-streams and avalanches. — Up to the present the investigations of 19 forefields within the European Alps are completed.

The first settlement of pioneers is dependent on 1. stabilization of the morainic deposits; 2. slipping due to gravitation (on slopes); 3. soil-movements caused by streamlets and mud-streams, the movement of the soil being modified by its grain size and inclination.

In spite of frugality concerning the mechanical refinement and the content of nutritive substances there are subtle differences between the ecological amplitudes of different species. Most important are availability of water and grain size of the soil.

Irregular conditions characterize the moraine just divested of ice. Within smallest spots grain size is varying, and no distinct relief is developed so that differences in water-availability might occur. With increasing distance from the glacier different sites are prepared. Meltwater and streamlets running down the slope are notching the scree and dividing the plane into ridges and depressions. Thus dry and moist sites are created. Although the brook flows at the base of the ridge the upper parts remain dry for the scree is lacking capillary force.

Fine sand and mere boulders even have a worsser water-regime than mixed materials do. They easily loose moisture by evaporation or may not retain it at all. On the other hand little patches of fine sand surrounded by larger stones are becoming wet quickly and are well preserved from rapid dessication.

Flowing water normally has an eroding effect but on very slight slopes its transporting capacity is limited and therefore sand becomes deposited soon. The groove is filled up, the brook overflows its banks and is flooding the adjacent area. Subsequently alluvial fields are formed where ecological conditions differ largely from those of the original morainic sites. — Deposition, flooding and dessication are the main factors modelling the primary site and changing continuously they create a large variety of new ecological conditions.

Mud-stream, falling rocks and pasturing are less effective for the development of the vegetation than the water factor is.

Vegetation-development is completely dependant upon these variations of site. Naturally sudden changes of the conditions mentioned above do not promptly cause corresponding changes of the set of species but the quantitative composition, the character and the vitality of the species suggest the preceding stage of the present phase.

In order to give an idea of the development of plant communities the conditions in the forefield of the Rotmoos-Glacier (Ötztal, Austrian Alps) may serve as a model. With no exception all series are starting with a community being composed of pioneers of which *Saxifraga aizoides* is mostly dominating. The moist resp. the dry variety of this community may be identified by a conspicuous addition of *Poblia gracilis* resp. *Rhacomitrium canescens*. This *Saxifraga aizoides*-community however is not restricted to the youngest parts of the forefield at all, it also colonizes the borders of meltwater-streams, habitats located at the slope and influenced by water, and isolated places in the oldest parts of the forefield.

In contrast to the *Saxifraga aizoides*-community the floristic composition of the *Cerastium uniflorum*-community indicates a poorer water-regime. This pioneer stage found on unsorted little influenced scree is the most common in the European Alps.

In the course of dessication the phase of a *Trifolium pallescens*-community develops on flat silt talus resulting from the activity of the meltwater-stream. Extreme lack of water, however, results in a *Rhacomitrium canescens*-community. This stage is characterized by the dominant species *Rhacomitrium canescens* and *Stereocaulon alpinum*.

Even slight changes in grain size combined with modifications in water-regime give rise to an exchange of the dominant species. *Rhacomitrium* insists on fine sand, while *Stereocaulon* takes possession of every water-lacking material. As a result of the increasing coverage water-regime meliorates, and the development goes though very slowly towards a *Poa alpina*-community.

The moist sere starts on alluvial sand, and usually the first phase is formed by *Poblia gracilis* only. Later on pioneers turn up and establish the connection to the moist variety of the *Saxifraga aizoides*-community.

In case of stagnant water and silty soil a *Salix herbacea*-community which resembles to the vegetation of snow coombs to some extent is developed. Afterwards it changes into the terminal community sometimes with contact to the *Poa alpina*-community.

The *Poa alpina*-community includes several varieties according to site conditions and the way of succession. Wet rocky stands are dominated by *Luzula alpino-pilosa*, formerly flooded and sandy soil is settled by various herbs like *Tanacetum alpinum* and *Agrostis rupestris*, and the morainic deposits not much influenced by environmental factors are distinguished from each other by a conspicuous part of grasses and secondary colonists.

With increasing age and density of the vegetation site conditions are meliorated. Precursors of the terminal community arrive, and favourable conditions provided a stage is developed which corresponds — regarding the list of species only — with a meadow or a pasture like Nardetum.

Within the alpine belt the development of vegetation on bare soils does not depend upon the supply of species and the age of the ground primarily. That is true for all forefields studied in the European Alps. The water factor modified by grain size and movement of the soil determines how succession turns out.

(The mentioned plant communities do not have the rank of associations in the strong sense of phytosociology, they are operational terms.)

## LITERATUR

- JOCHIMSEN, M. (1963): Vegetationsentwicklung im hochalpinen Neuland (Beobachtungen an Dauerflächen im Gletschervorfeld. 1958–1962). Festschr. H. Gams, *Ber. Naturwiss.-Med. Ver. Innsbruck* 53: 109–123.
- JOCHIMSEN, M. (1970): Die Vegetationsentwicklung auf Moränenböden in Abhängigkeit von einigen Umweltfaktoren. Veröff. Uni Innsbruck 46, *Alpin-Biol. Studien* 2: 5–22.

Anschrift des Verfassers:

Dr. M. JOCHIMSEN, Universität Hohenheim, Lehrstuhl für Botanik, 7000 Stuttgart 70, Kirchnerstr. 5.

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Verhandlungen der Gesellschaft für Ökologie](#)

Jahr/Year: 1976

Band/Volume: [5\\_1976](#)

Autor(en)/Author(s): Jochimsen Maren

Artikel/Article: [The development of pioneer - communities on raw soil above alpine timberline 61-63](#)