

Site-specific seed mixtures for restoration at high altitudes

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Introduction

In the last 150 years, agrarian usage at high zones and other less productive areas has clearly receded, which has led to a corresponding expansion of forested areas. As a result, the exploitation of alpine meadows intensified or was, on occasion, completely abandoned. In the subalpine zone, during the transition process from the lavish and intensively cultivated alpine meadow areas to the original forest vegetation, a creeping destabilization of the ecological systems of high alpine-meadow regions can arise.

Contrary to agricultural use, summer and winter tourism in the last few decades has led to extensive opening of high locations. There are already more than 13,000 lifts, cable cars and other transport facilities throughout the Alps, mostly used for tourism. Taking the calculations made in the middle of the nineties as a starting point, the actual area of ski runs and lift facilities is more than 110,000 hectares, of which 10,000 hectares are already covered by artificial snow. Even if an exact estimation is not possible, at least half of these areas are in high zones. As before, thousands of hectares are levelled annually as part of the opening to tourism, and infrastructural improvements, and now require restoration.

Specific Alpine Characteristics

Plants at high altitudes are often subject to an often and partly rough change of the climatic factors. The transition of the seasons takes place very quickly. With increasing altitude, the vegetation period takes around one week less per 100 metres of altitude. The differentiation of the macroclimate to the microclimate dependent on altitude and broad location is important. The climatic-vegetation period with average daily temperatures of over 10 °C, is around 67 days at an

altitude of 2,000 metres, which is a third of the vegetation period in the valley (KRAUTZER and WITTMANN 2006). The deep ground temperatures in the mountains strongly reduce the activity of micro-organisms. Reduction of dead organic mass and thus the provision of basic mineral nutrition is inhibited.

The use of seed mixtures is only sensible in high zones within which the species can still reproduce. This border is generally achieved at altitudes of 2300 to 2400 metres. Planning restoration at extremely high altitudes (over 2000 metres) is to be carried out by appropriately trained experts with sufficient experience. The methods given are suitable as relative to the climatic and geobotanical conditions and are principally for the restoration of alpine ecological systems.

Restoration with seeds

The conventional "high-zone mixtures" available on the market mainly comprise high-growing non-site-specific lower plants originally bred for grassland economy in valley locations or as grasses for sporting events. These species are adapted to lower, warmer locations and are generally not suitable for restoration in high zones. The high nutritional needs of these species require long-term, expensive fertilization measures to achieve the necessary grass density. Also relative is a high biomass production, which again requires regular cutting, grazing or removal of the materials arising because in the short vegetation period, no sufficient decomposition of the additional growth of biomass takes place and the chockin of the vegetation stigma would be the result.

The species in the high zones of naturally present grassland communities are adapted to an optimum degree to the soil and weather conditions of their habitat (short vegetation period, less provi-



Picture 1: Comparison of a standard seed mixture containing lowland species (left) and a site specific seed mixture (right) at location Hochwurzen, Austria, 1.600 m a.s.l.

sion of nutrition). Plant stands from site specific seed mixtures have low nutrition demands. They produce little biomass, but with an appropriate choice of species, they do produce high-quality feed. Seeding with site-specific seeds generally requires only slight amounts of nutrition, and short-term management measures lead quickly to natural, generally extensive self-maintaining grass, which has high persistency against subsequent uses for tourism and agriculture (KRAUTZER et al. 2003). With the use of site-specific seed mixtures, the required sowing volumes



Picture 2: Comparison of a standard seed mixture containing lowland species (left) and a site specific seed mixture (right) at location Grossglockner, Austria, 2.400 m a.s.l.

commonly used in practice can be lessened from 200 to 500 kg per hectare to 80 to 160 kg per hectare.

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