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Artikel: Vegetationskundlich-ökologische Untersuchungen und Bewirtschaftungsexperimente in Halbtrockenwiesen ("Mesobromion") auf dem Schaffhauser Randen = Phytosociological and ecological investigations and experimental management in mesobromion limestone grassland on the Randen, a Jurassic mountain in northern Switzerland

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ter oder dicht über der Bodenoberfläche liegen: vor allem die Moose, Keimlinge und Jungpflanzen sowie Rosetten-Hemikryptophyten (ausgenommen *Primula veris).* Gesamthaft war der Rückgang der Arten jedoch nicht sehr hoch.

14. Die relativ hohe Artenzahl in Mesobrometen wird folgendermassen erklärt: Eine gross- und kleinflächige Vielfalt an Standortsbedingungen, insbesondere die Differenzierung in kleinflächige Nischen, kann von zahlreichen Arten genutzt werden. Die Beschränkung der Dominanz allfälliger konkurrenzstarker (grosswüchsiger) Arten durch Nährstoffarmut, Trockenheit, Mahd usw. ermöglicht vielen stressresistenten Individuen, insbesondere als kleinwüchsige Jungpflanzen (die noch ausreichend Licht erhalten), auszuharren und günstige Bedingungen für das Wachsen und Fruchten zu nutzen. Die (zyklische) Varianz und in einem bestimmten Ausmass die Zufälligkeit von einzelnen Standortsfaktoren ermöglichen kein "jederzeit und überall" bestangepasstes Verhalten an den Standort. Einzelne Faktoren eines Standortes "ändern" sich fortwährend.

SUMMARY

The phytosociological complex of the *Mesobromion* limestone grassland (with transitions to the *Arrhenatherion* and the successional stages of both) on the Randen, a Jurassic mountain in the north of Switzerland (Canton Schaffhausen), was investigated in this thesis. In the two subregions of Bargen in Tannbüel and Merishausen in Grätental study areas were established and the vegetation patterns of microsites investigated by means of grid vegetation samples of 100 dm^2/1 m^2 each. These grid relevés served to determine the influence of cutting, burning and no management on the site conditions and the vegetation.

1. The five types of *Mesobromion* described by ZOLLER (1954b) are based on his vegetation samples of 1947/48 and were essentially confirmed by the samples of 1976/77 for this study. The species composition of the vegetation indicated, in general, conditions with more nitrogen (nutrient indicators). It could not be decided if this increase in nitrogen stemed from the atmosphere and/or if it was due to agriculture or methodical reasons. The more eutrophic *Mesobrometum*-type with *Inula conyza* was described as a "new" type without management.

2. Especially species on very oligotrophic areas of dry grassland, which are cut regularly but late in the year, are more threatened than in 1947/48. Species, such as *Crepis alpestris, Linum tenuifolium, Globularia elongata,* and *Hieracium cymosum,* as well as many orchids in former oligotrophic meadows showed a sharp decline.

3. Cutting, burning, and no management have different impacts on the vegetation and other site conditions. In this study, along with other sporadically effective, irregular, or cyclic site conditions (dry seasons, disturbance by herbivores, etc.), they were regarded as impulse donors that influence the vectors of vegetation change on the varying *Mesobromion*-sites.

4. The immigration of copse plants was investigated as an example of a vegetation change easy to trace back. Corresponding to different soil types and conditions of the surrounding area, the comparison of the dynamics on two experimental plots revealed two completely different processes. On subdivisions of the area BG, Bargen, Tannbüel, pioneer wood species appeared within a few years of no management. The

most important copse species here were *Pinus silvestris, Juniperus communis,* and *Picea excelsa.* Subsequently, no additional copses, but rather a 'stabilised' grass stage developed between the wooded parts. On MG, Merishausen, Grätental, however, only the longstanding cover of brushwood, *Prunus spinosa,* developed growing into the uncut meadow (which had no management and contained no copses) at a rate of about 30 cm/year.

5. When the investigation area BM was cut again, the nitrogen content of its soil did not differ from that of a second area that was still without management. On the burnt area, the nitrogen content available to plants increased slightly with a corresponding rise in the number of nutrient indicating species.

6. The fire temperatures in similar experiments in *Mesobrometum*-sites were largely confirmed. Maximum temperatures of up to 640 °C were measured a few millimeters above the soil surface. Hot headwind fires nearly completely destroyed the green plant parts above ground. Fires in the wind direction did not reach such high temperatures and resulted in the formation of a mosaic of damaged and undamaged living plant parts. Air-dried litter quantities of less than 100 g/m^2 could not be burnt.

7. The production of biomass varies, depending on varying annual weather conditions and on the site. Areas without management produced the highest amount of biomass, cut areas contained only little biomass, and burnt areas ranged in-between. Despite the low productivity of the sites at the start, the regular annual cut in late summer resulted in a decrease of surface biomass formation.

8. On the investigation site BM, Bargen, Tannbüel, the annual amount of nitrogen available to plants was assumed to be 1.5-3 g/m^2. The late summer cut withdrew about 1.55-3.55 gN/m^2 and 0.12-0.37 gP/m^2. On the other hand, when the area was burnt by means of medium and hot fires in spring, the total amount of phosphor and about one third of the nitrogen remained in the ashes.

9. The grid vegetation samples involved a great deal of work; however, they provided a good short-term impression of the dispersal pattern of the species in an area and gave indications of each species' behaviour and of vectors of vegetation fluctuations after only a few years. In this thesis, 26 distribution patterns (three annual sequences each) of 22 species are shown by way of examples.

10. Homogeneity and stability of a vegetation are integrative qualities. Homogeneous and inhomogeneous, stable and unstable species distribution patterns superimposed each other.

11. The grid vegetation samples gave evidence that some species behave equally on all similar *Mesobrometum*-sites that were investigated; other species, however, vary in their behaviour on these sites. The course of weather conditions, dry seasons in particular, essentially modify the conditions of a site. The litter layer, on the contrary, reduces the negative effects of dry periods and insolation. For example the new establishment of seedlings of many species was enhanced or reduced, depending on the densitiy of the litter layer.

12. A change in the management (from cutting to no management or vice versa) caused no short-term disappearance of species; neither was the establishment of species registered, which were new to the investigation area.

Cutting (especially at the end of the vegetation period) and no management induced little short-term changes to the composition of the vegetation on the investigated areas. Especially the very dry oligotrophic investigation areas ML und BL, which are exposed to strong insolation, reacted slowly. Faster changes were recorded on the mesic investigation area BS.

13. Burning had strong short-term effects on the composition of the vegetation. Particularly species with hibernating parts, which lie just below or above the soil surface, were concerned: especially the moss layer, seedlings, and young plants, as well as rosette-hemicryptophytes (except *Primula veris*). As a whole, there was no significant decline of species in the first years.

14. The relative high number of species in a *Mesobrometum* can be explained as follows: If site conditions vary and particularly if a differentiation into niches of a small size can be found, many species will establish themselves. The restriction of dominance of any possible competitive (tall-growing) plants by oligotrophy, dryness, cutting, etc. enables many stress-resistant individuals to survive, particularly as long as they are small young plants that receive sufficient light, and to wait for conditions that favour their growth and fructification. The (cyclic) variability and certain chance factors of some environmental influences make it impossible for a plant to develop a bestadapted behaviour to all microsites for all times.