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## SUMMARY

The aim of this thesis is to investigate the optimal management type to increase or preserve plant diversity of urban meadows. Between 1990 and 1994, 241 meadows in the area of the City of Zürich were studied with phytosociological and ecological methods, and with management experiments on five permanent plots.

### Results

#### Vegetation and site conditions

- 1 In the City of Zürich traditional meadows of a moderately nutrient-rich type (*Arrhenatheretum elatioris typicum*) are no longer found. Due to altered management practice this grassland type has been transformed into communities with only few species (*Lolio-Cynosuretum*), either by more intensive management, or by at least temporarily abandonment. The reduction of fertiliser input affected the succession of the *Arrhenatheretum*, which was either transformed into a nutrient-poor type with an urban character (*Arrhenatheretum elatioris salvietosum*, drought-resistant *Trifolium dubium* type), or into a nutrient-poor type similar to limestone grasslands. Vegetation changes also occurred on more or less humid sites near settlements on rich urban meadows and pastures (*Arrhenatheretum elatioris Lysimachia nummularia* subass., urban *Primula vulgaris* type). The urban character was indicated by the high frequency of plants with higher temperature requirements, and by the invasion of plants from gardens and by ruderal plants.
- 2 Most meadows and pastures of the City of Zürich are rich in species. On the 241 plots, 444 plant species were found (413 vascular plants and 31 mosses).
- 3 Some sites were especially rich in species, particularly on south-facing slopes (> 30%) (rarely north-facing), with calcareous (calcium carbonate > 20%) and nutrient-poor (phosphate < 25 ppm) soil. These meadows were usually found in semi-public urban places or in public rural places.
- 4 Meadows on urban slopes with nutrient-poor soil (nitrogen < 0.3%, phosphate < 25 ppm) were also sites of rare and endangered plant species, which occurred on older (> 75 years) rural slopes rather than on private property.

#### Experiments

- 1 The experiments showed, in three of four cases, that cutting of a former urban pasture leads to losses of typical pasture plants, whereas the vegetation of grazed control plots remained more or less stable. On one plot we observed a parallel variation in the composition of the vegetation. The development in both the grazed control plots and the mowed plots had obviously been caused by strong external influences.
- 2 In one experimental site the number of plant species increased on all mowed plots after changing the management practice, and remained constant on the grazed ones. In one site we found opposite results, and in two further study areas no variation of richness of species could be observed. These differences were explained by the following factors: nature of the original vegetation, local conditions, former grazing intensity and age of the meadow.
- 3 *Agrostis stolonifera*, *Bellis perennis*, *Cardamine hirsuta*, *Cerastium caespitosum* and *Poa trivialis* are species whose abundance was increasing after several years of grazing. *Bromus erectus*, *Galium album* and *Lotus corniculatus* had decreasing cover-abundance

values. Species which benefitted from the change to mowing are: *Helictotrichon pubescens*, *Salvia pratensis* and *Medicago lupulina*. *Trifolium dubium*, *Trifolium repens* and *Ononis repens* showed a decreasing cover-abundance value in response to the change from grazing to mowing.

- 4 The concentration of potassium rose significantly from 1.5 to 1.8 ppm on grazed control plots, but not in the mowed plots. Due to the systematic removal of grass cuttings, the concentration of phosphate decreased from 3 to 2.3 mg per 100 g on mowed plots and remained stable on grazed ones. The concentration of nitrogen fluctuated below the limit of detection.

### **Conclusions**

- 1 It is not possible to preserve or increase the plant diversity of meadows in the City of Zurich exclusively by cutting or by grazing. Both management systems complement each other: grazing stimulates the spread of new plant species and species from adjoining populations (by opening the vegetation, exchange of diaspores by sheep, changing the grazing intensity etc.), while cutting preserves the typical flora of meadows due to a continuous and constant cutting regime.
- 2 Traditional maintenance should remain the same, not only for grasslands of old cemeteries, public gardens and parks, but also for sites with a value as a natural monument or a natural area. All other types of urban meadows should be subject to management according to ecological principles and economic requirements.

