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in erster Linie der Phosphor-Eintrag ins Ried verhindert werden können (Kap. 5.4.).

3. Für die floristische Ueberwachung der Riedvegetation mit Dauerquadraten sind feinere Methoden als die klassische Vegetationsaufnahme zu verwenden (z.B. Individuenzählungen, phänologische Beobachtungen; Kap. 5.5.).
4. Eine durch zusätzliche(n) Schnitt(e) angestrebte Oligotrophierung muss sich nach der vorhandenen Vegetation (und dem Standort) richten. Der Festlegung des Schnittregimes hat deshalb eine Analyse der Vegetationszusammensetzung voranzugehen, um vor allem zu vermeiden, dass unerwünschte Arten von einem zu frühen oder zu späten Frühschnitt profitieren (Kap. 5.8., z.T. Kap. 5.7.). Auf nasseren Flächen kann oft auf einen zusätzlichen Frühschnitt verzichtet werden.
5. Auch wenn eine zu oligotrophierende Wiese unmittelbar in der Nähe von intakten Streuwiesen liegt, braucht das Ziel nicht "Regeneration einer Streuwiese" zu heissen, da die Aushagerung durch Schnitte ausserordentlich aufwendig ist. Alternativziele bei der Renaturierung von Intensivwiesen können z.B. ein- oder zweischürige (ungedüngte) Futterwiesen sein, die, von den Berggebieten abgesehen, ebenfalls ausserordentlich selten geworden sind (Kap. 5.9, z.T. Kap. 5.7.).

SUMMARY

Effects and elimination of fertilization influences on litter meadows. Simulation of eutrophication and regeneration experiments in the northern Swiss midlands

The study presented here, carried out in the northern part of the Swiss midlands, is a contribution to the solution of two problem complexes, with which nature conservationists working for the protection of litter meadows are confronted: A) avoidance of nutrient infiltration from the intensively used agricultural area ('buffer zone problem'); B) recovery of eutrophicated litter meadows and of nutrient rich meadows, which were once used as litter meadows, to an oligotrophic state (oligotrophication, regeneration, 'renaturation').
Litter meadows are unfertilized and therefore poor in nutrients. They are moist, and only cut once a year, in autumn, to gain bedding for the stables. The focus of the study is on the litter meadows dominated by Molinia coerulea (Molinion).

Problem complex A: eutrophication, 'buffer zone problem':
To simulate indirect fertilization (nutrient infiltration mainly by surface runoff and soil water) of the border zones of litter meadows, we fertilized the inner part of undisturbed areas. The aims were a list of species indicating fertilization influences (eutrophication indicators) and information about the importance of the main nutrients nitrogen, phosphorus, and potassium in the process of eutrophication.
In the fertilizer trial on mineral soil in the lower valley of the Reuss, nine plots of 100 m^2 were fertilized with PKN or PK mineral fertilizers for two years (1979, 1980); the vegetation was observed until 1983. The trial on fen peat in the airport area of Kloten, which based on the experiences of the first experiment, was carried out in 1982 and 1983, on plots with N, KN and PKN mineral fertilization covering an area of 135 m^2.

Problem complex B: oligotrophication, regeneration:
For the oligotrophication of eutrophicated and/or former litter meadows, we carried out, besides the mowing in autumn, an additional one in early summer, which should accelerate the nutrient impoverishment and damage plant species which are not typical for litter meadows. Two periods of early mowing were tested: the first half of June and the middle of July. As third treatment, the effect of mowing only once, in autumn, was investigated.
Test plots were the former PKN-plots of 25 m^2 of the fertilizer trial in the valley of the Reuss and five plots of 75 m^2 on disturbed meadows in the airport area of Kloten.
The study presented here reports the effects of two years additional early mowing on vegetation and soil.
The results of fertilization and additional early mowing were investigated with relevés, counting of individuals, measurements of standing crops and analyses of plant minerals. Vegetation data were mainly analysed with correspondance analyses.

Results:
1. On the control plots, numbers of individuals (of certain plant species) and standing crops showed strong year-to-year fluctuations.
2. Problem complex A: **fertilizer tests** (see also partial summaries: chap. 4.2.1.3., 4.2.4.):
   a) The list of eutrophication indicators contains, besides widespread species (e.g. Calamagrostis epigeios) and ruderal plants (e.g. Solidago serotina), mainly typical species of the alliances Molinion (e.g. Cirsium palustre), Filipendulion (e.g. Carex acutiformis) and Calthion (e.g. Agrostis gigantea).
   b) The wetter the plots the less the effects of fertilization.
   c) On slightly alcalic mineral soil (valley of the Reuss) and also on slightly acid fen peat (Kloten) phosphorus proved to be the prime limiting nutrient for plant growth (see also EGLOFF 1983).
3. Problem complex B: **regeneration experiments** (see also partial summaries: chap. 4.4.1.3., 4.4.2.5., 4.4.6., 4.5.6.):
   a) Relative to nutrient deprivation, the treatment with mowings in July and autumn is a little more efficient than the treatment with mowings in June and autumn. The treatment with one mowing in the middle of September follows with a clear difference.
   b) On mineral soil, the P-oligotrophication by mowings is much more difficult and more tedious than the impoverishment of nitrogen and potassium, due to the strong immobilisation of phosphorus: During the two years with two yearly mowings, the sites lost on a average a fifth of the N- and K-quantities, but only a tenth of the P-quantity from fertilizers.
   c) Relative to reaction of species to early mowing, on the one hand both treatments resulted in equal effects (e.g. Filipendula ulmaria, Cirsium arvense), while on the other, some species showed clearly different behaviour: Holcus lanatus and Rhinanthus alectorolophus for instance spread greatly on plots mown in July.
   d) Calamagrostis epigeios, Cirsium arvense, Filipendula ulmaria and Solidago serotina, frequent species in disturbed litter meadows, cannot be combatted by mowing only in autumn.

Main conclusions:
1. When the litter meadow is wet, the eutrophication may only be recognized after intervention in the water balance or after dry summers

(chap. 5.1., 5.3.) For this reason a yearly and methodically fine floristic surveillance is necessary (see 3. and chap. 5.5.).

2. On mineral soils, half-bogs, and fens, where the vegetation is dominated by the flying bent (Molinia coerulea), small sedges (Carex sp.) or small rushes (Schoenus sp.), phosphorus is on principal the prime limiting nutrient (chap. 5.3.). On fen, potassium can be almost as limiting. When therefore fertilization restrictions are decided for the surroundings of protected litter meadows, then mainly the phosphorus infiltration must be prevented (chap. 5.4.).
3. For the floristic surveillance of litter vegetation in permanent plots, finer methods than the classic relevé must be employed (e.g. counting of individuals, phenological observations; chap. 5.5.).
4. When an oligotrophication is aimed at by additional mowing(s), one must conform to the actual vegetation (and the site). An analysis of the composition of the vegetation must precede the determination of the mowing treatment, in order to prevent undesired species from profiting by an early mowing carried out too late or too early (chap. 5.8., in part 5.7.). On wetter areas one can often forgo an additional mowing.
5. If a meadow, which is to be oligotrophicated, is situated directly near an intact litter meadow, the aim need not be 'regeneration of a litter meadow', since nutrient impoverishment by mowings is extraordinarily tedious. Alternatives for the 'renaturation' of intensively utilized meadows can be for instance once or twice mown (unfertilized) hay meadows, which, except in the mountain regions, have also become extraordinarily rare (chap. 5.9., in part 5.7.).

RESUME

Effets de l'infiltration d'engrais dans des prairies à litière et leur suppression. Expériences d'eutrophisation et de régénération effectuées dans le nord du Plateau Suisse.

Cette étude, réalisée dans le nord du Plateau Suisse, veut contribuer à la solution de deux problèmes auxquels les organes de la protection de la nature se voient confrontés lors de la conservation des prairies à litière (léchères): A) éviter la fertilisation indirecte à partir des terres intensivement cultivées ("problème des zones tampons"); B) ramener des léchères eutrophisées ou transformées en prairies grasses à un état maigre (oligotrophisation, "rénaturation", régénération).
Les prairies à litière sont humides, non fertilisées et donc maigre, fauchées qu'en automne et la litière est récoltée pour l'étable. L'étude se concentre sur les prairies à molinie bleue, les molinaies (Molinion).

Problème A: eutrophisation, "problème des zones tampons":
Afin de simuler la fertilisation indirecte en bordure de léchères causée par l'eau s'infiltrant des alentours exploités intensément, on a effectué des essais de fertilisation sur des parcelles intérieures intactes, avec les buts suivants: dresser une liste d'espèces annonçantes des influences d'engrais (indicatrices d'eutrophisation) et gagner des informations sur l'importance des macro-éléments azote, phosphore et potasse dans le processus d'eutrophisation.
Dans l'essai de fertilisation sur sol minéral, dans la vallée de la