More problems arise from personal interests and adverse agricultural practices due to the subsidy system that still encourages intensification and increased production. Problems also arise from tourism, an economically important factor in many regions, and from the perceived need to open up all regions with roads. The number of people employed in agriculture, tourism and road construction is at least 10 to 20 times greater than the number of people employed in nature conservation. With respect to financial support of such projects, a similar ratio exists.

How can the last natural areas be conserved?

The outlook is very pessimistic, but there is still hope that the conservation of mires and mire landscapes at a national level may be possible. Despite all the constraints, it must be remembered what the Swiss population has, in principle, already accepted: "Mires and mire landscapes of particular beauty and national importance are protected areas."

2.3 Findings from the two national inventories of mire habitats

Andreas Grünig

After the classic book by FRÜH and SCHRÖTER in 1904, there was no systematic, updated information about the situation of mires in Switzerland until the 1980's. However, there was one exception: a set of about 170 short descriptions of individual mire sites (bogs and fens) from across Switzerland by LÜDI (1943–1951). Lüdi, a professional plant ecologist and palaeobotanist, described the condition and the vegetation of each site and rated, from his expert point of view, their individual value on behalf of the Swiss League for Nature Conservation. Sometimes the descriptions included phytosociological relevés, but vegetation maps or a systematic survey were never provided by Lüdi. Unfortunately, only a few of Lüdi's suggestions were realized.

In 1984 and 1990 respectively, the national bog and fenland habitat inventories were completed. These inventories were initiated in 1978 with the development of the raised bog inventory by the two main voluntary nature conservation organizations. The fenland survey was commissioned in 1986 by the federal authorities (BROGGI 1990). The two new inventories of mire habitats give a systematic and quite accurate figure about the (serious) state of our national mire heritage. Therefore, the scientific database for sustainable mire conservation now exists; ignorance can no longer be used as an excuse preventing political and practical action.

The area of Swiss mire habitats identified by the two national inventories of the raised bogs and of the fenlands totals approximately 30,000 ha, which is clearly less than 1% of the country's surface. These inventories include about 4,000 sites, of which approximately 1,500 mires with a total area of 20,000 ha are regarded to be Sites of National Importance.

Co-ordination problems became evident when it was attempted to aggregate the two mire habitat inventories. These are dealt with in Chapter 2.5.2.5.

Table 2.3.1. Dichotomous key used for mapping the vegetation for the raised bog inventory of Switzerland

- At a scale of 1 : 25,000, 1 mm² on the map represents a minimum area of circa 600 to 1,000 m² in the field. This is the resolution limit of that scale which should be employed both on the map and in the field.
- Only the existing vegetation mosaic is mapped (interpretation of potential or past vegetation should be avoided).
- Cover indication per species or species group is recorded according to the classes of the BRAUN-BLANQUET cover-abundance scale (cf. MUELLER-DOMBOIS and ELLENBERG 1974, p. 59):
  +: Few plant individuals, with low cover of the recorded area;
  1: Numerous plant individuals, but less than 5% cover, or scattered, with cover up to 5%; 2: Any number, with 5 – 25% cover; 3: Any number, with 25 – 50% cover; 4: Any number, with 50 – 75% cover; 5: Any number, with cover more than 75% of the recorded area.
- An additional characteristic for every mapped bog unit is an indication of its actual state (condition), i.e. the area is labelled as to whether it is in a near natural state (primary bog) or in a damaged state (secondary bog) (cf. inset on facing page).

Question	Decision	Go to question No.	Vegetation units of the raised bog inventory	Unit No.
1. Is the cover of *Sphagna* ≥ 2 ?	Yes	2		
	No	13	(No bog area)	
2. Is at least **one** species present out of a group of 4 reliable bog indicators consisting of *Andromeda polifolia, Drosera rotundifolia, Eriophorum vaginatum,* and *Vaccinium oxycoccos* ?	Yes	4		
	No	3		
3. Are at least three species present out of a group of 17 mire species which includes *Betula nana, Calluna vulgaris, Carex limosa, C. magellanica, C. pauciflora, Drosera anglica, D. intermedia, Empetrum nigrum, Lepidotis inundata, Melampyrum pratense, Pinus mugo, Rhynchospora alba, Scheuchzeria palustris, Scirpus cespitosus, Vaccinium myrtillus, V. uliginosum,* and *V. vitis-idea* ?	Yes	4		
	No	13	(No bog area)	
4. Is the bog area wooded, reaching a cover ≥ 2 ?	Yes	5		
	No	9	(Area partly cleared)	
5. Is the cover of *Pinus mugo* ≥ 1 ?	Yes	6		
	No	7		
6. Is *Andromeda polifolia, Drosera rotundifolia* or *Vaccinium oxycoccos* present ?	Yes		*Pinus mugo* bog (Treed bog with *Pinus mugo*)	3
	No		*Pinus mugo* forest	7
7. Is the cover of *Betula pubescens* and/or *Picea abies* ≥ 1 ?	Yes		Wooded bog with birch and/or spruce	5
	No	8		
8. Does the vegetation differ from the above (often composed of patchy, small areas) ?	Yes		Bog vegetation mixed with other vegetation types	6
	No	1		
9. Is the total cover of *Carex rostrata* and/or *Carex lasiocarpa* ≥ 3 ? (*Potentilla palustris* and/or *Menyanthes trifoliata* are "companions" with the cover of *Sphagna* often ≥ 2)	Yes		Transitional bog vegetation/ Veg. of bog channels, laggs and seepage zones	4
	No	10		
10. Is the total cover of *Scheuchzeria palustris* and/or *Carex limosa* ≥ 1 (often with open water areas, partially forming floating mats) ?	Yes		Bog hollow vegetation	2
	No	11		
11. Is the cover of species which are representative for (dried) hummocks and/or heather mires (i.e. dwarf shrubs, *Scirpus cespitosus, Molinia caerulea*) ≥ 3 ? Are there patches of bare peat, often forming fine-structured erosion complexes ?	Yes		Treeless heath bog/ Bog hummock vegetation	1
	No	12		
12. Does the vegetation differ from the above (often forming a mosaic with fine structures or with larger erosion complexes) ?	Yes		Bog vegetation mixed with other vegetation types	6
	No	1		
13. If the area appears to form an essential component in the sustainable conservation of the bog site under consideration, it should be surveyed and labelled according to units 7–20 which are stored in the raised bog inventory for both the "non-raised bog" vegetation types and the land use types (e. g. forest, pastured forest, pasture, shrub, fen, open water, peat reclamation area, meadow, arable land, residential area, dump area, area of tall herbs, mixed vegetation on mineral soil, etc.).				

2.3.1 The Federal Inventory of Raised and Transitional Bogs of National Importance

> ***Primary bog – secondary bog***
>
> *These terms are usually used in other countries (e.g. the United Kingdom) to distinguish between an intact dome of peat and a secondary surface from which peat has been removed. However, with respect to the Swiss raised bog inventory the terms primary and secondary also refer to the state of the vegetation (near-natural or damaged).*

The raised bog inventory was commissioned by the Swiss League for Nature Conservation and WWF Switzerland, and was conducted by three scientists between 1978 and 1984 (GRÜNIG et al. 1986). Usually, only sites containing more than ca. 1,000 m^2 of typical raised bog vegetation were considered to be a potential site of national importance. A vegetation map at a scale of 1 : 25,000 was produced for each individual bog site. Black and white standard air photos by the Federal Office of Topography (scale approximately 1 : 25,000) were used for field work. The map key (cf. Tab. 2.3.1) distinguishes 6 bog vegetation units, each either intact (primary bog) or impaired (secondary bog), and 14 other vegetation types. In the field, both the bog habitat itself has been mapped, and its immediate surroundings which should also be protected. Additional evidence from field investigation and information from literature not accessible to numeric processing were noted in a report on each individual bog site.

Including the surroundings, a total area of 5,100 ha has been mapped and described. The inventory revealed that, in 1984, the remaining area of raised bogs regarded to be of national importance covered only 1,460 ha, or 0.035% of the country's surface. It is estimated that this is barely 15% of the original area, which must have been more than 10,000 ha. Most of the raised bogs have fallen victim to peat cutting, land improvement and agricultural extension, afforestation and construction.

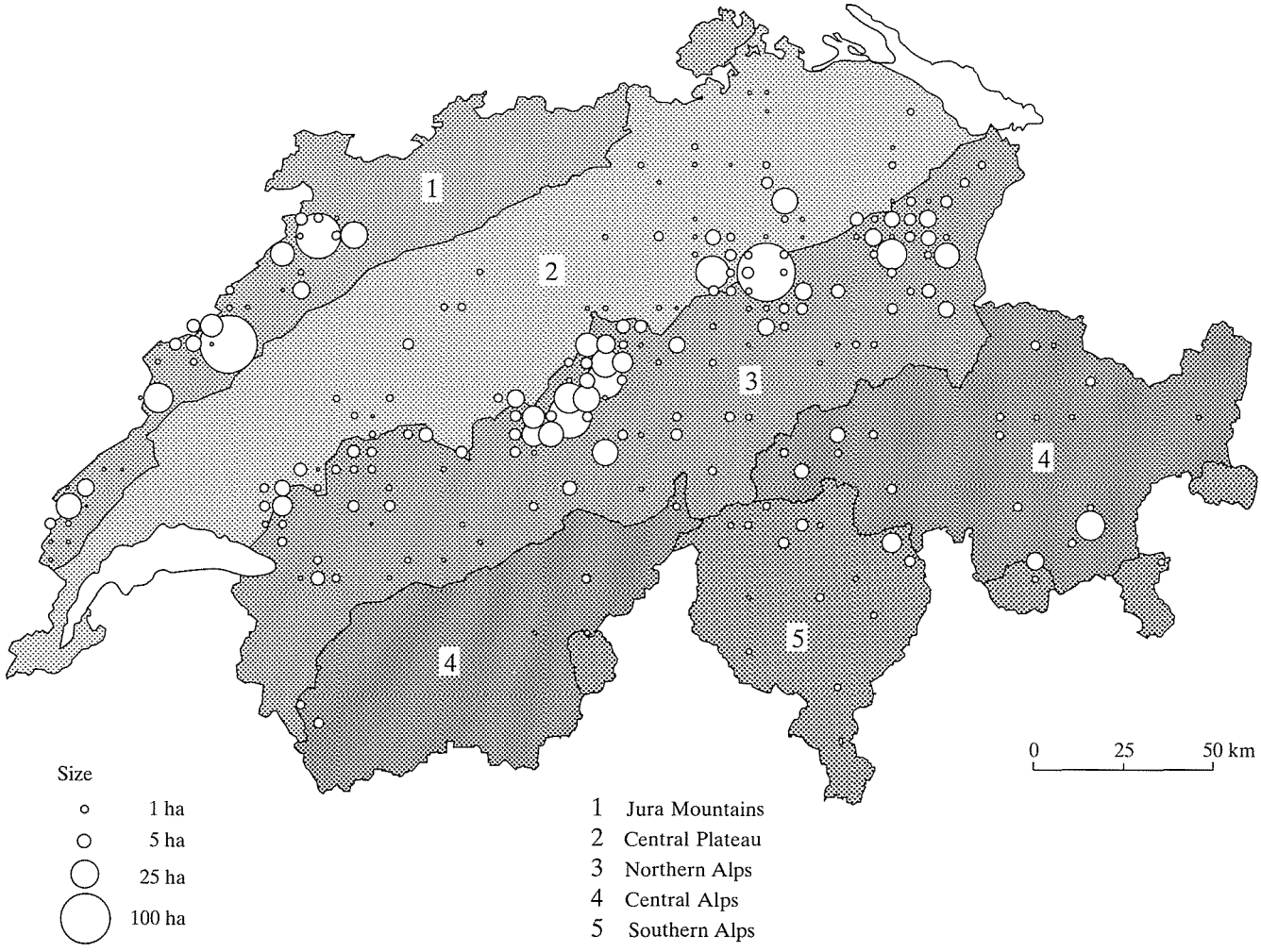

Fig. 2.3.1. Distribution and size of the Raised and Transitional Bogs of National Importance (modified from GRÜNIG et al. 1986).

The total area of the remaining sites with raised bog vegetation is distributed over 500 locations, unevenly scattered over the country (Fig. 2.3.1). With an average area of 3 ha, the individual bog sites are small and are mainly remnants from larger sites. There are only two sites which contain more than 100 ha of raised bog vegetation. More than half of all raised bog sites were concentrated in the Flysch region of the northern pre-Alps (cf. Fig. 2.3.2) where precipitation is high and the soil largely impermeable (cf. Figs. 1.5.6 and 1.3.15; Chapters 3.2, 3.4, 3.5). More than a quarter of the total raised bog surface of Switzerland is found in the calcareous Jura Mountains (cf. Fig. 2.3.1 and Chapters 3.7 to 3.10). In the Central Plateau most of the bogs have been destroyed by man. As a rule these remaining bogs are of no present economic importance.

The raised bog inventory also revealed that approximately 1,000 ha of the total surface area of 1,500 ha of this habitat, considered nationally important, are impaired by human activities such as peat cutting, drainage and overgrazing. The remaining one third of the area, only 500 ha, was considered to be more or less undisturbed and hence in a near-natural state. However, it was evident that continued land use pressure threatened the survival of even these remnants. The main threats were agricultural amelioration and intensification, peat cutting, housing, construction, and pollution. The protection of what has been left as raised bog sites was a matter of urgency and required national co-ordination of various measures.

The Federal Decree on Protection of Raised and Transitional Bogs of National Importance was finally enacted in 1991 by the Swiss Federal Council. With the exception of 5 smaller sites, it includes all 514 bogs of the scientific inventory listed as nationally important (cf. Chapter 6.4). This list is now an integral part of this decree along with the 514 bog maps at a scale of 1 : 25,000.

A more comprehensive presentation of the findings from the Swiss raised bog inventory is provided in the publication by GRÜNIG et al. (1986).

2.3.2 The inventory of the fenlands of national importance

The fenland inventory was commissioned by the Federal Office of Environment, Forests and Landscape to a private project management group. This group started work in 1986 with a preliminary survey to test methodological questions.The major findings of this preliminary project were:

1 to base the whole inventory mainly on vegetation criteria;
2 for reasons of consistency, to adapt the fenland map key to the three main geographical regions of Switzerland (Jura Mountains; Central Plateau; Alps, including the pre-Alps; cf. Fig. 1.1.1 and BROGGI 1990, appendix 2); and
3 not to survey fenlands which cover an area less than 1 ha because these sites would probably not have been rated nationally important.

Mapping was done in 1987 and in 1988. The fieldwork consisted of the following:

1 a survey of the fens according to a list of criteria;
2 a demarcation of the area on both the aerial photograph and the map (scale 1 : 25,000); and
3 a short site description.

Finally, the fenland area was surveyed on a sub-site level in more detail using special vegetation keys which distinguished the following wetland vegetation units (usually at the level of phytosociological alliances following BRAUN-BLANQUET; cf. Tab. 1.6.1; MUELLER-DOMBOIS and ELLENBERG 1974, p. 175): Phragmition, Magnocaricion, Scheuchzerietalia, Calthion and Filipendulion, Molinion, Caricion davallianae, Caricion nigrae, and eventually Oxycocco-Sphagnetea. For every sub-site, the total cover of each mire vegetation unit present in the area was estimated in increments of 10%.

In 1990, the criteria for rating sites of national or regional importance were evaluated and fixed (cf. Chapter 2.5.2.7), and corresponding site lists produced. That same year, the inventory was concluded. Creating the fenland inventory has engaged 50 people in total, 33 of them dealing with the field aspects.

This inventory revealed that 3,300 fen sites with a minimum area of 1 ha have been surveyed. They make up a total of 24,300 ha of fenland. Compared with the raised bog inventory, it is evident that more than 90% of the Swiss mire surface consists of fens.

Like the raised bogs, the fens are unevenly scattered over the country (Fig. 2.3.2). At present, they are found mainly on the Flysch soils in the north-alpine region, where more than half of all fens occur. Nearly 25% of the total fenland surface occurs in the north-eastern part of the Central Plateau and in western Switzerland. These fens are found along river-banks and lakes (e.g. Lake of Neuchâtel, cf. Chapter 3.6) resulting from the last glaciation (cf. Fig. 1.3.14). Fens are naturally less common in the central part of the Swiss Central Plateau (where there were no glaciers during the Ice Age), in the Southern Alps (cantons Valais and Ticino), and in the Jura Mountains. The latter is in contradiction to the findings of the raised bog survey (cf. Fig. 2.3.1).

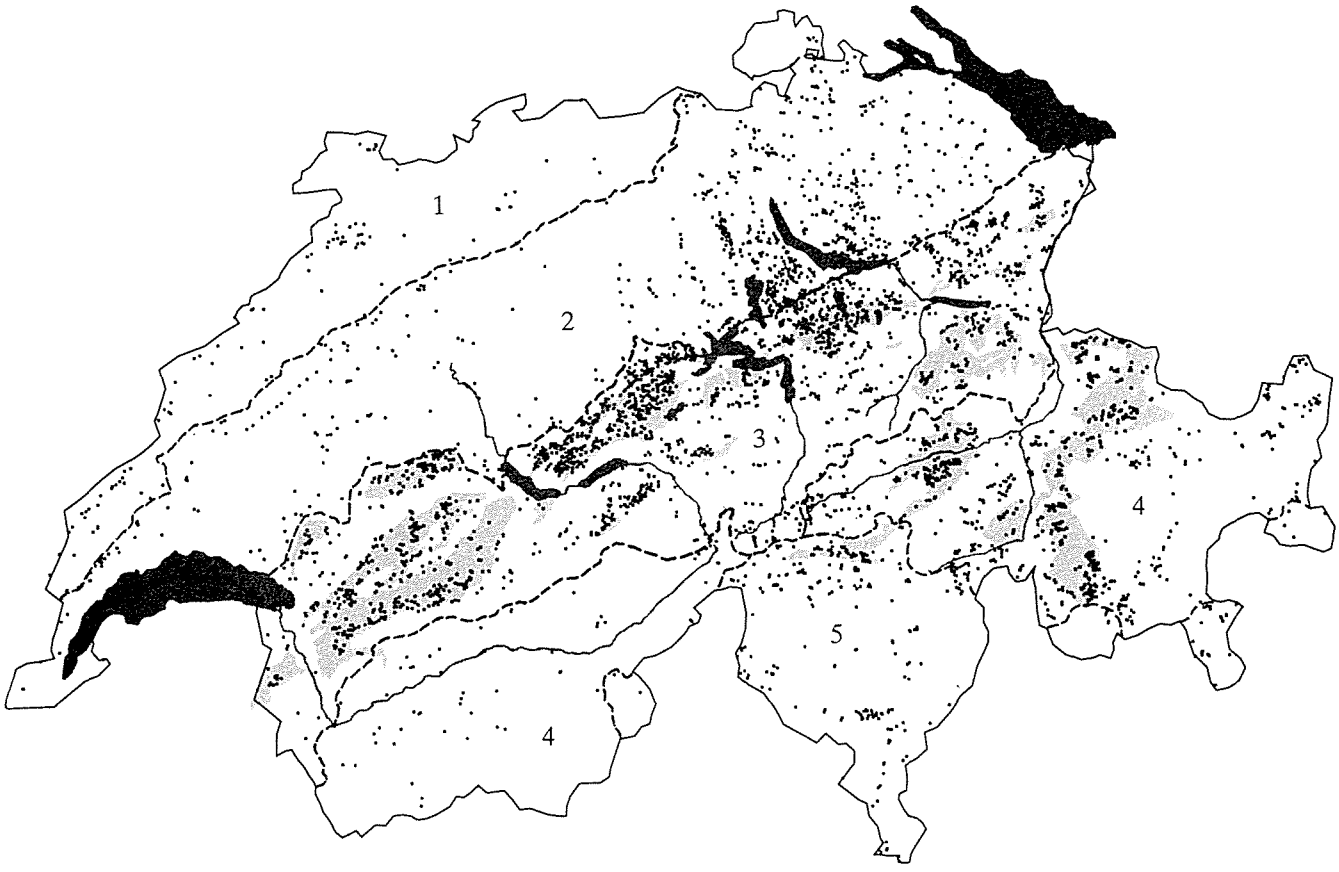

Fig. 2.3.2. Distribution of the fens of national and regional importance (modified from DFI 1990). Numbers: cf. Fig. 2.3.1 (modified from BROGGI 1990). Black dots = fen sites; black areas = lakes; gray shading = impermeable soils of the Flysch zone.

There are various types of fens reflecting the diversity of region, climate, geology, vegetation and of land use. The most common plant alliances of the Swiss fens belong to the base-rich Caricion davallianae and to the acidic Caricion fuscae (Figs. 2.3.3 and 2.3.4). More than one third, or 6,280 ha of the nationally important fenland area totalling 18,500 ha, belong to the Caricion davallianae alliance, stressing the influence of substrata upon the plant cover (cf. Fig. 1.3.15). The figure for Caricion fuscae is less than half or 3,060 ha. Nutrient-rich wetland alliances such as the Calthion and the Filipendulion (Fig. 2.3.5) occur all over the country but especially in the north-Alpine region, as a result of the increased use of fertilizers and continued drainage. They cover an area of 3,680 ha. The 500 ha of species-rich Molinion fen meadow which is the typical litter meadow alliance, are concentrated in the north-eastern part of the Central Plateau. In western Switzerland, almost all Molinion-bearing sites have been destroyed by drainage and land use pressure whereas in the central part of the Central Plateau this alliance is rare mainly because of natural influences (e.g. no glaciation).

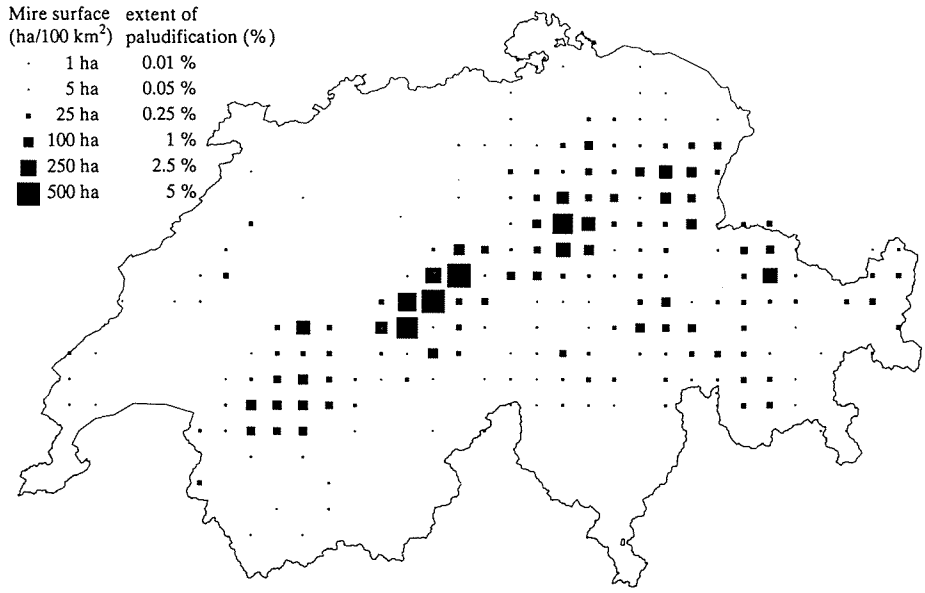

Fig. 2.3.3. Distribution of the Caricion davallianae alliance. The size of the squares is proportional to the surface of the fenlands (modified from Broggi 1990).

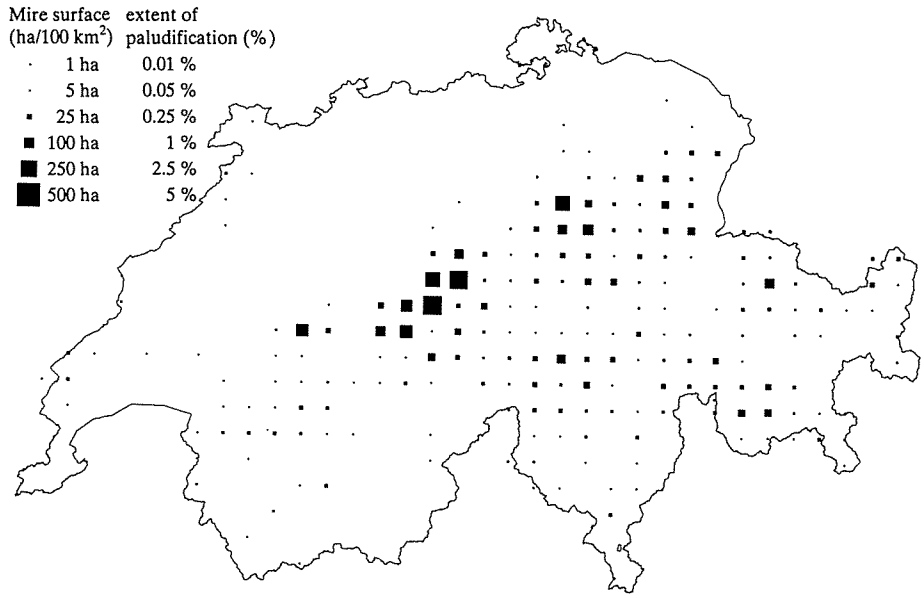

Fig. 2.3.4. Distribution of the Caricion fuscae alliance. The size of the squares is proportional to the surface of the fenlands (modified from Broggi 1990).

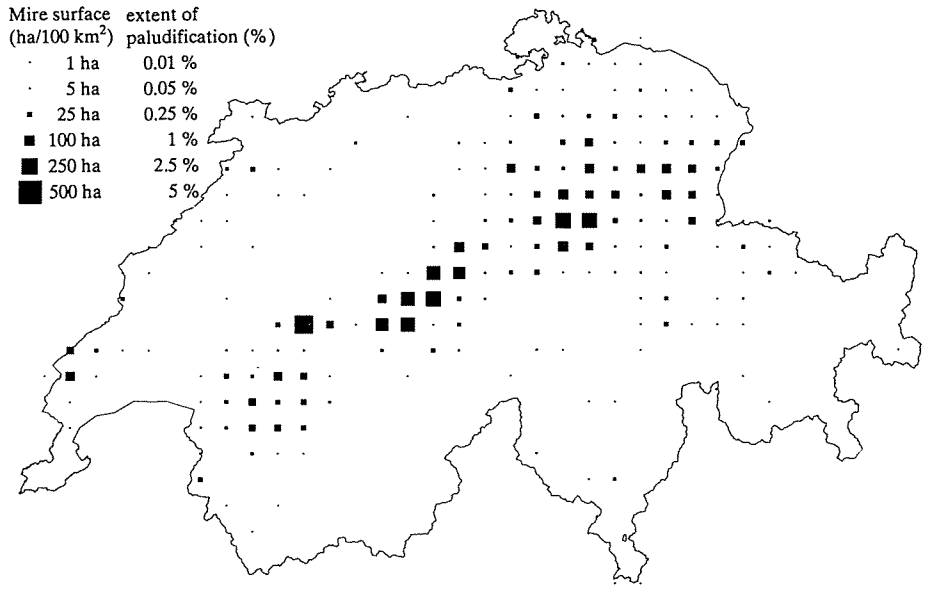

Fig. 2.3.5. Distribution of plant communities belonging either to the Calthion alliance or to the Filipendulion alliance. The size of the squares is proportional to the surface of the fenlands (modified from BROGGI 1990).

The list of the fenlands of national importance consists of 1,084 sites representing 18,500 ha. This is 32% of all surveyed fen sites greater than 1 ha. The average size is approximately 17 ha. The smallest fenland surveyed and rated to be of national importance is 1.2 ha, whereas the largest one extends to 213 ha.

With regard to agricultural management, about half of the fen sites considered to be nationally important are still exclusively used as traditional litter meadow with the grass cut once a year in autumn. A third of the sites are grazed completely, whereas another 253, mostly larger sites, are partly grazed and partly cut for litter. Overgrazing of fenlands is a problem especially in the Swiss pre-Alpine region. However, at almost half of the sites traditional land use has become irregular (cf. Chapter 2.5.2.6). The fallow areas are increasing. Hence on many sites, mire vegetation is being threatened by overgrowth of bushes, trees and woods. In summary, these results demonstrate that in regions where fens cover extensive areas of agricultural land, they either were, are, or could once again be of economic importance for local farmers.

Further information on the Swiss fenland inventory is provided in the publication by BROGGI (1990) and in Chapters 2.5.2.6 and 2.5.2.7 of this volume.

2.4 The inventory of the Swiss mire landscapes of particular beauty and national importance

Urs Hintermann

Article 24^{sexies} Paragraph 5 of the Federal Constitution aims at protecting not only particular mire habitats, i.e. bogs and fens, but also entire mire landscapes which must be regarded as protected areas when designated to be of particular beauty and national importance (cf. Chapter 6.1). This Paragraph 5 is very clear and rigorous in terms of protection and re-creation of the original conditions. However, interpretation is required of "undefined legal terms" such as mire, mire landscape, particular beauty, and national importance. Whereas the two inventories of the raised bogs and of the fenlands provide a clear idea about essence, number and distribution of the nationally important "mires" (cf. Chapter 2.3), it was a basic goal of this third mire inventory to find out how to identify mire landscapes and what they must look like to qualify for national importance and particular beauty.