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FIRST EXPERIENCE WITH CONSERVATION OF SOUTHERN EUROPEAN BRYOPHYTE SITES

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SUMMARY—Two examples are presented. Conservation of the habitat for rare xero-thermophilous bryophytes in a site of particular interest in south-western Switzerland (Follatères, Valais) requires maintaining the old, mainly man-made mosaic of steppe meadows and *Quercus pubescens* forest by traditional methods such as goat grazing. Management proposals could not yet be effectively applied. For the second example, the only station of the Lejeuneaceous liverwort *Marchesinia mackaii* in Mediterranean France, near Nice, has already been partly destroyed and the remnant, impoverished populations are highly endangered. Transplants to apparently similar habitats could not survive more than four years.

KEYWORDS: Conservation, site conservation, transplants, Switzerland, *Marchesinia mackaii*, France

RÉSUMÉ—Premières expériences de conservation de bryophytes en Europe méridionale

Le premier des deux exemples présente un site xéro-thermophile unique dans le Sud-Ouest de la Suisse (Follatères, Valais). Cet habitat d'espèces rares de steppes et à répartition méditerranéenne ne peut être conservé que par des méthodes traditionnelles, comme le pâturage caprin, qui préserve la mosaïque anthropogène de pelouses steppiques et de chênaie pubescente. Les mesures de protection proposées n'ont pas encore pu être appliquées. Le deuxième exemple concerne la station unique de *Marchesinia mackaii* en France méditerranéenne près de Nice. Elle a déjà été partiellement détruite et les populations restantes, appauvries, sont très menacées. Les transplants effectués dans des stations apparemment comparables n'ont pas survécu plus de quatre ans.

1. Background

Nature conservation philosophy was developed more than hundred years ago as a reaction to the increasing impact of industry and social development. The original ideas focused on integral preservation of ecosystems, preferentially excluding human influence, and led to the creation of National Parks, such as the Yellowstone Park in the Rocky Mountains in 1872, or the Swiss National Park in the south-eastern Swiss Alps in 1914. In densely populated regions like Europe it was soon clear that the assumption of rapid re-establishment of a natural equilibrium was illusive. Management programmes had to be developed, some for conservation of particular habitats, others conceived as species protection programmes, initially for popular and easily-recognized organisms like mammals, birds and flowering plants. Only recently, mushroom collecting has been restricted in some regions. Occupying particular niches corresponding to their ability to thrive under extreme conditions, bryophytes have too often been considered as insignificant constituents within the framework of otherwise more or less homogeneous vegetation. Bryophyte conservation is a new field with respect to its scientific as well as to its legal basis.

The role of scientists is to develop a thorough scientific base. Species are considered vulnerable or endangered when a decline in their distribution area or a significant decrease in their populations are observed. This demands reliable information on earlier occurrences for comparison. This is the only way to distinguish them from rare species with a naturally small distribution area, where they might have survived for a long time. For those, the risk of becoming «endangered» with any modification of habitat is of course greater than for species with a wider range. Chorological investigations are often hampered by the inaccessibility of the niches. Knowledge of actual and past distribution and of taxonomic delimitations are tools for the establishment of conservation programmes and Red Lists.

However, hypotheses are needed to explain the regression - or invasion - of species. In some cases, these may refer to simple ecological factors but in most cases we need results of observations in population biology, which unfortunately do not exist for many, particularly threatened,

bryophytes. Natural dynamics, e.g., in temporary habitats or with respect to natural succession stages, are important elements in the assessment of habitat changes. These processes should therefore be included in conservation programmes.

Another task for scientists, often omitted, consists of the production of educational material. Especially with respect to bryophyte conservation, we are not always prepared to defend biotope conservation in the presence of political or scientific authorities, or the resident and farming population. On the one hand, it could be argued that any human impact should be prohibited in a concept of self-assignment of nature, while on the other hand, our « natural » environment in Europe, at least in central and southern Europe, is a cultural landscape formed by human activities since neolithic time, which resulted in the creation of a high diversity of biotopes. Conservation of this diversity is therefore only possible with continuous but adequate and appropriate interventions.

2. Case studies

2.1. Les Follatères (Valais, Switzerland) – site conservation

Situated near Martigny in a dry inner alpine valley this region has been known to botanists at least since the publication of Gams (1927). It is now included in the 'Federal Inventory of the Landscapes and Natural Monuments of national importance' (IFP). Although set up by the Federal Office of Environment, Forests and Landscape (OFEFP), the citation in this inventory is not automatically followed by protection measures.

The region extends from the Rhone plain at 450 m a.s.l. where the regularly-flooded swamps have already disappeared since river correction at the beginning of this century, together with the second Swiss station of *Riella notarisii* (Mont.) Mont., to the zone of subalpine coniferous forest with spruce, fir and pine communities. Loess accumulation over siliceous bedrock explains the presence of basiphilous species. The most interesting part for bryologists is now the mosaic of steppe vegetation in the *Quercus pubescens* belt (for description of the vegetation see Delarze (1988) and Delarze & Werner (1988)). The bryophyte inventory was made by Geissler & al. (1994). 35 hepaticas and 175 mosses were found within the limits of the proposed reserve. The catalogue is certainly not exhaustive for the upper parts of the area nor for annual species. 38 taxa figure also in the Red List of Swiss Bryophytes (Urmi & al. 1992).

The bryophyte layer of these steppe communities is dominated by an extraordinary diversity of thalloid liverworts as well as of members of the families Pottiaceae and Grimmiaceae. Naturally, these biotopes would be entirely covered, with the exception of exposed rocks, by a low forest of *Quercus pubescens* Willd. However, this region has been under the influence of man for several thousand years with cattle grazing on the upper parts and vine growing on the lower parts of the slope. This has resulted in the creation of small niches that have allowed the establishment of species with a distribution centred in mediterranean and steppe regions. Two species of *Riccia*, *R. michelii* Raddi and *R. trichocarpa* Howe, have been found new to Switzerland during this work. Other taxa, like *Riccia nigrella* DC., *Oxymitra incrassata* (Brotero) Sérgio & Sim-Sim or *Targionia hypophylla* L. are known elsewhere in Switzerland only from the canton of Ticino.

From the above mentioned facts it becomes clear that from a national viewpoint at least conservation of this site is needed. Although most bryophytes of the Follatères are not endangered in Europe, a few species like *Asterella saccata* (Wahlenb.) Evans are proposed as « vulnerable » in the European Red List (ECCB, in press).

The following threats were observed. The traditional land-use of the steppe-forest mosaic was abandoned in the second half of this century. Tall grasses and bushes (mainly *Prunus spinosa* L.) have begun to encroach upon the open steppes through natural recolonization, threatening their survival (Delarze & Werner 1988). The small patches of earth-covered rocks within the vineyards are seriously suffering from the chemical treatment of the grapes, nowadays applied by helicopter. A third, less important risk is development of tourism.

The constitution of the Swiss Confederation (Art. 24 sexies) assigns application of nature protection to the cantons. Three federal legislations may be used: The federal law relating to the protection of nature and natural heritage, the federal law relating to physical planning (land-use) and the federal law relating to the promotion of agriculture and maintenance of farmers (a new article allows direct payment of ecological balance areas). In none of these bryophytes are explicitly mentioned (except for *Sphagnum*, treated as an ecological indicator), but some bryophyte-rich habitats like bogs and fens are included.

For the site of the Follatères, the creation of a nature reserve to protect this particular biotope is needed. Objectives and management plans for conservation (Delarze & al. 1991, Werner & al. 1992) have been developed by a working group appointed by the Federal Office of Environment, Forests and Landscape. With respect to bryophytes, several possibilities for restricting the invasion of trees may be considered. The most common practice in nature conservancy is mechanical mowing and wood-cutting. Gams (1927) complained of overgrazing by goats. Reintroduction of controlled grazing by goats could be an appropriate and more traditional means of management, but today it is difficult to find goats and experienced goatherds in the surrounding villages. Without any intervention, this remarkable area will soon be completely recovered with *Quercus pubescens*. Furthermore, the use of pesticides has to be controlled in the sensitive parts of the vineyards. During a recent visit to the site, we noted that a hidden trail, formerly only known to naturalists, has now been «improved» for hiking, thus destroying large areas of *Riccia* communities, which normally are not sensitive to trampling. Provision of all parties concerned with information is also an extremely important means to convince them of the need of nature conservation.

The 'Species conservation plan for Swiss bryophytes' (Urmi & al., in press) mentions five populations from this site. Besides the two extinct species *Riella notarisii* (Mont.) Mont. and *Sphaerocarpus texanus* Aust. (Urmi & al. 1992, Geissler & al. 1994), *Riccia trichocarpa* Howe, *Acaulon muticum* (Hedw.) C. Müll., and *Aloina brevirostris* (Hook. & Grev.) Kindb. were selected to be dealt with in detail. These documentation sheets present similar conservation recommendations as the ones proposed above.

The report (Werner & al. 1992) was transmitted to the cantonal nature conservancy office upon completion. A meeting with municipal, cantonal and federal authorities, scientific collaborators, and the Swiss League for Nature Protection has been planned since then, but has not yet taken place. Management plans have to be discussed with the different landowners, not at all an easy task with private owners, particularly viticulturists. Fewer problems will arise with publicly-owned ground. The forest belongs to the municipality and bourgeoisie of Fully. The core part of the *Quercus pubescens* forest is leased to the Institute of Silviculture of the Swiss Federal Institute of Technology, Zürich (ETHZ), as a test site within their research programme on various types of natural forests (Wendelberger 1979). The exposed rocky escarpment at the south-western end of the Follatères is property of the confederation and, as a military fortification, is inaccessible.

Effective introduction of conservation measures now depends on political decisions. In the meantime, monitoring of bryophyte populations will be continued. For that purpose, permanent plots have been established at particularly sensitive spots.

2.2. *Marchesinia mackaii* (Hook.) S. Gray in the Alpes-Maritimes near Nice (France) — species conservation

Along the left bank of the river Var north of Nice a network of narrow valleys and gullies are cut in the plioquaternary conglomerate zone at the foot-hills of the calcareous Alpes-Maritimes. The climate of the interior of these valleys is characterized by constantly high humidity, low temperature variation and reduced luminosity. The vegetation of the bottom of these « vallons obscurs » has been analyzed over a length of about 130 km by Salanon & Gandioli (1991). The constituents are orophilous or subatlantic-submediterranean elements, in contrast to the typical eu-mediterranean vegetation on top of the hills. The only French Mediterranean station of *Marchesinia mackaii* was discovered by N. Orzeszko in 1894 (Camus 1901) in the lower

part of the Vallon des Serres near Lingostière. It has not been found in any other part of these extended narrow valleys. The growth conditions are described in Salanon & al. (1990). One might imagine that the ecological requirements are so complex (absence of high or low temperature, freezing, drought, running water, high light intensity) and extreme, that this is the only place where they occur together. Plenty of healthy, fertile populations of this species could be observed over a length of about 100 m.

On the European level, *Marchesinia mackaii* is not an endangered species (see distribution map in Salanon & al. 1990). However, in mediterranean regions it is a rare species restricted to a few special stations that have the particular growth conditions described above. The closest occurrence are two places near Genova in Italy, where the climate is known for its high precipitation. All potential stands were explored along the French Mediterranean coast, but not yet so in Liguria.

The lower part of the Vallon des Serres belongs to a cement plant. In 1986 the entrance of the valley, the last 40 m, was destroyed, and with it about a third of the then-present populations. Furthermore, an engineering enterprise obtained the rights to extract materials from the quarry. The situation in 1994 is quite alarming. The bottom of the valley is warped with sediments and stuck with tree trunks thus rendering the flow of water after heavy rainfalls difficult and increasing the risk of drowning the *Marchesinia* populations. Clearing the forest on the slopes of the upper part of the valley is probably responsible for the disappearance of the up-valley populations. Some few spots at the junction of the two sections are still present, the epiphytic populations in a better state than the epilithic ones, but less frequently fertile than before 1986. Complete destruction of all *Marchesinia* populations might be imminent.

This is clearly a case for an « arrêté préfectoral de protection de biotope », which, in France, can be applied upon request of the municipal authorities delivered by the prefect, chief administrator of the department, here Alpes-Maritimes. Six valleys in the northern zone have already been protected by such measures. However, the Vallon des Serres is still part of the suburban zone of the city of Nice. The municipality is therefore not interested in any restriction of urban development. Legally, protection is perfectly possible because *Carex grioletii* Roemer, one of the species present in the list (without bryophytes) of the Nature Protection law of 1982, grows at the bottom of the *Marchesinia* stands.

In such a desperate situation, the botanists of Nice, R. Salanon and J.-F. Gaudioli, tried to transplant still healthy populations of *Marchesinia* in 1987. With their thorough knowledge of the ecology of these valleys, they chose the most similar habitats they could find. Fifteen populations on shingle or bark from freshly destroyed biotopes were fixed on two places in the Vallon du Magnan as well as in the upper part of the Vallon des Serres as a control. Half of them were still living in 1990, some even growing, but by 1994 all were dead. This is a further indication of the importance of studying the ecological requirements of a threatened species in a marginal part of its range.

3. Concluding remarks

Hopefully, these two examples are not representative for the situation in Europe. For the Follatères it is still quite possible to apply effective conservation measures, if the authorities act rapidly. At the moment, the economic situation does not favour extension of vineyards but on the other hand, financing nature protection management and application of measures has become more difficult in Switzerland.

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