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Artikel: Phenological methods in permanent plot research : the indicator value of phenological phenomena : a study in limestone grassland in Northern Switzerland = Phänologische Methoden bei Dauerquadratuntersuchungen : der prognostische Wert phänologischer Phänomene : eine Untersuchung in Halbtrockenrasen (Mesobrometum) in der Nordschweiz

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Kapitel: 1: Introduction

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1. Introduction

Changes in plant communities due to successional development or alterations in the management can be studied by short-term research, communities representing various stages of succession or different management forms being compared; alternatively, a long-term programme dealing with permanent plots can be established. Either of these approaches has its disadvantages: the predictive value of short-term investigations is not always infallible , whereas long-range studies are time-consuming and highly influenced by weather conditions.

Additional information thus being required to predict the future of the vegetation within a given site preferably after only a few years, phenological data seems to be helpful. Modifications of the physical environment due to a successional development or alterations in management may render the site favourable for some species yet disadvantageous for others. In earlier stages of succession, species not adapted to the new conditions most frequently show reduced vegetative vigour, blooming and fruiting (HARPER and OGDEN 1970, HARPER 1977) but they still persist, actual changes in the composition of the vegetation only later being observed. Phenological data is thus expected to reflect environmental changes earlier than the traditional relevés which are used in phytosociology (e.g. those of the Braun-Blanquet type).

Without doubt, man has always payed attention to the phenology of some particularly important species. However, symphenological records comprising the phenology of all or most species within a given plant community date back solely to the beginning of the present century (SALISBURY 1916, 1918, GAMS 1918, ALECHIN 1925, SCHENNIKOW 1927, 1932). Since then, phenological development of whole communities and their individual components has been described by numerous authors both verbally (e.g. BECKER 1941, WALTER 1968, BYKOW 1974) as well as diagrammatically (e.g. ELLENBERG 1939, FÜLLEKRUG 1967, 1969, BALÁTOWÁ-TULÁČKOWÁ 1970b, 1971, DIERSCHKE 1972, 1974, 1977, FALIŃSKA 1972, 1973a, b, 1975, 1976, KRÜSI 1977, 1980). Various ways of recording and presenting phenological data were reviewed by BALÁTOWÁ-TULÁČKOWÁ (1970b) and DIERSCHKE (1972, 1977). The bibliography of symphenological diagrams was compiled by

BALÁTOWÁ-TULÁCKOWÁ (1970a) and later by TüXEN and WOJTERSKA (1977).

It should be noted, however, that phenology is obviously not restricted to merely describing the developmental rhythm of plants or plant communities, but represents an important auxiliary science in various research fields, viz. climatology (e.g. SCHNELLE 1955, ELLENBERG 1956a, SCHREIBER 1968, 1977, HEGG 1967, 1977, LIETH 1974), taxonomy (e.g. MARCET 1956, FALIŃSKA 1974, 1978) or ecosystem analysis (e.g. ELLENBERG 1956b, FALIŃSKA 1978). As far as vegetation science is concerned, phenological observations are useful in delineating phytosociological units (e.g. ZOLLER 1954, HEJNÝ 1978) or revealing some developmental trends (e.g. WELLS 1971). The latter possibility is well known amongst students of vegetation. According to BRAUN-BLANQUET (1964), the direction of development of communities is often first heralded by changes in vigour of particular species. RABOTNOV (1969) considered the decrease in vigour of mature plants and not the actual changes in the number of individuals of a given species as an infallible indicator of its deteriorating life conditions. This aspect has also been emphasized by other authors (e.g. BOTTLÍKOVÁ 1973, FALIŃSKA 1975).

Save for the Russian school (see HARPER and WHITE 1974 as well as GATSUK et al . 1980 for a bibliography), little work has hitherto been undertaken using phenological information to predict developmental trends in plant communities, one of the rare exceptions being the investigation of WELLS (1971). A study was therefore undertaken to examine the possible indicative value of short-term and mid-term phenological observations carried out in limestone grassland ecosystems in northern Switzerland. On one hand, phenological responses of some species towards environmental changes were studied, and on the other hand, phenological behaviour of whole communities was observed in this respect. The present paper deals with the first results obtained in the course of these investigations.

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2. Description of the study areas

The four study areas are localized in northern Switzerland, within the Jurassic mountains belonging to the community of Merishausen 7.5 km NNW of Schaffhausen (National Grid Reference 688 500 / 291 000, Fig. 1). The substratum consists of Upper Jurassic limestone. The soils are of a mull-like rendzina type; the content of calcium carbonate within the uppermost 5 cm of soil ranging from 29 to 60 per cent, the corresponding pH values vary from 7.6 to 8.0. Climatic conditions are diagrammatically presented in Fig. 2.

The vegetation within all study areas corresponds to grassland of the *Mesobrometum* type. In the region of Schaffhausen this meadow type is usually cut once a year in mid June and very rarely or not at all fertilized. Prior to experimental management, two study areas had been used for hay-making (study areas 1 and 2), two others having been abandoned for ten and twenty years, respectively (study areas 3 and 4). One of the areas used until experimental management was started was drier and poorer in nutrients (study area 1) than the other (study area 2).

The phytosociological classification of the study areas offers some problems as far as nomenclature is concerned. According to ZOLLER (1954), who studied the dry grasslands in this region, our study area 1 should be considered as a *Medicago falcatae-Mesobrometum*, whereas study area 2 should correspond to a *Dauco-Salvio-Mesobrometum*; the study areas 3 and 4 abandoned for ten and 20 years respectively would represent the *Seselio libanotidis-Mesobrometum*.