River plants of Western Europe

The macrophytic vegetation of watercourses of the European Economic Community

RIVER PLANTS

OF WESTERN EUROPE

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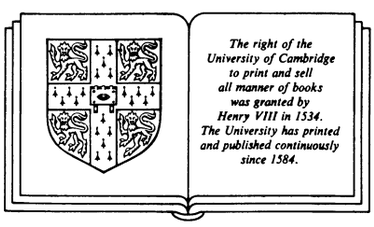

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Dedicated to those who have developed the study of aquatic macrophyte ecology in Britain:

D. F. Westlake (rivers, production, physiology)
D. H. N. Spence (lakes, physiology)
T. O. Robson (management, control)
B. A. Whitton (river distributions)

and the pioneers:
R. W. Butcher (rivers)
W. H. Pearsall (lakes)

on whose work the rest of us have built

Contents

Preface

This book describes and discusses, from various aspects, the vegetation of rivers and other watercourses in the countries of the European Economic Community (EEC). It is hoped that it thereby fills a gap in the general knowledge about the vegetation of flowing water, the vegetation of lakes and other standing water having been studied more. The book covers extensive and comparative aspects of vegetation rather than the intensive aspects so amply covered by other workers (particularly in Britain, Germany, The Netherlands). Distributional, community and historical ecology are stressed rather than physiological and productivity studies.

The sites recorded in each country (including e.g. empty channels and summer-dry source streams) number: Belgium, 750; Britain, 15000 (including some 3000 replicates); Denmark, 780; France, 4650; Germany, 2150; Ireland (Eire plus Northern Ireland), 1100; Italy, 1700; Luxembourg, 150; Netherlands, 1000. Greece joined the EEC only during the project and was not included, but *c.* 400 sites from South Norway were recorded and used for comparative studies. There is usually a recorded site 0–25 km from any named place in Belgium, Britain, Denmark, Ireland, Luxembourg and The Netherlands, and 0–50 km from such a place in France, Germany and Italy (excluding the Alps and Appenines, both of which mountain chains were under-recorded).

The main purpose of the book is to increase the understanding of river vegetation with respect of physiographic and associated variables. Physiography is even more important for vegetation in watercourses than on the land, because of the inherently different, and controlling character of the flowing-water habitat.

Submerged and floating macrophytes are always termed aquatic. However, the demarcation line between emerged aquatics and terrestrial plants extending to the water varies with the purpose of the investigation. This book is concerned with the angiosperms of the channel, and to a minor extent with the mosses and larger algae. This follows the selection used by e.g. Butcher (1927, 1933) and Kohler (e.g. 1978, 1981). Holmes (e.g. 1980) and de Lange and van Zon (e.g. 1983) include species growing higher up the bank, as is necessary when working intensively on the full river community. However, when work is concentrated on the vegetation that is directly affected by conditions within the river itself, the more contracted habitat used in this book is relevant. Pollution, for instance, acts through the soil as well as the water, and can affect only soil which has polluted water above it for much of the time, and on which polluted silt can be deposited. Plants rooted higher up the bank are affected through the water alone, and this polluted water may only affect the base of emergents, and may indeed affect them for only part of the time. The same applies to any nutrient or other chemical which is found in greater abundance in the water or unconsolidated silt than in the more stable parts of the substrate and subsoil. Wash-out from storm flows also has less effect on vegetation that is higher up a bank. In, for instance, British clay streams, Fringing herbs in the larger rivers are more frequent above than at the summer normal water-line. The plants do not anchor well in the latter habitat and are more subject to wash-out.

Most of the surveys outside Britain were carried out in 1977–80, and most of those within Britain in 1969–80. At each site, the species of macrophytes present were recorded, together with their relative abundance and cover. Mosses were recorded to the order, Characeae to the family and *Enteromorpha* to the genus. Trailing (filamentous) algae were recorded to the group, and termed Blanket weed. This consists mainly of *Cladophora* sp. but other genera may be present, particularly in dykes and canals (e.g. *Spirogyra*, *Vaucheria*). The abundance of each species or aggregate was recorded on a five-point scale (dominant, abundant, frequent, occasional and local). This was converted to a two-point scale for most analyses: during the period of maximum growth a species usually remains plentiful or remains sparse, though it may vary between e.g. occasional and local. The total percentage cover of vegetation across the shallower (up to *c.* 1 m deep) parts of the channel under consideration was noted. In channels of greater depth or containing turbid water, the vegetation within the bands at each side was recorded. In addition to the location, rock type, landscape type, channel size, and substrate of the habitat, the depth, flow and clarity of the water were also recorded, together with any other relevant variables such as recent dredging or trampling.

The survey method used was that described by Haslam & Wolseley (1981), records being taken from bridges and other point sites. The vegetation of most watercourses passed over was recorded, outside major

towns, giving a reasonable sample from the areas covered. Spot samples are usually representative for extensive work, though more continuous surveys are required for intensive studies (see e.g. G. Bouxin (personal communication) for sample sizes). Site species lists recorded from bridges are consistent from one bridge to the next, one bridge being like another. The lists may slightly over-record tall emergents, and if short brown or dark species are present in deep or turbid water, these will be under-recorded. This is a constant factor, present throughout the analysis. Small bridges rarely affect the river except for a few metres downstream of a pipe, concrete layer, etc., and these few metres are ignored. If e.g. turbulence is caused by piers on large bridges, this also can be seen and disregarded for the analysis (unless records are wanted in fast and slow flows of the same water quality etc.). Occasionally, bridges are sited where there are special landscape features (e.g. for large rivers, on firmer ground for support). Even more infrequently, bridges can be associated with special man-made features, e.g. paved fords. In such rare instances where river vegetation is affected by bridge position, this can usually be seen, and the appropriate corrections can be made. Weirs may be sited by, or away from, bridges. Their effects are independent of those of bridges. A vertical view of the whole width of a river can be obtained from a bridge, enabling in most cases easy and full identification of the species in a short length of the river (supplementary wading may sometimes be needed). All the records were taken by one team, and mostly by one observer (except where other work is specifically referred to) so minimising errors due to inconsistent recording.

Advice on generally acceptable methods of numerical analysis was sought from Mr M. O. Hill. In view of the extremely large amount of data and numbers of variables, a simple analysis of probability under null hypotheses derived from χ^2 was used. The figures were obtained by computer analysis of the data and included two-, three- and four-tailed analysis. As only sites containing macrophytes were used in the χ^2 calculations, all correlations refer to records in sites without total damage. The effects of extreme damage have not been separately analysed.

Replicate surveys have been mainly confined to Britain, and the relevant chapters (Chapters 11 and 28) describe this work. However, the records for the few other sites surveyed more than once during the course of the non-British surveys and those for four German rivers described by Kohler (e.g. 1982), show the same alterations and trends, and these can therefore be presumed to occur more widely. Otherwise the discussions and conclusions are based on evidence from several countries although the balance between the amount of British and non-British work presented does vary. Much of the work done by the author in Britain has already been published (Haslam, 1978a; Haslam & Wolseley, 1981; Haslam, 1982c) and, except where necessary to the argument, it is not repeated here.

This book has been written for river botanists, but it is hoped that river geographers, other river specialists and all those with a general interest in rivers may find something to interest them in this description of a fascinating habitat.

The nomenclature follows that of Haslam, Sinker & Wolseley (1982) except for the use of *Scirpus* (i.e. not *Schoenoplectus*) *lacustris*. The various methodologies, classifications, etc. described in this book which are not cited as the work of other scientists have been devised by the author, and do not necessarily reflect the views of other British botanists.

Extra surveys in six countries in 1984 indicated no community differences from the earlier surveys whose analysis is here described.

All maps are approximate.

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Mrs P. A. Wolseley has contributed Chapter 2, much of Chapters 4 and 5 and some other sections in addition to drawing most of the 'picture illustrations'. Mrs Y. Bower drew the maps, river maps and equivalent illustrations, and Miss J. Hulyer drew the graphs etc. Miss H. Howcroft collected many data on river discharges etc. Mr J. Horsely-Denton supplied the information on the history and distribution of canals in Chapter 26. Mrs Y. Bower carried out the χ^2 analyses. Miss A. Chapman prepared the original rock type maps for continental Europe and Ireland. In addition, Mrs Y. Bower and Mrs P. A. Wolseley carefully reviewed the whole typescript.

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November 1983 S.M.H.

Fig. 1.1. Map of the EEC showing countries and principal towns.