
Introduction

Man is placed in the middle between two infinities – the infinitely great and the infinitely small – both of which are incomprehensible to him.

Edinburgh Encyclopaedia

This is a book about mosses and liverworts, collectively known as bryophytes, a term derived from ancient Greek and first used around 1878. Britain is currently home to 1,044 species, comprising 752 mosses and 292 liverworts (1,048 if the four British hornworts are included). They are small, relatively simple plants that live on the land (although some have returned to freshwater), and depend upon water for fertilization. They are the earliest known land plants and were thriving on the ancient landmasses of Pangaea and Gondwana-land millions of years before flowering plants made their entrance onto the world's evolutionary stage. As a result of their small stature, they have been able to exploit a diverse range of niches of which many are unavailable to so-called higher or flowering plants. They are supremely adapted to life on earth, not least because of their ability to remain alive for long periods of time without water and yet rapidly recover when wetted with rain or dew.

In England, there are 666 mosses and 252 liverwort species (excluding four hornworts). Some 87 (9%) are on the revised Red List of British bryophytes, a system that estimates the extinction probability if nothing is done to change the situation. A total of 84 species of English threatened bryophytes is profiled in this book, and a further three species have not been seen in England for more than 50 years. But this is not a Red Data Book *per se*. Instead, the emphasis is on understanding rarity, what causes it and the implications for conservation. Rarity is a complex notion, yet we think we know what it means and use the term in everyday conversation. Many bryophytes are naturally rare and flourish, but many more have had rarity thrust upon them by human activities. If conservation can reasonably avert the extinction of a bryophyte, and the understanding gained thus helps safeguard other populations, then morally it is right that we do so. The key to preventing a plant sliding inexorably towards possible extinction is an awareness of what leads to a species becoming rare in the first place. This book brings together the relevant literature to understand what 'rare' means in the context of mosses and liverworts. In doing so the intention is not to elevate the importance of the rare at the expense of the common. Arguably the common species are more important in the wider picture; paradoxically a common species may be more threatened if it occupies an environment that is decreasing or if it has a life-history that depends on the maintenance of large or numerous populations. Bryophyte conservation and recording is not just about the plants; it is about people too, past and present, who have done so much to propel England (and Britain) into the position of one of the best bryologically known countries in the world. Their contributions are acknowledged throughout the book.

England is one of the mostly densely populated countries in Europe, with 395 people per square kilometre, constituting 84% of the total United Kingdom population. The most densely populated areas of England are the major cities and metropolitan areas of London and the South East, South and West Yorkshire, Greater Manchester and Merseyside, the West Midlands and the conurbations

It could be argued that many bryophytes were lost from these areas long ago, and that now the battleground has shifted to areas of the country that have been spared the ravages of the Industrial Age such as the south-west of England (although tin mining had a long and

productive history here and has given rise to important bryophyte habitats) and ostensibly protected areas, for instance the New Forest in Hampshire.

Wales and Scotland (for the latter see Rothero, 2005) also have a fair measure of threatened bryophytes but many of their rare and interesting species occur in more remote and relatively undisturbed habitats; there is greater pressure on lowland habitats and species further south in Britain. No part of Britain is, however, free from the pervasive effects of pollution, nutrient enrichment and climate change. Species action is often funded under UK or European initiatives, and then is normally implemented at the national level. The statutory conservation agency Natural England (*NE*) is the body tasked with ensuring that biodiversity, including bryophytes, is not eroded in England.

Bryophytes are no respecters of national frontiers. In a phytogeographical context England is part of the British Isles and the wider Atlantic Biogeographic Region which encompasses the UK, Ireland, and the western parts of Denmark, Germany, The Netherlands, northern Belgium, north-west France, the northern shores of Spain and a small area in the north of Portugal. This is a key concept in the EC Habitats Directive, a powerful European Union (EU) instrument, where sites for the protection of habitats listed at Annex I and species listed at Annex II of the Directive are selected in the context of such Regions. Site protection and habitat conservation are vital, if not the most effective mechanism available, to maintain and increase populations of bryophytes. This topic is covered in the section on 'Conservation measures' (*page 19*). The 'listing' of species and habitats is seen by some as an activity that is interminable, sometimes excessive and to the more cynical to keep bureaucrats in a job, but it is genuinely fundamental to any conservation programme. It provides not only an inventory of what species occur in any geographical area but guides the allocation of scarce conservation resources. Furthermore, lists are used extensively in enforcement and legislation, themes also covered in the section on 'Conservation measures' (*page 19*).

The species profiled in this book are English bryophytes drawn from the revised Red List of British bryophytes (Hodgetts, 2011). The Red List uses criteria and categories developed by the International Union for Conservation of Nature (IUCN) to determine which species are most threatened and hence in need of conservation action (*see page 31*). It is possible to apply the IUCN system at any geographical scale, but whether this would be sensible for a land the size of England is debatable. If the IUCN criteria were applied to England alone the list would be quite different. There are many bryophytes that would be regarded as rare in the English context if localities or populations were counted, but just across the border the same species may be frequent or even abundant. The wisdom of channelling finite resources into protecting such species is open to question. England has a very effective network of Wildlife Trusts that focus action at the county level and this is commendable since local extinctions can reverberate wider. Thus, although this book focuses on England's rare and threatened bryophytes derived from the British Red List, it provides pointers to conservation priorities at all levels.

Bryologically, the British Isles is one of the best mapped regions, with 'dot maps' that are envied across the world. Yet at the other end of the scale, at the site level, we are not so good. Conservation often falters because those who implement action on the ground are frequently unaware that a particular species is present. Regrettably, the lack of awareness of what species occurs on which site hinders progress in the conservation of England's bryophytes. It is an uncomfortable truth that simple neglect or the accidental obliteration of a bryophyte through ignorance is also a threat.

The consequences of *over*-collecting in the past cannot be denied and examples of where unrestrained collecting has arguably caused a significant decline of a species are mentioned in the relevant species profiles. Although the bryologist of today is more conservation conscious and acts responsibly, populations of rare bryophytes, even on designated sites, continue to be at risk because their presence is not known or known to only a few. In this book it was judged important to be as transparent as possible about sites where threatened bryophytes are known to occur.

A principal aim of this book is to make this particular group of plants and their conservation needs more accessible to a wider audience, through the eye of many skilled photographers, with images of the mosses and liverworts that in all their diversity are sadly at risk of extinction in England if we allow it to happen. Images are powerful: it is much easier to empathize with the loss of something precious if you have a picture of it in your mind. We are rightly concerned about the plight of the European Lynx. Most people have never seen one in the wild but nevertheless know what a lynx looks like because they have seen pictures of it in books, on the internet or on television. It is not to suggest that *Leiocolea rutheana* or *Timmia megapolitana* will ever be as iconic as charismatic megafauna but at least it is hoped that this book will enable readers to appreciate their beauty and be inspired to care for these and other threatened bryophytes.

The images are almost all digital and have been provided by many people; in terms of provenance most are from Britain (all the habitat pictures are), but several are from Europe and a couple are from North America. A bryophyte from the European mainland, or indeed from across the Atlantic, looks much the same as its English equivalent so the priority has been to select the best picture available to give a true likeness of the species. Photographs of bryophytes growing in the field are used wherever possible but for two species no images could be traced. *Lophozia herzogiana* is depicted by an illustration from Jean Paton's 1999 *British liverwort flora of the British Isles* and *Acaulon mediterraneum* is taken from volume 3 of *Flora Briofítica Ibérica*, 2006.