and *Sphagnum* moss creating peat for orchids. I have already commented on the manner in which textbooks overlook positive interactions (Keddy, 1990a), there are now several fine reviews on mutualism (Boucher 1985; Smith and Douglas 1987), and Bertness and his co-workers have increasingly documented the role of positive interactions in wetlands (Bertness and Yeh 1994; Bertness and Hacker 1994; Bertness and Leonard 1997). Rather than combine such positive interactions in one chapter, I have sorted them by their main effects: fish and plants are discussed under flooding, as are beavers, alligators digging is discussed under disturbance, and peat accumulation under succession and burial. Finally, time is a critical factor that could have been excised: pluvial lakes came and went from deserts over the past 20 000 years, peat accumulated as continental glaciers receded over thousands of years, beaver ponds come and go over centuries, and riparian wetlands are flooded each year. A synthetic approach to ecology requires us to be explicit about duration, rates, and the appropriate scale for measuring each ecological process (Delcourt and Delcourt 1988). I have not included time as a separate factor, deciding that time is really a surrogate for the specific factors that vary with time. Changes in hydrology during glaciation are therefore introduced in hydrology, changes in fertility with peat accumulation are discussed under fertility, fire cycles are discussed under disturbance, succession is discussed under zonation and burial, and so on. I do not want to argue or even imply that this is the only way to sort the many topics covered in this book. A book with separate chapters on salinity, positive interactions and time could also be written, and would undoubtedly have its merits.

Wetland classification

The six basic types

Given the many kinds of wetlands, an important first step in scientific study is to divide and sort them into similar types. Each type can be visualized as a particular set of plant and animal associations that recur. This recurrence probably means that the same causal factors, and similar ecological relationships occur within each type. Unfortunately, the terminology for describing wetlands varies both among human societies, and among their scientific communities. Thus one finds an abundance of words including bog, carr, fen, flark, hochmoor, lagg, marsh, mire, swamp, pocosin, pothole, quagmire, savannah, slough, swale, yazoo, etc. used in a contradictory way among English speaking people of the world. Many of these words can be traced back centuries to Old Norse, Old Teutonic or

Gaelic origins (Gorham 1953). Now add in modern foreign languages, and the problem is compounded.

One of the simplest classification systems recognizes only four types of wetland: swamps, marshes, fens and bogs. Let us begin with the four types and insist upon at least this much standardization.

Swamp
A wetland community that is dominated by trees that are rooted in hydric soils, but not in peat. Examples include tropical mangrove swamp (mangal) and bottom-land forests in floodplains.

Marsh
A wetland community that is dominated by herbaceous plants that are usually emergent through water and rooted in hydric soils, but not in peat. Examples include cattail (*Typha*) marshes around the Great Lakes and reed (*Phragmites*) beds around the Baltic Sea.

Bog
A wetland community dominated by *Sphagnum* moss, sedges, Ericaceous shrubs or evergreen trees rooted in deep peat. Examples include blanket bogs which carpet mountain sides in northern Europe, and floating bogs which cover the shores of many lakes in temperate and boreal regions.

Fen
A wetland community that is usually dominated by sedges and grasses rooted in shallow peat, often with considerable water movement through the peat. Examples include the extensive peatlands in northern Canada and Russia, as well as smaller seepage areas throughout the temperate zone.

Figure 1.7 shows each of these four types, and Table 1.4 presents some comparative data on their properties. Other wetland types could be added to these four. Two important ones are the following.

Wet meadow
A wetland community dominated by herbaceous plants rooted in occasionally flooded soils. Temporary flooding excludes terrestrial plants and swamp plants, but drier growing seasons then produce plant communities typical of moist soils. Examples include wet prairies along river floodplains, or herbaceous meadows on the shorelines of large lakes.

Figure 1.7 The four principal types of wetlands are swamp, marsh, bog and fen. (*a*) Silver Maple swamp, Ottawa River, Canada.

These wetlands are produced by periodic flooding and may be overlooked if visited during a dry period (Figure 1.8a, b).

Shallow water

A wetland community dominated by truly aquatic plants growing in and covered by at least 25 cm of water. Examples include the littoral zones of lakes, bays in rivers and the more permanently flooded areas of prairie potholes (Figure 1.8c, d).

Any attempt to sort the diversity of nature into four to six categories will have its limitations. With little effort it will be possible to find one or more situations that appear to defy categorization, or to recall a local community that the definition calls a bog but which has always been known locally as a mire. Rather than worry further about this, we should probably admit that wetlands show considerable variation, and agree to not get stalled or diverted by debates over terminology. As Cowardin and Golet (1995) observe 'no single system can accurately portray the diversity of wetland conditions world-wide. Some important ecological information inevitably will be lost through classification.'

Figure 1.7 (cont.) (*b*) Mangrove swamp, Caroni wetland, Trinidad.

(*c*)

(*d*)

(*c*) Temperate marsh, Ottawa River, Canada (courtesy of B. Shipley).
(*d*) Tropical marsh, Caroni wetland, Trinidad.

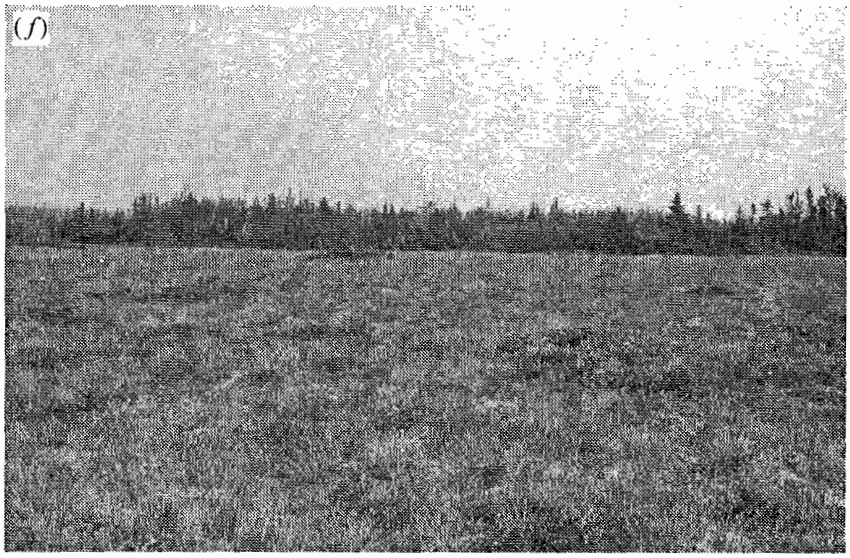
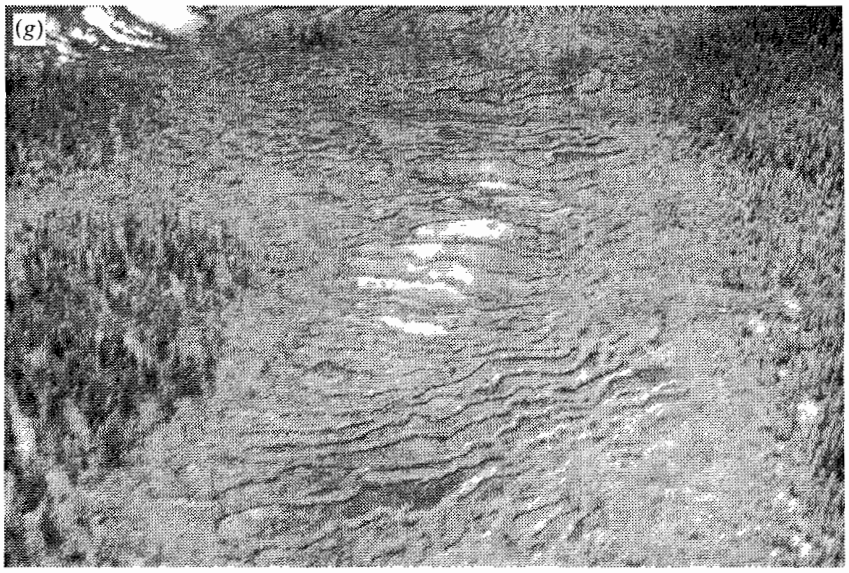


Figure 1.7 (cont.) (*e*) Lowland bog, Algonquin Park, Canada. (*f*) Upland coastal bog, Cape Breton, Canada.



(*g*) Patterned fen, northern Canada (courtesy of C. Rubec).

Other classification systems

Owing to the long history of interest in peatlands, there is a particularly diverse terminology here. Gore (1983) proposes that the term mire should be used to designate wetland types including bog, fen, moor, muskeg and peatland. Unfortunately, he also adds the word 'swamp', which some European ecologists use to describe eutrophic mires or marshes. Inconsistent use of the word 'swamp' causes problems even within England, says Burnett (1964), being defined virtually on a regional basis and differing again from usage on the continent. The term 'swamp' in British usage generally applies to wetlands in which the normal water level is above the soil surface, usually dominated by reeds (*Phragmites*), tall grasses, sedges or rushes; the commonest kind being a 'reed swamp'. Similarly, in Africa Thompson and Hamilton (1983) use the term swamp for grass, sedge and reed dominated herbaceous wetlands as well as for forested areas. In the definitions used in this book (p.18) herbaceous wetlands lacking peat are simply a kind of marsh; it may be further qualified with modifiers such as an 'emergent marsh', '*Phragmites* marsh', '*Papyrus* marsh'or 'lacustrine marsh' as the need arises.

Figure 1.7 (cont.) (*h*) Shoreline fen, Lake Ontario, Canada.