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4.3.3 Peat growth in a mountain mire

Fig. 124 Sedgeland, fernland, and shrubland in a mire occupying a depression in the gently sloping, forested headwater of the Ongarue River, at 820 m altitude near the top of Mt Pureora, Volcanic Plateau.

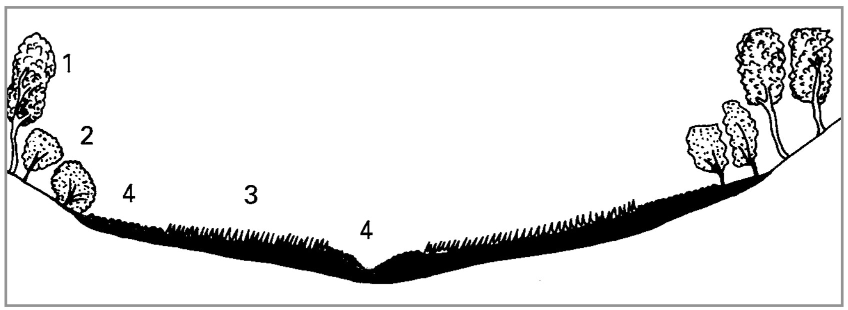

Fig. 125 Profile showing pattern of principal vegetation types:
1. Forest (surrounding): *Podocarpus hallii* and *Quintinia serrata*;
2. Bog pine (*Halocarpus bidwillii*) - mountain toatoa (*Phyllocladus alpinus*) scrub bog on relatively well-drained peat;
3. Fern bog on peat having little water movement: tangle fern, square sedge (*Lepidosperma australe*), *Carpha alpina*, and the moss *Dicranum robustum*;
4. Fern fen on wet peat with more water movement, near stream channels and on sloping upper sides of mire: tangle fern again but with much *Sphagnum cristatum* moss.

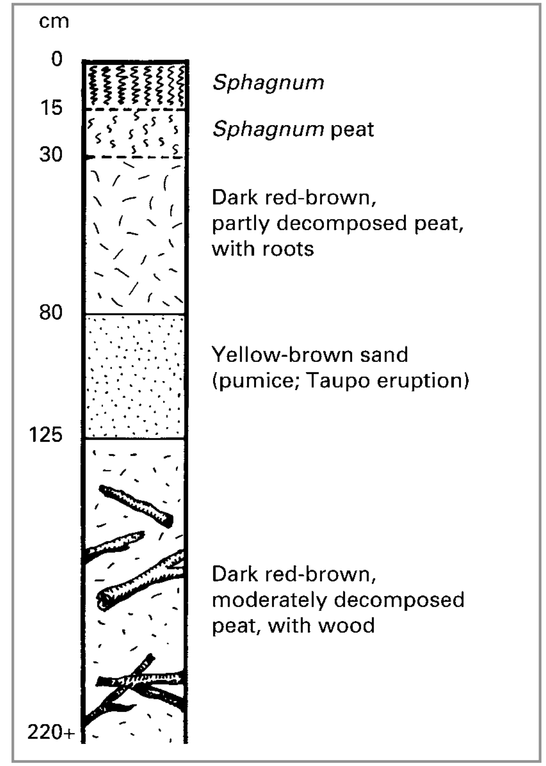

Fig. 126 Peat profile from Ongarue 'A' mire (simplified from Clarkson 1984). The peat in the lower part of the profile contains much wood, the remains of a wetland that had been dominated by bog pine and mountain toatoa. This is overlain by a deep layer of pumice sand, deposited by the Taupo eruption of about 1800 years ago, and a subsequent accumulation of 0.8 m depth of peat. The pH of the upper peat ranges from 4.5 to 5.7. This mire is relatively young. Much of it can be regarded as fen, with localised seepages. Those parts least affected by water draining in from surrounding slopes can be considered as bog, and this will probably become more the case in the future as areas of peat become somewhat raised, and as nutrient levels therefore decrease.

4.3.4 Peat structure and processes

Fig. 127 A shrub / tussock fen on a mountain slope near the treeline, its c. 1 m depth of peat and underlying bedrock exposed beside the tramping track to Key Summit, Fiordland.

Fig. 128 Peat is not always wet and slimy. If exposed to the air it can resume decomposition, or if dried out it can be resistant to rewetting, partly because of the concentration of waxes that would have come from the leaf cuticles of the original contributing plants. Wind-erosion of this dried peat patch reveals that this fen on the Garvie Mountains, northern Southland, has accumulated some 3 m depth of peat. Also revealed is part of an underground stream – a 'pipe' system of stream tunnels – such as would normally be unseen and unsuspected, yet a feature that may be quite common in sloping peatlands.

Fig. 129 A recently cleared drain through peatland on the Awarua Plain, Southland. Abundant buried tree trunks, limbs, and roots are proof that wood is well preserved within peat, and that this site had a former forest cover, probably as forest bog. Today's vegetation of flaxland and bracken fernland suggests that the former bog has become a fen, fertility and aeration having increased as a result of fires and drainage.

4.4 Mineral substrates

Bedrock provides the substrate for some wetlands, with perhaps a mere veneer of mineral or organic matter, in effect too thin and too young to be properly called a soil. The mineral component of a wetland soil can come from its underlying substrate and also from continuing inputs of materials carried by water, wind, or gravity. Substrate materials can be as diverse as river gravels, morainic till, volcanic ash, or dune sands, and these may initially be free-draining before wetland development begins. Much of the mineral material of wetlands is deposited by moving water. Depending on flow characteristics, sediments of different particle size such as gravel, sand, or silt are sorted and deposited in different places (Fig. 130). Particle size classes are described in Section 2.7.

Many North Island peatlands contain layers of ash deposited by airfall at times of volcanic eruption. A component of loess – wind-carried silt – is found in many South Island peats, especially in the lower parts of the peat profile that date from early post-glacial times when dusty, unvegetated outwash plains were widespread. Peatlands on dunes receive inputs of wind-blown sand. Mountain seepages and fens can be regularly nourished by nutrients from rockfall and avalanche debris (see Fig. 42).

Wetland soils derived from mineral parent materials undergo many characteristic physical, chemical, and biological processes as they mature. Like most soil types, they develop layers – or horizons – that become more distinctive over time, with surface litter and organic-rich topsoil overlying subsoil layers of weathering minerals. Examples of mineral wetland soils are shown in Figs 131 to 134.

As water percolates downwards through a soil, soluble matter and fine particles are leached from the upper layers and redeposited lower down. Leaching is most pronounced where rainfall is high, and strong leaching greatly reduces soil fertility by removing soluble nutrients to below the rooting zone of plants. A strongly leached soil can be recognised from the pale colour of its upper horizon of subsoil, resulting from the residual predominance of silica after removal of humus, iron and aluminium oxides, and clay. In soils which are saturated for prolonged periods the process of gleying imparts a grey or blue-grey colour to this horizon, a consequence of iron compounds being present in a state of chemical reduction, though the frequent presence of rusty mottling shows where re-oxidation of iron has occurred in better-aerated zones, such as around roots. When the products of leaching reach a lower subsoil level they precipitate as a dark colouration, often forming a thin, cemented pan of iron oxide and / or humus that then prevents drainage from the overlying soil.

Knowledge of soil structure, processes, and classification provide vital clues to understanding wetlands. Molloy (1998) gives a good introductory account of New Zealand soils, including those of wetlands. New Zealand handbooks on soil survey methods, description, and classification are provided by Taylor & Pohlen (1979), Milne et al. (1995), and Hewitt (1993). Published soil maps and surveys (e.g. NZ Soil Bureau 1954, 1968a,b) and land use capability maps can be a helpful source of information for the processes of location and inventory of wetland sites.

4.4.1 Inorganic substrate materials

Fig. 130 An example of particle sizes, clockwise from top left: fine silt, silt, sand, coarse sand, gravel, coarse gravel. These are from a bay head at Lake Wanaka, Otago. Each square of material is 15 × 15 cm. The fine silt (top left) is dense and plastic, being originally glacial flour that settled on the bed of a former ice-snout lake. The silt at top centre is brownish from being partly weathered, and because it includes some humus material. The materials had been sorted to their respective particle sizes by the differential energies of wave action. Particle size of inorganic materials influences the drainage characteristics and fertility of many lacustrine, riverine, and estuarine wetlands. Many peatlands are underlain by one or more of these types of material.

4.4.2 Some mineral wetland soils

Fig. 131 An ephemeral wetland soil. Profile (to 30 cm depth) beneath turf in a seasonally ponded depression, Arahaki Lagoon, Whirinaki, Volcanic Plateau (see Fig. 48). The upper horizon is firm silt, dark-stained by humus though only slightly organic. This grades down to compacted and then looser pumice gravels. Drainage is relatively good and this soil becomes moderately dry over summer.

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Fig. 132 A pakihi soil. Profile from an outwash surface, German Terrace, near Westport, Buller (see Fig. 19). A relatively uniform silty soil, highly infertile, from beneath tangle fern (*Gleichenia dicarpa) - Baumea teretifolia* fern pakihi. This soil allows for only very slow water movement, but can become quite dry at times of low rainfall if the underlying water table is lowered. The sampled core is not of sufficient depth to show the probable underlying iron-humus pan that is the main factor in restricting drainage.