Woodland regeneration in the Middle Neolithic: c. 3400–2860 BC (Zone 4: 338–296 cm)

The pollen of ribwort plantain does not register in this zone, grass representation is much lower and CFS (associated with dung) are not recorded, suggesting that farming was no longer practised in the catchment. In response to the removal of farming pressure, woodland regeneration followed. Elm recovered to its pre-Elm Decline levels, with elm pollen attaining its highest representation for the profile. Pine also played an important role in the woodland until c. 3160 BC, while marsh fern was once more an important component of the fen vegetation.

Local hydrological conditions changed c. 3100 BC, as suggested by the disappearance of spores of marsh fern. Woodland, predominantly hazel and birch, dominated the landscape, the latter probably growing on or around the edge of the fen. Pine was no longer an important tree of the local woodlands. A second crash in the elm population occurred, which, in the absence of human indicators, was most likely to have been also disease-related. The substantial increase in Poaceae values at this point probably reflects the growth of grasses as part of the fen community rather than on mineral soil.

Woodland dynamics in the Later Neolithic: c. 2880–2430 BC (Zone 5: 290–254 cm)

Hazel expanded to become the dominant woodland tree. Shrubs, ivy and, to a lesser extent, holly (*Ilex*) were part of the woodland. Birch was no longer important locally. Elm recovered but not to Middle Neolithic levels. Ash (*Fraxinus*), which may have been present at low levels in the landscape since before the Elm Decline, became established in the woodland and probably expanded into areas formerly occupied by elm. Similarly, yew (*Taxus*) expanded, although it failed to become the dominant woodland component as it did in other parts of western Ireland at this time (O'Connell et al. 1988; Molloy & O'Connell 2012). The expansion of *Pinus* and the record of a pine stoma suggest that pine was present locally on the bog surface (clusters of pine pollen were also noted). This corresponds to the expansion of pine onto blanket bog along the western seaboard at this time, which may be linked with a short-term climate change to drier conditions. (Note again that fossil timber, possibly pine, was hit while coring for the abandoned sample core BQWI.)

Surface conditions were drier. Ericaceae pollen, primarily from ling heather (*Calluna*), is more abundant now, reflecting the spread of these plants onto a drier fen/bog surface. Microscopic animals are also of use in reconstructing hydrological conditions in bogs/fens. The abundance of the testate amoeba *Assulina muscorum* (unicellular protozoans living on the surface of bogs) may be useful in this regard. *Assulina* is generally found in drier habitats such as moss hummocks on bog surfaces.

Renewed farming in the Early to Middle Bronze Age: c. 2430–1310 BC (Zone 6: 248–158cm)

Over a period of c. 1,100 years the pollen data suggest that people were present in the area and continuously practising farming, which was predominantly pastoral but with a minor arable component (cereal-type pollen and other indicators of arable farming are sporadically recorded). The level of intensity of land use varied throughout the period, with intense phases recorded at the opening of the zone, centred on 2320 BC, midway though the zone at 2000–1865 BC, and a more prolonged, intense phase at 1505–1295 BC. During each phase, pollen of key human indicators increases, including grasses and ribwort plantain. This occurs in conjunction with a high abundance of spores of bracken, a fern that quickly colonises newly opened ground and/or abandoned farmland. These, along with more sporadic pollen records for buttercups, docks (*Rumex*), clovers and dandelions, point to the creation of open, species-rich grasslands nearby. Cereal-type pollen is only recorded during the last, more intense phase of activity. (Cereal-type pollen generally tends to be poorly dispersed and therefore is often under-represented in the fossil record.) Pollen of the cabbage family (Brassicaceae), which is also an arable indicator, is recorded during each 'pulse' of activity, when small-scale woodland clearances occurred. The main tree affected was elm and, to a lesser extent, hazel, oak, ash and yew. In between the pulses of human activity a decline in the intensity of land use allowed for a degree of woodland regeneration—primarily elm.

The transition from fen to raised bog is recorded in this zone. *Sphagnum*, the main moss of raised bogs, becomes plentiful in the record from c. 2320 BC. The presence of the testate amoeba *Assulina* suggests, however, that the bog may have been relatively dry until c. 1830 BC, when a peak in the remains of *Amphitrema*, a testate amoeba indicative of wet conditions, coincides with an expansion in *Sphagnum* spores. *Assulina* becomes less frequent in the record after this. *Sphagnum* layers were observed in the stratigraphy of the core above 232 cm. Pollen of the insectivorous bog plant sundew (*Drosera intermedia*) was also recorded sporadically in this section of the core. Bog myrtle (*Myrica*), present at low levels in the landscape since c. 2840 BC, became more plentiful. Bog cotton was also present (there were macroscopic remains visible in the sediment), contributing to the peaks in sedge (Cyperaceae) pollen.

Decline in farming in the Late Bronze Age: c. 1310–910 BC (Zone 7: 152–122 cm)

Towards the end of the Bronze Age evidence for farming activity is minimal. Human indicators are at extremely low levels, suggesting that farming was no longer being practised adjacent to the bog. At Killarainy 3, to the north-east, however, a burnt mound has been dated to this period (Chapter 2). As pressure was taken off the land, woodland regenerated quickly. A hazel scrub developed, with some elm, ash, alder, oak and yew. Pine was probably no longer present locally. Arboreal pollen now accounts for >90% of the TTP, indicating that closed canopy woodland predominated.

Overall, the bog surface was dominated by heathers and *Sphagnum* mosses, with bog myrtle also present. Surface conditions appear to have become drier, as suggested by the decline of the *Amphitrema* amoeba in favour of *Assulina*.

Vegetation and land use in prehistory

As a bog system, Ballyquirke West has gone through substantial changes throughout the post-glacial period. Initially a shallow lake, it became a fen c. 8400 BC and eventually a western raised bog c. 3,800 years ago. The pollen profile recorded in our peat core sample provides insights into the human influence on vegetation structure in these environs from the early post-glacial period until the end of the Bronze Age.

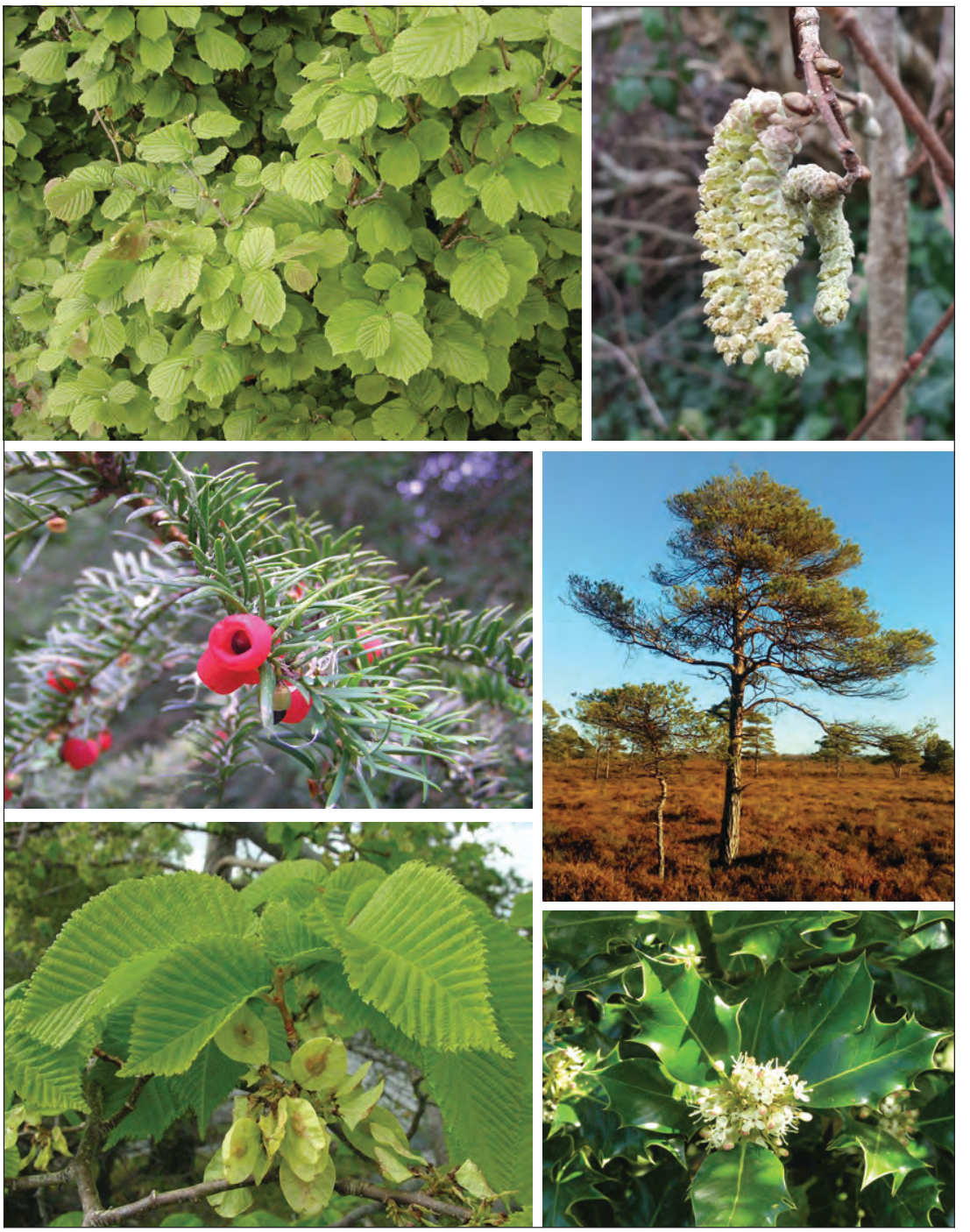
The early post-glacial woodlands were dominated by oak, elm, pine and hazel. A pronounced Elm Decline is recorded at 3800 BC and appears to reflect the collapse of the elm population as a result of disease. A similar feature is also reported in pollen diagrams from other parts of Connemara, including Lough Namackanbeg near Spiddal (An Spidéal) and, further west, Lough Sheeauns near Cleggan (An Cloigeann) (O'Connell et al. 1988; Molloy & O'Connell 1991).

Human activity and woodland disturbance first register immediately after the Elm Decline in the Early Neolithic period (c. 3750 BC), when the evidence points to the removal of woodland and the expansion of species-rich grassland associated with pastoral farming (Illus. 3.6). This phase of Neolithic farming lasted c. 400 years (with the most intense phase of activity in the early part) and is comparable with a *landnam* (woodland clearance) recorded at Lough Sheeauns (Molloy & O'Connell 1991). There is no evidence of arable farming at this time. A period of c. 1,000 years follows in which evidence for human activity in the landscape around Ballyquirke is lacking. A similarly 'quiet' period, lasting 700 years, is recorded at Lough Sheeauns. In the absence of human impacts, woodlands regenerated and elm, hazel, pine and, later, birch (probably on the peat surface) all flourished (Illus. 3.7). Pine appears to have become less common from c. 3100 BC to 2760 BC, after which it expands onto the bog surface for a short period of c. 100 years, presumably as a result of a short-term climate shift towards drier conditions. This may also have favoured yew, which appears in the pollen record at the same time. The expansion of yew here is not as marked as at other sites in Galway—for example, Lough Atalia, in Galway City (O'Connell & Molloy 2017), or Lough Namackanbeg (O'Connell et al. 1988)—where yew expanded to become the dominant tree, forming dark, dense woodlands by c. 2800 BC. Yew is a native evergreen tree that generally occurs on well-drained calcareous soils. (A good example of a native Irish yew wood can be seen in Reenadinna Woods, Killarney, Co. Kerry.) Given the limestone bedrock in Ballyquirke, it is difficult to understand why a more marked expansion did not occur here, as the local soil conditions would have been very favourable for the growth of yew.

In contrast to the Neolithic period, the Early and Middle Bronze Age is characterised by substantial though fluctuating levels of human activity. Initially, from c. 2400 BC to 2285 BC, there was a short interval when elm and, to a lesser extent, yew were cleared and pasture expanded. A

Illus. 3.6—Species-rich grassland, showing some of the anthropogenic indicator species and their pollen recorded in the Early Neolithic period in the pollen profile for sample core BQW2 from Ballyquirke Bog. Pollen types (L–R): dandelion type, ribwort plantain, grass, red clover and buttercup. (*NUI Galway*)

peak in micro-charcoal at this time suggests that fire may have played a role in woodland clearance/management. More sustained clearances, and of greater impact, are recorded in the Middle Bronze Age from 2000 BC to 1865 BC and from 1505 BC to 1295 BC. What is unusual, however, is the lack of evidence for farming in the Later Bronze Age, which is often seen in Irish pollen records as a period of intense human activity that involved substantial woodland clearance. Regionally, this has been reported from sites such as Caheraphuca Lough, Co. Clare (Molloy & O'Connell 2012), and Ballinphuil Bog, east Co. Galway (Molloy et al. 2014). While people may not have been present in the immediate area of the bog at this time, i.e. around Ballyquirke West, this does not mean that the wider study area was abandoned. To the north-west, in the townland of Killarainy, archaeological excavation has revealed finds dating from the Early Bronze Age to the early medieval periods (Chapter 2). It is possible that available land at Ballyquirke became less favourable for farming as bogland expanded, or simply that the local focus of settlement shifted to beyond the catchment of the bog and thus is no longer registered in the pollen record here.



Illus. 3.7—Some trees represented by pollen in the Ballyquirke peat core (clockwise from top-left): hazel leaves and catkins; Scots pine on peat; holly, flowering; wych elm leaves and fruit; yew with fleshy seed cones. (*John Conaghan*)