Bibliography, IRELAND **Aileen O'Sullivan & Declan J. Little**

Woodland Structure

Binggeli P., Rushton B.S. (1985): A Management-oriented study of Birch-Rowan-Hazel woodland at Murlough Bay, Co. Antrim, Northern Ireland
Irish Forestry 42 (1), 16-32
Abstract: A management oriented study of the birch-rowan-hazel woodland at Murlough Bay, Co. Antrim, Northern Ireland, was conducted in order to establish the balance of tree species composition, population age structure and regeneration of the tree species, grazing pressure and the status of Sycamore (*Acer pseudoplatanus* L.) and Ash (*Fraxinus excelsior* L.) which are invading the woodland. The woodland forms part of the National Trust Nature Reserve.
Results indicated that:

1. the most common trees were Birch (*Betula pubescens* Ehrh.) 1016 trees/ha, Rowan (*Sorbus aucuparia* L.) 244 trees/ha and Hazel (*Corylus avellana* L.) 236 trees/ha whilst Sycamore and Ash accounted for 21.4 and 14.8 trees/ha respectively;
2. the main tree species were, by and large, segregated within the woodland with Hazel just below the cliff, Birch in the lower, damper areas and Rowan between;
3. plots of Log. Tree Number against Log. Tree Age indicated that populations of all the above five tree species were declining;
4. regeneration appeared to be sparse despite the very large numbers of seedlings produced whilst there was extensive evidence of grazing pressures from goats and sheep;
5. assuming no regeneration or mortality of the Sycamore, its canopy cover is likely to increase from 4.0% to 11.4% of the total in the next 40 years; that of Ash will increase from 2.0% to 6.7% over the same period.
   A management plan, directed towards restricting grazing and Sycamore eradication by tree-barking is suggested.

Key-words: Woodland dynamics, woodland management

Iremonger S.F. (1990): A structural analysis of three Irish wooded wetlands. Journal of Vegetation Science 1, 359-366
Abstract: Transect analyses emphasise the differences in tree species composition and structure of three different wooded wetland tracts in Co. Kerry, Ireland. These are variously dominated by *Alnus glutinosa*, *Betula pubescens*, *Fraxinus excelsior*, *Quercus robur*, and *Salix cinerea* ssp. *oleifolia*. Stand density ranged from 15 to 54 live trees per 100 m^2, tree height did not exceed 15 m, mean individual basal area ranged from 78 to 165 cm^2 and the average total basal area per hectare was between 3.6 and 4.1 m^2. The sites were quite different in a number of the characteristics recorded. The Irish forests were smaller in stature and denser than others in both temperate zones (Continental Europe, North America, Japan) and the tropics. Crown area indices were also lower than for other areas, ranging from 1.15 to 1.79. The height:diameter relationships may reflect the state of sylvigenesis of each stand. Death by blowdown appears to be less frequent in the younger stands than death by suppression. Gaps are therefore formed gradually, not suddenly, allowing neighbouring suppressed trees to develop into the spaces formed.
Key-words: Basal area, crown area index, woodland dynamics, stand profile diagram

O'Sullivan A. (1991): Historical and contemporary effects of fire on the native woodland vegetation of Killarney, S.W. Ireland. Ph.D. Thesis, University of Dublin (Trinity College), Dublin

Abstract: This study attempted to reconstruct woodland history by determining the ages of oak trees in selected woodlands in the Killarney area. This analysis was supplemented with pollen data from mor humus and small peaty hollows within the woodlands, which provided a broader record of woodland history. A series of circular plots were located within three oak woodlands. The plots measured either 20 m or 30 m diameter (i.e. area 314.2m^2 or 706.9m^2), depending on tree density. Within each plot, the location of standing live and dead trees of all species, with GBH>15cm, were mapped. Tree girth at breast height (GBH) was measured, also tree height, and an increment core was taken from all oak trees, to determine tree age. Two „peak" periods of oak establishment were detected, one in the early 1800's A.D., the other in the later 1800's. These establishment phases were spatially separate. The later phase gave rise to smaller stands at the fringes of existing woods. Oak establishment in the 20th century has been more restricted, and probably occurred after small-scale removal of oak from existing woodlands. The data showed poor correlation between girth and age of oak trees.

Key-words: Woodland age structure, stand structure, woodland dynamics, oak

Turner J.S., Watt A.S. (1939): The oakwoods (*Quercetum sessiliflorae*) of Killarney, Ireland Journal of Ecology 27, 202-233

Abstract: This is one of the earliest descriptions of the Irish oakwood vegetation. The study was carried out in Derrycunnihy Wood, which lies within the Killarney National Park. Descriptions of soils and vegetation are presented, together with diagrams to illustrate woodland structure. The authors identify three woodland types within Derrycunnihy Wood. For each woodland type, structural data are presented for the dominant species in the canopy, understorey and dwarf shrub layers, i.e. tree density; girth at breast height (range and mean values); height of trees (maximum and mean values). The study also explores the successional relationships between the different woodland types observed.

Key-words: Woodland vegetation, woodland structure, soils, woodland succession

Woodland Monitoring

Bleasdale A., Conaghan J. (1996): Study of woodland exclosures in Glenveagh National Park, Co. Donegal

Report submitted to the Office of Public Works. Glenveagh. 30 pp.

Abstract: This report examines the effects of excluding grazing animals for 20 years from two areas of woodland in the Glenveagh National Park, Co. Donegal, north-west Ireland. Observations of vegetation changes in the two exclosures demonstrate the pathways by which woodland herbs and trees grow and regenerate after grazing animals are excluded. These data also help to determine the length of time of for which grazing animals need to be excluded in order for adequate levels of tree regeneration to be achieved. The study follows on from the work of Telford (1977) and of Van Doorslaer & O'Sullivan (1987), and methods used are as described for the latter study (below). A comparison of the changes in vegetation cover in the permanent plots is presented by means of vegetation tables and photographic evidence. In addition, the number and cover of seedlings and saplings in each plot are presented. Six new permanent plots were established in other woodlands, which have recently been either fenced or cleared of *Rhododendron ponticum*. Management recommendations are suggested for each of the woodlands surveyed, with a view to encouraging woodland regeneration, expansion and floristic diversity.

Key-words: Woodland dynamics, vegetation monitoring, grazing experiment, Rhododendron removal

Hayes C., Dower P., Kelly D.L., Mitchell F.J.G. (1991): The establishment of permanent quadrats for the monitoring of grazing and its effects on tree regeneration in the Killarney oakwoods
Report submitted to the National Parks and Wildlife Service of the Office of Public Works. Dublin, 124 pp.
Abstract: At Killarney National Park, south-west Ireland, are the most extensive tracts of semi-natural native woodlands remaining in the country. On the soils overlying the Old Red Sandstones on the south and west of the Park, oak (mostly *Quercus petraea*) is the dominant species in the woodlands. Typically, there is a dense understorey of holly (*Ilex aquifolium*) with scattered birch (*Betula pubescens*) and rowan (*Sorbus aucuparia*). In the National Park, tree regeneration is left to nature. Tree seedling recruitment is dependent on overcoming not only environmental factors, such as sufficient light and moisture, but also pressure from grazing animals. The woods are heavily grazed by sika deer, sheep and to a lesser extent by red deer and goats. Attempts to control grazer populations are in progress by the Park authorities, with the exclusion of sheep from the late 1960's (although trespass still occurs) and the implementation of a sika deer culling programme in the mid-1970's. In this study, a total of 52 permanent plots were established in summer 1991, in three different woodlands, to monitor tree regeneration. Some of these plots were established in woodland, which had been recently cleared of dense *Rhododendron ponticum*, to monitor vegetation recovery. Quadrats measured 4x4 m. For each quadrat, the following were recorded: location, slope, aspect, altitude, topography, soils, vegetation structure, cover/abundance of tree seedlings/saplings & higher plants. Other features of the surrounding woodland were noted. These plots are similarly recorded about every five years.
Key-words: Woodland regeneration, vegetation monitoring, grazing, Rhododendron

Kelly D.L. (1975): Native Woodland in Western Ireland with Especial Reference to the Region of Killarney
Ph.D. Thesis, University of Dublin (Trinity College), Dublin.
Abstract: The largest remaining tracts of Irish native woodland occur at Killarney. Much of this woodland lies within the Killarney National Park, which was the first N.P. established in Ireland. A comprehensive account of the native woodland vegetation at Killarney is presented in this thesis, with an experimental assessment of the effects of grazers on woodland dynamics. A monitoring experiment was established to quantify the effects of large herbivores on woodland vegetation. Five exclosures were established in three woodlands, in which detailed records were made of vegetation and stand structure. [Note: „Exclosures" are areas which are fenced to exclude large grazing animals.] Exclosures were established in Blechno-Quercetum woodland, and also in a woodland where the canopy is almost solely formed of Taxus baccata - this stand is unique in these islands. Regeneration of woodland vegetation within these exclosures is still monitored to this day. This thesis contains detailed descriptions of the methodology used in one of Ireland's longest-running woodland monitoring programmes.
Recently, monitoring was expanded to examine the influence of grazers on woodland vegetation outside the fenced exclosures (see Hayes et al., 1995).
Key-words: Woodland regeneration, vegetation monitoring, grazing

Little D.J., Ryan D., Farrell E.P., Boyle G.M. (in press): Intensive monitoring of an oak woodland in western Ireland
Development of an Irish Ecological Monitoring Network (IEMN). COFORD, Dublin.
Abstract: The need to improve our understanding of the structure of ecosystems and of the processes which control their stability and development led to the proposal to establish an Irish Ecological Monitoring Network (IEMN). Work has begun with the establishment of a prototype site for the network, i.e. Brackloon Wood, Westport, Co. Mayo. This semi-natural, oak-dominated woodland was chosen as the prototype since it had existing installations and

monitoring activities, which could be supplemented. The Forest Ecosystem Research Group at University College, Dublin has carried out monitoring of ionic inputs in Brackloon, since 1991. Since 1996, monitoring has been expanded to incorporate vegetation (including higher plants, lichens and bryophytes), birds, mammals (including bats) and soil fauna (including earthworms), as well as radionucleides from weapons and Chernobyl fallout. Research into land-use history and ecosystem disturbance at Brackloon has been carried out. This research, along with analyses of archaeological artefacts, pollen and soil, in conjunction with radiocarbon- and lead-dating techniques, all serve to elucidate current ecological trends, and potential future developments. Monitoring and research results are utilised in the development of management plans for Brackloon, with the aim of maintaining the ecosystem in a viable condition. On a broader scale, long-term monitoring and biodiversity research carried out at Brackloon should provide indicators for the sustainable management of oakwood and other forest ecosystems.

It is envisaged that the Irish Ecological Monitoring Network (IEMN) will eventually comprise all representative ecosystems extant in Ireland. Developments leading to the launch of the IEMN are well under way. Since the inception of this project late in 1995, links have been made with ecological monitoring networks worldwide, including the Global Terrestrial Observation System (GTOS) based in Switzerland, the International Long-term Ecological Research Network (ILTER) based in the U.S., and the British Environmental Change Network (ECN). These links are important, primarily in drawing upon the experience of others in establishing networks and to integrate Irish sites into worldwide databases concerned with long-term monitoring.

Key-words: Long-term monitoring, ecological monitoring network, biodiversity, woodland management

NOTE: See also the following related ecological monitoring/research reports (unpubl.):
Forest Ecosystem Research Group (FERG) Internal reports No.'s 6, 13, 18, 21, 26, 27, 28, 29, 30, 31, 32, 33, 34, 37, 39, 40, 42, 43 & 44. Department of Environmental Resource Management, University College Dublin. http://www.ucd.ie/~ferg

Telford, M.B. (1977): The Vegetation of Glenveagh: Past and Present Vegetation
Ph.D. Thesis, University of Dublin (Trinity College), Dublin.

Abstract: This thesis outlines the approach used and methods adopted in setting up a monitoring experiment which is focussed on assessing the effects of grazing on woodland regeneration and spread, in Glenveagh National Park, Co. Donegal, north-west Ireland. The woodland vegetation type is acidophilous oak woodland (Blechno-Quercetum), and monitoring continues to the present (see Bleasdale & Conaghan 1996, Van Doorslaer & O'Sullivan 1987).

Key-words: Woodland regeneration, vegetation monitoring, grazing

Van Doorslaer L., O'Sullivan A. (1987): The Glenveagh exclosures - twelve years on.
Report submitted to The Office of Public Works. Glenveagh National Park, Co. Donegal.

Abstract: In 1976, two woodlands in Glenveagh National Park were fenced, to exclude deer and encourage natural development of woodland vegetation. At that time, 7 quadrats, most of which measure 2mx2m each, were permanently marked within the two woodlands, and an experiment was initiated to monitor vegetation development within the exclosures. In the summer of 1987, vegetation in the fenced areas was re-examined, and additional plots were set up and permanently marked. The additional plots expanded the scope of the monitoring project, and were established in: a) open habitat adjacent to woodland, to monitor woodland spread; b) woodland areas recently cleared of dense *Rhododendron ponticum*, to monitor post-clearance woodland recovery. The size of plots varied, depending on the density of trees and shrubs present. Abundance of saplings and trees was measured in plots ranging from 8 to 36m^2. Ground

flora, including tree seedlings, were recorded in plots measuring 4 to 9m^2, using the 10-point Domin-Krajina scale of cover/abundance. Bryophyte species were recorded only on the basis of their presence/absence. Note: Bleasdale & Conaghan (1996) carried out a further survey of these exclosures.
Key-words: Woodland dynamics, vegetation monitoring, grazing experiment

Woodland Vegetation Description & Classification

Cross J.R. (1992): The distribution, character and conservation of woodlands on esker ridges in Ireland
Proceedings of the Royal Irish Academy, 92B, 1-19
Abstract: The word „esker" is an Anglicised version of the ancient Irish word eiscir, which was applied to any raised (and therefore usually dry) morainic deposit. Today, it has a strict geomorphological definition, being applied to fluvio-glacial deposits laid down by subglacial streams. Eskers are a prominent feature of the landscape of the Irish midlands, forming low, steep-sided ridges, which may extend for many kilometres. Most of these ridges are too steep for cultivation and are utilised largely for grazing, but in places, patches of native woodland occur, some being several kilometres in length. These woodlands have been surveyed as part of a national woodland survey and this paper describes their character, extent and conservation value. Their significance in respect of the very small area of native woodland remaining in the country is discussed, with particular reference to their history and possible relationship with the original post-glacial forests.
Key-words: Native woodland, woodland structure, phytosociology

Cross J.R. (1998): An outline and map of the potential natural vegetation of Ireland
Applied Vegetation Science 1, 241-252
Abstract: A map of the potential natural vegetation of Ireland with an outline description of the vegetation units is presented. The vegetation of Ireland has a distinctive and highly oceanic character as a result of its location on the north-western extremity of the Eurasian landmass and its recent geological and vegetation history. Forests would normally cover the greater part of the island but the long history of forest decline over the last 6,000 years, due to clearance by man and paludification, has led to the present situation where native forest cover is less than 1% of the land area. Together with intensive land use, drainage, peat cutting and the introduction of alien species, this presents considerable difficulties in the construction of mapping units.
The map, which has been compiled as part of the Vegetation Map of Europe at a scale of 1:2.5 million, contains 20 mapping units. They comprise: nine forests, i.e. montane birch forests (one unit), acidophilous oak forests (two units), forests of oak or oak and ash with hazel on mostly base-rich soils (four units), forests on alluvium and gleyed clays (one unit each); five mire types and six minor units. As a result of human activity, the potential natural vegetation, especially the forests, will differ considerably from the former climax vegetation.
Key-words: Forest vegetation types, mapping and distribution, phytosociology

Ferguson D.K., Westhoff, V. (1987): An account of the flora and vegetation of Derryclare Wood, Connemara, (Co. Galway), western Ireland
Proceedings of the Royal Irish Academy, 90C (2), 139-172
Abstract: The flora and vegetation of Derryclare Wood, a deciduous wood in western Ireland, are examined. The geological history of the area and its present climate are discussed in relationship to woodland ecology. Human influences have also been effective in moulding the vegetation. A floristic list is presented, accompanied by noted on individual species. The woodland syntaxa down to the rank of subassociation are dealt with. These vegetation units are mapped and their

relationship to the geological substrate is clarified. The wood is characterised by a luxuriant epiphytic flora. Some of the factors affecting the suitability of vascular plants for an epiphytic mode of life are discussed. The account is concluded with some suggestions for conservation.
Key-words: Vegetation, phytosociology, epiphytes

Kelly, D.L. (1981): The native forest vegetation of Killarney, south-west Ireland: An ecological account
Journal of Ecology 69, 437-472
(1) This study presents a general account of the native forest vegetation of the Killarney district, the site of one of Ireland's major National Parks. Quantitative floristic data are presented in tabular form: the bryophytes are fully treated, and the floristic accounts are accompanied by a range of edaphic data.
(2) The Killarney woods fall naturally into two sectors, along a geological divide. The larger area, on Devonian Old Red sandstone, supports a relatively homogeneous acidophilous forest type, dominated by *Quercus petraea*, and referable to the Blechno-Quercetum Association of Braun-Blanquet & Tüxen (1952): The main gradient in this vegetation is from a relatively species-poor variant in the lower-rainfall woods, to one with a rich and luxuriant bryophyte and epiphyte flora, corresponding to well-developed Blechno-Quercetum scapanietosum subassociation. Accounts are presented of the bryophyte micro-communities on the forest floor, and of the epiphyte communities on *Quercus*.
(3) The forest vegetation on the Carboniferous Limestone is described for the first time. The unique moss-rich *Taxus baccata* forest on limestone outcrops is a facies of the Corylo-Fraxinetum Association (Br.-Bl. et Tx. 1952). An account is presented of the epiphytes on Taxus. The „carr" forest, which covers substantial areas of low-lying swampy ground, is also described.
(4) A brief account is given of the distribution and ecology of alien plant species in the Killarney woods, in particular the strongly invasive *Rhododendron ponticum*.
Key-words: Woodland vegetation, woodland ecology

Kelly D.L., Iremonger S.F. (1997): Irish wetland woods: the plant communities and their ecology
Biology and Environment: Proceedings of the Royal Irish Academy 97B (1), 1-32
Abstract: Floristic and environmental data were recorded from wetland woods in all regions of Ireland, with more intensive studies in the Killarney area. The principal gradients in the environment are found to be edaphic and hydrological. Seven vegetation groups are distinguished; two represent communities not hitherto described from Ireland. Group A is mostly riparian woodland and equates with the *Salicetum albo-fragilis*. Group B is found in stagnant conditions, mostly near lake shores, and corresponds to the *Osmundo-Salicetum atrocinereae*. Group C1, a rare community of mires irrigated by calcareous groundwater, equates with the *Alnus glutinosa-Carex paniculata* community; one site corresponds to classic swamp carr. Group C2, typically associated with springs or flushed sites, largely equates with the *Carici remotae-Fraxinetum*. Group D, on soils that are waterlogged in winter but dry out in summer, is classified as the deschampsietosum caespitosae subassociation of the *Corylo-Fraxinetum*. Group E, associated with oligotrophic peat that is relatively dry, equates with the *Betuletum pubescentis*. Group F, of waterlogged oligotrophic peat, equates with the *Sphagnum palustre-Betula pubescens* community. The richness and diversity of Irish wetland woods has been underrated; we emphasise the need for active conservation measures.
Key-words: Phytosociology, plant diversity, woodland vegetation, ecology

Kelly D.L., Kirby E.N. (1982): Irish native woodlands over limestone. In: White J. (ed.) Studies on Irish Vegetation. Royal Dublin Society. Dublin, 181-198.
Abstract: The history and phytosociology of Irish native woodland on free-draining soils over limestone are described. The structure of present-day scrub and forest and their successional

status in relation to other woodland communities are discussed. The probable history of the major tree species is outlined in the light of palynological evidence.
We consider that the normal community of both scrub and forest belongs floristically to the association *Corylo-Fraxinetum* (Br.-Bl. & Tx. 1952), as here emended. We subdivide the redefined association into a neckeretosum subassociation of rocky limestone terrain, a veronicetosum subassociation of leached soils, and a species-poor typicum subassociation.
Key-words: Phytosociology, woodland vegetation, woodland ecology

White, J. & Doyle, G.J. (1982): The vegetation of Ireland: a catalogue raisonné
In: White, J. (ed.): Studies on Irish Vegetation. Royal Dublin Society, Dublin, 289-368
Abstract: A comprehensive review of the vegetation of Ireland, as described to date in phytosociological accounts. Vegetation associations that have been described for all habitat types, including woodland and scrub communities, are placed in context and their phytosociology discussed.
Key-words: Phytosociology, vegetation classification

Palynology & Woodland Dynamics

Bradshaw R.H.W. (1988): Spatially precise studies of forest dynamics
In: Huntley, B. and Webb III, T. (eds.): Handbook of Vegetation Science, Volume 7: Vegetation History. Junk. Dordrecht.
Abstract: Small wet hollows, accumulations of mor humus and soils of low biological activity can all preserve pollen under closed forest canopies. Such sites recruit most of their pollen from the surrounding 20-30m, and therefore permit vegetation reconstructions of high spatial resolution. Problems with poor pollen preservation and accurate dating can occur, but temporal resolution can be high, and information can be obtained about taxa that are poor pollen producers, and that are therefore poorly recorded in the larger basins usually studied by palynologists. Case studies presented here, from northwest Europe (i.e. Denmark, Sweden & Ireland) and U.S.A., show how spatially precise studies of forest dynamics can complement regional pollen studies and bridge a gap between conventional pollen analysis and present day plant ecology. "Successional" studies of discrete communities can benefit most from closed canopy pollen analysis.
Key-words: Palynology, vegetation history, forest succession, woodland dynamics

Dodson J.R., Bradshaw R.H.W. (1987): A history of vegetation and fire, 6,600 B.P. to present, County Sligo, western Ireland
Boreas 16, 113-123
Abstract: Two lake sites on metamorphic rocks with small catchments and one mor humus deposit have been analysed to assess the relative influence of fire, man and climate upon the regional and local vegetation of the Lough Gill region of county Sligo. The vegetation of the area was dominated by mixed woodland from 6,600 B.P. to 600 B.P. The first evidence of human impact on the forests was around 5,400 B.P. in the form of clearance for pasture. The intensity of human impact varied between sites, and there were periods of forest recovery as well as decline. From 600 B.P. widespread forest destruction took place, and pasture with heathland became predominant. *Pinus sylvestris* had a major presence until about 5,400 B.P. It declined from this time and had a patchy distribution by 2,000 B.P. The decline of *Pinus* was linked with the expansion of treeless peatland in what are presumed to be wet periods, and *Pinus* recovery in drier periods. Fire may have encouraged the spread of peatland at the expense of *Pinus*. Arbutus unedo pollen was found at Slish Lake as early as 1,900 B.P., suggesting that it is native to this area. Isolated trees survive today at woodland edges. Charcoal particles occurred in all the

profiles. Fire was particularly associated with heathland communities, and may have been used as a management tool to improve grazing conditions. Some of the phases of woodland decline correlate strongly with charcoal inputs suggesting forest destruction by fire.
Key-words: Palynology, forest succession, fire, *Pinus sylvestris*, *Arbutus unedo*

Hannon G.E., Bradshaw R.H.W. (1989): Recent vegetation dynamics on two Connemara lake islands, western Ireland
Journal of Biogeography 16, 75-81
Abstract: Primary woodlands are of scientific interest for the study of natural population dynamics and of conservation interest because of their formerly widespread distribution in Europe. Field recognition of primary woodland based on the present vegetation alone can be very difficult, and no system for recognition of such sites has been established in Ireland. Many Connemara lake islands support dense, low woodlands that have been proposed to be representative of Irish ancient woodland. Thick mor humus layer cover these islands, which form a contrast with the treeless mainland covered by blanket peat.
Pollen analysis of the humus layers from two islands of different size revealed that the present woodland was about 300 years old, and both islands were cleared of trees before that time. An earlier phase of more diverse woodland on the larger island pre-dated the clearance. Several woody taxa colonised the islands after the clearance episode, and *Taxus baccata* L. was an early dominant in the absence of grazing. *Quercus petraea* (Mattuschka) Liebl. became established on the larger island, but failed to dominate, and *Ilex aquifolium* L. became the most abundant species, both as mature trees and as seedlings.
Pollen analysis of more humus is an ideal method for establishing the recent history of an individual woodland, and also for examining successional relationships between woody taxa that cannot be easily ascertained from studies of contemporary woodland.
Key-words: Palynology, mor humus, ancient woodland, woodland succession, lake islands

Jessen K. (1949): Studies in late Quaternary deposits and flora-history of Ireland.
Proceedings of the Royal Irish Academy, 52B, 85-290
Abstract: Palynology, the study of pollen, seeds and other plant parts which are preserved in sediments, was pioneered in Ireland by Knud Jessen, the Danish researcher. Irish peat deposits and lake sediments proved very suited to this type of analysis. His studies illustrated, for the first time, the pattern of forest development and subsequent formation of open peatlands, on a regional scale, during the Post-glacial period in Ireland.
Key-words: Palynology, woodland development, woodland decline

Mitchell F.J.G. (1988): The vegetational history of the Killarney oakwoods, SW Ireland: evidence from fine spatial resolution pollen analysis
Journal of Ecology 76, 415-436
Abstract:
(1) Pollen data from small hollows in two woods in the Killarney Valley are presented. These data illustrate woodland vegetation dynamics for at least the last 5,000 years. Pollen-vegetation correction factors for the major tree taxa in Killarney are also presented.
(2) The small hollow pollen data are compared with previously unpublished regional pollen data from Killarney. This comparison indicates that the regional pollen data lack sufficient spatial resolution to detect isolated woodland disturbances or establish past woodland composition.
(3) The past woodland in Killarney was more diverse than today and Pinus was an important component. The reduction in diversity is associated with man-induced disturbance.
(4) Historical documents are considered in association with, and independently of the pollen data, to quantify the more recent woodland disturbance in the Killarney Valley.
(5) The status of the Atlantic bryophyte communities in the area is considered.

Key-words: Palynology, woodland disturbance, woodland dynamics

Mitchell F.J.G. (1990a): The impact of grazing and human disturbance on the dynamics of woodland in S.W. Ireland. Journal of Vegetation Science. (1): 245-254
Abstract: Pollen data from three mor humus profiles taken from within native woodland in the Killarney National Park are presented. The pollen records illustrate the woodland history over about 250 years.
The dynamics of woodland on the mainland are compared with those of a small ungrazed lake island. Human disturbance of the woodland in the form of felling and burning is recorded at both locations.
Following the disturbance, open vegetation predominated in which Arbutus unedo was widespread. This species declined as canopy woodland re-developed.
The pollen records illustrate the dynamics of the developing woodland during which the role of *Ilex aquifolium* and *Taxus baccata* was strongly influenced by grazing. The past importance of *Taxus baccata* in western Irish woodland is considered.
Key-words: Palynology, Arbutus unedo, mor humus, vegetation dynamics, woodland disturbance, woodland succession

Mitchell F.J.G. (1990b): The history and vegetation dynamics of a yew wood (*Taxus baccata* L.) in S.W. Ireland
New Phytologist 115, 573-577
Abstract: Reenadinna Wood is one of the largest *Taxus baccata* dominated woods in Ireland and Britain. It is therefore of considerable ecological and conservation interest [note: the wood is within the Killarney National Park]. To investigate the history and dynamics of the wood, pollen data from a small hollow within the wood are described. These data are compared with the regional pollen record and local historical and archaeological information. The yew wood appears to have developed at least 3,000, but probably 5,000 years ago from a wood previously dominated by pine, oak, elm and hazel. There is evidence to suggest that the wood has been disturbed by periods of patch cultivation and site occupancy.
Key-words: Palynology, *Taxus baccata*, vegetation dynamics, woodland history

Mitchell G.F., Ryan M. (1997): Reading the Irish Landscape
Town House, Dublin.
Abstract: A comprehensive account is presented, of the development of the Irish landscape and vegetation since the first recovery after the last Ice Age, c. 13,000 B.P. The early development of vegetation is described, based on palynological data available for Ireland, and the character of the early forests is outlined. Early human influence on the landscape and forests is discussed, with accounts of the development of agriculture and the subsequent demise of the primeval forests. This account combines palynological, geological, botanical, zoological and archaeological data, to interesting effect.
Key-words: Vegetation history, landscape history, human influence

Dendrochronology

Baillie M.G.L., Brown D.M. (1995): Some deductions on ancient Irish trees from dendrochronology
In: Pilcher J.R., Mac an tSaoir S.S. (eds.): Wood, Trees and Forests in Ireland
Royal Irish Academy, Dublin, 35-50.
Abstract: The collection and dating of some thousands of Irish oak specimens from all periods in the last seven millenia allow a basic description of the general character of oak in Ireland. This paper looks at some parameters such as age structure, size and growth rate for different classes of timber, namely modern oaks, bog oaks and archaeological trackway oaks. The results are not

always self-evident. Additional information is presented on the frequency of oak survival with time. This demonstrates periods of abundance and depletion, which almost certainly relate to anthropogenic factors which may themselves be dependent on overriding environmental conditions.

Key-words: Dendrochronology, *Quercus petraea, Q. robur*

Pilcher J.R., Baillie M.G.L. (1980): Six modern oak chronologies from Ireland
Tree-ring Bulletin 40, 23-34

Abstract: Six modern oak tree-ring chronologies from Ireland are presented. All are from planted or from disturbed-natural woodland of *Quercus petraea*. The final chronologies were tested for climate content by the response function method. The results range from 5% to 52% of the chronology variance explained by temperature and precipitation of a 14-month period during and prior to the growing periods. The relationship between the individual chronologies to each other is examined and the hypothesis put forward that Ireland can be considered as a single tree-ring area from a dating viewpoint.

Key-words: Dendrochronology, climate, *Quercus petraea*

Soils

Cunningham D.A., Farrell E.P., Collins J.F. (1999): Soil responses to land-use change – a study in south-west Ireland
Forest Ecology and Management 119, 63-76

Abstract: Two sets of soils, one developed under semi-natural woodland and a second in an adjacent non-wooded site, were studied to elucidate the effects of land-use change on soil development. Pollen analysis, supported by 14C dating, was used to reconstruct the vegetation history of the non-wooded site, and to confirm historical documentary evidence that woodland clearance occurred c. 350 years B.P. Oakwood clearance has resulted in changes in soil morphological, physical and chemical properties. Increased effective precipitation and reduction in nutrient cycling has caused greater podzolisation in well drained areas and has resulted in a greater degree of hydromorphism in the poorly drained areas. The accumulation of surface organic material, evident in many of the soils in the cleared area, with or without the development of an iron-pan, is a precursor to the formation of blanket peat.

Key-words: Soils, woodland clearance, land-use change, podzolisation

Little D.J., Collins J.F. (1995): Anthropogenic influences on soil development at a site near Pontoon, Co. Mayo
Irish Journal of Agricultural and Food Research 34, 151-163

Abstract: Modification of soil profile development as a result of successive phases of disturbance at a site that almost certainly supported woodland up to c. 1750 A.D. is discussed. The interruptions include: final clearance of woodland vegetation in the latter half of the 18th century following which tillage cropping with oats and potatoes is believed to have become progressively more intense up to 1840/50 A.D.; a likely decline in tillage to the 1930's; and lastly, a change to marginal pasturing accompanied by the development of a *Pteridium/Calluna* vegetation to the present. The resultant soil is compared with one which has had a continuous woodland vegetation, dominated by Quercus petraea and Ilex aquifolium. Data are presented for two soil profiles, one under semi-natural oak woodland, the other on a previously cultivated site located nearby. Both were located in an area dominated by peaty, iron-pan podzols derived from a parent material dominated by granitic till in Co. Mayo. The Wooded profile had analytical and morphological properties typical of a well-developed humus-iron podzol with spodic and albic horizons clearly expressed beneath a dark, fibrous and peaty surface organic mat. The Non-

wooded soil differed by having a fibrous, peaty surface organic horizon over a new sequence of horizons in the abandoned plough layer. It had higher values of pH, base saturation and extractable aluminium species, and lower values of exchangeable hydrogen, calcium, magnesium, potassium and extractable iron species.
Key-words: Soils modification, podzols, forest clearance, iron speciation

Little D.J., Farrell E.P., Collins J. (1997): Land-use legacies and soil development in semi-natural ecosystems in the marginal uplands of Ireland
Catena 30, 83-98
Abstract: The relationships between semi-natural oak woodlands and the podzolic nature of their soils were investigated at 14 wooded and 9 non-wooded sites located in otherwise similar environments in Ireland. Historical records and palynological data were used to evaluate vegetation-soil dynamics and land-use history for both site types. Wooded site podzols were found to have mor- or moder-like O horizons, a distinctive eluvial-illuvial sequence and were generally friable and deeply rooted. Non-wooded soils differed in having deeper, more fibrous Of horizons, E horizons with fragipan-like characteristics, and spodic B horizons frequently containing thin ironpans that restricted vertical rooting. There were appreciable amounts of mobile, organically-complexed and inorganic, poorly crystalline iron, especially in the spodic upper B horizons of most sites. This suggests that podzolisation was, and continues to be, a dominant process in virtually all the soils studies. Podzolisation may have been initiated by the presence of *Pinus* and episodic natural and/or anthropogenic fires. The *Pinus* climax occurred c. 8,000 B.P. and this species persisted regionally to c. 4,000 B.P. Though podzolisation is still the dominant soil process at the wooded sites, the presence of oak seems to retard podzolisation compared to non-wooded sites, where acidophilous species such as *Calluna vulgaris* dominate.
Key-words: Podzols, oakwoods, land-use history, vegetation-soil dynamics

Biodiversity

Brown A.G. (1998): The maintenance of biodiversity in multiple-channel floodplains
In: United Kingdom Floodplains. Westbury Publishing.
Abstract: There is evidence that multiple-channels characterise northwest European floodplains prior to deforestation and channelisation. Multiple-channel floodplains have high biodiversity due to high ecotone/area ratios. Two examples are used to describe how diversity is brought about. The Gearagh in southwest Ireland is one of the last semi-natural forested floodplains in Europe, and illustrates the processes which maximise floodplain forest diversity. Here, windthrow and debris dams allow the co-existence of organisms with different ecological requirements. The Ae in Scotland, a braided/wandering bedded river is a partly deforested multiple-channel floodplain and shows the creation of backwaters by the deposition of gravel bars around large debris.
The implications of these examples for floodplain restoration and management are discussed and considered to be compatible with the use of floodplains for flood storage.
Key-words: Geomorphology, alluvial forest, biodiversity

Fahy O., Gormally M. (1998): A comparison of plant and carabid beetle communities in an Irish oak woodland with a nearby conifer plantation and clearfelled site
Forest Ecology and Management 110, 263-273
Abstract: In 1996, plant and carabid beetle communities were examined in a semi-natural oak woodland (Derryclare Wood) and compared with communities of a nearby mature conifer plantation and a plantation clearfelled in 1994. At each site, 10 quadrats (2mx2m) and 10 pitfall traps were used to sample the ground vegetation and carabid beetle communities respectively.

Forty-one plant species were recorded in the oak woodland while 38 species were found in the clearfelled site and 19 species in the conifer plantation. The median plant-species richness per quadrat was significantly greater ($p<0.01$) in the oak woodland (16.5) than in the other two sites and the clearfelled site (11) was significantly more species-rich ($p<0.02$) than the conifer plantation (6.5). A total of 21 carabid species (895 individuals) were captured, with 74.5, 13.9 and 11.6% of individuals being caught at the oak woodland, clearfelled site and conifer plantation, respectively. The median number of carabid species per pitfall trap was significantly greater ($p<0.01$) in the oak woodland (6) than in the clearfelled site (3.5) and conifer plantation 920. In addition, median species richness per pitfall trap was significantly higher in the clearfelled site than in the conifer plantation at $p<0.02$. Median diversity per pitfall trap was also significantly less in the conifer plantation (1.19) than in the oak woodland (2.43, $p<0.01$) and clearfelled site (1.55, $p<0.05$). While the Sorenson similarity index for both vegetation and carabids shows that the conifer plantation and the clearfelled site were most similar in species composition, nevertheless, the clearfelled site has demonstrated signs of increasing species only 2 years after clearfelling. It is concluded that while semi-natural woodlands support a greater range of species than conifer plantations, clearfelled areas that are not replanted can enhance species richness within commercial conifer plantations.

Key-words: Vegetation, woodland, carabidae, ground beetle, species richness

Little D.J., Bolger T. (1996): The effects of contrasting land-uses on soil properties and animal communities in Brown Earth soils

Biology and Environment. Proceedings of the Royal Irish Academy 95B, 183-193

Abstract: An investigation of contrasting land-uses on Brown-Earth soils in eastern Ireland indicated modification of physical, chemical and morphological soil properties co-incident with changes in soil animal diversity and abundance. The study area consisted of three adjacent plots, which had comparable histories until the early 1950's, but were then individually planted with Norway spruce, ash and grasses. Forth-three years of Norway spruce monoculture increased acidity, reduced nutrient recycling, induced some mobilisation of organo-metallic complexes and reduced the numbers and species of earthworms. A moder-like surface organic layer developed. Under a 44-year-old ash stand, pH and total exchangeable bases, especially Mg and K, were maintained at high values. These were c. 2 times greater than those in the A1 horizon under spruce, and 7 and 3.5 times greater, respectively, than those in the A1 horizon under pasture. High biological activity was reflected by an appreciable diversity and abundance of arthropod and earthworm species. Amounts of Fea and Fep species in the A1 horizon were 2 and 10 times lower, respectively, than in the A1 horizon under spruce. Fertility of the pasture soil was maintained as indicated by high Ca values and high biological activity. The absence of an organic surface horizon was reflected in lower organic matter and total nitrogen contents compared to the forested soils. Very low levels of Fea and Fep species were found in the topsoil. Bulk density was higher under pasture than in the forested soils. The microarthropod species found in each land-use reflected differences in micro-habitat conditions, especially litter quality, and earthworm diversity was affected by alternative management practices.

Key-words: Contrasting land-uses, biodiversity, soil modification

O'Halloran J., Walsh P.M., Giller P.S., Kelly T.C., Duffy B. (1998): An assessment of avian biodiversity and opportunities for enhancement in Ireland's forests: preliminary results

Irish Forestry 55, 2-14

Abstract: Forest expansion in Ireland has led to concern for the characteristic plant and animal communities associated with the planted land. If carefully planned, however, forestry may provide opportunities for conservation and enhancement of biodiversity. This study sets out to provide systematic data on bird assemblages in Irish plantation forests, and to suggest ways in which the biodiversity, as represented by birdlife, might be enhanced. Preliminary data are

presented on the general bird assemblages of „mature" (pole-stage) forests in southwest Ireland during spring/summer, autumn and winter 1996/97, and on bird/habitat relationships. A total of 38 bird species was recorded within the 20 forest compartments studied, with goldcrest (Regulus regulus) being the most abundant and widespread. Some species showed marked seasonal variation in forest usage. Habitat factors which showed a positive relationship to bird species richness and/or bird density included, on varying scales, the number of broadleaf species present, proximity to forest edge, and the amount of undergrowth. Some bird species also showed evidence of association with particular species of conifer.
Key-words: Bird diversity, conifers, tree species, forest edge

Rackham O. (1995): Looking for ancient woodland in Ireland. In: Pilcher J.R., Mac an tSaoir S.S. (eds.): Wood, Trees and Forests in Ireland. Royal Irish Academy. Dublin, 1-12.
Abstract: This paper is concerned not so much with Irish woodland history in general as with the question of whether historic woods, or remains of them, still exist in the Irish landscape. Evidence for woodland history comes from various independent sources: documents, pollen analysis, and the archaeology, structure and vegetation of ancient woods as they are now. All these need to be pursued simultaneously if a true story is to be reconstructed. Irish woods turn out to have a history not very different from that of England or most of Europe, except that Ireland has always had relatively little woodland and little of the evidence has survived the last 300 years. Ancient woods do exist, however precariously, and need to be recognised and studied before it is too late.
Key-words: Woodland history, woodland conservation

Speight M.C.D. (1989a): The Irish Elaterid and Buprestid fauna (Coleoptera: Elateridae and Buprestidae)
Bulletin of The Irish Biogeographical Society 12, 31-62
Abstract: A revised list of Irish Cerambycidae is presented. three species are removed from the list and one, Nathrius brevipennis, is added. The cerambycid fauna of Ireland is compared with that of Great Britain and Northern France. It is suggested that the unexpectedly small number of species associated with oak and elm in Ireland is due primarily to eradication of much of the fauna by man's forest-clearing activities during the historic period. It is concluded that colonisation of Irish deciduous woodland by additional cerambycid species is extremely unlikely in the foreseeable future, even with appropriate woodland management. Cerambycid species that can be recognised as now threatened with extinction in Ireland are indicated.
Key-words: Invertebrate fauna, cerambycids, forest removal

Speight, M.C.D. (1989b): Saproxylic invertebrates and their conservation. Nature and Environment Series, No. 2. Council of Europe. Strasbourg.
Abstract: Saproxylic invertebrates are species of invertebrate that are dependent, during some part of their life cycle, upon the dead or dying wood of moribund or dead trees (standing or fallen), or upon wood-inhabiting fungi, or upon the presence of other saproxylics. This paper presents European data on saproxylic invertebrates gathered by a Council of Europe Consultant's Group, whose aims were:
a) aiding in the process of identifying forests of international importance for nature conservation;
b) aiding in the conservation of a diverse and seriously threatened assemblage of invertebrates important in the recycling of energy and nutrients in natural forest.
This extensive review discusses the many aspects of the habitat requirements of saproxylic invertebrates and forest ecology, and presents a list of rare species, and a list of European forests identified as being of potential international importance by their fauna of saproxylic invertebrates. The latter includes forests in Austria, Belgium, Cyprus, Denmark, Federal Republic of Germany, Finland, France, Greece, Italy, Liechtenstein, Norway, Spain, Sweden,

Switzerland and U.K.
Key-words: Saproxylic invertebrates, dead wood, forest ecology, threatened species, forest conservation

Webb D.A. (1983): The flora of Ireland in its European context. Journal of Life Sciences, Royal Dublin Society 4, 143-160
Abstract: The Irish flora is reviewed in relation to its European distribution. If Pteridophytes, doubtfully native species (including most weeds), apomicts and other critical taxa of uncertain distribution are excluded, the flora amounts to 815 species as against 1,172 for Britain. The traditional explanation for this discrepancy (the earlier isolation of Ireland in post-glacial times) is seen to be only partly true; one half of the British species absent from Ireland can be regarded as being excluded by ecological factors. Although many Irish species have a wide distribution outside Ireland, less than half can be regarded as Pan-European. 73 Irish species have a more or less Atlantic or Mediterranean-Atlantic distribution; these terms are defined more closely than has been customary and the list of species revised accordingly. The arctic-alpine group is also discussed critically, and seen to contain only 16 species. The 15 Irish species not found in Britain are considered in detail; maps illustrate their unusually large disjunction from their nearest stations on the continent. It is concluded that for most of them the supposition that they survived the last glaciation in Ireland or on land now submerged off its west coast is less unlikely than any alternative explanation.
Key-words: Native flora, plant diversity, biogeography

Wilson J. (1977): Some breeding bird communities of sessile oak woodlands in Ireland. Polish Ecological Studies 3, 245-256
Abstract: An account is given of an investigation of the breeding bird communities of four sessile oak [*Quercus petraea* (Mattuschka)] woodlands in Ireland. The density of breeding birds was found to range from 979-1,555 pairs/km^2 and a total of 29 territory holding species were recorded. Some species showed changes in density from plot to plot which could be directly related to differences in the structural complexity of the woodlands brought about by grazing and man. A comparison with similar data from sessile oak woodlands in Scotland and Wales demonstrated quite dramatic differences between their breeding bird communities. It is argued that destruction and fragmentation of native woodlands rather than either the existence of zoo-geographical barriers or operation of the „island effect" is the main reason for Ireland's depauperate woodland avifauna.
Key-words: Bird diversity, oak woodland, human influence