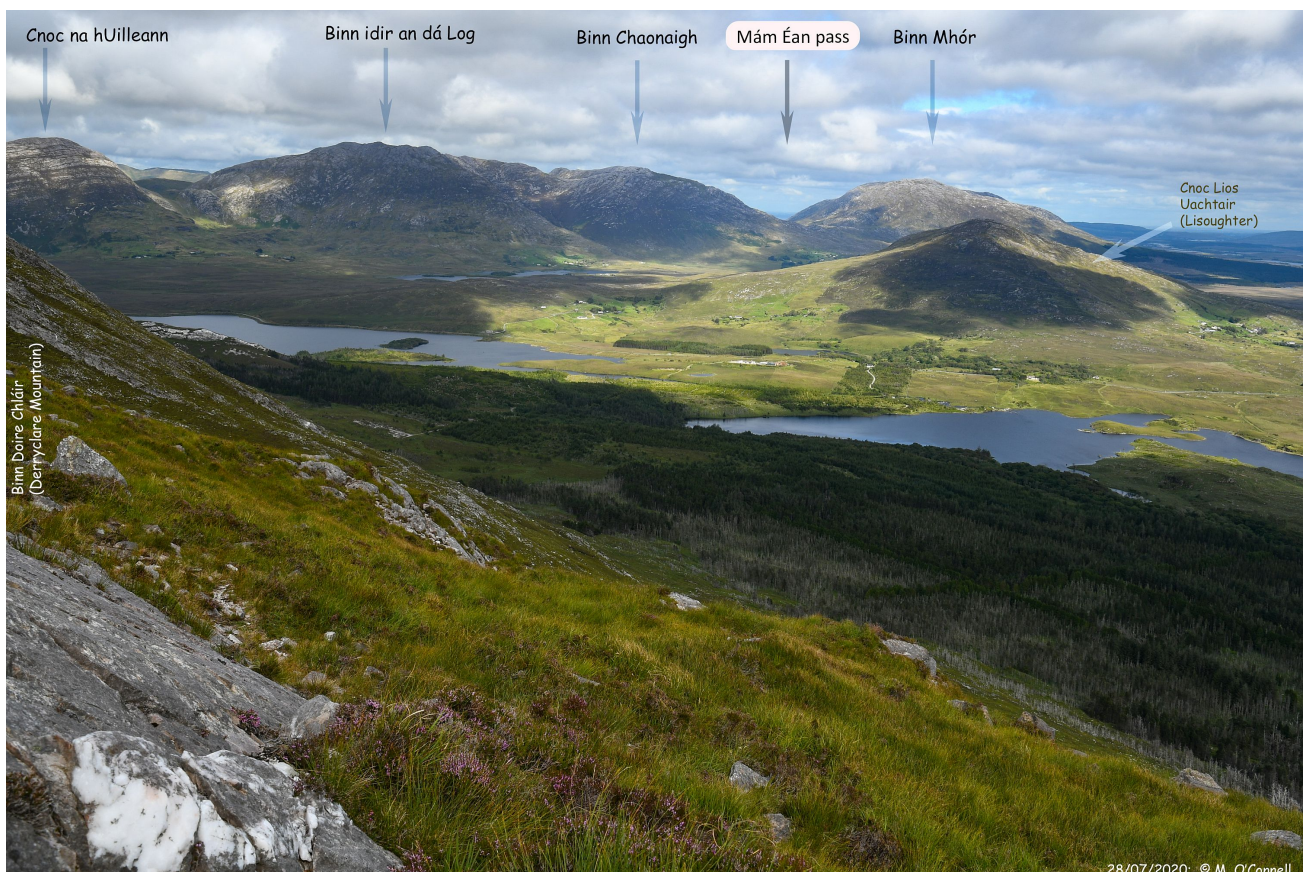


## Advances in the study of post-glacial environmental change with particular reference to western Ireland

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### *Uplands in western Ireland — a long-term perspective*

Irish uplands are invariably treeless, i.e. at least prior to recent large-scale afforestation, largely covered by bog and heath, and support extensive grazing, often but not exclusively, by sheep. A detailed history of how these important landscapes evolved and the factors involved in bringing about the many changes that have shaped them — including geology, natural processes, climate and human impact — has yet to be written. A paper recently published in *Review of Palaeobotany and Palynology* is a contribution towards this end<sup>1</sup>. The publication focusses on Mám Éan, a corrie lake at the top of a pass in the Maumturk Mountain Range, central Connemara (Figs 1 and 2).



**Fig. 1.** View of the Inagh Valley and Maumturk Mountain Range from Derryclare Mountain (Twelve Bens). Photo: 28/08/2020; M. O'Connell.

The site, often referred to by its anglicised name 'Maumeen', is well known for its association with St Patrick and has long been the site of pilgrimage or pattern (Fig. 3). A 4 m-long sediment core from this small lake has provided a palaeoenvironmental record that spans the Holocene, i.e. the post-glacial period. These sediments, initially investigated in the context of research towards a PhD

<sup>1</sup> O'Connell, M. 2021 Post-glacial vegetation and landscape change in upland Ireland with particular reference to Mám Éan, Connemara. *Review of Palaeobotany and Palynology*, 104377, <https://doi.org/10.1016/j.revpalbo.2021.104377>

by C.C. Huang<sup>2</sup>, have been revisited, all available data have been re-evaluated and a new synthesis made.



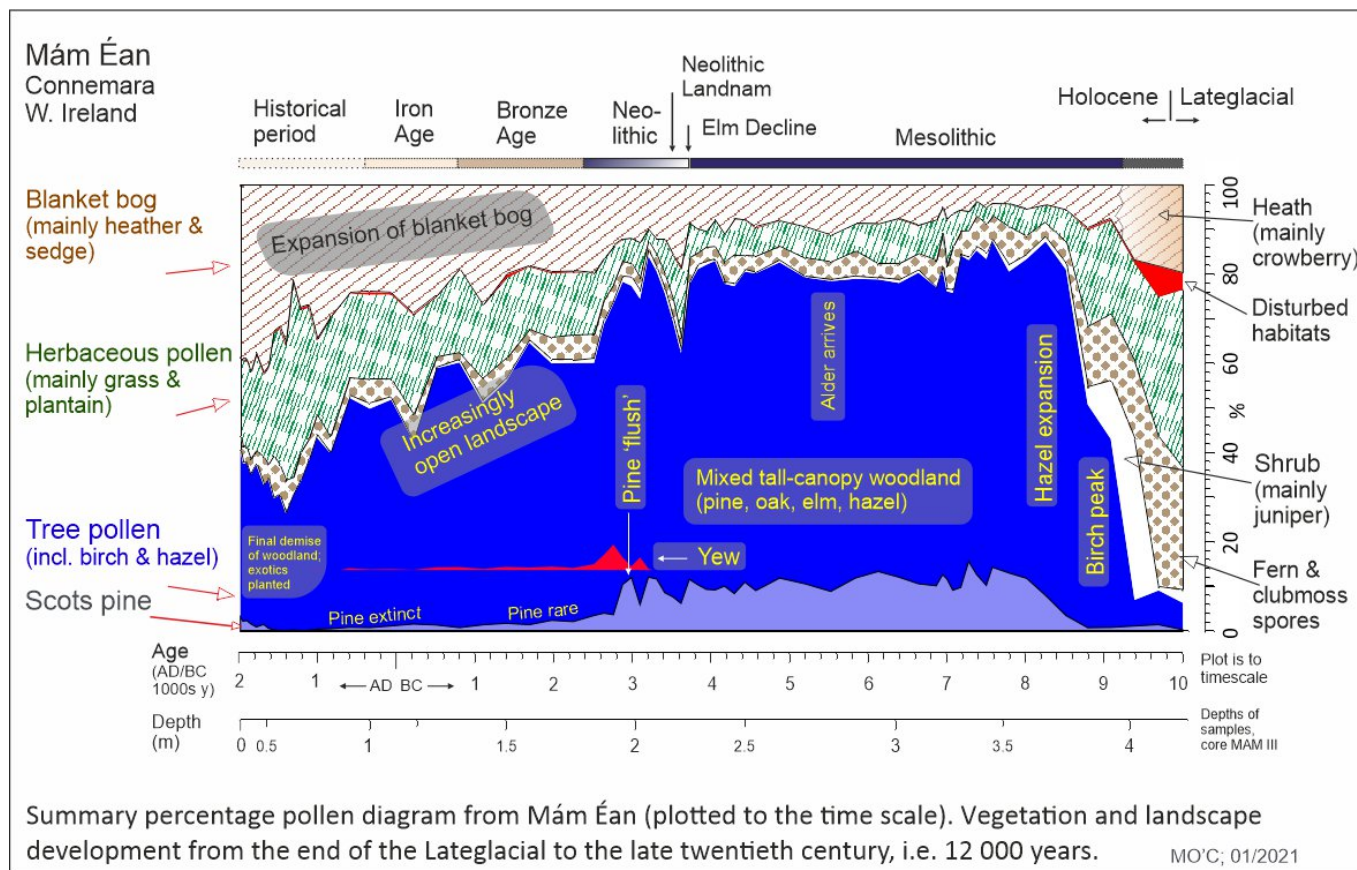
**Fig. 2.** View of the treeless landscape at the pass at Mám Éan showing the statue to St. Patrick and the corrie lake (max. depth: ~5 m). Photo: 15/03/2020, M. O'Connell.



**Fig. 3.** Hand-coloured, engraved print depicting a pattern in the early nineteenth century at Mám Éan (view from the southern approach; Bartlett and Griffiths, 1835). Note the complete lack of woody vegetation then as now.

<sup>2</sup> Huang, C.C. 1994. *Multi-disciplinary studies of lake sediments towards the reconstruction of Late-glacial and Holocene environments in western Ireland*. PhD thesis, Department of Botany, UCG (NUIG), 234 pp.

As is obvious from the graphical summary of fossil pollen and other data shown in Fig. 4, the local and regional environment in this part of Connemara has seen many changes during the course of the last 12 000 years, i.e. since the end of the last Ice Age. As temperatures rose and soils developed, the open treeless landscapes at the beginning of the post-glacial were transformed by the rapid expansion of shrubs and especially juniper. This was followed quickly by birch and hazel. Then tall canopy trees, including pine, elm and oak and finally alder, arrived and expanded to varying degrees to give more or less full woodland cover. Bog too was present from an early stage though it was not until the early Bronze Age, about 4300 years ago, that widespread bog expansion took place.



**Fig. 4.** Environmental change at Mám Éan — an overview.

Once farming commenced in the early Neolithic (ca. 5700 years ago), open landscape began to inexorably expand but yet, as the blue (tree pollen) component in Fig. 4 shows, the situation remained highly dynamic in that woody vegetation recovered whenever the opportunity presented itself. Such opportunities arose as a result of less grazing pressure, which, in turn, reflects a decline in farming and overall human activity that undoubtedly also involved population decline.

In the publication, these long-term changes at Mám Éan are discussed in the context of what is known about vegetation patterns in Connemara generally and also the changes taking place in the wider region and especially the Nephin uplands of Mayo. This region, sometimes referred to as 'Wild Nephin' because of its expansive upland wildernesses, lies immediately to the east of Achill, and is partly within Ireland's most recently established National Park, i.e. Ballycroy National Park.

Another aspect that receives special attention is the phenomenon of bog-deal and particularly bog-pine. Pine stumps and occasionally trunks are a feature of most blanket bogs in Ireland and Britain,

including upland blanket bog (Fig. 5). Results of radiocarbon-dating of bog-pines from uplands in Connemara, Kerry (mainly the Killarney area), and also west Cork and Wicklow, are presented. While there is a considerable spread of dates, many of these timbers are shown to be about 5000 years old. The increasing scarcity of dates thereafter is also noteworthy. In fact, dates younger than ca. 3500 years ago are seldom recorded, reflecting no doubt the scarcity of pine and especially the greatly increased wetness of bog surfaces generally that effectively ruled out these as potential habitats for pine.



**Fig. 5.** Sampling pine stumps in the Hag's Glen, Killarney, Co. Kerry. Peat cutting has exposed many pine stumps beneath shallow covering of blanket bog. This particular stump appears to have been blown by the wind. Photo: 24/08/2010, M. O'Connell.

The publication is Open Access (OA) thanks to a recent agreement between the journal publisher, Elsevier, and the Consortium of Irish Higher Education Institutions. So the paper itself and also the many supplementary files associated with the paper are available on and freely downloadable from the journal website<sup>3</sup>.

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<sup>3</sup> <https://www.sciencedirect.com/science/article/abs/pii/S0034666721000014>

## **Archiving palaeoecological data generated in the period ca. 1975–2010 in the Palaeoenvironmental Research Unit (PRU), NUIG**

On retirement in January 2011, I set myself a general goal of writing-up still ongoing investigations, i.e. mainly investigations relating to Co. Sligo. Another important goal was to archive palaeoecological investigations that had been carried out in the PRU over several decades<sup>4</sup>. This has involved compilation of various data relating to these investigations, many of which were completed in the context of postgraduate degrees (eleven and eight PhD and MSc theses, respectively) and, in some instances, research projects to which Fourth Year BSc (Hons) students contributed substantially. These investigations were carried out in the Department of Botany, sometimes in co-operation with the Department of Archaeology<sup>5</sup>. In many instances, several papers resulted from individual projects but, in some cases, the projects were only partly and perhaps not published at all! In the case of the latter, there may be little available up to now by way of permanent records.

The main body of data generated relates to pollen analytical investigations. Fortunately, care was taken from the beginning to collate and archive data. Records of pollen counts<sup>6</sup> were stored and continue to be curated in the PRU. From the beginning, all records were computerised. Most of these records were processed and stored on mainframe Digital VAX computers, and pollen data were plotted (so-called pollen diagrams) on large roller plotters using in-house FORTRAN programs (I even found the time to write these!) that employed GINO-F routines. Computer Services, centrally organised and headed-up for much of this time by Bobby Curran, was crucial to these activities<sup>7</sup>. Many of these university-centralised facilities moved to personal PCs from the mid-1980s onwards, a transformation that was largely completed with the discontinuance of BODKIN, a Digital VAX 6610 mainframe computer, in 2008. Fortunately, all data (stored in ASCII format on BODKIN; backups on magnetic tape) were transferrable to PC-based systems. In the meantime, conversion of records to PC-compatible programs continues as data are prepared for archiving<sup>8</sup>.

The database chosen for archiving the data and making them publicly available is PANGAEA ([www.pangaea.de](http://www.pangaea.de)), an e-publisher in Bremenhaven, Germany, that provides database facilities for many types of palaeoenvironmental proxies<sup>9</sup>. In compiling the data, attention has not only been

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<sup>4</sup> PRU was established in the mid 1980s in the Department of Botany, University College Galway (UCG; the name change to National University of Ireland Galway (NUIG) took place in 1997, following on from the Universities Act 1997 that facilitated the change). The PRU continued within Botany until 2000, when it transferred to Geography (within the then School of Geography and Archaeology; now the School of Geography, Archaeology and Irish Studies).

<sup>5</sup> Technical assistance, provided over many years by Patrick O'Rafferty and in earlier years by Pádraig Cooke (both Department of Botany), is gratefully acknowledged. Contributions of individual researchers, including students, are detailed in the relevant PANGAEA entries.

<sup>6</sup> In many instances, 1000 pollen were identified and counted per sample; numbers of samples per project varying from some 10s of samples to >300 samples in the case of An Loch Mór, Inis Óirr (analyst: K. Molloy). A comprehensive collection of pollen reference slides was created to aid pollen identification to the lowest level of taxonomic identification (to species level where possible) using high magnification, light microscopy.

<sup>7</sup> The staff of Computer Services are thanked for the great service provided over many years; in particular, thanks to George Deacy, the long-time Operations Manager. Dorothy O'Regan is thanked for providing information regarding Computer Services.

<sup>8</sup> Ingo Feeser is thanked for writing the program CountPol that not only facilitates pollen data calculations and plots pollen diagrams (the successor to PLOTPN, the mainframe program) but also enables conversion of PRU data to spreadsheet (Excel, etc.) format.

<sup>9</sup> Diepenbroek, M. (2018). PANGAEA — Data publisher for earth & environmental sciences. *PAGES Magazine* 26 (2), 59. Stefanie Schumacher is thanked for careful checking of submissions to PANGAEA and converting the pollen data to rotational database format.

given to pollen but also to other details (so-called metadata) including locations of sampling sites, basin size, catchment characteristics and other features of importance for the interpretation of the data.

Macrofossil, physical and geochemical data, where available, have also been compiled. Dating evidence for individual core/profiles has been reviewed. This has involved re-calibration of radiocarbon dates and construction of new age-depth models that takes into consideration not only the results of <sup>14</sup>C dating but also other relevant chronological data. Photographs (scans of both prints and photographic slides) that document sampling and general site characteristics, at the time of sampling and later, are also provided.

Meanwhile, the job of collating the data of yesteryear and submitting them to PANGAEA continues.

### **Overview of PRU projects archived in PANGAEA**

(as of January 2021; see [www.pangaea.de](http://www.pangaea.de) for details)

#### *Co. Galway*

O'Connell, M. (2018). Holocene environmental reconstructions at Lough Namackanbeg, Spiddal, Co. Galway, Ireland: pollen and geochemistry [3 datasets]. PANGAEA, <https://doi.org/10.1594/PANGAEA.895299>

O'Connell, M. (2018). Late-glacial environmental reconstruction at Lough Namackanbeg, Spiddal, Co. Galway, Ireland: pollen and geochemistry [5 datasets]. PANGAEA, <https://doi.org/10.1594/PANGAEA.895340>

O'Connell, M. (2018). A Holocene pollen profile (FRK II) from Connemara National Park, Letterfrack, Co. Galway, Ireland [5 datasets]. PANGAEA, <https://doi.org/10.1594/PANGAEA.892677>

O'Connell, M. and K. Molloy (2018). Lough Sheeauns, Co. Galway (profile SHE III): a detailed record of the Elm Decline and Neolithic Landnam in north-west Connemara [5 datasets], PANGAEA, <https://doi.org/10.1594/PANGAEA.896784>

O'Connell, M. and C. C. Huang (2020). Mám Éan, Co. Galway, Ireland: a record of Holocene vegetation and landscape change from upland Connemara [5 datasets], PANGAEA, <https://doi.pangaea.de/10.1594/PANGAEA.922145>

#### *Co. Mayo*

O'Connell, M. (2018). Pollen analytical investigations at Carrownaglogh prehistoric field system, County Mayo, Ireland [7 datasets], PANGAEA, <https://doi.org/10.1594/PANGAEA.885701>

O'Connell, M. (2018). Holocene environmental reconstruction at Lough Doo, Co. Mayo, Ireland: pollen, chemistry and palaeomagnetism [3 datasets]. PANGAEA, <https://doi.org/10.1594/PANGAEA.892447>

O'Connell, M., Molloy K. and Jennings, E. (2020). Pollen analytical and bog-pine investigations relating to Céide Fields and Garrynagran, Co. Mayo, Ireland [26 datasets], PANGAEA, <https://doi.org/10.1594/PANGAEA.911684>