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Editors: Alexis FitzGerald & Ciarán Flynn

Silene acaulis (Moss Campion) in flower on Benbulben, Co. Sligo (**H28**). Photo E. Gaughan © 2023 (p. 81)

Contributions intended for *Irish Botanical News* No. 35

Should reach the Editors Mr. Alexis FitzGerald and Mr. Ciarán Flynn before December 31st 2024
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Please note the formatting style of references in this current issue and adhere to same before sending on contributions

Committee for Ireland

2023 – 2024

The following is the Committee as elected at the Annual General Meeting in the National Botanic Gardens, Glasnevin, on Saturday 21st October 2023. Office bearers were subsequently elected at the first committee meeting. The Committee is now:

Robert Northridge (Chair)
Shane Brien (Joint Hon. Secretary)
Kim Lake (Joint Hon. Secretary)
Mark McCorry (Vice-Chair and Field Meetings Secretary)
Oonagh Duggan (Treasurer)
John Faulkner
Ciarán Flynn
Jessica Hamilton
David McNeill
Cilian Roden

The following are nominated observers to the committee:
Lorna Somerville (Department of Agriculture, Environment and Rural Affairs)
Mike Wyse Jackson (National Parks & Wildlife Service)
Maria Long (Board of Trustees)
Jen Farrar (BSBI Northern Ireland Botanical Skills Officer)
Paul Green (Manager of the BSBI Targeted Aquatic Plants Project)

Draft Minutes of the BSBI Irish Branch AGM 2023 are available at:
http://governance.bsbi.org/ireland

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Any opinions expressed in the articles below are those of the authors and do not necessarily reflect the views of BSBI.

All species and common names in *Irish Botanical News* follow those in the database on the BSBI website http://rbg-web2.rbge.org.uk/BSBI/ and Stace, C. (2019). *New Flora of the British Isles*. 4th edition. C & M Floristics, Suffolk.

Front cover photo: *Arenaria ciliata* (Fringed Sandwort) in flower on Benbulben, Co. Sligo (**H28**). Photo E. Gaughan © 2023 (p. 81).

Notes & Articles

Notes from the BSBI Ireland Officer – Bridget Keehan

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Looking back over 2023

2023 was a great year for the BSBI in Ireland! In spite of less-than perfect weather, a total of 81,170 Irish records were submitted for 2023, thanks to our fantastic and dedicated team of County Recorders. Fifteen field meetings were held across all the corners of Ireland, including the truly spectacular BSBI Annual Summer meeting which this year was held in Killarney, Co. Kerry, from 19-22 May, and attended by 65 people, many travelling from the UK. It attracted lots of new botanists wanting to develop their skills, and really boosted the profile of the BSBI in Ireland to members from the UK. Added to this, seven Aquatic Plant Project workshops took place across the country, led by the inimitable Nick Stewart, with help from Paul Green, Cilian Roden, and local VCRs, which brought in lots of new records and refinds, and helped many people develop skills in aquatic plant ID.

As part of the launch of BSBI's Plant Atlas 2020, launch events were held in Ireland at Glasnevin, Dublin on 9th March (attended by the Minister of State for Heritage and Electoral Reform, Malcolm Noonan) and the National Museum of Northern Ireland, Belfast on 15th March. The Atlas made headlines in national media, rightly challenging governments to do more to protect the environment.

Two magnificent Conferences were held in Ireland in 2023, both at the National Botanic Gardens, Glasnevin. We really appreciated the freedom of being able to attend these in person again, after the years of restriction. The Spring Conference took place on Saturday, 22nd April and was attended by 90 people, while the Autumn Meeting and AGM was held on 22nd October, with around 75 attendees. If you missed them, you can view the programmes and talks on the BSBI website (https://bsbi.org).

In 2023, BSBI grew to its largest size in its history, with more new members joining than ever before. Membership in Ireland reached a new high of 497 members at the end of 2023 - an increase of 30% on the previous year. As we continue to grow, our goal is to make sure all members have opportunities to get involved with the work of the BSBI and develop their plant ID skills.

In autumn 2023, BSBI were delighted to launch 'BSBI eBooks': a new way to access and use BSBI's extensive catalogue of botanical handbooks and other publications, at a lower cost and without cluttering up your bookshelves! These digital versions are available at https://bsbi.org/ebooks. VCRs and Referees are entitled to free access to the entire digital collection, in recognition of the contribution of the time and effort they contribute to the life of BSBI. If you're a Referee or VCR, and haven't received the email directing you to this resource, please get in touch.

What's new?

BSBI is currently trialling a new recording app to assist with gathering records in the field. While MapMate remains the preferred mode of data entry for many VCRs, it is recognised that it is not compatible with all systems and so might not be the best choice for all recorders. If any Ireland VCRs haven't yet seen the app and would like to give it a try, I can send you a link to the information sheet which will direct you to the app – just let me know.

Following on from Michael Philip's inspiring talk on 'Botanical Networks' at our 2023 Autumn Meeting (accessible from the BSBI Autumn Meeting webpage), we are looking for recorders who might be interested in setting up, or joining, a new local Botanical Network in Ireland. Michael, a VCR himself who pioneered this approach in Scotland, has kindly offered to assist and mentor people wishing to set up such a group in Ireland. If this sounds interesting to you, please contact me (or Jen Farrar – jen.farrar@bsbi.org – if you are in Northern Ireland).

After Plant Atlas 2020 – what's next? BSBI will be launching a new Science Strategy this year, setting out the next phase of work we want to achieve to understand and conserve our wild plants. This will be unveiled soon, so keep a look-out!

New appointments in Ireland

As you will probably all know by now, I became Ireland Officer in summer 2023, when Paul Green retired from the role. Happily, Paul will continue as Targeted Aquatic Plant Project Manager for the 2024 TAPP season - and of course he remains a VCR for Co. Wexford, so his incredible knowledge and expertise is still to hand! Immense thanks are due to Paul for all his hard work as Ireland Officer, and also for his advice and support since handing over the role. Thanks for all the help and patience shown to me by VCRs too, as I settled into the post.

In October 2023, Jen Farrar became BSBI's first Northern Ireland Botanical Skills Officer, thanks to funding from DAERA. Jen previously worked as a botany lecturer and taught plant identification at Gatsby Plant Science Summer School. She is partially based in the DAERA offices in Belfast, but will travel widely across Northern Ireland to meet with VCRs, recorders and partners, and to deliver training. Jen has been very busy in her first few months in the role, meeting with VCRs, putting together a programme of NI training events for 2024/2025, and liaising with others on progressing the National Plant Monitoring Scheme (NPMS) in NI. She is also consulting with NI VCRs regarding the reconfiguration of the Rare and Scarce plant register with the rest of the UK. We wish her all the best in this exciting new role!

VCR News

It is great to report that Ireland now has a full house of VCRs, with at least one VCR in every vice-County. Co Cavan at last has its own VCR, since Aoife Delaney moved there last year and offered to take up the role, which had been vacant for several years. Aoife was previously co-VCR for Co Leitrim and is well-known for her work with NPWS where she is currently employed as Monitoring Ecologist.

Special thanks are due to Eamon Gaughan, who has agreed to continue single-handedly as VCR for both Counties Leitrim and Sligo, where he works tirelessly to keep the northwest on the map – as his articles in this edition of IBN prove!

Oliver Lynch-Milner, a Co Kerry native and Master of Science student studying Plant Ecology, took up the role of Co Limerick VCR in October. His specialist area of study is in grassland ecology, through his involvement in the StableGrass Project (which he wrote about in the September 2023 edition of BSBI News). We were very sorry that Tanya Slattery decided to step down from this role last summer, and would like to thank her very sincerely for all the effort and hard work she put in during her time as VCR. Sylvia Reynolds, now

VCR Emeritus, who fulfilled the role so brilliantly for many years, is a hard act to follow, and we are very grateful to both Tanya and Olly for lending their time and expertise to the role.

Recognising that being a VCR can be a demanding task, BSBI would encourage the appointment of more co- or assistant VCRs, to help share the burden of work, or provide a backup at busy or difficult times. If any VCR would appreciate some help, or knows someone who might be persuaded to take on a supporting role, please do bear this in mind. Or – if anyone would like to get more involved with recording in their County, please contact your local VCR (and if you live in the very north-west and would like to try your hand at being a Vice-County recorder, Ralph Sheppard in West-Donegal is very keen to mentor someone to help out with VCR duties and perhaps take over the reins in a few years).

Targeted Aquatic Plants Project

This project is to run again this year, thanks to renewed funding from NPWS. This year's programme kicked off with two ID workshops in Glasnevin in February, and going forward will be similar to last year, with online webinars and a programme of field workshops all around the country, as well as targeted surveys to re-find rare species. We are delighted to again have Paul Green at the helm, as Project Manager, and Nick Stewart on board to lead events. The big news this year is that we now have an underwater drone to assist with surveys for the more inaccessible species! It's very exciting that we are able to use the latest technology to help us with this project.

New Year Plant Hunt (NYPH)

The 13th annual New Year Plant Hunt, which ran from December 30th to 2nd January 2024, was the most successful ever! Over 3,000 lists were submitted in total, with 171 Hunts completed across Ireland – an increase of 74% on the previous year! For the first time ever, BSBI introduced an online sign-up system, and produced 'Spotter's Sheets' of the Top 20 species which, along with an email helpdesk and social media presence, made it easier for non- and beginner botanists to join in. In Sligo, the NYPH became a festive meet-up for our local BSBI group: some blustery botanising around Strandhill was followed by a pub lunch, then some more plant-hunting to help the lunch go down – and a lovely time was had by all!

Congratulations are due to the Raheen Ramblers, who recorded the longest list in Ireland, an impressive 54 species!

This year's combined results for the UK and Ireland show that just over half of the species recorded were "autumn stragglers", which managed to persist into mid-winter as a result of mild autumn and winter weather. Roughly one-quarter were spring-flowering plants, with a further 20% being either all-year-round or specifically winter-flowering species. Around half were non-native plants and/or garden escapes. The longest lists were generally from urban areas and milder, more southerly locations.

If you didn't get to do the NYPH this year - why not sign up for the 2025 hunt, and let's see if we can break a new record for Ireland!

Field meetings 2024

As usual, we have a great selection of field events lined up for 2024, which are publicised on our website and in the BSBI Yearbook. Remember to book a place, as numbers may be limited; this will also allow you to receive updates if plans change.

Conferences in 2024

The Irish Spring Conference will be held as usual at the National Botanic Gardens, Glasnevin, Dublin on Saturday 20th April. It promises to be a great day, so please do come along if you can! This year's Irish Autumn Meeting and AGM, in mid-October, will be held in Northern Ireland – details to be confirmed closer to the time.

Closing Thoughts

It just remains to extend a huge vote of thanks for everyone who has contributed to the work of the BSBI over the last year, and to those who are busy behind the scenes working on plans for the coming season! All of the last year's magnificent achievements would not have been possible without the staunch support of BSBI's recorders, committee members and other volunteers – your work is highly valued and much appreciated.

And lastly, wishing everyone happy plant-hunting this season, with lovely weather, new records and lots of lucky finds!

Vice-county Recorder vacancies

Aoife Delaney has decided to move from her previous position as joint VCR for Co. Leitrim (**H29**) to become sole VCR for Co. Cavan (**H30**). Therefore, we currently have no vacant vice-counties in all of Ireland. Nonetheless, if you have an interest in becoming a VCR/joint VCR for an Irish county in the future, or want more details about what is involved or how you could help out with recording, please get in touch with our Ireland Officer, Bridget Keehan – bridget.keehan@bsbi.org

Introduction from newly appointed Vice-county Recorders

Limerick (H8)

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I, Oliver, am a native of Castlegregory, Co. Kerry, and was recently appointed VCR for Limerick, following on from the formidable footsteps of Sylvia Reynolds and Tanya Slattery. I have a lifelong interest in the outdoors and nature, but my botanical devotion developed during my undergraduate degree in Wildlife Biology, which I graduated with from the Munster Technological University, in Tralee, Co. Kerry. This interest in specialising in botany led to my rapid learning curve and development of my botanical skills over the past three or four years. I began exploring the botanically rich Maharees Peninsula, which is nearby to my home, followed by other areas to which life took me. After a short-

term ecology contract in Connemara after the completion of my undergraduate degree, I decided that I wanted to continue my formal education in Botany, so I started a MSc in Plant Ecology in October 2022 (finishing in August 2024). For this, I aim to assess how plant diversity has changed across twelve grassland sites from the Irish Semi-natural Grassland Survey 2007-2012. During this time, I spent a considerable amount of time in the field, identifying plants, and doing some recording as a hobby in the long summer evenings.

I spent the summer of 2023 doing my fieldwork under the tutelage of Phoebe O'Brien (VCR for Clare, **H9**), as well as ingratiating myself with the BSBI community of botanical heroes during field meetings. During this time, I was informed of the vacant position of VCR for Limerick. With the hopes to continue my recording 'career' for the BSBI, I nominated myself for the position, with Phoebe's blessing and gentle encouragement! While I do not live in the vice-county (yet), I am determined to make it work. As expected, my favourite habitats include semi-natural grasslands, as well as coastal habitats and uplands. While these may be few in Limerick (and largely restricted to the limestone area of the north/north-west of the county, Shannon Estuary, and the Galty's, respectively), I hope to search out fragments of nice habitat, and promote the botany of 'less attractive/scenic' areas during his work. I am interested in finding other like-minded people, with the potential of developing a botany group in the future, or even a co-VCR, if someone is interested!

Changes of Editorship and Contribution Deadline Date for *Irish Botanical News*

Alexis FitzGerald has been editing *Irish Botanical News* since 2021. With a view to maintaining a high-quality final product in future years, he has requested that a Co-Editor be brought on to help in the editing workload. Ciarán Flynn kindly volunteered for this role and has co-edited the present issue, under the mentorship of Alexis. He will also be co-editing with Alexis for subsequent issues going forward. Alexis will review in the coming years whether other obligations will require him to retire from the position of Editor at a later time.

The Editors of *Irish Botanical News* have decided to bring forward the deadline date for article contributions by one month from January 31st to December 31st of each year to suit our typical time availability for editing work. Therefore, contributions intended for *Irish Botanical News No. 35* should reach the Editors Mr. Alexis FitzGerald and Mr. Ciarán Flynn before December 31st 2024. Articles should be sent to both Editors together in one email (email addresses as presented on the rear of the front cover above), following the formatting in the latest issue closely, including the formatting of references. Photographs or other images should be sent as original JPEG/PNG files. We look forward to receiving any and all contributions.

Alexis FitzGerald & Ciarán Flynn

Studies in the genus *Equisetum* L. 1. Some phytogeographic, taxonomic and biological observations, together with a detailed focus on the critical diagnostic characters of *E*. x *litorale* Kühlew ex Rupr. (Shore Horsetail) populations

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Abstract

Within the plant kingdom, the near-cosmopolitan genus *Equisetum* L. (Horsetails) (Equisetaceae) is of exceptional interest to botanists, as it is arguably the oldest living vascular plant genus on Earth. On current evidence, this visually distinctive genus consists of just fifteen species and twenty binary interspecific hybrids. Yet the critical identification of its *non-coning* taxa, presents ongoing, formidable challenges, bearing in mind that *all* of its species and interspecific hybrids are notoriously phenotypically plastic in response to varying ecological conditions, while hybrid morphology often overlaps that of the parent species. This current paper provides an overview of the phytogeography, taxonomy and biology of the genus *Equisetum*, in addition to a detailed account of *the critical* diagnostic characters of the interspecific hybrid, *E*. x *litorale* (Shore Horsetail) (= *E. arvense* (Field Horsetail) x *E. fluviatile* (Water Horsetail)) – the *first* hybrid recorded within this genus worldwide, and certainly the most frequent *Equisetum* hybrid in mainland Europe, Britain and Ireland. *E*. x *litorale*, (like its parents) is a highly variable taxon morphologically, whose extreme phenotypes are still frequently misidentified as forms of its parent species, *or* are occasionally confused with variants of *E. palustre* (Marsh Horsetail) or, more rarely, with the interspecific hybrid, *E*. x *dycei* (= *E. palustre* x *E. fluviatile*). Consequently, a detailed diagnostic key to *non-coning* material of *E.* x *litorale*, and the often-associated *Equisetum* taxa with which it is regularly confused, is provided in this paper, to assist with the more accurate, confident determinations of these taxa. Photographs of *coning* material of *E. fluviatile*, *E*. x *litorale* and *E*. x *dycei* are also included, to augment the descriptive data, by familiarising botanists with the appearance of the fruiting bodies of these taxa.

Introduction

The *herbaceous* genus *Equisetum* L. (Horsetails) (Equisetaceae) is of absorbing and exceptional interest to the botanical community worldwide, for the following reasons. **1**. It is arguably the oldest surviving genus of vascular plants on Earth, with an ancient lineage (the Sphenophyta), reaching back to the Upper Devonian period. **2.** *Its highly distinctive and ultra-conservative* architecture and gross morphology, e.g., *jointed, ridged-and-furrowed* aerial stems, *their leaves transformed into connate, tubular, apically-toothed sheaths* (but the sheaths commonly *bell-shaped or funnel-shaped* on *coning* stems: see **Plates 2-4**), that encircle the stem nodes, and the *presence of nodal whorls of jointed branches* in many taxa. **3**. This combination of attributes, together with a suite of other fascinating and morphologically distinctive features (cf. Husby, 2013), mark *Equisetum* out as a *unique* genus of plants. Husby (2013: 170) succinctly summed up its history thus: "*Equisetum* is a surprising case of an ancient and morphologically conservative plant genus,

with many unusual characteristics and adaptations that has persevered across geological time and geographical and ecological space." Moreover, the wide distributional range of many of its species, ensures that horsetails are a familiar sight to botanists and the general public alike. Nevertheless, *in the absence of coning material* (particularly in paludal habitats where intermixed populations of species and putative interspecific hybrids occur), *accurate* identification of the constituent taxa can prove a very difficult and daunting task, requiring an *intimate* knowledge of the *more stable* suite of morphological diagnostic characters that circumscribe each taxon.

Phytogeography

As an indigenous genus, *Equisetum* is almost worldwide in distribution, though surprisingly *absent* from New Zealand and Australia, wherein *one* species, *E. arvense* L. (Field Horsetail), occurs as a naturalised, rampageous, weed. Currently, this genus is known to consist of just *fifteen* diploid species (plus some diploid subspecies) (Hauke, 1963, 1978) and *twenty* diploid interspecific hybrids (Lubienski & Dörken, 2016), which are distributed within two subgenera, namely: subgenus *Hippochaete* (Evergreen Horsetails/Scouring Rushes) and subgenus *Equisetum* (Deciduous Horsetails/Annual Horsetails). (**Note**: The suite of morphological features that delimit both subgenera, are detailed below.) While many *Equisetum* taxa have very wide-ranging distributions, *some* species exhibit *highly disjunct* distributions, and certain hybrids occur in areas where one of their parent species is not known to be present – phytogeographical conundrums of enormous interest, that have long intrigued pteridologists. For example, within subgenus *Hippochaete*, *E. laevigatum* (Smooth Scouring Rush) is the *only Equisetum* species *endemic* to North America (Hauke, 1960, 1963). By contrast, *E. ramosissimum* (Branched Horsetail), which has a near-cosmopolitan distribution, only occurs in North America *as a naturalised ballast-alien* (Hauke, 1979, 1992), while its status in Britain *is controversial*, Alston (1949) and Rumsey & Spencer (2012) leaning towards giving it native status, while Acock (2015) regarded *E. ramosissimum* as an adventive species there. Just as puzzling, is the fact that, while *E. ramosissimum* has *never* been recorded from the island of Ireland, its interspecific hybrid, *E. hyemale* (Rough Horsetail) x *E. ramosissimum* (= *E.* x *moorei* Newman (Moore's Horsetail)) was added to the Irish Flora from coastal dunes and wet, rocky coastal cliffs in Co. Wicklow (**H20**) in 1851, by David Moore and J. Melville (Moore, 1854). Subsequently, the distributional range of *E.* x *moorei* in coastal southeast Ireland, was extended to Co. Wexford (**H12**) in 1868, when it was found on the sand-dunes at Courtown, by A.G. More and J.T. Boswell Syme (More, 1868). Later, further fieldwork by Alexander Goodman More, filled in the distributional gaps for this hybrid along the Wexford-Wicklow coastline. Commenting on these additional finds, More (1872: 37) stated: "Sandhills north of Courtown, Wexford [**H12**]; sandhills near Arklow [**H20**] and thence northwards in many places along the coast, extending to near Seapark House, three miles south of Wicklow [**H20**]." (**Note**: Paul Green, in his current *Flora of County Wexford* (Green, 2022), comments that *E.* x *moorei* is still of common occurrence at Courtown and other Wexford coastal sites.)

Intriguingly, *another E. ramosissimum* hybrid, i.e. *E. ramosissimum* x *E. variegatum* (Variegated Horsetail) (= *E.* x *meridionale* (Milde) Chiov. (Southern Horsetail)) is now known to occur in a number of English and Welsh coastal sand-dune sites (Jepson

et al., 2013; Stace, 2019) – once again highlighting the question as to the *true* status of *E. ramosissimum* in the British Flora. Perhaps the icing on the cake in the recent list of *Equisetum* hybrid discoveries, is that of *E. scirpoides* Michaux x *E. variegatum* (subgenus *Hippochaete*), confirmed recently from Lapland ((Sweden) by Lubienski & Dörken (2016), and given the binomial, *Equisetum* x *lapponicum* Lubienski & Dörken. In the boreal regions of Northern Europe, both of its parents cohabit in locations in Finland, Sweden, Spitsbergen, Norway and parts of N. European Russia, while *E.* x *lapponicum* is now known to occur in Sweden and Spitsbergen, and may yet prove of widespread occurrence in neighbouring countries. In reference to this long-anticipated find, Lubienski & Dorken (2016: 129) stated: "*Equisetum* x *lapponicum* represents the missing link in a worldwide hybridization scheme within subgenus *Hippochaete*, underlining the high degree of reticulation in this ancient group of plants. Every species in the subgenus is involved in at least one hybridization event over the complete natural range of the members of this group, comprising South, Central and North America, Europe, Eurasia and Africa."

Taxonomy

The modern-day monographs that stabilised and clarified the taxonomy of the genus *Equisetum*

Within each subgenus, many *Equisetum* taxa (i.e. both species and interspecific hybrids) are confusingly similar in morphology and visual appearance – though in stature they vary from the diminutive boreal species, *E. scirpoides* Michaux (stems 3-28 cm high x 0.5-1mm wide (Øllgaard, 2000)), to the Giant Horsetails of predominantly subtropical habitats in Mexico, Central America and South America, which bear aerial stems that reach to 8m or so in height, and have a stem diameter of 2-4 cm (Hauke, 1963). The current consensus on *fifteen* species for this genus, is a relatively recent event, based entirely on two, major, revelatory monographic works by Richard L. Hauke (Hauke, 1963, 1978). *Prior* to Hauke's near-exhaustive detailed research and profoundly insightful and enlightening publications, the taxonomy of the genus *Equisetum* worldwide, *lacked cohesiveness and clarity*, in that the number of *genuine* species and interspecific hybrids *remained unknown*, the general view among specialists in this field of botanical research at that time period, being that *Equisetum* consisted of approximately *twenty-three* species. Hauke's meticulous research (which culminated in his two, published monographs), *showed this view to be mistaken*, for he pointed out that, within subgenus *Hippochaete*, previous workers had given species status to some taxa that in reality were interspecific hybrids. *More profoundly*, Hauke opted to *retain* the subgeneric division of *Equisetum*, rather than recognise two distinct genera: he outlined his careful thinking on this matter, within a series of very helpful résumés (i.e. Hauke, 1961, 1962a, 1962b, 1962c), which latter made his work on subgenus *Hippochaete* more readily available to the worldwide community of botanists and expert pteridologists. Indicating some of the factors that influenced his decision *not* to give generic status to *Hippochaete* and *Equisetum*, Hauke (1961: 35) commented: "There are, indeed, absolute and apparently inviolable differences between the two groups in stomatal structure [while] the chromosomes have some distinctions, so far as they are known (Manton, 1950), and hybrids between these groups are probably never formed. These differences, however, are few, when compared to the great similarities in general morphology, anatomy and reproductive structure. The contrasts of deciduous stems with blunt cones in *Equisetum* vs

evergreen stems with apiculate cones in *Hippochaete*, though usually distinctive, are violated by *E. laevigatum* and *E. ramosissimum* subsp. *ramosissimum*." **(Note**: Most interestingly, these two *Equisetum* taxa, share some other distinctive features. For example: **1**. They are both *poor* silica-assimilators and, as a consequence, their stems are winter-tender, *often dying back* (at least distally) during severe cold snaps – thus mimicking the annual horsetails of subgenus *Equisetum* in this respect. **2**. Another consequence of poor silica-uptake in the stems of both taxa, is that the stems are *far smoother* to the touch, than other members of subgenus *Hippochaete*. **3**. Throughout the distributional range of both *E. laevigatum* and *E. ramosissimum* subsp. *ramosissimum*, *their fertile cones can either have an apiculate or a blunt apex*. **4**. *Equisetum ramosissimum* is only represented in Europe by subspecies *ramosissimum* – and is the *only* indigenous European member of subgenus *Hippochaete* to display *regular nodal whorls* of branches.)

While Hauke's assessment of the number of species of *Equisetum* that occur worldwide (i.e. fifteen species) has remained unchallenged to date, there remains ongoing debate as to whether *to retain* the current taxonomy of two subgenera, *or* to give both, generic status. The issues of debate, revolve around the central fact that, to date, *no* interspecific hybrids *between* both subgenera have ever been confirmed – *though unsubstantiated claims for inter-subgeneric hybrids* are noted in the *Equisetum* account in *Flora Nordica* **1** (Øllgaard, 2000).

The suite of contrasting morphological characters *that clearly define and delimit* subgenus *Hippochaete* from subgenus *Equisetum*, are as follows:

Subgenus *Hippochaete*

Stems: *monomorphic*, and either (**a**) *evergreen, overwintering* and lasting two or more years, their **ridge-crests** *biangulate-tuberculate*, each angle *separated by a longitudinal, median sulcation*, and bearing a single row of silica tubercles (i.e ***E. hyemale***, ***E. variegatum*** and ***E***. x ***trachyodon* (Mackay's Horsetail)**) *or* (**b**) **stems** *winter-tender and frequently wilting distally*, their **ridge-crests** ± *rounded*, and their **silica tubercles** *variably fused*, so as to form *distinctive cross-bands* on the ridge-crests (i.e. ***E. ramosissimum***, ***E***. x ***moorei*** and ***E***. x ***meridionale***). With the notable exception of ***E. ramosissimum***, the stems of which are *freely branched* in their central region (though with only *c*. six branches per nodal whorl), *all* of the remaining *European* species and interspecific hybrids *lack* symmetrical whorls of branches, although *sporadic, asymmetrical branches* (long or short) frequently sprout from *damaged* distal or proximal stem nodes; **stomata** *sunk* beneath the epidermis, *forming a single, vertical line* at each margin of a stem furrow, adjacent to a rib or, occasionally, *twinned lines* at each margin, in some populations of ***E. ramosissimum*** subsp. ***ramosissimum***; **cones** (i.e. strobili) bearing an *apiculate* apex in *European* species (save in some populations of ***E. ramosissimum***); **stem sheaths** *often becoming grey- or black-girdled, or wholly black*, with age; **stem sheath teeth** *rarely remaining intact*. **1**. For example, *uniquely* in ***E. hyemale***, the teeth *usually disarticulate very quickly* (*as a ring-like tooth-whorl unit*) from their sheath apex, *each* tooth-whorl *ultimately stacked one on top of the other, to form a pagoda-like structure* topping the *sterile* stems (**Plate 1**). **2**. In other taxa, by contrast, while the **teeth-bases** remain firmly attached to their sheaths, the *apical* portion of each tooth *is frequently lost* over the course of a year. (**Note**: It remains to be ascertained, if the *shape* of the **remnant basal tooth-portion** (i.e.

truncate/crenate/lingulate/ bluntly triangular) is *diagnostic* for some taxa – e.g., compare **Plate 1** and its caption).

Subgenus *Equisetum*

Stems *all annual, wilting to a bone-white or greyish colour and dying back each winter*; either (**a**) summer-flowering (May-July) *monomorphic* taxa with the fertile stems ± identical to the sterile vegetative stems and appearing simultaneously with them (i.e. ***E. fluviatile*** and ***E. palustre***) *or* (**b**) their cones produced between February and April in the *dimorphic* species, ***E. arvense*** and ***E. telmateia*** **(Great Horsetail)** and the *semi-dimorphic* species, ***E. sylvaticum*** **(Wood Horsetail)** and ***E. pratense*** **(Shady Horsetail)**; **stem ridge-crests** *uniangulate* (but *biangulate* in ***E. sylvaticum***); **stomata** on the surface of the epidermis (i.e. *superficial*), and *scattered abundantly across the full width* of the stem furrows; **stem sheath teeth** *persistent* (although the scarious, subtranslucent, *brittle margins* that are displayed by some species, *frequently disintegrate with age*); **cones** of *all* taxa with an *obtuse* (never apiculate) apex;

Some ecological, morphological and biological notes on *Equisetum*

The genus *Equisetum* is predominantly associated with *paludal* habitats, where its massive underground rhizome system (in some species *forming tiered, horizontal layers of rhizomes*, that run to great depths), allows its various taxa to form extensive clonal populations over a wide area of suitable habitat. (Indeed, Borg (1971) found that *E. palustre* may produce more than one hundred times more rhizome biomass than aerial stem biomass.) While the overall gross morphology of this genus is very distinctive, an unfortunate consequence of this morphological uniformity is that many taxa (within each subgenus) *look superficially similar in visual appearance*, while the genus as a whole *is notoriously phenotypically plastic* in response to a range of environmental conditions – two factors that *constantly* cause identification problems for botanists *not* intimately acquainted with the suite of *more stable* morphological characters that circumscribe each species. Presciently, these very problems were highlighted exactly a century ago, by a former American *Equisetum* expert, John H. Schaffner, in a paper entitled: 'How to distinguish the North American species of the genus *Equisetum*' (Schaffner, 1923), when he stated: "Because of the decided simplicity and sameness of structure exhibited by most species of *Equisetum*, and because of the great fluctuations often shown by a single species, it is important that one should learn to recognize them *by such hereditary characters as appear to be least influenced by external conditions* [my emphasis]." Regrettably, this sage advice is frequently overlooked in the current literature on *Equisetum*, where many taxa within subgenus *Equisetum* are commonly keyed out on the basis of *highly variable* morphological features such as the following. **1. The ratio of stem central cavity diameter to stem diameter** – a highly fluctuating ratio that frequently overlaps between species and interspecific hybrids. **2**. The fact that "… most quantitative characters in the genus vary with stem size, and therefore are *not* strong criteria for determination" (Lubienski & Dörken, 216: 124). **3**. The emphasis on the **ratio between the first branch internode length, relative to the length of its adjacent stem sheath** – which erroneously intimates that this feature is stable in most taxa. This diagnostic character is certainly very useful for the recognition of *E. palustre* and *E. fluviatile*, in that the first branch internode in these two species is *always shorter* than its

adjacent stem sheath, *throughout the length of the stem*. However, the **stem sheaths** of other taxa, *progressively shorten in length* in the upper three-quarters of the stem, thus *altering* the **first branch internode length/stem sheath length ratio.** This is the case in *E. pratense*, where the first branch internode at the *proximal* stem nodes *is shorter* than its adjacent stem sheath, and conversely *longer* than the stem sheath at the *distal* stem nodes. The situation in *E. arvense* is even more extreme, where frequently *all* of the first branch internodes at all the stem nodes, *are much longer* than their adjacent stem sheath. Interestingly, this ratio in *E*. x *litorale* largely mirrors that of its *E. arvense* parent – *save* that the branch internode length at the *two, lowest* stem nodes, is usually *slightly shorter* than the adjacent stem sheath, thus showing the influence of its *E. fluviatile* parent.

A *further* confounding factor relating to the accurate identification of taxa, is the presence in many areas of binary interspecific hybrids, which latter display *a variable admixture* of morphological characters inherited from their two parent species. Obviously, such hybrids are more readily and confidently identified when *coning* stems are available for scrutiny, *as* the (usually small) *predominantly dysfunctional cones, remain tightly closed* (**Plates 2-4**) and, on dissection under a microscope, their numerous spores are observed to be *malformed and colourless*, while their *elaters* are either *absent or rudimentary*. In total contrast, the *functional*, fertile cones of the parent species are generally much larger dimensioned than the hybrid cones (cf. **Plate 2**) and, while their tiered whorls of peltate sporangiophores are tightly packed when young, these become more widely spaced as the maturing cone elongates (**Plate 2**), at which point, the sporangia (borne several together round the undersurface of the sporangiophore), *dehisce*, thus allowing the *well-formed, subglobose, chlorophyllous* spores to disperse. Very often however, only vegetative *Equisetum* material is encountered during fieldwork and, as noted above, where a range of (usually highly morphologically variable) species and putative interspecific hybrids appear to cohabit, *nothing less than an intimate, detailed morphological knowledge of this genus*, is required for accurate determination of taxa!

Silica dioxide assimilation in the genus *Equisetum*, and the use of its characteristic epidermal patterns as critical diagnostic aids in the identification of its species and interspecific hybrids

An especially noteworthy feature of the genus *Equisetum* is that *all* of its taxa are *silica-dioxide accumulators/assimilators*, the silica being deposited *on the epidermal stem ridges, branch ridge-crests, and in the stem furrows*. Moreover, these deposits are *not* random, but rather form *distinctive patterns* that can greatly assist in the accurate determination of taxa. While the assimilation of silica in subgenus *Hippochaete* is generally more pronounced than in subgenus *Equisetum* (e.g. the cutting of stems of most *Hippochaete* taxa, gives the impression that one is cutting stiff plastic), yet the *uptake* in *some* of its taxa *is minimal* – as in *E. laevigatum*, *E. ramosissimum* and their interspecific hybrids, so that the stems of all of these taxa *tend to wilt distally* in harsh winters. In a contribution highlighting the value of *silica tubercle* patterns as critical diagnostic aids in *Equisetum*, Jepson *et al.* (2013) have provided an excellent selection of Scanning Electron Microscope (**SEM**) photomicrographs of silica deposition patterning on **stem internode rib-crests** in *E. hyemale, E. variegatum, E. ramosissimum* and their interspecific hybrids, *Equisetum* x *meridionale*, *E*. x *moorei* and *E*. x *trachyodon*, which clearly demonstrates their value as *critical diagnostic aids*, in these

taxa. Moreover, a further **SEM** photomicrograph provided by them, reveals a *new* (or, rather, previously overlooked!) diagnostic character for *E.* x *trachyodon*, namely, *the presence of conspicuous, hook-like, rigid silica spicules on the dorsal face of the stem* sheath *teeth*. This distinctive morphological feature in *E.* x *trachyodon*, is a boon identification-wise, in the *absence* of coning stems in this interspecific hybrid. Similar diagnostic aids are *also* present in subgenus *Equisetum*. For example, in both *E. pratense* and *E. sylvaticum*, *minute, patent, rigid, needle-like silica spicules* occur on the **stem rib-crests** of the vegetative (sterile) stems, and are usually most obvious beneath the nodes. In *E. telmateia*, on the other hand, the **branch internode rib-crests** are *biangulate* (as the angles are separated by a central, longitudinal sulcation), and each angle displays a wholly distinctive line of *sharp, saw-like, siliceous teeth* – which marks *E. telmateia* out from all other species within subgenus *Equisetum*. **(Note**: The interspecific hybrid *E.* x *font-queri* (= *E. palustre* x *E. telmateia*) inherits *both* of these *E. telmateia* distinctive microcharacters, but in a *diluted* form, with *more feebly* biangulate branch internode rib-crests, combined with blunter, somewhat saw-like, siliceous teeth.) Within subgenus *Hippochaete*, these *saw-like* siliceous teeth are *also* present on the **branch internode rib-crests** of *E. myriochaetum* Schlecht & Cham. (one of the two, subtropical, Giant Horsetail species of Mexico, Central America and South America) and (mirroring the situation as just described for *E.* x *font-queri* in subgenus *Equisetum*), this character *appears in a modified form* on the branch internode rib-crests of *E.* x *schaffneri* Milde – the hybrid between *E. myriochaetum* and *E. giganteum* L. (the second giant horsetail).) Continuing this theme, I have long noticed that the *uniform silica tubercle deposition* on the **branch internode rib-crests** of *E. arvense*, *fancifully resembles a row of human molar teeth* (x 100) – the individual 'teeth' *squarish in outline, slightly broader than long, and more or less flat-topped*. This distinctive micromorphological silica tubercle feature in *E. arvense*, was *also* commented on by Benjamin Øllgaard (Øllgaard, 2000), which strongly indicates that it is *a stable* diagnostic character for delimiting *E. arvense* (and also *E.* x *litorale*, which inherits this character from its *E. arvense* parent (pers. obs.)), from superficially similar taxa. Interestingly, my observations of the **branch internode rib-crests** of *E. fluviatile*, reveal *an admixture* of *truncated and conical* silica tubercles which, on the basis of more extensive observation, may yet prove of diagnostic value in its own right. With regard to the comparative **silica tubercle** pattern on the **branch internode rib-crests** of *E. palustre*, my limited observations to date, show these to be basically *conical* in outline – which, should it prove to be a stable character, *clearly differentiates* this species from both *E. arvense* and *E.* x *litorale*. (**Note**: Some invaluable, original research in this field, was undertaken by Chris Page, on *the stomatal-unit micromorphology* of subgenus *Equisetum* species (Page, 1972a), his Scanning Electron Microscope (**SEM**) findings being published in a paper entitled: 'An assessment of inter-specific relationships in *Equisetum* subgenus *Equisetum*.') Subsequently, Hauke (1978a) published a paper on *a more practical technique*, which allowed access to this micromorphological data, *without* the need for the Scanning Electron Microscope.

Interspecific binary hybrids within subgenus *Equisetum* and subgenus *Hippochaete*, added to the British and Irish Flora during the time period, 1962-2007

With regard to the discovery of *new* interspecific hybrids within subgenus *Equisetum*, it is clear that modern-day *European* botanists have been far more successful to date, at detecting these, then have their American counterparts – most of the British and Irish finds having been made within the time period *c*. 1962-2007, and the majority of them being *new to science*! For example, an extraordinary list of remarkable discoveries was made by Chris Page (a professional botanist and Pteridologist, based at Edinburgh Botanic Gardens, and a world-renowned specialist in the study of the genus *Equisetum*), during the period 1962-2007. Of these discoveries, Page originally found *Equisetum* x *dycei* (= *E. palustre* x *E. fluviatile*) on the island of Harris, in the Outer Hebrides (Scotland) in 1962, and he subsequently published a description and silhouettes of this taxon, which was *new to science* (Page, I963). (**Note**: This data was later reproduced and expanded on, in his excellent publication, *The Ferns of Britain and Ireland* (Page, 1982 and 2nd edition, 1997), wherein he reported finding populations of *E*. x *dycei* along the western coasts of Ireland, from Kerry north to Sligo, this hybrid being new to the Irish Flora.) Page (1973) later reported the discovery of two additional *Equisetum* interspecific hybrids that were new to the British Flora: *E. arvense* x *E. palustre* (= *E*. x *rothmaleri* C.A. Page) and *E. palustre* x *E. telmateia* (= *E*. x *font-queri* Rothm.), the former being *new to science*. Page, and other workers, subsequently expanded the known range of *E*. x *rothmaleri* in these islands and, in regard to the new stations and their ecology, he commented (Page, 1997: 512): "Vegetatively more extensive (though seldom very large or vigorous) colonies of *E*. x *rothmaleri* occur in a number of more or less constantly surface-scoured sites, which are also ones which are frequently or regularly inundated with moving fresh water. These sites include the gravelly shores of various loughs, and the margins of streambanks, especially through the west of Ireland (where I have seen it occurring as thin colonies in such sites from Sligo to Kerry) …" Moreover, in his book, '*Ferns: their habitats in the British and Irish landscape'*, Page (1988b: 383), the caption to a photograph of a lough margin in Co. Sligo (**H28**) states: "… lough margin community, with at least three hybrid horsetails: *Equisetum* x *litorale*, *E*. x *dycei* and *E*. x *rothmaleri*." Then, in July 1984, A.J. Willmot discovered the interspecific hybrid, *E. fluviatile* x *E. telmateia* on a roadside bank near the Black River, north of Dowra, Co. Cavan (**H30**), this hybrid being *new to science* also. It was formally named and described as *E*. x *wilmotii* C.N. Page (Page, 1995a), and was later found in a number of widely dispersed sites in Britain (cf. Acock, 2015). Page (1988a) published descriptions of two further additions to the British Flora: *E*. x *bowmanii* C.N. Page (= *E. sylvaticum* x *E. telmateia*) and *E.* x *mildeanum* Rothm. (= *E. pratense* Ehrh. x *E. sylvaticum*) – the former hybrid *new to science*. In 1999, the continental pteridologist, *Marcus Lubienski*, added *E*. x *font-queri* (= *E. palustre* x *E. telmateia*) to the Irish Flora (Lubienski, 2000) from Co. Sligo (**H28**) and, hot on the heels of this find, came the discovery of the hybrid, *E. arvense* x *E. telmateia* on Anglesey Island (**VC. 52**) in July 2000 (Dines & Bonner, 2002), a hybrid apparently *new to science*. The finders formally named this hybrid, *E*. x *robertsii* T.D. Dines – in honour of the Welsh Botanist, R.H. Roberts, whom, they stated, had made an outstanding contribution to the knowledge of the Anglesey Flora. A short time later, Page *et al.* (2007) added *E*. x *mchaffieae* C.N.Page (= *E. fluviatile* x *E. pratense*) to the British Flora from Scotland, in 2006. Then, from subgenus *Hippochaete*, came the exciting discovery of *E*. x *meridionale* (Milde) Chiov. (= *E. ramosissimum* x *E. variegatum*) from

one Welsh and two English coastal sand-dune sites (Jepson *et al*., 2013) – once again rekindling the controversy as to the status of *E. ramosissimum* in the British Flora.

A potted history of *Equisetum* x *littorale*

Equisetum x *litorale* (Shore Horsetail), the interspecific hybrid between *E. arvense* and *E. fluviatile*, holds the distinction of being *the first* recorded hybrid within the genus *Equisetum* worldwide, while nowadays it is also the most frequently recorded hybrid of the genus throughout mainland Europe, Britain and Ireland. Most curiously however, although the *consistent spore-sterility* of *E.* x *litorale* clearly attested to its hybrid nature (as also did the *admixture* of morphological characters derived from its parent species, *E. arvense* and *E. fluviatile*), yet its hybrid status *remained contested* by some *Equisetum* authorities, up until the publication of the classic cytological work by Irene Manton, entitled: '*Problems of cytology and evolution in the Pteridophyta.'* (Manton, 1950), which unequivocally demonstrated its hybrid origin. In an overview of the reasons for such historical ambivalence with regard to granting hybrid status to *E.* x *litorale*, the American *Equisetum* authority, Richard Hauke (Hauke, 1965) stated: "Ruprecht described it [i.e. *E.* x *litorale*] as a species in 1845, from [Russian] material supplied by Külewin. He noted that it was intermediate between *E. arvense* and *E. fluviatile*." In the same paper, Hauke further stated: "… Milde, after studying its internal structure and noting the constant spore abortion, decided it was such a hybrid [Milde, 1851]. He [Milde] later (1867, p. 368) was impressed with how common *E.* x *litorale* seemed, and decided on that basis that, rather than a hybrid, it was a species becoming extinct (hence the sterility)." In the wake of Milde's authoritative statement, an extended period of irrational doubt as to the *true* taxonomic status of *E.* x *litorale*, ensued, until (as noted above), the publication of Manton's (1950) work. In retrospect, this prolonged negative stance was all the more baffling, given the fact that Robert Lloyd Praeger, in a paper entitled '*Equisetum litorale* in Ireland' (Praeger, 1917), had provided *a forensic-like analysis* of a population of *E.* x *litorale* that he added to the Irish Flora from the Rocky River, in the Mourne Mountains of County Down (**H38**) in 1917, where the hybrid was accompanied by five horsetail species, namely: *E. hyemale, E. sylvaticum, E. palustre, E.arvense* and *E. fluviatile*. In my view, Praeger's critical study of this *E.* x *litorale* population *was exemplary*, as he quickly and masterfully ascertained the essential diagnostic delimitation characters of the hybrid and its parents. (**Note**: Praeger's initial observations (characters **1-4** below) were made in the field, while characters **5-6** were gleaned from later *microscopic* examination of collected material of cohabiting *E. arvense*, *E. fluviatile*, *E. palustre* and putative *E.* x *litorale*.) In his paper, Praeger commented on the critical delimitation characters of the three species firstly, and *then* noted the assemblage of characters inherited by the hybrid, which, in his view, *totally ruled out* the input of *E. palustre*.) In brief, Praeger was convinced that the following characters clearly defined *E.* x *litorale*:

1. Barren and fruiting stems *monomorphic* (as in *E. fluviatile*), *not* dimorphic (as in *E. arvense*).
2. **Cones** the same shape and pale yellowish colour of *E. arvense*, *not* the black hue which characterises *E. fluviatile* and *E. palustre*.
3. The rarity and poor development of the fruiting organs suggested a hybrid origin.

4. Stem central cavity 1/2-2/3 the width of the stem, the latter somewhat firm, and yielding elastically to lateral pressure – *not* collapsing as in *E. fluviatile*, and *not* feeling solid, as in *E. arvense*.
5. Hybrid anatomy similar to *E. fluviatile*, in that *no* layer of thickened cells forming a ring inside the vallecular canals [i.e. an *endodermis*] was present (as it is in the case of *E. arvense*) which, in the latter species, causes the torn stems, if crushed, to separate readily into an inner and an outer cylinder.
6. Cones rarely produced and, on dissection, their **spores** were seen to be *abortive* and their **elaters** *were absent*.

Yet, for whatever reason, Praeger's (1917) paper seems to have *essentially been overlooked*, as it is *not* mentioned by Hauke (1965) nor by Page (1982, 1997) – both of whom, I have no doubt, would immediately have recognised its taxonomic diagnostic value, had this paper been drawn to their attention. **(Note**: Merryweather's (1991) observation and statement that part-torn stems of *E. arvense*, when pulled apart, reveal a protruding [pipe-like] inner cortical cylinder [see **Plate 5**] *put a practical spin* on Praeger's much earlier observation (character **5**, above) that the presence of an *endodermis* in *E. arvense* "… causes the torn stems, if crushed, to separate readily into an inner and an outer cylinder.")

Some observations on the critical morphological delimitation of *E.* x *litorale* from its parent species

(**Note:** An asterisk* in the text from this point onwards, highlights my own observations of seemingly previously overlooked characters)
On the basis of my own long-term observations of *highly polymorphic* populations of *Equisetum* x *litorale* and its parents, *E. arvense* and *E. fluviatile*, it is clear to me that this hybrid is *much more likely to be confused* with the former, rather than the latter parent, as many of its *external* morphological characters mimic *E. arvense*. For example: (**a**) the **branch internode furrows** are often *V-shaped and flat-walled* in cross-section, and (**b**) usually display *a basal, longitudinal, gutter-like channel* of varying conspicuousness – all *E. arvense* characters; (**c**) the *distal* half of sterile stems are *conspicuously ribbed-and-furrowed*, while (**d**) **the first branch internode** (at most stem nodes) *is much longer* than the adjacent stem sheath. Moreover, I have also observed that **three* further *E. arvense* characters are frequently inherited in *E.* x *litorale* populations – yet, I have *not* seen these characters recorded in descriptions of the hybrid. (**e**) ***The presence of *distorted, swollen, geniculate* **lower stem nodes (Plate 6)** (a feature *unique* to *E. arvense*, according to Page (1997: 435), who described these lower stem nodes in the following way: "… bent and distinctly inflated, giving the unbranched lower part of the shoot *a knobbly and arthritic appearance*.") Yet, Page did *not* mention the occurrence of this distinctive and prominently visual feature, in populations of *E.* x *litorale*! **(f) ***The frequent occurrence of short (up to 7 cm long)* **secondary branches**, *these asymmetrical, and occurring in 1s and 2s at sporadic branch nodes* and (**g**) ***stem sheath teeth** at some nodes, *conjoined laterally in 2s and 3s*.

Yet, even when *all* of these *E. arvense external* morphological characters are found manifested in *E.* x *litorale* populations, *a hybrid determination can still be confidently made*, by ascertaining the presence of the following *E. fluviatile* suite of diagnostic

characters in the hybrid progeny. **1.** Torn stems displaying only ragged margins and *a large central cavity, 1/2-2/3 the width of the stem*. **2. Branch internodes** displaying a *variable-sized central cavity, c. *1/5-1/3 the width of its branch. **3. Branch sheath teeth** awl-shaped, *c*. 1.2 mm long, and **usually neatly appressed* to the branch internode immediately above it. **4. Branch internode ridge-number and sheath teeth number** (4-)*5-7. **5.** Stems *± *smooth-walled proximally* (as in *E. fluviatile*) but distinctly ridged-and-furrowed distally (as in *E. arvense*). **6. First branch internode** (at the lowest stem nodes only) frequently *clearly shorter* than the adjacent stem sheath. **(Note**: In descriptions of both *E. fluviatile* and *E*. x *litorale*, as far as I am aware, the general literature *never provide*s *a ratio* for the **branch internode central cavity/ branch internode width**. In the case of *E. fluviatile* in my experience, *this ratio is approximately 1/2 or slightly more, the cavity being conspicuous and readily observable to the naked eye. With regard to *E.* x *litorale* however, I have found the *diameter* of the **branch internode central cavity** to **vary between populations*. On the basis of my own figures above, the **branch internode central cavity** (in *E*. x *litorale*) **is conspicuous* at 1/3 the width of its branch: *at 1/5 the width of the branch, however, *it is barely visible* to the naked eye (*c*. *140 µm (=0.14 mm) in diameter), and I have found that **its presence is best confirmed* by cutting 2mm long branch sections, then pinning these laterally on a blade-tip, and examining under a dissecting microscope (at a magnification of x 20), when light can be seen to shine through the minute central cavity.)

(Note: While the following key is *exclusively* designed for the critical identification of *sterile, vegetative Equisetum* material (bearing in mind that such material is the most difficult to identify in the field), it is obviously a great boon when *coning* material (whether fertile or sterile) is present also, as it adds to the certainty of accurate identification of taxa. To help in this regard, the present paper includes *photographs and captions* for *coning* material of the following taxa: *E. fluviatile*, *E*. x *litorale* and *E.* x *dycei* (see **Plates 2-4**). Additionally, *comparative* vegetative material (i.e. **nodal branches** and **stem sheaths**) of *E. arvense* and *E. palustre* are included (**Plate 5**) to show the *relative ratio* of **first branch internode length to adjacent stem sheath length** in both species, while their *torn* stems (**Plate 5**) display the *protruding, pipe-like, central cortical cylinder* that is present in these two species.)

A detailed key to non-coning material of *E*. x *litorale,* and associated taxa with which it is frequently confused

1a Stems thick-walled and ± firm, their **central cavity** 1/5-1/4 the width of the stem, and *equalling *or distinctly smaller* than the peripheral ring of vallecular canals; **stem sheaths** *c*. *twice as long as broad* (**Plate 5**), their **teeth** with *conspicuously broad hyaline or scarious margins*; **first internode of branches** (at the proximal stem nodes) *only half as long* as the adjacent stem sheath (**Plate 5**); **branch sheath teeth** *clasping, c*. *1 x 0.7 mm, **subdelate*, with *broad, conspicuous, hyaline margins*; **stem internode furrows** *roundly concave* and *lacking* a central, longitudinal, gutter-like channel: **branch internode central cavity** **minute*, **often smaller* than the peripheral ring of vallecular canals, *which latter are conspicuous at x 100; **branch internode ridge-crest** bearing a single row of **domed* **silica tubercles** (x 100): ……..... **E. palustre**

1b Stem central cavity *usually much larger* than the peripheral ring of vallecular canals; **stem sheaths** ± *as broad as long*; **stem sheath teeth and branch sheath teeth** with ± *vestigial* scarious margins: …… **2**

2a Stems when part-torn and pulled apart, *displaying a central, protruding, pipe-like cortical cylinder* (**Plate 5**); **stems** *firm- walled, and distinctly ridged-and-furrowed throughout their length*; **first branch internode** (at most or all stem nodes), *much longer* than the adjacent stem sheath (**Plate 5**); **stem sheath teeth** *often cohering laterally in groups of 2s and 3s*, their ***teeth sinuses** *narrowly V-shaped*; **branch sheath teeth** *subulate or narrowly triangular-attenuate, twice as long as broad and* generally *out-curved*; **branch internode furrow** *deeply V-shaped and flat-walled,* **its base** with a *longitudinal gutter-like channel*; **branch internodes** 3-5-ribbed, with a *solid* 'hub' in cross-section; **branch internode ridge-crests** with a single row of *± *square, truncate-topped* **silica tubercles** (x 100); **basal stem nodes** frequently conspicuously *swollen, geniculate, and arthritic-like in appearance, and bulging out their enveloping sheaths* (**Plate 6**); **stem sheaths** *never* orange-tinted: …….. **E. arvense**

2b Stem internodes when torn, *displaying only a ragged margin and often a wide central cavity*; **stem sheaths and/or teeth,** *frequently orange-tinted* (particularly in *E. fluviatile* and *E*. x *dycei*, (**Plate 4**); **branch sheath teeth** *usually neatly appressed* to the branch internode above it: **branch internodes** displaying **a variable-sized central cavity* in cross-section; **stem nodes** either (**a**) *frequently grossly swollen and geniculate (**Plate 6**) and the **branch internode furrows** often V-shaped, with a weak, basal, longitudinal, gutter-like furrow (= *E*. x *litorale*) *or* (**b**) **stem nodes** *never* grossly swollen and geniculate, and their **branch internode furrows** *rounded* and *without* a basal, longitudinal gutter-like groove (= *E.* x *fluviatile* and *E*. x *dycei*): ……..**3**

3a Stem base to 10 mm in diameter, the **stems** *tubular, pipe-like, thin-walled and* ± *smooth throughout their length*; **stem central cavity** 4/5-7/8 the width of the stem, which latter *collapses readily* when lateral pressure is applied; **stem sheath teeth sinuses ****obtuse to broadly rounded*, the teeth thus **wide-spaced and non-coherent*; **branch internodes ****5-8-ribbed*; their **central cavity** *visible to the naked eye, and *c. *1/2 or slightly more, the width* of its branch internode : …….…… **E. fluviatile**

3b Stem base no more than 6 mm in diameter, and often less, the **stems ±** thick-walled and firm, **commonly smooth-walled proximally and ridged-and-furrowed distally*: …… **4**

4a Stems *slender*, up to 45 cm in height x 2-3 mm in diameter, *usually procumbent-ascending, their very long, branchless, distal portion characteristically flexuous and whip-like* (flagellate); **nodal branches** (when present) *long, asymmetrical and confined to the lower 1/4-1/3* of the stem; **branch internode furrows** *shallowly rounded* and *without* a basal, longitudinal, gutter-like channel; **stem central cavity** 1/3-1/2 the width of its stem;

first branch internode *as long* as the adjacent stem sheath: …….. **E.** x **dycei**

4b Stems usually *erect, stout and robust*, to 100 cm high and up to 6 mm in diameter, *conspicuously ridged-and-furrowed distally*, and *with numerous, symmetrical, central whorls of nodal branches*; **stem central cavity** *1/2–2/3* the width of the stem; **branch internode furrows** *commonly V-shaped and flat-sided*, with a variably conspicuous longitudinal, gutter-like channel; **branch internode central cavity** **1/5–1/3* the width of its branch; **first branch internode** (*at the two lowest stem nodes) usually *slightly shorter* than the adjacent stem sheath: …… **E.** x **littorale**

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Protecting the threatened flora of old walls – Position Paper No. 2

Prepared on behalf of the Dublin Naturalists' Field Club by the Conservation Sub-committee: Declan Doogue, Rosaleen Fitzgerald, Philip Grant, Ursula King, Melinda Lyons (Chair), David Nash and Charles Shier

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Old walls act as refugia for many plant species which were once common in the Irish landscape but are now rare following the destruction of their natural habitats. Many towns and villages still have old walls and they are often respected as testimony to earlier times,

irreplaceable survivors of former cultures and social activity. The oldest walls are usually associated with religious establishments or Anglo-Norman castles. More recent constructions from the 19th century, such as estate walls, canal embankments and river and railway bridges, are also of value. The wildlife (flora and fauna) and historical conservation value of these structures are now under threat from a variety of processes. In this position paper we set out the scientific reasons for our concerns about these built habitats. We recognise that the loss of these habitats is part of a wider downgrading of our natural biodiversity, and we appreciate that often very well-intentioned but unhelpful voluntary actions have been conducted in an information and knowledge vacuum. Accordingly, we set out an evidence-based rationale for the protection of these special habitats while they still survive. In addition, we suggest ways in which the ongoing losses of these habitats might be prevented, and we indicate pathways for well-directed conservation actions by concerned citizens.

The geological background

The Irish landscape consists of a large variety of rock types, formed during different geological periods and modified by tectonic processes, such as folding, volcanic events and metamorphism. In places, outcropping bedrock of various types has been exposed through uplifting, glacial action, soil erosion or quarrying. These rock features vary from relatively low protuberances to substantial mountains and the various minerals from which they are formed have different chemical characteristics and physical properties. When materials from these features are used for wall building, it results in the formation of a variety of habitat conditions suitable for natural colonisation by certain plants, lichens and invertebrates.

Much of the bedrock of lowland Ireland is covered by glacial till — a mixture of stones and smaller particles deposited by the melting glaciers. Glacial depositional features, such as eskers and moraines, often contain boulders and large stones which have subsequently been incorporated into built structures.

Quarrying has exposed the bedrock in many places and provides striking examples of the affinity of certain plant species to particular substrates. The soils that have formed on these exposed outcrops are usually very shallow, free-draining and seldom dominated by the heavier grasses found on deeper soils, which can smother smaller, short life-cycle species.

Traditionally, rocks for wall building were quarried locally. In recent decades bedrock extraction has increased to satisfy demand from the building and road construction industries. As a result, many of the characteristic species of these exposures have now been eliminated from the immediate landscape. Meanwhile, other outcrops have become overgrown by encroaching heavy scrub, their abandonment brought on by difficulties with ploughing the land where there has been a shift to cultivation, or the need to protect livestock.

Diversity of wall habitats

While most old walls were originally constructed from materials available at close hand, some decorative ornamental stone from less immediate sources was used to embellish windows and doors of churches and abbeys. Medieval stonework was often precisely

crafted by expert stone masons. In many parts of the Irish midlands, stones rounded by glacial action were used to strengthen earth banks or were cemented together by primitive forms of mortar. Many walls, mainly in the west of Ireland are freestanding, dry-stone constructions, enduring tributes to the wall-builders' art. Elsewhere, walls were formed by skilled artisans, using the characteristics of the locally available bedrock, their artifice predicated by the bedding characteristics of the immediately available stone provided by quarrymen. The stones and rocks were secured in place by combinations of thoughtful design, supplemented by various forms of mortar, again derived from local sources — powdered limestone or lime-rich seashells. In some instances, limestone mortar was used on walls constructed from stone other than limestone (e.g. granite or sandstone), enabling lime-loving indigenous plant species to spread by natural means beyond their original limits to areas poor in lime.

Walls, in their finished state, have different construction and design features, which in turn lead to the formation of various ecological niches for characteristic flowering plants, ferns, mosses, lichens and invertebrates. This structural diversity underpins much of what has subsequently resulted in terms of habitat and hence species diversity. Some walls (especially those of limestone and granite) are topped with cut blocks. Others, particularly those of shales, are capped with sloping slabs, reflecting the bedding characteristic of the rock employed. In later years, the tops of some walls have been cemented over and sealed to prevent rainwater percolating into their interstices and undermining their structural integrity. As a result, the water supply to the roots of certain species has been compromised.

Depending on the shape of the wall tops and sides (and mortar composition, where present), thin or skeletal soils gradually form from decomposing mosses and lichens and accumulating sand. This provides a growth medium for a variety of shallow-rooted, usually short-lived plant species, collectively classified as winter annuals. Their seeds germinate over winter, then flower and set seed in spring, dying shortly before the summer droughts. In many instances, where carpets of dense moss have formed over skeletal soils, they act as incubators for the next generation of these very small plants which will grow there with their roots anchored and protected from sudden dry spells. Typically, these winter annual communities include *Erophila verna* (Common Whitlowgrass), *Saxifraga tridactylites* (Rue-leaved Saxifrage), *Veronica arvensis* (Wall Speedwell), *Stellaria pallida* (Lesser Chickweed) and *Arenaria serpyllifolia* (Thyme-leaved Sandwort).

The composition of the flora of natural rock outcrops is determined to a large extent by the nature of the bedrock and its constituent minerals. Gardeners appreciate the relative differences in the environmental requirements of certain plant species. Some thrive on soils derived from limestone; others do best on acid ground. Alpine gardeners are particularly aware of the need for free-draining substrates and sunshine, emulating the conditions which these species occupy in their natural world. Similarly, walls of differing rock types will have different species growing naturally on them. *Umbilicus rupestris* (Navelwort), *Sedum anglicum* (English Stonecrop) and the fern, *Asplenium adiantum-nigrum* (Black Spleenwort), for example, typically occur on acid rocks and are often prominent features on non-limestone walls, such as those composed of granite and siliceous shales. Many species grow on limestone walls and one of the less plentiful is *Arabis hirsuta* (Hairy Rock-cress) which has steeply declined along with other limestone grassland species.

Free-standing walls, depending on their directional alignment in the Irish landscape, will experience different patterns of temperature, rainfall and other ecological conditions on their contrasting sides. Those that are laid out in an east-west direction will have one very hot south-facing side with the other much cooler. Walls in a north-south orientation will be much wetter on the side facing the prevailing winds (usually from the south-west). As a result of these and other processes, the range of species on contrasting surfaces can be considerable.

An interesting aside is the matter of retaining walls — i.e., those which have been constructed to prevent soil slipping onto roadsides where civil works have created unstable banks positioned at an excessively steep angle of repose. This is particularly evident where ground water, percolating through the earth banks, threatens to undermine the stability of the bank. Such walls, backed by the retained material, are usually damper and cooler on the outer side and therefore suitable for colonisation by a range of small ferns, mosses and liverworts. In addition, they are often shaded by overhanging vegetation, which, in turn, prepares suitable ground for colonisation by larger humidity- and shade-demanding species such as ferns — for example, *Dryopteris filix-mas* (Male-fern), Soft Shield-fern *Polystichum setiferum* (Soft Shield-fern) and *Asplenium scolopendrium* (Hart's-tongue) — and mosses. Sea walls, e.g. where protecting coastal railway lines, provide habitat for the salt-tolerant plants (halophytes) *Spergularia rupicola* (Rock Sea-spurrey), *Crithmum maritimum* (Rock Samphire), *Limonium binervosum* agg. (Rock Sea-lavender) and more exceptionally for the shade-demanding *Asplenium marinum* (Sea Spleenwort), these being usually plants of cliffs in the sea spray zone.

Ferns and mosses are particularly indicative of rock type, with allowances being made for the locally distorting effects of mortar on acid rocks. Walls composed of calcareous rock (e.g. limestone) or cemented with lime-rich mortar are often colonised by the mosses *Homalothecium sericeum*, *Rhynchostegiella tenella*, *Ctenidium molluscum* and several small cushion-forming acrocarps. Occasionally, much rarer moss species such as *Entosthodon muhlenbergii* and *Leucodon sciuroides* are found on base-rich walls. In contrast, certain species of *Hypnum* and *Racomitrium* may colonise old, undisturbed base-poor walls, especially in the uplands. *Bryum pallescens*, another uncommon moss, is unusual in that it often colonises old walls irrigated from above by water dripping from metal roofs, apparently tolerating or even benefiting from the metalliferous run-off.

Mosses and ferns reproduce by spores which are highly mobile in moving air and will colonise suitable walls once the relevant factors necessary for establishment are present. Old walls often provide very suitable alternative refugia for these plants when all other outcropping rock habitats have been erased from the landscape. Some species of open sunny rock faces such as *Asplenium ruta-muraria* (Wall-rue), *A. trichomanes* (Maidenhair Spleenwort), *A. ceterach* (Rustyback) and some *Polypodium* species (Polypodies) have spread throughout Ireland and may also grow on some more recently constructed structures such as civic and institutional buildings, finding niches analogous to their natural habitats. Other species e.g. *Cystopteris fragilis* (Brittle Bladder-fern) are occasionally found on damper walls and bridges and are more common on rocks in upland situations where the local climate is cooler and moister. Churchyards can also be important in providing a range of different substrates due to the variety of rock types used for headstones and other structures.

River bridges, especially older ones, are often the only place where certain species now occur. This is particularly the case in upland areas. Formerly, some native species, especially *Hieracium* species (Hawkweeds) (see page 44) occurred on rocky ground above river gorges. These species are particularly susceptible to the effects of sheep-grazing. Though perennial, most of their living biomass is above ground. Thus, being easily grazed, they are unable to form stems, flowers and fruits. Many are usually encountered nowadays on bridges crossing these upland streams and rivers, where they are secure from grazing. Sadly, some colonies of these very rare and undoubtedly indigenous species are now endangered by re-pointing older stonework, or by other less necessary cosmetic actions. Similarly, another suite of Hawkweed species, which are relatively recent arrivals, has made its way onto old railway walls and the garden walls of some heritage houses. These species were originally transported as seed and dispersed accidentally and are now clinging on in small towns where not only have the train stations been closed but the permanent way itself, with its steep banks and stone chippings, has been erased from the rural landscape. These precariously small colonies, self-sustaining but isolated from others, have now come under pressure, as more and more of the older walls are either cleaned up, repointed or re-purposed as ornamental features. Once eliminated there is no available source for natural re-colonisation by these species.

In addition to their significance for plant species, old walls secured by early forms of crumbling mortar provide suitable lime-rich environmental conditions for a number of rare woodlice (e.g. *Porcellio spinicornis*) and some species of terrestrial mollusc. Snails such as *Helicella itala, Cernuella virgata, Xeroplexa intersecta* (syn. *Helicella caperata*) and *Cochlicella acuta* were formerly widespread species of semi-natural lime-rich grassland and, being vulnerable to trampling by cattle, are now largely confined to walls and banks. One of the most characteristic snails of mortared walls is *Lauria cylindracea* which thrives secreted in cracks. *Balea perversa* lives in similar situations, especially on walls shaded by vegetation and the minute *Pyramidula umbilicata* can often be seen on exposed wall tops, especially on dry-stone walls. Various bee and other heat-demanding species use wall spaces for their tunnels and nests, assisted by the heat-retaining characteristics of the stonework, especially when the structure is situated on bedrock.

Invasive species on walls

In common with many other Irish habitats, walls have been invaded by a number of plants of garden origin. Many of these are true species (as opposed to cultivated garden varieties), occurring naturally elsewhere in the world. Islands such as ours have depleted insect faunas which results in the scarcity of predators which in a natural setting would keep these robust plant species in check. Therefore, these garden escapes are able to spread and reproduce, curtailed only by the prevailing environmental conditions of an area. Many of these invasive species are now so widespread that they are often assumed to be natural components of our indigenous Irish flora. Some of the species that have come to invade our old walls are originally species of hot rocky ground elsewhere in the world and were intentionally introduced as garden plants but have subsequently escaped onto our old walls.

The main culprit in this respect is *Centranthus ruber* (Red Valerian), a long-established garden escape which can have dense flower heads of pink, red or white. Originally introduced from Mediterranean regions to bedeck garden walls and rockeries, it

has, in recent years, become a major pest species. Its destructive roots insinuate themselves into and between the mortar. Its leaves, being broad and mildly succulent, can block out the sun from the much smaller, short-lived native annuals that could otherwise grow on the wall tops. In this way it completely changes the microclimate for plants and other organisms at the tops and upper sides of the walls. Because it is a colourful fast-colonising species, especially now in times of milder winters and hotter summers, Red Valerian is often tolerated or seen as an asset.

The less aggressive species, *Erinus alpinus* (Fairy Foxglove), from south-west Europe, is another such interloper. Its lower stature does not lend itself to becoming a dense canopy-forming species, but it lays down a thick carpet of vegetation. It was noted as becoming a colonist of old walls with suitable microclimate by the middle of the nineteenth century in Ireland and still persists in some of the sites where it was first recognised. This and other species such as *Erigeron karvinskianus* (Mexican Fleabane) were deliberately imported as garden plants, long before society became aware of the need to protect our own complement of native species. The related *Erigeron floribundus* (syn. *Conyza floribunda*) (Bilbao's Fleabane) is a recent arrival, initially colonising sunny urban sites and now often encountered on walls.

Cymbalaria muralis (Ivy-leaved Toadflax), as its scientific name suggests, has a strong association with walls and was similarly imported, from south-central Europe. Its vegetative parts are very susceptible to herbicide application, but it has the unusual capacity of being able to insert its seed capsules into cracks and crevices after flowering. Though the parent plants may die, whether from herbicide or drought, the concealed seeds remain viable and may germinate the following year. Where spraying incidents occur, and all other wall dwelling plant species have been killed off, Ivy-leaved Toadflax can re-assert its presence year after year, often flowering amidst the dead remains of the native species which have been cleared in the interests of tidiness. Indeed, in the absence of other wall-dwelling species, its presence indicates the casual manner in which the indigenous has been replaced by the opportunist.

One of the most pernicious new weeds being consciously introduced is *Sedum album* (White Stonecrop). This succulent, originally a species of dry landscapes in mainland Europe, was brought into Ireland as a plant suitable for rockeries and walls. Its clusters of white flowers make it an attractive species which needs minimal maintenance or attention. Requiring little watering, it is now firmly established in graveyards and has spread thence onto old walls where it is robustly displacing other drought-tolerant species, including the related indigenous *Sedum acre* (Biting Stonecrop). White Stonecrop is widely promoted by commercial interests as a component in green roofing — supposedly as an eco-friendly measure — but without any advice or apparent awareness as to the environmental consequences of its introduction. It needs little encouragement. The current and much-needed enthusiasm for the protection of biodiversity unfortunately — in the course of doing something positive for some non-native species — leaves natives disadvantaged or locally exterminated.

A species that is increasingly becoming problematic on old walls are *Hedera* species (Ivies). While having acknowledged benefits for wildlife — providing nectar or pollen later in the season for bees and wasps and berries for birds, in addition to providing shelter for over-wintering butterflies and other invertebrates — there are certain situations

where this species should not be encouraged, for example, on old walls constructed with lime mortar. Once established at the base of such walls, this species has the capacity to grow rapidly, displace smaller, long-established native species and undermine the wall itself as its stems can easily penetrate between the stones, weakening any lime mortar present. Over time, as it grows and its stems increase in girth, smaller stones and mortar fall out, destabilising sections of the wall itself.

Long-established colonists of historic interest

In Ireland we have a number of other species associated with old walls from much earlier periods, for example, species associated with the castles and tower houses of the Norman era. Indeed, the prominent position of many of these structures often testifies to the proximity of natural bedrock.

The composition of the botanical clothing of the walls of these structures and of their immediate surroundings indicates that several species were used and probably introduced by medieval herbalists and others. Some — for example *Smyrnium olusatrum* (Alexanders) which is often found in the shelter of these walls — have a long-established reputation as culinary herbs. The reasons for the presence of others are more obscure and some may have had decorative or mystical significance. Modern research methods at the molecular level are now able to detect differences in the genetic composition of different colonies of certain species. In the case of Ireland, where spatially isolated colonies of a given species have maintained themselves independent of other colonies of the same species, it may, in time, be possible to ascertain the historical provenance of these colonies, thus throwing light on the practices and paradigms of medieval and pre-medieval religious orders, herbalists and gardeners. In too many instances excessive wall-cleaning has resulted in the needless destruction of the dwindling body of historical evidence associated with these old structures. In certain circumstances, especially on taller buildings, it is still possible to see the remnants of this botanical evidence high up on their walls, safe beyond the reach of herbicides, power washers and cement.

The exact status of some of these species thus remains to be explored. *Erysimum cheiri* (Wallflower) originally from the East Mediterranean, for instance, is a well-known and conspicuous feature of many medieval towns. Other built areas of similar vintage and with apparently similarly aged buildings are missing this species. Whether the Wallflower ever occurred in these towns or has simply been cleared away, may never be known. The status of *Parietaria judaica* (Pellitory-of-the-wall) is an even more challenging issue. It occurs on very old buildings far from other colonies, but also in natural habitats such as coastal rocks and shingle. It is a puzzle as to whether it spread from one castle (and its often-supporting bedrock) to another, or perhaps was introduced separately to different sites for reasons now obscured by history.

The use of culinary and medicinal herbs forms a potentially fascinating area for study by medieval historians. On occasions, following excavations around old structures, long-buried but still viable seed is brought to the soil surface where it germinates and sometimes sets seed, thus perpetuating the occurrence of these seldom-seen species on their sites. The temptation for site managers is sometimes to spray off these plants before they can set seed and to jeopardise the survival of future generations of the colony.

Protecting the historical evidence and the habitats

The casual erasure of this body of historical biological evidence is now a matter of considerable concern endangering our botanical heritage. In addition, the decline of these important habitats as refuges for our native rock outcrop and scree plant species, means that various invertebrate species are similarly threatened. While major issues such as the threat to existing bat colonies through depletion of wall roosting sites are already well-flagged, the habitats of many invertebrate species are now also under active threat. They are often eliminated by people who are unaware of their presence or the significance of their occurrence. Herbicide spraying, power washing, rendering, re-plastering, grouting and pointing (particularly with modern cements) are all actions whose enduring consequences are often not appreciated. The living elements have survived for hundreds of years on these sites but their historical testimony can be eliminated in a few days of well-intentioned 'tidying'.

Wherever and whenever wall-clearing and other works are under consideration, a number of points should be considered.

Firstly, it is worth asking whether the contemplated action is really necessary. Where compelling matters of public safety are a genuine concern, there is little at issue and the necessary works should be undertaken using appropriate materials.

Secondly, the removal of ivy is often a contentious matter. It is perhaps best not to let it become established in the first instance. If it is being removed this may dislodge old mortar and stonework, which then necessitates various supplementary repair works. This, in turn, can have a devastating impact on invertebrates such as spiders, snails, woodlice, lepidoptera and certain solitary bees that find the micro-climate that forms under the canopy of vegetation congenial to their environmental requirements. One overarching conservation and legal consideration relates to the welfare of our bat species, many of which are strongly associated with old ruins. If the removal of long-established ivy on such ruins is being considered, a bat survey must be carried out before any works take place.

Thirdly, consider the impact of the proposed action on the existing flora and fauna. Is the action purely cosmetic — tidying for the sake of tidiness or planting for the sake of adornment? If so, is it really justified to remove both the indigenous species and the inherent historical evidence that has taken centuries to form and maintain itself? Similarly, is it really necessary to 'repair' the whole wall in one operation rather than incrementally over a number of years? An essential characteristic of rare species is their association with rare self-sustaining ecological conditions which are not easily reproduced or maintained. Even if these conditions were to become available in the future, source populations for recolonisation are often no longer present in the hinterland.

We appreciate that it is not easy for well-motivated, concerned citizens in this area to access the knowledge necessary to form prudent judgements on contemplated 'improvements'. There is a current genuine concern for the protection of biodiversity. Unfortunately, we are running the risk that, without expert guidance, efforts to protect a structure from some colonists may result in the local extermination of other species of greater ecological or historical value. A number of suggestions which we hope may guide are offered here.

At a minimum, prior to any works taking place on old walls, a survey should be conducted by a competent botanist who is familiar with the species concerned and

knowledgeable as to their occurrence within the immediate locality. This entails both a **diagnosis** (stating which significant species are present on the walls in question and in the immediate locality), and a **prognosis** (a statement as to what the regional consequences of the proposed actions are). The County Botanical Recorder of the Botanical Society of Britain and Ireland (BSBI) is the best person to be contacted in relation to plant species, usually via the Heritage Officer or Biodiversity Officer network of the local authorities. Additionally, information of the local occurrence of rare invertebrate species may be provided by the various research scientists of the National Biodiversity Data Centre (NBDC) and National Parks and Wildlife Service (NPWS).

The Dublin Naturalists' Field Club (DNFC) has produced a paper (available at dnfc.net/wildflower-seed-mixtures) outlining the consequences of the inappropriate introduction of so-called 'wildflowers' into areas where they never occurred naturally. Sowings of this nature are strongly discouraged.

In the meantime, and as an initial measure, much useful work can be done by preventing the establishment of ivy and alien invasive species such as *Buddleja davidii* (Butterfly-bush) and *Centranthus ruber* (Red Valerian) on our older walls. In certain circumstances it is now possible, using digital photography to canvass the opinion of other professional ecologists and *pro bono* field botanists regarding the current state and significance of particular walls. This should result in reducing the impact of any contemplated action on the quality of the existing habitat.

The alternative is to contemplate the continuation of the erosion of our native biodiversity and its replacement by an overgrowth of warmth-aided garden escapes, along with a substantial further depletion of the surviving ecological and historical evidence contained in the species growing on old walls. It is now imperative to instigate measures and thinking that will ensure continuity of these supporting habitats and their living evidence-base into the future.

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Atlas 2020 – an imperfect masterpiece

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Background

There were three main outputs from Atlas 2020: the on-line Atlas[1]; the printed Atlas book in two volumes[2]; and two printed summary documents, one for Britain[3] and one for Ireland[4]. The summary for Britain was drafted by a team of staff from BSBI and the Centre for Ecology and Hydrology who had been closely involved with the analyses of the data, but

none of whom were based in Ireland. While the expertise of the team was beyond doubt, the BSBI's Committee for Ireland was concerned that the summary for Ireland should fully reflect the character of Irish botany. Perhaps foolishly, I offered to try to co-ordinate the Irish summary and do the drafting. It was a salutary experience!

If a salutary experience is one from which you learn, then it was ideal. I will try to outline here some of the more significant points that I learned during the process of producing the summary, both from the viewpoint of a recording foot-soldier and that of someone trying to understand what the findings mean. The purpose is to help the botanical fraternity to understand, especially from an Irish perspective, some of the strengths and limitations of the Atlas data. The strengths emerge from the summary documents, but the limitations hardly surface in the Irish summary document.

From the outset it must be stated that the Atlas is a very remarkable achievement, not least in respect of Ireland. For practical purposes, the whole of Ireland was effectively covered, with more records of more species by more recorders than ever before. The facilities available on the website allow you to examine the data in many different ways, some of which can be very revealing. You can also call up images of each species. What follows here addresses some of the minor imperfections of the Atlas, with the intention of enabling reliable interpretation of the data. For a more erudite discussion of the issues, I recommend reading chapters 4 to 7 of the Atlas[2].

Estimating change

One of the key aims of the Atlas was to identify and quantify changes in the flora over time, based on the presence or absence of records of species in each hectad and comparing the recent data with those from earlier time periods. Sounds easy? It was anything but! It might have been more so if we could assume that the data were a random sample of actual distributions; they clearly were not. It might also have been easier had there been similar amounts of surveying in each time period; there wasn't that either. Recording activity has undoubtedly varied hugely over both space and time. How then does one attempt to analyse such a mish-mash of data? The answer adopted for Atlas 2020 was FRESCALO, described as a modelling approach that makes adjustments for these variations using the frequencies of some locally common benchmark species that are likely to have been well recorded in all areas and time periods. The method is described in Chapter 6 of the Atlas, but I make no claim to understand the details of the analyses fully. Their outputs, however, tell some interesting stories.

For each species, separate analyses were carried out for the British and the Irish data, and for the short-term and the long-term (that's no mean task – in the order of 22,000 analyses[5]). The short-term constituted three date classes and the long-term constituted four date classes. For each species (excluding the rarest), 100 hypothetical linear trends over time were generated that would be compatible with the observed data. From these, a single mean trend line was calculated. If it sloped upwards, the species was probably increasing; if downwards, it was probably decreasing. Associated with this mean trend line were uncertainty (or "confidence") intervals – narrow if the 100 linear trends were closely bunched, wide if they were disparate.

As well as for individual taxa, the data were analysed in a similar way for groups of taxa typical of various habitat types (e.g. woodlands), or of taxa with biogeographic affinities in common (e.g. Mediterranean-Atlantic).

This modelling method is designed to allow for variation in recording effort generally, but it cannot allow for systematic bias resulting from botanists giving more attention to, for example, certain species, habitats or seasons in different time periods.

On the whole, the calculated Irish trends had noticeably wider uncertainty intervals than the British ones. To some extent, this was expected as there were fewer data overall, but there were also disturbances due to other factors as outlined below.

In the rest of this paper, I have tried to outline some of the underlying reasons why the calculated trends cannot always be taken at face value. To supplement my own impressions, at one stage during drafting of the Irish summary report I canvassed the opinions of an *ad hoc* panel of 10 experienced Irish recorders about 22 particular species, and some of my comments below reflect a consensus of their views.

Uneveness across time – deficient date classes

For the short-term analyses, the three date classes used were 1987-1999, 2000-2009, and 2010 to 2019. For the long-term analyses, the same three classes were used along with the period 1930-1969. These date classes are not quite identical with those used for the maps in on-line Atlas. The latter uses 5 date classes: pre-1930, 1930-69, 1970-86, 1987-1999, and 2000-2019 records. The key points about the date ranges are:

- Pre-1930 records are not included in the analyses, presumably because they were too sparse or haphazard.
- The initial date class (1930-1969) for the long-term analyses was much longer than the later data classes, and includes data from the first BSBI Atlas[6].
- The period 1970-1986 is a gap in the analysed long-term series, presumably because it was relatively deficient in records, particularly those of commoner species.
- The Atlas 2020 recording period of 2000-2019 was divided into two equal length periods for both analyses.

In principle, the FRESCALO model should iron out variations over time caused by different intensities of recording, and no doubt it did achieve this aim to a considerable degree. However, the 2000-2009 date class, common to both the long-term and short-term analyses, is problematic for the Irish data. It appears that general recording was not a priority in this period. Irish VCRs, perhaps wanting a change from the square bashing needed for Atlas 2000, did not so far as I am aware anticipate that this date class would ever be treated as a separate period for analytical purposes. As a result, the data depart very considerably from being a consistent set across the whole Irish flora. Some examples will emerge below.

Geographical unevenness – sparse areas

There are far more records per hectad in some areas than others. The average number of records per hectad in 2000-2019 was *c.* 2850, but the average is pulled upwards by the huge numbers in two VCs – Waterford and Wexford. Even if we were to take 2000 records per hectad as a more realistic norm, there are large blocks of hectads where the norm was exceeded and corresponding large blocks where it was not remotely achieved. A little of

this difference might be explained by there being a richer flora in some areas than others, but overwhelmingly it is due to variations in recording activity.

This kind of unevenness is to be expected. It matters only if it distorts or obscures the wider conclusions that we are trying to draw out of the data. Obviously, while thorough recording is to be encouraged, it may never be feasible to record everywhere up to the standards of the best. It is however, worth looking more closely into the least-well recorded areas (see page 46). Some hectads within them have fewer than 500 records in total for the period. The blocks tend to be in the west and/or midlands and, by omission, they almost certainly colour the apparent distribution patterns of some middle-of-the-range species.

There are about 5 blocks of Irish tetrads showing much lower than average numbers of records for 2000-2019. Broadly speaking, these are clusters of several hectads, most or all of which have fewer than 1000 records each in the 20 year period. They show up clearly on the map on page 4 of the Plant Atlas 2020 summary booklet "Ireland's Changing Flora" (available on BSBI website). Small numbers of records do not necessarily translate linearly into few taxa being recorded, but they are certainly indicative of a lower level of recording. These blocks are under-explored areas for the time period. Because they may span two VCs, they are identified below by the grid ref of one of the central hectads of the group rather than by vice-county.

- C00 (697) – an inland north-western mountainous area with valleys running through
- F93 (430) – a large western coastal peninsula, with one well recorded and severally thinly recorded tetrads.
- M54 (605) – a low-lying inland west midlands block, with 10-15 thinly recorded hectads
- N77 (719) – an east midlands, inland lowland area with a few thinly recorded hectads.
- Q92 (792) – a south-western block including some coast and some hilly ground with some very well-recorded tetrads abutting it.

It's unlikely that these areas of sparse recording have materially affected many of the trend analyses, unless there are species that happen to be concentrated in one or more of these areas.

Uneven seasonal recording

Few plant species are equally obvious at any time of year. Some, indeed, are practically invisible or unidentifiable outside a narrow window. Part of the skill of plant recording is to recognise and attempt to compensate for this effect. But there are practical limits to how well one can compensate for the variability of life-forms.

Some likely casualties of seasonal recording are those species or groups that are not easily recorded in midsummer, only later or earlier. Clear-cut examples would be *Ficaria* ssp. (discernible in April-May) and coastal *Atriplex* (August to October). *Ficaria verna* (Lesser Celandine) *sensu lato* was recorded in virtually every hectad in Ireland in 2000-2019, but in many hectads there is no record of whether it was ssp. *fertilis* or ssp. *verna* or both. More insidiously, many species are more obvious or more identifiable in some months than in others, notably grasses and sedges. There is a clear message here that comprehensive recording does require paying attention to seasonal differences. Two short

field sessions at different seasons may well result in more species being recorded than one long one.

Habitat recording

The Irish data include records from habitat surveys commissioned by the National Parks and Wildlife Service and Northern Ireland Environment Agency. In some cases, the records from these surveys comprise a substantial portion of all the data for species typical of the habitat. Intensive surveys are likely to raise the proportion of occupied sites that are recorded as having these characteristic species present, creating a bias towards those date classes in which the survey took place. Examples would include woodland and wetland surveys.

Even though these habitats tend to be reasonably well surveyed outside of commissioned surveys, nevertheless the estimated trends for certain species show some odd features. For instance, woodland surveys were undertaken both north and south in 2003-07. In the DDb data, *Ajuga reptans* (Bugle) has a disproportionately large number of records in the 2000-09 date class. This peak is in the third of the four long-term periods and seems to have the effect of creating an apparent increase in the long-term trend for the species. On the other hand, it is in the second of the short-term periods, in which there appears to be a slight (but clearly non-significant) decrease in the short-term trend.

Another woodland species, *Veronica montana* (Wood Speedwell), shows a more dramatic effect. It also has a peak of records around the same time, but so much so that it emerges as having the 4th highest long-term increase of all species in Ireland – native and otherwise. That is extremely unlikely to be a true picture, given the fast rate at which some introduced species have been spreading.

Erratically recorded groups

There are certain other groups which have been recorded erratically, e.g. by some botanists and not others, in some areas more than others, and in some date classes more than others. Trees and aquatics come to mind. Erratic recording may also have applied to non-natives as a whole in earlier date classes.

Because of their wider ecological significance, some botanists have considered it important to record most trees that are not in gardens. Others largely ignore or overlook them unless they are native species and/or self-sown. It can also happen that recorders look downwards at herbaceous plants most of the time and forget to look up at the trees! The Atlas data suggest, for example, strong increases in the two Lime species *Tilia* x *europaea* (Lime) and *T. platyphyllos* (Large-leaved Lime) in Ireland, but the apparent increase is almost certainly due to recorders taking more notice of them rather than being due to a genuine increase. Tree identifications are sometimes tricky and a specimen may be wrongly assumed to be the "usual" species. The genera *Populus*, *Sorbus*, *Abies*, *Ulmus*, and *Malus* would be cases in point, and even *Tilia* may sometimes be mis-recorded. (Note that *Abies* and *Tilia* were omitted entirely from Webb's Irish Flora[6], often used as the standard flora until recently.)

Aquatics are perhaps a special case because thorough surveying demands specialised equipment and experience not available to most recorders, and microscopic examination might be required. Change over time in aquatics, particularly the submerged

ones, is better recorded by repeated systematic surveys rather than in general surveys. Even relatively straightforward aquatic species for a land-based general recorder show some surprising calculated trends. In *Potamogeton natans*, for instance, the long-term Irish trend is a marked increase whereas the short-term one is a decline.

Other candidates for erratic recording would include grasses in the vegetative state, sedges generally, and genera such as *Epilobium*. In many cases, an experienced botanist looking at the Atlas outputs will readily understand which are these problem groups, but occasionally the data appear – to me at least – to reveal biases which may not be obvious.

Validations and ID errors

Primary responsibility for validating records lies with VCRs, although much initial work was also done by the BSBI scientific staff. The outcome is that the Atlas data are probably much better than they would have been without these inputs. Nonetheless, the apparent distributions of certain species or hybrids would appear to have been influenced by how strict and thorough VCRs and others have been in their validation and editing of records.

Two taxa that I am aware of that seem to be victims of inadequate scrutiny in Ireland in the Atlas are the hybrid Polypody *Polypodium* x *mantoniae (P. vulgare* x *P. interjectum*) and *Carex acuta* (Slender Tufted-sedge). The former has a concentration of records in and close to my vice-county. I confess here that I did not get around to validating hybrids thoroughly for the Atlas, but now that I look carefully at this one, I can see that its records all originate with one now-deceased recorder who I understand worked entirely by eye and never used a microscope. Undoubtedly he had a very good eye, but in this case the experts generally advise that you cannot tell the hybrids with enough certainty without looking at the spores. So those records, while they appear in the Atlas, have now been labelled in the DDb as dubious.

The second case is a straightforward one of misidentification. I have visited many of the recorded sites of *C. acuta* throughout Ireland. This is a long-lived rhizomatous sedge, but only in a small minority of instances is there any *C. acuta* present. More often, there is one or more different tall riparian *Carex* species there that could easily be mistaken for *C. acuta*, such as *C. acutiformis* (Lesser Pond-sedge) or *C. aquatilis* (Water Sedge). *C. acuta* has been over-recorded and its records not challenged rigorously enough, with the result that the maps suggest it is much commoner than it really is. Errors like this are potentially serious if, as in this case, they concern threatened or declining species.

Captions

Reading through some of the texts that accompany each taxon, one of the first things that struck me as bizarre is that some of the joint authors died many years ago. The explanation is that these are generally adaptations of the text from the New Atlas[7] (*i.e*. the 2000 Atlas) and both the original author and the adaptor have been credited. This is understandable when you take into account the huge number of texts that had to be drafted in a short space of time. We should be very grateful to the stalwart band of authors who soldiered their way through so many captions in the short time they were allowed.

As I delved deeper though, it also became apparent that the texts had sometimes been drafted without the author(s) having had access to the modelled trend data for the species they were writing about. The outcome is that the text is sometimes at variance with

the trends. As an example, the text on *Carex caryophyllea* (Spring Sedge) reads "...over much of the range...it appears to be stable and there are numerous new records since the turn of the century most notably in Ireland where its distribution is now much better known...". In contrast, the Irish short term trend data actually show a strong decline. The consensus view of my expert panel was that the species had indeed declined.

A divergence like this would be acceptable if the authors were putting forward reasons why the modelled trend might be misleading, but obviously they could not do that without access to the figures.

In the main report, it is suggested that the modelled trends and the authors' captions can be seen as two partially independent views. I find this suggestion a rather lame one. The fact that it is buried deep in the introductory text does not help. The Atlas would have been improved if it had been consistently possible for authors to offer explanations of any apparent discrepancies between the modelled trends and their interpretations. Unfortunately, Atlas users may gravitate towards one or the other, or occasionally – perish the thought! – select whichever suits their ulterior purpose.

The limitations of presence/absence data

The Atlas is based on records of the presence or supposed absence of species in hectads and takes no direct account of their abundance. No distinction is made between a single plant and many thousands, an extensive clone and a solitary seedling. This observation is not one that is by any means specific to Atlas 2020, but it is one that grows on you as you try to interpret what the data mean in terms of plant ecology. To a minor extent, the starkness of the contrast between presence and absence in a hectad can be ameliorated by looking at the data on number of occupied tetrads in each hectad. This does not work well in the Irish data, and the underlying data still do not quantify abundance. The upshot is that rare species occurring in tiny quantities in a few hectads are not distinguished through their maps from species that are equally local but very abundant where they do occur. One has to rely on the accompanying text to make the distinction.

A more insidious consequence may arise in estimating change. As a hypothetical case, suppose a species is declining such that the number of occupied hectads reduces by half between successive date classes. We might legitimately say that the range has declined by 50%. Depending on the distribution pattern, the decline in number of individuals may be far greater. Michael Braithwaite[8] has argued that scarce species typically occur singly or in groups of colonies, and has demonstrated that repeated hectad surveys can give similar estimates of loss to those of repeated tetrad surveys. If similar outcomes applied at successively finer scales, my concerns would be allayed, but (as he implies) this topic needs further investigation.

Quantifying change in abundance is an issue which BSBI will undoubtedly want to address more effectively in the future if its data output is to be more directly useful for conservation purposes. This, of course, is not a uniquely Irish point, but there is a uniquely Irish dimension in it. In the UK, there is the National Plant Monitoring Scheme which addresses this point in part, but in Ireland it operates only in the northern counties. We clearly need a scheme which generates compatible data from both north and south.

Conclusion

When you read the title of this article, did you place stress on the final word (which defines the Atlas) or the one before it (which defines the subject of the article)? Recall then the advice of Voltaire: *Le mieux est l'ennemi du bien*[9]. Had BSBI striven too hard to better the Atlas by eliminating its imperfections, we would have had no Atlas. Describing Atlas 2020, I feel confident Voltaire, despite his tendency to understatement, would surely have used *très bien.*

Acknowledgments
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Vaccinium vitis-idaea (Cowberry) a new species for the Co. Wexford (H12) side of the Blackstairs Mountains, and the overlooked Co. Carlow (H13) record

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Vaccinium vitis-idaea (Cowberry) is a low-growing creeping evergreen shrub which is rare on the island of Ireland, and is generally confined to cliffs, heaths and the drier parts of blanket bogs in the mountains.

As it was a nice sunny June day in 2023, I thought it perfect for a walk along the forest roads and moorland tracks to the ridge of Black Rock Mountain. My reason for the walk was there were two monads S8552 and S8652 that I had never walked in before where I was hoping I might have luck and add *Carex bigelowii* (Stiff Sedge) to both. This wasn't to be, but instead I found *Vaccinium vitis-idaea* (Cowberry) (see page 42) new for Co. Wexford on a rocky Heather (*Calluna vulgaris*) and Bilberry (*Vaccinium myrtillus*) covered knoll (S858525) at an altitude of 580m. This site is 2km from the County Carlow border.

The Blackstairs Mountains range can be split into two by Scullogue Gap, with Mountain Leinster to the north and Blackstairs Mountain to the south. Collectively these are known as the Blackstairs Mountains. My new site is to the north of Scullogue Gap. The nearest sites being to the north on the Wicklow Mountains, Co. Wicklow where it is found at a scattering of locations, and to the west on the Comeragh Mountains, Co. Waterford where there are seven small populations.

On my return home, I was surprised to find that the *Flora of County Carlow* (Booth, 1979) doesn't even list *Vaccinium vitis-idaea*, as I was sure I had read about it growing on the Blackstairs Mountains. The *Census Catalogue of the Flora of Ireland* (Scannell & Synnott, 1987) has it listed as occurring in **H13** which is Co. Carlow.

It was Mike Wyse Jackson who said I needed to read *Notes on the plants of some of the mountain ranges of Ireland* (Hart, 1884). Hart had the *Vaccinium vitis-idaea* on the summit of Blackstairs Mountain, descending down the west side. This site being about 8km from where I found my *Vaccinium vitis-idaea*. The *Atlas of the British Flora* (Perring & Walters, 1962) does map Hart's record, but the following two atlases, *New Atlas of the British & Irish Flora* (Preston, Pearman & Dines, 2002) and the *Plant Atlas 2020* (Stroh *et al*., 2023), have both dropped this record.

The challenge going forward is to try and re-find *Vaccinium vitis-idaea* on the Co. Carlow side of the Blackstairs Mountains.

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Antrim's rare plants – Part 4

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In this penultimate part of my series on the rare plants of County Antrim, we will be looking at the species of loughs, rivers and wetland. Unfortunately, this is a habitat which has seen the loss of several species, as discussed in the first part of the series.

Nowhere is this more apparent than by the shores of Lough Neagh, the largest of Ireland's many loughs. Lough Neagh has a wide water catchment area and drains northwards through Lough Beg and the lower part of the River Bann. Its waters are severely

enriched and, in recent years, have been blighted by the growth of dense blue-green algae. Many parts of the shoreline have been reclaimed or built on and there are very few unspoilt areas with public access.

All of Lough Neagh's northern shore and much of its eastern shore lie in County Antrim. Remnants of the old flora survive on the northern shore at places like Farr's Bay and Rea's Wood. The eastern shore has fared less well and the best plants are now found some distance back from the shore at places like Portmore Lough and Montiaghs Moss. The old Lough Neagh flora also occurs on the eastern shore of Lough Beg and very occasionally at points along the lower River Bann.

Several tall sedges are found around Lough Neagh and hardly anywhere else in the county. *Carex elata* (Tall Sedge) has only been recorded since 2000 from Portmore Lough and by Lough Beg. *Carex riparia* (Greater Pond-sedge) survives at Selshan and is abundant at Portmore Lough and along the old canal near Aghagallon. *Carex pseudocyperus* (Cyperus Sedge) is found in a few ditches at Montiaghs Moss and turned up recently in a brand new site at Farr's Bay. Another survivor is *Carex elongata* (Elongated Sedge), still in quantity at Rea's Wood, also found at other sites on the northern and eastern shores of Lough Neagh, and discovered in 2018 at a previously unknown site beside the River Lagan in Belfast. *Carex acutiformis* (Lesser Pond-sedge) was found beside Lough Beg by John Harron in 1972, but the only post-2000 record of this species is by the same recorder from a small riverside site NW of Doagh.

Oenanthe fistulosa (Tubular Water-dropwort) may have disappeared from the main Lough Neagh shores, having last been recorded south of Toomebridge in 1998. There are three post-2000 records from different locations on Lough Beg. *Lathyrus palustris* (Marsh Pea) was only ever recorded from Selshan on the eastern shore of the main lough. It was still there in 2005, despite private development which has probably wiped out Ireland's only population of *Hierochloe odorata* (Holy Grass) and other rarities. There is a fine display of *Leucojum aestivum* (Summer Snowflake) in Rea's Wood and it may still survive in the woods at Langford Lodge, to which I have been unable to gain access. *Ranunculus lingua* (Greater Spearwort) was probably always a rare plant at Lough Neagh. It survives at Portmore Lough and beside the Broad Water between Moira and Aghalee. *Typha angustifolia* (Lesser Bulrush) seems to be confined to Portmore Lough, where it was last recorded in 2014.

In the water itself, *Elatine hydropiper* (Eight-stamened Waterwort) was found in 2019 at Gawley's Gate on the eastern shore of Lough Neagh during the BSBI Aquatic Plants Project. *Ranunculus circinatus* (Fan-leaved Water-crowfoot) was also found at Gawley's Gate and at Derrymore Quay nearby. Both of these species were once recorded more widely. *Eleocharis acicularis* (Needle Spike-rush) is very rare indeed, with only one post-2000 record on Lough Beg. Montiaghs Moss holds a few other aquatic plants – *Hydrocharis morsus-ranae* (Frogbit) in ditches; *Sparganium natans* (Least Bur-reed) and *Utricularia australis* (Bladderwort) in bog-pools. There are also confirmed records of *Utricularia australis* from Portmore Lough and Rathlin Island but the distribution of *Utricularia* species is still being worked out for the county.

Lowland loughs are quite scarce in other parts of the county. Some of the best small loughs are on Rathlin Island. Possibly the only native sites for *Nymphaea alba* (White Water-Lily) in the county are on the southern arm of the island. Lakelets near the northern

cliffs are the only sites in the county for *Hypericum elodes* (Marsh St. John's Wort). One lough just below the eastern scarp of the Garron Plateau has a population of *Groenlandia densa* (Opposite-leaved Pondweed), found nowhere else in Northern Ireland. It was first discovered in 1971 and was still present in 2022.

Cladium mariscus (Great Fen-sedge) is found at only 2 sites – beside a small lough on the southern edge of the Garron Plateau and an infilling lough at the western end of Rathlin Island. *Carex aquatilis* (Water Sedge) occurs along the River Main north of Cullybackey and the Kells Water in Glenwherry. *Trocdaris verticillata* (Whorled Caraway) puts on wonderful displays at its two sites near the north coast – Aird above the Giant's Causeway and Carnsampson near Ballycastle.

Taxonomic challenges and my fear of water mean that submerged aquatics have not been recorded thoroughly in the post-2000 period. Visits by Nick Stewart and others, as part of the BSBI Aquatic Plants Project, have been very welcome. Unfortunately, habitat degradation in Lough Neagh has decimated many of the rarer submerged aquatics. A recent visit to Rathlin Island by Cilian Roden proved very worthwhile, and Cilian is hoping that one of our *Chara* specimens will earn a place in the closing instalment of County Antrim's Rare Plants.

Hedera helix subsp. *poetarum* (Yellow-berried Ivy): the first record for Ireland

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As the common name implies, *Hedera helix* subsp. *poetarum* (Yellow-berried Ivy) has yellow berries that are slightly larger than, and with brighter green, usually less deeply lobed leaves than, *Hedera helix* (Common Ivy), which has black berries.

In Co. Wexford (**H12**), our native ivy is *Hedera hibernica* (Atlantic Ivy) which is extremely common in the county apart from the high ground of the mountain ranges where it is absent, and it has never been recorded on Saltee Island Great.

The only reliable way to separate *Hedera hibernica* and *H. helix* is to look at the hairs on the lower side of the young leaves, which is not always very easy. *H. hibernica* usually has pale yellowish-brown hairs, which has the rays of the hairs lying parallel to the leaf surface. *H. helix* has hairs which are whitish with the rays lying parallel and projecting away from the surface.

In April 2019, I had noticed that the berries of two patches of ivy in a roadside hedge at Seaview (T211471) west of Cahore had yellow-greenish berries. It never crossed my mind that it could be anything special as I just thought they hadn't yet turned black, and there was the usual *H. hibernica* in the hedge also, and I never returned for another look.

In June 2021, while surveying *Achillea maritima* (Cottonweed) at Lady's Island Lake, Paul Maher mentioned he had seen an ivy with very yellow berries in a hedge near where he lived at Seaview. As I was busy writing the *Flora of County Wexford* (Green, 2022), I never managed to follow this up. In 2023, Paul sent me some photos, and 'wow' was all I could say. The berries were a stunning shade of yellow (see page 41). To make matters worse Paul said it was *Hedera helix* subsp. *poetarum*, which wasn't a problem in

Equisetum photographs – pages 39-41. For captions see page 86.
Photos T. O'Mahony © 2023 (for article see page 7)


Plate 4


Plate 5

Hedera helix subsp. *poetarum* (Yellow-berried Ivy) grown on in a garden from a cutting of a wild population at Seaview, Co. Wexford (**H12**). Photo P. Maher © 2023 (p. 38)

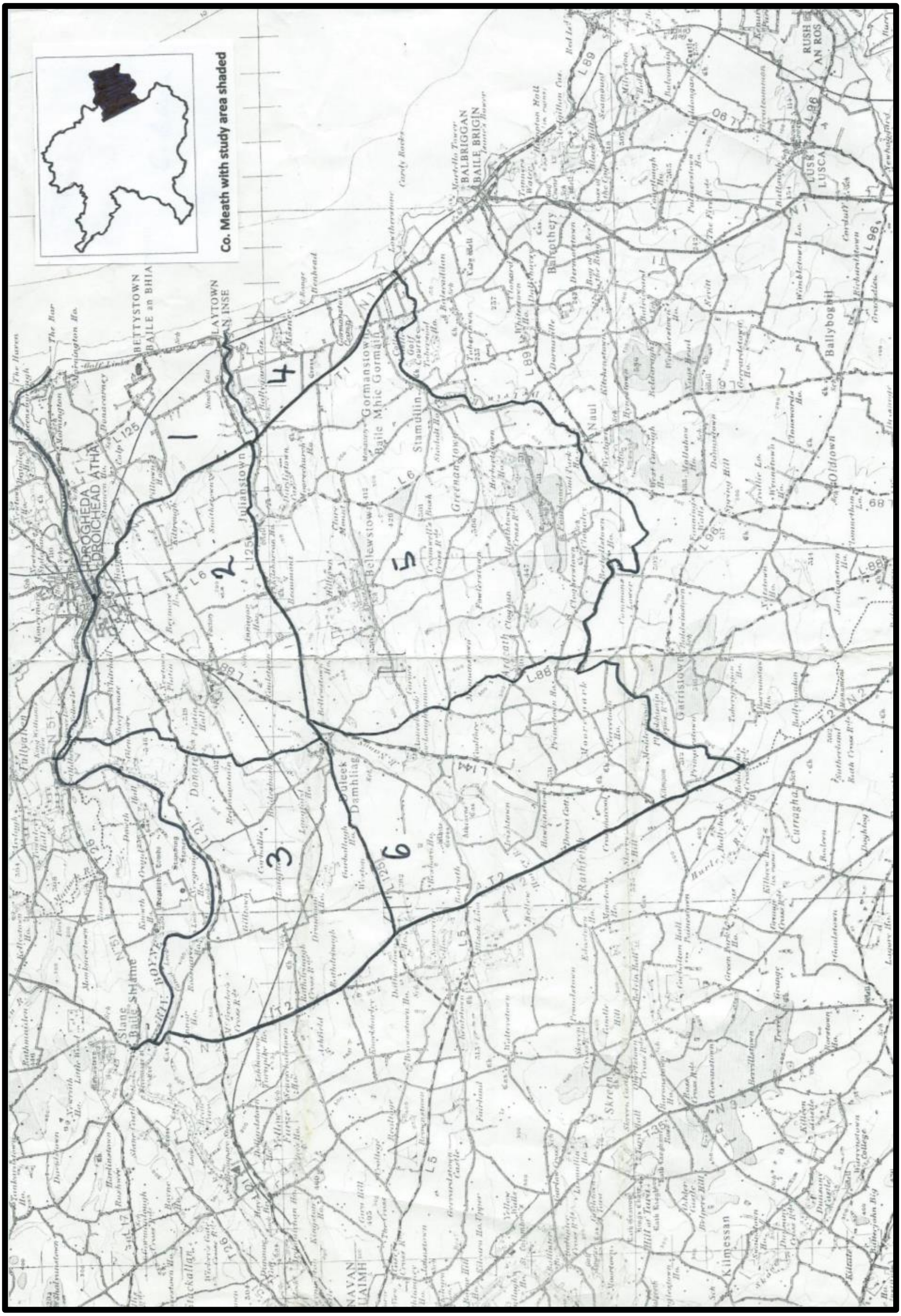
Vaccinium vitis-idaea (Cowberry) on Black Rock Mountain, Co. Wexford (**H12**). Photo P. Green © 2023 (p. 35)

Polygonum oxyspermum (Ray's Knotgrass) at Streedagh, Co. Sligo (**H28**). Photo E. Gaughan © 2023 (p. 81)

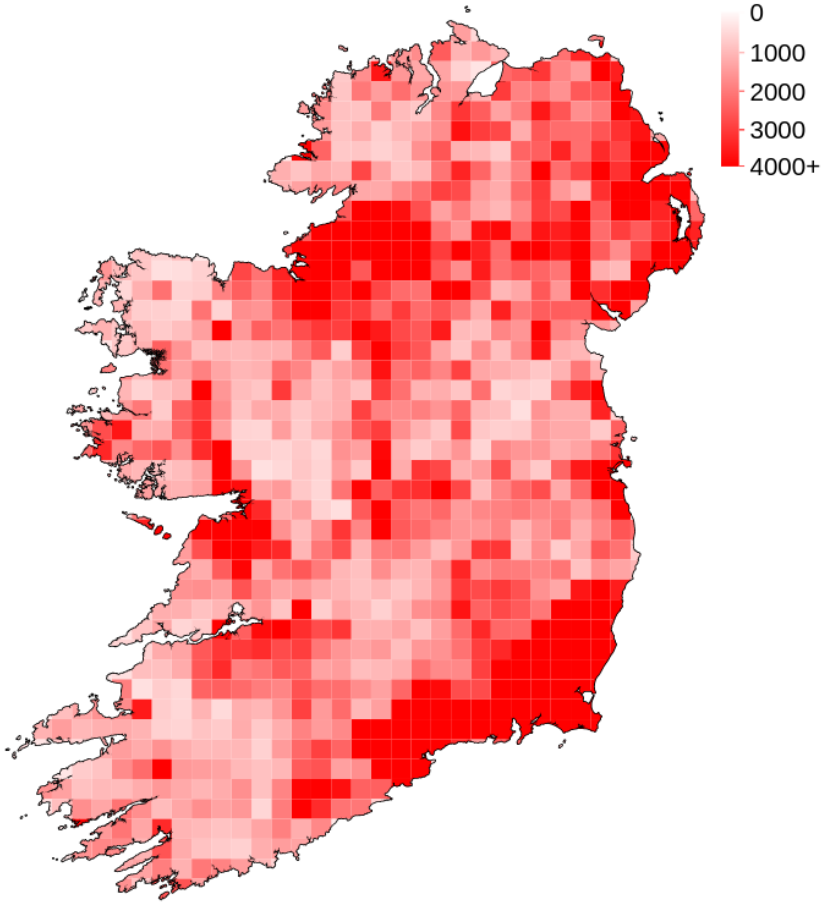
Pyrola rotundifolia subsp. *maritima* (Round-leaved Wintergreen) at Strandhill, Co. Sligo (**H28**). Photo B. Keehan © 2023 (p. 81)

Hawkweed (*Hieracium* sp.) on bridge spanning the River Liffey in Co. Kildare (**H19**). Photo DNFC © – see page 20 for article on the threatened flora of old walls

Church wall in Glencullen, Co. Dublin (**H21**), 4th July 2022. Photo S. Hanley © 2022 – see page 20 for article on the threatened flora of old walls



The original field map of the Duleek study area showing its subdivisions into six districts (p. 54)



Plant records per hectad across Ireland for the period 2000-2019, reproduced from: Faulkner, J. (2023). *Ireland's changing flora: a summary of the results of Plant Atlas 2020/Flóra na hÉireann ag Athrú: Achoimre ar thortaí Atlas na bPlandaí, 2020*. Botanical Society of Britain and Ireland, Durham; BSBI © 2023 (p. 28)

itself as he was correct, and it was a new species for the county. This rang alarm bells as there were no confirmed records of *Hedera helix* from Co. Wexford. I started checking the ivies even more carefully when out and about and managed to find three sites for *Hedera helix*. It would seem *Hedera helix* is overlooked in the county, but is likely to be very rare.

Hedera helix subsp. *poetarum* grows along a half kilometre stretch of roadside hedge, which is on the bank of a river adjoining fields. It would certainly be worth looking elsewhere along the river to see if berries washed down river have germinated, and if there are bird-sown yellow-berried ivies elsewhere in the vicinity.

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A new county record for *Trichomanes speciosum* (Killarney Fern) in the Cooley Mountains (H31)

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Introduction

Trichomanes speciosum (Killarney Fern) is one of three Irish species within the Hymenophyllaceae which are characterised by the presence of thin, translucent fronds. This restricts the sporophyte to the oceanic climates of Macaronesia, the Atlantic fringes of Iberia and France, Britain and Ireland (Page, 1997; Sell & Murrell, 2018; Stace, 2019). Outlying stations also occur on the west coast of Italy (Rumsey *et al.*, 2005). In Ireland, populations are concentrated in the south-west with a stronghold in Co. Kerry (**H1** and **H2**) (Ní Dhúill, 2014; NPWS, 2019; Stroh *et al.*, 2023).

The life cycle of *T. speciosum* is unique amongst Irish pteridophytes. Unlike the short-lived prothallus of other species, it produces a perennial, filamentous gametophyte capable of vegetative reproduction (Page, 1997) which is often found in the absence of sporophytes (Rumsey *et al.*, 1998). Alternation of generations is not required for the survival of this species. Hence, the gametophyte may be considered independent of the sporophyte stage (Rumsey *et al.*, 1998). Both generations grow in areas of constant high humidity such as near waterfalls and in shallow caves (Kingston & Hayes, 2005; Page, 1997). Darker, drier sites unsuitable for the sporophyte may be occupied by the gametophyte (Kingston & Hayes, 2005). In contrast to the restricted sporophyte distribution, the gametophyte is more widely distributed. Within Europe, it occurs as far east as Poland (Krukowski & Świerkosz, 2004). Twenty-four Irish vice-counties (VCs) have post-1990 records. Yet, the only eastern coastal VCs with recent records are Co. Wexford (**H12**), Co. Wicklow (**H20**) and Co. Antrim (**H39**) (Botanical Society of Britain and Ireland, 2023; Northridge & Northridge, 2007; NPWS, 2019). Both generations occur in Antrim whereas only the gametophyte occurs in Wicklow presently, despite the historical occurrence of sporophytes (Ní Dhúill, 2014).

Site and population description

On 16th April 2021, CF and Enda Flynn encountered what appeared to be *T. speciosum* gametophyte (see page 89) growing in a shallow cave on Slieve Foy, Co. Louth (**H31**) (hectad J11) within Carlingford Mountain SAC. The habitat, growth habit and the dry 'cottonwool' texture fitted the description in Merryweather (2020). A small sample was collected and sent to Rory Hodd who confirmed the identification. Voucher material was subsequently deposited in the National Herbarium, National Botanic Gardens, Glasnevin (**DBN**).

The site was revisited on 7th September 2023 when further details were noted. The cave is at 400m altitude with a westerly aspect. Gabbro outcrops here, a feature which is reflected by a mildly calcicolous flora including *Asplenium ruta-muraria* (Wall-rue), *A. scolopendrium* (Hart's-tongue), *Polystichum aculeatum* (Hard Shield-fern) and *Amphidium mougeotii*. The cave is 4.5m deep. Humidity is maintained by water dripping from the walls and the roof. As the gametophyte grows in small, scattered patches, it was difficult to calculate colony size. Its location within the cave appears to be influenced by both light levels and bryophyte cover. Bryophytes are concentrated in areas with elevated light levels. The gametophyte is most abundant in darker areas such as the roof and side walls where bryophytes are generally absent. Associated species within one metre of the gametophyte include *A. adiantum-nigrum* (Black Spleenwort), *Cardamine flexuosa/hirsuta* (Bitter-cress), *Thamnobryum alopecurum*, *Amphidium mougeotii*, *Pellia* sp., *Kindbergia praelonga*, *Fissidens taxifolius* and *Metzgeria* cf. *conjugata*.

Shaded mountain caves with few associated bryophytes comprise a common habitat for *T. speciosum* (Kingston & Hayes, 2005; Rumsey *et al.*, 1998). However, the aspect and substrate at the Co. Louth site differ from most others. A majority of the 23 Irish gametophyte colonies examined by Kingston & Hayes (2005) were located on acidic bedrock; most faced north or northeast and may therefore have been subjected to reduced levels of desiccation. Firstly, despite the Cooley site's westerly aspect, the depth of the cave and the presence of dripping water may maintain sufficient humidity. Secondly, substrate pH may be less relevant than humidity. Instead, porosity could be more important (Ratcliffe *et al.*, 1993; Rumsey *et al.*, 1998). By retaining more water, porous rocks can maintain high ambient humidity. The coarse-grained nature of the gabbro here may enhance water retention.

No sporophytes were found at this site. However, juvenile sporophytes growing within a gametophyte colony are easily overlooked (Rumsey & Sheffield, 1996). Sporophytes appear to require milder winter temperatures (Ratcliffe *et al.*, 1993) and higher humidity (Johnson *et al.*, 2000) than the gametophyte. Indeed, mean relative humidity values of over 94% have been recorded at sporophyte sites (Ní Dhúill, 2014). Currently, almost 10% of gametophyte colonies without mature fronds contain juvenile sporophytes (NPWS, 2019). However, high mortality of juvenile sporophytes due to suboptimal conditions for this generation (Rumsey & Sheffield, 1996) may inhibit mature sporophyte development. Sporophytes might nevertheless be produced on Slieve Foy although it remains unclear whether future temperature and humidity conditions will be conducive to their persistence. Conservation of gametophyte populations are, consequently, important for future sporophyte production under different climatic conditions. Moreover, genetic

diversity is mostly partitioned between gametophyte populations rather than within them (Ní Dhúill, 2014; Rumsey *et al.*, 1999). It is therefore important to protect each population (Ní Dhúill, 2014; Rumsey *et al.*, 1999) as the loss of one reduces regional genetic diversity.

***Trichomanes speciosum* distribution and oceanic taxa recorded from Cooley**

Continuous microhabitat availability and limited dispersal have influenced *T. speciosum* distribution. Although it is restricted globally to oceanic climates, there is no simple correlation with climate and sporophyte distribution (Ratcliffe *et al.*, 1993; Rumsey *et al*., 1998) at smaller spatial scales. Microhabitat conditions are critical for *T. speciosum* (Rumsey *et al.*, 1998) but these are not captured by regional climatic measures. Local increases in parameters such as shade and substrate porosity appear to be necessary for its survival. As the regional climate becomes drier, it is likely that sites of sufficient humidity become increasingly rare. Measures of climate 'wetness' such as precipitation and the number of wet days (days when precipitation equals or exceeds 1mm) decline from west to east in Ireland (Curley *et al*., 2023). This climatic control on suitable microhabitat availability probably contributes to its restricted distribution near the east coast. The sporophyte is, however, curiously absent from many apparently suitable habitats which cannot be explained simply by over-collecting (Ratcliffe *et al.*, 1993). Furthermore, CF has failed to locate the gametophyte in other ostensibly favourable locations in Cooley. One explanation could be an insufficient knowledge of the subtleties of its ecological requirements. Alternatively, historical factors may have strongly shaped its distribution (Kingston & Hayes, 2005; Rumsey *et al*., 1998). *Trichomanes speciosum* may have been extirpated during the last glacial period; subsequent recolonisation via long-distance transport of spores and gemmae from refugia outside Ireland likely occurred (Kingston & Hayes, 2005). Alternatively, the species may have survived and spread within Ireland. Most Irish populations occur in areas which are often considered to have remained largely free of ice sheets during the last glacial period (Kingston & Hayes, 2005). However, recent examination of offshore glacial features demonstrates that the ice sheet extended to the edge of the continental shelf (Ballantyne & Ó Cofaigh, 2017). The gametophyte may, nevertheless, have survived the glaciation in the microhabitats it currently occupies such as cave entrances and under boulders (Ní Dhúill, 2014). A warmer and wetter climate for a time during the post-glacial promoted dispersal. Once unfavourable climatic conditions became established, its dispersal ability was reduced. Even in humid environments, temperature appears to limit dispersal (Ratcliffe *et al*., 1993). This situation prevails today in which sporophyte and gametophyte reproduction is mostly vegetative (Ní Dhúill, 2014). Long-distance dispersal via spores is, thus, limited. If conditions, even temporarily, become inimical to survival, then a population may become extinct, and remain so, in spite of suitable conditions becoming re-established later (Rumsey *et al.*, 1998). In this scenario, one could view the Cooley gametophyte as a relic of a previously more widespread sporophyte distribution locally. The more exacting conditions required of the sporophyte have been lost whereas the more resilient gametophyte stage has survived. Moreover, on a regional scale, its intermediate position between Antrim and Wicklow indicates a more contiguous distribution may have once occurred along the east coast.

The discovery of *T. speciosum* is somewhat unsurprising given the presence of other oceanic taxa in Cooley. Both *Hymenophyllum wilsonii* (Wilson's Filmy-fern) and *H.*

tunbrigense (Tunbridge Filmy-fern) occur here, albeit at only one site each. Recent fieldwork has highlighted the presence of oceanic bryophytes in Cooley which are uncommon or rare in the east (Lyons & Doogue, 2023). These include Atlantic species (*sensu* Ratcliffe, 1968) such as the liverwort *Jubula hutchinsiae* (Hodgetts, 2023; Lyons & Doogue, 2023). This taxon is one of the most common associates of *T. speciosum* sporophyte and both species exhibit a similar distribution in Europe (Ratcliffe *et al.*, 1993). They have not been found growing together in Cooley. Nonetheless, this liverwort's presence highlights the potential suitability of sites for *T. speciosum.* However, as the latter is almost always absent from apparently suitable habitats (Ratcliffe *et al*., 1993), *J. hutchinsiae* is a poor predictor of the fern's presence (Rumsey, 1994 cited in Kingston & Hayes, 2005). Taken together, *T. speciosum* and these other taxa show that, at least locally, oceanic habitat conditions occur in Cooley. Given the rarity of Hymenophyllaceae and Atlantic bryophytes in the east of Ireland, it is necessary to evaluate the presence of this assemblage here. Alongside *T. speciosum*, many Atlantic bryophytes have a distribution limited by historical factors as they are poor dispersers (Ratcliffe, 1968). However, Atlantic bryophytes are a heterogenous group of species with various ecological requirements (Ratcliffe, 1968) and differences in dispersal ability might be expected. *Jubula hutchinsiae*, for example, may have moderate dispersal abilities as it frequently produces sporophytes in Britain and Ireland (Blockeel *et al.*, 2014) although whether this varies regionally is unclear. Even if such species have the capacity to disperse over short time scales, a lack of suitable habitats regionally would inhibit recolonisation as nearby populations are absent. Hence, it is plausible that the occurrence of both *T. speciosum* and this assemblage of certain oceanic species is shaped by the need for continuously available, humid microhabitats.

The simple scenario of a relictual distribution masks some complexities highlighted by palaeoecological work. The distribution of *T. speciosum* is influenced by many variables and their interactions including climate, substrate and competition. The role of historical factors alongside current conditions remains somewhat unclear. In the Killarney woodlands, palaeoecological data indicate previous substantial levels of disturbance due to felling, fire and grazing, yet a rich Atlantic bryophyte flora occurs here (Mitchell, 1988). Investigations in Snowdonia highlight the context-dependent effects of disturbances. Impacts on the Atlantic bryophyte communities are reduced if the woodland canopy is quickly re-established after, for example, felling, or if very shaded, humid microhabitats exist. It also appears that, in marginally suitable habitats, these species are a better indicator of habitat continuity due to their inability to tolerate disturbance here (Edwards, 1986). This assumes, however, that dispersal after a disturbance is limited although this cannot be ruled out (Mitchell, 1988). In light of this, two questions arise here. How marginal are the habitats in Cooley for various Atlantic taxa? How sensitive is *T. speciosum* to disturbance under different climatic and microhabitat conditions? On Slieve Foy, the cave may have provided a refugium for the gametophyte after climatic changes and/or loss of habitat led to the extirpation of the sporophyte. What are perhaps more interesting to consider are the wooded ravines with Atlantic species such as *H. tunbrigense* and *J. hutchinsiae*. Given that Cooley has a drier climate than Killarney and Snowdonia (based on annual precipitation and number of wet days) (Curley *et al.*, 2023; Page, 1997), are the local habitat conditions capable of buffering these taxa against disturbances? This is important in both interpreting the sites as areas of mostly continuous woodland cover and

predicting the effects of any future habitat changes. This question could be extended to other sites near the east coast of Ireland where *T. speciosum* is rare. One potential complication is the under-recording of gametophyte-only populations. However, new populations are frequently discovered nationally, but rarely in the east (NPWS, 2019), suggesting a genuinely restricted distribution here. Yet the discovery of further populations locally would not diminish the conservation value of the Slieve Foy colony due to the partitioning of genetic diversity between populations (Ní Dhúill, 2014). In addition, the earlier discussion on its previous distribution is quite speculative. Palaeoecology has limited utility in reconstructing this. Spores of *T. speciosum* have been identified from sediments (Overland & O'Connell, 2008) although they are usually indistinguishable from *H. tunbrigense* (Jessen *et al.*, 1959). A further limitation of the fossil record is that *T. speciosum* is highly underrepresented (Overland & O'Connell, 2008).

Conclusion

The discovery of *T. speciosum* gametophyte in Co. Louth extends the known distribution of this unique plant. Its presence in Cooley, alongside *Hymenophyllum* spp. and the Atlantic bryophytes, adds to the conservation importance of the area. Much exploration of the peninsula remains to be done. Hence, the existence of separate sporophyte populations cannot yet be ruled out. Additionally, juvenile sporophyte production is possible on Slieve Foy. Even in the absence of the sporophyte, the gametophyte stage serves as a reservoir of propagules and genetic material for future dispersal. In an era of rapid climatic change, it is intriguing to consider such an event.

Acknowledgements

I am indebted to Rory Hodd for confirming the *T. speciosum* identification and for assistance with bryophyte determination. Many thanks are due to Declan Doogue and Melinda Lyons for their constructive comments and insights on a draft text and to Enda Flynn who provided the image of the gametophyte. Melinda Lyons also kindly provided a report on bryophytes in Cooley. I would also like to thank Fraser Mitchell for highlighting some relevant palaeoecological papers.

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Historical records by William Arthur Barnes (1839-1912)

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Botanical annotations by William Arthur Barnes (WAB) in a copy of the second edition of *Cybele Hibernica* (Colgan & Scully, 1898) offered for sale at Naughton Booksellers, Dún Laoghaire in 1989 were transcribed by MN at that time. The majority of these records referred to that part of Co. Meath (**H22**) near Barnes' home at Westland in Moynalty (Norton, 2022). His marginalia also included records from the neighbouring counties of Dublin (**H21**), Westmeath (**H23**), Cavan (**H30**) and Louth (**H31**). In some cases, the locations given may have referred to more than one vice county. The records are significant as they add to the body of botanical knowledge from the early 1900s. Undated records were most likely made between 1901 (the date inscribed by Barnes in his copy of *Cybele Hibernica*) and 1909 (the last-dated entry before his death in 1912). Comments in square brackets [ ] in the listing below are by MN.

Trifolium medium (Zigzag Clover): [H22/H30] along Navan to Kingscourt Railway (WAB, undated). [Published as H22 (Norton, 2023), but the reference to Kingscourt suggests the record may also apply to H30. Not listed for H30 by Praeger (1901). The record by Barnes predates the single record given by Reilly (2001).]

Sinapis alba, [as *Brassica alba*] (White Mustard): [H31] common in tillage fields in district between Dundalk and Louth (1901, WAB). [Considered to be frequent throughout H31 by Praeger (1901); now rarer in the county.]

Lysimachia nemorum (Yellow Pimpernel): [H22/H30] on road from Moynalty to Bailieboro[ugh] (1902, WAB); ditto from Moynalty to Kingscourt (1905, WAB). [Published as H22 (Norton, 2023), but the references to Bailieborough and Kingscourt suggest this record may also apply to H30. A frequent species in H30 and thus sites not specified by Praeger (1901) or Reilly (2001)].

Galium saxatile (Heath Bedstraw): [H22/H30] on road near Mullagh Bridge (undated, WAB). [Mullagh Bridge is on the border between H22 and H30, thus this record may be assignable to either vice county. Noted as 'strongly calcifuge, and distributed accordingly' in Ireland by Praeger (1901) who did not publish locations. The record by Barnes predates those listed for H30 by Reilly (2001).]

Myosotis secunda, [as *M. repens*] (Creeping Forget-me-not): [H22/H30] on road from Moynalty to Kingscourt (1905, WAB). [Published as H22 (Norton, 2023) but the reference to Kingscourt suggests the record may also apply to H30. This site is additional to those listed for H30 by Praeger (1901) and Reilly (2001).]

Origanum vulgare (Wild Marjoram): [H22/H23] abundant on road from Oldcastle to Finea (undated, WAB). [Published as H22 (Norton, 2023) but the reference to Finea suggests the record may also apply to H23. This site is additional to the single location listed for H23 by Praeger (1901).]

Tripolium pannonicum, [as *Aster tripolium*] (Sea Aster): [H22/H31] abundant along Boyne from Drogheda to sea (undated, WAB). [Published as H22 (Norton, 2023), but the record may also have included the N bank of the Boyne which lies in H31. Listed without sites for both vice counties by Praeger (1901).]

Dipsacus fullonum, [as *D. sylvestris*] (Wild Teasel): [H31] along Boyne on road from Drogheda to Baltray (1903, WAB). [This site is additional to the two listed for H31 by Praeger (1901).]

Cicuta virosa (Cowbane): [H30] plentiful in ditches about Bellamont Forest, Cootehill (1901, WAB). [This site is additional to those listed for H30 by Praeger (1901). It was subsequently recorded again from Cootehill in 1999 (Reilly, 2001)].

Angelica sylvestris (Wild Angelica): [H21] plentiful on road ex Dublin to Finglas, near latter (1900, WAB). [A widespread and common plant in H21 (Doogue *et al.*, 1998).]

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The Flora of Duleek, Co. Meath (H22), a project of the Dublin Naturalists' Field Club

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Introduction

The Flora of Duleek project, initiated by the Dublin Naturalists' Field Club (DNFC) during the 1960s, encompassed much of the east of Co. Meath (**H22**) within which lies the village of Duleek. The completion of *A supplement to Colgan's Flora of the County of Dublin* (Anon., 1961) by the DNFC, presented the opportunity for club members to engage in a new project. Encouraged by Howard Hudson, a major contributor to that publication, the then-named Flora Plant Group (FPG) of the field club embarked on extensive fieldwork led by Donal Synnott and Con Breen. Synnott, who would later become Director of the National Botanic Gardens, had lived in his birthplace of Duleek for many years and had already accumulated considerable knowledge of the local flora. Breen, Secretary to the DNFC at that time and the emerging BSBI vice county recorder for Meath, was similarly well positioned to lead the project. Members of the DNFC, including Praeger, had previously explored the lower River Boyne and Meath coastline (e.g. Praeger, 1893; 1901; Anon., 1894; 1911), while David McClintock contributed many records from the east of the county to the *Atlas of the British Flora* (Perring & Walters, 1962). However, the subject of this account is the data generated during the Flora of Duleek project. Targeted fieldwork by the DNFC was conducted between 1968 and 1970. The results were augmented by additional fieldwork by Breen and Synnott within the wider time frame of 1963 to 1986. It was envisaged that a flora would be produced during the 1970s (Perring 1971). Instead, results were published intermittently, many of the more salient records appearing in the *Irish*

Naturalists' Journal. The extensive study by Synnott on the flora of the commons at Duleek was documented in *A Common Green* (Synnott, 1980). New vice county records were included without site details in the two editions of the *Census Catalogue of the Flora of Ireland* (Scannell & Synnott, 1972; 1987). However, the majority of the project results were never published nor included in the BSBI Distribution Database (DDb). Both published and unpublished records are now of considerable value as they provide a snapshot of the flora and its habitats during the latter half of the twentieth century. A selection of the more significant records is presented below.

The study area extended eastwards from the N2 [= T2] road to the coast, bordered by the R. Boyne on the north and Co. Dublin on the south. This included that part of Drogheda town which lies on the south bank of the R. Boyne, which although part of the administrative county of Louth, belongs to the botanical vice county of Meath (Praeger, 1896; 1901; Webb, 1980). The study area was subdivided into six districts based largely on existing road systems, their boundaries marked on a copy of the Sheet 13 Meath map (Ordnance Survey, 1985) (see page 45). Data were collected on a site-specific basis using the field card employed during the BSBI Distribution Maps Scheme for the *Atlas of the British Flora* (Perring & Walters, 1962). Records were subsequently manually transferred onto individual index cards, each card listing the occurrence of a particular taxon in each of the six districts. Historical records were also noted on the index cards (Ray, 1696; Threlkeld, 1726; Colgan & Scully 1898; Praeger 1896-1900; 1901; 1905). Voucher specimens of many of the rare or critical taxa were collected; these are now housed in the herbarium of the National Botanic Gardens, Dublin (**DBN**).

The following account employs the taxonomy and nomenclature adopted by Stace (2019), with the exception of *Rubus* which follows Sell & Murrell (2014). First county records are denoted by an asterisk (*). In many instances the most recent occurrence of the taxon within the study area is also given. Places names follow those on the Sheet 13 Meath map, scale 1:126,720 (Ordnance Survey, 1985) or the Sheet 43 Discovery Series map, scale 1:50000 (Ordnance Survey Ireland, 2020). Surnames are given for determiners of critical material and for authors of published works. The unpublished manuscript diaries of Brunker (housed in the library of the National Botanic Gardens) are denoted by Brunker-*ms*. Initials are used for recorders as follows: those whose records pre-date the project (-1962) include Nathaniel Colgan (NC), David McClintock (DMcC) and Robert Lloyd Praeger (RLP); those involved in the project (1963 to 1986) include Con Breen (CB), James P. Brunker (JPB), Howard Hudson (HH), Maura Scannell (MPJS) and Donal Synnott (DS); those who contributed recent records (1987-) include Shane Farrell (SF), Roger Goodwillie (RNG), Paul Green (PRG), Jesmond Harding (JMH), Margaret Norton (MN), Sylvia Reynolds (SR), Tim Rich (TCGR) and Nick Stewart (NFS).

Boyne above Oldbridge

The R. Boyne from Slane to its estuary at Mornington formed the northern boundary of the study area. Its freshwater section extends from Slane to Oldbridge (District 3). The Boyne Navigation or Boyne Canal, of which the Slane, Stalleen and Oldbridge sections (Holten, 2016) are within the study area, runs roughly parallel to the river as far as Oldbridge. This series of discontinuous canals, now largely disused and overgrown, was built to enable horse-drawn boats to by-pass the many weirs associated with the mills of the lower R.

Boyne. The range of habitats provided by the Boyne River and canal supported a diverse flora, much of which is still present. Particularly significant was the first authentic record from Ireland of **Juncus compressus* (Round-fruited Rush), which is now included in the Flora (Protection) Order of 2022 (Government of Ireland, 2022). It was discovered by Synnott in the winter-wet, alluvial pasture on the bank of the R. Boyne at Ros(s)naree (1968, DS **BEL** & **DBN;** Synnott, 1968b). He recorded it later that same year on a riverside pathway at Slane (Synnott, 1968b; 1969) and subsequently on a 'path through a damp meadow' at the same site (1971, DS **DBN**). Its continuing presence on the Boyne was recently confirmed when it was located in a small bay on the riverbank below Slane Bridge (2015, MN; Norton, 2018) where it was noted again in 2022 (MN). Also significant was the discovery of *Hordeum secalinum* (Meadow Barley), conspicuous in the alluvial pasture at Rosnaree (1968, DS **DBN**; Synnott, 1968b). This grass, extremely rare when last observed there (1991, MN & DNFC; Norton, 2018), is also included in the Flora (Protection) Order of 2022 (Government of Ireland, 2022). Another discovery of particular interest was **Leucojum aestivum* (Summer Snowflake) in marshy ground by the R. Boyne at Oldbridge (1964, DS **DBN**; Synnott, 1965), subsequently found upriver of there at Stalleen (1965, DS; Synnott, 1967a) and downriver at Rathmullan (1968, DS & DNFC). Considered native in the south of Ireland (Knowles & Phillips, 1910), the proximity of the Oldbridge site to gardens at Glenmore (within the Oldbridge estate) prompted Synnott to suggest that the *Leucojum* may have been an escape from cultivation in Meath (Synnott, 1965). It is still present at several locations along the lower Boyne.

Although records from the Boyne were not always clearly allocated to either the river or canal, they provide a comprehensive account of the waterside flora. *Rorippa amphibia* (Great Yellow-cress), *Lysimachia vulgaris* (Yellow Loosestrife) and *Schoenoplectus lacustris* (Common Club-rush) were all recorded below Slane (1969, DS), at Rosnaree (1969, CB) and at Roughgrange (1968, DNFC), while *Rumex hydrolapathum* (Water Dock) occurred below Slane (1986, HH & DNFC) and at Rosnaree (1969, CB & DNFC); all four species are still characteristic of the emergent vegetation of the lower R. Boyne. The presence of *R. amphibia* (as *Raphanus aquaticus*) was first documented from Meath as growing 'upon the Borders and Brink of the East of the River Boyne, over-against Proudfortstown and Old-bridge' (Threlkeld, 1726). Also widespread were *Thalictrum flavum* (Common Meadow-rue), today most frequent in the narrow belt of ungrazed grassland by the riverbanks, and *Jacobaea* x *ostenfeldii* (*J. aquatica* x *J. vulgaris*) now more common in the riverside pastures than either of its parents. *Symphytum officinale* (Common Comfrey) was recorded below Slane (1969, CB & DNFC), at Rathmullan (1963, DS **DBN**, conf. Perring, 1968) and at Drogheda-Mornington (1968, CB & DNFC); it is still present on the riverbanks of the Boyne. The confirmation of the plant at Rathmullan by Perring established the occurrence of true *S. officinale* in contradistinction to the more widespread *S.* x *uplandicum* (Russian Comfrey), their distribution being the subject of the BSBI *Symphytum* Survey (Perring, 1970). *Crepis paludosa* (Marsh Hawk's-beard) was recorded in the alluvial meadow at Slane (1968, DS; Synnott, 1968b). It occurred again with *Stellaria palustris* (Marsh Stitchwort) and *Oenanthe fistulosa* (Tubular Water-dropwort) below Slane (1969, DS) and at Roughgrange (1968, DNFC), while the *Oenanthe* was also found in the alluvial pasture by the R. Boyne at Rosnaree (1968, DS **DBN**; Synnott, 1968b). These three species, although now rare, are still present in the floodplains of the lower Boyne, the

Stellaria until recently also occurring in the overgrown canal below Slane. *Bidens cernua* (Nodding Bur-marigold) and *B. tripartita* (Trifid Bur-marigold) were noted below Slane (1969, DNFC), the former occurring again at Roughgrange (1969, CB), while the latter was found at the additional sites of Rosnaree (1968, DS & BSBI; Synnott, 1969) and Donore (1963, DS **DBN**). Neither *Bidens* has been recently recorded from within the study area (demarcated by the S bank of the Boyne), although present on the N bank of the river: *B. cernua* at Crewbane (1991, MN & BSBI) and *B. tripartita* at Dowth (2000, MN). *Sagittaria sagittifolia* (Arrowhead), *Alisma plantago-aquatica* (Water-plantain), and *Sparganium erectum* (Branched Bur-reed) were scattered between Slane and Roughgrange; all three still occur amongst the emergent vegetation of the river and canal. *Hydrocharis morsus-ranae* (Frogbit) was recorded from the Boyne Canal at Oldbridge (1970s, DS); it is now scattered along the canal and river margins, but is most plentiful where previously noted in the canal at Oldbridge (MN, 2022). *Butomus umbellatus* (Flowering-rush) was recorded below Slane (1969, DS) and at Rosnaree (1968, DS & BSBI; Synnott, 1969), and in the canal at Oldbridge (1963, DS **DBN**) and near the Obelisk Bridge (1965, Synnott, 1967a). It is now widespread and plentiful in the river and canal between Slane and Oldbridge. *Carex acuta* (Slender Tufted-sedge) was recorded on the S bank of the river below Slane (1969, DS), on riverbanks at Rosnaree (1969, CB), and upriver of Oldbridge at Stalleen (1965, DS; Synnott, 1967a), the specimen labelled 'Boyne meadow at Donore' collected from the latter site (1965, DS **DBN**, conf. Pearman 1995); this sedge is now seldom encountered on the Boyne. *Glyceria maxima* (Reed Sweet-grass), which was recorded at several sites, is still widespread and is particularly abundant in disused sections of the canal.

A number of non-riparian species were recorded within the lower Boyne valley. *Arabis hirsuta* (Hairy Rock-cress) occurred below Slane (1969, DS). This now-rare species was first recorded from the county on old walls near the town of Slane (Wade, 1804); it occurred more recently on the mortared wall by Slane Bridge on the fringe of the study area (1990 to 1995, MN) but has not since been seen there, the walls now frequently cleared of vegetation. *Poterium sanguisorba* (Salad Burnet) occurred at Slane (1968, HH & DNFC) while *Armoracia rusticana* (Horse-radish) was found below Slane (1969, DS); both still occur within the study area. *Pulicaria dysenterica* (Common Fleabane) was recorded below Slane (1969, DS & DNFC), at Rosnaree (1969, CB) and at Roughgrange (1968, DNFC); it too is still present in the Boyne valley although perhaps now less frequent. The hybrid X *Schedolium loliaceum* (*Schedonorus pratensis* x *Lolium perenne*) (Hybrid Fescue) was recorded in marshy ground by the river below Slane (1969, DS), at Roughgrange (1968, DS **DBN**; Scannell & Synnott, 1990) and on the riverbank at Stalleen (1968, DS & BSBI; Synnott, 1969); it is still widespread in pastures by the lower Boyne.

Boyne below Oldbridge

The tidal section of the R. Boyne extends from the sea to its tributary the Mattock R. at Oldbridge. Thus, below Oldbridge and through Drogheda the waters are saline (District 1 & 2), while saltmarshes and mudflats have formed towards its mouth in the townland of Mornington (District 1). The saline marsh by Marsh Road beneath the Boyne Viaduct at Drogheda was explored. This habitat, with species such as *Lysimachia maritima* (Sea-milkwort) and *Juncus gerardii* (Saltmarsh Rush), was subsequently land-filled as the adjoining town dump of that time gradually expanded. *Cochlearia anglica* (English

Scurvygrass) and *Apium graveolens* (Wild Celery), indicative of brackish conditions, were recorded in the marsh (1969, DS & DNFC); both species still occur at and upriver of Drogheda, the *Cochlearia* extending as far inland as the Oldbridge Sealock [= Tiernan's Lock] (2020, MN). *Bolboschoenus maritimus* (Sea Club-rush) noted in the same saline marsh, is now abundant by the pools at Stagrennan below Drogheda (2023, MN). *Carex riparia* (Greater Pond-sedge) also recorded from that marsh (1969, DS & DNFC) and at Glenmore, Oldbridge (1965, DS **DBN**) is today widespread along the Boyne's tidal riverbanks. *Tripolium pannonicum* (Sea Aster) found upriver of Drogheda (1968, DNFC) and toward the mouth of the Boyne (1968, DNFC), is now widespread on the tidal riverbanks. *Typha latifolia* (Bulrush), which occurred near Drogheda (1969, CB) and half a mile W of Mornington village (1969, CB), still tolerates the saline conditions of the lower Boyne.

Also on this tidal section, about a ¼ mile below the railway viaduct at Drogheda, was the old town dump alluded to above. Three species of Melilot occurred here (1967, DS & DNFC): **Melilotus albus* (White Melilot) (DS **DBN**), **M. officinalis* (Ribbed Melilot) and **M. indicus* (Small Melilot), none of which had been previously recorded from the county (Synnott, 1968a). *M. albus* has been recently recorded at Stamullin (2016, RNG), *M. officinalis* on the dry-fill at Stagrennan (2023, MN) and *M. indicus* has yet to be re-found in the county. Moving slightly further downriver, the area of dry-fill on the R. Boyne estuary at Stagrennan on the Mornington [Marsh] Road yielded several species associated with free-draining often disturbed ground. These included *Trifolium hybridum* (Alsike Clover) (1986, DS **DBN**), recorded there again more recently (2002, MN) and on a building site at the SW margin of Drogheda (2018, SF). Also at Stagreenan was *Carduus crispus* (Welted Thistle) (1986, DS **DBN**), elsewhere recorded below Slane (1969, DS) and at Laytown S of the R. Nanny (1969, CB & DNFC); it was most recently found in the quarry at Naul (2018, RNG). *Conium maculatum* (Hemlock) present at Stagrennan (1986, DS **DBN**) has not been re-found there although present within the study area at Laytown, S of the R. Nanny (2014, PRG). **Vulpia myuros* (Rat's-tail Fescue), again from Stagrennan (1986, DS **DBN**), has not since been recorded in the study area but does occur nearby and is increasing its range in Meath. Two native species which were noted on the dry-fill at Stagrennan, *Parapholis strigosa* (Hard-grass) and **Puccinellia distans* (Reflexed Saltmarsh-grass), both (1986, DS **DBN**), were subsequently re-found there (2002, MN); they have more recently been recorded from brackish grassland above the upper saltmarsh at The Crook, Mornington (2023, MN).

Towards the mouth of the Boyne, extensive saltmarshes have formed. Species recorded there included: *Limonium humile* (Lax-flowered Sea-lavender), *Armeria maritima* (Thrift), *Spergularia media* (Greater Sea-spurrey), *Atriplex portulacoides* (Sea-purslane), *Beta vulgaris* (Beet), *Salicornia* spp. (Glasswort), *Suaeda maritima* (Annual Sea-blite), *Lysimachia maritima* (Sea-milkwort), *Plantago coronopus* (Buck's-horn Plantain), *P. maritima* (Sea Plantain), *Tripolium pannonicum* (Sea Aster), *Triglochin maritima* (Sea Arrowgrass) and *Juncus gerardii* (Saltmarsh Rush), all (1968, DNFC), while *Cochlearia officinalis* [agg.] (Scurvygrass) and *Carex distans* (Distant Sedge) were added the following year (1969, DNFC); these are all still present today. Large mudflats occur in the townland of Mornington on the western side of The Crook [= the point of land where the river turns SE before entering the sea]. These mudflats yielded rooting plants of both *Zostera marina*

(Eelgrass) and *Z. noltei* (Dwarf Eelgrass), the former at Mornington (1968 & 1969, CB **DBN**), the latter W of the fish-meal factory [= tip of The Crook] at Mornington (1969, CB **DBN**). There are no recent records for *Zostera* from Meath.

Rivers Nanny and Delvin

The R. Nanny traverses the study area from Balrath Cross Roads eastwards through Duleek and Julianstown before entering the Irish Sea at Laytown. Fieldwork during the Flora of Duleek project focused on its saline section and saltmarshes between Julianstown and Laytown. In particular, the south bank of the river (District 4) was explored. All of the species noted on the Boyne saltmarshes were again recorded with the exception of *Cochlearia officinalis* [agg.] and *Spergularia media*. The rare *Isolepis cernua* (Slender Club-rush) was found near Ballygarth Demesne where *Samolus valerandi* (Brooklime) also occurred (1969, CB); neither are recently recorded from the R. Nanny but both still occur within the study area near Benhead. Other species recorded from the R. Nanny near Ballygarth included *Ranunculus sceleratus* (Celery-leaved Buttercup), *Rorippa palustris* (Marsh Yellow-cress), **Spergularia marina* (Lesser Sea-spurrey), *Juncus maritimus* (Sea Rush), *Bolboschoenus maritimus* (Sea Club-rush), *Carex riparia* (Greater Pond-sedge) and *Puccinellia maritima* (Common Saltmarsh-grass), all (1969, CB). Away from the river, *Chaerophyllum temulum* (Rough Chervil) was recorded on the roadside near houses of a lane on the S side of the R. Nanny, Laytown (1980, DS **DBN**); it has yet to be re-found within the county. The Delvin R. defines the county boundary with Dublin for much of its length, extending from west of Naul, and thence through Naul Bridge and Stamullin, before entering the Irish Sea in the townland of Gormanston. There was little exploration of this river, which has no saltmarshes, during the project.

Coast north of Laytown

Meath's short coastline of *c*.12km (Finch *et al*., 1983) is unique in an Irish context in that it is composed entirely of sandy beaches with no rocky outcrops. The coast, which stretches from the mouth of the R. Boyne to that of the Delvin R., is bisected by the R. Nanny at Laytown. The northern half from Laytown to Mornington (District 1) consists of accumulated wind-blown sands. A wide band of sand dunes gives way on the landward side to older fixed dunes which include the golf links that extend from Mornington to Bettystown. A diverse range of species was recorded during the Flora of Duleek project from these dunes, all (1968/1969, DNFC) unless otherwise indicated. These included *Sedum acre* (Bitting Stonecrop), *Anthyllis vulneraria* (Kidney Vetch), *Ononis repens* (Common Restharrow), *Viola canina* (Heath Dog-violet), *V. tricolor* (Wild Pansy), *Euphorbia portlandica* (Portland Spurge), *E. paralias* (Sea Spurge) (1964, DS **DBN**), *Erodium cicutarium* [agg.] (Common Stork's-bill) (1964, DS **DBN**), *Cerastium diffusum* (Sea Mouse-ear), *Centaurium erythraea* (Common Centaury) (1964, DS **DBN**), *Thymus drucei* (Wild Thyme), *Rhinanthus minor* (Yellow-rattle) (1964, DS **DBN**), *Anacamptis pyramidalis* (Pyramidal Orchid), *Carex arenaria* (Sand Sedge), *Koeleria macrantha* (Crested Hair-grass) and *Phleum arenarium* (Sand Cat's-tail), all still present within the dunes today. The grasses *Ammophila arenaria* (Marram), *Elymus junceiformis* (Sand Couch) and **Leymus arenarius* (Lyme-grass) were also noted (1968, DNFC), the *Leymus* first recorded in 1966 (DS **DBN**; Synnott, 1967b); all three stabilising grasses are still

plentiful on the outer mobile dunes. *Elymus athericus* (Sea Couch) was not recorded, perhaps indicative of a cautionary approach given that it has in the past been greatly over-recorded for the hybrid *E.* x *drucei* (*E. repens* x *E. athericus*) (Stroh *et al.*, 2023); both taxa are now recorded from the coast (2021, MN, det. Wilcox). Also noted were *Cakile maritima* (Sea Rocket), *Honckenya peploides* (Sea Sandwort) and *Salsola kali* (Saltwort), all (1968, DNFC); these species are still common today as pioneer plants of the foredunes. The *Cakile* (as *Eruca marina*) was first documented as 'growing hard by Mayden-Tower near Drogheda, upon the Sands' (Threlkeld, 1726).

Amongst the more unusual sand dune plants was the rayless form of *Jacobaea vulgaris* (Common Ragwort) recorded at Drogheda-Mornington (1968, CB), most likely referring to the sand dunes at Mornington where it is still abundant. It was first recorded there by Sherard as 'Flore nudo copisossime nascens in sabulosis prope littus, tribus vel quatuor milliaribus a *Drogheda*; adeo ut e mille plantis vix unum flore radiato reperies' (Ray, 1696), translated as 'Most copiously on sands by the shore three or four miles from Drogheda, so that of a thousand plants you shall scarce find one with a radiant flower' (Colgan & Scully, 1898). Also noted by More (1872) from 'Sandhills between Gormanstown and Maiden Tower, in many places', it is still abundant in the sand dunes of Meath. Other species recorded during the Flora of Duleek project included *Rosa spinosissima* (Burnet Rose) from Drogheda-Mornington (1968, CB) most probably referring to the sand dunes at Mornington where several plants still occur (2021, MN). *Viola canina* (Heath Dog-violet) was recorded from Mornington-Bettystown (1969, DS & DNFC), a species now frequent in the older fixed dunes at Mornington. *Linum bienne* (Pale Flax) was noted from Mornington-Bettystown (1969, DS & DNFC) and further south at Gormanston (1968, DNFC); there are recent records for it from Mornington (2019, MN) and Laytown (2022, MN). *Cerastium arvense* (Field Mouse-ear) recorded from Mornington-Bettystown (1969, DS & DNFC) still occurs at Mornington, most usually amongst the taller grasses on the margins of fixed dunes (2019, MN). *Gentianella amarella* (Autumn Gentian) was plentiful in the sand dunes at Mornington (1969, CB; 1970, CB **DBN**) from where there are no recent records; it has since been found in mossy vegetation on the railway embankment south of Laytown (2002, CB & MN). *Calystegia soldanella* (Sea Bindweed) was recorded from Mornington dunes (1970s, Synnott *in litt.*, 1982); although not since noted at Mornington, it now occurs in the low dunes immediately N of Bettystown (2022, MN). *Eryngium maritimum* (Sea-holly) occurred in dunes S of South Bull at Mornington prior to the levelling of that area of dunes (1970s, Synnott *in litt.*, 1982); there are no recent records in the county for this conspicuous species. *Ophrys apifera* (Bee Orchid) was noted in sand dunes S of the lighthouse [= South Bull] at Mornington (1969, CB & DNFC; CB **DBN**); this orchid, often erratic in its occurrence, was recently recorded from those same dunes (2020, JMH). *Vulpia fasciculata* (Dune Fescue), a sand dune grass of predominantly southeasterly distribution in Ireland, was noted at Mornington (1970s, Synnott *in litt*., 1981; 1982); it is still abundant in the fixed dunes at that site (2023, MN).

Several of the rarer species which occurred near the Maiden Tower at Mornington, most probably amongst the low turf of the older fixed dunes to the south of the tower, have no recent records from that location. *Cuscuta epithymum* (Dodder) was obvious on *Thymus drucei* near Maiden Tower (1963 to late 1970s, DS), its presence there first documented by Threlkeld (1726) based on an earlier record by Sherard (Synnott, 1997). Although not

recently reported from Meath, *Cuscuta* is known to undergo considerable annual fluctuations in population size (Stroh *et al*., 2023) and may yet reappear. *Antennaria dioica* (Mountain Everlasting) recorded from Mornington-Bettystown (1969, DS & DNFC) was still present in 1984 (DS & DNFC) when it grew sparingly in the mossy vegetation of old fixed dunes near Maiden Tower; it has not since been seen by the coast. *Anthriscus caucalis* (Bur Chervil) recorded from Mornington-Bettystown (1969, DS & DNFC) is a rare plant of well-drained often sandy ground with no recent Meath records. The rare orchid *Anacamptis morio* (Green-winged Orchid) noted in sand dunes to the S of Maiden Tower (1968, DS; 1969 DS & DNFC) was still present in 1984 (DS & DNFC); it has not since been observed in the study area although present elsewhere in the county.

Disturbed sand within the dunes provides the opportunity for plants to reappear from dormant seedbanks. *Salvia verbenaca* [subsp. *horminoides*] (Wild Clary) is one such plant. Found on a SSW-facing sand-bank of the Mornington-Bettystown golf links (*c*. 1970, CB & DS **DBN**) with a further station on the W-facing slope of the big blowout at Mornington (1978, Synnott *in litt.*, 1978), it was most recently recorded on disturbed sand by rabbit burrows at Mornington (2019, MN). *Echium vulgare* (Viper's-bugloss), another plant of disturbed sandy ground, occurred on sandhills at Mornington (1964, DS **DBN**), S of the lighthouse at Mornington (1969, CB & DNFC), on the S side of the estuary at Laytown (1968, CB; 1969, DS & DNFC), near Mosney Station (1969, CB) and at Gormanston (1969, CB); it still occurs at scattered locations along the coast. *Lycopsis arvensis* (Bugloss) found S of the lighthouse at Mornington (1969, CB & DNFC), at Laytown (1968, DNFC), S of the Nanny at Laytown (1969, DS & DNFC) and at Gormanston (1969, CB), still appears sporadically on disturbed sands in coastal areas (2019, MN). *Cynoglossum officinale* (Hound's-tongue), which also favours disturbed sands, was recorded from Mornington (1968, DS) and Bettystown (1969, DS & DNFC); it was last seen at Laytown dunes [= near Mosney] on the southern half of the coast (1990, SR).

Records of *Equisetum fluviatile* (Water Horsetail), *Ranunculus flammula* (Lesser Spearwort), *Lycopus europaeus* (Gypsywort) and *Eleocharis palustris* (Common Spike-rush) from the coast between Mornington and Bettystown (1969, DNFC) indicate the presence of dune slacks which were then wetter, as such species are no longer evident within the dune system. These dune slacks would have provided habitat for the *Ophioglossum vulgatum* (Adder's-tongue), *Sagina nodosa* (Knotted Pearlwort) and *Samolus valerandi* (Brookweed) recorded S of the lighthouse at Mornington (1969, CB & DNFC), the *Ophioglossum* and *Samolus* subsequently re-found in a damp hollow in that area (1999, SR & MN), as was also the *Sagina* (2001, MN). *Botrychium lunaria* (Moonwort), recorded as abundant in damp sand at Mornington (1968, DS; Synnott, 1970) and (1969, DS & DNFC), was again noted in the same dune slack amongst the high dunes near Maiden Tower (1984, DS & DNFC). *Equisetum variegatum* (Variegated Horsetail) occurred in damp hollows in the dunes at the Bettystown end of the golf course (1969, CB & DNFC; CB **DBN**).

Coast south of Laytown

The landform of the southern half of the coast from Laytown to Gormanston (District 4) is classified as a sandur, a flat to slightly undulating outwash feature of glaciofluvial sands and gravels (Meehan, 2012). The eroded face of this sandur forms a steep to gently-angled

cliff along the shoreline, its materials supplemented by some wind-blown sand at its base. This stretch of coast includes the more pronounced cliff face at Benhead, the eastern limit of the Galtrim moraine. Exploration of the southern half of the coast during the Flora of Duleek project yielded several additional coastal species to those already listed. The very rare *Glaucium flavum* (Yellow Horned-poppy) was noted in gravel deposits (where the gas pipeline was laid) on the coast between Gormanston Station and Benhead (1970s, CB), the construction work possibly bringing dormant seeds to the surface; there are no recent records for it from Meath. **Thalictrum minus* (Lesser Meadow-rue), another very rare species, was recorded on sandhills south of Laytown (1969, DS **DBN**), the site now largely overgrown by scrub; the only other Meath record is that of a small patch on a dune slope at Mornington (2014, PRG).**Trifolium arvense* (Hare's-foot Clover) was recorded on the south side of the R. Nanny estuary at Laytown (1968, CB); it is now most frequent on disturbed sand within the dunes at Mornington (2023, MN). *Malva arborea* (Tree-mallow) occurred on the S side of the estuary at Laytown (1968, CB & DNFC); previously noted at Laytown where it was first recorded in the county (1955, DMcC), this conspicuous plant is now common by coastal roads, particularly at Mornington. *Samolus valerandi* (Brookweed) was found near the sea at Gormanston (1963, DS & DNFC; DS **DBN**); it now occurs in lime-rich freshwater seepage with *Isolepis cernua* (Slender Club-rush) on the sea-cliff immediately S of Benhead (2022, MN). *Pulicaria dysenterica* (Common Fleabane) recorded from Gormanston and near Mosney, both (1969, CB), also occurs in seepage on a more gently-sloped section of the sea-cliff S of Benhead (2022, MN). *Hydrocotyle vulgaris* (Marsh Pennywort) was found near Mosney (1969, CB), possibly in the small dune slack S of the stream where both it (2003, MN) and *Equisetum variegatum* (2019, SF) were more recently recorded. Inland, the *E. variegatum* was noted in old sand quarries S of Laytown (1978, DS; Synnott *in litt*., 1978), this area being within the sands and gravels of the Gormanston to Laytown sandur.

Railways

The Dublin to Belfast railway runs along the coastline of Meath, with stations at Gormanston and Laytown before turning inland through Colp towards Drogheda Station (Districts 1, 2 & 4). The branch that runs inland from Drogheda past Duleek Station, Thomastown and Downestown Bridge in the direction of Navan (Districts 2 & 3) is now restricted to freight traffic. Several species of interest were recorded from these railways and their embankments. The now rare *Veronica agrestis* (Green Field-speedwell) occurred at Gormanston railway bridge (1969, CB). *Neottia ovata* (Common Twayblade) was found near Mosney Station (1969, CB). Travelling northwards, *Poterium sanguisorba* (Salad Burnet) and *Gymnadenia conopsea* [s.l.] (Fragrant Orchid) were found on the railway embankment between Bettystown and Laytown (1969, CB). *Achillea ptarmica* (Sneezewort) occurred by the railway line (1970, CB **DBN**) and *Jacobaea erucifolia* (Hoary Ragwort) on the railway embankments (1969, CB **DBN**), both N of Laytown. Turning inland towards Drogheda, *A. ptarmica* occurred again by the railway, while *J. erucifolia*, *G. conopsea* [s.l.] and *Bromopsis erecta* (Upright Brome) occurred on the embankments, all recorded near Colp Bridge (1969, CB). *Diplotaxis muralis* (Annual Wall-rocket), a plant often associated with railways, was noted on waste ground below the Boyne Viaduct at Drogheda (1968, DS **DBN**; 1969, DS & DNFC), while *B. erecta* occurred again on the NE

side of the railway at Stameen, Drogheda (1969, CB **DBN**). Further inland *Ononis repens* (Common Restharrow), *N. ovata* and *Anacamptis pyramidalis* (Pyramidal Orchid) were recorded at Thomastown (1969, DS & DNFC). *Veronica officinalis* (Heath Speedwell), *Valerianella locusta* (Common Cornsalad) and the rare *Arabis hirsuta* (Hairy Rock-cress) occurred between Thomastown and Downestown Bridge, all (1969, DS). With the exception of *V. agrestis* and *J. erucifolia* (which occurs nearby), all are recently recorded from the study area, although not necessarily from the railways.

Thomastown Bog

An area of wetland that represents the most eastern patch of raised bog in Meath occurs by the railway at Thomastown (District 3). Often referred to as Thomastown Bog, it is now largely covered by wet woodland dominated by birch and fringed by willow scrub. A small fragment of raised bog at its centre is no longer easily accessible. Explored by Breen and Synnott with the DNFC in 1969, the mosaic of vegetation types within the birch scrub supported *Pteridium aquilinum* (Bracken), *Athyrium filix-femina* (Lady-fern), *Blechnum spicant* (Hard-fern), *Dryopteris carthusiana* (Narrow Buckler-fern), *Comarum palustre* (Marsh Cinquefoil), *Vaccinium myrtillus* (Bilberry), *Menyanthes trifoliata* (Bogbean), *Carex pulicaris* (Flea Sedge) and *Molinia caerulea* (Purple Moor-grass). The fragment of raised bog at the centre had *Osmunda regalis* (Royal Fern), *Drosera rotundifolia* (Round-leaved Sundew), *Calluna vulgaris* (Heather), *Erica tetralix* (Cross-leaved Heath), *Vaccinium oxycoccos* (Cranberry), *Narthecium ossifragum* (Bog Asphodel), *Eriophorum angustifolium* (Common Cottongrass), *E. vaginatum* (Hare's-tail Cottongrass) and *Carex echinata* (Star Sedge). Dense undergrowth inhibited access to this fragment of raised bog when the site was subsequently re-visited (1991, MN & BSBI). *Equisetum telmateia* (Great Horsetail), a plant of lime-rich water most usually found in spring or seepage lines, occurred both at Thomastown (1969, DS & DNFC) and on the nearby commons at Duleek (Synnott 1980); it was recently recorded by the railway between Thomastown and Drumman Bridge (2015, MN).

Duleek Commons and Greenanstown

Streams from Thomastown, in addition to lime-rich springs, provide water to the commons at Duleek, herein referred to as Duleek Commons (District 3). The following description is a brief summary of the rich flora observed by Synnott over many years and documented in *A Common Green* (Synnott, 1980). Undated records were most likely made in 1966 (DS & DNFC). An area of thin fen peat with *Schoenus nigricans* (Black Bog-rush) (1966, DS **DBN**) supported *Selaginella selaginoides* (Lesser Clubmoss) (1965, DS **DBN**), *Parnassia palustris* (Grass-of-Parnassus) (1963, DS **DBN**), *Sagina nodosa* (Knotted Pearlwort), *Lysimachia tenella* (Bog Pimpernel), *Pinguicula vulgaris* (Common Butterwort), *Pedicularis palustris* (Marsh Lousewort) and *Carex lepidocarpa* (Long-stalked Yellow-sedge) (1968, MPJS **DBN**). The rare **Carex dioica* (Dioecious Sedge), was recorded in this area of fen peat (1966, JPB & DNFC, Brunker-*ms*.; 1966 DS **DBN**; Synnott, 1967b) where it occurred with *C. hostiana* (Tawny Sedge). A spinose variety of *Ononis repens* (Common Restharrow) occurred on dry ground near the fen peat, one colony about six square yards in extent (1965 & 1966, DS **DBN**; 1966, DS & DNFC, Brunker-*ms*.; Synnott, 1967a); the colony subsequently became extinct (Synnott *pers. comm.* 2024). Calcium-rich marshy

areas yielded *Hydrocotyle vulgaris* (Marsh Pennywort), *Triglochin palustris* (Marsh Arrowgrass), *Neottia ovata* (Common Twayblade) (1965, DS), *Gymnadenia conopsea* [s.l.] (Fragrant Orchid), *Dactylorhiza fuchsii* (Common Spotted-orchid), *D. incarnata* (Early Marsh Orchid) (1965, DS **DBN**), **D. traunsteinerioides* (Narrow-leaved Marsh-orchid) (1966, DS **DBN**, det. Hunt; Scannell, 1973), *Eriophorum angustifolium* (Common Cottongrass) (1967, DS **DBN**), *E. latifolium* (Broad-leaved Cottongrass) (1967, DS **DBN**; Synnott, 1968a; 1969), *Eleocharis quinqueflora* (Few-flowered Spike-rush) and *Isolepis setacea* (Bristle Club-rush). The rare **Eleocharis uniglumis* (Slender Spike-rush), a species more usually of saltmarshes, was recorded on the sides of natural drains leading from the fen area (1968, DS **DBN**). Also present was *Nasturtium* x *sterile* (Hybrid Water-cress) (1966, DS **DBN**, conf. Webb) with both its parents *N. officinale* (Water-cress) and *N. microphylum* (Narrow-fruited Water-cress). Rarities found on slightly drier raised ground included *Coeloglossum viride* (Frog Orchid) (1965, DS **DBN**) and *Anacamptis morio* (Green-winged Orchid) (1965, DS; Synnott, 1967a); neither have been subsequently recorded from the commons. Small hummocks of leached grassland supported *Galium saxatile* (Heath Bedstraw), *Pedicularis sylvatica* (Lousewort), *Achillea ptarmica* (Sneezewort), *Dactylorhiza maculata* (Heath Spotted-orchid), *Nardus stricta* (Mat-grass) and *Danthonia decumbens* (Heath-grass) (1966, DS **DBN**). Many of these plants still persist on the commons today despite the now drier conditions and the change in grazing regime from geese to cattle. Nearby, what is locally known as the Off-commons was also visited (District 3). The swampy ground there supported *Baldellia ranunculoides* (Lesser Water-plantain), *Sparganium emersum* (Unbranched Bur-reed) and *Carex lepidocarpa* (Long-stalked Yellow-sedge), all (1965, DS **DBN**). To the SE of Duleek, some distance away (*c*.7km), lies a smaller area of fen peat at Greenanstown. This site yielded *Hydrocharis morsus-ranae* (Frogbit) and *Carex paniculata* (Greater Tussock-sedge) (1970s, DS). Both are recently recorded from this location: the *Hydrocharis* in two pools (2001, MN) and the *Carex* in rough grassland on the periphery of the site (2018, MN).

Woodlands

Several woodland sites, in addition to that at Thomastown, were explored during the Flora of Duleek project. The ground flora at Somerville (District 6) included *Ficaria verna* (Lesser Celandine), *Viola reichenbachiana* (Early Dog-violet), *Lysimachia nemorum* (Yellow Pimpernel), *Sanicula europaea* (Sanicle), and *Neottia ovata* (Common Twayblade), all (1969, DS & DNFC). The woodlands at Rosnaree (District 3) within the Boyne valley supported *Chrysosplenium oppositifolium* (Opposite-leaved Golden-saxifrage), *Circaea lutetiana* (Enchanter's-nightshade), **Veronica montana* (Wood Speedwell), *Ajuga reptans* (Bugle), *S. europaea*, *Conopodium majus* (Pignut) and *Allium ursinum* (Ramsons), all (1969, CB & DNFC). *Luzula sylvatica* (Great Wood-rush) and *Carex sylvatica* (Wood-sedge), the former rare in the east of the county, occurred in the wood above the R. Boyne at Donore (District 3) (1963 & 1965 respectively, both DS **DBN**). *Orchis mascula* (Early-purple Orchid) was found in the woodland at Kennel Road, Plat(t)in Hall (District 2) (1966, DS **DBN**) and at Oldbridge (District 2 & 3) (1967, DS), while *Galium odoratum* (Woodruff) was amongst the species recorded at Bellewstown (District 5) (1969, CB & DNFC). With the exception of *A. reptans* which occurs on the N bank of

the Boyne at Crewbane, all of these species are recently recorded within the study area, although not necessarily at the aforementioned sites.

Limestone outcrops at Caraguban

An exploration of the limestone outcrops at Caraguban between Duleek and Donore (District 3) yielded *Polypodium cambricum* (Southern Polypody), *Anacamptis pyramidalis* (Pyramidal Orchid), *Trisetum flavescens* (Yellow Oat-grass) and *Avenula pubescens* (Downy Oat-grass), all (1965, DS), while *Anthyllis vulneraria* (Kidney Vetch) and *Pimpinella saxifraga* (Burnet-saxifrage) were added the following year (1966, DS). *Geranium lucidum* (Shining Crane's-bill), then a relatively uncommon plant in the county, was abundant on the sheer, northern face of the limestone outcrop (Synnott, 1967a). The now rare *Arabis hirsuta* (Hairy Rock-cress) was found near a cave on the NW face of the limestone outcrop (1965, DS **DBN**, det. Titz), while *Anacamptis morio* (Green-winged Orchid) was noted on a grassy W-facing slope, E of Carragubann [= Caraguban] (1966, DS **DBN**). These limestone outcrops do not appear to have been re-visited in recent times. However, all of the above species, with the exception of *A. morio*, have been recently recorded within the study area.

Base-poor soils at Bellewstown

In direct contrast to such limestones are the base-poor thin soils at Bellewstown (District 5), which overlie a core of Ordovician and Silurian shales (Meehan, 2012). *Teucrium scorodonia* (Wood Sage) was found there (1969, CB & DNFC), a very rare plant within the county with no recent records. *Asplenium adiantum-nigrum* (Black Spleenwort) and *Galium saxatile* (Heath Bedstraw), species most usually associated with base-poor conditions, were also recorded (1969, CB & DNFC). Slightly further south, *G. saxatile* occurred again with *Umbilicus rupestris* (Navelwort) in the shaley area just N of Naul, both (1969, CB & DNFC). The latter three species still occur, but are uncommon, within the predominantly base-rich study area.

Archaeophytes at Duleek

Several species of archaeophyte status (Jebb, 2019) were recorded in the neighbourhood of Duleek village (District 3). *Verbena officinalis* (Vervain) was noted near the moat [= possible site of Norman motte] at Duleek (1965, DS), although not seen for some years thereafter (Synnott, 1980); it was most recently recorded on the roadside by Duleek Commons (1982, MN). *Ballota nigra* (Black Horehound) was found in a hedge along the Commons Road near the aforementioned moat at Duleek (Synnott, 1980) where it occurred with *Malva sylvestris* (Common Mallow) (1963, DS **DBN**; Synnott, 1980). Both were still present in 2020 (MN) but subsequent clearance of the hedge in 2021 for construction works has caused damage to these colonies (2023, MN). The *Ballota* was also recorded on the roadside near the dump by the R. Boyne below Drogheda (District 1) (1969, CB **DBN**).

Evolving taxonomy

The *Flora of the British Isles* (Clapham *et al.*, 1952) had been widely employed by botanists during the BSBI Distribution Maps Scheme for the *Atlas of the British Flora* (Perring & Walters, 1962). Clarification on the taxonomy of many critical genera and an improved

knowledge of plant distribution justified the production of a second edition of that Flora (Clapham *et al.* 1962). It was within this improved taxonomic understanding, and its ongoing evolution, that the Flora of Duleek project was conducted. Certain taxa could now be determined with greater precision. The *Polypodium vulgare* aggregate (Polypodies) is one such example, the characteristics of the three species therein having been clarified by Shivas (1962). As a result, all three taxa were identified within the study area. *P. vulgare* (Polypody) was added to the list of calcifuge species from Bellewstown where it was noted on Silurian rocks (pre-1990, DS; Scannell & Synnott, 1990). This fern although rare in the predominantly base-rich east of Meath is now widely recorded from the base-poor soils of the northern half of the county. **P. interjectum* (Intermediate Polypody) was found on the rock face near the natural arch by the canal between Rosnaree and Slane (1967, DS **DBN**, conf. Jermy). It is now known to be widespread and common on base-rich substrates, especially mortared walls, throughout the county. *P. cambricum* (Southern Polypody), the rarest of the three taxa in Meath, was recorded on W-facing limestone outcrops at Carraigobann [= Caraguban] (1965, DS **DBN**, conf. Jermy). The site was revisited the following year by Synnott with the then informally named Active Service Unit (ASU) of the DNFC, the fern noted by Brunker in his diaries as '*P. australe*, the new split' (1966, DS & DNFC; DS **DBN**, Brunker-*ms.*). It was also recorded by Synnott below the waterfall in the gorge at Naul on the Meath bank of the Delvin R. (1969, DS), a site now largely inaccessible following the recent damming of the gorge. The fern had been previously collected by Praeger on limestone rocks at Beauparc (1893, RLP **DBN**), the specimen labelled *P. vulgare* f. *serratum* subsequently re-determined in 1967 by Synnott as *P. cambricum*. Synnott noted this fern at two further sites in the Boyne valley, which like Beauparc, were above Slane and thus outside the study area. It has however been recently recorded within the study area, an extensive patch occurring on the S-facing rock escarpment of dark limestone and shale immediately NE of Slane Bridge (2015, MN).

The taxonomic study of *Sparganium erectum* **(**Branched Bur-reed) by Cooke (1961) in Britain alerted Irish botanists to the existence of its subspecies, all four of which were subsequently recorded during the Flora of Duleek project. *S. erectum* subsp. *erectum* occurred on the R. Boyne at Roughgrange and at Stalleen, both (1969, DS **DBN**). *S. erectum* subsp. *microcarpum* was recorded from the R. Nanny below Duleek (1969, DS **DBN**), while *S. erectum* subsp. *neglectum* was found at Duleek Commons (1969, DS **DBN**) and at Thomastown (1969, DS & DNFC). The first Irish record of **S. erectum* subsp. *oocarpum* was made from the canal south of the R. Boyne at Slane (1969, DS **DBN**; Synnott, 1970); it was recorded later that same year on the bank of the R. Boyne at Roughgrange (1969, DS **DBN**).

The now-named *Tripleurospermum maritimum* (Sea Mayweed) and *T. inodorum* (Scentless Mayweed) were treated as conspecific under *Matricaria inodora* in *Irish Topographical Botany* (Praeger, 1901), and under *T. maritimum* in the *Atlas of the British Flora* (Perring & Walters, 1962). The merit of recognising these taxa at species level was clarified by Kay, who later set out their morphological distinctions (Kay, 1969; 1972). This enabled both species to be recorded for the first time from Meath. **T. maritimum* [s.s.] was noted from dry-fill in the R. Boyne estuary, Mornington Road [Stagrennan] (1986, DS **DBN**); it is now known to occur widely in coastal areas of the county. **T. inodorum* [s.s.]

was noted by the canal lock at Slane [on the fringe of the study area] (1984, DS **DBN**); it is now widely recorded within the study area.

Herbarium specimens of critically determined groups are of particular value as they can subsequently be reviewed in light of evolving taxonomy. Specimens of *Dryopteris*, *Rosa*, *Rubus* and *Rorippa* lodged in **DBN** were later reappraised by visiting experts. *Dryopteris* plants of interest collected by Synnott (1965, **DBN**) from the WNW-facing sloped woodland above the R. Boyne at Donore included *Dryopteris filix-mas* (Male-fern) (det. Corley 1974), **Dryopteris affinis* subsp. *affinis* (Golden-scaled Male-fern) (det. Fraser-Jenkins 1988) and their hybrid **D.* x *complexa* nothosubsp. *complexa* (det. Fraser-Jenkins 1988). While both parents are still known to occur within the study area, their hybrid has yet to be re-found within the county. The interpretation of what constitutes species, subspecies and hybrids within the genus *Rosa* is constantly evolving. Thus, determinations should be viewed within the context of the systematics applied during the time frame in which they originated. *Rosa* specimens from the study area were reviewed by Primavesi in 1991. **Rosa corymbifera* (Hairy Dog-rose) was collected from Boolies, Duleek (1976, DS **DBN**, det. *R. canina* group *Pubescentes*). *R. sherardii* (Sherard's Downy-rose) was found in old hedges along a grassy road on the Duleek side of Rosnaree (1975, DS **DBN**), while *R. rubiginosa* (Sweet-briar) occurred in a hedge at Rosnaree (1975, DS **DBN**) and in a hedge at Riverstown, Duleek (1976, DS **DBN**). The predominantly base-rich nature of Duleek and its environs militates against the formation of a rich *Rubus* flora. Nonetheless, a number of specimens were preserved enabling their subsequent critical determination. **R. altiarcuatus* (Dark-stemmed Bramble) was recorded from Laytown (1969, CB **DBN**, det. Allen 2009; Allen, 2013), while **R. pruinosus* (Pruinose Bramble) was collected from Mosney, S of Laytown (1969, CB **DBN**, det. Newton 1984; Norton, 2021). *R. subadenanthus* (Broad-toothed Bramble) occurred on the roadside at Ballygarth, 1.5km SE of Julianstown (1969, CB **DBN**, det. Allen 1998 as *R. adenanthoides*; Norton, 2021). Specimens of an unusual *Rorippa* collected from a wet, muddy bank of the R. Boyne at Stalleen, Donore (1966, DS **DBN**) were subsequently determined as **Rorippa* x *anceps* (Hybrid Yellow-cress) (= *R. sylvestris* x *R. amphibia*) (det. Rich 1989). The hybrid is recently recorded along the R. Boyne at intervals from Oldbridge to Drogheda, most recently noted amongst boulders subject to tidal inundation at the Mary McAleese Bridge, with some plants showing introgression to its parents (2017, TCGR & MN).

New vice county records

The Flora of Duleek project resulted in the addition of many taxa to the then known flora of Meath. Of particular significance is the first county record of **Spartina* (Cord-grasses), then recorded as *S. townsendii* [s.l.], noted from the inlet on the west side of the road to the factory [= tip of The Crook] and on the east side of the foreshore, Mornington (1968, CB & DNFC). The name *S. townsendii*, as used at that time, encompassed both the now-named S. x *townsendii* (Townsend's Cord-grass) and *S. anglica* (Common Cord-grass). Today, *S. anglica* is known to be locally common on the tidal mudflats and lower saltmarshes of the Boyne and Nanny rivers. Listed as an invasive species, with a risk rating of high impact (National Biodiversity Data Centre, 2024), *S anglica* has the potential to expand further on the saltmarshes at the mouths of the Boyne and Nanny rivers. Also significant is the first sighting in Meath of **Leymus arenarius* (Lyme-grass), noted in small amounts on the sandy

foreshore near the river [Boyne] mouth at Mornington, and on the foreshore under the high eroded dune between Mornington and Bettystown, both (1966, DS **DBN**; Synnott, 1967b). Synnott suggested that the Bettystown plants may have spread from the adjacent county of Dublin, where it was first discovered near Skerries in 1882 (Hart, 1883). It was later observed, again near Skerries, in considerable quantity over about 100 yards (1902, NC; Colgan, 1904) and had become more widespread on the Dublin coast by 1961 (Brunker *et al*., 1961). It is now common along the foreshore of Meath, most particularly on the seaward side of the foredunes on the northern half of the coast.

Many other taxa, not previously mentioned in this account, were first recorded from the county during the project. These included **Epilobium ciliatum* (American Willowherb) recorded at Butlin's Holiday Camp, Mosney (1980, DS **DBN**; Synnott, 1983); now abundant throughout the county, its rapid spread in Meath is similar to that observed elsewhere in Ireland (Doogue *et al*., 1985). **Rorippa sylvestris* (Creeping Yellow-cress) was noted at Duleek (1968, DNFC), most probably by the R. Nanny which runs through that village; it still occurs by that river, from where it was most recently recorded below Julianstown (2018, MN). **Bunias orientalis* (Warty-cabbage) noted at Mornington (1968, DS) appears to have been of casual occurrence as it has not since been recorded from the county. **Spirodela polyrhiza* (Greater Duckweed) was found in Taaffe's Lake at Caraguban, Duleek (1978, DS; Synnott *in litt*., 1978); uncommon in the county, it was last recorded within the study area from a eutrophic pond at Thomastown (1991, MN & BSBI). **Glyceria declinata* (Small Sweet-grass), which occurred at Dardistown Castle (1969, DS & DNFC), was most recently recorded within the study area 1.5 km E of Duleek Cement Factory [= Irish Cement at Platin] (1992, NFS). **Ribes rubrum* (Red Currant) occurred at Thomastown, W of Duleek (1969, CB) where it was recently noted at the base of the railway embankment (2015, MN). Attention to detail and improved taxonomic understanding resulted in the addition of several sub-specific taxa to the flora list for Meath. Those within *Sparganium* have already been noted. **Ficaria verna* subsp. *verna* (Lesser Celandine) was found by a stream in the woodland at Stameen, Drogheda (1967, DS **DBN**). **Veronica hederifolia* subsp. *hederifolia* (Ivy-leaved Speedwell) occurred as a garden weed at Duleek (1985, DS **DBN**). **Carex divulsa* subsp. *divulsa* (Grey Sedge) was found on the W-facing limestone bluff at Caraguban, Duleek (1978, DS **DBN**, det. Chater 1995). The latter three taxa are all recently recorded within the study area.

Project outcomes

In summary, although not all of the records gathered by Breen, Synnott and the Dublin Naturalists' Field Club towards a Flora of Duleek have been included in this account, the wealth of knowledge accumulated during the project is apparent. In excess of 3500 field records were collected on a site-specific basis, which together with the 268 herbarium specimens lodged in **DBN**, included over 500 different taxa. These records informed the selection of sites in Meath chosen for botanical interest as Areas of Scientific Interest (ASI) and were the basis of the reports compiled by An Foras Forbartha (Young, 1972; Cabot, 1981). Sites from within the study area listed in those reports included Bellewstown Racecourse, Boyne Estuary, Cromwell's Bush fen [= Greenanstown], Duleek Commons, Flemingstown woodlands [= Somerville], Laytown dunes, Mornington dunes, Naul, Rosnaree riverbank, Slane riverbank and Thomastown bog. The site-specific nature of the

data accumulated during the Flora of Duleek project makes it possible to compare with a high level of topographical precision the state of the flora and habitats at that time with the current botanical environment. The project, extending over more than two decades from 1963 to 1986, bridges the gap between the records previously compiled for the original *Atlas of the British Flora* (Perring & Walters, 1962) and those which were yet to be generated for the *BSBI Monitoring Scheme 1987-1988* (Rich & Woodruff, 1990) and the *New Atlas of the British and Irish flora* (Preston *et al*., 2002).

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An annotated list of ferns occurring in Clare (H9)

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Introduction

Presented is an annotated list of native and naturalised pteridophytes (fern and fern allies) occurring in Clare (Biological Vice County **H9**) which covers the administrative county of Clare, the Aran Islands in County Galway, and a small part of Co. Limerick.

Subspecific taxa and hybrids are included. Nomenclature follows Stace (2019). Grid references provided are Irish National Grid (ING). This work has been compiled drawing from various sources including published scientific literature, records held by the Botanical Society of Britain and Ireland (BSBI), as well as records made by the author in recent years. Information on the general distribution of species in the vice county has been primarily informed by the BSBI online Distribution Database (BSBI, 2024) unless otherwise stated. Records gathered by the author are initialled 'DÓC'.

Notes are provided on the distribution and ecology of each taxon found within the vice county. The annotated list of taxa presented is also not considered to be complete and was based on information sources available to me. I would be most grateful to receive any observation regarding omissions or additional information I may have overlooked.

ASPLENIACEAE – *Spleenwort family*

Asplenium scolopendrium L. (*Phyllitis scolopendrium* (L.) Newman) – *Hart's-tongue*. Widespread and common; generally, more abundant over limestone. Various habitats on free-draining substrates including earth-banks, hedges, woodland, stone walls, banks of stream and rivers, exposed rock and grikes. Prefers shaded or semi-shaded conditions. The abundance and variety of forms of *A. scolopendrium* in the Burren is noted by Colgan & Scully (1898); *'This species is especially abundant on the limestone of the Burren district where many of the more striking varieties occur.'* F.J. Foot (1871) remarked *'There are several varieties among which may be mentioned, Multifidum, Digitatum, Cornutum, Marginatum, Laciniatum, and Crispum, and, as a matter of courses many intermediate forms.'* First Record: Inishmore (Andrews, 1845).

Asplenium ruta-muraria L. – *Wall-rue*. Widespread. Common on limestone rocks and lime-mortared walls. Occasional on old red sandstone in Slieve Aughty region. Foot (1860) describes an unusual form near Tulla *'On the wall of Kiltannan demesne, near Tulla, the fronds of this fern attain a length of six to eight inches, being proportionately broad and luxuriant.'* First record: Inishmore (Andrews, 1845).

Asplenium ceterach L. (*Ceterach officinarum* Willd.) – *Rustyback.* Widespread. Limestone rocks and walls. Frequent in the Burren and Aran Islands, less so in areas of acid geology where it is usually restricted to lime mortar walls or limestone masonry. Irish populations of this fern tend to have larger fronds with more strongly crenate margins than British plants; these have been referred to var. *crenatum* Moore (Page, 1997). First Record: Burren (Mackay, 1806), '*On limestone rocks and walls near Corrofin and other places in the County of Clare'*.

Asplenium adiantum-nigrum L. – *Black Spleenwort.* Widespread but rarely abundant. On walls, in rock crevices, banks, cliffs, usually semi-shaded habitats. More common on limestone but also occurs on other rock types. First record: J.R. Kinahan c. 1854 (as cited in Synnott, 1968), *'Feakle, rare; Tullagh and Ennis, more plentiful.'*

Asplenium trichomanes L. – *Maidenhair Spleenwort.* Widespread. Frequent on masonry walls, rockfaces and outcrops, limestone pavement, quarries etc. Three subspecies are recorded from Ireland and there are records for all from Co. Clare:

Ssp. quadrivalens. D.E Mey. In Webb and Scannell's *Flora of Connemara and the Burren* (1983) the authors note that most plants examined within their study area were referable to this subspecies, even where it occurs on non-calcareous substrates.

Ssp. trichomanes. Records from two localities in the Burren at R2096 Noughaval-Lismoher and M2305 Ballycahill, Aillwee; both records date from 2014. Given these are the only records, confirmation of these records would be desirable.

Ssp. pachyrachis. (Christ) Lovis & Reichst. No modern records. Recorded from one locality; Black Head in 1863. The collections are old and require confirmation (Parnell & Curtis, 2012). The Black Head record, which appears to be the only Irish record, is based on specimens gathered as *Asplenium Trichomanes var. havorii* in 1863 and stored in Kew Gardens herbarium (**K**) (Rickhard, 1989).

First Record: Inis Mór (Andrews, 1845).

Asplenium marinum L. – *Sea Spleenwort.* Coastal. Maritime rocks and walls near the coast. Frequent on the north Clare coast and Aran Islands, elsewhere records are more thinly scattered. First Record: Inishmore (Andrews, 1845).

HYMENOPHYLLACEAE – *Filmy-fern family*

Hymenophyllum wilsonii Hook. – *Wilson's Filmy-fern.* Occasional in Slieve Aughty Mountains region where it occurs on rock faces, outcrops and boulders in both wooded and more exposed situations on heathland. Occasionally as an epiphyte on *Crataegus monogyna* (Hawthorn) and *Salix cinerea* (Grey Willow). Typical habitats for this species in the Slieve Aughty Mountains are described in detail in Roden *et al.* (2021). Rare elsewhere: two sites are known in Slieve Bearnagh & Broadford Hills region of East Clare: Gortacullin Bog and Kyle townlands, both 2023 (DÓC).

Known from one site in the Burren, Poulavallan Doline, where it was found by D.A Webb on the base of a small tree (Webb, 1963). Re-found by a group including the present author in 2024 on large windblown *Salix capraea* (Goat Willow). One other North Clare record: woodland at Clifden Hill near Corrofin 2022, on sandstone rocks on the north-facing aspect of the hill (DÓC). No records from Slievecallan and surrounding upland area in West Clare. First record: Slieve Aughty Mountains. (G. H. Kinahan, 1863).

Hymenophyllum tunbrigense (L.) Sm. – *Tunbridge Filmy-fern.* Locally abundant in the Slieve Aughty Mountains, where it is confined to the old red sandstone rocks including cliffs, and boulders in heathland and woods (Roden *et al.*, 2021). Much rarer in other parts of the county with a small number of sites in West Clare including Knockatunna and Cloonlaheen East 2022 (Ó Catháin, in press). North Clare 2023: Cahersherkin, abundant on rocks in a small wood (DÓC). Recorded from three sites in Broadford Hills, South-east Clare: Gortacullin Bog, Formoyle Beg, and Kyleglass 2023 (DÓC). First record: J.R. Kinahan (1858), '*Clare: Monounta, Feakle, abundant on bare cliff, 500 feet high'*

Trichomanes speciosum Willd. (*Vandenboschia speciosa* (Willd.) G. Kunkel) – *Killarney Fern.*

Sporophyte. Very rare. First recorded west of Ennis by T.H. Corry in 1879 (Corry, 1880), who discovered a single population at a waterfall near Lissycasey. No subsequent records until found in Slieve Aughty Mountains in 2022 by C. Roden and M. Sheehy-Skeffington. Found in the same year by the author at a location in West Clare where two sporophyte patches were recorded in a wooded ravine in 2022 (Ó Catháin, in press).

Gametophyte. Occasional. Slieve Aughty Mountains: occasional; sandstone cliffs, in crevices and undercut cliff bases and amongst conglomerate boulders in woodland/scrub. West Clare: Slieve Callan upland region in rock crevices along upland streams (Ó Catháin, in press). Slieve Bearnagh & Broadford Hills: 2023 in rock crevice in hazel woodland (DÓC).

First record: T.H. Corry 1879 (Corry, 1880). Waterfall on Owenslieve River.

ATHYRIACEAE – *Lady-fern family*

Athyrium filix-femina (L.) Roth. – *Lady-fern.* Common except over limestone. Occurs on acid soils mainly in woodland or otherwise shaded habitats. Also occurs on wetland margins. First record: J.R. Kinahan *c.* 1854 (as cited in Synnott, 1968); *'Clare and Galway: Lowlands.'*

POLYPODIACEAE – *Polypody family*

Polypodium vulgare L. – *Polypody*. Widespread. Found throughout the county. Grows on walls, rocks, earth banks, and epiphytically on trees. Less frequent on limestone

rocks than the other two species found in Clare. First record (for *P. vulgare s.l.*): Mackay (1806). Aran Islands.

Polypodium interjectum Shivas. – *Intermediate Polypody.* Fairly widespread, frequent on walls and earth banks. Records concentrated in Burren, Aran Islands, and around Ennis. Scattered records from throughout the county. First record: Shivas (1962). H9.

Polypodium cambricum L. **–** *Southern Polypody***.** Locally abundant on rocks, walls and banks. Records concentrated in Burren and Aran Islands; few records elsewhere in the vice county but probably under-recorded. First record: Shivas (1962). H9.

Polypodium x mantoniae Rothm. *(P. vulgare* x *P. interjectum) – Manton's Polypody*. First and only record, A. Willmot, found on *'a mortared limestone wall at Ennistimon (R/13.90).'* (Willmot, 1979). No further records of this hybrid. Likely to occur elsewhere as it is considered the commonest of the *Polypodium* hybrids (Page, 1997).

DRYOPTERIDACEAE – *Buckler-fern family*

Dryopteris filix-mas (L.) Schott. – *Male-fern.* Widespread and common throughout Co. Clare and Aran Islands. More abundant over limestone. Found in hedgerows, woodland, scrub and rocky habitats. First record: J.R. Kinahan c. 1854 (as cited in Synnott, 1968). Feakle and Kilkee.

Dryopteris dilatata (Hoffm.) A. Gray. – *Broad Buckler-fern.* Very common throughout study area. Occurs in a range of habitats including woodland, heaths, hedgerows, around rock outcrops, and occasionally as an epiphyte on trees in humid woodlands. First record: J.R. Kinahan c. 1854 (as cited in Synnott, 1968). Feakle, Caher, and Burren.

Dryopteris aemula (Aiton) Kuntze – *Hay-scented Buckler-fern.* Frequent in humid and sheltered woodland sites, especially in wooded ravines, stream-sides, and wooded rock exposures. First record: J.R. Kinahan c. 1854 (as cited in Synnott, 1968). Lough Graney and Monounta.

Dryopteris carthusiana (Vill.) H. P. Fuchs – *Narrow Buckler-fern.* Existing records indicate this species is more common in the eastern half of the county. There is also a cluster of records on the Clare shales around Slieve Elva. No records retrieved for limestone areas of the Burren limestones. First record: R. A. Phillips. Cratloe Wood (Philips, 1924).

Dryopteris affinis (Lowe) Fraser-Jenk. – *Golden-scaled Male-fern.* Three subspecific taxa recorded. Given the variety of forms and inherent difficulty in identifying taxa within the *D. affinis* agg., the distribution of the various subspecies and their hybrids is likely to be poorly represented in existing records. The following taxa have been recorded:

Ssp. affinis Fraser-Jenk. Two records, both by R.M Walls: 2008 Mountshannon R717862, Jul. 7, 2008; and Craglea R687760, July 8, 2008.

Ssp. cambrensis Fraser-Jenk. 2008 single record from near Lough Dreg at Mountshannon, R.M. Walls.

Ssp. borreri (Newman) Fraser-Jenk. A small number of records from the Burren and from near Lough Derg.

Dryopteris x complexa Fraser-Jenk. *(D. filix-mas* x *D. affinis)*. First and only record by A. Willmot (as *Dryopteris* x *tavelii*) *'in tall grass by roadside near Ennistimon (R/13.90)'* (Willmot, 1979).

Polystichum setiferum (Forsk.) Woynar – *Soft Shield-fern*. Widespread and common in woodland habitats and hedgerows. Generally, more abundant in limestone areas. First record: Oliver (1851). Inishmore.

Polystichum aculeatum (L.) Roth – *Hard Shield-fern*. Locally common in the Burren, very rare elsewhere. Early records include an interesting observation by J.R. Kinahan (1858): '*Feakle, rare.'*; and he remarks '*the form met with near Feakle differs so much in character from the ordinary plant, that I have some hesitation in positively considering them identical, being much stunted and narrower in its form, and retaining this character in cultivation.'* First record: Recorded in the Burren by Rev, T. O'Mahony c. 1852 (O'Mahony, 1860).

Polystichum x bicknellii (Christ) Hahne. *(P. setiferum* x *P. aculeatum)*. Single record: Burren R29, D.L Kelly, 1974.

THELYPTERIDACEAE – *Marsh Fern family*

Phegopteris connectilis (Michx.) Watt – *Beech Fern.* Very rare. Muingboy near Broadford 2023 in woodland (DÓC). There are two early records for this species: first from a waterfall at Glenageer townland on the east side of Slievecallan (Foot, 1860), the second from Glendree, Slieve Aughty Mountains (Kinahan, 1862). First record: F.J. Foot (1860). Waterfall at Glenageer, Slievecallan.

Thelypteris palustris Schmidel – *Marsh Fern.* Occurs on limestone lowlands spanning from The Burren south as far as Ballycar Lough, NE of Newmarket-on-Fergus. There are records from a total of eight 10km grid squares. Records are concentrated around East Burren limestone lakes including Lough George, L. Bunny, and L. Skeardeen to the NE of Corofin. Not recorded from Ballycullinan L. since found there by R.L Praeger (Praeger, 1905). First Recorded: Mackay (1806) *'In a Marsh by the River Fergus, a little above the bridge at Ennis.'*

Oreopteris limbosperma (All.) Holub **–** *Lemon-scented Fern.* Rare but likely under-recorded. All modern records are from East Clare. Historic records include F.J Foot (1860) *'Locality-Stream, boundary townlands of Cloonulla and Gortnaha, on the north side of the road, about two miles west of Killadysart; also on the side of the road south of Clondegad.'* Recorded also by Kinahan (1861) as *'Very abundant in the glen about Feakle, &c'.* Listed as occurring in North Clare near Lisdoonvarna in R.L Praeger's *Irish Topographical Botany; 'Lisdoonvarna '00-Miss Knowles. Widespread but rare'* (Praeger, 1901). Recent records (2023) from localities in East Clare as follows: Gortavrulla, Corbehagh, and Ballycroum Hill (DÓC). First record: J.R. Kinahan (1858). *'Clare: Feakle, very abundant.'*

OPHIOGLOSSACEAE – *Adder's-tongue family*

Ophioglossum vulgatum L. – *Adder's-tongue.* Occasional. Damp grasslands. Majority of modern records from the Burren and Aran Islands. Scattered records elsewhere in the county including part of the west Clare coast and at the extremity of Loop Head peninsula, Kilmore on the Shannon Estuary R1053, Caher Rice R5590 near Lough Graney,

and East Clare lakes of Finn Lough R4369, and Rosroe Lough R4469. Early records include West Clare by M.C. Knowles & R.D. O'Brien (1909): *'Ophioglossum vulgatum. – near Gortgloss Lake.*'; and East Clare by G.H. Kinahan *'...Glenaagalliagh, abundant…'* (Kinahan, 1860). First record: Newman (1854). Inis Mór.

Botrychium lunaria (L.) Sw **–** *Moonwort.* Rare. Modern records all in the Burren, with the exception of a single outlier at Caheraghacullin R0768 in West Clare. Recorded from a woodland habitat at Clooncoose, near Glasgeivnagh Hill R2995 (Doyle, 1985) which is an unusual habitat for this species. No modern records from Aran Islands: Portcowragh on Inis Mór (Nowers & Wells, 1892).

East Clare, no modern records: Slieve Aughty, Kinahan (1861): *'...found wherever a search was made for it.'*; he lists the following *'abundant localities'*, the Bleach River, a mile west of Corlea Bridge; Corley Valley; hills east of Lough Graney; and *'the slope on the north of the new road that runs from Mount Shannon to Bohateh, due north of the R. C. Chapel.'*. Kinahan (1860) at '*...N.W of Killaloe Crag west side of stream'.* Foot (1860): Spancel Hill and Ardbooley.

CYSTOPTERIDACEAE - *Bladder-fern family*

Cystopteris fragilis (L.) Bernh – *Brittle Bladder-fern.* Frequent in the Burren, very rare elsewhere. A number of notable outliers in the early records include Cairn Hill near Ennis (Foot, 1860): *'the cleft in the rocks at Corrin Hill is a dark and damp place, which causes the ferns to assume a long attenuated form, very different from the Burren plants...'*. F.J. Foot also recorded this species from Marble Hill, Tulla *'...growing sparingly on the roadside...'.* Willmot (1979): Moy House near Lahinch. Other notable outliers include Kildysart *'Cystopteris fragilis – Walls of the park at Paradise.'* (Knowles & O'Brien, 1909). And Kinahan (1861): *'Road-side, S. of Scarriff Bay'***.** No records from Aran Islands. First record: Recorded in the Burren by Rev, T. O'Mahony *c.* 1852 (O'Mahony, 1860).

Gymnocarpium dryopteris (L.) Newman – *Oak Fern.* Single record: *'Roadside between Broadford Village and the Cliffs of Moher, T.H Wright'* (Colgan & Scully, 1898). The reference to 'Broadford' in the aforementioned work is an error which was repeated in R. L. Praeger's Irish Topographical Botany (1901); the record actually relates to *Roadford* near Doolin village. A corresponding herbarium specimen dated 1876 exists and the original label states *'near Roadford, Co. Clare (in the wild district of the Burren) sparingly, Thos. Wright Jnr Aug 1876'* (Hackney, 1993). It is speculated this Roadford record may been of a transient population established in the wild from spores of garden origin (Synnott, 1992).

Gymnocarpium robertianum (Hoffm.) Newman – *Limestone Fern.* Introduced. Translocated in 1996 and 2003 to a site with limestone pavement in the Burren near Mullach Mór (Wyse Jackson *et al*., 2016). The species still occurs at this site.

BLECHNACEAE – *Hard-fern family*

Blechnum spicant (L.) Roth – *Hard-fern.* Frequent except over limestone. Habitats include acid woodland, peatlands, and upland grasslands. Not seen on Aran Islands since first recorded there by H.C. Hart (Hart, 1875), where it is thought to have been brought in with turf and to have persisted for a time (Webb, 1980). First record: J.R. Kinahan c. 1854 (as cited in Synnott, 1968). Feakle.

DENNSTAEDTIACEAE – *Bracken family*

Pteridium aquilinum (L.) Kuhn. – *Bracken.* Widespread and abundant in all parts of the vice county. First Record: Inishmore (Andrews, 1845).

PTERIDACEAE – *Ribbon Fern family*

Adiantum capillus-veneris L. – *Maidenhair Fern.* Mainly restricted to the Burren limestones, and there concentrated mostly near the coast. Aran Islands: present on all three islands. Recorded as an introduction at Cahiracon House beside the Shannon Estuary 2019 (S. Ward), where it grows from the cellar walls in the basement of the abandoned house. Also as an introduction at Limerick City 2017, (part within H9) (M. Quirke & T. Harrington). First Record: Lhwyd (1712): *'In the Isle of Aran (near Galloway) we found great plenty of the Adianthum verum...'*. Here '*Galloway*' is Galway.

OSMUNDACEAE – *Royal Fern family*

Osmunda regalis L. – *Royal Fern.* Found in peatlands and fens throughout most of County Clare. No records from Aran Islands or Burren limestone upland areas, probably due to absence of suitable wetland habitat. First record: Kinahan (1858); '*Lough-a-torrig, local.'*. Probably *Lough Atorick.*

SALVINACEAE – *Water Fern family*

Azolla filiculoides Lam. – *Water Fern.* A non-native invasive aquatic fern. Recorded from Lough Derg and River Shannon. Likely to be more widespread. First Record: Reynolds (2005). Along north side of R. Shannon below Limerick City.

LYCOPODIACEAE – *Clubmoss family*

Huperzia selago (L.) – *Fir Clubmoss.* Scarce. Only four records retrieved for this species. No records from upland regions of Slievecallan and Slieve Bearnagh, which would be expected to have suitable habitat. Recorded by the author at Glendree, where a small group of plants were found in a recess on a rocky scarp in heathland; this specimen corresponded to subsp. *selago.* The record for subsp. *arctica* in the Burren (Stace, 2019) appears erroneous. First record: Praeger (1901). No details given only that it occurs in all counties except for Limerick.

SELAGINELLACEAE – *Lesser Clubmoss family*

Selaginella selaginoides (L.) P. Beauv. – *Lesser Clubmoss.* Mainly restricted to Burren limestones. Outside of the Burren recorded from limestone lakes in East Clare, and two records from Slieve Aughty Mountains in East Clare. First record: Mackay, J. T. (1806). Burren *'On moist grounds near Gleninagh'.*

Selaginella kraussiana (Kunze) A. Braun. – *Krauss's Clubmoss.* A neophyte of which a naturalised population occurs in SE Co. Clare 2021 along the Blackwater River near Limerick City (DÓC) and near Parteen. The origin is unknown but it appears to be long-established due to its occurrence at two well separated locations. First record: P. O'Brien & F. Giaquinto. Derryfadda, Parteen, 2018.

ISOETACEAE – *Quillwort family*

Isoetes lacustris L. – *Quillwort.* Recorded from Slieve Aughty area at Lough Graney and Lough Atorick. Recorded from Doon Lough near Broadford. Found in most of the larger lakes in the shale uplands of the western part of the county. Absent from limestone lakes in Burren and East Clare lowlands. First record: M.J.P Scannell 1978: *'Knockerry, E of Kilrus Lough'* probably referring to Knockerra Lough located c. 6km east of Kilrush.

Isoetes echinospora Durieu – *Spring Quillwort.* Occurs only in the western half of the county where it is recorded from a number of lakes on shale geology. First record: Monmor Lough (probably Moanmore Lough; Q9861) in 1908 (Praeger, 1909; 1929).

EQUISETACEAE – *Horsetail family*

Equisetum fluviatile L. – *Water Horsetail.* Common throughout the vice county. Occurs in a wide variety of wetland habitats including lakes, mires, and slow-moving watercourses. First record: Praeger (1901). No details given only that it occurs in all vice counties.

Equisetum sylvaticum L. – *Wood Horsetail.* Frequent in East- and mid-Clare. Absent from Burren limestone uplands and Aran Islands. Few records in the southwestern part of the county however it is likely to be under-recorded. First record: Praeger (1901). All vice counties.

Equisetum telmateia Ehrh. – *Great Horsetail.* Frequent, however there are few records from the limestone Burren uplands, and Slieve Callan upland area of West Clare. Only recorded from Inis Mór on the Aran Islands. First record: Praeger (1901). All vice counties.

Equisetum palustre L. – *Marsh Horsetail.* Frequent in the north and east of the county, rare in west Clare. First record: Praeger (1901). All vice counties.

Equisetum variegatum Schleich. ex Weber & Mohr. – *Variegated Horsetail.* Mainly in the east Burren lowlands. Also abundant along Caher River, Carron (Webb & Scannell, 1983). Two records in the eastern half of the county. In the Aran Islands only recorded from Inis Mór and not recorded there since the late 19th Century (Webb, 1980). First record: R.L. Praeger 1895 (Praeger, 1895). Inis Mór.

Equisetum hyemale L. – *Rough Horsetail.* Two modern records both in 2023. Found at a new site by M.S. Skeffington and Cilian Roden at the River Corra in Slieve Aughty Mountains region. Recorded by the present author c. 1km south of O'Briensbridge along a back-drain and embanked path beside the River Shannon. First record: R.D. O'Brien 1904, at Parteen (Praeger, 1905).

Equisetum arvense L. – *Field Horsetail.* Widespread and common throughout County Clare and Aran Islands. Abundant along roadsides and on recolonising disturbed ground.

Equisetum x trachyodon A. Braun (*E. hyemale* x *E. variegatum*) – *Mackay's Horsetail.* Very local and recorded from only four sites in the study area, all of which are lowland lakes or wetlands over limestone, these are Lough Bunny in east Burren, Cappafeean Lough R3984 south of Crusheen, Cragmurnia Lough R5480 east of Tulla, and Moyree Wood R3688. First record: Praeger (1934). South end of Lough Bunny.

Equisetum x dycei C. N. Page. (*E. fluviatile* x *E. palustre*). Two records for this hybrid in the vice county. First recorded from Caher River Valley in the Burren by C. N.

Page in 1984 (cited in Scannell & Jebb, 2000). The second record is from Doon Lake, where a single population was recorded along approximately 500m of the eastern shore of the Lough (Bruinsma *et al*., 2009). First record: C. N. Page in 1984 (cited in Scannell & Jebb, 2000). Caher River Valley, Burren.

Equisetum x rothmaleri C.N. Page (*E. arvense* x *E. palustre*). Single record from Caher River Valley in the Burren where it was found by C.N. Page in 1984 (cited in Scannell & Jebb, 2000).

Equisetum x litorale C.N. Page (*E. arvense* x *E. fluviatile*) – *Shore Horsetail.* Most common of the *Equisetum* hybrids with scattered records, mostly in northwest and east of county Clare. Mostly found on the shores of limestone lakes. Recorded form Inis Meáin. First record: Praeger (1932). Caher River Valley, Burren, *'in the median flat portion of the valley'.*

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Vice-county Reports

Recording in Leitrim (H29) 2023

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Compared with previous recent years the number of records was down but nevertheless over 2,200 records were collected and entered into the BSBI database. There were some good finds/refinds. Firstly, two native species were found for the first time in Leitrim; On July 27th, Robert Northridge and Bridget Keehan found *Elatine hexandra* (Six-stamened Waterwort) in Upper Lough McNean. On August 16th I found *Erigeron acris* (Blue Fleabane) on a forest layby near Kiltyclogher. Both are first county records for Leitrim.

On April 9th on one of my few outings to South Leitrim in 2023, I found *Moehringia trinervia* (Three-nerved Sandwort) and *Viola reichenbachiana* (Early Dog-

violet) east of Mohill. Both are new to the hectad N1196. It was only the second Leitrim record for the *Moehringia* since 1999.

During May, July, August and September, there were a number of outings to the uplands of Glenaniff and Glenade in the Dartry Mountains. The northern end of Glenaniff has some nice limy flushes on the lower slopes with much *Parnassia palustris* (Grass-of-Parnassus), *Carex dioica* (Dioecious Sedge), *Pinguicula vulgaris* (Common Butterwort), *Pedicularis palustris* (Marsh Lousewort), *Eleocharis quinqueflora* (Few-flowered Spike-rush) and *Selaginella selaginoides* (Lesser Clubmoss), amongst others. Some of the monads in this area had few records and the *Carex dioica* was found in a new hectad site. Higher up on the limestone cliffs were *Silene acaulis* (Moss Campion), *Saxifraga oppositifolia* (Purple Saxifrage), *Saxifraga hypnoides* (Mossy Saxifrage), *Saxifraga aizoides* (Yellow Saxifrage) and *Rhodiola rosea* (Roseroot), amongst others. A new hectad site was found for *Polystichum aculeatum* (Hard Shield-fern) and the local *Oreopteris limbosperma* (Lemon-scented Fern) was found in two places. On September 6th Bridget Keehan and I climbed up to the Glenade cliffs to update records of two species which are extremely rare in Leitrim. The first was *Epilobium alsinifolium* (Chickweed Willowherb). A bit late in the season but we saw much small vegetative material, some of which Bridget sent to the *Epilobium* referee and at least one sample was confirmed as *E. alsinifolium* from its only known Irish site. The second was *Equisetum pratense* (Shady Horsetail) which we failed to find. I am familiar with this Horsetail from its Fermanagh sites and would have recognised it if we saw it. A difficult area to explore and hopefully the Horsetail is still there.

On Sept 13th Bridget Keehan and I explored the eastern end of Lough Gill to update records of some rare species. In particular we saw a good bit of *Sorbus rupicola* (Rock Whitebeam) by the rocky shore. Nearby *Hypopytis monotropa* (Yellow Bird's-nest) was still to be seen. We then went to a site near Drumkeeran for *Sorbus hibernica* (Irish Whitebeam) and found the tree near the road. First found here by Robert and Hannah Northridge in 2017 at its only known Leitrim site.

In August I found *Mycelis muralis* (Wall Lettuce) near Kiltyclogher and this was only the second record for Leitrim.

Compared with North Leitrim, South Leitrim is still a bit under recorded and I plan to devote more time to recording monads with few or no records in the area in 2024. Hopefully the summer won't be as wet as in 2023 so that recording aquatic species will be easier.

Recording in Sligo (H28) 2023

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Over 22,000 Sligo records were gathered and uploaded to the BSBI database in 2023. Recording took place in every month of the year. Space does not permit me to include all the good finds in this article but some of the highlights are outlined below.

Perhaps the most exciting find was on June 22nd when a training group led by Rory Hodd, Maria Long, Aoife Delaney, Phoebe O'Brien & Eoin McGreal found *Botrychium lunaria* (Moonwort) (see page 88) at Glencarbury on the Dartry Mountains. Only the second post 1999 record in Sligo for this elusive fern.

The modest little Speedwell *Veronica agrestis* (Green Field Speedwell) was seen in flower near Coolaney on January 4th. It was in fact my first time to see it in Sligo. Later in the year I found it at two other new sites in August. It remains a rare species in this part of the country.

The uncommon hybrid Horsetail *Equisetum* x *trachyodon* (Mackay's Horsetail) was recorded in a new hectad site by the riverside walk in Coolaney in March. Patricia McHugh spotted it there in recent years. Two other new Sligo sites were found; one at Glencar Lake in September and another by a wooded stream bank west of Coolaney in February. Don Cotton had recorded it elsewhere by Glencar Lake in the past. Sligo and Leitrim must be one of its Irish strongholds. Sligo is also a good place to find the uncommon fern *Polystichum aculeatum* (Hard Shield-fern) especially in the area south of the Ox Mountains. 23 records of the fern in Sligo were added to the database in 2023, nearly all from previously unrecorded monads.

On March 22nd, Patricia McHugh & I found a good bit of *Juncus tenuis* (Slender Rush) on a mountain track near Cloonacool. Although locally common in parts of Ireland, this was only the second Sligo sighting, the last one was in 1929 (unlocalised in an adjacent hectad).

Other good early season finds were *Cerastium semidecandrum* (Little Mouse-ear) at Rosses point in April (new to the Rosses Point area and the hectad G64), *Bromus racemosus* subsp. *racemosus* (Smooth Brome) near Aclare and *Potamogeton coloratus* (Fen Pondweed) in a drain near Tubbercurry. There are only four previous sightings of *Bromus racemosus* (any subspecies) in Sligo and two of them are old. Later in the year I found the *Potamogeton* in good quantity in a drain by a rough fen near Templeboy. One of the marker species for a good fenny habitat is the local *Juncus subnodulosus* (Blunt-flowered Rush) which was present in the latter site in quantity. This is a rush I hardly recognised a few years ago and to date I haven't seen it in Leitrim. This year alone I have recorded it in 17 Sligo sites, most of them new and one a new hectad. As the rush flowers late, it is worth returning to its sites earlier in the summer to see some nice species including orchids.

On May 8th, six of us (Noel Raftery, Sandie McCanney, Patricia McHugh, Sarah Andrews, Mary McCormack and I) explored the southern slopes of Knocknarea, primarily to relocate *Neotinea maculata* (Dense-flowered Orchid) which was first found on this mountain in 2020 (only two spikes). We were rewarded with 25 flowering spikes of the orchid and saw several other nice species on the day.

On June 9th (a fine very warm day) I led a group of 5 of us (Andy King, Sarah Andrews, Patricia McHugh, Mary McCormack & I) up Benbulben to view some of the plants of that famous mountain. Before we got near the highest ground, we saw *Arenaria ciliata* (Fringed Sandwort in flower (see front cover), *Asplenium viride* (Green Spleenwort) (see page 88), *Cystopteris fragilis* (Brittle Bladder Fern) and *Carex caryophyllea* (Spring Sedge) all in good quantity. Further up we saw *Silene acaulis* (Moss Campion), *Oxyria digyna* (Mountain Sorrel), *Galium sternerii* (Limestone Bedstraw), *Rhodiola rosea* (Roseroot), *Sesleria caerulea* (Blue Moor-grass). *Salix phylicifolia* (Tea-leaved Willow)

grew only by the cliff edges and I was the only one brave enough to get close to it and bring a small sample back for others to see. The latter is known in Ireland only from the Benbulben/Dartry ranges of Sligo and Leitrim. Andy spotted a nice colony of *Neottia cordata* (Lesser Twayblade) in flower near the summit. The bogs below the mountain also provided some nice species; *Carex dioica* (Dioecious Sedge), *Carex lepidocarpa* (Long-stalked Yellow-sedge), *Pinguicula vulgaris* (Common Butterwort) and the very local *Eleocharis quinqueflora* (Few-flowered Spike-rush), amongst others. Disappointingly, the *Silene acaulis* was not in flower at the time, but in September I saw plants with many flowers out on another trip up to the shaded northern cliff bases of the mountain (see rear of the front cover). On seeing it in full flower some would fancy picking some for their rock garden but its main flowering period is very short and the species is too rare in Ireland to even think about uprooting it.

In June I recorded three monads in the Sligo part of the hectad G21 near Ballina. These monads belong administratively to Co. Mayo but botanically to Sligo H28. Hardly any previous Sligo records. The sessions generated at least 15 hectad singletons and a few nice species were seen; *Polystichum aculeatum* (Hard Shield-fern), *Geum* x *intermedium* (*G. rivale* x *G. urbanum*), *Catabrosa aquatica* (Whorl-grass), *Sorbus aria* (Common Whitebeam) and *Trifolium medium* (Zig zag Clover), amongst others.

A significant refind in June was *Carex pallescens* (Pale Sedge) by the entrance to Slish Wood. There are very few recorded Sligo sites for this sedge and the last record for Sligo was in 1996 (Don Cotton *et al.*). By contrast, I have found it in several places in Leitrim, though still very local there.

On Sunday July 2nd, I led my first Sligo Field Outing in Strandhill. Nine people attended including our then new Irish officer, Bridget Keehan. Strandhill has many nice species including several orchids. *Epipactis palustris* (Marsh Helleborine) was plentiful and at its best, accompanied by *Gymnadenia* spp. (Fragrant Orchids), *Dactylorhiza* spp. (Spotted and Marsh Orchids) and *Anacamptis pyramidalis* (Pyramidal Orchid). On the downside we failed to find any *Ophrys apifera* (Bee Orchid) plants (normally frequent in the area). Other nice species were *Pyrola rotundifolia* subsp. *maritima* (Round-leaved Wintergreen) (see page 43), *Antennaria dioica* (Mountain Everlasting), *Koeleria macrantha* (Crested Hair-grass), *Catapodium marinum* (Sea Fern-grass), *Phleum arenarium* (Sand Cat's-tail), *Carlina vulgaris* (Carline Thistle) and a *Hieracium* sp. (Hawkweed). We visited the caravan park where I found *Polycarpon tetraphyllum* (Four-leaved Allseed) (see page 88) in May 2020. It was still there. Luckily there were no caravans in the bays where the plant grew. The Hawkweed was later keyed out and found to be *Hieracium iricum* (Erin Hawkweed) and although there are other Sligo records, it is a new record for the Strandhill area.

On September 1st five of us went to Streedagh (Andy King, Patricia McHugh, Aisling Blackburn, Honor Broderick & I), primarily to refind *Spiranthes spiralis* (Autumn Lady's-tresses) and *Polygonum oxyspermum* (Ray's Knotgrass) (see page 42) which hadn't been seen there in recent years. We refound both, though only 6 spikes of the *Spiranthes*, but a large colony of the *Polygonum*. On the dunes or in the salt marsh were some other good species; *Juniperus communis* (Juniper), *Euphorbia portandica* (Portland Spurge) & some Oraches and Glassworts. Significantly we saw some *Atriplex praecox* (Early Orache) which was only recently recorded for Sligo on the other side of Sligo Bay. Detailed pictures

sent to Paul Green confirmed the day's sighting, which is only the second in Sligo. Nearby was some of the uncommon *Salicornia fragilis* (Yellow Glasswort) in a new hectad. As Sligo has several estuaries with salt marsh, more work needs to be done in those habitats.

On Sunday October 8th, Bridget Keehan, Robert Northridge, Mairead Kavanagh and I explored the north shore of Lough Easkey. Several uncommon aquatic species were found mainly thanks to Robert whose finding and identification skills were put to good use. The most significant find was *Elatine hexandra* (Six stamened Waterwort). To date, Lough Easkey holds the only Sligo records for the *Elatine*. The first and only other Sligo record for this elusive aquatic species was by the EPA at the southern end of the lake in 2002. Other good species on the day were *Isoetes lacustris* (Quillwort), *Eleocharis acicularis* (Needle Spike-rush), *Lobelia dortmanna* (Water Lobelia), *Myriophyllum alterniflorum* (Alternate Water-milfoil), *Utricularia minor* (Lesser Bladderwort) and *Callitriche brutia* (Pedunculate Water-starwort).

I will round off this article by mentioning a few other interesting Sligo finds in 2023. On May 27th I found a good colony of *Drabella muralis* (Wall Whitlowgrass) above Castlebaldwin. It was the first record for south Co. Sligo. This taxon was first recorded in Sligo in 2013 (in the town). Since then, it has been found at several sites scattered about the county. On October 9th by the coast road near Strandhill, I found two alien species which were at least semi-naturalised. *Iris foetidissima* (Stinking Iris) grew by a roadside hedgerow and *Pyracantha coccinea* (Scarlet Firethorn) on rough ground on the coastal side of the road. Both are new county records for Sligo. Finally, Patricia McHugh found *Mycelis muralis* (Wall Lettuce) on a track near Coolaney and later I saw it at another site in Sligo and also at one place in Leitrim. Although locally common in some parts of Ireland, it is very rare in Sligo and Leitrim.

Field meeting reports – 2023

Newry (West), Co. Armagh (H37), 16th September 2023

Newry was chosen as a venue for an Irish urban botany meeting on account of several interesting finds there in recent years. Recording in urban areas has not been high on the agenda of Irish botanists, save perhaps for those in Dublin and Belfast or those taking part in a New Year Plant Hunt, so it was an opportunity to sample the delights of one of the other larger towns at a more promising time of year than early January.

The most significant of the finds in Newry had been *Potamogeton trichoides* (Hair-like Pondweed), first discovered in the canal in 2020 and at that time believed to be the first confirmed Irish record. Other recent finds included two species of *Erigeron* (Fleabane), *Lactuca serriola* (Prickly Lettuce) and *Galinsoga quadriradiata* (Shaggy Soldier), all very scarce or unrecorded in the vice-county previously. In the course of a rapid reconnaissance visit a week before the meeting I had also found *Jacobaea erucifolia* (Hoary Ragwort) at what is probably its most northerly valid site in Ireland, and certainly a new vice-county record.

Our meeting place was Newry Railway Station, to facilitate any participants who wanted to avail of the opportunity to travel "green", an option that is not feasible for most BSBI field meetings. It also happens to be close to a recent rock cutting through which the new approach road to the Station passes, and where some interesting species had taken root. What was expected to be a brief dander along to the cutting in practice detained us almost until lunch time. Plants seen included *Oenothera glazioviana* (Large-flowered Evening Primrose), *Verbascum Thapsus* (Great Mullein), *Cochlearia danica* (Danish Scurvy-grass) (moribund on the verge of the A1) and *Erigeron floribundus* (Bilbao's Fleabane). Despite the cutting having been recorded twice in recent years, we also found seven new species for the tetrad in or close to it, including two species of *Galeopsis* (Henbit), *Hypericum humifusum* (Trailing St John's Wort), and an (as yet) unidentified *Hieracium* sp. (Hawkweed).

Our second stop was in the city centre where we looked at the aquatic plants in the canal, successfully fishing in the water for the *Potamogeton trichoides* and extracting a small sample for closer examination of the fine acute-tipped linear leaves with their midribs prominent on the underside. We had hoped it might have fruits, which have not yet been recorded at the site, but none were evident.

From there, we walked downstream along the east side of the Albert Basin, an area with very sparse vegetation. Aquatics were few and far between, with nothing of particular note, but the terrestrial flora proved more interesting. One plant of *Polypogon viridis* (Water Bent) – a terrestrial plant despite its English name – was noted as just the second record in the vice-county. *Erigeron canadensis* (Canadian Fleabane) was present in numbers at the seaward end of the basin, with a substantial population of *Lactuca serriola* (Prickly Lettuce) nearby, and also some *Fumaria officinalis* (Common Fumitory), which is actually one of the scarcer members of the genus in Armagh. The *pièce de résistance*, however, was a small colony of an *Orobanche* sp. (Broomrape) (see page 88). The overall form of the plant was suggestive of *O. hederae* (Ivy Broomrape), but confirmation requires examination of features of the flowers, and these were thoroughly withered. If it is indeed that species it will be a new vice-county record, so a repeat visit will be needed in 2024.

On return to the car park, a cold wind had developed and we decided to conclude the proceedings with a little refreshment. We had seen a good selection of urban "weeds", including many species which present identification difficulties of one kind or another, most but not all of which we had overcome with the help of the varied experience of our doughty participants. Newry had lived up to its growing reputation!

Some readers may question why I am claiming Newry for the vice-county of Armagh, when it is commonly referred to as "Newry, Co. Down". The reason is that both are correct. Although the vice-county boundaries in Ulster follow the county boundaries closely, there are a few exceptions. One of these is the boundary in Newry. Under Praeger's 1901 definition of the vice-counties, Newry to the west of the Newry River, which includes more than half of the central area, was regarded as in the historic county of Armagh. The centre of Newry, however, had been transferred (I think in 1898) from the administrative county of Armagh to join that of Down. In any case, counties in Northern Ireland have not been units of government administration since 1973, but they live on in popular culture.

John Faulkner

Captions for pages 39-41 (see page 7 for article relating to Plates 1-6)

Plate 1. 7th June 2022. ***Equisetum hyemale* & *E.* x *trachyodon***

Young stems of Co. Cork (cultivated) ***Equisetum hyemale*** (left) and ***E.* x *trachyodon*** (right). ***E. hyemale***: (**a**) *Disarticulated* sheath teeth-whorls stacked one on another, at the apex of the sterile stems, forming a pagoda-like structure; (**b**) sheath teeth remnants green and ± crenate. ***E.* x *trachyodon***: (**a**) Stem sheath teeth subulate, their attenuate apices *undulate* and *tardily* deciduous; (**b**) sheath teeth basal remnants black-coloured and *bluntly triangular in outline.

Plate 2. 4th June 2023. ***E. fluviatile* & *E.* x *litorale***

Fertile cone of ***E. fluviatile*** (left) and sterile cone of ***E.* x *litorale*** (right). **Location**: (**H4**: W612764). Cohabiting populations in a small, impounded mire, bordering the Blarney-Waterloo Pedestrian Walk, Mid Cork.

Plate 3. 11th July 2023. ***Equisetum* x *litorale***.

Three coning stems of ***E.* x *litorale***, their cones sterile and tightly closed; their spores aborted. **Cones** yellowish-green, *c*. 6-17 x 3-7 mm. **Location**: (**H4**: W579898). Common in a roadside mire, situated between Ballyknockane road junction and the bridge over the nearby Peastinagh Stream, west of the N20 (Cork-Mallow Road).

Plate 4. 4th June 2021. ***Equisetum* x *dycei***.

Location: North Kerry. (**H2**: V9.8.) Cultivated material of ***E.* x *dycei***, originally found and collected in July 1998, along the scoured, wave-washed, eastern shore of **Castlelough Bay, Lough Leane, Killarney**. (**Note**: Nodal branches *never* produced in this cultivated material!). **Cones** *c*.*5-8 x 3-4 mm, remaining tightly closed, their spores malformed and sterile.

Plate 5. 8th November 2023. ***E. arvense* & *E. palustre***

Location: (**H5**: W654895). Roadside mire and embankment, close to the bridge over the Toor River, on the western arm of Roche's Crossroads, East Cork. Vegetative stems of (left) ***E. palustre*** and (right) ***E. arvense***, the torn stems of both species, displaying a protruding, pipe-like, inner cortical cylinder. (**Note**: The diagnostic differences in both species in comparative stem sheath length/width ratio, and the ratio of the first branch internode length, to the adjacent stem sheath length, are also obvious.)

Plate 6. 30th November 2023. ***E. arvense* & *E.* x *litorale***

The *proximal* stem nodes of ***E. arvense*** and ***E.* x *litorale*** are frequently *grossly swollen and geniculate*, giving their stems a distinctive *zigzag* pattern.

Captions for page 88 & back cover:
Plate 1. Putative *Orobanche hederae* (Ivy Broomrape) at Albert Basin, Newry, Co. Armagh (**H37**). Photo J. Faulkner © 2023.
Plate 2. *Botrychium lunaria* (Moonwort) at Glencarbury on the Dartry Mountains, Co. Sligo (**H28**). Photo A. Delaney © 2023.
Plate 3. *Polycarpon tetraphyllum* (Four-leaved Allseed) at Strandhill, Co. Sligo (**H28**). Photo E. Gaughan © 2023.
Plate 4. *Asplenium viride* (Green Spleenwort) on Benbulben, Co. Sligo (**H28**). Photo E. Gaughan © 2023.
Plates 5. *Trichomanes speciosum* (Killarney Fern) gametophyte growing in patches on the wall of a shallow cave on Slieve Foy, Co. Louth (**H31**). Photo E. Flynn © 2023.
Plates 6. *Salix phylicifolia* (Tea-leaved Willow) on a cliff edge on Benbulben, Co. Sligo (**H28**). Photo E. Gaughan © 2023.
Plates 7. *Neotinea maculata* (Dense-flowered Orchid) from the southern slopes of Knocknarea, Co. Sligo (**H28**). Photo E. Gaughan © 2023.
Plates 8. *Elatine hexandra* (Six-stamened Waterwort) at Lough Easkey, Co. Sligo (**H28**). Photo E. Gaughan © 2023.

Plate 1 (p. 84)

Plate 2 (p. 81)

Plate 3 (p. 81)

Plate 4 (p. 81)

Plate 5 (p. 47)

Plate 6 (p. 81)

Plate 7 (p. 81)

Plate 8 (p. 81)