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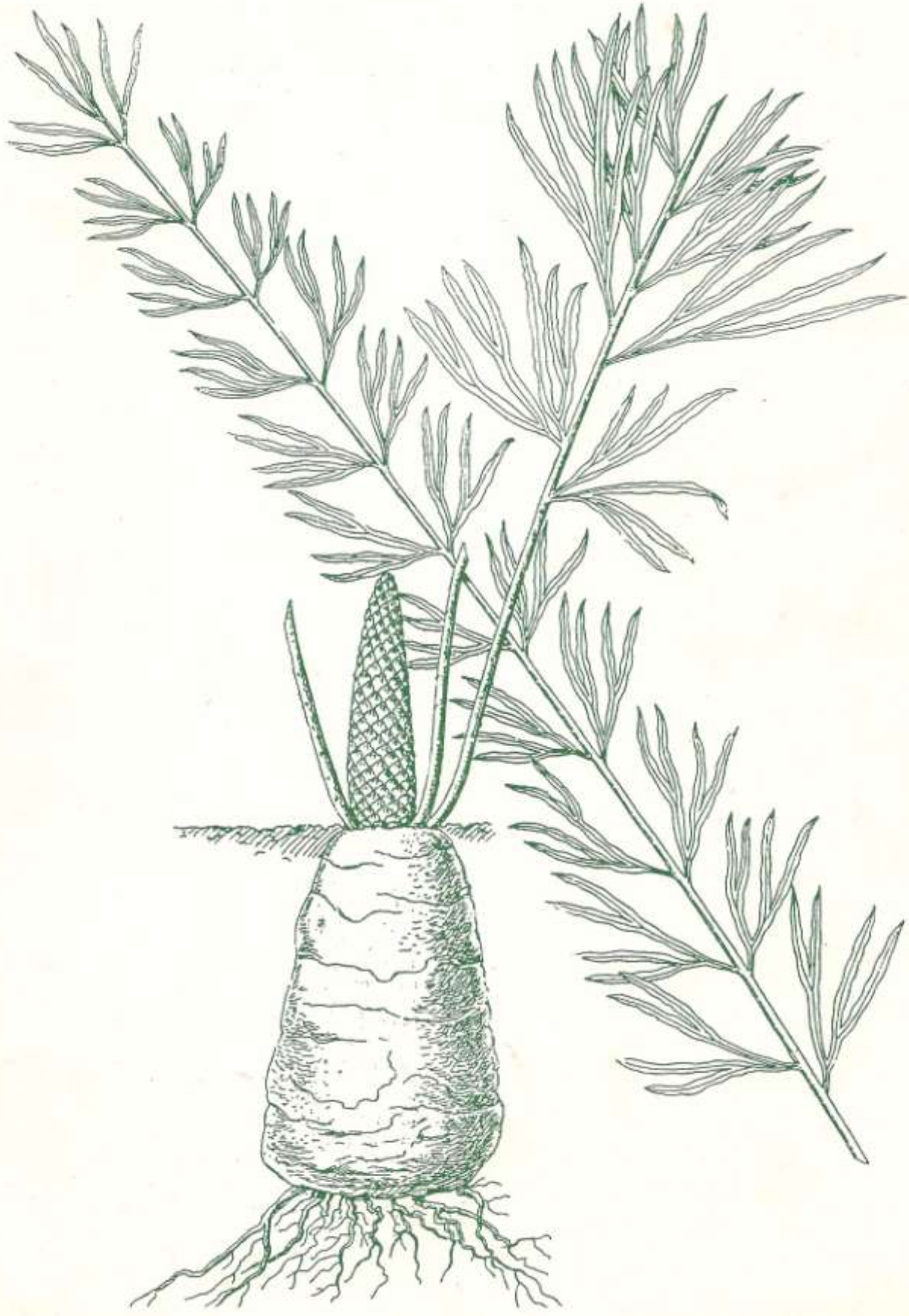

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Contents

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OPINION

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THE IDEA OF A BOTANIC GARDEN

Introduction

The most simple definition of the term 'botanic garden' is a purposeful collection of living plants. This implies that the collection is at least correctly named, labelled and managed on a continuing basis. It is necessary to use this kind of definition as the use of the formal title 'botanic garden' is not used with any consistency. From this starting point it is possible to explore the functions of botanic gardens, discuss the agencies responsible for them, and arrive at a robust form of optimisation. In the modern world, botanic gardens have adopted a range of functions. These functions justify, as they always have historically, continued funding or patronage. It is argued that the functions and capabilities of different gardens are so complimentary that a compelling case for voluntary networking is made. Networking is obviously practised and widely preached amongst international botanic gardens. However it seems to be confined to the exchange of plant material and ideas, rather than functional co-operation.

It is, however, possible to illustrate the scope for a functional networking framework within Ireland that may serve as a model for wider application. To regard the totality of botanic garden resources in Ireland as a 'hyper-garden' is an attractive idea.

Functions

Academic research

This is clearly a complex function, which implies the availability of people, facilities and financial resources for research and resultant publication. Also desirable is a tradition of scholarly activity and a research mission. Commonly, research is linked to an herbarium collection, and an active interest in taxonomy. But most areas of plant biology may be served by Botanic Garden facilities. These include physiology, ecology, plant structure and plant pathology.

Commercial research

There is not a hard line between academic and commercial or applied research. Economic botany has traditionally been pursued by state botanic gardens, utilising the capacity to maintain and propagate living plants from all parts of the world. The development of crops such as rubber, tea and cocoa had their historical origins in botanic gardens. Garden-worthy species, drug-bearing plants, and the pathology of commercial species are all research roles for gardens.

Conservation

In the last twenty years, ideas on the conservation of plants have expanded from the core concept of establishing field reserves of key natural vegetation types. The roles of Botanic Gardens in conservation include the following:

a) Propagation of vulnerable, rare and endangered species as a method of protecting biodiversity of wild plant populations. This can include the collection and distribution of seed from wild and cultivated sources, establishment of nurseries, and the clonal propagation of selected types, including micropropagation.

b) Applying similar measures to cultivated species of special value to horticulture or commerce. An example of this kind of activity is the development of "National Collections" by the National Council for the Conservation of Plants and Gardens (NCCPG) centred in Britain.

c) Maintenance of gene banks, usually of seeds stored at low moisture content and at low temperature. This function is one that needs substantial commitment, even when practised at a relatively small scale. Seed needs to be carefully collected from correct provenance and properly prepared for storage. Germination testing should be carried out soon after collection and periodically during storage. Record keeping must be meticulous, with the expectation of storage of material for at least some decades. Projections of the viability of small seeds stored in this fashion extend for some hundreds of years.

d) Cultivation of species to facilitate critical research. This role is especially important in a conservation context, for example in determining the details of reproductive biology of a species, or comparing ecotypes or races.

e) Development of exhibits to promote conservation consciousness. Education has always been important in the conservation movement as a method of achieving practical and political support.

f) Serving as an agency for documentation and collective action such as the organisation of conferences and expeditions. The Botanic Gardens Secretariat of the International Union for the Conservation of Nature, based adjacent to the Royal Botanic Gardens, Kew, serves this function for the larger gardens internationally.

It is not seriously contended that the mere holding of species of conservation interest in a living collection, makes a direct contribution to its survival. This has been clear since the complexities of gene pools have been revealed. The use of molecular genetics, DNA analysis, should be brought into play to establish the diversity of gene pools in conservation collections. This is difficult to determine where species are long-lived and slow to reproduce, for example cycads, palms and tropical trees.

The conservation of global biodiversity is a very large task, with plant species conservation at its core. This task alone justifies the sharing of problems between all agencies capable of sustaining a role.

Education

Formal education is that conducted within specific institutions, schools and colleges, with a formal structure of curricula, assessments and standard qualifications. In Ireland this comprises the full range from primary to tertiary education. If a garden assumes a specific role in any part of the formal system, it must be conducted on a long term basis with appropriate levels of liaison with the authorities concerned. There is unrealised potential in Ireland for the use of groups of gardens to support aspects of primary and secondary curricula. However for this potential to be realised, education staff need to be provided for the network.

Informal education is a no less important, but more loosely organised system. It has a wide scope, ranging from facilitating the understanding of casual visitors to the organisation of particular courses. Most gardens open to the public have a great unfulfilled potential, which needs both guidance and funding to unlock. A powerful approach is that of "Interlink", which develops educational linkage between agencies with similar objectives. Typically these may be gardens, zoos, galleries and museums.

Training

Training is defined as education heavily weighted towards the development of practical skills. Botanic Gardens have always assumed this role, either informally, giving experience, or formally through courses. Horticulture in general, and Botanic Gardening in particular, is totally dependent on a work force with a good practical training. However the manner of this training should be a matter of continuing debate. There is a strong case for courses ranging from the most elementary to powerful and specialised in-service courses for experienced gardeners. This is clearly an area for liaison and cooperation between gardens. Ireland could create an internationally recognised course for Botanic Gardeners, with the specific function of training staff for newly developed gardens.

Amenity

In the mind of the public, the prime function of all gardens is amenity. It certainly does not detract from amenity values to have plants labelled, or even displayed to illustrate taxonomic, ecological or biogeographic features. The capacity to display plants from tropical environments is well known as a positive amenity feature.

The problem with amenity is that high levels of staffing are required to provide both security and maintenance for the system. A benefit is that income may result directly from amenity uses, supporting these provisions. This is generally true in the case of tourism, with Irish gardens now being widely recognised as major

items in the inventory of resources for special interest tourism. A danger that must be recognised is the failure to support this resource, other than by the payment at the gate, or by tax relief. Income from tourism is widely distributed, especially to carriers, providers of accommodation and governments. A levy system which enables critical funding of tourism resources such as gardens seems to be essential for a sustainable future.

Agencies

A range of agencies is responsible for the management of botanic gardens on a world scale. An overview of this range will make it clear that these agencies tend to have very different agendas, emphasising different combinations of the functions listed above — see Figure 1. The role of different types of agency may be demonstrated using Irish examples.

National governments

On a world scale state-supported 'National Botanic Gardens' are a central and vital phenomenon. It is typical that a state recognises that it may project important signals regarding national self esteem and culture through this medium. The National Botanic Gardens, Glasnevin, is an important example of the type, which also embodies a National Herbarium. This could supply taxonomic support to other gardens.

The creation of a 'co-ordinated system of associated botanic gardens' with Glasnevin as a 'key garden in the complex' (Office of Public Works 1992), is an important and timely move. Another example is the cluster of gardens managed by the Royal Botanic Garden, Edinburgh. In both cases, advantage is taken of existing garden collections and a more favourable span of climatic conditions.

The garden network concept is clearly being applied in these systems, but in the case of Ireland, it is stated that this formal linkage does not preclude other informal networking.

Local government

In most cases of municipal gardens, the amenity function reigns supreme, with no mandate for other functions. However there are important exceptions. Examples are the Belfast Botanic Gardens (Belfast City Council), the Talbot Botanic Gardens (Fingal County Council) and St Anne's Rose Garden (Dublin City Council). In all these cases important plant collections are maintained and displayed, without compromising the gardens' prime amenity functions.

Universities

The Trinity College Botanic Garden is now typical of the modern academic garden, despite being founded in 1688 to support the study of 'physic'. Its functions have evolved continuously with the developing needs of botanical science teaching, research and plant conservation. Its principle strength is the linkage with the academic and technical tradition of the University. This represents a powerful potential resource in a networking system. In principle this centre should be able to offer taxonomic help, low temperature seed storage and a range of propagation facilities including micropropagation. Like the National Botanic Gardens, it is a member of the International Federation of Botanic Gardens, which provides access to plant material world-wide. It is significant that Dr Peter Wyse-Jackson, a former administrator of this garden, is now the Secretary General of the I.U.C.N. Botanic Gardens Conservation International. This organisation is the key facilitator of international co-operation between major botanic gardens of the world.

A university initiative of a different kind is the support of the Guy Wilson 'National Collection' of daffodils by the University of Ulster at Coleraine. This resembles the development and maintenance of botanical interest in the campus landscapes of University College Cork, University College Dublin and Trinity College.

Non-governmental organisations

The only large garden-owning NGO in Ireland is the National Trust in Northern Ireland. Its magnificent holdings are managed in a co-ordinated manner, with a central adviser. This model is approached by the OPW-managed chain mentioned above. This comparison suggests that a similar outcome may be achieved by different means. The long term future of, for example, the Fota Arboretum, now managed by an NGO, the Fota Foundation, may well be in the hands of the State.

Private individuals

There are perhaps fifty privately-owned gardens in Ireland in which the plant collections are of major importance.

They range from Birr Castle Demesne, Mount Usher, Mount Congreve and Annes Grove to more modest collections. Those open to the public are a crowning glory to amenity horticulture in Ireland. Their continued existence is clearly dependant on income from tourism, and networking in the form of concerted marketing is a useful form of cooperation.

They would clearly benefit from other aspects of networking. This may be illustrated by what amounted to a collective catalogue of the holdings of trees and shrubs in a limited range of gardens of all categories (Forrest & Nelson 1985). The important feature of this exercise was that it was suggested by Michael Rosse, and implemented by the Heritage Gardens Committee of An Taisce — an NGO. The committee, however, co-ordinated inputs and support from all the agencies listed above. The scale and scope of the operation was only limited by funds then available. Since then, improvements in information technology would make it possible for a collective catalogue to be more or less continuously updated and available on-line. The expensive part of an extended operation is still meticulous fieldwork and impeccable taxonomic backup. This is only achievable through the kind of network created at the time.

Table 1.
The relationship between the functions of botanic gardens and the agencies responsible for them.

	Government agencies				
	State	**Local**	**University**	**NGOs**	**Private**
Academic research	*	?	***	?	?
Commercial research	**	?	**	**	?
Conservation	**	**	**	**	*
Education					
Formal	*	*	***	*	?
Informal	***	**	*	**	*
Training	**	*	*	*	?
Amenity	***	***	*	***	***

***	Prime functions
**	Important but secondary
*	Usually in place but minor
?	Uncertain but possible

NCCPG National Collections Scheme

Some 500 plant collections are listed in the 1991 National Plant Collections Directory of the National Council for the Conservation of Plants (NCCPG 1992). The nature of this scheme transcends the classification of agencies above, and covers most of the functions described. It represents a successful example of networking, even though further evolution is required.

Functions

Resource conservation

The prime motive for setting up this particular network is to enable the continued availability of desirable garden plants. To be rational, the collection system should be made as international as good will permits.

It must be questioned if the holding of complex living plant collections is the optimum long-term method for the conserving of garden plants. Pending a viable method of gene banking tissue from cultivars, this is probably a viable short-term solution. Dangers lie not only in the inherent long-term instability of a system dependent on the good will, energy and financial input of individuals, but also in virus and other diseases and the genetic properties of the taxa concerned.

There is not a good match between the needs of plants and the climate associated with some collections.

Research
The collections represent a substantial research resource, enabling comparative research in taxonomy, phytochemistry, physiology, ecology and horticultural science. Unless this is harnessed, the energy invested in the collections will not be fully rewarded.

Commercial use
Collections are exploited both as source material and for the checking of identity. A relationship should be built up in which the European industry acknowledges and financially supports the network.

Education and training
Great educational value already attends well displayed and labelled collections. Preparation of keys to flowering and non-flowering material, propagation workshops and the employment of students in curating collections, are examples of activities that should be encouraged

Amenity
Many collections already constitute an important element in amenity gardens. Even if better ways of conserving material are developed, this may well provide sufficient motivation to sustain many collections.

To make best use of the total resource, each collection should be given appropriate assistance to achieve these functions. This might take the form of a linkage between collections and agencies such as universities, research institutions or education authorities. Funding through research awards or sponsorship must be obtained.

To achieve this ambitious objective, co-ordinators are obviously required. They need local knowledge, and a regional structure within Europe might be considered desirable in the long term, i.e. regional co-ordinators working to a central secretariat. This means creating a network for this particular purpose.

Conclusion

There are presently a series of factors which could encourage the networking of gardens in Ireland. These include:-

IGPS-NCCPG linkage and the presence of a limited number of 'National Collections' in Ireland;
The activities of An Taisce Heritage Gardens Committee;
The proposed integration of the OPW gardens;
The existing linkage between National Trust (Northern Ireland) gardens;
The recent (March 1994) launch of Irish Genetic Resources Conservation Trust;
The concerted marketing of 'Gardens of Ireland' by Bord Fáilte.

All these factors indicate that gardens are co-operating at one level or another, for a variety of motives. A simple next step might be for the directors and curators of Irish gardens to meet to determine if a common agenda for the future can be established. I am willing to facilitate this step, and would be pleased to hear from like-minded individuals.

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MICHAEL CREGAN

THE GREENS OF DUBLIN

The greening of our cities is the fashionable encapsulation of our concern with their state. Fashion notwithstanding, the concern represents a belated and welcome response to the damage being inflicted on life-sustaining natural systems, and relates to our loss of contact with the natural world. The values of open space have been invoked as part of the greening endeavour. They afford a source of psychic relief from the stresses of urban life, and contribute to the healthy sustenation of natural systems. In the context of this movement, it is interesting to note that an awareness of the values of open space to the well-being of cities is documented as early as the Hellenistic Period. (Glacken 1967)

The medieval green or common was an important contributor to urban life from the middle ages until well into the nineteenth century. It served a wide variety of functions despite its unstructured form. As a model it has been largely by-passed, particularly by the social reform values which initiated the Victorian public parks' movement. It arguably is a model which could have a relevance to our contemporary urban concerns.

Most medieval cities had at least one common ground which was used for recreation, play, communal activities, military training and as pasture. The medieval town was nearer to a village than to a crowded trading centre, and in it people maintained a close association with the neighbouring countryside. The towns were surrounded by fields, some of which were reserved as greens as the towns expanded. Francis the first of France set aside *terrains vaques* by a river bank in Paris for the recreation of university students. In 1222 the young citizens of London 'kept games of defence and wrestling near the hospital of St Giles where they challenge and had the mastery of men in the suburbs'. (Jackson 1979) Nuremberg had a common on the river island called the Schutt just inside the city walls. Florence had a *pratum commune* established by statute in 1290. Sienna had a similar meadow, Piazzale del Prato, established in 1309 'to increase the beauty of this town as a pleasure resort for inhabitants and foreigners'. (Gotheim 1979) Gotheim records some other famous names — Prado in Madrid, Prater in Vienna, and Le Pre aux Clercs in Paris. The root word 'pratum' refers to a wide meadow. It originated from the common ground of pre-medieval villages, on which villagers discussed communal affairs, conducted celebrations, and protected their livestock at night. (Bailey 1985) Mumford (1961) notes the persistently rural character of medieval towns. Rural based pursuits such as fishing and fowling formed part of daily urban life. Vegetables were brought into the city, and refuse and dung were used to fertilize gardens in the towns, and fields in the surrounding countryside. The profusion of open space, the careful disposal of waste matter, the abundance of scavenging animals, and the nearness of the countryside combined to sustain a high level of hygiene in medieval towns.

From the late middle ages in various European towns a growing population, unable to expand beyond the city walls, consumed open spaces by building. Thomas (1983) attributes a yearning for countryside and its associated pleasures from the early modern period to this process of deruralization. On the other hand Mumford notes that the disorder and clutter of the late medieval city had become intolerable and fostered the need to pierce through the crooked alleys, to build straight streets and open rectangular squares. The greens were much valued and attempts to intrude on them were stoutly resisted, though not always successfully.

Dublin, in the words of a twelfth-century scribe was built 'among oaken groves and surrounded by the haunts of wild beasts'. (Hemp 1978) Extensive lands in the ownership of religious houses encircled the city including the lands of Kilmainham, a portion of which later became the Phoenix Park. The burghers of the city had access to greens for grazing and for public activities. Simms (1978) cites an entry in Alen's register of *c.* 1192 which states that the Archbishop's 'men of city and suburb shall have the freedom of the city in common pastures and all else'. The well-known medieval greens of Dublin were St Stephen's Green, Oxmanstown Green, Hoggen Green, the Staine, Little Green and Kilmainham. Beyond the city walls and probably of a considerably later period than the city commons were the commons of Dalkey, Harold's Cross, Crumlin, Irishtown, Donnybrook and Finglas. It is probable that these latter lands were unassigned meadows, not designated as commons by statute, but popularly used for sport and other activities by local communities.

Dalkey commons was located between the village and Sorrento, and up to the middle of the nineteenth century was 'a place of singular beauty much in vogue as a holiday and Sunday resort for Dublin folk'. (Joyce

1976) Harold's Cross Park was developed in 1894 by the Rathmines Commissioners on what had previously been a common. It had in the words of a contemporary been 'in a wild state of nature in which it had existed for hundreds of years ... affording precious living to horses, donkeys, goats ... which were rudely dispossessed of their ancient patrimony when the Green was taken over'. (Joyce 1976) The Green had for centuries been outside the city walls and its neighbourhood was settled by 'poorer' people who reared animals on it. From the middle of the eighteenth-century it developed a reputation as a healthy place where fresh renewing breezes from Kilmashogue could be enjoyed. It was a popular venue for may sports played around a may pole, and curiously the Archbishop of Dublin maintained a gallows on the Green. (Anon 1894) Palmerston Park, also developed by Rathmines Commissioners in the 1890s, was on common lands called 'Bloody Fields' dating back to the twelfth century. On so-called Black Sunday the guilds of Dublin marched there to commemorate a notorious battle fought between 'citizens and certain Wicklow clans'. (Webb 1929) Sandymount village came into favour as a watering resort in the early part of the nineteenth century, and the Central Green was conserved as a common until the nineteenth century when it was taken over by Dublin Corporation. (Hussey 1971)

From *c.* 1204 every year in August, Donnybrook fair provided excitement to the populace. In the words of a contemporary: 'it far surpassed all other fairs in the multitude and grossness of its disgusting incidents of vice'. (Kingston 1966) The fair grounds were located on what are now Bective rugby club grounds and extended to the convent grounds and the C.I.E. depot across the Stillorgan Road. The fair was abolished in 1855 by Dublin Corporation at a time when the city was expanding radially along roads to the south of the city. The Corporation acted on behalf of self-righteous residents who found the style of the fair abhorrent. Evans comments that the absence of moral restraint which led to extremes of lawlessness at such fairs was a normal and characteristic accompaniment to these folk gatherings. (Evans 1907) The dispute that led to the closure of the fair is thus an early example of the conflict between urban and rural values.

Early records describe St Stephen's Green as marshy ground favoured by wildlife. In the twelfth century it was the setting for a leper hospital. Sometime later it became the city's common pasture. It was ordained by the city fathers that the green was to be kept open for the grazing of cattle, and for the citizens 'whereon they might take air and exercises'. Access was secured to it by means of a narrow lane, now Grafton Street. (Chart 1907) Economic necessity caused the Dublin City Assembly to set out the periphery of the Green in building plots. Twenty-seven acres were retained as open space. These were levelled, enclosed by a stout hedge outside of which ran a deep ditch. Inside was a wide walk set between two rows of lime trees. An English visitor at the end of the eighteenth century admired 'the fine meadow' but felt that it was disfigured by 'the dirty ditch formed on every side, the receptacle of dead cats and dogs'. (Maxwell 1956) The Green remained as a meadow used for grazing, recreation and military assembly. In the eighteenth century the Green was known as a resort of youths and Liberty Boys. Their games frequently attracted large and unruly mobs whose behaviour led to their being dispersed by the police. (Peter 1975) These sports, deriving as they did from armed conflict with outsiders, retained a violent competitive nature, and were based on notions of territoriality and community status. The games were rough and undisciplined, but very popular among adolescents as a way of letting off steam and achieving personal renown. (Jackson 1979) The Green gradually lost its 'commonage' status, and became the preserve of the gentry occupying the dwellings on its periphery. The Green became a public park in 1880, laid out to a design by William Sheppard, and aided by a grant of £20,000 from Lord Ardilaun. (O'Brien 1982)

The historian Falkiner (1906) refers to attempts made in the early seventeenth century to preserve the city's greens 'whole for the use of the citizens and other, to walk and take the open aire, by reason this cittie is at present groweing very populous'. Of the six city greens previously mentioned, St Stephen's Green is the only one to survive, somewhat attenuated, into the eighteenth century. Oxmanstown Green occupied much of the land on the north side of the Liffey between the present-day quays and the North Circular Road. In 1665 it was let by the Corporation but, in contrast with the planning of St Stephen's Green, the plots covered all the ground except 'a convenient highway and a large market place' and a large open space to the west. The market place is the present-day Smithfield. In 1669 a further portion of the green was taken for the King's Hospital 'for the sustenation and relief of poor children, aged, maimed and impotent people ... inhabiting Dublin'. (D'Alton 1976) The remaining open space retained its value as a recreation area throughout the seventeenth century. It had a popular bowling alley 'a most noble place and every evening my Lord Deputy bowls here and the ladies at kettlepins, which spoils the playhouse'. The remaining open space was gradually consumed by buildings in the intervening years, and what is left of it now is the open space adjoining King's Inns.

Hoggen Green was on the site of present day College Green. As well as providing grazing, it was used for pageants, bowling, al fresco plays and for archery practice. Dixon (1902) refers disparagingly to the Green in connection with the establishment of Trinity College in 1593: 'between the gates of the sixteenth-century college

Oxmantown Green, 1757 (John Rocque)

and the castellated walls of Dublin lay the Green, upon which swine and cattle grazed, interfering with the security and comfort of pedestrians'. Adjoining Hoggen Green was the conical hill called the Thingmote, used by horsemen as a place of assembly, and subsequently preserved by municipal edict as a place for recreation. (Little 1952) Nearby was land called the bowling alley where reals or ninepins were played, and behind it was another place of sport called Tib and Tom (William St) 'where merrymakings of the city youth were held before the restoration and after'. (Falkiner 1906) Hoggen Green ceased to function as a common with the building of the 'hospital', which subsequently became the Parliament House and of Dame St. An ordinance was passed in the early seventeenth century to preserve the Thingmote but 'necessities of Reformation compelled the sale of the lands'. In the sale, it was stipulated that a passage-way be retained to the top of hill to allow people to enjoy the splendid prospect over land and sea. In 'a flagrant act of vandalism of that improving age', the Thingmote was levelled in *c.* 1683 and the spoil used to raise the level of Nassau St above College Park. As regards the other commons, the Staine is now the small segment of ornamented space between Pearse St and D'Olier St. A portion of Abbey Green became the site for Newgate Prison and subsequently became a small park at Halston St.

It is interesting to realize that some of Dublin's best-known open spaces have been in existence since the middle ages, and have been witness to the city's evolution and changing fortunes for almost 800 years. They represent perhaps the most significant extant fragments of the ancient city and they differ importantly from archaeological remains in that they are still functioning as vital elements in the life of the city. As such they merit particular care and attention.

Principles of building conservation are by now well-established, and much of the focus of planning in respect of historic conservation has focused on the built environment. For some reason, the space between buildings, including parks and other urban spaces, has received relatively little conservation attention. There is arguably a need for a coherent set of conservation policies and principles to ensure the continuance of these historic open spaces, and in a form both consonant with their present role in the city's life and at the same time respecting their historic patrimony.

Their present garb derives from nineteenth-century thinking about parks. The parks are enclosed in the belief that they are retreats from the evil city. The activities expected of the users are quiet and genteel while the setting is informed by an ironically anti-nature bourgeois aestheticism. There is nothing inevitable about this treatment, nor is it necessarily the form in which they will continue in the future. Parks have, as discussed, responded through the years to the needs and values of the citizens. The continued relevance of Victorian values may come to be questioned, as they have been in countries such as Holland, Germany and Britain. Formally the demand is for more naturalistic landscapes consistent with an 'ecological' consciousness. At the same time there is an acknowledged need to cater for the wide variety of needs and tastes to be found in the contemporary city, including contact with nature, and boisterous sports. The commons represent one useful model offering design guidance on the future forms for our urban parks.

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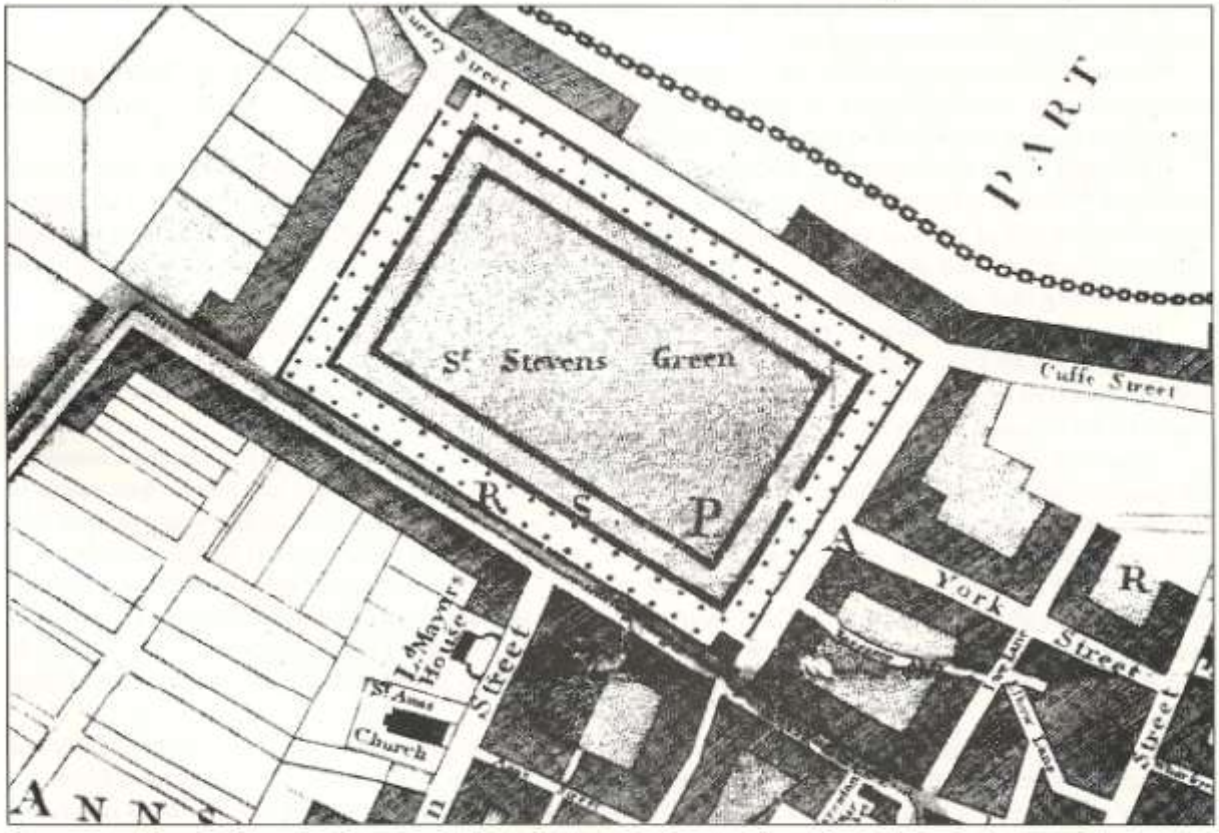
CIARAN PARKER

IMPROVEMENTS TO ST STEPHEN'S GREEN, 1709–13

The unpublished minutes of the St Stephen's Green Committee for the years 1709-1713, now preserved in the Dublin City Archives, provide an insight into the development of this public place. St Stephen's Green was first laid out as a park in the 1660s and by the early years of the following century improvements were required. The Green had been granted for life to Thomas Brabazon, earl of Meath, a substantial landholder on the south side of Dublin, and after his death in February 1708, the city assembly decided not to lease it again, as 'there is not on all the south side of the city any place for citizens and children to walk in nor a proper place for the militia to ... exercise in'.

The improvements recommended by the Committee in May 1709 included repairs to the walls and the provision of new piers for the Green's main gate opposite York Street. The waterway or 'canaille' around the green was to be dug deeper and better drains were to be provided. However, the most significant embellishment suggested was the removal of the existing grass banks and gravel walks and their replacement by new gravel and grass terrace walks.

Progress proceeded at a leisurely pace, and it was not until the following year that estimates were submitted. One was from Michael Rorke, a gardener of Ballybough lane who claimed he was 'an artist in the making of gravel walks' and had been responsible for the bowling-green 'over the water' at Oxmanstown. Despite having the backing of prominent Dublin citizens such as Sir John Eccles, he was not appointed, partially because he



St Stephen's Green, 1728 (Charles Brooking's map of Dublin)

inferred in his tender that the construction of the gravel walks, which required two different types of gravel, was very difficult. Instead the Committee chose another Dublin gardener, Robert Belford, and in May 1710 he entered into articles of agreement with the Dublin City Treasurer, Sir William Fownes.

The existing gravel walks were to be taken up and the gravel they contained topped by coarse gravel excavated within the Green and covered in turn by a topping of finer gravel brought from outside. These raised walks were to be bound on either side by a verge of grass sods four feet wide. In addition, four new grass terrace walks of twenty feet in width were to be constructed. They too were to be made from two different types of gravel and the crown of the walks sown with hay seed.

St Stephen's Green suffered from drainage problems, and in addition to new drains forty-seven wells were built alongside the gravel walks and some of the excess water was used for decorative purposes in small fountains or showers. While Belford promised to provide his own tools, the city provided him with two large wooden rollers which were used to level the various walks.

Gravel walks were problematic as there was a danger of hollows developing, especially along the verges. Belford's articles included a provision that he would make good any settling provided it was not caused by horses treading on the walks, people walking on them with pattens (elevated wooden overshoes worn in wet weather), or the playing of bullets along their length, a pastime which was particularly popular in Ireland in the time of King William III. He was also given permission to prevent walkers from using the gravel walks after the fine top gravel had been laid down for the first time, and to bar them at any time during wet weather

By October 1710, the walks were nearly finished, and the Committee sought to improve other aspects of the Green. For example, eight new seats were erected alongside the gravel walks. Furthermore Belford was given leave to cut down the existing hedges, and to plant thirty new lime trees. He was also ordered to cut the trees so that they were 'even to a standing gauge'. A proposal was received from one Jonah Gunson to plant scots pines and spruces on a four-year trial, after which time he would take them away 'if they did not answer their expectation and prove to be a sufficient ornament to the said walks'.

However, the lawns within the Green had suffered as a result of the building of the walks. In June 1710 the Committee ordered Belford not to bring gravel through the Green for use on the western and northern walks, but to transport it round the Green to the York Street entrance. Once the walks were finished, he was required to fill in the gravel pits and to 'sow the Green with clover and any other grain which he shall think proper' so that it would be as smooth as a bowling-green.

Although Belford complied with this, he never stopped reminding the Committee that it had not been part of his original agreement. Even when the work of levelling and sowing was completed, he warned, a considerable time would have to be allowed so that defects could appear.

In order to help him defray the additional costs involved in sowing and levelling, Belford was granted custody of the Green for a year on 11th November, 1710. The means by which he attempted to recoup his outlays was to convert part of it into a market garden growing a variety of vegetables such as carrots, turnips, parsnips, radishes, lettuce, spinach and cardoons. Of these the most profitable were carrots, fetching £11 when sold, no doubt reflecting their novelty value. Another crop grown was barley.

However, the venture did not provide the expected returns. For one thing, his kidney beans were almost totally destroyed by frost, while the initial sowing of peas had been a complete failure because the ground had not been prepared for the seed. He was also faced by literal 'overhead' costs such as employing boys to scare off birds and the expenses of buying shot to kill the latter.

After only a year Belford was losing money at an alarming rate. In April 1711 he petitioned the Committee for financial relief, explaining that his crops had not brought in the expected amount and that he was unable to complete the levelling of the Green. They granted him the custody of the Green for a further year, together with £40, on condition that the job was completed by the first of December. Yet in January 1712 Belford again asked the Committee for money, stating that he needed a further £25 in order to bring the green to 'an equal rising in the centre from all its several sides'. The Committee's response has not survived. Nevertheless the work was eventually brought to a satisfactory, if belated, conclusion, for in April 1713 Belford was granted £100 in consideration of his labours in levelling the Green, which, it was finally admitted, had not been part of his original indenture.

Throughout his employment Belford was faced with an uncooperative work-force. He complained that one of the greenkeepers, a certain Mr White, was a 'very rude idle drunken man who often absents himself from his business'. When Belford chastised him, he replied with 'scorulous language and said that he had a friend that would stand by him and ... would not obey your petitioner'. Belford sought clarification of his powers to dismiss the green-keepers, and when these were given, White was sacked. The latter then retaliated by entering the Green

by night and cutting down three of Belford's newly-planted trees.

Some of the keepers also complained that Belford did not give them time off to go to church, probably because they failed to return, and the Committee directed him to allow half of them to attend services on alternate Sundays. An anonymous letter insinuated that money granted to Belford for paying the green-keepers would go into his own pocket, and that the workmen would be afraid to complain, lest they lose their jobs.

Belford's attempts to preserve both the walks and the Green itself also faced opposition from a hostile public. After he expelled a dog, its owner threatened that he and his friends would do more damage to the Green than the dog ever could.

By the spring of 1713, then, it would appear that the improvements to St Stephen's Green had been brought to a satisfactory conclusion. Belford considered. that it 'may compare with any in this and the neighbouring kingdom for ornament and pleasure'. Amongst its admirers was Dean Swift, who was not given to idle praise. This was in no small way a reflection of the efforts of the Committee for the Green and the labours of Robert Belford.

E. CHARLES NELSON

THE CYCAD COLLECTIONS IN THE NATIONAL BOTANIC GARDENS, GLASNEVIN, DUBLIN

Cycads are 'primitive' seed-bearing, vascular plants which had their hey-day during the so-called age of dinosaurs and have since dwindled to a small number of genera representing three families, Cycadaceae, Zamiaceae and Stangeriaceae. All the extant cycads are native in tropical and sub-tropical regions; there are concentrations of species in South Africa, eastern Australia, south-eastern Asia and central America. None is native in Europe, but many species are cultivated in European botanic gardens. In gardens such as the National Botanic Gardens, Glasnevin, Dublin, where the climate is relatively severe, the cycads are confined indoors throughout the year, and therefore the size of the collections is usually limited. The present collections in Glasnevin contain about 60 specimens representing perhaps 30 taxa. Cycads can be cultivated out-of-doors in southern Europe where their 'architectural' qualities — they can be described as palm-like and resemble tree ferns — are much appreciated.

Superficially cycads resemble palms (Figure 1; but palms and cycads are not related plants); many cycad species have stout woody trunks, and large, leathery, compound leaves like those of *Phoenix canariensis* (Canary Island date-palm), and other species look like giant ferns, with short, sometimes subterranean trunks, and arching compound leaves. Cycads are not flowering plants — they are more closely allied to conifers. Mature plants produce cones (Figure 2) which contain either male or female generative cells — individual cycad plants are unisexual. Their reproductive cycles are prolonged, and their growth rates are often extremely slow, which characteristics may account for the rarity of many. Rarity, alas, means that cycads are now very collectable plants, and large mature individuals of the scarcer species can fetch thousands of dollars. Cycads are protected in many of their native countries, but some species known to have flourished last century are already extinct in the wild and others are close to extinction.

Glasnevin and cycads

The Botanic Gardens at Glasnevin was established in March 1795, funded by the Irish parliament, and nominally controlled by the Dublin Society; at the time it was the largest publicly-supported botanic garden in the world (for a comprehensive history see E. C. Nelson & E. M. McCracken (1987). *The Brightest Jewel: a history of the National Botanic Gardens, Glasnevin, Dublin*. Kilkenny). No expense was spared in the first few years to fill the new garden with the best and scarcest plants. The earliest published catalogues, dated between 1800 and 1804, indicate that several cycads were acquired, and that they were accommodated in the greenhouse. *Cycas revoluta, Zamia integrifolia* [*Z. florida*] and *Z. debilis* [*Z. media*] were listed in 1801 but the latter died before 1804 and was replaced by *Zamia cycadis* [*Encephalartos longifolius*].

Unfortunately no other catalogues were published, and the accessions records for the next century are sketchy, often noting little more than, for example, '30 July [1862] From C. Moore Esq. Director Botanic Gardens, Sydney. Wardian case of rare plants'. A manuscript catalogue, prepared in 1838 by David Moore when he took over from Ninian Niven as curator, lists *Cycas circinalis, C. revoluta, Zamia pumila, Z. horrida* and *Z. pungens*. Comprehensive accession records, listing plants by name commence about 1880, and often contain notices of cycads, but finding the names is a tedious and lengthy task as the manuscript record books have to be searched line by handwritten line.

David Moore is a most significant character in the history of Glasnevin — the native Natal lily, *Crinum moorei* commemorates him, as does *Agapanthus mooreana*. He became curator in 1838, and gradually assumed more and more control over the Gardens until he was given the title Director; he died in 1879 and was immediately succeeded by his son, Frederick Moore.

Significantly too, David's brother, Charles, was curator (later director) of Sydney Botanic Gardens in New South Wales, and the records indicate that Charles Moore sent cycads to Glasnevin in the latter half of the nineteenth century — the Wardian case received on 30 July 1862 evidently contained plants of *Macrozamia dennisonii* 'supposed to be the first, or at least among the first of [the] species which reached Europe' (Moore 1862). Charles Moore had a considerable interest in cycads, and was responsible for recognizing and naming several species, including *Macrozamia secunda, M. heteromera* and *M. fawcettii*, and in turn he was honoured by

Ferdinand von Mueller in *Macrozamia moorei*.

No complete record of the state of the cycad collection during David Moore's decades has survived, but we do know that there was at least one plant in Glasnevin which Moore believed might be a new species. On 18 March 1878 he read a paper to an evening meeting of the Royal Dublin Society 'On a supposed new species of *Ceratozamia*', and at the same event displayed female plants of *Encephalartos villosus* and *Stangeria eriopus*. The principal subject, the new *Ceratozamia*, had been 'brought direct to Ireland from Havanna, and ... said to be native in Cuba; but I cannot find that it has been noticed among the plants of that island.' Moore suggested it may have been imported from Mexico into Cuba, and added that it had been in Glasnevin 'about thirty years'. The particular cycad was a female. Moore sent material to Dr Eduard Regel in St Petersburg for identification, and Regel, writing on 26 February 1878, pronounced that it was *Ceratozamia longifolia*:

Figure 1. A mature, female cycad, photographed in the National Botanic Gardens, Glasnevin. *c.* 1910 (probably *Encephalartos* sp.)

> Your Cycadea is the Ceratozamia longifolia Miq. We have specimens with similar pinnulae and a petiolior basi tenore aculeatior [illegible] in the specimen of which you have send "pinnulae rhachis et petioli basior". in consequence I have no any doubt that it is the veritable C. longifolia. C. Masteriana is a very different species, of which you can receave in the summer a living plant. In the next time I will dispatch to your address the demanded seeds.

Moore disagreed, and provisionally named the Glasnevin cycad "*Ceratozamia fusca-viridis*". The fact that he explicitly stated in his published paper that 'I propose to name it, provisionally ...' means that his name is not valid, although indubitably the binomial has been validated elsewhere by another author.

Ceratozamia fuscoviridis is still cultivated in the National Botanic Gardens, Glasnevin, but I cannot be certain that the present plants are directly descended from the original — the chances are high that this is so, but when researching this paper I discovered an entry in the accession books (see Table 1) which indicates that a plant of *Ceratozamia fuscoviridis* was purchased in 1903 from William Bull & Sons for 2 guineas (perhaps Glasnevin was merely buying back stock?).

Table 1 — list of entries from accessions registers 1879-1920; indicating the growth of the Glasnevin collections

Date	Source	Cost	Name in register
1879.10.	Hart	donated	*Cycas circinalis* [seed]
1882	Kew	donated	*Macrozamia miqueliana; M. douglasii*
	Treub	donated	*Macrozamia tenuifolia; M. cylindrica; M. perowskiana; M. douglasii; M. miquelii; M. mackenzii; Cycas media*
1884.09.	Mueller	donated	*Macrozamia moorei* [seed]
1888.06.	Shuttleworth		*Zamia montana*
1888.10.	Kew	donated	*Zamia integrifolia; Z. wallisii*
	Shuttleworth		*Zamia montana*
1890.-.	Bull	£0. 7. 6.	*Bowenia spectabilis serrulata*
	Sander	£0. 15. 0.	*Zamia* sp.
1890.01.	Kew	donated	*Zamia lindenii*: 2 plants
1890.04.	Shuttleworth	donated	*Zamia montana*
1891.-.	Bull	£6. 6. 0.	*Zamia roezlii*
1891.10.	Sydney	donated	*Macrozamia fawcetti; M. secunda*
1893.-.	Bull	£0. 7. 6.	*Bowenia spectabilis serrulata*
1893.01.24	Protheroe & Morris	£0. 18. 0.	*Zamia integrifolia*
1893.05.	Shuttleworth	donated	*Zamia montana*
1893.09.	Kew	donated	*Cycas seemannii*: 3 plants
1893.10.24	Protheroe & Morris	£0. 5. 0.	*Zamia lindenii*
1894.-.	Bull	£2. 2. 0.	*Stangeria paradoxa*
1895.-.	Bull	£10. 10. 0.	*Encephalartos*
1896.-.	Sander	£5. 5. 0.	*Zamia ghellinckii*
1896.08.		donated	*Bowenia spectabilis*
1898.-.	Bull	£3. 3. 0.	*Cycas thouarsii*
		£5. 5. 0.	*Encephalartos regalis*
		£1. 10. 6.	*Zamia prasina*
	Sander	£0. 2. 0.	*Zamia mooreana*
1898.05.	Kew	donated	*Stangeria paradoxa*
1901.-.	de Smet-Duvirier	£0. 2. 0.	*Bowenia serrulata*
	Sander	£0. 10. 6.	*Encephalartos barteri*
1902.-.	Sander	£0. 5. 0.	*Cycad* sp.
1902.10.	Kew	donated	*Macrozamia preissii*
1903.-.	Bull	£2. 2. 0.	*Ceratozamia fusco-viridis*
		donated	*Encephalartos* sp.

Date	Source	Cost	Name in register
		£3. 3. 0.	*Encephalartos hildenbrandtii*
		£19. 19. 0.	*Encephalartos vroomii; E. vroomi* var.
		£1. 1. 0.	*Macrozamia corallipes*
	Sander	£5. 5. 0.	*Encephalartos lehmanni*
1904.-.	Bull	£2. 2. 0.	*Cycas revoluta*
		£1. 1. 0.	*Zamia integrifolia*
	Sander	£1. 1. 0.	*Dioon pectinata*
		£10. 10. 0.	*Katakidozamia macleayi*
		£2. 2. 0.	*Macrozamia corallipes*
		£2. 2. 0.	*Macrozamia heteromeria* var. *tenuifolia*
		£0. 10. 6.	*Macrozamia cylindrica*
1905.-.	Bull	£5. 5. 0.	*Catikidozamia* sp.
1905.04.	Sander	£3. 3. 0.	'1 new cycad from Micholitz' *friderici-guilielmi*
		£1. 1. 0.	*Macrozamia fawcettii*
		£1. 1. 0.	*Macrozamia flexuosa*
		£0. 10. 6.	*Macrozamia secunda*
		£1. 1. 0.	*Encephalartos* 'way of *E. Alten[steinii]*'
1905.06.		£1. 1. 0.	*Encephalartos ghellincki*
		donated	*Encephalartos* 2 plants
1905.08.		£1. 1. 0.	*Macrozamia pauli-guilielmi*
1906.-.	Pynaert, Ghent		*Encephalartos laurentianus; E. lemarinelliarum*
	Sander	£2. 2. 0.	*Cycas micholitzii*
1906.08.		donated	*Cycas micholitzii*
1907.-.	Blaydes	£9. 0. 0.	Cycad
	Sander	£7. 10. 0.	*Encephalartos friderici*
1908.-.	de Cock	60 francs	'*Cycas* var. *undulata*'
	Sander	£1. 10. 0.	*Bowenia spectabilis serrulata*
		£1. 1. 0.	'*Cycas* sp. Brisbane'
		£1. 1. 0.	*Encephalartos barteri*
1908/1909	Sander	£3. 3. 0.	*Macrozamia corallipes* var. *bifurcata*
		£2. 2. 0.	*Macrozamia fawcettii*
1909.05.	Sander	donated	*Macrozamia* sp.
1910.-.	Bull	£2. 2. 0.	*Encephalartos hildebrandtii*
1911.08.	Melbourne	donated	*Macrozamia spiralis* seed
1912.-.	New York BG	donated	*Zamia calcicola* 32882

Date	Source	Cost	Name in register
1912.01.	Schlecter, Berlin	donated	*Macrozamia*
1912.08.	New York BG	donated	*Zamia floridana; Z. kickxii*
1912.10.	Kew	donated	*Encephalartos barteri*
1913.-.	de Cock, Gand	25 francs	*Zamia kuesterianus*
1913.08.	Sander	£2. 2. 0.	*Zamia forgetiana*
1914.04.	Kew	donated	*Encephalartos brachyphyllus; Zamia integrifolia*
1914.04.	Sander	£3. 3. 0.	*Macrozamia miquelii*
1914.08.		£3. 3. 0.	*Cycas media*
1915.06.11	Sander	£2. 2. 0.	*Zamia ampliata*
		£2. 2. 0.	*Zamia* sp.
		£1. 1. 0.	*Zamia* sp.
1920.09.	Sander	£0. 7. 6.	*Bowenia spectabilis*
undated	de Cock, Gent	40 ps	*Macrozamia plumosa*

Frederick Moore came to Glasnevin in July 1879 direct from Trinity College Botanic Garden at Ballsbridge, Dublin. He had been at school in Hanover and trained in continental horticultural establishments. Frederick's passion was epiphytic orchids and within a few years of assuming his late father's position, he was actively buying orchids at auctions in London and from nurserymen in England (there were no suppliers of orchids based in Ireland). With the orchids, Moore often also purchased cycads. David Moore had 'bequeathed' a reasonable collection of cycads, and we know from the papers of Professor William R. McNab, Scientific Superintendent of the Royal Botanic Gardens, Glasnevin (1879–1890), that *Macrozamia denisonii* and *M. perowskiana* coned at Glasnevin in the 1880s — both these plants are *Lepidozamia peroffskyana*. The former came from Sydney in 1862 (as noted above); in 1882 a plant labelled *'Macrozamia perowskiana'* was received from Dr Melchior Treub, Director of the Buitenzorg Botanic Gardens in the Dutch East Indies (now Bogor in Indonesia). The cone of *Macrozamia denisonii* was photographed and copies of these photographs were rediscovered in 1994. J. Murray, assistant foreman in the National Botanic Gardens, Glasnevin, chanced to find one of the photographs in an old gardening book that he purchased; it is the most interesting of the photographs (see Figure 2) being signed H.B. White. From a letter sent by McNab to the Royal Botanic Gardens, Kew, this can be dated 188?.

Frederick Moore was prepared, within reason, to pay substantial sums for cycads. In 1894 for example, one plant of *Encephalartos friderici-guilielmi* cost ten guineas — all cycads were priced in guineas! — a hard-won 'bargain' price because the nursery had wanted more. Packed in a basket (costing 5 shillings and 6 pence), this cycad was transported to Dublin by railway and ship.

15th August 1894

Dear Sir:

My son is anxious that you should have the Encephalartos so have sent it at the price you offered, and trust it will reach safely. It is forwarded pr L & N W R[ailway] via Holyhead c/o Messrs Jno Wallis & Son, Dublin.

Yours faithfully

William Bull

A second plant, purchased under the name *Encephalartos friderici*, and costing £7. 10s. 0d. (one of the few not priced in guineas), came from Sander in 1907. Most of the purchased cycads were acquired between 1890 and 1915, and the standard price was one guinea, and two guineas for less common species. Most of Glasnevin's plants came from two suppliers, William Bull & Sons, 'Establishment for New & Rare Plants', King's Road, Chelsea, and from Sander & Sons of St Alban's, 'Growers, Importers and Exporters of Orchids' (which firm also had a base at Bruges, Belgium). But Moore's earliest acquisitions were not purchases. In 1882, Dr Melchior Treub sent a substantial consignment from Java to Dublin; most of the names applied are now regarded as synonyms of *Macrozamia miquelii*. Frederick's uncle, Charles Moore, still active in Sydney, also augmented the collections with gifts of plants.

By the mid-1910s Glasnevin had growing in its collections or, at least at some stage, had acquired 50 different cycads (Table 2); some of these were minor variants but given the complexity of cycad taxonomy they had received specific binomials. The current collection at Glasnevin contains 60 specimens, representing perhaps 30 species; some plants are original nineteenth-century acquisitions, some are offsets, and there are a few recently-acquired seedlings.

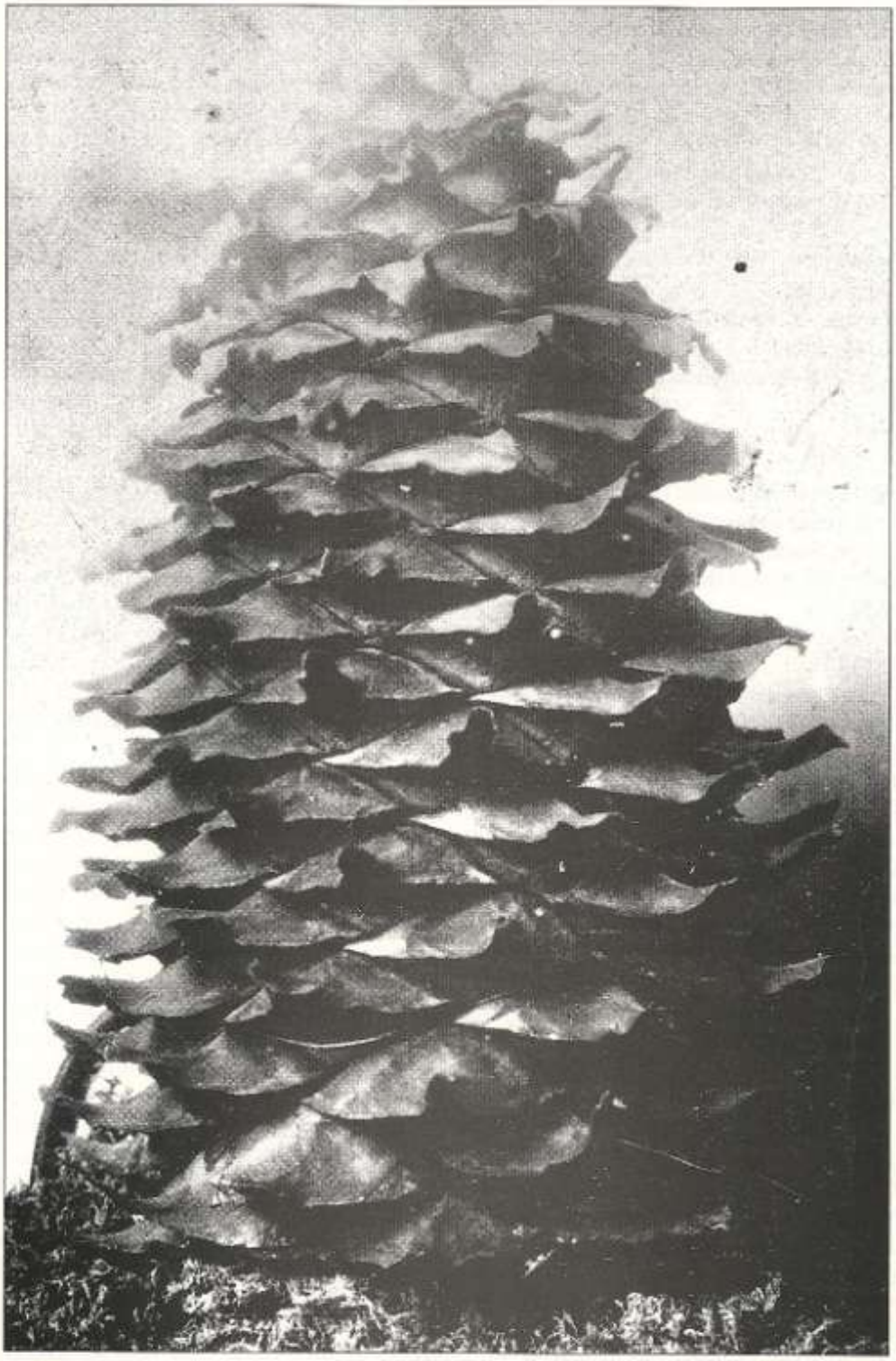


Figure 2. The cone of *Macrozamia denisonii* photographed by H. B. White in the 1880s for Professor W. R. McNab (by courtesy of J. Murray)

Table 2: Cycad species recorded in the National Botanic Gardens, Glasnevin.

BOWENIA

— *serrulata* (Bull) Chamberlain

Bull: 1890. [Bowenia spectabilis serrulata] @ 7s. 6d.
Bull: 1893. [Bowenia spectabilis serrulata] @ 7s 6d.
de Smet-Duvivier: 1901 [Bowenia serrulata] @ 2s. 0d.
Sander: 1908. [Bowenia spectabilis serrulata] @ £1. 10s. 0d.

— *spectabilis* Hook.f.

Sander: 1896.08. [Bowenia spectabilis]
Sander: 1920.09. [Bowenia spectabilis] @ 7s. 6d.

CERATOZAMIA

— *kuesteriana* Regel

de Cock, Gand: 1913. [Zamia kuesterianus] @ 25 F.

— *mexicana* Brongn.

Bull: 1903. [Ceratozamia fusco-viridis] @ £2. 2s. 0d.

CYCAS

— *circinalis* L.

Hart, Dr: Sierra Leone: 1879.10 [Cycas circinalis seed]
Kew, Royal Botanic Gardens: 1893.09. [Cycas seemannii] (3 plants)

— *circinalis* ssp. *madagascariensis* (Miq.) Sch.

Bull: 1898 [Cycas thouarsi] @ £3. 3s. 0d.

— ? *circinalis*

de Cock: 1908 [Cycas var. undulata] @ 60p.

— *media* R.Br.

Treub, Dr.; Buitzenzorg: 1882 [Cycas media]
Sander: 1914.08. [Cycas media] @ £3. 3s 0d.

— *micholitzii* Dyer

Sander: 1906. [Cycas micholitzii] @ £2. 2s. 0d.
Sander: 1906.08. [Cycas micholitzii]

—? *micholitzii*

Sander: [i1 new cycad from Micholitzí] @ £3. 3s. 0d.

— *revoluta* Thunb.

Bull: 1904 [Cycas revoluta] @ £2. 2s. 0d.

— sp. ined.

Sander: 1908 [iCycas sp. Brisbaneí] @ £1. 1s. 0d.

DIOON

— *edule* Lindl.

Sander: 1904. [Dioon pectinata] @ £1. 1s. 0d.

ENCEPHALARTOS

— *altensteinii* Lehm.

Bull: 1903 [Encephalartos vroomii] @ £19. 19s. 0d.
Bull: 1903. [Encephalartos vroomi var.]

—? *altensteinii*

Bull: 1898. [Encephalartos regalis] @ £5. 5s. 0d.

— *barteri* Miq.

Sander: 1908 [Encephalartos barteri] @ £1. 1s. 0d.
Sander: 1901 [Encephalartos barteri] @ 10s. 6d.
Kew, Royal Botanic Gardens: 1912.10. [Encephalartos barteri]

— *caffer* (Thunb.) Lehm.
Kew, Royal Botanic Gardens: 1914.04. [Encephalartos brachyphyllus]
— *friderici-guilielmi* Lehm
Sander: 1907 [Encephalartos friderici] @ £7. 10s. 0d.
Bull: 1895 [Encephalartos friderici-guilielmi] @ £10. 10s. 0d.
— *ghellinckii* Lem.
Sander: 1896 [Zamia ghellinckii] @ £5. 5s. 0d.
Sander: 1905.06. [Encephalartos ghellincki] @ £1. 1s. 0d.
— *hildebrandtii* A.Braun & BouchÈ
Bull: 1903 [Encephalartos hildenbrandtii] @ £3. 3s. 0d.
Bull: 1910 [Encephalartos hildebrandtii] @ £2. 2s. 0d.
— *laurentianus* de Wild
Pynaert, Ghent: 1906 [Encephalartos laurentianus]
— *lehmannii* Lehm.
Sander: 1903 [Encephalartos lehmanni] @ £5. 5s. 0d.
— ? *longifolius* (Jacq.) Lehm.
Bull: 1903 [Encephalartos] ? donated
— *poggei* Aschers.
Pynaert, Ghent: 1906 [Encephalartos lemarinelliarum]
— ? *woodii* Sander
Sander: ['way of Encephalartos Alten[steinii]'] @ £1. 1s. 0d.
— sp.ined.
Sander: 1905.06.- [Encephalartos] @ 2pl.

LEPIDOZAMIA
— *peroffskyana* Regel
Moore, Sydney: 1862 [Macrozamia dennisoni]
Treub, Buitenzorg: 1882 [Macrozamia perowskiana]
Sander: 1904 [Katakidozamia macleayi] @ £10. 10s. 0d.
— sp.ined.
Bull: 1905. [Catikidozamia sp.] @ £5. 5s. 0d.

MACROZAMIA
— *fawcettii* C.Moore
Sydney, Royal Botanic Garden: 1891.10. [Macrozamia fawcetti]
Sander: 1908/1909 [Macrozamia fawcetti] @ £2. 2s. 0d.
Sander: 1905.04. [Macrozamia fawcettii] @ £1. 1s. 0d.
— *miquelii* (Mueller) A.DC.
Treub, Dr.; Buitzenzorg: 1882 [Macrozamia cylindrica]
Treub, Dr.; Buitzenzorg: 1882 [Macrozamia douglasii]
Treub, Dr.; Buitzenzorg: 1882 [Macrozamia mackenyii]
Treub, Dr.; Buitzenzorg: 1882 [Macrozamia miquelii]
Kew, Royal Botanic Gardens: 1882 [Macrozamia douglasii]
Kew, Royal Botanic Gardens: 1882 [Macrozamia miqueliana]
Sander: 1904 [Macrozamia cylindrica] @ 10s. 6d.
Sander: 1914.04. [Macrozamia miquelii] @ £3. 3s. 0d.
—? *miquelii*
Treub, Dr.; Buitzenzorg: 1882 [Macrozamia tenuifolia]
— *moorei* Muell.
Mueller: 1884.09. [Macrozamia moorei seed]
Sander: 1898 [Zamia mooreana] @ 2s. 0d.
— *pauli-guilielmi* Hill & Muell.
Sander: 1905.08. [Macrozamia pauli-guilielmi] @ £1. 1s. 0d.
de Cock, Gent: [Macrozamia plumosa] @ 40ps

— *pauli-guilielmi* ssp. *flexuosa* (C.Moore) L. Johnson
Sander: 1905.04. [Macrozamia flexuosa] @ £1. 1s. 0d.
— *riedlei* (Gaudich.) C.A.Gardn.
Kew, Royal Botanic Gardens: 1902.10. [Macrozamia priesii]
— *secunda* C.Moore
Sydney, Royal Botanic Garden: 1891.10. [Macrozamia secunda]
Sander: 1905.04. [Macrozamia secunda] @ 10s. 6d.
— *spiralis* (Salisb.) Miq.
Melbourne, Royal Botanic Gard: 1911.08. [Macrozamia spiralis seed]
_ ? *spiralis*
Bull: 1903 [Macrozamia corallipes] @ £1. 1s. 0d.
Sander: 1904 [Macrozamia corallipes] @ £2. 2s. 0d.
Sander: 1908/1909 [Macrozamia corallipes var. bifurcata] @ £3. 3s. 0d.
— ? *stenomera* L.Johnson
Sander: 1904 [Macrozamia heteromeria var. tenuifolia] @ £2. 2s. 0d.
— sp.ined.
Sander: 1909.05. [Macrozamia]
Schlecter, Berlin: 1912.01. [Macrozamia]

STANGERIA
— *eriopus* (Kunze) Nash
Bull: 1894. [Stangeria paradoxa] @ £2. 2s. 0d.
Kew, Royal Botanic Gardens: 1898.05. [Stangeria paradoxa]

ZAMIA
— *floridana* A.DC.
New York Botanic Garden: 1912.08. [Zamia floridana]
— *lindenii* Regel
Kew, Royal Botanic Gardens: 1890.01. [Zamia lindeni] @ 2pl.
Protheroe & Morris: 1893.10.24 [Zamia lindeni] @ 5s. 0d.
— *loddigesii* Miq. var. latifolia ???
Bull: 1898 [Zamia prasina] @ £1. 10s. 6d.
— *media* Jacq.
New York Botanic Garden: 1912. [Zamia calcicola 32882]
— ? *media*
Kew, Royal Botanic Gardens: 1888.10. [Zamia integrifolia]
Protheroe & Morris: 1893.01.24 [Zamia integrifolia] @ 18s. 0d.
Bull: 1904. [Zamia integrifolia] @ £1. 1s. 0d.
Kew, Royal Botanic Gardens: 1914.04. [Zamia integrifolia]
— ? *montana* A.Braun
Shuttleworth, Clapham: 1888.06. [Zamia montana]
Shuttleworth, Clapham: 1888.10. [Zamia montana]
Shuttleworth, Clapham: 1890.04. [Zamia montana]
Shuttleworth, Clapham: 1893.05. [Zamia montana]
—*pseudoparasitica* Yates
Bull: 1891 [Zamia roezlii] @ £6. 6s. 0d.
— *pygmaea* Sims var. kickxii (Miq.) Schuster
New York Botanic Garden: 1912.08. [Zamia kickxii]
— *skinneri* Warsz.
Sander: 1913.08. [Zamia forgetiana] @ £2. 2s. 0d.
— *wallisii* A.Braun
Kew, Royal Botanic Gardens: 1888.10. [Zamia wallisii]
— sp.ined

Sander: 1890. [Zamia — 'Cycad (Zamia sp.)'] @ 15s. 0d.
Sander: 1915.06.11 [Zamia sp.] @ £2. 2s. 0d.
Sander: 1915.06.11 [Zamia ampliata] @ £2. 2s. 0d.
Sander: 1915.06.11 [Zamia sp.] @ £1. 1s. 0d.

unidentifiable taxa

Sander: 1902. [Cycad sp.] @ 5s. 0d.
Blaydes: 1907 [Cycad] @ £9. 0s. 0d.

Among the older specimens in the Great Palm House, where the collection is housed, is *Encephalartos woodii*, a single-stemmed tree now about 2 metres from soil to caudex apex. There is no specific record of Glasnevin's acquisition of this rare Natal species — I suspect that the accessions' register entry for Sander & Sons in about April 1905 reading 'Encephalartos way of E. Alten[steinii]' is this species. If my supposition is correct it was a rather cheap plant costing just one guinea.

The most interesting cycad is perhaps *Cycas micholitzii* which thrives and occasionally (as early in 1993) produces cones; the Glasnevin plant is male (the 1993 cone has been preserved in the herbarium at the National Botanic Gardens). This particular plant was the only one recorded in cultivation, according to the survey of the Botanic Gardens Conservation International Cycad Survey, but we have recently learned that there are plants in the Fairchild Tropical Garden, Miami, USA.

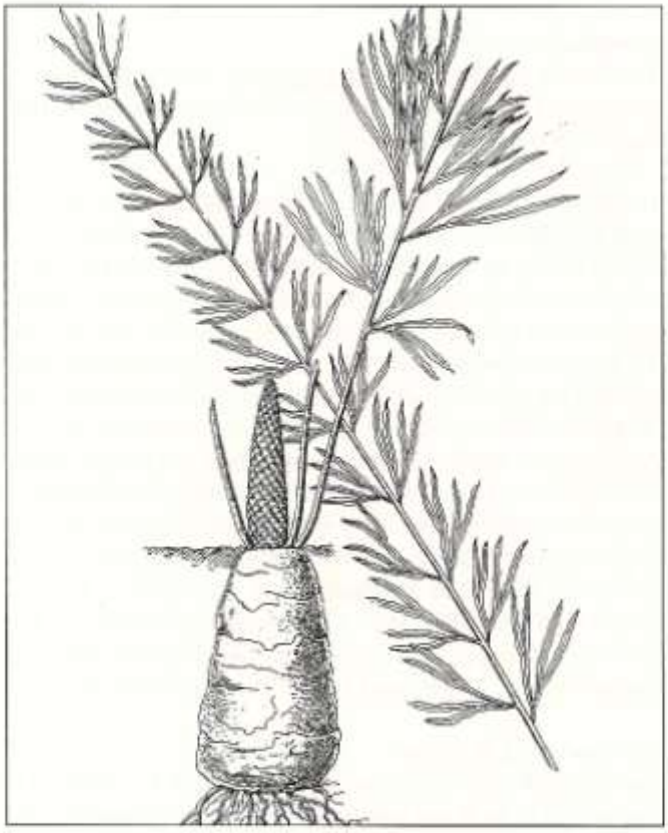


Figure 3. *Cycas micholitzii*: an illustration published in 1905 when the species was described

Cycas micholitzii is indigenous in south-eastern China and northern Vietnam where it grows in sub-tropical forest habitats on limestone, and it is listed as endangered by IUCN. Distinguished by bifurcating pinnae and subterranean caudex, this fern-like species (Figure 2) was discovered in Annam by Wilhelm Micholitz, a professional collector employed by the London orchid firm Messrs. Sander & Sons. Micholitz sent plants to London for sale, and also gave material to Henry Ridley in Singapore Botanic Garden. The species was named in 1905 by William Thistleton-Dyer. The records of purchases in Glasnevin suggest that Moore acquired two, probably three plants; in 1906 two are entered in the Gardens'accession registers, but there is also an entry for about April 1905 for '1 new cycad from Micholitz' and this most probably is also a reference to *Cycas micholitzii*. The earlier plant cost 3 guineas; in 1906 one cost 2 guineas and the second of that year was a gift.

Cycads have formed an important component of the collections in the National Botanic Gardens, Glasnevin, for at least one and a quarter centuries, being most significant during Sir Frederick Moore's keepership. Current work on the collections includes the long-overdue recording of the sex of each plant — only six of the individuals have coned since the survey began. The older cycads now dominate the Great Palm House, and in about a year's time when the magnificent iron conservatories by Richard Turner, the Curvilinear Range, has been restored, it is hoped to display the finest specimens in less crowded conditions in the splendid central pavilion.

A earlier version of this paper was published in *Encephalartos, Journal of the Cycad Society of South Africa* 33 (1993); it is reprinted here by kind permission of that society and the editor of *Encephalartos*, in expanded form with additional tables and new illustrations.

DANIEL L. KELLY

A SHORT GUIDE TO IRISH OAKS

Introduction

The Sessile Oak (Dair Neamhghasanach) has been officially adopted as Ireland's national tree. This has led to a demand for the species for commemorative plantings. However, experience indicates that the quest for true material is not a simple one.

Two kinds of oak are widespread in Ireland, *Quercus petraea* and *Q. robur*. Various vernacular names have been used for the two kinds, but none is entirely satisfactory. I would stick to Sessile Oak for *Q. petraea* and Pedunculate Oak (Dair Ghasanach) for *Q. robur*. These may sound a bit clumsy, but the alternatives one meets are either ambiguous or tendentious. Forms that are intermediate between the two species are widespread, and represent every degree of transition between the extremes. In certain localities intermediates are so common that the distinction between the two kinds of oaks is blurred. Indeed, doubts have been raised from time to time as to whether we are really dealing with two distinct species (e.g. Olsson 1975). However, the production of a range of intermediates, through hybridization and back-crossing, is by no means a rare phenomenon in the plant world. Experimental studies have shown that there is a partial 'reproductive barrier' between the two kinds of oak: when the stigma of one species is artificially dusted with pollen from the other, acorn production is very low — far lower than when pollinated by another individual of the same species (Rushton 1977). Moreover, pollen viability tends to be lower in intermediate forms, indicating some degree of hybrid sterility (Rushton 1988). The occasional production of hybrids and backcrosses must be seen in the context of a large seed output over a long life-span. Within their total joint range (both species are distributed over much of Europe), and over Ireland as a whole, the distinction between the two species holds up. As we shall see, this distinction is not based on one or two characters only, which could be governed by one or two genes only, but on a whole suite of correlated characters.

Distinguishing features

The mature leaves of the two species differ in a number of important respects (Figures 1, 2; Table 1). However, it won't do to pick just any leaf! Ideally, one should examine several well-developed leaves from the crown of the tree, or at least from a fair-sized branch. The brushwood growing out of the bole (epicormic shoots — the easiest part to reach) tends to produce narrow leaves in which the distinguishing features of the species are poorly developed. The same problem applies to lammas shoots (shoots produced in the second flush of growth in July–August) and to seedlings and young saplings: the characteristic features of the mature leaves (such as the auricles of *Q. robur*) tend to be poorly developed or lacking.

The other valuable clues for identification are the acorns — if you can find them, your task is much easier. Here the problem is supply. Oaks have occasional years with a bumper crop (mast years) and many lean years when acorns are few or absent altogether. So, for oak identification, acorns must be regarded as a bonus, not a pre-requisite.

In a nutshell — *Q. robur*, the Pedunculate Oak, has acorns on long stalks (peduncles — Figure 3) and leaves on short stalks. The leaves have distinctive lobes at the base (auricles); the margins of the auricle are folded back on the underside. *Q. petraea*, the Sessile Oak, has acorns on peduncles that are short or virtually non-existent (sessile means stalkless — the extreme case). The leaves are on long stalks; the leaf-base may taper into the stalk (as in Figure 1) or may be rounded or heart-shaped, but it lacks reflexed auricles. Perhaps the best diagnostic character of *Q. petraea* is the clustered hairs; these occur on the underside of the leaf (best seen along either side of the midrib) and on the (short) peduncle. You are advised to use a x10 hand-lens to check these hairs; *Q. robur* leaves and peduncles are usually hairless, but sometimes they have small, non-clustered hairs, especially when young.

In addition, the *Q. petraea* leaf tends to have a larger number of rather shallow lobes, and is broadest at or just above the middle, making a rather symmetrical outline. The *Q. robur* leaf is more irregular in outline, with a small number of deeply cut lobes, and is usually broadest well above the middle. In *Q. petraea* there tends to be

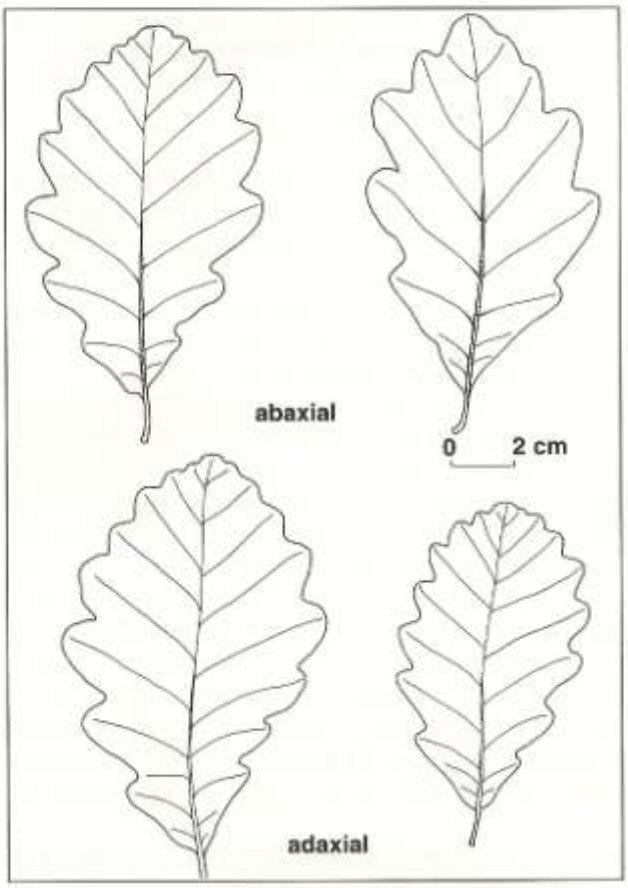


Figure 1. *Quercus petraea*: four leaves from a single acorn-bearing shoot: a,b — underside; c,d — upper side. Hybrid Index 97%. Ross Island, Killarney, November 1973.

a regular pattern of one lateral vein to each lobe; in *Q. robur* additional lateral veins run to most of the indentations between the lobes.

Further characters are harder to quantify but may be useful nonetheless. The leaves of *Q. petraea* are somewhat glossy above, whilst those of *Q. robur* have a mat surface. *Q. petraea* leaves are somewhat less prone to insect damage (Mitchell 1974), though both oaks may be defoliated by Tortrix caterpillars. The knopper gall, — a weird-looking knobbly excrescence caused by the grub of a minute wasp, a recent introduction to Ireland, — is found on the acorns of *Q. robur* only (Nelson & Walsh 1993). How far one can distinguish the two species at a distance, from the overall form of the tree, is debatable. Sometimes one does see the 'classic' *Q. petraea* shape with tall, straight trunk and branches radiating to give a fan-like appearance. *Q. robur* tends to have a more irregular crown, with sinuous, almost zigzag branches. However, crown shape is so variable and so much influenced by the environment — especially by distance from neighbouring trees — that it should not be treated as diagnostic.

Coping with intermediates

As already noted, every degree of intermediate exists between the two oak species. Given this situation, can we find a middle course between arbitrary reliance on one or two imperfectly diagnostic characters, and the laborious analyses appropriate to a specialist study? I have found a scoring system to be useful, modified from Carlisle & Brown (1965), and incorporating information from Jones (1959) and later authors. Imagine our oaks as forming a spectrum of variation with 'pure' robur at one extreme and 'pure' petraea at the other; we can consider one end of the spectrum as having 0% of the characters of one species and the other end as having 100%. A form that is intermediate in every respect will have a score of 50%. Which species we place at a given end of the spectrum is arbitrary. Suppose we place pure petraea at 100%. We then allocate a score of 1 for every petraea character, 0 for every robur character, and 0.5 for every character that is

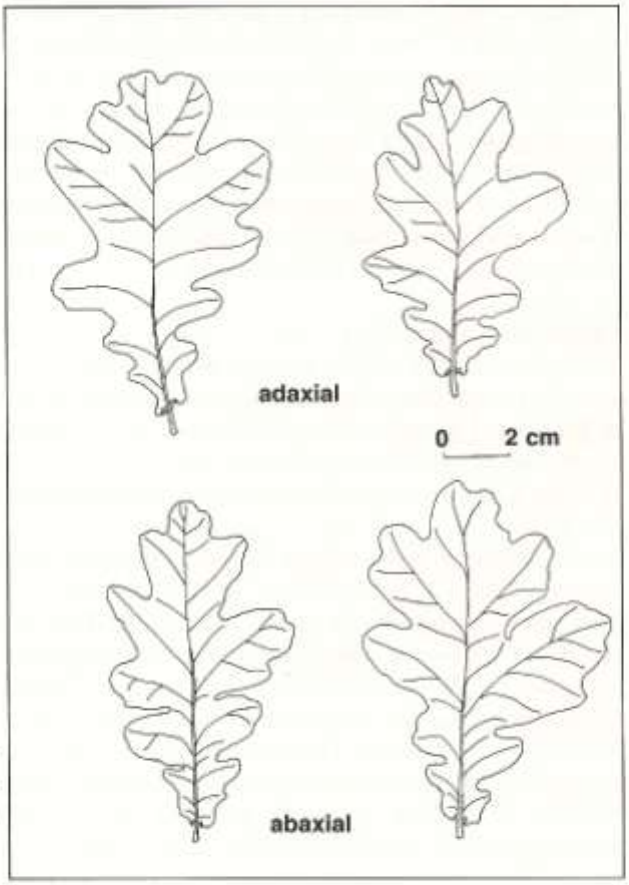


Figure 2. *Quercus robur*: four leaves from a single acorn-bearing shoot: a, b — underside; c, d — upper side. Hybrid Index 3%. Game Wood, Killarney, November 1973.

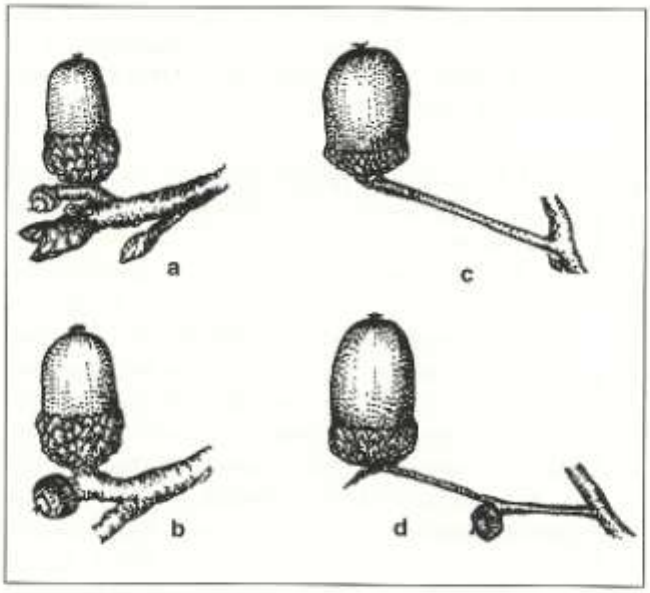


Figure 3. Fruiting structures: a, b: *Quercus petraea*, Muckross, Killarney, October 1993; c, d: *Quercus robur*, Clonskeagh, Dublin, October 1993.

intermediate (Table 1). Next, add up the scores for all the characters recorded. (The number of characters will vary depending on whether we found acorn-bearing shoots or not). Divide the total score by the number of characters and multiply by 100, and we have a Hybrid Index for our specimen, ranging from 0 to 100%.

Taking an example of an oak from Cloghereen Wood, Killarney: the leaves had reflexed auricles in most cases (score 0.25); lacked stellate pubescence (score 0); had stalks about 10 mm long (score 0.5); had 4-5 lobes on each side (score 0), but these were shallow (score 1); some had one or two veins to the indentations between the lobes (score 0.75); the leaves were broadest some way above the middle (score 0.5). The peduncles were about 1 cm long (score 1) and had a few clustered hairs (score 0.5). Total score 4.5, Hybrid Index 50% — exactly intermediate between the two species. I think we can safely deduce the specimen to be a hybrid.

It must be emphasised that individuals with scores of 0 or 100% are rare. 'For a tree to have a percentage hybrid index of <10 or >90 it has to be very typical of the species indeed' (Carlisle & Brown 1965). All characters show some degree of overlap between the two species (Aas 1993). No-one can say where variation within the species ends and variation due to hybridization begins.

To assess the local taxonomic situation with confidence, it is necessary to look at several representatives of any population. Quantitative analyses of the taxonomic status of Irish oak populations have been carried out by Cousens (1965), Mercer (1967), Rushton (1983), Minihan & Rushton (1984). Rushton (1988). The situation for the north-east of Ireland is summarised by Brian Rushton as follows: 'Intermediates are less common than either of the typical species forms but most stands contain individuals that cannot be assigned with certainty to either species. Rarely, in the north-east, do these intermediates exceed 10% of any given population' (in Hackney 1992). In a detailed study of Breen Wood (N. Antrim), Minihan & Rushton (1984) confirmed, using pollen viability studies, that the intermediates are indeed of hybrid origin and probably represent both F1 and backcrossed individuals. They found some oaks that were morphologically indistinguishable from 'pure' *Q. petraea*, but with low pollen viability, and concluded that these were in fact backcrossed hybrids — a finding that may well cause dismay to those who like to get a simple answer to a simple question!

Distribution and ecology

The range of both species extends across much of Europe: *Q. robur* is more 'Continental' in distribution, extending eastwards as far as the Urals. *Q. petraea* is less tolerant of harsh winters, and virtually disappears east of Poland and Romania (Jalas & Suominen 1976). Both species are distributed widely across Britain: *Q. robur* is the prevailing species across the lowlands of southern England, whilst *Q. petraea* prevails in the upland regions (Perring & Walters 1976). Intermediates are particularly prevalent in Scotland and northern England (Clapham et al. 1987).

In Ireland *Q. robur* is again the oak of the fertile lowlands; it is the commoner oak in the Central Plain, over limestone bedrock (Kelly & Kirby 1982). *Q. petraea* is the oak of mountainous areas, of glens and rocky ground over siliceous bedrock (Kelly & Moore 1974). This distribution reflects the ecological preferences of the two species. *Q. petraea* is generally *calcifuge*, i.e. confined to acid soils; it also shows a preference for well-drained soils and an intolerance of flooding. Among the finest old *Q. petraea* woods extant are Tonnafinnoge Wood (Coolattin estate, Co. Wicklow) — happily reprieved from the chainsaw, Curraghmore estate (Portlaw, Co. Waterford) and Killarney National Park (Kelly 1981). *Q. robur* is a species of base-rich soils: the finest stands are on deep drift soils over limestone, in the estates of Abbey Leix (Co. Laois) and Charleville (Tullamore) (Kelly & Fuller 1988). This is also the principal oak on drumlins and on eskers. *Q. robur* is relatively tolerant of waterlogging and even flooding. Old stands of riparian woodland dominated by *Q. robur* survive by the R. Nore

at Abbey Leix and between the braided channels of the R. Lee near Macroom (fragments of the old Gearagh).

We know little of the history of the two oak species in Ireland. There is plenty of fossil evidence of oak, from pollen grains and timber preserved in peat and mud, but unfortunately no-one has yet managed to assign fossil material to either species. Both species have been widely planted, particularly *Q. robur*, still the kind more commonly offered for sale. It has even been questioned whether *Q. robur* is in fact native to Ireland (e.g. Moore 1967). However, I see no reason to doubt its indigenous status. We have a wide scattering of woods of undoubted antiquity in which this species is the principal or only oak, and the general pattern of distribution of the two species in Ireland today would appear to stem logically from their known ecological preferences.

Provenance and conservation

At present most of the oak that is being planted in Ireland, of whichever species, is from imported seed. For commercial plantations, it is appropriate to propagate oaks that are 'best' in sylvicultural terms, whatever their source. In commemorative or specimen tree planting, both heritage and the niceties of taxonomy should influence selection. There must be a case for the production of nursery stock of Irish oaks, especially of authentic *Q. petraea* originating from one of its strongholds. It is also of long-term importance to conserve the diverse 'gene-pool' of Irish oak populations — just as it is important to conserve the genetic diversity of any species of economic significance. This consideration is widely overlooked; even official schemes that have been marketed under the name of 'Conservation' have imported their acorns from the Continent. When it comes to amenity planting in rural areas, there is surely an obligation to plant oak of local stock, even if the vagaries of the acorn supply impose a little patience. After all, an oak is not a thing to be rushed ... .

Acknowledgements

I am grateful to Elinor Jennings for drawing Figure 3 and re-drawing Figures 1 and 2, to Dr Brian Rushton for helpful comments, to Dr Sean Mac an tSaoir for useful information and to Professor Fergus Kelly for linguistic advice.

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Table 1: Characters used in the assessment of taxonomic status

	Quercus petraea Score 1	*Quercus robur* Score 0
Leaf characters		
1. Auricles	absent or not sharply delimited	sharply delimited
2. Clustered hairs on underside		
3. Length of leaf-stalk	> 13 mm	< 7 mm
4. Number of lobes	5 or more	5 or less
5. Depth of lobes	shallow	deep
6. Veins to indentations between lobes	absent	present
7. Shape of leaf	broadest at or just above middle	broadest well above middle
Fruiting characters		
8. Total length of peduncle	< 2 cm	> 3 cm
9. Clustered hairs on peduncle	plentiful	absent

C.R. TYRIE

THE FOUNDATION OF A CULTIVATED PLANT COLLECTION IN THE ULSTER MUSEUM HERBARIUM

The herbarium in the Ulster Museum is an amalgamation of the collections of the Belfast Museum and Art Gallery and the Queen's University, Belfast. It currently holds an estimated 100,000 specimens, mostly from the British Isles and Europe, but also from many other countries in the world. The herbarium is particularly strong in voucher material for Northern Ireland's native flora, which at an estimated 1,000 species of flowering plants and ferns, is a relatively impoverished version of the flora of Great Britain, estimated to be around 1,500 species, and is vastly smaller than the European flora, standing at around 17,000 species.

This relatively restricted list of native plants, however, bears no resemblance to the great range of plants actually growing in Northern Ireland, whose very mild climate facilitates the cultivation of a great number of species from around the world. Some of these species have now become naturalised — for example giant hogweed *Heracleum mantegazzianum* from the Caucasus; flowering currant *Ribes sanguineum*, snowberry *Symphoricarpos albus* and fuchsia *Fuchsia magellanica* from the Americas; New Zealand privet *Griselinia littoralis* and shrubby veronicas *Hebe* spp. from New Zealand. Indeed, some originally imported as garden plants have not only become naturalised but have done so with such vigour that they are now classified as invasive aliens, such as Japanese knotweed *Polygonum cuspidatum*, Himalayan balsam *Impatiens glandulifera*, acaenas and giant hogweed.

It is one of the duties of Museum botany staff to monitor the Northern Ireland plant environment, and it was felt that this should be seen as including introduced plants, whether or not they had become naturalised. The prevailing situation in the herbarium where introduced plants appeared only when naturalised, as aliens in the native collections, was imbalanced; this could be rectified by the establishment of a cultivated plant herbarium where these plants would also be represented from their original, intended, habitat, the garden.

Several other factors indicated a need to expand our collections along these lines. Enquiries from the public for plant identifications, for example, include a sizeable proportion of cultivated plants. For this, reference specimens for comparative purposes are a useful, not to say necessary, tool. There is no such reference material in a public herbarium in Northern Ireland and its need was clearly felt.

Northern Ireland also has a notable history of plant breeding, ranging from the famous Daisy Hill and Slieve Donard nurseries of the past, through Dickson's and McGredy's, to today's nurseries such as Seaforde and Carrigdale. Indeed, the range has widened further with the clonal selection schemes and other plant breeding programmes operated by the Department of Agriculture at Lough Gall, for example. It was felt that attention must be paid to this facet of horticulture in Northern Ireland as well. This is particularly appropriate in one instance, where the nucleus of a living collection, the Slieve Donard cultivar collection, has been established in the Botanic Gardens, Belfast.

Once the need for a cultivated plant herbarium had been recognised, it was decided to approach local horticultural organisations, both professional and amateur, to publicise the herbarium and to elicit co-operation. Accordingly, a long round of visits was made to institutions in Northern Ireland, such as Dept of Agriculture establishments (Lough Gall, Greenmount, Castlewellan), National Trust properties (Rowallane, Mount Stewart), Belfast Parks, local colleges and universities. With many of these bodies formal agreement was reached, and also with the Irish Garden Plant Society, recognising the new herbarium as the official herbarium in which to lodge specimens of cultivated plants.

Local nurseries such as Ballyrogan, Carrigdale and Seaforde were also approached and agreed to help. The help offered by individual gardeners, both in donating specimens and, equally importantly, in offering to assist, has been particularly encouraging.

With the establishment in principle of the new collection more or less complete, it was necessary then to consider its accommodation within the herbarium. This is in a large, low-ceilinged, air-conditioned area inside the main Museum buildings, lit only by fluorescent light.

Figure 1

Wooden cupboards containing the specimens are stacked from floor to ceiling in long rows, back-to-back. Each cupboard, approximately 110 x 80 x 60 cm h x w x d, has double dust-proof doors opening to show two columns of six herbarium trays, which slide out on fixed tracks. Each tray carries the pressed specimens mounted on stiff paper, grouped into species, with each species group enfolded in a light paper folder, and groups of species folders representing the genus enclosed in a heavy card folder, the genus folder. The size of the folders, and, ultimately, therefore, of the cupboards, and even to some extent the actual size of the specimens held, is governed by the size of the sheet on which the specimens are mounted — the ' Kew' size sheet, 42 x 26 cm, is normally used for pressed specimens.

Figure 1

Figures 2, 3

As a reflection of the proportions of material held, with a high percentage of specimens of local origin, the collections are physically divided into 3 main zones — Irish, Great Britain and the rest of the world. Within each of these geographical collections, specimens are stored in a systematic order which reflects their biological relationships — this facilitates easy retrieval and ready comparisons between related groups. With Irish and British material, for instance, nomenclature and storage followed a list of the flora of the British Isles by Dandy (1958), but they are now being changed to conform to the flora recently published by Stace (1991).

With the new cultivated plant herbarium it was felt that although these new collections would represent plants growing in N. Ireland, they were likely to be so far removed taxonomically from the local flora that nothing would be gained from storing them with local material. It was further felt that the study of cultivars would be helped by them not being dispersed among the collections of wild plants, to which they had no real relevance.

Accordingly, a number of cupboards was set aside, literally, to accommodate the new herbarium, the organisation of which, it was decided, would follow the systematic order set out in Rouleau (1981) *Guide to index Kewensis*. The first specimens incorporated in the new cupboards in this order were those encountered and abstracted when working on the local collections. To these were gradually added specimens collected from several new sources:-

Figure 2

Clonal selection schemes — these are operated by the Department of Agriculture, Northern Ireland with some help from Northern Ireland horticulturists. Their original purpose was to select, from a range, the specimen most closely representing the published characteristics of a particular cultivar, and, by official endorsement and propagation, to encourage dissemination of this 'best of range' plant. Such is the variation in plants and the enthusiasm for plant breeding, however, that it quickly became clear that the process would have to start one stage

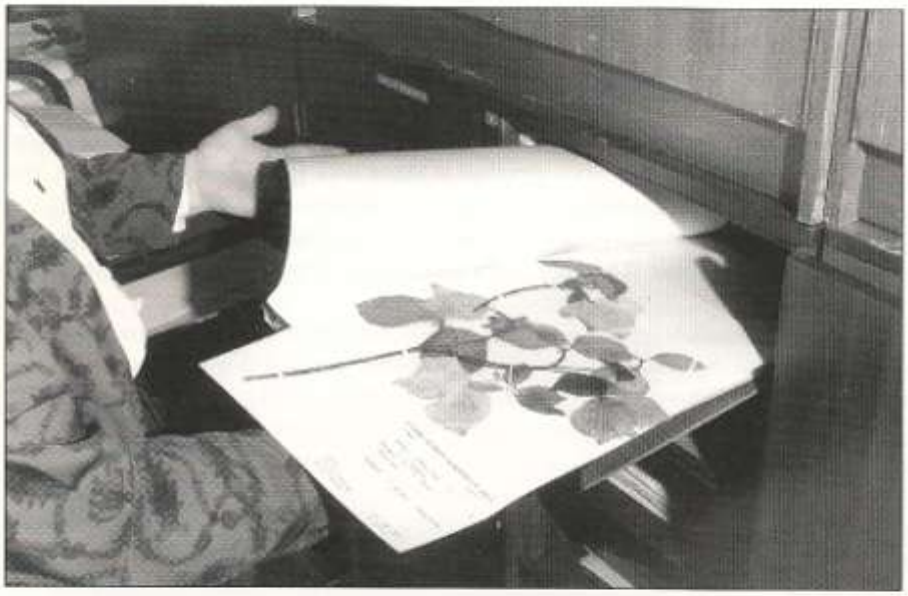

Figure 3

further back,with a weeding out of incorrectly named plants supplied under a particular cultivar name.

The schemes have been in operation now for several years and the final selections for a number of species and cultivars have been made by a panel of experts. The Ulster Museum has been recognised as the official repository by the Northern Ireland Horticultural and Plant Breeding Station at Lough Gall, and voucher specimens for the selected clones of *Clematis montana* 'Tetrarose' and several *Escallonia* cultivars have been lodged in the herbarium. Propagation has been commenced and stocks of the selected clones are now available for horticulturists.

National collections — these living collections, comprising all the known or surviving representatives of a plant group, are held usually by an institution, large estate or an individual. The main purpose of these collections is to prevent the loss to cultivation of some less 'fashionable' strains of species, with the resultant depletion of the gene pool. The Museum now has specimens from the national *Eucryphia* collection held at Seaforde. It is hoped that in 1994 specimens will be collected from the national *Penstemon* collection at Rowallane and plans are in progress to sample the national daffodil collection at Coleraine.

National Trust gardens — the generous support and co-operation of the staff of the two main National Trust gardens has been noteworthy, in particular the help afforded by the Head Gardeners, Nigel Marshall from Mount Stewart and Mike Snowden from Rowallane. They have advised on choice of specimens and made available the entire National Trust estate gardens for collecting. The herbarium now contains many rarities which it would not otherwise have had.

Individuals — the Museum is indebted to many individuals who have generously opened their gardens to enable uncommon or rare species to be for addition to the herbarium. As gardening is such a widely practised occupation, the wealth of N Ireland gardens is now available to add selections to the collections. Notable donors are Mr K. Gass, Mrs E. Chapman and Mrs J. Merrick, all from Belfast, Mr J. Pringle from Downpatrick, Mr A. Bingham from Newcastle and Mrs M. Garner from Helen's Bay.

Other large institutional establishments — specimens have been collected with the willing co-operation of the following: Belfast Parks, which apart from its Palm House and Ravine, also has living collections of Slieve Donard plants and other famous Irish cultivars and species; from the National Arboretum at Castlewellan; from Stranmillis College and Queen's University, whose head gardeners have permitted access to otherwise inaccessible areas; and from Greenmount Agricultural College.

The main method of acquisition is field collection by staff, often in parties consisting of one member of Museum Staff accompanied by one or several other people. Specimens are also regularly brought in by some individuals whose contributions have significantly broadened the range of the collections.

Good quality material is selected from the chosen plant — usually having several good leaves, several flowers

in various stages of development from bud onwards, and, if possible, fruiting parts too. Other plants parts are also taken — for example twigs and bark, especially if there is something about these particular parts which make the plant noteworthy. Where possible, material is not collected shortly after hail, frost or heavy rain, as delicate structures have often been bruised or broken. At the time of collection, each specimen is assigned the unique accession number which will accompany it throughout processing and stay with it after mounting and incorporation in the herbarium. The parent plant is often photographed to show both general habit and detail, and any prints and transparencies are also given this accession number for cross-referencing.

Specimens are closed in snap-seal polythene bags with a field label, which records name, date of collection, collector(s), location, habitat and accession number. They are taken back to the museum where the process of pressing commences.

In order to conveniently store many thousands of specimens, botanists use the technique whereby a three-dimensional plant is flattened and dried simultaneously into a two-dimensional form. The problems inherent in this technique are sometimes obvious, but at others not so. For instance, it is clear that forcing a woody twig to stay flat during the early stages of processing will be difficult, and the presence of spines and thorns can make the exercise hazardous. Delicate petals and leaves, however, also have their own associated problems, as during processing they can stick to the pages enclosing them and then tear when the folders are opened. This can also happen when pressing plants with succulent leaves and sticky sap. Colour changes also often occur during processing and the formation of mould in the press in humid weather is a problem all collectors have encountered.

Colour change in processing, in the context of a cultivated plant collection, is a matter requiring special consideration. With cultivated plants it is likely that one of the most important reasons for a plant' s original selection for cultivation would have been its colour, and it therefore becomes necessary to observe and record what the original colours of the plant are before these colours change during processing.

Figure 4

Accordingly it was decided to develop a colour record sheet — simply a form, where along with the name, family and accession number of a specimen, the colours of its various parts could be recorded. For this to be a useful record, all observations follow a set procedure — colour matching uses the Royal Horticultural Society's Colour Charts (4 fans of varying colour shades and tones) and is carried out under standard lighting conditions. These colour codes are noted on the record sheet in the following way:-

Petals	RHS Yellow-orange 20B, blotched RHS Greyed-purple 183B at base

Figure 4

Figure 5

The specimen is then placed in a folder 'sandwich', consisting of 2 outer folders of blotting paper to absorb moisture squeezed out during pressing, with an inner liner of newsprint, which allows the moisture to pass through to the blotters without the plant becoming stuck to it — although, as mentioned above, there can be problems here. The field label still accompanies the specimen. Pairs of folders are separated by corrugated cardboard allowing for free passage of air. The press is closed and the springs tensioned to exert a firm pressure.

Figure 5

Depending on the moistness of the specimens and the atmospheric humidity, the closed press may be put in a hot air cabinet to hasten drying.

Figures 6, 7

Blotters are changed every two days to encourage drying and prevent the formation of mould, and also to prevent loss of colour as much as possible. At the early stages minor adjustments can be made to the aspects of leaves and petals, while they are still moist but somewhat flaccid from loss of water. Most plants would be dry with 10 days to 2 weeks.

Figure 6

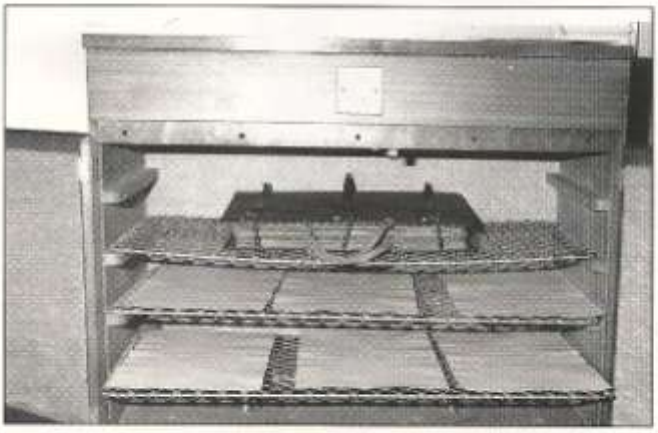

Figure 7

Figure 8

When dry the specimens are mounted on Kew-size herbarium sheets, using either slim gummed paper straps, or small amounts of glue to hold them in place. A new label with full documentation is glued at the bottom right hand corner of the sheet. At this stage, nomenclature is checked for the last time, ensuring, for instance, that the name of the author is present. Good reference works are essential for this e.g. *Bean's trees and shrubs hardy in the British Isles, Index Hortensis, Index Kewensis* etc.

Other types of material may also be collected

Figure 8

and although stored differently will still require similar processes of drying and documentation, often, however, without pressing. Thus seeds, nuts, timber, or bark would be air dried and stored with other similar material in the Museum's collections, while plant tissue can also be stored in chemical fixatives in wet collections.

Figure 9

Before incorporation in the herbarium, the final stage of conservation occurs — all specimens are deep-frozen, at -18°C for 3 days, to kill all insect pests and their eggs. The threat of insect infestation in a herbarium is a serious one, and the damage inflicted by the book louse and other pests on dried material can be disastrous. Although formerly sprays containing dissolved poisons were used to keep the collections pest-free, no chemical insecticides are now used — this makes the collections much safer for the researcher to work with. It also means that as herbarium material has only been dried and then frozen, the DNA in the plant tissue has been preserved unaltered and can be extracted in the future if desired.

The collection and handling of large amounts of fresh material for the new cultivated plant herbarium has needed a lot of work. The Museum has been privileged to have the help of two voluntary members of staff, Knox Gass and Jan Merrick, whose horticultural knowledge and interest have greatly fostered its development. That the herbarium today stands at about 1800 sheets, with many more awaiting mounting and incorporation, is testimony to their encouragement and generosity with both specimens and time.

The future for the herbarium seems likely to be a busy one. Contact has been established with the new Royal Horticultural Society cultivated plant herbarium in Wisley. Ever widening co-operation with horticulturists and institutions should mean that these collections will be seen as an important reference tool for the maintenance of standards in identifying cultivated plants.

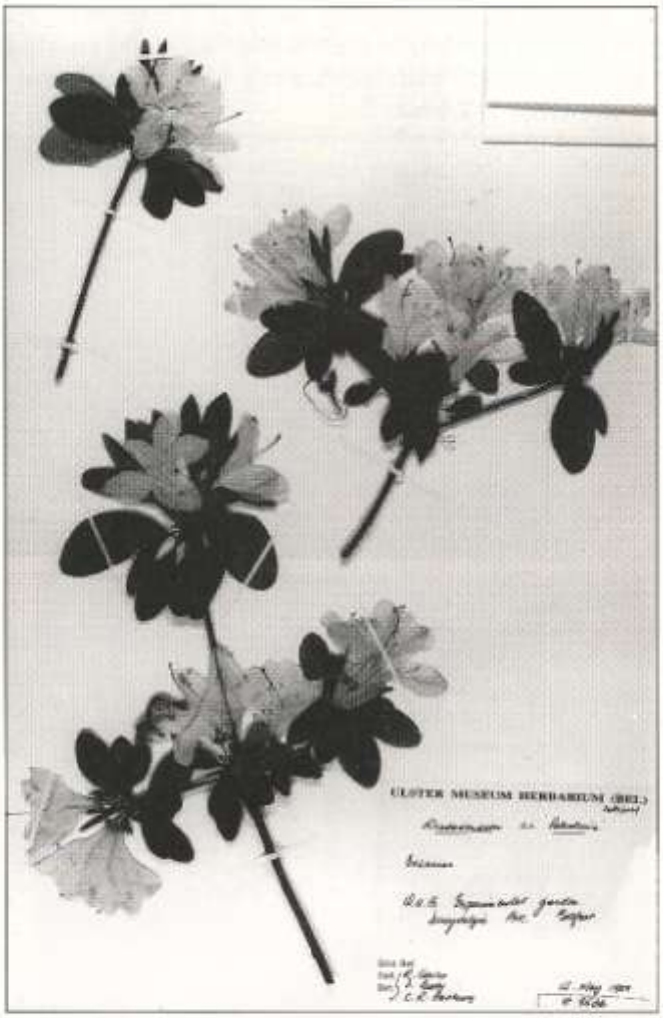

Figure 9

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Book Review

A man who can speak of plants. Dr Thomas Coulter (1793–1843) of Dundalk in Ireland, Mexico and Alta California. **E. C. NELSON & A. PROBERT, Privately published by E.C. Nelson in an edition limited to 500 copies. 181pp**

Dr Thomas Coulter: the portrait in oils, painted before 1824 (by courtesy of Trinity College, Dublin).

Thomas Coulter is best known to gardeners as the discoverer of *Romneya coulteri*, the attractive, large, white-flowered, Californian tree-poppy, now fairly frequently grown in Irish gardens. However as Nelson & Probert elegantly show, Coulter was in fact a man of many parts; caring physician, ardent fly-fisherman and crack-shot, keen natural historian, somewhat unsuccessful, but nevertheless well-paid, mine-manager, accurate surveyor, under published plant-taxonomist and prolific plant-hunter.

The book itself is clearly the product of decades of dedicated scholarship; it is uniformly well written (concise and accurate but never prolix) and well illustrated (with a block of 10 excellent colour plates, including *R. coulteri*, and a large number of black and white figures). The black and white illustrations are scattered throughout the text. They include a frontispiece by Wendy Walsh of a cone of *Pinus coulteri* (one of a number of pine species described from specimens Coulter collected), portraits of some of Coulter's friends (including A-P. deCandolle — one of the most famous botanists of the 19th Century, and Reverend Thomas Romney Robinson — the astronomer at Armagh), attractive vistas of the regions Coulter worked in (Mexico and California), examples of his correspondence, solitary scientific paper and personal effects.

Also included are photographs of some of the specimens Coulter collected. As Coulter published only one scientific paper these specimens undoubtedly constitute his major legacy; they are still preserved in the herbarium of Trinity College, which was founded by Coulter. Finally I am pleased to say that the book is well proof read (I detected only a few trivial oversights), has a nice type-face and is exceptional value for money. The fact that no publisher was willing to undertake its production is a condemnation of the general lack of imagination in publishing houses.

J. Parnell

The Irish Garden Plant Society was formed in 1981 to assist in the conservation of garden plants, especially those raised in Ireland. It also takes an interest in other aspects of the preservation of Ireland's garden heritage.

This journal is devoted to papers on the history of Irish garden plants and gardens, the cultivation of plants in Ireland, the taxonomy of garden plants and reports of work carried out by the society and its individual members.

The editorial committee invites contributions from members of the society and others. Please submit manuscripts on disk or typed on A4 sheets, double-spaced and on one side of the sheet only, to the Editors, c/o National Botanic Gardens, Glasnevin, Dublin 9.

Moorea 11 was edited by David Jeffrey; production by Mary Davies.

Distributed free to members of the society.

Price to non-members IR £7.50