



BOTANY DIVISION

1985-87
TRIENNIAL
REPORT



DEPARTMENT OF
SCIENTIFIC AND INDUSTRIAL
RESEARCH



Triennial Report of Botany Division

Christchurch — New Zealand

Postal address: Botany Division
DSIR, Private Bag, Christchurch

Telephone: Christchurch 252-511

Telegrams: Plantlab

Telex: LINSIR NZ4703

Facsimile: 252-074

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STAFF LIST

(31.12.87)

DIRECTOR: W. HARRIS, B.Sc. (Hons.), Ph.D. (Cantuar.)

ASSISTANT DIRECTOR:

P. WARDLE, M.Sc. (NZ), Ph.D. (Cantab.), F.R.S.N.Z.

Advisory and Extension History, Biography, Bibliography Administration	T.A. MITCHELL, B.Sc. (Cantuar.) A.D. THOMSON, M.Sc. (NZ), Ph.D. (Cantab.) R.H. BARTON, B.Com. (Cantuar.) V. CHANDRA, C.A.S. (Fiji) J.M. STENNING, located at Dunedin C.C. THOMPSON (née Tonks), located at Nelson
Typists	H.J. WALLACE, located at Dunedin A.J.M. MARTIN (née Campbell) S.L. KELLY M.E. RAE, located at Nelson
Library	H.M. THOMAS, located at Dunedin R.E. McNAUGHTON, M.A. (Otago), Dip. Lib. (Wales), A.L.A. L. NESBITT H.M. REID
Botanical Artists	P.A. BROOKE, Dip.T.D. (Hons., Bradford) C.L. BROWNE, Dip.F.A. (Otago Poly.)
Gardens	A.W. PURDIE, Scottish Dip.Arg. (Edinburgh) D.J. PURCELL W.R. CARTER K.A. LLOYD, B.Sc. (Cantuar.) R.G. MUDGWAY S.N. OLIVER
BIOSYSTEMATICS GROUP	M.S. McGLONE, M.Sc. (Wellington), Ph.D. (Cantuar.) (Group Leader)
Taxonomy Section	C.J. WEBB, B.A., B.Sc. (Hons.), Ph.D. (Cantuar.) (Section Leader) E. EDGAR, B.A., M.Sc., Ph.D. (NZ), F.L.S. A.J. FIFE, B.Sc. (Hons.), M.Sc., Ph.D. (Michigan) P.J. GARNOCK-JONES, B.Sc. (Hons., Welling- ton), Ph.D. (Cantuar.) D.R. GIVEN, B.Sc. (Hons.), Ph.D. (Cantuar.), F.L.S., C. Theol. B.H. MACMILLAN, N.Z.C.S. M.J. PARSONS, M.Sc. (Wellington), Ph.D. (Adelaide) W.R. SYKES, B.Sc. (London), N.D.H. (R.H.S. London)

- P.C.M. DOUGLASS
 J. GLASSON
 M.A. O'BRIEN (née Bloomfield), N.Z.C.S.
 J.E. SHAND
 M.D. WILSON
 E.H. WOODS
 M.S. MCGLONE, M.Sc. (Wellington), Ph.D.
 (Cantuar.) (Section Leader)
 R.N. PATEL, B.Sc. (Hons., Vallabh.), M.Sc.
 (London), Dip.For. (Oxon.)
 M.N. PHILIPSON, M.Sc. (NZ), Ph.D.
 (Cantuar.)
 M.I. DAWSON, N.Z.C.S.
 J.V. MYERS
 M.K. REYNOLDS
 K.J. STEWART, N.Z.C.S.
 A.F. WATKINS
- Palynology and
 Morphology Section
- ECOLOGY GROUP
- South Island Ecology
 Section
- P. WARDLE, M.Sc. (NZ), Ph.D. (Cantab.),
 F.R.S.N.Z. (Group Leader)
 P.A. WILLIAMS, M.Sc. (Wellington), Ph.D.
 (Cantuar.) (Section Leader), located at
 Nelson
 R.B. ALLEN, B.Sc., Dip.Sci., Ph.D. (Otago),
 located at Dunedin
 P.N. JOHNSON, B.Sc., Dip.Sci., Ph.D.
 (Otago), located at Dunedin
 W.G. LEE, B.Sc., Dip.Sci., Ph.D. (Otago),
 located at Dunedin
 C.D. MEURK, B.Sc. (Hons., Cantuar.),
 Ph.D. (Otago)
 B.P.J. MOLLOY, M.Sc. (NZ), Ph.D.
 (Cantuar.), Dip.Ag. (Massey),
 Dip.Tchnng.
 T.R. PARTRIDGE, B.Sc. (Hons.), Ph.D.
 (Otago)
 R.P. BUXTON, B.Sc. (Cantuar.)
 G.Y. WALLS, B.Sc. (Hons., Wellington)
 I.A.E. ATKINSON, M.Sc. (NZ), Ph.D.
 (Hawaii), (Section Leader), located at
 Taita
 G.C. KELLY, M.Sc. (Wellington), located at
 Taita
 B.D. CLARKSON, M.Sc., D.Phil. (Waikato),
 located at Rotorua
 A.E. ESLER, M.Agr.Sc. (NZ), located at
 Auckland
 N.M.U. CLUNIE, B.Sc., M.Sc. (Auckland),
 Ph.D. (Australia), located at Kaikohe
- North Island Ecology
 Section

Research Associates	J. BEEVER, M.Sc. (Auckland), Ph.D. (Leeds)	
	M.J.A. BULFIN, B.Sc. (NZ), Dip.Hort. (Massey)	
	U.V. CASSIE-COOPER, M.A., Ph.D. (NZ)	
	H.E. CONNOR, M.Sc. (NZ), D.Sc. (Cantuar.), F.R.S.N.Z.	
	A.P. DRUCE, B.E. (NZ)	
	E.A. FLINT, M.Sc. (NZ), Ph.D. (London), F.L.S.	
	E.J. GODLEY, M.Sc. (NZ), Ph.D. (Cantab.), Hon. F.L.S., F.R.S.N.Z.	
	N.T. MOAR, M.Sc. (NZ), Ph.D. (Cantab.), F.L.S.	
	Friends of the Herbarium	D.A. BANKS
		J.V. LOVIS, B.Sc. (Hons.) (London)
J. MCCALLION		
A. MCMILLAN, B.Sc. (Cantuar.)		
M.E. SHAW		

REGIONAL STATIONS

	Officer-in-Charge	Postal Address	Location
Kaikohe	Dr N.M.U. Clunie	Botany Division DSIR PO Box 194 Kaikohe Phone 80-556 Telex 21623 (closed from 31.3.89)	Cumbers Road Kaikohe
Auckland	Mr A.E. Esler	Botany Division DSIR Private Bag Auckland Phone 893-660 Telex 21623 Fax 863-330	120 Mt Albert Rd Auckland
Rotorua	Dr B.D. Clarkson	Botany Division DSIR C/- FRI Private Bag Rotorua Phone 475-899 Telex 21080 Fax 479-380	Whakarewarewa

Havelock North	Mr G.Y. Walls	Botany Division DSIR Private Bag Havelock North Phone 778-196 Fax 774-761	Goddards Lane Havelock North
Wellington	Dr I.A.E. Atkinson	Botany Division C/- Division of Land and Soil Sciences DSIR Private Bag Lower Hutt Phone 673-119 Telex 3814 Fax 673-114	Eastern Hutt Rd, Taita
Nelson	Dr P.A. Williams	Botany Division DSIR Private Bag Nelson Phone 81-082 Fax 69-464	Milton St Nelson
Dunedin	Dr P.N. Johnson	Botany Division DSIR Private Bag Dunedin Phone 774-052 Fax 775-232	764 Cumberland St, Dunedin

INTRODUCTION

(Dr W. Harris)

This tenth Triennial Report of Botany Division of the Department of Scientific and Industrial Research records activities in the years 1985 to 1987. The Triennial Reports provide a continuous record of 30 of the 50 years since Botany Division was given the status of a Division in 1938. Commencing in 1989, reporting of Botany Divisions activities will be on an annual basis. This change is required to provide earlier reporting of the work of Botany Division to account for the use of the funds the Division receives from the Crown through DSIR, from the Department of Conservation as part of the transferred funding arrangement established in 1987, and from other clients who commission work by the Division.

The 1985 to 1987 triennium has been exceptionally difficult and consequently very challenging for Botany Division. This situation primarily arose from the 27% reduction of the Crown allocation to DSIR over three years commencing from the 1985/86 financial year. There was an expectation by the Crown that this reduction of funding could be made up by DSIR charging for work it undertook for its various clients, particularly where the clients benefited economically from the work. Although it was clear that Botany Division would have difficulty in obtaining revenue directly from clients because the work it does is not usually of direct economic benefit to clients, but provides benefits which are widely distributed and in the general public good, the Division, nonetheless, was subjected to very severe reductions of Crown funding during the triennium.

A major application of Botany Division's work is towards conservation of the indigenous flora and vegetation of New Zealand. This application was recognised when the Department of Conservation was established in 1987 at which time 20% of the Crown allocation to Botany Division was transferred from DSIR to the Department of Conservation to meet the new department's requirement for conservation related research. Although this transferred fund arrangement has similar intent to the commercial servicing by other DSIR divisions of the clients they were established to serve, it was not recognised as revenue earned for Botany Division in a way which would have assisted the Division to meet the requirements of 'user pays policy' linked to reduced Crown funding. Also, the transferred funding arrangement has added considerable administrative complexity without there being any clear evidence to date that the arrangement results in the more effective application of the results of botanical research to conservation management requirements. The funding of Botany Division's work has been adversely affected further by reduced Crown funding of agencies who have been clients in the past, financial difficulties of the private sector, and inadequate adjustment of funding to cover inflation.

In response to the marked reduction of Crown funding Botany Division has endeavoured to seek clients prepared and able to pay for services provided by the Division. However, the real effect of the funding situation during the triennium is that Botany Division has had to severely reduce expenditure. This has mostly been achieved by not replacing staff who have retired or resigned. The result of these measures was that at the end of the 1987/

88 financial year, Divisional expenditure was within income, but this has had deleterious effects on the Division's operation. Key skills supported in the national interest and built up over many years have been lost, and there has been insufficient operating money to allow the most effective use of the division's expert personnel and specialised facilities.

It is regrettable that this report has to begin with such negative statements. However, it is necessary to make them as a record of the operational environment in which Botany Division has continued to carry out and to bring to completion botanical research of high quality in the national interest.

ROLE, GOALS AND OBJECTIVES

Changes of funding arrangements and administration, as well as the departmental requirement for divisions to review and restate their objective and functions, has led to changes to the objectives and functions stated in previous Triennial Reports. The statement of role, goals and objectives that follows was prepared on the basis of discussions held at the biennial meeting of Botany Division in September 1987.

ROLE

Botany Division's role is to undertake research on plants and vegetation and to transfer and apply botanical knowledge for the cultural, social and economic benefit of New Zealand.

GOALS

To be the Centre of excellence for the study of the wild plants of New Zealand and the South Pacific, and the primary institutional source of information about them.

RESEARCH

1. Describe, classify and name the flora of New Zealand and the South Pacific region.
2. Describe and classify vegetation communities and to investigate plant ecological processes and vegetation history of the New Zealand region.
3. Develop expertise in specialist fields in support of 1 and 2.

INFORMATION TRANSFER

4. Build and maintain the herbarium and other specialist botanical collections, the library and other information bases.
5. To ensure that our research and experience in interpreting botanical information is widely available in an accessible form.
6. To contribute to science education at all levels.

APPLICATION

7. Maintain specified specialist botanical services to provide expert advice on the economic and cultural uses of plants.
8. Ensure that botanical knowledge and research is directed towards effective vegetation and land management by:
 - a. Defining principles, promoting understanding and encouraging action on the conservation of the native plants and plant communities of New Zealand.

b. Providing comment on the impact of development on environmental quality as this relates to plants and plant communities to ensure that development is beneficial and balanced.

c. Providing comment on noxious or potentially noxious plants.

9. To be cost effective in the use of Crown contract funding and as far as possible identify and obtain income from clients who directly benefit from the Division's work.

OBJECTIVES

1. Maintain and improve research effort.

2. To respond to reduced Crown contract funding levels.

3. Streamline Botany Division's management and communication structures.

4. To strengthen productive linkages with other organisations.

5. To improve public image and target publicity to appropriate groups.

STAFF

Five long serving staff members retired during the triennium and could not be replaced because of reduced income. Also, cessation of the government Project Employment Programme and completion of three contracts funded by the Noxious Plants Council resulted in a significant reduction of the number of staff employed by Botany Division compared to the previous triennium.

Further changes of the administrative structure of DSIR Lincoln, associated with the completion and occupation of centralised administrative, meeting, reception and cafeteria facilities shared with the Ministry of Agriculture and Fisheries, has meant the loss of direct identity of dedicated administrative staff with Botany Division. Administrative staff who directly service Botany Division are named in the staff list. Although Library, Illustration and Garden staff are incorporated into the DSIR Lincoln administration and servicing centre, Botany Division has continued particular operating links with these staff and changes in these areas are noted.

Mrs M.J.A. Bulfin, née Simpson, retired in June 1985 completing 35 years service for Botany Division. She commenced as a technician in 1950 when Botany Division was located in Wellington, and was appointed scientist in 1974. Margaret Bulfin's main effort later in her career was towards preparation of a seed atlas for New Zealand dicotyledons. She is continuing this work in retirement as a Research Associate.

Mr I.C. Brown retired in June 1986 completing 28 years service for Botany Division. This began in 1958 when he was appointed to the garden staff at Lincoln two years before the Division established its headquarters there. Ivor Brown took over the charge of the experimental garden soon after his appointment and contributed significantly to its establishment and development. He was appointed technician and curator of the gardens in 1961. When Mr Brown retired, Mr A.W. Purdie transferred from the South Island Ecology Section to the gardens to take over Mr Brown's responsibilities.

Dr U.V. Cassie-Cooper retired in September 1986 completing an association with DSIR which started in 1957 when she was appointed to

the New Zealand Oceanographic Institute in Wellington. She was appointed to the Botany Division substation, Auckland, in 1975. There her research was mostly directed to studies of fresh water algae and in recent years she paid particular attention to diatoms and algae of thermal waters. Dr Cassie-Cooper continues her phycological work in retirement as a Research Associate.

Mr E.J. Beuzenberg retired in December 1986 ending an association with DSIR beginning with his employment by Crop Research Division in 1952. He transferred to Botany Division in 1954 to work as a technician with Dr J.B. Hair and contributed significantly to the systematic determination of the chromosome numbers of New Zealand indigenous plants, the results of which are published in the series 'Contributions to a Chromosome Atlas of the New Zealand Flora'. Miss H. Rendle was appointed in June 1987 to continue cytological investigations of New Zealand plants but left after a brief period. Mr M.I. Dawson has been able to continue some cytological work.

Dr N.T. Moar retired in December 1987 after 40 years service for Botany Division which commenced in Wellington under the Division's first director, Dr H.H. Allan. By application of his specialist skills in palynology Neville Moar made significant contributions to the interpretation of vegetation changes in New Zealand during the Quaternary, used pollen identification to determine the nectar sources of honeys and undertook the systematic description of the pollen of New Zealand dicotyledons. He also assisted significantly in the administration of Botany Division. He continues his professional interests as a Research Associate working to bring to completion an illustrated atlas of the pollen grains of the New Zealand dicotyledons.

Dr A.J. Fife was appointed to the permanent staff of Botany Division at the completion of a National Research Advisory Council Fellowship in September 1987. His objective is to prepare a Flora of the New Zealand Mosses.

Mrs E.H. Woods replaced Mr E.D.W. Freeman as the assistant in the herbarium preparation room in April 1985. During the triennium Mrs J.B. Cummack (née Francis) returned from overseas travel to fill a technicians position in the Taxonomy Section vacated by Ms J.E. Shand. Later Ms Shand returned to a part-time position and Mrs Cummack resigned to take up a position with the Wheat Research Institute.

Three positions funded by the Noxious Plants Council terminated during the triennium. Ms L.J. Mather concluded a one year study of *Erica lusitanica* in May 1985, Mr N.J. Taylor concluded a three year study of *Nassella trichotoma* in May 1987 and Dr C.J. West left in advance of the completion of a three year contract to study *Clematis vitalba* to take up the position of editor of the *New Zealand Journal of Botany* in May 1987.

Mr R.E. McNaughton was appointed Librarian in Charge of the DSIR Lincoln library in August 1985. Mrs S.J. Taylor resigned as library assistant in August 1987 and Miss H.M. Reid was employed under the Maori and Pacific Islander Scheme to a position shared between the library and centre records in September 1987. Miss V.E. New resigned as Botanical Artist in January 1986 and was replaced by Miss A.M. Hodgins who returned from overseas travel. Miss Hodgins resigned in December 1986 and was

replaced by Ms C.L. Browne. Mr A. Dodds resigned from the gardens in October 1986 and was replaced by Mr S.N. Oliver.

Dr D.M.R. Harvey was employed under joint funding from Botany Division and the Biological Industries Group of DSIR from November 1986 to June 1987 and worked with Dr M.N. Philipson on the ryegrass endophyte in the Electron Microscope Unit. Botany Division supported three DSIR-University contracts during the triennium. Ms B.A. Horrell, Botany Department, University of Otago, studied juvenile and mature forms in New Zealand native woody plants. Mr M.F. Large, Botany Department, University of Auckland, undertook a survey of the spores and gametophytes of New Zealand ferns, and Mr C.H. Lusk, Botany Department, University of Auckland, studied the dynamics of podocarp/kamahai forest, Tongariro National Park.

Mr G.Y. Walls established the Botany Division regional station at DSIR Havelock North in April 1985. As has been the case with other regional stations of the Division, location of a regional botanist has considerably advanced knowledge of the vegetation of the region in which the station is centred. During the triennium, Mr Walls was also engaged to a significant extent in undertaking a pilot study in New Zealand in connection with the Commonwealth Science Council's Biological Diversity and Genetic Resource Project coordinated by Dr Promila Kapoor located in London. Mr Walls was assisted in the pilot study by Ms S.M. Scheele and Mrs A. Paul through a special grant from DSIR Head Office. Also as part of the C.S.C. project, Dr W. Harris, Dr M.J. Parsons and other staff members devoted considerable effort towards preparations for an International Workshop on Ethnobotany held at the Te Rehua Marae, Christchurch, in February 1988.

Dr W.G. Lee completed a DSIR Study Award at the Botany Department, University of Cambridge, England, in September 1985 which involved collaborative research with Dr P.J. Grubb on the ecology of shrub species. Monsieur Luc Decourtye, Director, Laboratoire des Arbustes Ornementaux, Station de Recherches d'Arbiculture Fruitière et d'Amélioration des Arbustes Ornementaux, was located at Botany Division, Lincoln, from December 1985 to May 1986 to investigate the potential for use of New Zealand plants as ornamentals in France. A collaborative study with Dr W. Harris to investigate the cold hardiness of *Leptospermum scoparium* was started in the course of this visit.

ADMINISTRATION

Further progress was made during the triennium towards the integration of Botany Division's administration and servicing requirements into the DSIR Lincoln Centre. As well there was a need to put into place administration to meet the joint requirements of DSIR and MAF in what has been named the Canterbury Agriculture and Science Centre. DSIR Lincoln Centre is serviced by an Executive Committee consisting of the Directors of Botany Division and Crop Research Division, a representative of the DSIR regional stations at Lincoln, and Mr B.W. Stewart, Senior Executive Officer, DSIR Lincoln. A DSIR Lincoln Centre Committee, which includes representatives of all DSIR Divisions at Lincoln and senior administrative staff, meets monthly and receives reports from various sub-

committees representing various service groups of DSIR Lincoln. A Canterbury Agriculture and Science Centre committee meets quarterly to discuss administrative and site development matters relating to the Centre. During the triennium, Botany Division benefited from very positive cooperation between MAF and DSIR and between DSIR Divisions at Lincoln.

Within Botany Division there has been further evolution towards a programme and project orientated administrative structure to replace the sectional structure. During the triennium the research work of Botany Division was continued as two major programmes, Biosystematics of the Flora, and Plant Ecology and Vegetation Survey led by Dr N.T. Moar and Dr P. Wardle respectively.

Dr C.J. Webb took over the role of leader of the Taxonomy Section from Dr E. Edgar so that she could concentrate her efforts on preparation of the Grass Flora and Dr M.S. McGlone took over leadership of the Biosystematics of the Flora Programme when Dr N.T. Moar retired. Dr M.J. Parsons took over the role of Herbarium Keeper in April 1986 allowing Dr D.R. Given to concentrate his efforts towards the study and conservation of threatened plants, which includes a commission from the IUCN and WWF to write a book on Principles and Practice of Plant Conservation.

BUILDINGS AND EQUIPMENT

The triennium was notable for significant improvements in building and servicing facilities available to Botany Division. Development of the Canterbury Agriculture and Science Centre has provided Botany Division with modern, well appointed reception, cafeteria, meeting, photographic, illustration and administrative facilities. Botany Division staff in Dunedin also benefited from the completion of a custom designed building shared with staff of Soil Bureau and Geological Survey.

A major development in the history of Botany Division was the commencement in June 1986 and completion in October 1987 of the second stage of the herbarium extension. This was based on plans begun in 1973. The completion of this extension increased the storage capacity of the herbarium nearly three times, will allow appropriate arrangement of different plant groups forming the collection and provides well appointed offices, preparation rooms and a computer room to service the collection. The herbarium is now equipped with the building to service the national requirement for such a facility well into the 21st century. Unfortunately, due to funding reductions, it will be some time until the herbarium is adequately furnished to make it fully operational.

During the triennium the Hitachi Hu-11B transmission electron microscope installed in 1965 was replaced by a Ziess 902 instrument. Funding of this instrument was assisted by contributions from the Biological Industries Group DSIR, the Wool Research Institute and MAF. The instrument first installed proved to be operationally defective, and this was replaced by Ziess by a new upgraded model at the end of 1987.

EXTENSION

The pressure to seek revenue to compensate for reductions of crown funding placed greater emphasis on the extension activities of Botany

Division during the triennium. However, assessment of revenue generating market opportunities available to Botany Division indicated the inappropriateness of diverting too much effort into this area. Botany Division does not have the same opportunity to earn commercial revenue as do those DSIR Divisions whose work serves agricultural and industrial activities. However, there was a considerable demand from the Department of Conservation to interpret for management purposes the results of Botany Division research.

During the triennium, Miss S.J. Gamble, the first advisory officer, left in 1985 and was replaced by Mrs C.M. Wilson (née Brown) at the completion of her work preparing a Guide to the Threatened Plants of New Zealand which was funded by the New Zealand Lottery Board. Mrs Wilson resigned in November 1987 and was replaced by Miss T.A. Mitchell. The position of advisory officer has been heavily involved in promoting the Division's work and servicing the much increased demand for reporting for accountability purposes. A particularly visible part of this work has been the selling of books, posters and cards, which both publicises the work of Botany Division and provides revenue.

Botany Division has enjoyed a high level of presentation of its work to the public directly through the *Botany Division Newsletter* and *Resource Research* and through items in newspapers, magazines, and presentations on radio and television. Staff have continued to be in demand to give public lectures and talks and to contribute their expertise to boards and committees.

MEETINGS

The Eighth Biennial Meeting of Botany Division was held at Lincoln in July 1985 and involved an internal review of the Division's current research activity and an assessment of the priorities and balance of different parts of the research programme. This meeting also functioned as a preliminary to a meeting held at Cass in May 1986 to draw up a plan for the Division which was in line with DSIR Corporate objectives. As noted previously, the role, goals and objectives formulated at the Cass meeting were reviewed at the 1989 Biennial Meeting. Modelled on the experience of the 1983 meeting held at Akatarawa, Wellington, the September 1987 meeting was held at Waihora, near Dunedin. Largely organised by the Dunedin regional botanists, the meeting was used to make contact with local people interested in botany and this contact was highlighted by a very successful day devoted to the theme "Botany as a Cultural Pursuit".

During the triennium the Division organised several public meetings to mark significant achievements by the Division and the research contributions of long serving staff members. These were a "Lichen Seminar" held in March 1985 to launch "Flora of New Zealand Lichens" written by Dr D.J. Galloway, a "Seed Seminar" held in July 1985 to mark the research contributions of Mrs M.J.A. Bulfin, a seminar on "The Use of Experimental Gardens for Botanical Research" held in June 1986 to mark Mr I.C. Brown's contributions to the divisional garden, a seminar on "Phycology and Water Quality" to mark Dr U.V. Cassie-Cooper's contributions in this area held in October 1986, and a conference on "Time, Change and the Vegetation of New Zealand" held in November 1987 to mark the retirement of Dr N.T. Moar. Accounts of the first four seminars are available as supplements of *The Botany Division Newsletter* and the proceedings of the conference

marking Dr Moar's retirement are to be published by the Royal Society of New Zealand.

Botany Division staff have also been to the fore in assisting in the organisation of meetings by those societies that relate to botany. The Division has been supportive of the New Zealand Botanical Society which began its existence during the triennium arising from initiatives taken at the symposium which marked Dr E.J. Godley's retirement in 1984. It is appropriate to note here the particular contribution which has been made by Mr A.E. Wright, Herbarium Curator, Auckland Institute and Museum, to the establishment of the New Zealand Botanical Society.

RESEARCH PROGRAMMES

The comprehensive listing of current projects first made in June 1983 was updated in 1985. The update due for June 1987 was not carried out because of corporate demands by both DSIR and DOC to redefine projects in terms intended to facilitate accountability procedures. Practical definition of these terms was not achieved during the triennium. In spite of what was a very unsettling situation of administrative change and financial uncertainty very significant progress was made towards well defined research objectives. Some highlights are noted in this section and details are given in the body of this Report.

The triennium saw the completion of major stages of the Flora of New Zealand Series. The Lichen Flora was published in 1985, and the work of Dr H. Croasdale, Dartmouth College, New Hampshire, USA, and Dr E.A. Flint, Research Associate, Christchurch, resulted in the publication of Volume I, and completion of the text of Volume II of the Desmid Flora in 1987. The Flora for naturalised dicotyledons, gymnosperms and pteridophytes was brought to a stage in preparation for publication in 1988 and there was continued intensive effort on the Grass Flora.

Further significant progress was made in the survey of natural vegetation in New Zealand both through the biological Surveys of Scenic and Allied Reserves and Protected Natural Areas Programmes which came under the administration of DOC, and through projects initiated by Botany Division. There has been a firm intent to advance studies of processes both at species and community levels in recognition of the need for information in this area to assist management of vegetation for both conservation and production purposes. Work on three books, "The Vegetation of New Zealand" by Dr P. Wardle, "Wetland Plants in New Zealand" by Dr P.N. Johnson and illustrated by Ms P.A. Brooke, and "Threatened Plants of New Zealand" by Mrs C.M. Wilson and Dr D.R. Given reached advanced stages of preparation during the triennium.

The value of knowledge gained about past climatic changes by application by Botany Division's palynologists of techniques to describe vegetation changes during the Quaternary, was highlighted by increasing concern about the impacts of global warming through the "greenhouse effect". It is regrettable that work in this area, as well as in freshwater phycology, cytology, seed morphology and plant taxonomy, all of which have made unique contributions in the national interest, has had to be severely curtailed because of funding cuts. This negative development has been compensated to a very helpful extent by the voluntary work of the Research Associates and

Friends of the Herbarium whose continuing efforts will allow the achievement of several long term objectives and more effective operation of the national facilities provided by Botany Division.

THE HERBARIUM

International Code, CHR

(Herbarium Keeper Dr M.J. Parsons)
(Assistant Keeper Miss B.H. Macmillan)

The Herbarium at Botany Division, the largest in New Zealand, has about 477,000 specimens (as of December 1987); this includes all groups of plants. Although the Herbarium has a small important Greta Stevenson collection of fungi, most other fungi are placed in the Herbarium of Plant Diseases Division (PDD), DSIR in Auckland. We believe we hold the largest South Pacific Island collection after the Bishop Museum in Honolulu, Hawaii.

During the 1985-7 period an average of 8484 higher plant specimens were deposited each year. While the taxonomic staff have been engaged in writing the volume of the Flora dealing with naturalised pteridophytes, gymnosperms and dicotyledons, there has been a special effort to include more of these plants into the annual accessions. Various families of the angiosperm collections have been revised as a result of the preparation of the text for the Flora of New Zealand Vol. 4. Approximately 240 new genera of higher plants have been added to the Herbarium during this period.

As a method of day to day insect control we have phased out heat treatment which often made the specimens very brittle and now use a 700 litre deep freezer to sterilise all incoming parcels of specimens and mounted specimens before filing.

IDENTIFICATION SERVICE

Botany Division's identification service, managed by Mrs Pauline Douglass, was used extensively by other government departments and the public, especially the Ministry of Agriculture and Fisheries, Forestry and Noxious Plants Officers. This specialised service is based on the extensive herbarium collections, accumulated research experience and skilled staff of the Division. The Division benefited from this identification service as a valuable source of weed distribution information and new records of weeds in New Zealand. In 1985 1177 specimens were determined. In September 1986 the general government policy of recovering costs for services was implemented and we charged \$20 for an identification. As a result of this policy we only handled 619 identifications in 1986. The first full year of charging for identifications was 1987 when we handled only 204 specimens. We believe the loss of weed distribution information as a consequence of this charging policy is considerable.

EXTENSIONS TO THE HERBARIUM

The most important event for the Herbarium in the 1985-7 period has been the building of extensions. Planning for these began as long ago as 1973 when the then Director, Dr Eric Godley, asked the younger botanists to think about extending the Herbarium which was rapidly filling with specimens so that the working space was greatly reduced. In 1979 Mr Les Matthews, a young architect, with the Christchurch District Office of the Ministry of Works and Development, produced the basic plans for the outline of the present building.

The urgent requirement for extra space was met by a two-stage plan. The first stage adding six meters on to the front of the older Herbarium and lifting the roof line, was completed in March 1981. The larger second stage which includes a two-storied section built on the side of the older portion, was started in June 1986 and handed over in October 1987. This will increase the storage capacity of the Herbarium by nearly three times. There is a special room for the plant drier and the Preparation Room is about three times larger, affording plenty of room for several people to be pressing, mounting and sorting specimens. Seven new staff rooms and a purpose-built computer and labelling room have eased the previous congestion. The old preparation room has been converted into a laboratory with a water and soil proof resin bench top to provide a preparation area for soil-encrusted plants or the wet collections of marine or freshwater algae.

An interesting feature of the building is a trombe wall that will supplement the heating of the herbarium by using solar energy. The contractors were J.J. Construction Company Ltd with the successful tender of \$937,000. The building has been supervised by John Blackwell, John Snackers and Whareanga Rigby of the Ministry of Works and Development, Christchurch.

This fine new building is a far-sighted commitment to meet the national requirement for a herbarium and biosystematic research on plants well into the next century. Recent cuts in government finance to DSIR has meant that initially only 25 tall herbarium cabinets could be bought and second-hand furniture was obtained to furnish part of the new area from other sections of DSIR that had closed down or moved from Christchurch during 1987. On 19 October, 1987, the staff began moving into their new offices and later the mosses, liverworts and half the lichens were moved into the cryptogamic room upstairs. The other cryptogams will be moved when there are sufficient cabinets.

With the extensive re-arrangement of collections and the production of a new volume of the angiosperm Flora due in November 1988, the opportunity to update the angiosperm classification has been taken. The old system based on Hutchinson, J. 1926-1934, *The Families of Flowering Plants*, has been replaced by one modified from Dahlgren, R. 1983, *Nordic J. Bot.* 3: 119-149; and Dahlgren, R.; Clifford, H.T.; Yeo, P.F. 1985, *The Families of the Monocotyledons*.

It is planned to open the Herbarium extensions on 21 November, 1988. Two large signs in brass as well as the new Divisional logo or badge of a *Podocarpus totara* in granite now distinguish the Herbarium building for the visiting public.

FRIENDS OF THE HERBARIUM

In August 1986, the first of five members of the Canterbury Botanical Society volunteered their services to the Herbarium. Up until the end of 1987 these five "Friends of the Herbarium" as they are known, have given 1830 hours of voluntary service to the general curation in the Herbarium. They have been mounting, laying in, and sorting specimens, checking map references and recently have been using the CHIRP computer program to produce herbarium labels. Their assistance is invaluable and their presence a considerable boost to staff morale in these financially difficult times. The Friends have also been actively promoting the sale of Botany Division posters and cards. In 1987 eight coloured transparencies from the Margaret Aiken Collection were made up into plain landscape-style cards of "New Zealand's Native Plants" featuring: *Arthropodium cirratum*, *Brachyglottis lagopus*, *Gentiana bellidifolia*, *Geranium traversii*, *Parsonsia capsularis*, *Ranunculus crithmifolius*, *R. lyallii*, *Selliera radicans*. Three to five lines of up-to-the-minute botanical information was included along with the new totara logo of the Division. The Friends also operate the mail order service for cards and posters for the Division.

HERBARIUM QUICK CHECK

During a visit in April 1987 by Dr Warwick Harris to the Herbarium of the Botanic Gardens in Sydney (NSW) he used the "spot collection" in the genus *Leptospermum*. Representative specimens of each species, subspecies, variety or form recognised within the genus had been placed together in a folder or folders, the "spot collection", and placed at the beginning of the genus for easy reference. This proved to be so convenient that the idea has been taken up by our Herbarium, but we have called ours "Quick Check". Herbarium folders tagged with blue card and the words "Quick Check" will now be placed at the beginning of each genus as time permits. The blue colour code was chosen to distinguish these folders from the red reserved for types and yellow for loans. It is believed that this system will help visitors in the absence of a special public reference collection.

HERBARIUM ELECTRONIC DATA PROCESSING (CHIRP)

The first attempts at Electronic Data Processing (EDP) using the Christchurch Herbarium Information storage and Retrieval Project (CHIRP) began in 1982. At this time it was intended to use the SELGEM program to sort and retrieve information but the more recent (1986) development of the Database Vax (Division of Information Technology (DIT), DSIR) at Gracefield, using the indexing capacity of the BASIS data management system, has superceded the SELGEM program. Modifications have been made in the development of CHIRP by Bruce Muschamp (DIT) so that a wider range of terminals e.g. Digital VT100 and VT200 series can be used. Although CHIRP's basic conception, operating features and programming was satisfactory, an underestimation of the overall size of the task, unrealised financial support, staff reluctance to become involved and weakening of the management effort, necessitated a review of the Herbarium and EDP operations in June 1985. The Review Committee recommended that to overcome the widespread mistrust of the

CHIRP system, and resistance to it by plant collectors, the field form and the final herbarium label should be modified to allow more free-form writing area so that both would become more like the conventional herbarium label but with the addition of habitat keywords (for the ecologists) and an increased area in the remarks (for the taxonomists).

A new field form was designed and given a year's trial in July 1986. This has proved to be more acceptable. The present hardware consists of two Digital VT220 terminals with a Microline 92 dot matrix printer using specially formatted labels. The map grid references are now converted from imperial to metric and to latitude and longitude automatically.

The CHIRP User's Manual originally written by Bruce Muschamp (DIT), was extensively edited by Janie Glasson, Colin Meurk and Murray Parsons to enable any staff member to begin using CHIRP to place information on file and to produce herbarium labels. All early CHIRP records and those of the pilot scheme have been checked against the new CHIRP program and any errors corrected. There is at 31 Dec. 1987, a database of 12,877 records on the Database Vax at Gracefield. All new accessions are being added to the database. The backlog of specimens (25,000 of which are already prepared by temporary workers) will only be processed as time and money permits. The volunteers, the Friends of the Herbarium, have been assisting by putting new accessions on file and producing labels.

Comprehensive thesauri of Plant Names, Authors and Habitat Keywords have been developed and incorporated into the CHIRP program to be a spelling and format check and for retrieval. Additions can be made to the thesauri at any time.

There is a purpose-built room in the Herbarium extensions for the two terminals and the Microline printer used for printing herbarium sheet labels.

MANAGEMENT AND STAFF

In 1985 a small committee was set up to review the CHIRP electronic storage and retrieval system for herbarium records. This review committee also recommended that there be an Herbarium Management Committee of three: Dr M.S. McGlone, Dr C.D. Meurk and the Herbarium Keeper. In 1985 Dr D.R. Given, the Herbarium Keeper, was invited by IUCN (International Union for the Conservation of Nature) and WWF (World Wildlife Fund) to write a book on the Principles and Practice of Plant Conservation. Dr Given relinquished the position of Keeper and was replaced on 1st April 1986 by Dr M.J. Parsons. At this time it was also decided that the position of Herbarium Keeper would be reviewed every two years.

There have been few staff changes in the Herbarium during this triennium. We are very grateful for assistance from the Project Employment Programme (PEP) where young people worked with us for six months at a time. G.L. Ashby assisted by preparing backlog specimens for the computer program CHIRP. Karen L. Rooks helped to file away part of the important Pacific Islands collections. Elizabeth H. Woods began helping prepare specimens for the computer backlog and then she moved into a temporary staff position in the Preparation Room when David Freeman resigned. Deidre McFie, Phillipa Rutledge and Jill Slow also helped with the Pacific Islands collections and the grasses in the Herbarium.

We are grateful to the following donors of specimens:

Dr J. Beever: Mosses of northern North Island

Dr P. Berry: *Fuchsia*

Mrs J. Brownlie and family: G. Brownlie bryophyte herbarium

Mr W.D. Burke: Nelson Lakes National Park

Dr J.R. Clarkson: Isotype of *Jedda multicaulis*

Mr S. Courtney: East Cape and South East Is, Chatham Is

Dr K. Dickinson: Nokomai and Umbrella Ecological Districts

Dr J. Elix: Lichens from Australia and New Zealand

Dr D.J. Galloway: Lichens, especially *Pseudocyphellaria*

Mr D. Glennly: Mosses of Nelson and Canterbury

Mr P.J. de Lange: Waikato region

Mr A.P. Druce: Nelson mountains

Mr A.J. Healy: Naturalised species

Dr H. Hertel: New Zealand lichens

Ms C. Mason: Heron Ecological District

Mr C.C. Ogle: Wildlife Service Surveys

Messrs J.W. and P.J. Parham and Mrs E.H. Woods: Specimens, catalogues and notebooks of B.E.V. Parham

Mr R.D. Seppett: Monocotyledons and *Acaena* from Macquarie Island

Mr W.B. Shaw: Urewera National Park

Dr L. Tibell: Lichens, especially Caliciales

Dr A. Whistler: Pacific Islands

Mr H.D. Wilson: Banks Peninsula

Aquatic Plants Section, Ministry of Agriculture and Fisheries: Vouchers from Upper Hurunui R. lakes

In 1985 Mr J. Habgood of Lincoln donated Volumes I and II of a collection of British grasses and sedges "arranged according to the third edition of practical observations on grasses, by Mr William Curtis . . . sold, properly arranged, by Curtis and Salisbury, at the Botanic Garden, Brompton, 1802". It is suggested that these volumes may have been brought to New Zealand last century and used for teaching at Lincoln College. The specimens are in very good condition.

LOANS

One hundred and twenty-six outward loans were made; 72, more than half, to overseas institutions.

Ninety-three inward loans, 27 from overseas, were concerned with the revision of grasses, naturalised plants and mosses for the Flora series.

EXCHANGE

Duplicate specimens were sent to 47 herbaria. Some of the larger consignments were received in exchange from:

Australia: State Herbarium, Adelaide; Tasmanian Herbarium, Hobart; National Museum, Melbourne; Royal Botanic Gardens, Sydney.

USA: Bishop Museum, Honolulu; Missouri Botanical Gardens.

Europe: Royal Botanic Gardens, Kew; Komarov Botanical Institute, Leningrad.

Japan: Kobe-Gakuin University; University of Tokyo.

New Zealand: Auckland Institute and Museum; University of Auckland. Exchange was opened with four Chinese herbaria, at Guangxi, Guangzhou, Nanjing, and Beijing, following the visit to China by Dr W. Harris.

We are particularly grateful to the Missouri Botanical Garden for a large number of specimens of the woody flora of New Caledonia collected by Mr G. McPherson. The extension of the Herbarium allows us to curate and file this important material.

VISITORS

Overseas visitors who have worked in the Herbarium are Drs R.J. Chinnock, P.S. Green, H. Hertel, H. Mayrhofer, C. Quinn, C.E. Sonck, J. West, M. Willson, and Messrs J. Alex, R.O. Belcher, C. Crane, M. Gray, C.G. Gunn, N. Lander and D.M. Porter.

ANNOTATED CHECKLISTS OF NEW ZEALAND PLANTS

In June 1987 it was decided to proceed with a series of Checklists of New Zealand Plants for all groups except the fungi. It is believed that this will be an appropriate way of communicating accepted name changes to the botanical public of New Zealand. These checklists, which will include synonyms, will be maintained by the Herbarium staff according to the current practice used in our Herbarium where changes come about under the direction of the various taxonomic specialists in New Zealand. In some cases the checklists will be maintained by the taxonomists involved in their special groups.

These checklists will provide a statement on current botanical taxonomic knowledge and will serve to emphasize those areas that require taxonomic revision. These lists might well assist in establishing priorities and encourage other botanists, especially students at University, to participate in revising genera.

At present many of the checklists are being compiled to the first draft stage. Information from these drafts is available on request but it is likely to be some time before many of the lists are able to be published.

Recently published checklists include:

Revised checklist of Freshwater Algae of New Zealand, Parts I and II (excluding diatoms and Charophytes) as published by Cassie, V. 1984, Water and Soil Technical Publication Nos 25 & 26.

Checklist of Freshwater Diatoms of New Zealand, as published by Cassie, V. 1984, *Bibliotheca diatomologica* 4 (3): 5-129.

Checklist of New Zealand Pteridophyta, by Brownsey, P.J.; Given, D.R.; Lovis, J.D. 1985, *N.Z. J. Botany* 23: 432-435.

Checklist of Gymnosperms naturalised in New Zealand, by Sykes, W.R. 1981, *N.Z. J. Botany* 19: 339-341.

Checklists of New Zealand Dicotyledons, based on list below:

1. Webb, C.J. 1978, Umbelliferae. *N.Z. J. Botany* 16: 387-390.
2. Sykes, W.R. 1978, Lamiales. *N.Z. J. Botany* 16: 391-395.
3. Given, D.R. 1979, Valerianaceae, Dipsacaceae, and Calyceraceae. *N.Z. J. Botany* 17: 301-302.
4. Garnock-Jones, P.J. 1979, Rhoadales. *N.Z. J. Botany* 17: 303-310.

5. Webb, C.J. 1980, Leguminosae. *N.Z. J. Botany* 18: 463-472.
6. Webb, C.J. 1981, Araliaceae, Buxaceae, Cornaceae, Casuarinaceae, Celastrales, Euphorbiaceae, Linaceae, Malvaceae, Polygalaceae, Urticales. *N.Z. J. Botany* 19: 45-51.
7. Sykes, W.R. 1981, Scrophulariales. *N.Z. J. Botany* 19: 53-57.
8. Garnock-Jones, P.J. 1981, Aizoaceae, Caryophyllaceae, and Portulacaceae. *N.Z. J. Botany* 19: 59-65.
9. Garnock-Jones, P.J. 1981, Ceratophyllaceae, Nymphaeaceae, Ranunculaceae, and Violaceae. *N.Z. J. Botany* 19: 157-160.
10. Sykes, W.R. 1981, Polemoniales and Boraginaceae. *N.Z. J. Botany* 19: 311-317.
11. Sykes, W.R. 1981, Apocynales, Campanulales, Ericales, Gentianales, Loganiales, Plantaginales, Primulales, and Rubiales. *N.Z. J. Botany* 19: 319-325.
12. Sykes, W.R. 1982, Haloragales, Myrtales, Proteales, Theales, Violales (excluding Violaceae). *N.Z. J. Botany* 20: 73-80.
13. Given, D.R. 1982, Rosaceae. *N.Z. J. Botany* 20: 221-226.
14. Sykes, W.R. 1982, Chenopodiales and Polygonales. *N.Z. J. Botany* 20: 325-331.
15. Sykes, W.R. 1982, Annonales, Berberidales, Cactales, Fagales, some Geraniales, Juglandales, Laurales, Rurales, Salicales, Sapindales, Tiliales, Nyctaginaceae, and Zygophyllaceae. *N.Z. J. Botany* 20: 333-341.
16. Given, D.R. 1984, Compositae — tribes Vernonieae, Eupatorieae, Astereae, Inuleae, Heliantheae, Tageteae, Calenduleae, and Arctoteae. *N.Z. J. Botany* 22: 183-190.
17. Given, D.R. 1984, Crassulaceae, Escalloniaceae, Philadelphaceae, Grossulariaceae, Limnanthaceae. *N.Z. J. Botany* 22: 191-193.

Checklist of the New Zealand Monocotyledons:

1. Edgar, E.; Shand, J.E. 1987, Checklist of Panicoid grasses naturalised in New Zealand; with a key to native and naturalised genera and species. *N.Z. J. Botany* 25: 343-353.

The Flora of New Zealand, Volume IV, describing naturalised dicotyledons, gymnosperms, ferns and fern allies, will be published in late 1988.

ALGAE (Mrs M.D. Wilson and Dr M.J. Parsons)

During this triennium the general curation of the marine algal collections has been completed, repairing specimens, sorting and remounting small sheets from the W.A. Scarfe and L.B. Moore collections and inserting many sheets into light weight paper folders ("flimsies") for better protection. Some duplicates of these collections have been set aside for distribution later. The algal collections are now in need of further space; some overflow from the browns and the greens has been boxed. No duplicate marine algae have been sent out since 1984 but valuable exchange material has been received from Santiago (SGO), Chile; Dr M. Edding, Coquimbo, Chile; Prof. H.B.S. Womersley, Adelaide (ADU), Australia (139 Tasmanian marine algae and 92 Exsiccatae Marine Algae of Southern Australia).

The 5 × 8 card index to all algal names used in New Zealand has been added to with student help during the summer vacation.

BRYOPHYTES AND LICHENS (Miss B.H. Macmillan and Dr A.J. Fife)

The bryophyte collection is much improved with the incorporation of exchange material received from Missouri Botanical Garden, University of Michigan, New York Botanical Garden, University of Helsinki, British Antarctic Survey, Dr C. Matteri, Buenos Aires, and National Botanic Gardens, Canberra. The R. Spruce exsiccata Musci Amazonici et Andini (1849-60), which was received from Victoria University Botany Department in 1969 and totals 871 specimens, has been recurated and prepared for incorporation into the main herbarium.

Dr Fife has contributed 2,429 collections, and Dr J. Beever, Dr S. Halloy, D. Glennly and H.D. Wilson have presented vouchers from their study areas. In 1987 the family of the late Dr G. Brownlie presented his bryophyte collection of 827 specimens from Canterbury and Nelson. The moss and hepatic collections of Dr J. Child, 12,300 packets, which were received in late 1984 have been numbered and prepared for incorporation.

Dr J. Engel of Field Museum, Chicago, has begun sending named duplicates of New Zealand collections of hepatics. The hepatic specimens of Dr J. Child have been divided to provide a set for study by Dr Engel and retention at Field Museum, as was Dr Child's wish.

A start has been made with the amalgamation of the indigenous and foreign hepatics into the system proposed by Grolle, R. *Nomina Generica Hepaticarum Acta Bot. Fennica 121*: 1-62, 1983, with guide cards colour-coded for geographical regions.

The lichen collection has received an impetus with the publication of Dr D.J. Galloway's *Flora of New Zealand — Lichens*, 1985, which provides an invaluable reference to synonymy and to type specimens. We are grateful to Drs D.J. Galloway, British Museum, J.A. Elix, Australian National University, L. Tibell, Institute of Systematic Botany, Uppsala, and H. Hertel, Botanische Staatssammlung, Munich, who sent duplicates from the groups on which they work. Royal Botanic Gardens, Sydney, sent 127 duplicates of early Australian and New Zealand collections.

Following the death of Mr Peter Child of Alexandra, Otago, in April 1986, his family presented his lichen herbarium of 2,860 packets. Peter had corresponded with David Galloway since 1973 and contributed much information to the Flora volume.

A great deal of repackaging of older New Zealand specimens of bryophytes and lichens is required. Our present level of staffing does not permit this. The assistance of temporary workers and Friends of the Herbarium with curatorial work is much appreciated.

Loans to taxonomists working on bryophytes and lichens are continually requested and constitute 30 percent of the outward loans sent by the Herbarium.

THE LIBRARY

(Mr R.E. McNaughton)

The triennium was a period of change and challenges for the DSIR Lincoln Library. The new economic climate resulted, as elsewhere, in financial pressures, but it was a time of much progress with the introduction of extensive library automation.

The library lacked a librarian-in-charge for some 14 months after the resignation of Mr John Knox. However, in August 1985, Mr Ritchie McNaughton was appointed to the position. Mrs Jan Taylor was supported by Botany Division to study for the New Zealand Library Studies Certificate, which she completed successfully in May 1987. However, she resigned in August 1987 and it was not possible to replace her. In March 1987 Miss Heather Reid was employed by DSIR Lincoln under the Maori-Pacific Islander Scheme and her time was shared equally between the library and the Centre's Record Section.

After the appointment of the new librarian-in-charge, the DSIR automated library systems were implemented in full. Training was given by DSIR Library Centre in all aspects of the systems. The library already possessed a VT220 terminal, and was able to purchase the other necessary equipment — an Anadex printer to produce high quality catalogue cards, and a Bondwell personal computer (with printer) which could also be used as a VAX terminal. The library was now able to computerise cataloguing, card production, book ordering, and the production of disposal lists and overdue notices; it could also create its own databases and exploit to the full the resources of the automated systems. In 1986 the library also gained access to NZBN (New Zealand Bibliographic Network), which contains the national union catalogue and the national bibliography and also the national bibliographies of the United Kingdom, the United States, Canada and Australia. Extensive use of DIALOG continued.

As a result of the implementation of the DSIR automated library systems, it was an important priority to record the library's holdings on the DSIR Bibliographic Network's database LIBRA. DSIR's union catalogue, to prepare for a completely automated catalogue in the future. As the library's serial holdings were inadequately recorded, the cataloguing of the serials collection was undertaken with some urgency, and considerable progress was made. The A.P. Druce Collection at Botany Division's regional station at Taita, donated to the Division by Mr A.P. Druce on his retirement in 1982, was catalogued and a database (DRUCE) created for the records. Catalogue cards for the library, Mr Druce and the New Zealand Soil Bureau Library at Taita, and a printed list were produced from the database.

Financial constraints resulted in the necessity to cancel some 20 journal subscriptions in 1986 and another 50 in 1987, with a total saving of about \$7000. Some useful weeding of subscriptions was achieved, but journals of interest were cancelled, including some held by no other New Zealand library. After February 1986 it was not possible to order any new books or journals for Botany Division for the rest of the triennium as funds were not available.

The library received many generous gifts of books from staff, former

staff and interested individuals and organisations, and the library was grateful to be able to strengthen its collection with these donations. Also, in 1985 the library successfully applied for a Strengthening Resources Grant of \$2400 from the Trustees of the National Library and was therefore able to purchase Lamarck's Herbarium on microfiche.

The circulation of journals on the Lincoln campus ceased in mid 1986 and a display system was instituted with great success. Current journals became immediately available to all staff and the strength of the collection became more apparent. Circulation to regional stations and other libraries continued.

The volume of interloans continued to increase, both for outgoing and incoming requests. The library was a net lender, lending some two and a half times more items than it borrowed.

In early 1987 the library became involved with the Centre's Records Section in an advisory capacity. After training at Head Office in the use of the Records Management System, the librarian-in-charge assisted the Section with the automation of its records.

From October 1987 the library became part of the DSIR Lincoln Centre and ceased to be administered by Botany Division. As a result, both Botany Division and Crop Research Division and all the regional stations on the Lincoln campus now contributed to the funding of the library's overhead costs.

EXPERIMENTAL GARDENS

(Mr A.W. Purdie)

Location:	23 km southwest of Christchurch
Latitude:	43°38' South
Longitude:	172°30' East
Altitude:	11 m a.s.l.
Topography:	Flat to undulating
Soils:	Wakanui plus Templeton soil series on post-glacial alluvium
*Rainfall:	Mean annual 744 mm Annual variation in rainfall is large and rain does not fall uniformly throughout the year. Periods of low rainfall or drought can occur
*Temperature:	Mean maximum 15.3°C Range of means 9.7°C (July) to 20.9°C (January) Mean minimum 5.8°C Range of means 1.5°C (June) to 10.7°C (January)
*Ground frosts:	Mean annual 89 days
Wind run:	Mean annual 10,973 km
Prevailing winds:	NW, SW, and NE Most wind occurs in Spring and Summer (September-March) with least in Winter (May-July).

* Meteorological data from DSIR Weather Station, Lincoln.

A major staff change occurred with the retirement in June 1986 of Mr I.C. Brown who had been Officer-in-Charge of the Experimental Gardens since 1960. A seminar on "The Use of Experimental Gardens for Botanical Research" was held at DSIR, Lincoln, to celebrate Mr Brown's retirement. He is succeeded by Mr Andrew Purdie, a Senior Technical Officer at Botany Division with experience in plant breeding and biochemistry.

FUNCTION OF EXPERIMENTAL GARDENS

The primary function continues to be the maintenance of experimental plant collections for the purposes of a wide range of botanical research. Specimens cultivated are predominantly New Zealand indigenous species, although related plants from other Pacific Islands and elsewhere are also grown. A more recent, and increasingly important, function is the propagation and production of a diverse collection of native and exotic plants for landscape purposes at the adjacent Canterbury Agriculture and Science Centre at Lincoln.

Plants are also cultivated for divisional revenue purposes. A policy for the sale of plants has been prepared and a number of revenue-earning projects are already under way. These include the commercial production of selected native and exotic plants. A seed collection for sale and exchange purposes is also proposed. This would be established in conjunction with an Index Seminum for circulation in New Zealand and overseas.

The present plant collection includes approximately 10 000 container-grown specimens and 6 500 specimens in experimental and landscape plantings. 497 genera and 1 158 species are represented.

SUPPLEMENTARY COLLECTIONS

In October 1986 we relinquished the noxious plants collection which had been maintained at the Experimental Gardens for many years on behalf of Canterbury Branch of the Noxious Plants Council. Loss of this collection can be attributed to DSIR's new revenue-earning policy by which we are obliged to charge for our services. The Noxious Plants Council were unable to provide the small financial contribution requested for the maintenance of the plant collection at Lincoln and subsequently relocated it on Council land at Rangiora.

A small collection of plant cultivars and forms of horticultural potential are held for Plant Variety Rights, Ministry of Agriculture and Fisheries.

In late 1987 a national flax collection was established to preserve the resource of this important native fibre plant (*Phormium tenax*). The collection is based on plants gathered from 60 localities throughout New Zealand over the past 30 years by Mrs Rene Orchiston of Gisborne. Mr Geoff Walls of Botany Division's sub-station at Havelock North supervised the acquisition of the collection which is duplicated at Havelock North and Lincoln.

EXPERIMENTAL LAND

The gardens occupy 9 ha of land at two localities. The Headquarters Block, consisting of approximately 2 ha of flat land, is divided into 15 experimental plots each of 1 000 m² and fully irrigated from a 15 cm well and portable surface spraylines. A new sprinkler system, introduced in 1986,

replaced a less efficient oscillating system. Current long-term experimental projects in plots include plants of *Sophora*, *Fuchsia*, *Pachystegia*, native brooms (*Carmichaelia*, *Notospartium*, *Coralliospartium* and *Chordospartium*), as well as New Zealand and Australian species of *Leptospermum* and the related *Kunzea*. A valuable reference collection of New Zealand and South American species and hybrids of *Cortaderia* is maintained, and a pilot project in Economic Botany to determine fructose levels in *Cordyline australis* complete the Headquarters Block. Seven ha at East Block, which is situated 1.5 km away from the Division's headquarters, has been developed to accommodate large projects and permanent plantings. This area, although fully irrigated, is under-utilised for experimental purposes and is likely to remain so on account of its relative isolation and poor soil type. Plants featured at East Block include indigenous *Nothofagus* species, *Sophora* hybrids and *Phormium tenax*.

PROPAGATION AND NURSERY FACILITIES

These include two 5.5 × 9.0 m glasshouses attached to a potting shed, three 2.5 × 3.0 m isolation glasshouses, a 5.0 × 9.0 m glasshouse for ecological experiments, and a 3.0 × 7.0 m propagation glasshouse equipped with a new two-stage mist control system. All glasshouses have supplementary heating and automatic ventilation is being progressively installed.

Three 5.5 × 9.0 m shadehouses with automatic overhead irrigation, a 2.5 × 7.5 m shadehouse, four 2.5 × 7.0 m coldframes and a new 8.0 × 17.0 m nursery yard complete the experimental facilities.

PLANT COLLECTIONS

A wide range of container-grown plants is maintained for scientific and landscape purposes. The main experimental collections include native ferns, grasses, orchids, brooms, and conifers, *Celmisia*, *Leucogenes*, *Helichrysum*, *Raoulia*, *Hydrocotyle*, *Rhopalostylis*, *Lepidium*, *Clianthus*, *Leptospermum*, *Kunzea* and *Acaena*. Small collections of sub-Antarctic, Raoul and Norfolk Island endemics are maintained.

A large number of native plants are being propagated and maintained for use in the proposed re-landscaping of Botany Division grounds which have been extensively disturbed during development of the Canterbury Agriculture and Science Centre and completion of the Botany Division Herbarium extension. The project, now in the planning and development stage, will feature systematic plantings of native species including Chatham Island plants, conifers (*Podocarpus*), cedars (*Libocedrus*), celery-leaved pines (*Phyllocladus*), small-leaved and "divaricating" shrubs, deciduous natives, and species with distinctive juvenile forms.

ART AND GRAPHICS

(Ms P.A. Brooke)

Vicky New left on 31 January 1986 to join an Art and Graphics team working for the Correspondence School in Wellington. Anne Hodgins returned from her long leave in England to rejoin Art and Graphics on

10 March 1986 — ten months later she returned to England as Mrs Hodgins Jones. Carolyn Browne then joined the staff as a replacement for Anne.

As well as servicing the other DSIR Divisions, the illustrations section has done the artwork required for the publications produced by Botany Division during the last three years. In order to gain revenue the section has also contributed botanical drawings to publications by scientists from other establishments.

There is now a great demand for design and display work for exhibition purposes. In 1985 there were four requests for displays, in the last year there have been twenty-four such requests — a reflection of the changing style of the Department and cheering evidence of our scientists' ability to take their work out-and-about. The installation of a computer based desk-top publishing unit next year (May 1988) should further the revenue earning capability of the section. Art and Graphics became part of the DSIR Lincoln Centre in October 1987. Altogether this was a stimulating and innovative, if somewhat hectic, three years.

ADVISORY AND SERVICING

(Miss T.A. Mitchell)

More than ever before the Division is involved in responding to requests for botanical and administrative information. To help minimise disruption to the scientific programme an advisory officer is employed, and this position has evolved over the years. In reaction to an imposed revenue earning requirement it became necessary to raise public awareness of our research activities, national role, and to inform potential clients of our capabilities. In furthering this aim a brochure outlining services and research opportunity was produced; its cover features the new logo. The logo, designed by Carolyn Browne, is eye catching and attractive; it depicts a fruiting totara branch set against a backdrop of hills and mountains. The totara represents strength and durability, and a tree will be planted to mark the opening of the new Herbarium wing.

In some areas we were able to provide services on a cost recovery basis, for example, in plant identification, pollen analysis of honey for export, as consultants to advise on the impact of development proposals, and vegetation surveys in this country and overseas. As little of Botany Division's work readily lends itself to commercial application, careful thought is necessary before resources are allocated to further commercial development. Other promotional work is achieved through displays of the Division's work, articles in various newsletters and magazines, and through the sale of publications, cards and posters.

During the period under review the Division commented on 209 environmental impact assessments, including planning and legislative documents, land use policy, mining and prospecting licence applications. These ranged from those concerning local issues to various large scale proposals such as gold mining on the Coromandel Peninsula and peat mining on the Chatham Islands. In addition comment was supplied on procedural matters of national significance such as the Town and Country Planning Act.

Formal association with the Christchurch Botanic Gardens has begun with staff spending time working at the information centre on a rostered basis. The Division benefits by having access to collections held there, a high profile venue for displays, and a retail outlet for selling cards and posters. In return the Gardens are able to call on our expertise in their own research areas and we can answer botanical enquiries from visitors to the information centre. Due to the increasing demand for accountability within government departments advisory and servicing work will continue to expand in the future.

INFORMATION SERVICES

(Dr A.D. Thomson)

BOTANY DIVISION NEWSLETTER

The purpose of *BD Newsletter* was summarised in *Triennial Report 1982-84*, p. 24. During the present triennium 17 issues were distributed (Nos. 100-117). In addition 4 supplements were distributed:

1. *BD Newsletter Supplement No. 2* (1985) recorded the proceedings of a Lichen workshop to commemorate the publication of David Galloway's "Flora of New Zealand Lichens" (1985).

2. *BD Newsletter Supplement No. 3* (1986) recorded the proceedings of a Symposium on Research on the Vegetation of New Zealand to mark the retirement of Dr Eric Godley in 1984.

3. *BD Newsletter Supplement No. 4* (1987) recorded the proceedings of a Seed Seminar to mark the retirement of Margaret Bulfin in 1985.

4. *BD Newsletter Supplement No. 5* (1987) recorded the proceedings of a Gardens Seminar to mark the retirement of Ivor Brown in 1986.

Because of the need to recover the cost of producing the Newsletter and to improve its distribution, *BD Newsletter* has been formally registered as a publication though it remains the house journal of Botany Division. The subscription is \$12.00 for 3 issues (including postage) and includes any supplements that are published from time to time. There is a concession subscription rate of \$1.50 for 3 issues to cover postage for those who cannot afford the full rate. Copies of all issues from No. 1 (1974) are available at \$4.00 per copy. In addition copies of any particular items can also be provided.

To enhance the value of *BD Newsletter* a cumulative index from No. 1 to No. 106 (1985) was prepared by Dr David K. Holdsworth during a temporary work appointment to Botany Division during the summer of 1986. The index requires checking but will be published to provide ready access to *BD Newsletter*. The categories included in the index are as follows:

1. General index
2. Botany Division, Lincoln
3. Botany Division, Substations
4. Staff, including temporary staff
5. Overseas visits by staff

6. Plant names
7. Cockayne
8. Director's column, Herbarium, Library and Archives
9. Conferences
10. Visitors

TAXONOMY

(Dr C.J. Webb)

Floras are published works devoted to the plants of a particular region, and also are usually restricted to a major segment of the plant kingdom (e.g., mosses, flowering plants). They are both an inventory of the species of plants of a particular group in a definite area, and a means of identifying and naming these plants. Floras usually provide keys to aid identification, as well as descriptions and often illustrations.

For each species the following information is usually provided: scientific name, author citation, reference to source of original publication, other names by which the species has been known (scientific and common), detailed description of the plant, distribution within the area in question, status (whether endemic, indigenous or naturalised), and notes on ecology, as well as discussion of distinguishing characters, variation, relationships and other cultural and historical information.

Floras are compiled from all available sources, especially from (a) published specialist accounts, (b) information gained from herbarium collections, and (c) from the results of new work by the Flora writer on plants in the field or in cultivation. It is in the last two of these, and particularly the last, that a Flora makes its greatest contribution to botanical knowledge.

Floras are important because:

1. They are basic reference works about the world around us.
2. They are the authoritative texts on which many popular books (botanical, agricultural, horticultural and more general works) are based, and from which informed decisions about plants can be made.
3. They provide a recommendation as to the correct names of plants in a region.
4. In aiding plant identification, they give access to other information about plants (rarity, drug/poisonous/medicinal properties, uses as food and other traditional uses, etc.).
5. They are of use to ecology and conservation (identification of indigenous plants, rare plants etc.), horticulture and agriculture (identification of weeds and cultivated plants), and education. They are used extensively both within the region for which they are written and in other regions, particularly those which share many of the plants, by both professional and amateur biologists.
6. They serve as the authoritative text on the plant group of their region often for several decades before they are revised in whole or in part.

7. They encourage botanical research by highlighting problem groups of plants, and in so doing may soon be out of date. Thus, in New Zealand, where many plant groups are not well understood, there is a need for frequent revision of Floras.

8. They are essential to many economic pursuits, and are of major cultural and social value. Floras are not produced with the aim of immediate economic gain, neither as books in themselves nor in their direct applications.

Volumes of the Flora of New Zealand Series are the main publications resulting from the work of taxonomists at Botany Division.

The first Volume was Dr H.H. Allan's (1961) treatment of the indigenous dicotyledons, gymnosperms and pteridophytes. This work was brought together by Dr L.B. Moore, who also, with Dr E. Edgar, wrote Volume 2 treating the indigenous monocotyledons except grasses (1972). Dr Edgar combined with Mr A.J. Healy to produce Volume 3 (1980) which treats all the naturalised monocotyledons except grasses. Progress toward completion of Volume 4 and 5, treating the naturalised dicotyledons, gymnosperms and pteridophytes, and the grasses respectively, is reported on below.

Few Southern Hemisphere countries have adequate Floras for any non-vascular plant groups. This triennium has seen the publication of Dr D.J. Galloway's Flora of New Zealand Lichens (1985) and the first Volume of a Flora of New Zealand Desmids (1986). Progress on other Volumes is mentioned below.

DR LUCY MOORE

Dr Lucy Beatrice Moore M.B.E., M.Sc., D.Sc. (Cantuar.), F.L.S., F.R.S.N.Z., died on 9 June 1987, in her 81st year. She was on the staff of Botany Division from November 1938 until July 1971, first in Wellington, then at Lincoln; and from her retirement at age 65 she continued to live at Lincoln and work as a Research Associate for almost another eight years. In early 1979 (not late 1980 as stated by Godley, *Proc. Roy. Soc. N.Z.* 1988) she returned to Warkworth, her home town north of Auckland, to look after her brother, but never lost touch with her botanist friends in Canterbury. The last entry in her impressive list of publications is the description of 34 species of indigenous *Myosotis* in Vol. 4 of the Flora of New Zealand, published 17 months after her death, and updating her account in Vol. 1 (1961).

Dr Lucy will always be remembered for her work on the taxonomy of the indigenous seed plants of New Zealand. Yet she did not begin this seriously until the latter half of her career. She was appointed to Botany Division to take charge of all cryptogamic work, but despite a keen interest in algae and bryophytes her earlier publications (all with Lucy M. Cranwell) dealt with the ecology of the high peaks, the offshore islands, or the intertidal zone, in northern New Zealand. By 1953 when, at the age of 47, she was asked to assist Dr H.H. Allan (then aged 70) in the preparation of Vol. 1 of the "Flora of New Zealand" she had published two taxonomical papers, one on barnacles and the other on variation in seaweeds (*Pterocladia*). But her general training was fully equal to this major change to the indigenous dicotyledons. Under Dr Allan's general supervision she prepared the Balanophoraceae, Boraginaceae, Caryophyllaceae, Plantaginaceae, *Haloragis*,

Myoporum (in part), *Myriophyllum* (with assistance from Miss R. Mason), *Pomaderris* and *Tecomathe*. And she also drove him to and from work and looked after his wellbeing during the day. But her greatest contribution to Vol. 1 was to supervise its completion after Dr Allan's death in 1957, including revising the large genus *Hebe*.

Dr Lucy's other major task before retirement was her authorship (with Dr Edgar) of Vol. 2 of the Flora, covering indigenous monocotyledons except grasses. Visits to overseas herbaria, including five months at Kew, were followed by four preliminary papers giving detailed descriptions of old and new species in *Bulbinella* (1964), Australasian asteliads (1966), and *Libertia* (1967), as well as taxonomic notes on orchids etc. (1968). The full Flora was published in December 1970, seven months before she retired. A relaxation from the rigid framework of a Flora must have been the very useful and attractive "Oxford Book of New Zealand Plants" which she wrote with Bruce Irwin in her retirement.

Dr Moore's taxonomic decisions were based on work in both herbarium and field. From the strenuous field trips of her younger days to her regular outings with botanical societies in her last years, she probably did more field work than most botanists of her time. She also used the glasshouse and experimental gardens where feasible. Cytology, palynology and plant chemistry were not overlooked, and she made good use of her large number of contacts throughout the country. Her work was characterised by patience, industry, attention to detail and accurate recording of the facts. Many younger people who assisted her have been grateful for the standards which she set for them to attain. (Dr E.J. Godley).

AUSTRALASIAN ALPINE SYMPOSIUM

A symposium 'Origin and Evolution of Australasian Alpine Biota' was held at Thredbo, Kosciusko National Park, Australia in 1985. Several taxonomists from the micro-continent of New Zealand presented papers that were subsequently published in the proceedings (*Flora and Fauna of Alpine Australasia: Ages and Origins*, edited by B.A. Barlow).

Dr A.J. Fife discussed the phytogeographic affinities of the alpine mosses of New Zealand. Approximately 150 species of mosses have been documented from the alpine vegetation belt of New Zealand, this being *c.* 28% of the known New Zealand moss flora. The alpine moss flora has its closest relationship with that of Australia, with 24% of the species shared with that continent. The second largest element is a bipolar one (23%) and many of these species also occur in Australia. Several South American taxa have been recently discovered in New Zealand and further collecting and taxonomic study is likely to increase the number of species shared with that region. In marked contrast to the angiosperm flora, only 13% of the alpine moss flora is endemic. Dr Fife suggested that during the Tertiary the larger landmass of the Campbell Plateau could have provided a refugium for a cold-adapted flora. Long distance dispersal has also been important in determining present distributions.

In a second paper Dr Fife, in cooperation with Drs H.P. Ramsay, H. Streimann, A.V. Ratkowsky, and R. Seppelt, all of Australia, concluded that the Australian alpine moss flora has its closest relationship with that of New Zealand. In total 56 species are shared.

Dr Webb used leaf, fruit and breeding system characters to assess the relationships of the Australasian genera *Aciphylla*, *Anisotome*, *Scandia*, *Lignocarpa* and *Gingidia* (Apiaceae). *Scandia* and *Lignocarpa* are endemic to New Zealand. In the whole group only one species, *Gingidia montana*, is shared between Australia and New Zealand and this appears to represent a recent dispersal event from New Zealand to Australia. Two other species of *Gingidia*, two species of *Aciphylla*, and one species of *Anisotome* are endemic in Australia. All three genera are better represented in New Zealand and in each case the Australian species belong to the most primitive groups within their genera. Dr Webb suggested that *Gingidia*, *Anisotome* and *Aciphylla* evolved in Australia and have dispersed to New Zealand where they have greatly diversified in the more extensive alpine and subalpine regions.

In their paper on "Australasian Alpine Grasses: diversification and specialization", Dr H.E. Connor and Dr Edgar principally discussed the four dominant alpine tussock-forming genera — *Poa*, *Festuca*, *Chionochloa* and *Rytidosperma* — which reached Australasia by very different routes — *Poa* and *Festuca* from the Northern Hemisphere, *Chionochloa* and *Rytidosperma* from ancient austral stock. They drew attention to the ecological diversification which has occurred within *Chionochloa* and *Rytidosperma* and to morphological groups which have developed within Australasian *Poa*, with tussock-forming species predominating in Australia and prominent in New Zealand, where as well there has developed a substantial lax, softly leaved element, and also a southern subantarctic/alpine group of tallish wide-leaved species which exhibit considerable variation in their sex expression. They also discussed generic evolution within subfamily Arundinoideae, postulating an ancestral danthonioid complex in Gondwanaland from which evolved Laurasian *Danthonia* to the north, and to the south, *Chionochloa* by linear rearrangement of chromosomes within the basic number $x = 6$, *Monostachya* in New Guinea by reduction of the basic number — dysploidy, *Rytidosperma* and *Monachather* by the formation of an allopolyploid genome, and *Cortaderia* by the formation of a new basic number.

Dr P.J. Garnock-Jones and Dr J.G. West (Australian National Herbarium, Canberra) presented a cladistic assessment of the relationships of species within the small, predominantly Australasian genus *Scleranthus* (Caryophyllaceae). They concluded that the alpine species were probably relatively recently derived from an ancestor shared with one of the species now occupying semi-arid grasslands in Australia. The group probably has had a long history in Australia, and a clear relationship with three Northern Hemisphere species has not yet been established. Dr Garnock-Jones and Dr West favour a Gondwanan origin for Australasian *Scleranthus*.

The taxonomy and relationships of the large, chiefly alpine genus *Celmisia* (Asteraceae) were discussed by Dr D.R. Given and Mr M. Gray (Australian National Herbarium, Canberra). A tentative arrangement of the Australian species was put forward. This includes several as yet undescribed species which are widespread throughout alpine regions of Southeast Australia. Fieldwork has been carried out in alpine areas of southeastern Australia to determine the distribution and variation in alpine *Celmisias*. Examination of leaf surfaces, hairs and glands using SEM techniques shows that such

features are a valuable diagnostic aid to classification and identification at the subgeneric and sectional level. Among some Australian species, leaf hair morphology can be used to characterise tomentum type which differs among species. Dr Given and Mr Gray concluded that the *Celmisia-Olearia* complex had its initial development in Australia followed by radiation in New Zealand and transfer of some of these elements back to Australia. Within *Celmisia* itself, Australian species belong to herbaceous elements of the genus that are probably relatively advanced and may represent separate east-west migrations from New Zealand to Australia.

NOMINA NOVA

Dr Connor and Dr Edgar prepared a consolidated list from the three earlier parts of Nomina Nova and also accounted for the more recent name changes published up to the end of 1986 (*N.Z. J. Botany* 25: 115-170). This latest paper in the series differs from preceding ones in that new combinations are made, in order to provide a complete treatment for some genera which have been realigned without transfer of all relevant species, for example, all species of *Hymenanchera* are transferred to *Melicytus*, three indigenous species formerly placed in *Gnaphalium* are transferred to *Anaphalis*, and *Senecio kirkii* and *S. turneri* transferred to *Brachyglottis*, and some new taxa are described, for example, two new species in *Ranunculus*. In *Ranunculus* and *Crassula* new names were provided for some species that did not have legitimate ones. Seven botanists, as well as the two authors, have contributed new descriptions and/or new combinations. In addition Dr Garnock-Jones provided a section on orthographic changes for names of New Zealand vascular plants.

DICOTYLEDONS

(Dr C.J. Webb)

Most of the research effort on dicotyledons has been concentrated on finishing Flora of New Zealand, Volume 4, Naturalised Pteridophytes, Gymnosperms, Dicotyledons. The text for this Volume has now been completed and only awaits final editing before publication. During this period Dr Webb and Dr Garnock-Jones completed a treatment of the largest family, the Asteraceae (215 naturalised species), Dr Webb and Mr W.R. Sykes revised the third largest family, the Rosaceae (99 naturalised species) and Mr Sykes provided a new treatment for the succulent family Crassulaceae (32 naturalised species). Dr Given assisted with a revision of the difficult *Rubus fruticosus* aggregate — he and Dr Webb now recognise 19 segregates in this group. All major editing and reviewing of the text has also been completed and the introductory sections of the Flora drafted.

Some taxonomic work has been required to clarify the status of naturalised plants. Species of the South American genus *Soliva* (Asteraceae) are troublesome lawn weeds in New Zealand; the plants are usually referred to as Onehunga weed. Four species have usually been recognised in subgenus *Soliva* and three of these have been recorded for New Zealand; these are

identical vegetatively but differ markedly in fruit characters. Dr Webb demonstrated (*N.Z. J. Botany* 24: 665-669) that achene form varies continuously and that the recognised "species" are perpetuated by selfing. Experimental crosses between the most extreme forms produced fully fertile progeny with achenes intermediate in form. He concluded that subgenus *Soliva* should be treated as the single species *S. sessilis*.

Revisions of some native genera have accompanied work on the weed flora, particularly for genera which also contain naturalised species. Miss B.H. Macmillan prepared a treatment of *Acaena* for the Flora. This treatment includes a newly described species, *A. dumicola* (*N.Z. J. Botany* 23: 337-340), and refers to two other new species, in section *Ancistrum*, for which a paper has been prepared. In order to identify *A. hirsutula* Bitter (known only from the type at Munich) leaf material was prepared from the type and from *A. caesiiglauca* and *A. saccaticupula*, of similar age, for S.E.M. analysis of the cuticle (cell shape, wax pattern and hair morphology) in collaboration with Mr D. Waller of Canterbury University. This established convincing results for future taxonomic use. Field work required to establish the identity of *A. viridior* (Cockayne) Allan, for which no type has been found, has been completed. In addition, Miss Macmillan studied comparative fruit coat epidermal cell morphology as a taxonomic character, and presented results at the Symposium on seeds at the time of Mrs M.J.A. Bulfin's retirement in 1985. Vouchered fruits of *Acaena* were selected for photographing for the Seed Atlas in preparation by Mrs Bulfin.

The new Flora treatment of *Gunnera* (Gunneraceae) and *Cassinia* (Asteraceae) accepts fewer indigenous species than does Volume 1. Dr Allan accepted 10 species of *Gunnera*, but only five of these are accepted by Dr Webb, the others being based on fruit colour forms and hybrids. The five species are easily distinguished by infructescence and leaf characters (*J. Canterbury Alpine Garden Society* 5: 13-14, 19). Dr Allan accepted five species of *Cassinia* but the characters he used to distinguish them do not work well in the field. Dr Webb chose to treat all indigenous *Cassinia* as a single species, *C. leptophylla*, while recognising that the species varies considerably (*J. Canterbury Alpine Garden Society* 5: 8-9).

Many New Zealand groups of Asteraceae are not as yet referred to their appropriate genera. Some progress has been made in solving these generic level problems particularly in the tribes Senecioneae, Inuleae, and Anthemideae. In the Anthemideae, Dr Webb and Dr D.G. Lloyd, University of Canterbury, have reinstated *Leptinella* at generic rank and referred most indigenous species previously treated in *Cotula* to it (*N.Z. J. Botany* 25: 99-105). *Leptinella* is distinguished from *Cotula* by the conspicuous "inflated" corollas of the female florets and by chromosome numbers based on $x = 26$; most species are also distinguished by a number of habit characters, particularly the prostrate stems which root at the nodes.

Other systematic work has not been associated directly with Volume 4 of the Flora. Dr Garnock-Jones compared the supposedly endemic New Zealand species *Myosurus novae-zelandiae* (Ranunculaceae) with all other species in the genus. It was found to belong to the *M. minimus* complex and differed only slightly from some forms of that species. The rank of subspecies was proposed, *M. minimus* subsp. *novae-zelandiae*. The South

American *M. patagonicus* is probably also a part of the *M. minimus* complex (*N.Z. J. Botany* 24: 351–354).

In *Fuchsia* (Onagraceae) flavonoids were analysed in *F. perscandens* and *F. × colensoi* from New Zealand and *F. cyrtandroides* from Tahiti by Dr Garnock-Jones and Dr C.A. Williams, University of Reading (*Phytochemistry* 25: 2547–2549). These data, and data from previously published studies, were analysed phenetically and cladistically. The data support the hypothesis that *F. cyrtandroides* is a sister group to a clade comprising all the New Zealand species. The biogeographic interpretation of this is that it is not necessary to postulate that *F. cyrtandroides* reached Tahiti after long distance dispersal from New Zealand.

For several hundred early names of New Zealand plants, the identity of the type specimen(s) has not been checked. This is usually because the types are housed in overseas herbaria, or are lost, or consist of several collections which must be examined in detail by a specialist. Dr Garnock-Jones completed a project (*Taxon* 35: 123–128) checking the types of names of New Zealand and South Pacific plants published by K.P.J. Sprengel in 1807. The type specimens, all collected by the Forsters on Cook's second voyage, are now widely dispersed in European herbaria; some are lost. Because Sprengel's publication was previously overlooked in New Zealand literature, this work disclosed the illegitimacy of several names for well-known species.

The 1986 Boden Conference was held at Thredbo, Kosciusko National Park, Australia and had as its theme the systematic status of large flowering plant genera. Dr Webb was invited to present his views on the use of breeding system characters in systematics. He suggested that characters of the reproductive system are often of little use in systematics as particular breeding systems, pollination systems, and dispersal mechanisms frequently evolve independently within a plant group. A lack of understanding by taxonomists of the function of breeding systems has led to errors, in extreme cases with different breeding system morphs described as distinct species or genera based on minor characters associated with the pollination mechanism. Similarly, it is important to understand the ecological context — certain breeding systems and dispersal mechanisms are frequent in particular habitats or geographic regions. Although theoretical work in reproductive biology has produced evolutionary models which allow accurate prediction of many characters associated with particular breeding systems, it is important to remember that these models are not phylogenetically based; rather they describe the action of the same selective pressures in unrelated plant groups. On the other hand an appreciation of the function of reproductive structures is essential to a realistic interpretation of reproductive characters in systematics. The proceedings of this conference were published in the *Australian Systematic Botany Society Newsletter* 57: 26–93.

MONOCOTYLEDONS: POACEAE

(Dr E. Edgar)

The draft manuscript of the volume of the Flora of New Zealand dealing with grasses, being compiled by Dr Edgar and Dr Connor, is about three quarters completed. The final treatment will comprise some 180 native species and about 250 naturalised species.

The revision of *Poa* undertaken by Dr Edgar has been published (*N.Z. J. Botany* 24: 425-503), recognising 35 native species, with 8 described as new, and 10 naturalised species; nine interspecific hybrids are also discussed.

Revisions of *Chionochloa*, *Puccinellia*, *Trisetum*, and the three related genera *Agrostis*/*Deyeuxia*/*Lachnagrostis* are in progress. In order to treat this latter group satisfactorily the problem of generic delimitation has to be tackled and an attempt made to obtain generic agreement with Australia, with which a number of species are shared. At present, species placed within *Lachnagrostis* and *Deyeuxia* in New Zealand are treated as *Agrostis* in Australia. The indigenous New Zealand taxa can be distributed among the three genera on the basis of floret morphology: *Agrostis* with hyaline glabrous lemma, palea 0 to *c.* 1/3 lemma, callus glabrous or with minute hairs and rachilla not prolonged; *Deyeuxia* and *Lachnagrostis* both with palea *c.* 2/3 lemma, callus hairs long, rachilla usually obviously prolonged. However, *Deyeuxia* has hardened scabrous lemmas and firm panicles, whereas the lemma in *Lachnagrostis* is membranous, usually hairy, and the panicle is delicate, breaking off and blowing in the wind — the common name for *Lachnagrostis filiformis* is New Zealand wind grass. In Australia this species is known as *Agrostis avenacea* and in South Africa as *A. eriantha*. It has been introduced into South America and is there known as *Lachnagrostis filiformis* being considered generically distinct from the South American species of *Deyeuxia*.

Elsewhere, S.E.M. studies of the ligule epidermis in *Agrostis* and related genera have been used to clarify generic groupings and it remains to be seen whether characteristics of the lemma epidermis will support the present generic grouping of New Zealand species.

Deyeuxia is sometimes equated with Northern Hemisphere *Calamagrostis* in which the lemmas are short and hyaline and often much exceeded by callus hairs. The generic distinctions are not always clear cut and may prove difficult to uphold.

Draft manuscript descriptions for all naturalised species, except those of *Festuca*, have been prepared. A checklist of Panicoid grasses, compiled by Dr Edgar and Ms J.E. Shand, with keys to native and naturalised genera and species, has been published (*N.Z. J. Botany* 25: 343-353). Two further checklists, Poooid grasses, compiled by Dr Edgar, Ms Shand and Ms M.A. O'Brien and Chloridoid grasses by Dr Edgar and Ms Shand are in preparation.

PTERIDOPHYTA

(Dr D.R. Given)

A major achievement in research on ferns and fern allies is the publication of an annotated checklist of the New Zealand species (*N.Z. J. Botany* 23: 431-489). This was a joint project involving Dr Given, Dr P.J. Brownsey (National Museum) and Professor J.D. Lovis (University of Canterbury). A large part of the checking of references and names was done by Mr M. Daellenbach who worked as a student at the Division. Type descriptions and references to types (where known) are held as a data base. The checklist accounts for all known names of pteridophytes in the New Zealand region; it also includes reference to as yet undescribed taxa.

BRYOPHYTES

(Dr A.J. Fife)

Dr Fife joined the permanent staff of Botany Division in September 1985, having been previously employed at the Division as an NRAC Fellow. His primary task is to prepare a moss volume for the Flora of New Zealand Series. To this end, work was commenced in 1986 on a checklist of the mosses of New Zealand. This manuscript includes extensive annotations which discuss taxonomic and nomenclatural problems, clarify geographic distributions, and serve as guides to the literature pertinent to the study of the New Zealand moss flora. Publication (probably in 1989) of the nearly completed checklist will provide a reference point concerning the status of all the mosses (c. 540 species) occurring in New Zealand and will serve as an interim curatorial tool and discussion paper while work on the actual Flora volume continues.

Three papers dealing wholly or in part with Southern Hemisphere representatives of the moss family Funariaceae have reached publication stage during the triennial period. Reviews of the biosystematic literature on New Zealand bryophytes and of the alpine moss flora have been presented at conferences in New Zealand and Australia, and both studies have been subsequently published.

Bryo-floristic exploration has continued, particularly in the mountains of Nelson, Canterbury, and Fiordland. In addition to increasing information concerning the distributions of poorly-known members of the flora, such exploration is continuously expanding the known New Zealand moss flora. Some of the more interesting observations include (1) the widespread occurrence, in the South Island and Stewart Island, of *Ptychomnion densifolium*, a predominantly Patagonian species previously known in Australasia only from Campbell and Auckland Islands; (2) the occurrence on the South Island of an undescribed species of *Epipterygium*, a genus not previously known in the Southern Hemisphere; (3) the discovery of the Northern Hemisphere *Pohlia camptotrachela* at three localities in the South Island; (4) the widespread occurrence of *Isopterygium distichaceum*, previously known only from the Northern Hemisphere.

Herbarium studies have likewise revealed previously unrecognised species as occurring in New Zealand. One example is provided by the recent discovery that material of so-called *Rhizogonium spiniforme* from the Kermadec Islands is correctly referable to the Australian *Pyrrhobryum paramattense* and that at least two North Island collections are also referable to that species.

Smaller, ongoing, projects include the periodic updating of a checklist of mosses of Arthurs Pass National Park, a study of persistent protonemal filaments in the genus *Calomnion* (by Dr Fife), periodic updating of a checklist of the mosses of Banks Peninsula, and a study of the bryophytes of the Riccarton Bush Reserve (by Miss Macmillan).

Ecological studies of mosses, hepatics, and lichens have been initiated. Their distribution on land slips of various ages in Fiordland was investigated in conjunction with a study of vascular plant distributions with Prof. A.F. Mark and Dr K. Dickinson of the University of Otago; this study has been completed and submitted for publication. A more detailed study of non-vascular cryptogam distributions in subalpine forest at Arthurs Pass has been initiated by Dr Fife and Dr C.D. Meurk.

A series of bryological field workshops, initiated by Botany Division staff in 1982, have continued as annual events held in various parts of the country. During the triennial period Dr Fife and Miss Macmillan were instrumental in organising workshops at Arthurs Pass (Feb. 1986) and at Nelson Lakes (Nov. 1987). In November 1986, Dr J. Beever in conjunction with Dr J. Braggins of the University of Auckland organised a workshop at Leigh in North Auckland. Each of these meetings has attracted over twenty participants from throughout the country and overseas.

LICHENS

(Dr A.J. Fife)

Dr D.J. Galloway's Flora of New Zealand, Lichens was published on 8 February 1985 and a summary of the contents of the Flora was provided in the 1982-84 Botany Division Triennial Report. To mark the publication of this important Flora, a workshop on New Zealand lichens was held at Botany Division on 5-7 March 1985. The workshop was organised by Dr Fife and Miss Macmillan, and was attended by 38 workers, including professional lichenologists from New Zealand, Australia and Europe. David Galloway was unfortunately prevented from attending by professional responsibilities at the British Museum.

Two of the workshop's days were devoted to presentations concerning the study of New Zealand lichens. Taxonomic and evolutionary discussions of several groups of Australasian lichens were presented, as well as discussions of lichen chemistry, the use of lichens in air pollution monitoring, the physiology of the family Stictaceae, and the phytogeographic relationships of the New Zealand flora. Dr Edgar provided some historical background to Galloway's Flora, and Dr Fife provided a non-specialist's critique of the work. Dr Bruce Hayward discussed the ways that amateurs could

contribute to New Zealand lichenology and Dr Jack Elix commented on future directions for the speciality within New Zealand.

“Hands-on” sessions, using the new Flora were also held, giving the less confident a chance to become familiar with its taxonomic keys with guidance from more experienced workers. A one-day trip was made to an area adjacent to Montgomery Scenic Reserve on the Banks Peninsula, to permit field observation, instruction, and limited collection. A special feature of the trip was a rich crustose lichen flora on exposed boulders and ledges on an exposed summit near the Reserve.

ALGAE

(Dr M.J. Parsons)

MARINE ALGAE

Identifications were made of voucher specimens of marine algae collected by the chemists of the University of Canterbury, Christchurch, N.Z. for chemical analysis especially for compounds showing biological activity and antiviral properties. Species of *Plocamium*, *Laurencia* and *Ptilonia* have been important here.

The Checklist of New Zealand Marine Algae is at the first approximation stage (before first draft). It is based on the Flora published in various parts by V.J. Chapman and other authors, and on the more recent regional species lists published in the National Museum miscellaneous publications series. Further species names and literature will be added from a 6x8 card system used in the Herbarium. The building of the extensions to the Herbarium and associated administrative duties have greatly reduced the time available for studies on marine algae.

FRESHWATER ALGAE

Dr Vivienne Cassie-Cooper, since preparing the important checklists of freshwater algae in New Zealand (published in 1984) as mentioned in the previous triennial report, has continued her studies on the diatoms and the other algae associated with thermal springs in New Zealand and on the microalgae in Lake Pupuke in Auckland.

Dr Cassie-Cooper officially retired from Botany Division on 29 September 1986, and a seminar on Phycology and Water Quality was held in her honour at Lincoln on 14-15 October, 1986. The proceedings of this meeting are still to be published. Dr Cassie-Cooper continues her work in her retirement. The collections of freshwater algae that she has made while at DSIR are held at the Botany Division Regional Station at DSIR Mount Albert, Auckland, although they are considered part of the main Herbarium, CHR.

Dr Elizabeth Flint, who retired in 1974, continues her work on the three volumes of the Flora of New Zealand, Freshwater Algae, Desmids. Each year since 1983, Dr Flint has spent some weeks in USA with Dr Hannah Croasdale working on the manuscripts. The first volume of the Desmid Flora was published on 16 June, 1986 and the second volume is in press (published 23 September, 1988).

It is important to note that at present there is no phycologist on the

staff at Botany Division working on the freshwater algae to update the checklists and work towards the development of Flora volumes and identification manuals as Dr Cassie-Cooper has not been replaced. We are grateful that in retirement both Dr Cassie-Cooper and Dr Flint continue their work without remuneration.

FRESHWATER ALGAL CULTURES

The 87 isolates of freshwater algal cultures from the University of Canterbury mentioned in the previous triennial report have been maintained by Mrs Mary Wilson. No new isolates have been added although attempts have been made to isolate several common desmid species to illustrate these algae during public open days and to advertise the recently published volumes of the Desmid Flora. These desmid cultures were not maintained after a month or two as they became very contaminated. No attempt was made to establish unialgal cultures of these desmids. With the retirement of the freshwater phycologist Dr Vivienne Cassie-Cooper on 29th September 1986, the future of the algal cultures depended on the possibility of the appointment of a new freshwater phycologist. As this has not eventuated it was decided at the end of 1987 to discontinue these cultures. Fortunately Dr Charles O'Kelly, Massey University, Palmerston North, has agreed to take these cultures over. He intends to check the identifications of the cultures and to dispose of those that are incorrectly labelled and of no further use.

REPRODUCTIVE BIOLOGY

(Dr C.J. Webb)

Although there has been little time available for experimental work in reproductive biology during this period, it has been possible to bring together the results of some experimental studies with those of other published work and so develop some more general ideas on the way flowers function. This work has been carried out in cooperation with Prof. D.G. Lloyd of the University of Canterbury. In particular the avoidance of interference between pollen dispatch and receipt within hermaphrodite flowers has been explored in detail. Interference is avoided by separation of the two pollination surfaces either spacially (herkogamy) or temporarily (dichogamy). In both cases there are many pollination mechanisms which facilitate precise pollination in spite of the separation of these surfaces.

DICHO GAMY

Dichogamy is a widespread but neglected feature of angiosperm flowers. It has usually been interpreted as an outcrossing mechanism although many dichogamous species are also self-incompatible. Prof. Lloyd and Dr Webb have suggested that dichogamy acts in general to reduce self-interference within a flower and often also reduces self-fertilization (*N.Z. J. Botany* 24: 135-162).

Dichogamous species are usually classified by whether they present pollen before stigmas (protandry) or stigmas before pollen (protogyny). Other

features of dichogamy are also important, for example, the degree to which pollen or stigma presentation is synchronised among flowers, and the floral units involved.

Whether pollen or stigmas are presented first in dichogamous species appears to be influenced by a number of factors. These include the relative ease with which anthers and stigmas can be moved before or after functioning, the extent to which anthers or stigmas act as signals or rewards, the effects of post-pollination changes on the flower, and sometimes special features of the interaction between the plant and its pollinator, as in refuge and trap blossoms.

Two New Zealand genera provide examples of species with protandrous flowers in which the pollen is presented in the same position as the stigma but is easily moved before the stigma opens. *Discaria toumatou* is self-incompatible as well as protandrous and the flowers are small enough that the simple removal of pollen from its presentation position creates enough space for the stigma to open (*N.Z. J. Botany* 23: 331-335). In *Gentiana serotina* and *G. saxosa* it also appears that the ease with which stamens are moved may influence the order of presentation as the stamens present pollen in the centre of the flower but the filaments move the anthers back to the corolla or even outside it before the stigma opens. The fact that the flowers of these two gentians close after the stigma is pollinated also means that protandry is favoured over protogyny (*Ann. Miss. Bot. Gard.* 74: 51-57).

HERKOGAMY

Like dichogamy, herkogamy has usually been interpreted as an outcrossing mechanism in spite of the fact that many herkogamous species are self-incompatible. Although it is a widespread feature of angiosperm flowers it has received little attention this century. In reviewing the subject Dr Webb and Prof. Lloyd recognised various classes of herkogamy (*N.Z. J. Botany* 24: 163-178). The primary division is into homomorphic herkogamy in which the spatial separation of stigmas and pollen is within the one flower and all flowers are of a single form, reciprocal herkogamy which is similar but all flowers are not identical (there being two or three reciprocal morphs), and interfloral herkogamy where pollen and stigmas are to some degree separated among blossoms.

There are various forms of homomorphic herkogamy but the most common is that termed approach herkogamy. In approach herkogamy, pollen and stigmas are placed so that stigmas are contacted first as a visitor enters a blossom, and pollen contacted secondly as the pollinator seeks nectar. Generally, herkogamy appears to be an effective means of avoiding interference between pollen dispatch and receipt although both pollination surfaces are presented simultaneously within a flower.

REPRODUCTIVE BIOLOGY OF FABACEAE

The pods characteristic of the pea family make scoring of seed abortion and maturation particularly easy. In two species, Dr Webb has studied fruit and seed production patterns in legumes. The first, investigated in cooperation with Dr K.S. Bawa of the University of Massachusetts, was of a small Costa Rican tree *Bauhinia unguolata* (*Pl. Syst. Evol.* 151: 55-

65), and the second, in cooperation with Ms J.E. Shand, was of wild and cultivated plants of the fodder tree *Chamaecytisus palmensis* (tree lucerne) in New Zealand (*N.Z. J. Botany* 23: 597-606). In both species under open pollination wild plants produced pods from only about 10% of flowers and within pods only half of the ovules matured into seeds. Again in both species ovules in more distal positions within a pod had a greater chance of developing into a seed.

In tree lucerne the pollination of flowers was also investigated. The species is self-compatible, at least to some degree, and self-pollen adheres to the stigma and germinates before the flowers open. Nevertheless the typical flag blossoms contain nectar and are visited by bumble-bees. The rapid growth of this short-lived tree and its prolific flowering in winter and spring make it a useful species for stock fodder and bee foraging.

REPRODUCTIVE BIOLOGY OF *ARTEMISIA*

Artemisia vulgaris is a common roadside weed in western Europe. It is gynomonocious, wind-pollinated, and possibly self-incompatible. Its pollen is a minor agent in hayfever. Dr P.J. Garnock-Jones began a study of its reproductive biology in England in 1982, followed up later on material sampled at that time. In all plants the ratio of female to hermaphrodite florets is more or less the same, but large plants set more seed per floret. The capitula move from a pendent position at flowering to become erect at the fruiting stage. Usually one hermaphrodite floret in a capitulum has dehiscent anthers on any one day during the flowering period, but many female and hermaphrodite florets have receptive stigmas (*Bot. J. Linn. Soc.* 92: 285-302).

SEEDS

(Dr C.J. Webb)

The retirement of Mrs Margaret Bulfin in June 1985 brought to an end several decades of seed studies at Botany Division which began with the work of Miss Ruth Mason. Funding levels have not allowed the appointment of a new seed specialist and so activity in this area will be maintained at only a low level and mostly in association with other projects. The two main activities during this triennium have been a Seed Seminar to mark Mrs Bulfin's retirement and work on the Seed Atlas of New Zealand Dicotyledons. In addition, requests for seed both from within New Zealand and from overseas, for information on seed germination, and for identification of seeds from various sources, have been met by Mrs Bulfin with the assistance of Mary Wilson.

SEED SEMINAR (Dr T.R. Partridge)

A seed seminar was held at Lincoln on 2 and 3 July 1985 to mark the retirement of Mrs Bulfin. There were 87 participants and 23 presented papers over the two days of the seminar. The papers covered a wide range of seed related topics except for the agricultural. Seed identification and the use of seeds and fruits in taxonomy were themes in a number of papers.

Many of the presentations described physiological and ecological attributes of germination in habitats as varied as estuaries and subalpine scrub. Reproductive strategies in relation to pollination and dispersal were also covered. Two papers examined commercial aspects including collecting and promoting nursery produced seed of rare species. A further two papers described fossil seeds including those from the Pureora buried forest. Finally, a number of presentations covered the history of seed studies undertaken at Botany Division, including two by Margaret Bulfin on her seed germination and seed atlas projects.

SEED ATLAS

Seeds are usually hard and persist long after other plant parts have disintegrated. They are often distinctive in size, shape, or surface pattern and so can often be identified to genus and species. Seed identification is therefore an important tool in archaeological investigations, forensic work, paleoecology, and animal and plant ecology. The completion of a seed atlas of the New Zealand dicotyledons would benefit all these areas of research, and some progress on the seed atlas has been made in this period.

Light microscope and S.E.M. photographs have now been taken for almost all families of indigenous dicotyledons with most families represented by several genera and many species. Photographs of the species to be included have been selected by Mrs Bulfin and arranged into plates with the assistance of Ms K.J. Stewart. Ms Stewart has also completed mounting all of the plates.

PACIFIC ISLANDS

(Mr W.R. Sykes)

Little time has been available for work on Pacific Island floras during this triennium, but some progress has been made on the flora of the Cook Islands. Efforts have been devoted to the study of pteridophytes because the taxonomy of several genera is poorly understood in the South Pacific region generally. It now appears that the checklist of pteridophytes in the Cook Islands (Brownlie, G. and Philipson, W.R. *Pacific Science* 25: 502-511) will need substantial revision in the families Aspleniaceae, Aspidiaceae, Tectariaceae and Thelypteridaceae. The revision is being carried out with the cooperation of Dr J.E. Braggins of Auckland University, and Dr J. Game of the University of California who is currently cultivating many Cook Island ferns. Work on pteridophytes will contribute towards the eventual production of a Flora of the Cook Islands.

SUBANTARCTIC ISLANDS AND ANTARCTICA

(Dr C.D. Meurk)

SUBANTARCTIC ISLANDS

A comprehensive tour of New Zealand's southern islands was organised in 1985 (Botany Division Internal Report 534) by the National Film Unit (who produced the natural history documentary "Beyond the Roaring Forties"), and the then Department of Lands and Survey (who made ground checks for topographic maps of the islands). The RNZ Navy provided logistic support centred on HMNZS Monowai. While these other tasks of the expedition took precedence, a contingent of scientists from DSIR and Universities were able to make useful collections and observations. The islands visited were Campbell, Adams, Auckland, Rose, Enderby, Snares, Antipodes and the Bounty group. Dr Colin Meurk was able to conclude his vegetation and environment sampling programme (with Dr Martin Foggo, Central Institute of Technology, Trentham) which had previously been confined to Campbell and Auckland Islands. The analysis of this extensive data set will form the basis for several publications on the plant ecology of this fascinating territory. Some of this work was presented at international symposia in Europe in 1987.

There has been ongoing monitoring of permanent quadrats and transects since 1970 on Campbell and Auckland Islands to assess the effects of grazing and the subsequent removal of feral animals on the vegetation. Experience gained from this work has enabled Dr Meurk to contribute information on Management Plans for the Islands, and to the film quoted above (and a book of the same title) directed by Mr Conan Fraser.

BOTANY OF TERRA NOVA BAY

In November-December 1984 a botanical party visited Terra Nova Bay in North Victoria Land (75°S). This included Dr D.R. Given, and was undertaken in cooperation with the West German GANOVEX 4 operation. This was a preliminary visit to investigate reports of plants growing in the crater of Mount Melbourne, an active volcano, and to collect plants and delineate plant communities in the region.

Results have now been published for the work on Mount Melbourne. The moss *Campylopus pyriformis* and liverwort *Lepidoziella exiliflora* were identified along with algae and heterotrophic micro-organisms. These are restricted to geothermally warm sites at about 2700 m.

Study of collections from several coastal sites at Terra Nova Bay and Wood Bay (Gerlache Inlet, Inexpressible Island, Edmondson Point and Cape Washington) indicates that this region has a diverse and relatively rich cryptogamic flora, reflecting a wide range of rock types and topography.

As a follow-up, an expedition including Dr Meurk and Dr Given is planned for the 1988-89 summer. This will investigate several additional sites, and will also undertake vegetation-environment analysis, plant resource mapping and environmental impact at Terra Nova Bay and Wood Bay. These studies will contribute to predictions of impacts from mineral prospecting and global warming.

PLANT PATHOLOGY

(Dr A.D. Thomson)

VIRUS DISEASES OF INDIGENOUS SPECIES

An outline of aspects of this project and a more general consideration of diseases affecting indigenous plants was given in the proceedings of the Gardens seminar to mark the retirement of Mr Ivor Brown, "Experimental gardens as a source of information for plant pathology" (*BD Newsletter Supplement No. 5: 33-35, 1987*).

NEW RECORDS OF PLANT VIRUSES IN NEW ZEALAND

The home garden of Mr A.J. Healy in Christchurch has provided the specimens for the following records.

Cucumber mosaic virus was recorded in 1985 from *Dracunculus vulgaris* Schott. showing a bright yellow leaf mosaic and vein-banding symptoms. The same virus was also recorded in 1985 from *Tragopogon porrifolius* L. showing yellow mottle and yellow streaking on leaves (*BD Newsletter No. 106: 5, 1985*). There are no previous records of viruses from these species in New Zealand (S.R. Pennycook, pers. comm., 24 December 1985).

Cucumber mosaic virus was also recorded in 1979 and 1986 from *Helleborus orientalis* Lam. (*BD Newsletter No. 48: 8, 1979*) showing leaf mosaic symptoms. There are no previous records of viruses from *Helleborus* in New Zealand (S.R. Pennycook, pers. comm., 4 December 1979).

Potato virus Y was recorded in 1986 from an *Echium pininana* Webb and Berth. plant showing leaf vein-banding and interveinal yellow mottle accompanied by some down-curling of leaves; the plant eventually succumbed. I have no record of potato virus Y from *Echium*.

Tomato spotted wilt was recorded in 1986 from a stunted *Zantedeschia aethiopica* (L.) Sprengel plant showing an irregular leaf mottle with crinkled and distorted flowers. Chamberlain ("Plant Virus Diseases in New Zealand", 1954, p. 95) records tomato spotted wilt from *Zantedeschia* spp.

A virus was discovered in 1986 causing yellowing leaf symptoms on a *Prunella vulgaris* L. plant growing in the home garden of Dr W. Harris at Lincoln (*BD Newsletter No. 111: 21, 1986*). Nothing is known about the virus particles but the reactions of the virus on the *Gomphrena globosa* L. local lesion assay host and in *Prunella* are noteworthy. The speed of reaction of the virus on *Gomphrena* is exceptional and macroscopic lesions have been recorded in under 24 hours after inoculation, with one recording at 19 hours. Other viruses in this common assay host induce local lesions about 7 days after inoculation. I have no knowledge of such a rapid induction of macroscopic symptoms with any plant virus. Another unusual property of the *Prunella* virus is its apparent complete loss of infectivity in the original *Prunella* host during growth in the glasshouse in the winter months.

RARE AND ENDGANGERED PLANTS

(Dr D.R. Given)

CHECKLIST AND DATA BASE ON THREATENED PLANTS

An updated checklist of threatened plants was produced in 1987. It is planned to produce new editions annually, but the list is also held on computer so it can be continually updated. Associated with the checklist are site record sheets which are now the basis of site/event records of threatened species. Site record sheets and the associated protocol are being used widely by both amateurs and professionals to record the occurrence of populations of threatened plants throughout New Zealand.

One of the major difficulties with the threatened plants checklist has been in providing lists of threatened species for particular regions. The present data base is manual and arranged by species. This makes geographic searches extremely slow. Upgrading the system by adaption to a computerised system is being investigated. This will allow faster searches using a variety of fields such as geographic distribution, reserve status, and habitat. One of the constraints which is being considered is to protect information on precise location of critically threatened species, so that site details are only available on request for bona fide purposes.

WWF PROJECT 3329 INTERNATIONAL "PRINCIPLES AND PRACTICE OF PLANT CONSERVATION"

This project has been undertaken at the request of the IUCN Plant Advisory Group, as part of their Plant Conservation Programme. There is increasing need for a comprehensive book to deal with conservation of threatened species. What is needed is a book which can address the needs of administrators, planners, protected area and botanic garden managers, consultants and others who do not necessarily have an advanced scientific training. At the same time the book needs to be a state of the art document which can lead into more advanced literature.

Initial discussions with IUCN and WWF in April 1986 led to a draft outline which was discussed with the Plant Advisory Group at their meeting in Colombia in July 1986. This was followed up by further overseas travel to discuss and research the book: USA, United Kingdom, Italy and Australia (November-December 1986), South America (April 1987) and United Kingdom (April-May 1988). The book is financed through WWF International as a contract.

Seventeen chapters cover a wide range of topics: distribution, evolution and diversity of plants; population and ecosystem biology; threats and extinction; in situ and ex situ management; management in disturbed habitats; legislation; documentation and data bases; ethnobotany; education; structures and administration; economics of conservation. An extensive literature data base has been set up and contact made with several hundred specialists world-wide. Many people have been highly generous in providing both published and unpublished material, as well as personal comments and observations. In the course of overseas travel it has been possible to see field situations as well as discuss the project with specialists. This has

included several days at the Minimum Critical Areas study site near Manaus in Amazonia and a workshop in the Galapagos Islands.

This project will not only assist internationally in drawing together principles of plant conservation and consequent techniques for management, but will also help in the devising of a long term strategy for threatened plant conservation in New Zealand.

MONITORING SYSTEMS

An increasing number of threatened species sites are being monitored by staff of the Division. In some instances this is in conjunction with translocation projects where plants are being propagated from material taken at the field site so that vigorous young plants can be transplanted back to the wild. Species for which this is being done include *Chordospartium muritai*, *Carex inopinata* and *Hebe armstrongii*.

There is a need for a simple monitoring system which can be used widely for periodic analysis of trends, especially in more critically threatened populations of plants. A preliminary system was tested on the Chatham Islands in 1986. This has since been upgraded on the basis of this trial and comments by prospective users, and will be more extensively field-tested during 1988. The need for such systems has been recognised by the IUCN Conservation Monitoring Centre through their "Plantwatch" concept. This is intended to promote the development of computer-compatible monitoring systems for use in a variety of regions and situations.

GUIDE TO THREATENED PLANTS

Catherine Wilson (née Brown) commenced work on this in November 1984, financed by a Lottery Board grant. The text of the guide has been completed, illustrations prepared, and publication is envisaged for late 1989. The Guide gives short standardised accounts of Extinct, Endangered and Vulnerable plants in New Zealand. Each species is illustrated (most in colour) and the text is designed for the layperson as well as the specialist.

FIELD AND RESEARCH

Field observations remain the backbone of the locality data base for threatened plants. During early 1985 Chatham Island was visited for two weeks, with particular attention given to peatlands of the northwest part of the island and the southern tablelands. Some key sites were resurveyed and many new sites found for endemic species, especially around the lakes of the southern tablelands. Of particular significance were the discovery of several small populations of the endemic and endangered Chatham Islands toitoi, *Cortaderia turbaria*; the documentation of remnant patches of endemic species along the coast west of Port Hutt, and the discovery of additional sites for *Desmoschoenus spiralis* (pingao) and *Embergaria grandifolia*.

Publication of lists of threatened species by Botany Division has stimulated searching of sites from which species may have been extirpated as well as searching of apparently suitable vegetation from which rare plants have not yet been recorded. Two examples illustrate this. Recent investigation of salt-pan sites in Otago by the Department of Conservation has yielded several previously unknown populations of *Lepidium kirkii* (Endangered) and led to the rediscovery of *Lepidium matau* (Presumed Extinct). Formerly,

L. kirkii was known in the wild only from a single highly threatened site. A second example concerns *Hebe armstrongii*. In recent years this was known from only a single reserve in Canterbury where several adult plants of the *Hebe* have been planted back onto the site. A chance discovery of *H. armstrongii* in the Esk catchment led to surveys of bog pine communities in that area and the location of several hundred plants of the *Hebe*.

For several species, stocks from different populations are being built up, both as live garden plants and in a seed bank, so that there is adequate genetic diversity held at Lincoln. Particular emphasis is initially being placed on *Lepidium* spp., *Plantago picta*, *Clianthus puniceus*, and several *Hebe* species. This will provide genetically diverse material for translocation, research and as an insurance against loss of wild stocks. Trial plots of *Clianthus puniceus* have been planted out at Lincoln to complement field studies of this species by Forest Research Institute. Recently, the possible role of tissue culture, especially in relation to translocation projects, has been investigated. The Division is currently cooperating in study undertaken by the University of Canterbury of tissue culture techniques for several threatened species.

ADVOCACY

There are increasing demands for lectures and conference contributions on conservation of threatened plants, not only from conservation and botanical organisations but from such diverse groups as service clubs and business organisations. Conference and course presentations included: International Conference on the Conservation Strategy and Botanic Gardens (Canary Islands), the annual conferences of the New Zealand Institute of Horticulture and the New Zealand Institute of Parks and Recreation Management, the International Rangers Course held by Department of Conservation, and a Workshop on Ethnobotany.

ETHNOBOTANY

(Mr G.Y. Walls)

In 1985, through the Director-General of DSIR and the DSIR's International Science Unit, Botany Division became involved in the London-based Commonwealth Science Council (CSC) Biological Diversity and Genetic Resources Project. Dr W. Harris was asked to develop the project proposal for the CSC and in doing so recommended that a pilot study be implemented in New Zealand and the Pacific. The CSC adopted the proposal and appointed Dr Promila Kapoor to implement it on a Commonwealth-wide basis from London. In January 1986 Mr G.Y. Walls was appointed as co-ordinator of the pilot study for New Zealand and the South Pacific. He began putting the project into practice: the task of cataloguing all known traditional uses of indigenous plants, developing a contact network of knowledgeable people and institutions throughout the region, and beginning the active conservation of the most sought-after plants. To do this he enlisted the aid of two researchers: Sue Scheele to explore the archives and compile a computerised database, and Atareta Paul, a skilled

Ngati Kahungunu weaver, to do liaison work and explore the requirements of Maori fibre arts and crafts. Atareta has covered most of the North Island in numerous trips, Sue has travelled to most major libraries and museums in the country, and Geoff has not only covered New Zealand but has also visited the Cook Islands, Hawaii, Sri Lanka and Britain as regional project representative.

Enormous progress has been made in the short time available, paving the way for very valuable future endeavours. These could include assembling national collections of traditional flax varieties, small-scale industries based on flax, cabbage tree or plants with antibiotic properties or essential oils, cultivation of pingao and kiekie, establishment in New Zealand of paper mulberry and pandanus for Pacific Island use, and similar efforts in the islands of the tropical Pacific.

PALYNOLOGY AND MORPHOLOGY

(Dr M.S. McGlone)

Major changes in direction have occurred in this subject area. Some are a result of staff losses, but more because of the changing scientific environment. Servicing remains an important component of the Section's work, with wood identification, chromosome, pollen and electron microscope skills all generating a steady but modest demand. Scientifically, the interest in recent and future environmental change will mean an increasing effort in this field. With the retirement of Dr N.T. Moar, with no replacement, work on pollen morphology will be curtailed. The Electron Microscope Unit has increasingly developed strong links with agriculture and horticulture, and this is where the future of the Unit will lie.

WOOD ANATOMY

(Mr R.N. Patel)

Studies are continuing on the wood structure of the indigenous dicotyledonous shrubs and trees so that detailed anatomical descriptions of individual species can be prepared. These results are used to identify wood in its various forms for people throughout New Zealand.

The work on the wood anatomy of the Fagaceae (*Nothofagus*; *N.Z. J. Botany* 24: 189-202), Lauraceae (*Beilschmiedia*, *Litsea*; *N.Z. J. Botany* 25: 477-488), and Tiliaceae (*Entelea*; *N.Z. J. Botany* 26: in press) has been completed.

The wood of *Entelea arborescens* (whau) can be exceptionally light, and is sometimes lighter than balsa wood. Its most prominent feature is the unusual type of thin-walled, pith-like axial parenchyma which occurs in bands. *E. arborescens* is the only indigenous species known to have pith-like parenchyma and tile cells, and is therefore easily recognised. Crystals

of druse type are present in chambered ray cells. Such crystals are most uncommon in New Zealand wood.

The composition and structure of forest at Pureora, central North Island overwhelmed and buried by pumiceous tephra during the *c.* AD130 Taupo eruption have been described as deduced from the identification of plant macrofossils which include leaves, seeds and wood (Clarkson, B.R; Patel, R.N.; Clarkson, B.D. — in press: *J. Royal Society N.Z.*) About 200 wood samples were identified for this study. A tall, dense podocarp forest dominated by *Dacrydium cupressinum* (rimu), and *Phyllocladus trichomanoides* (tanekaha) with occasional *Prumnopitys taxifolia* (matai), *P. ferruginea* (miro), *Dacrycarpus dacrydioides* (kahikatea) and *Podocarpus totara* (totara). Understorey plants included *Myrsine salicina* (toro), *Pseudowintera colorata* (horopito), *Neomyrtus pedunculata*, *Metrosideros diffusa*, *Blechnum discolor* (crown fern) and *Leptopteris superba*. Comparison with present day forest revealed some major differences.

A similar study of a forest at Benneydale, central North Island buried during the Taupo eruption is in progress.

A 426 year chronology was developed from cross-sections of *Phyllocladus trichomanoides* logs preserved in the forest buried at Pureora (Palmer, J.G. & Ogden, J. from Auckland University, Patel, R.N. — in press: *J. Royal Society N.Z.*). Incomplete outer growth rings observed in the wood suggest that the Taupo eruption occurred in late summer or early autumn.

^ About 200 wood samples, including some involving forensic matters, were identified mainly for various Government Departments and Universities. Some of the samples were collected by the inquirers from a wide variety of sources such as swamps, excavation sites, deep wells and sewer drains. The woody components of a prehistoric Maori back pack approximately 530 years old together with a bundle of sticks which lay beneath the pack were identified for the Canterbury Museum, Christchurch.

CYTOLOGY

(Mr M.I. Dawson)

With the retirement of Mr E.J. Beuzenberg and the brief tenure of Ms H. Rendle, current cytological work is mostly undertaken in response to requests from within Botany Division and external sources, on groups of particular taxonomic interest.

Chromosome Atlas number 29, which covers the 6 New Zealand genera in Myrtaceae, and corrections and additions to number 21 Umbelliferae (*Hydrocotyle*) are both in press. Chromosome counts of indigenous and overseas *Corynocarpus* are complete, and the investigation of Orchidaceae continues.

CELLULAR BOTANY

(Dr M.N. Philipson)

The three-year period 1985–87 has been one of transition and change, with the removal to Christchurch Boys' High School of our old Hitachi HU11B transmission electron microscope (installed 1965), and the installation of the new Zeiss 902 instrument with its integrated microanalytical mode using electron spectroscopic imaging. Unfortunately, this microscope was dogged by a number of faults which caused much down-time and eventually its replacement at the end of 1987 by a new, thoroughly reliable, upgraded model.

Despite intermittent microscope time, a number of projects were advanced.

As a result of an embryological investigation of the grass *Danthonia spicata*, it was found that the reproductive mode in the panicle did not conform to the generally accepted modern view that aerial panicles are chasmogamous, i.e., fertilization occurs in florets that open in the usual manner. For more than a hundred years, the breeding system of *D. spicata* has been a subject of much controversy, most authors believing the panicle to be chasmogamous, while two (1902, 1928) considered it to be cleistogamous, i.e., fertilization occurring within non-opening florets.

Our work showed that in the panicle a larger proportion of florets were cleistogamous than chasmogamous, and that chasmogamous florets occurred more often in the lower parts of the spikelet and in the lower spikelets of the panicle. In addition, the rare presence of two or more ancillary embryo sacs adjacent to the legitimate sac in cleistogamous florets suggested that apomixis (embryo development without the need of fertilization) may also occasionally function. This study, therefore, refuted the claims of a number of recent publications which were based on an incorrect assumption, and established the nature of the breeding system in the panicle.

In 1986, the unit undertook an investigation into an abnormal seed condition in peas which had been gaining in prevalence and importance for a period of five years or more. In the electron microscope, this condition was shown very quickly to be due to a virus, as indicated by the presence of cytoplasmic modifications brought about by the virus and known as 'pin-wheels'. Preliminary investigations on kiwifruit and hops were also made, but the increasing importance of studies on the ryegrass endophyte and the volume of work this entailed, forced us to direct all our efforts in this direction, apart from two smaller lines of research — one in collaboration with ABD (now Biotechnology) on flavour precursors in onion, and another on sterility in some of the lines being produced by barley breeders in Crop Research Division.

A number of these projects require the use of cryo-techniques in the preparation of specimens. In November 1986 Dr Diane Harvey, formerly of the University of Sussex, England, collaborated with us for a period of five months. Dr Harvey has experience in freeze substitution, and we were able to apply this technique to the preparation of specimens for analysis, using the electron spectroscopic imaging mode of the microscope. Three low temperature resins for embedding were also investigated for their comparative usefulness for this work.

Since our earlier elucidation of the mode of transmission of the ryegrass endophyte from one generation to the next, we have turned our attention to an ultrastructural study of the plant/fungus association in the vegetative phase of the host plant. Two endophytes had already been isolated from ryegrass (Latch, Christensen and Samuels 1984), one, the well-known and widely distributed *Acremonium lolii*, and the other, a fungus the authors called '*Gliocladium*-like', which was believed to be much less widely spread, and little known.

From our work we found the *Gliocladium*-like fungus at certain times of the year was a predominant feature of the pasture under study, where it occurred in tillers either in varying and mostly high proportions with *Acremonium*, or more rarely, apparently without the other endophyte. We have determined the ultrastructural features of the *Gliocladium*-like endophyte, as related to seasonal change and to position in the host plant. In addition, this study has resulted in the finding of asexual sporing bodies on the leaf blades of ryegrass pasture plants. Until this time, benign endophytes were regarded as being transmitted by hyphae in the host seed. Spore formation of the endophyte on or in the host plant was unknown. This finding may explain the very rapid increase in endophyte level that occurs in some pastures.

Whether the *Gliocladium*-like endophyte is able to induce the neurological disorder known as 'staggers' in ruminant animals has yet to be determined. Information has been gathered on two other ascomycetous saprophytes/parasites found to be commonly associated with ryegrass shoots and degrading leaf tissues. This will further our knowledge of the organisms ingested by animals during their grazing of ryegrass pastures under conditions when 'staggers' occurs.

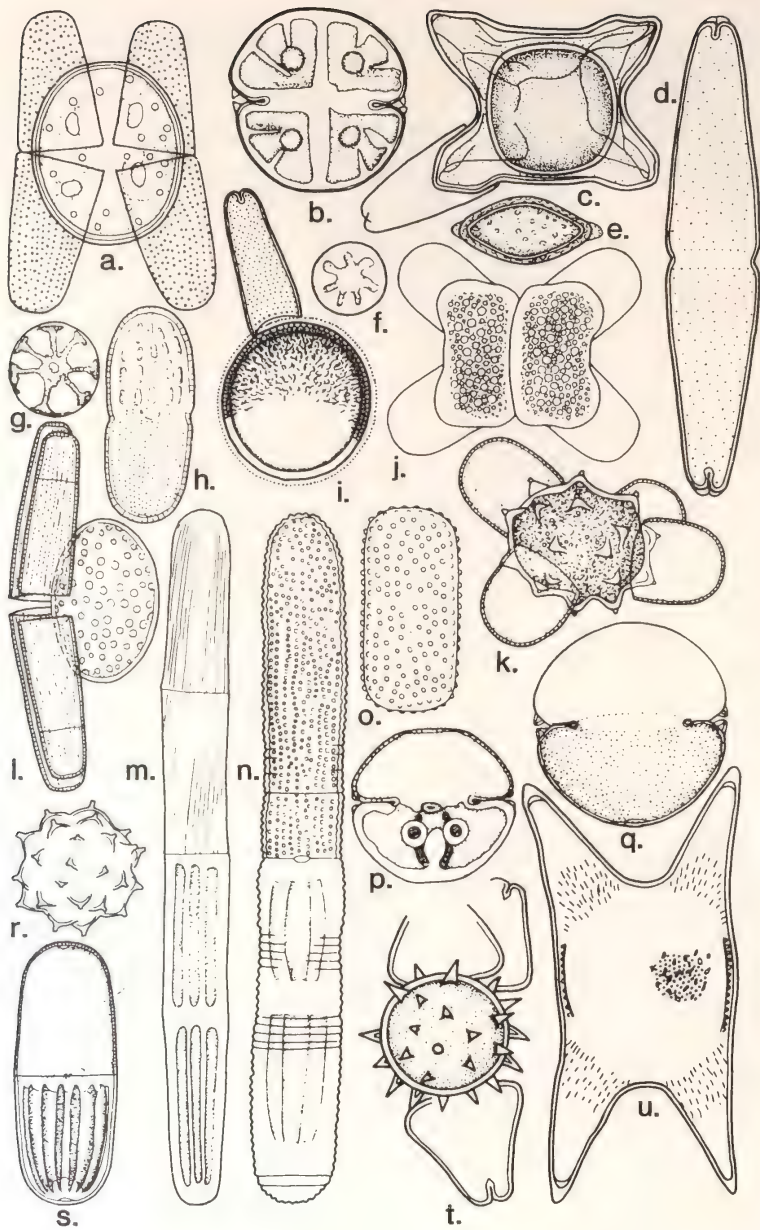
QUATERNARY BOTANY

(Dr M.S. McGlone and Dr N.T. Moar)

Palaeoecological investigations have been directed towards five major areas.

1. Climatic change
2. Effects of volcanic eruptions
3. Consequences of Polynesian and European deforestation
4. Biogeography and biostratigraphy of the Quaternary
5. Sedimentation in estuaries

There has also been a constant flow of requests for information about past vegetation for lectures, etc. More than ever before Universities have been encouraging MSc and PhD students to undertake palaeoecological studies, particularly in pollen. Over the last three years at least eight studies have been devoted at least in part to Quaternary palaeoecological problems. Our laboratory has usually been involved with these studies to some degree, as supervisors, examiners or as providers of training and advice. Our involvement with Universities has therefore been substantial.



- a. *Penium margaritaceum*
 b. *Cosmarium obsoletum* var.
punctatum
 c. *Tetmemorus laevis* var. *laevis*
 d. *T. laevis* var. *tropicus*
 e. *T. laevis* var. *laevis*
 f. *Actinotaenium subglobosum*
 g. *A. cucurbita*
 h. *P. spinospermum*
 i. *T. granulatus*
 j. *A. diplosporum*

- k. *A. cucurbita*
 l-m. *P. spirostriolatum*
 n. *P. margaritaceum*
 o. *P. cylindrus*
 p. *C. obsoletum*
 q. *C. obsoletum* var. *sitvense*
 r. *A. subglobosum*
 s. *A. rufescens*
 t. *Euastrum obesum* var. *obesum*
 u. *T. laevis* var. *tropicus*



N.T. Moar retired from Botany Division on 30 November 1987.



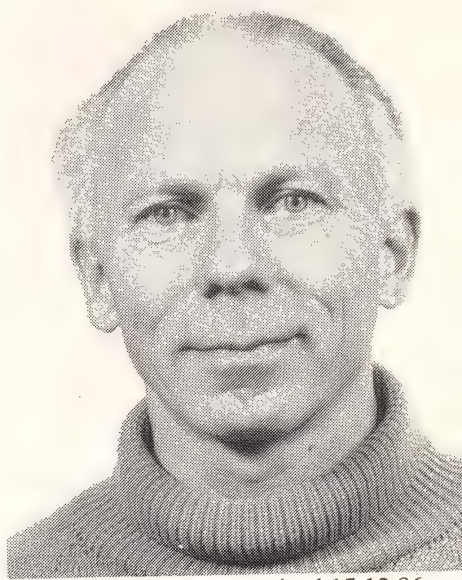
M.J.A. Bulfin retired 7.6.85



U.V. Cassie-Cooper retired 29.9.86



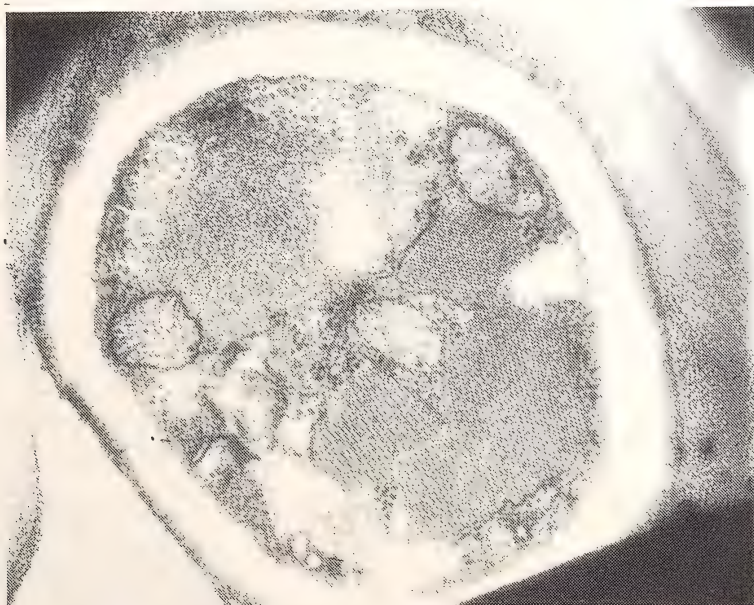
I.C. Brown retired 20.6.86



E.J. Beuzenberg retired 15.12.86



South Westland, Gorge River, field camp for ecological studies. R.P. Buxton and Dr P. Wardle drying out gear and plant specimens.



Acremonium lolii, the common endophyte of ryegrass (*Lolium perenne*). Transverse section of hypha lying in the intracellular space of leaf tissue. $\times 43,290$.

CLIMATIC CHANGE

The remorseless increase of CO₂ and the other 'greenhouse' gases as a consequence of the burning of fossil fuel and intensive agriculture and deforestation is theoretically capable of warming the earth's atmosphere. At present the consequences of such a warming can be only guessed at. Therefore, there is a major international effort underway to learn more about the atmosphere and how it works. Large and expensive computerised models of the atmosphere have been devised, and these are being used to make predictions as to the possible effects of the predicted CO₂ warming.

These complex models require testing before their predictions can be used with any confidence as a guide for future action. The COHMAP group (Climates of the Holocene Mapping Project), based at Brown University, Rhode Island and the Center for Climatic Research, Madison, Wisconsin, is an international team of climate modellers, palaeoclimatologists and palaeoecologists who aim to test by fossil data the predictions that the climate models make for selected periods in the past.

Dr McGlone has been a member of the project group since June 1984, and has attended the annual workshops in 1985, 1986 and 1987. The aim of the group has been to produce a single volume work which comprehensively describes and tests the model on a global scale. The annual workshops, however, ranged over a very wide field of palaeoclimatology and palaeoecology, and spawned other projects and opportunities. The major task of the COHMAP workshops now have been accomplished, the group has disbanded, but informal collaboration continues.

New Zealand's small size and oceanic position means that it has no significant effect on world climate. It is, nevertheless, one of the few large land masses south of latitude 35° South, and the only one in a wide expanse of the southwest Pacific. The contribution that New Zealand research can make to international questions of climate change is to give a terrestrial component to information derived from seacores in the same sector of ocean. Our results to date suggest strongly that climatic change was as severe here as in many continental areas, despite oceanic moderation of our climate, and that changes in major sea boundaries have been the driving force behind the major alterations of the climate.

EFFECTS OF VOLCANIC ERUPTIONS

Work has continued on this topic in the central North Island, recently in collaboration with Massey University and the Institute of Nuclear Sciences, DSIR. Dr Cynthia Lees (Massey University) was co-supervised by Dr McGlone in her work on the effect of recent eruptions on the forests on and adjacent to Mt Taranaki. Her work showed the complex changes resulting from both eruptions and climatic change. Dr McGlone has concentrated on the effects of the Taupo pumice eruption of 1 750 years ago, and numerous pollen diagrams now span the period after the eruption. It can now be confirmed that revegetation after this most devastating of recent eruptions was rapid, and full forest may have re-established as soon as 200–300 years after the final phase of the eruption.

CONSEQUENCES OF POLYNESIAN AND EUROPEAN DEFORESTATION

Nearly all pollen diagrams which extend to the present, show the effects

of Polynesian and European clearances. These well-marked events are of importance as time horizon markers in sediments which are difficult to date by other means. In recent years the date of first settlement of New Zealand has become a matter of some controversy, as has the whole question of extinction of the larger biota and the relative role played by environmental change, such as forest destruction. A continuing research effort is therefore investigating these questions.

BIOGEOGRAPHY AND BIOSTRATIGRAPHY OF THE QUATERNARY

Dr Moar has in the last few years concentrated his attention on the problems of the West Coast, South Island interglacials. This is the area from which we have the most complete record of glaciation, and it is now being matched by a comprehensive vegetation record. Many of these vegetation records are preserved as macrofossils and pollen in silt and loess layers interbedded with or on top of outwash and moraines. Dr Moar will continue his work on these sequences as a major part of his work as a research associate.

Dr McGlone in a review of Quaternary vegetation history and present day phytogeography, developed the idea that some clusters of species in regions of New Zealand — such as north-west Nelson — were a consequence of the major tectonic changes. Further work is not envisaged on this theme. Work on long Quaternary sequences from the central North Island has proceeded slowly, and little new work will be started in this time range.

SEDIMENTATION IN ESTUARIES

Increased emphasis on environmental management has meant that much more information is required than previously about natural systems before major modifications or developments are approved. Dating of sediments in estuaries is difficult as a result of influx of old carbon, bioturbation and reworking of shell deposits. Pollen analysis of estuarine sediments can produce surprisingly good records of terrestrial vegetation change, with excellent resolution. Not only can sedimentation rates be estimated from the occurrence of events — such as the influx of exotic pollen — which are of known age, but the changing vegetation of the catchments which feed the estuaries gives some indication of the nature of the changes which trigger increases in sedimentation. Pollen analysis of estuaries is likely to continue to be an important service provided by our laboratory.

POLLEN MORPHOLOGY

(Dr N.T. Moar)

There is a steady demand for help with pollen identification and the need for pollen keys continues. The text of the pollen atlas was completed late in 1987 and is being critically read before editing begins. A collection of photomicrographs and scanning electron micrographs of New Zealand pollen grains, especially of the dicotyledons, supplements the pollen slide collection which still remains a necessary tool for pollen identification.

MELISSOPALYNOLOGY

(Dr M.S. McGlone and Dr N.T. Moar)

Our work in this area is now almost entirely confined to servicing the honey industry. There is a moderate but consistent demand for pollen analysis of honey from a variety of exporters and producers.

PLANT ECOLOGY

(Dr P. Wardle)

The triennium has seen changes that have drastically altered the ground rules developed over the years for the conduct of ecology in Botany Division. First, our two largest clients, the Department of Lands and Survey and Forest Service were abolished, and the new Department of Conservation set up. Obviously Botany Division is in a position to assist the new department scientifically, but the change created an element of uncertainty which was by no means resolved by the end of the triennium.

At the same time, DSIR began a far-reaching reassessment of its *modus operandi*. During the triennium the main effect of this, for the Ecology Sections of Botany Division, has been a reduction in direct funding, the development of a "transferred funding" arrangement with the Department of Conservation, and the need to seek contracts from both private and public sectors.

Fortunately, the Ecology Sections have remained at full strength through the period, and although unable to extend our capability through summer employment of students, an active and productive programme continued. With the exception of Nelson, work on existing Scenic and Allied Reserves in the South Island was virtually completed, and good progress made in the North Island. Many other surveys were carried out in mainland New Zealand and outlying islands, some in direct response to requests for information, and others as part of a strategy of exploration of areas poorly known botanically. The ecology of individual species has been pursued both by staff ecologists, and by persons employed under contract to the Noxious Plants Council — a promising avenue that unfortunately is now closed.

Perhaps most important of all, as far as helping to build a scientific basis for management of natural lands, have been studies of environmental processes in vegetation ranging from far-northern gumlands to far-southern wetlands.

THE VEGETATION OF NEW ZEALAND

There is a growing awareness of the uniquely New Zealand character of our vegetation, flora and associated landscapes. Planners and land managers, as well as ecologists and educators, need a new comprehensive account of the vegetation of New Zealand. The last such account was published in 1928, and since then both our understanding of the vegetation

and the vegetation itself have changed greatly. Preliminary work consisted of compiling a bibliography, and filling in gaps in field knowledge in the course of meeting Botany Division's commitments with respect to vegetation survey. A first draft is now nearing completion and illustrations have been selected. The material should be with Cambridge University Press for publication before the end of 1989. (Dr P. Wardle).

BIOLOGICAL SURVEYS OF SCENIC AND ALLIED RESERVES

NORTHLAND

Fieldwork and records for 47 Scenic Reserves of Whangarei County (including Whangaruru-North Head Scenic Reserve) and 6 reserves of Hobson and Bay of Islands Counties (including the large Trounson Kauri Park and Ngaioitonga Scenic Reserves) is complete, and final reports are being written-up. (Dr N.M.U. Clunie).

SOUTH AUCKLAND

Surveys of more than 90 reserves are now completed. A manuscript has been prepared for the Rotorua Lakes and White Island Ecological Districts. Several of the reserves are nationally significant as they contain some of the best examples of geothermal vegetation or successions following recent volcanic activity. Scientific supervision was given to Sarah M. Beadel (Department of Lands and Survey) and W.B. Shaw, who completed a survey of thirteen reserves covering a total of 1 444 ha in the Taneatua Ecological District in February 1986. This awaits publication by the Department of Conservation. The main vegetation types represented tawa-dominated broadleaved forest and rewarewa-dominated secondary forest. As coastal dune system vegetation, lowland conifer forest, lowland forest with a distinctive coastal element, and kanuka forest are under-represented in the reserve system, priorities for reservation were identified. Additional information was gained on the distribution of the coastal tussock *Stipa stipoides* and the threatened orchid *Bulbophyllum tuberculatum*. (Dr B.D. Clarkson, Dr Clunie).

HAWKE'S BAY AND EAST COAST NORTH ISLAND

The Havelock North Regional Station of Botany Division was established in 1985, with the region of responsibility being the eastern North Island from Cape Turnagain to East Cape and inland to the axial ranges. This part of New Zealand has the least percentage of its land area protected in reserves, as almost all of the original forest of the lowlands has been destroyed since human arrival, undoubtedly aided by a relatively warm, dry climate. However, there are over 80 Scenic and Allied Reserves in the lowlands, containing the best remnants of indigenous forest, even if small in area. Most have been visited and about half of those in the Hawke's Bay Land District have been fully surveyed. Missing from the reserves system, but still attainable are: coastal cliff and sand-dune systems containing plants such as karaka, ngaio, *Olearia solandri*, matagouri, coastal flax, spinifex and pingao; major wetlands (estuaries, lakes, swamps); inland kanuka-

dominated communities; low-altitude communities of broadleaved trees (lacebark, karaka, titoki, tawa, maire, puriri, kohekohe, etc.). (Mr G.Y. Walls).

MARLBOROUGH SOUNDS

Although the reserves in the Marlborough Sounds have already been surveyed (published by Department of Lands and Survey in 1984), management issues continue to arise and these require botanical input. In the Arapawa Island Scenic Reserve, Dr G.N. Park (Biological Resources Centre, Wellington) and Mr Walls have monitored vegetation enclosure plots since 1978, and as a consequence have crystallised the case for a fence to protect the special Cook Strait narrows forests, and for feral sheep, goats and pigs to be drastically reduced in number. The result is a marked recovery in forest health. (Mr Walls).

OTAGO

Since publication of 55 reserve surveys of Otago Land District (Allen 1978), a further 80 new and proposed reserves have been surveyed (22 by Botany Division staff and 58 by Ms G. Ward and Mr C. Munro, employed by the Department of Lands and Survey under Botany Division supervision). Most of these new reports will appear in a second Otago volume of reserve surveys, due for publication in 1988. There is a continuing involvement with surveys of new reserves or additions to reserves, though the support for this work in the south is limited by preferential funding to northern land districts in which most existing reserves have yet to be surveyed. (Dr R.B. Allen, Dr P.N. Johnson).

SOUTHLAND

Publication by the Department of Conservation of the survey of 52 scenic and allied reserves in Southland is expected in 1988. This work was completed by Botany Division staff in 1984, but there is a continuing involvement as information on new reserves and additions to existing reserves is required.

Surveys of new, proposed, and reclassified reserves and conservation covenants in Southland have tended to concentrate on the Invercargill area, where several surveys have been done of dune and alluvial forests and on vegetation bordering river and estuary. Most such work has been done for local administering organisations (DOC, local bodies, QEII Trust, Catchment Board) where botanical inventory and advice on management has been the main aim. One study with a difference has been in Mores Scenic Reserve near Riverton, wherein some of the largest landmark trees appear to be poisoned by vandals. (Dr Allen, Dr W.G. Lee, Dr Johnson).

REGIONAL VEGETATION SURVEYS

NORTHLAND

Botanical inventory and assessment to identify requirements for nature conservation in the Aupori and Te Paki Ecological Regions has continued. The main surveys completed during 1985-87 were of the Shenstone land purchases and Te Marua blocks (Te Paki) and Lake Ohia (Aupori). A botanical survey of the Te Paki Ecological Region (including compilation

and updating of earlier botanical records), being done in association with DOC, is partly completed but has been deferred by funding cuts.

Surveys in relation to environmental impact assessment and information for land purchase and allocation have involved Waipoua Forest Sanctuary (impact of the highway upgrading and maintenance programme on the vegetation); Ruakaka area water supply (water catchment and storage systems); Maungaturototo, Te Pahi (land purchase) and Kerikeri, Kaimaumuau, Sweetwater (land allocation).

Evidence has been presented to the Planning Tribunal in relation to: mineral exploration (Waikare area — Bay of Islands); impact upon wildlife refuge (Waipu area), and use of wetlands for sewage effluent treatment (Whangarei). (Dr Clunie).

EGMONT NATIONAL PARK

The results of a survey of the Kaitake Range which employed a rank data method suitable for rapid survey by solo field workers were published in 1985. The vegetation pattern was correlated with altitudinal and other environmental gradients and an annotated list of indigenous vascular species presented. The significance of the lowland and semi-coastal forest types as the only substantial areas remaining in the Egmont Ecological District was established.

The results of a survey of Egmont National Park were published in 1987 as No. 5 in the National Parks Scientific Series, intended for use by the public, land managers and other scientists. Some 60 species were illustrated in 18 plates drawn by Mr J. Bruce Irwin. The vegetation types were described, photographically illustrated and mapped. The differences in vegetation on each of the three main volcanoes in the park were related to landscape history. Some management priorities were identified in the conclusion. (Dr Clarkson).

GISBORNE LAND DISTRICT

With Lindsay Daniel (Department of Lands and Survey, now Department of Conservation, Gisborne), Mr Walls surveyed several pieces of land either proposed for reservation or requiring vegetation management, including Motuoroi Island off Anaura Bay (results published in *Wellington Botanical Society Bulletin* 43, 1987), and Pourewa Island near Tolaga Bay. With FRI staff Mr Walls visited known wild populations of kakabeak (*Clianthus puniceus*) on the East Coast. Several new records were made, some through the help of local enthusiasts, but this plant remains very much at risk in the wild. (Mr Walls).

HAWKE'S BAY LAND DISTRICT

Botanical surveys of several parcels of land proposed for protection have been completed. Notable among these are a private forest remnant in the lower Tukituki Valley containing a large plant of the rare *Pittosporum obcordatum* (now fenced from stock), the cliffs, hillslopes and sand systems of Cape Turnagain, and the inland kanuka-clad Sparrowhawk Range. Visits have also been made to forest remnants on the Maraetaitara Plateau, sections of the coast between Cape Turnagain and Mahia Peninsula, and numerous lowland patches of forests and shrublands.

A visit to Pohokura, a peak at the south-west end of the Urewera mountains revealed a surprising richness of new plant records.

Motu-o-kura or Bare Island, Hawke's Bay's major island, was surveyed for the Department of Conservation by a DSIR team from Botany Division, Ecology Division and Soil Bureau. (Mr Walls).

STEPHENS ISLAND, COOK STRAIT

In order to compile an operations plan for this cliff-encircled island, home to thousands of tuatara and millions of breeding seabirds, the Department of Conservation requested Dr Williams, Mr Walls and Shannel Courtney (Department of Conservation) to make a detailed botanical survey. Of greatest concern are the domestic sheep and cattle that remain on the lighthouse part of the island, and the weeds wandering jew, mignoette vine and periwinkle, but the regenerative potential of native vegetation is impressive. Mr Walls, having spent a year on the island in 1974-75, was able to bring a historical perspective. (Mr Walls).

WESTERN NELSON

A botanical survey of Karamea Ecological District was carried out, with the assistance of three students, during the summer of 1984-85. The resulting report, including broad classification of landscape and vegetation, and species lists, assisted land use decisions in that district.

Since the study of vegetation on limestone mountains in Marlborough and Nelson was completed (Heine et al. 1987, Druce et al. 1987), further field work has concentrated on the flora and vegetation on ancient volcanic rocks in the Tasman Mountains. A draft manuscript describes the relationship between 26 vegetation types, the geological terrain types, and climate gradients, between Boulder Lake and Cobb Valley. (Dr P.A. Williams, Mr A.P. Druce).

SOUTH WESTLAND

The tract of land between Haast and Fiordland National Park was, a few years ago, one of the largest tracts of "botanical unknown" in the south. Expeditions by Botany Division over several years have filled many of the gaps in our knowledge, and the 1975-78 period has seen production of our last two reports, viz. on the Big Bay area and on Gorge River. With recent moves towards a south-west heritage National Park and increased focus on this region, these botanical data, gathered largely in the spirit of expansion of knowledge, will have direct application in future land use and land status decisions. (Dr Allen, Mr R.P. Buxton, Dr Johnson, Dr Wardle).

OTAGO AND SOUTHLAND

Vegetation surveys have been carried out throughout Otago and Southland to identify areas with significant biological values, to describe proposed reserves, and to provide information and advice on management of vegetation for a variety of purposes.

Dunedin staff have been involved as scientific advisors to the Protected Natural Areas (PNA) programme studies of four Central Otago ecological

districts, and with the subsequent assessment and implementation of proposals for protection arising from the PNA reports.

Several monitoring projects have been established to assess long-term changes due to fire, grazing and soil nutrient status in a number of locations. The results will be used to determine management requirements for maintenance of biological values. (Dr Lee, Dr Johnson).

CHATHAM ISLANDS

Over a period of six weeks in 1985, four members of the Division studied the botany of Chatham Island peatlands, a project funded by the Liquid Fuels Trust Board. In December 1987, Mr Walls and Dr M. Rudge (Ecology Division) led a small team to Pitt Island, to re-examine reserves administered by the Department of Conservation. It was eight years since their previous visit, when the reserves were newly gazetted and fenced. By re-measuring established vegetation plots, the deterioration of forest canopies could be assessed; at the present rate these canopies will totally disappear within 20-80 years. However, where feral and domestic stock have been excluded, regeneration will ensure forest continuance. Vegetation maps were made of all reserves, and extra plots and photopoints were established to monitor future changes. (Mr Walls).

SURVEYS OF VEGETATION TYPES

PAKIHI VEGETATION IN WESTLAND

This low vegetation consists mainly of rushes, sedges, ferns and smaller specialised plants found on wet organic soils. A study in seven ecological districts shows that the main geographic differences are between pakihi on either side of the Paparoa Range. Classification and ordination results show the main factors determining the vegetation composition are soil drainage and nutrient status, and fire frequency. Without repeated fires, most pakihi areas will return to forest via a succession of tall scrub. This may initially favour fern birds which have been a major stimulus for the conservation of pakihi, but smaller pakihi plants would be shaded out. Management of pakihi reserves will need to take this into consideration. (Dr Williams, Messrs S. Courtney, D. Glenny, G. Hall).

WETLANDS

"Wetland Plants in New Zealand" by P.N. Johnson and illustrated by P.A. Brooke is due for publication in 1989. With illustrations and descriptions of 530 native and naturalised plants of swamps, bogs and other wetlands throughout New Zealand, it aims to assist with the identification of the flora of habitats which are now receiving widespread attention for their biological, hydrological and wildlife values.

A contribution to the 'Lake Managers' Handbook' (1987) on survey, management and conservation of marginal vegetation of lakes, as its title implies, also aims to extend a broad knowledge of lake-margin botany to managers of such habitats.

The need for botanical studies in relation to the hydro-electric project at Lakes Manapouri and Te Anau was one of the reasons for establishing

the Dunedin regional station of Botany Division in 1973. Since then, ecological data have helped determine how the lake levels are currently managed. Guidelines for lake management are now incorporated in Government legislation, and their derivation has been documented (with Prof. A.F. Mark, Otago University). Periodic monitoring of shoreline vegetation continues at both lakes.

Bog and flush vegetation of the east Otago uplands has been the subject of three surveys. On the Lammerlaw Range, large basin sphagnum and cushion bogs are fed by fingers of flush vegetation which arise from small string bogs and snowbanks on the tussock adjacent hill-crests. These systems lie on pastoral lease land and their conservation depends on strategies being developed in conjunction with the Department of Conservation and the runholder.

On the southern end of the Rock and Pillar Range, the former Great Moss Swamp has now been flooded by the Logan Burn Reservoir, but remnant wetlands above the new lake level have been identified for conservation in conjunction with adjacent tussock grasslands. The former extensive oxbow swamps of the Great Moss swamp have now gone, but an opportunity to protect similar systems lies at the head of Lake Onslow to the west where botanical survey has described the patterns of turfy, swampy or impounded oxbows among a matrix of red tussock grassland.

East of Alexandra, a botanical survey has been done of wetlands in the upper catchments of the Manorburn Ecological District. Further assessment of conservation opportunities for diverse bog and swamp types here depends both on the cooperation of runholders who are concerned at the possible loss of grazing country, and on the Department of Conservation's ability to finance a Protected Natural Area survey of this Ecological District which has been given high priority for survey. (Dr Johnson).

KETTLE HOLE VEGETATION

In eastern inland South Island, there are two main areas between Marlborough and Otago where kettle holes (surface depressions on moraines) have a rich native flora of semi-aquatic and turf species. As time allows, representative sites are being sampled in each area, and the current period has seen one visit to the Lake Tekapo area, and the compilation of data on Marlborough and North Canterbury sites. (Dr Johnson).

ECOLOGICAL STUDIES OF INDIVIDUAL SPECIES AND SPECIES GROUPS

SPANISH HEATH (Funded by Noxious Plants Council)

A study of the distribution of *Erica lusitanica* throughout New Zealand and its ecology in Canterbury were completed in 1985 by Ms L.J. Mather. All stages of the life cycle were examined, beginning with its prolific flowering which can occur on four year old bushes. Vast numbers of small seeds are produced which are readily dispersed by wind and animals. They require moist conditions, moderate and fluctuating temperatures, and light for

optimal germination. Overwintered seeds are more germinable than fresh seeds, while many enter the soil seed bank. These often germinate en masse, after adult plants have been killed by spraying and following ground disturbance, to form "seedling banks".

Seedlings grow best under moderate shade. High shade causes morphological changes, and pasture inhibits seedling growth. However, they can survive to flowering beneath the moderate shade of exotic pine plantations. Seedlings can also tolerate moderate simulated grazing, and once they reach a certain size they are largely unpalatable. Population age structures were studied in the Geraldine area where the oldest plant was 44 years old. Here, *E. lusitanica* is spreading into rough pasture, aided by its ability to resprout after fire. The management implications of these biological attributes have been disseminated in popular articles.

TRAVELLER'S JOY (Funded by Noxious Plants Council)

Clematis vitalba has become a major conservation weed, that is rampant in many scenic reserves, especially in central parts of New Zealand. In 1984 Carol West began an ongoing study, supported by NPC until 1986. The work has produced a literature review, survey of field sites, and experiments on growth rates, seed production and germination. Results indicate that while traveller's joy is unlikely to be a problem on the infertile soils where most native vegetation grows, it is very much a problem on fertile sites, where settlement has already greatly reduced the extent of native vegetation.

NASSELLA TUSSOCK (Funded by Noxious Plants Council)

By the late 1940s, nassella (*Nassella trichotoma*) had become a weed of alarming proportions on pastoral land in parts of North Canterbury and Marlborough. Special boards were set up to carry out intensive campaigns to destroy the tussock. These were successful to the extent that nassella tussock no longer directly causes loss of production. However, few of the original infestations have been totally destroyed, and many new ones have been recognised, from the far north to Central Otago.

In 1945 Mr Arthur Healey of Botany Division wrote a bulletin that has been the most important source of information on nassella tussock to date. However, the changing circumstances of the plant indicated a need to reconsider strategies, and to look again at the ecology. Mr Nigel Taylor was engaged for this purpose from 1984 to 1986. Although long-term experimentation proved difficult in face of the "killer policy" conducted by nassella boards, reports were written on ecological aspects, the New Zealand and overseas literature, and on all the known nassella sites in the country.

GENECOLOGICAL STUDIES OF MANUKA AND KANUKA

Over 150 provenances of *Leptospermum scoparium*, *Kunzea ericioides* and several other species of *Leptospermum* from Australia have been grown in the experimental garden, Lincoln, since 1983. Observations have been made of the growth form, flowering, cold hardiness and other characteristics of the provenances to determine genetically based differences among them. The study will increase knowledge of the biosystematic relations between

tea trees within New Zealand and with related species in Australia. The material grown has been used in preliminary investigations of essential oil production and the use of the species for ornamental purposes. (Dr W. Harris).

AGRONOMIC EVALUATION OF *CORDYLINA* AS A FRUCTOSE SOURCE

Recent investigations by Dr Barry Fankhauser, University of Otago, of the process of extraction of fructose from cabbage tree or ti kouka (*Cordyline australis*) by the ancient Maori led to the suggestion that the plant might be an economic source of fructose. As no information on the yield of cabbage tree grown as a crop was available a simple agronomic trial growing cabbage trees from four sources at three densities was planted in November 1986 and harvested one year later. The data will provide a baseline to determine the economic potential of cabbage tree compared to other sources of fructose. (Dr Harris, Ms K.J. Stewart, Dr J. Mann, Crop Research Division).

SYCAMORE IN CANTERBURY

Sycamore (*Acer pseudoplatanus*) is a European tree causing management problems in exotic forests and reserves of indigenous vegetation. Sycamore populations are being studied to assess its dynamics and persistence in different communities. Sycamore will not establish in intact forest, but relies on some disturbance event. Efficient seed dispersal, rapid growth rate, ability to coppice and high shade tolerance, allows sycamore to persist in native forests once established. Sycamore is palatable to stock and does not threaten pastoral land, but will invade marginal areas. (Mr Buxton).

CELMISIA SPEDENII, AN ULTRAMAFIC ENDEMIC

Soil conditions supporting the rare ultramafic endemic *Celmisia spedenii* were studied on West Dome in northern Southland. Compared with adjoining beech forest, red tussock grassland and several shrubland communities, the species occupies distinctive soils with coarse textures, high magnesium concentrations, and low levels of other major nutrients. (P.D. McIntosh, Dr Lee).

ECOLOGY OF GORSE IN THE DUNEDIN DISTRICT

The successional role of gorse (*Ulex europaeus*) around Dunedin was investigated at 125 sites with a view to determining conditions favouring the establishment of native species likely to eventually replace the pioneer gorse. The majority of gorse stands support few native species, even when adjacent to native forest. The establishment of native woody species was favoured by low density, taller gorse, where litter depth was shallow, and areas of bryophyte and bare soil were available. In some habitats gorse domination appeared to be permanent. (Dr Lee, Dr Allen, Dr Johnson).

BARBERRY IN THE DUNEDIN ECOLOGICAL DISTRICT

Barberry (*Berberis darwinii*) is a prominent shrub and small tree in stands of secondary native forest on the hills around Dunedin. It is spreading markedly, and could become a significant weed of poor agricultural land. This study aims towards understanding barberry's ability to compete with

or displace native plants, its persistence, reproductive capacity, and its ability to spread within and beyond scrub and forest. (Dr Allen).

RARE PLANTS IN OTAGO AND SOUTHLAND

As an extension of the nationwide involvement of Botany Division with rare and endangered plants, Dunedin Regional Station has prepared lists of rare plants for Otago and Southland, collated site record forms, and is involved with monitoring of rare plant populations, such as the rare forget-me-not *Myosotis albosericca* on the Dunstan Mountains. (Dr Johnson).

OLEARIA LYALLII ON THE AUCKLAND ISLANDS

The ecological potential of *Olearia lyallii* on the Auckland Islands was investigated to see if this recent immigrant would displace southern rata forests. The longevity, growth rates, seedling establishment sites, and community structure of the two forest-forming trees were examined. Results suggest that *Olearia* and rata have only slightly overlapping ecological tolerances, and that *Olearia* will not exclude rata from sheltered sites around the Auckland Islands. Exclosure plots were established in forest areas to assess the impact of pigs and goats on understory development. (Dr Lee, P.C. Kennedy, Dr J.B. Wilson).

ECOLOGICAL STUDIES OF ENVIRONMENTAL PROCESSES

GUMLAND SCRUB COMMUNITIES

The distribution, floristics, spatial patterns and structure of gumlands scrub communities is being examined in order to elucidate the major pathways of succession and ultimately to identify the primary causes of the changes occurring. The work includes study of woody adventives with a view to their management and control. (Dr Clunie).

WEEDS AND RESERVES

There are about 75 problem weeds in New Zealand reserves that are difficult to eradicate and which substantially change the indigenous vegetation of sites where they occur. Many are short trees with rapid growth rates and a specialised dispersal mechanism. However, several of the worst weeds do not fit these characteristics, e.g. lianes. Therefore it will always be difficult to predict which weeds are likely to become troublesome.

An alternative approach to predicting which plants would be likely to become weeds was to determine the factors influencing weeds in reserves. Data from the Scenic Reserve Surveys of South Auckland, Taranaki and Marlborough were analysed. Results emphasise the need for vigilance by managers in small, narrow reserves close to towns, with clearings and on fertile soils. (Dr Williams, Ms S.M. Timmins).

ROLE OF BRACKEN IN SUCCESSION

Bracken (*Pteridium esculentum*) is a common fireweed in many parts of New Zealand, that regenerates from underground stems (rhizomes). On

quality pasture it can be controlled by intensive grazing, but many areas are unable to sustain sufficient stock numbers. Research has concentrated on the role of this species in succession, especially to forest. Studies indicate that in the dry Canterbury climate, the seeds of woody species dispersed into adjacent bracken stands germinate in autumn and spring. Such seeds are not dispersed far and there is no stored seed bank (except of occasionally gorse or broom), so dispersal is restricted to near bracken/forest ecotones. In November, the new fronds of bracken commence growth and the seedlings, placed under both competitive and moisture stress, do not survive. There is also often a thick bracken litter layer through which few seeds fall, and those that do, fail to re-emerge as seedlings.

In moister areas an occasional young plant survives to eventually reach above the bracken. Once it has done so, it outcompetes the shade-intolerant bracken, creating suitable conditions for the establishment of more seedlings. This type of invasive succession is therefore slow, with the bracken playing an inhibitive rather than a facilitative role. The exception is where other species establish with the bracken as part of an initial floristic composition following fire. These plants are restricted to other fireweeds and include gorse, broom, and if the fire is not too intense, manuka. When such plants reach above bracken height they can compete better for light, and the bracken gradually disappears. Removing them from the initial mix promotes bracken as a persistent species, removing the bracken however makes no difference to the growth rates of the woody species. This follows closely a tolerance model of succession. The role of bracken therefore seems to be to compete, usually successfully, against seedlings but to tolerate those already established. Traditional facilitative models seem inappropriate except that in certain circumstances, bracken can protect forest seedlings from being grazed by stock. (Dr Partridge).

LUPIN DESTRUCTION BY KOWHAI MOTH

Kaitorete Spit, Canterbury, is one of New Zealand's most valuable natural sand-dune systems, but is in part under threat from both marram and tree lupin. In summer 1984-85, the entire population of lupin was severely grazed by the larvae of kowhai moth. Very few plants survived to the next year, but there were numerous seedlings from seed left in the soil. Seed of lupin mostly germinates within one year. There were, however, no larvae of kowhai moth that year. We believe there were so many the previous year, that there was insufficient food for them to reach pupation. Furthermore, in 1986-87, a root disease was killing lupins. Most of the lupin will succumb to this disease, and with an absence of soil seed, the population will take a long time to recover. This study has important implications concerning predator/food supply relations. (Dr Partridge, Dr B.P.J. Molloy).

ECOLOGY OF HARD BEECH IN SOUTH WESTLAND

The age, stand structure, growth rate and distribution of several isolated stands of hard beech in South Westland were studied to determine the viability and ecology of these outliers, some 260 km south of the nearest conspecifics in North Westland. Results indicate that hard beech is competing

successfully with podocarps and other beech species on warm aspects where soils are shallow and free-draining. (Dr Lee).

EFFECTS OF FIRES ON THE COMPOSITION AND NUTRIENT CONTENT OF SNOW TUSSOCK GRASSLAND NEAR DUNEDIN

Two areas of snow tussock grassland on Flagstaff Hill were burnt in Autumn and Spring 1976, respectively. Plant species cover and frequency were recorded in 1977 and 1985. In 1977 the Autumn burnt site had more bare ground and lower plant cover and frequency than did the Spring burnt site. In 1985 cover and frequency values were similar on the two sites, and bare ground was rare. Between 1977 and 1985, tussock-forming plants recovered in size to suppress smaller plants initially favoured by reduction of competition after fire. (Dr Allen, Dr T.R. Partridge).

In the year after burning, *Chionochloa rigida* characteristically flowers heavily and produces a large flush of new growth. In subsequent years the tussocks have depressed leaf growth rates. A study of nutrient concentrations in *Chionochloa rigida* plants, up to 13 years after spring burning, showed that the nutrient resources for flowering and vegetative growth are mainly obtained from the roots. The post-fire long term reduction in leaf growth is closely matched by a similar depression in nutrient concentrations in the roots. (I.R. Payton, Dr Lee, R. Dolby, Prof. A.F. Mark).

INVASION OF SNOW TUSSOCK GRASSLAND BY EXOTIC CONIFERS, OTAGO

Lodgepole pine (*Pinus contorta*), Douglas fir (*Pseudotsuga menziesii*), larch (*Larix decidua*) and other northern hemisphere conifers have shown an alarming tendency to establish within, and eventually replace, native tussock grasslands in the eastern South Island high country. To gain an insight into the mechanism of seedling establishment of these species, the physical and biological characteristics of establishment microsites are being studied at a number of sites across Otago. The results of this study should have direct application in the management of grasslands to prevent the establishment of conifers. (Dr Allen, Dr Lee).

DISTRIBUTION OF INDIGENOUS FOREST IN EASTERN OTAGO

Remaining native forest in eastern Otago has many unusual characteristics of species distribution and regeneration of the dominant tree species. This study aims to classify the forest types and relate them to broad pedological, geological, topographical, rainfall and temperature parameters. It should result in better understanding of the pre-Polynesian distribution of forest in this area, of the regeneration requirements of forest species in this varied environment, and of the management needed to maintain or restore protected forest. (Dr Allen).

SUCCESSION FOLLOWING FIRE, CATLINS ECOLOGICAL REGION

On Cedar Hill an area of similar-statured rata and kamahi trees, with a few silver beech trees and the remains of manuka stems, is surrounded by much more diverse forest dominated either by silver beech or by rata

and kamahi, and lacking manuka. Diameter measurements and age estimates showed that the similar-statured rata and kamahi established at the same time, but that silver beech trees with them were of three distinct age groups. Tree population structures, the presence of manuka stems, and the absence of evidence of landslides or windthrow, suggest that this forest established after a prehistoric fire. (Dr Allen).

WETLAND VEGETATION PROCESSES

Vast peatlands of the Awarua Bog in Southland have had a long history of fire, yet little is known about the original vegetation or about processes of recovery after burning. In 1975, two fires on part of the Seaward Moss proposed scientific reserve gave an opportunity to record vegetation recovery, initially at 6-monthly intervals, on transects placed within what had been different vegetation types (red tussock, *Sphagnum*, *Baumea* bog, bracken, manuka, gorse). Results so far indicate rapid recovery by rhizomatous plants, a brief period where herbaceous colonists dominate, rapid seedling establishment by manuka but much slower by epacrid shrubs, gradual recovery of some red tussocks, failure of *Donatia* cushion bog to tolerate fire, and rapid expansion of gorse stands after fire.

In Waituna Lagoon Scientific Reserve, the normally subalpine *Donatia* cushion bog grows at sea level but is under threat from expanding colonies of black backed gulls. Massive nutrient enrichment of peat accompanies the gulls, so also invading weed species, but monitoring of sites where gulls have been discouraged indicates a trend beyond invading annual species, towards *Carex* and *Juncus* rushland.

Teviot and Red Swamps on the Lammerlaw Range are sufficiently large to illustrate what is interpreted as a cyclical sequence of bog vegetation. On the gently sloping fans of peat, *Sphagnum* dominates broad sheets where water flow is active, but as the moss surface grows above the water table, and as water flow is directed elsewhere across the fans, other cushion bog species colonise, initially *Oreobolus* and *Dracophyllum prostratum*, and later *Phyllachne* and lichens. As water courses resume flow across the oldest stage, *Sphagnum* re-invades to start the growth cycle again. (Dr Johnson).

ECOLOGICAL TECHNIQUES

COMPUTER-BASED RESOURCES

Computer databases and software are being developed to facilitate access to the large resource of ecological and biogeographical information in the Herbarium, and to upgrade analytical approaches to ecological data. Contributors include Dr Trevor Partridge (multivariate analysis), Dr Nigel Clunie (species list generation for Reserves survey), Mr Bruce Muschamp of Division of Information Technology (development and programming of Herbarium database facility), Dr Colin Meurk, Dr Murray Parsons and Ms Janie Glasson (method, design, planning, testing and use of the Herbarium facility), and Dr Colin Meurk (Register of permanent plots). (Dr C.D. Meurk).

BIBLIOGRAPHY, BIOGRAPHY AND SCIENCE HISTORY

(Dr A.D. Thomson)

LEONARD COCKAYNE

During the triennium further data has been assembled for the full account of the life and work of Leonard Cockayne including some 29 items in *BD Newsletter* No. 100 to 117. Perhaps the most significant items were unpublished manuscript notes by Cockayne which have relevance to contemporary botany. The inclusion of the manuscript notes was made possible by the generosity of the Auckland Institute and Museum Library. Significant items relating to Cockayne in *BD Newsletters* No. 100 to 117 are as follows (the issue number and pages are given in parenthesis): "Cockayne: Atkinson correspondence" (100, 16-17), "Cockayne's reports on the botany of Wellington" (101, 21-22), "Opening of Cockayne Memorial Garden in the Christchurch Botanic Gardens" (101, 4-5), "Cockayne's observations on salt meadow plant formations on west side of Avon River" (103, 14-16), "What happened to Leonard Cockayne's papers after his death at Ngaio in 1934?" (106, 7-8), "Leonard Cockayne's Dilcoosha" (108, 28-31), "Addition to Cockayne bibliography" (109, 20), "Cockayne and his mates in Christchurch: Michael Murphy, F.L.S." (109, 14-15), "Cockayne in Wellington" (110, 27), "Cockayne in Wellington and his botanical reports — 2" (111, 21), "Expedition by Cockayne and Speight to Lake Sumner and the Upper Hurunui" (111, 23-25), "Botanical notes on an expedition to Lake Sumner and the Upper Hurunui in October, 1917, with R. Speight by Leonard Cockayne" (113, 33-35), "The pioneers 7. C.E. Christensen" (116, 17-19).

These and all other items in *BD Newsletter* relating to Cockayne will be incorporated into the full biography which is scheduled for completion by March 1990. It will broadly follow the section headings in the outline biography "The Life and Correspondence of Leonard Cockayne" which was published in 1983 and the major difference will be a more detailed account of Cockayne's contribution to science, and especially to botany, horticulture, forestry and conservation with an assessment of his work. The biography will encompass a large sector of an important era in New Zealand botany and Dr Thomson feels a particular responsibility to write an account to do justice to New Zealand botany and to the memory of Cockayne.

BIOGRAPHY OF BOTANISTS

An attempt has been made in *BD Newsletter* to record the passing of New Zealand botanists and others associated with Botany Division and to give a brief account of their contributions. Fellows of the Royal Society of NZ are of course given a formal obituary in *Proceedings of the Royal Society of N.Z.* However the work of only a few botanists will be recorded in this way. In some cases just a brief notice is included in Newsletters but where possible an outline of the botanist's contributions are recorded. During the present triennium some account is given of the following botanists and colleagues: Ronald Melville (105, 1), Pat Brenan (105, 2), Sir Bruce

Levy (105, 2), Lance McCaskill (105, 2), Jörg Cramer (107, 2), Vera Brockie (108, 4), Ted Gourlay (108, 4), Graham Bagnall (108, 5), Eric Mangan (108, 5), Helen Oliver (108, 5), John Bartlett (108, 5), Ellison Gallagher (109, 1), Peter Child (110, 3), Marie-Hélène Sachet (110, 3), Garth Brownlie (110, 4), Sir Malcolm Burns (111, 7), Charlie Devonshire (111, 7), Stanley Brooker (111, 8), John Yeates (113, 7), Lionel Corkill (113, 7), Rolf Dahlgren (113, 7), Les Copp (113, 7), Lucy Moore (114, 2), Kamla Pandey (114, 2), Bay Parham (114, 3), Kazimierz Wodzicki (114, 3), Sir Charles Fleming (116, 5), Ross Michie (117, 2-4, contributed by Dr R.C. Cooper). The most extensive tribute with a full bibliography was given for Lucy Moore (*BD Newsletter No. 114*: 8-19, 1987) a former staff member and the "mother of New Zealand botany".

From time to time aspects of the work of significant botanists and their associates are recorded in *BD Newsletter* in the series entitled "The pioneers": 1. Melissopalynology [R. Waters] (104, 16-17), 2. Ellen Wright Blackwell (106, 6-7), 3. Thomas Cheeseman (107, 16-17), 4. H.B. Dobbie (110, 28), 5. Thomas Kirk (111, 22), 6. James Edward FitzGerald (113, 25-26), 7. C.E. Christensen (116, 17-18).

INDEX BOTANICORUM NOVAE ZEALANDIAE

An account of this project was included in the Triennial Report 1982-84, p. 67 and in the *N.Z. Botanical Society Newsletter No. 2*: 25-26, 1985. Important accessions during the period of the triennium were as follows (the gifter is given in parenthesis):

Bibliography of the publications of John Child (provided by Professor John Parker), data relating to visit of A.A. Dorrien-Smith to New Zealand in 1907-8 (John Adam), bibliography of the publications of Mr E.D. Hatch including an account of his introduction to the study of orchids, bibliography of the publications of Dr F.B. Sampson, bibliography of publications and curriculum vitae of Mr E.B. Bangerter, bibliography of the publications of Dr P.J. Garnock-Jones, curriculum vitae of Dr R.C. Cooper and Dr Vivienne Cassie-Cooper, bibliography of publications of Miss Jeanne H. Goulding, bibliography of publications of Dr B.A. Fineran and Dr Judith M. Fineran (née Greenall), Dr G. Brownlie's correspondence relating to pteridophytes and a bibliography of his publications and biographical data relating to his university career (Mrs Jean Brownlie), biographical report on Professor T.C. Chambers from *N.Z. Herald* (Dr R.C. and Vivienne Cooper) and a portrait photograph used in the article (Dr R.E. Beaver on behalf of the Auckland Botanical Society), additions to Dr Ella O. Campbell's bibliography, of publications of Dr K.K. Pandey (Mr P.M. Sanders), reprint of tribute to Dr Charles Hébaut (Dr B.A. Fineran), portrait of Mr D. Petrie (Sir Charles Fleming), chronology of discovery in New Zealand science.

The chronology referred to in the Triennial Report 1982-84, p. 67 was published as "The New Zealand Book of Events" in 1986. Everyone will have a different viewpoint on significant events in science and my attempt was a first approximation and it is hoped to reassess the chronology in due course. In the immediate future the notable events in New Zealand botany and plant science in general are being extracted to form a separate chronology. This will be assembled as a booklet and distributed to botanists

in New Zealand to obtain their viewpoint to try to obtain a consensus. It is hoped the chronology will eventually be used to write a history of New Zealand botany.

STAFF RETIREMENTS

MR E.J. BEUZENBERG

(Dr N.T. Moar)

Ernst Beuzenberg joined Botany Division in 1954 when he transferred from Crop Research Division to work as technician with John Hair who had recently returned from overseas where he had studied cytological techniques. Ernst was employed at Crop Research Division in 1952 to assist the then Director, O.H. Frankel, with research into the cytology of wheat. When Frankel moved to Australia Ernst continued at Crop Research as a photographer, but was able to assist John Hair on a part-time basis until his continued involvement and obvious interest in cytology led Eric Godley, Frankel's successor to recommend that he transfer to Botany Division. The transfer was approved; a transfer resulting in thirty-two years of work which in association with John Hair laid the foundations of cytogenetics and cytotaxonomy in New Zealand.

Ernst worked at Lincoln throughout his years with DSIR and retired on 15 December 1986. When he transferred he joined John Hair at Lincoln College in what had been the Wheat Research Institute building until the present Botany Division headquarters were opened in 1960.

Much of Ernst's time was taken up with work relating to the chromosome atlas, that is, the determination of chromosome numbers of plant species indigenous to New Zealand. These numbers were published in the series "Contributions to a chromosome atlas of the New Zealand flora" of which twenty-eight papers have appeared to date. Ernst was author or co-author of nineteen of these and when John Hair died he shouldered the task of collating John's unpublished notes for publication in the Contributions. Ernst was involved in one way or another with the rest, sometimes working behind the scenes or helping junior staff, e.g. Barbara Groves, Murray Dawson, come to terms with the demands and skills of cytology. He was always prepared to help a genuinely interested beginner who wanted to learn but he was quick to detect a lack of commitment and found it difficult to work with anyone under such circumstances. Between them, he and John Hair have helped many a budding cytologist.

Besides his work with the chromosome atlas Ernst had an enduring interest in sex expression in plants. This is demonstrated by his work on the cytotaxonomy of and the development of sex expression in *Melicytus* and *Hymenanchera* (Violaceae). This study not only traced the development of sex in the flowers, but provided evidence that the separation of these two genera was artificial and therefore not justified. He worked for many years with *Fuschia procumbens* following up his early observation that a male phenotype descendant of a female-hermaphrodite cross grown in isolation

for 10 years suddenly began producing a few fruits. Sadly this work was never brought to any conclusion because of the ever present demands of the atlas programme, but a brief summary of his experimental work appears in the Miscellaneous series of unpublished Botany Division reports.

In addition Ernst collaborated with staff of Botany Division and of other DSIR divisions based at Lincoln. Much of this work has gone largely unused — Ernst certainly did not advertise it but to the staff concerned it was an invaluable contribution to their studies. In this way he contributed to our knowledge of *Hebe* when he worked with the late Dr Lucy Moore; he collaborated with Dr Mary Kalin Arroyo producing chromosome numbers for her revision of *Ourisia* and he was actively involved with Dr David Drury who revised the taxonomy of the erectitoid senecios.

He contributed especially to projects of Applied Biochemistry Division (now Biotechnology) and CRD staff at Lincoln. He worked with Dr J.D. Ferguson who was developing culture techniques of plant tissues and the results of this collaboration based on meticulous laboratory procedures and the study of hundreds of slides remain relevant to work which continues to this day. He applied the same skills and patience when he collaborated with Mr D.B. McGibbon, also of ABD, in locating glucosinolase in the head and thorax muscles of the cabbage aphid. The enzyme is capable of breaking down complex glucosinolates ingested by the aphid and which explained why this aphid was host specific. The proof depended upon the use of a low temperature fixing agent to prevent the destruction of the enzyme, the use of a specially developed stain and careful longitudinal, lateral and transverse sectioning to “map” the distribution of the enzyme within the muscles of the aphid.

Crop Research Division staff also consulted Ernst, whose advice was much appreciated in various programmes including those relating to barley, blackberries and strawberries. For example cytological investigation of strawberry chromosomes was difficult because of their minute size, but he was able to show that material supposedly of the clone “vista” was in fact an incomplete 16-ploid mutant which accounted for its sterility.

He was meticulous in everything that he did, an attitude equally evident in his use and understanding of the tools of his trade. He developed expertise with a wide range of equipment which he shared with staff whenever technical difficulties arose for them. For Botany Division he advised on the purchase of equipment and in the sixties was in the forefront of the drive to upgrade the quality of instruments available to staff, and then to maintain it. The so-called “five year” plans initiated during this period resulted in the present acceptance of the need for quality equipment and its proper maintenance. This interest inevitably led him into the role of instructor and anyone who learnt microscopy from Ernst was fortunate indeed.

The demands of producing routine chromosome counts frustrated Ernst’s interests in more fundamental topics and which held greater interest for him. Nevertheless, in his last years before retirement he was able to return to the earlier study of the Podocarpaceae initiated by John Hair, and with whom he collaborated. Most of the data has been re-examined, new material studied and we now hope the data will be brought to publication before long. During this period he began a study of juvenility in the New Zealand flora, a long term interest, but the technical requirements for detailed

physiological work were outside the scope of Botany Division's activities, and the project was allowed to lapse. Because of this he tended to undervalue the importance of his contribution to New Zealand botany and to cytology in particular. He was equally modest in relation to his many outside interests which in fact further demonstrated the talent and dedication which was characteristic of his whole approach to life. We wish him well in his retirement.

MR I.C. BROWN

(Dr B.P.J. Molloy)

Mr Ivor Brown retired on 20 June 1986, after 28 years service to Botany Division, having joined in 1958, two years before the official opening of the Division's headquarters at Lincoln.

Following an early career with a local engineering firm, Ivor went overseas with the 15th Reinforcements in World War II. He served in the Middle East, Italy and Japan, and upon his retirement was the last World War II veteran on the staff of Botany Division.

After the War Ivor's work included deer culling, and construction works with the North Canterbury Catchment Board.

Ivor Brown joined the Botany Division Gardens staff as a wage worker in 1958, when the late Mr Lewis Nicholls was in charge. When Lewis Nicholls transferred to the Ministry of Works and Development shortly afterwards, Ivor was acting head of the Gardens. In 1961 he was appointed officer-in-charge and placed on the permanent staff.

From his appointment in 1961 until his retirement Ivor was a central figure in the development and maintenance of the Lincoln Centre gardens in general and the experimental facilities and live plant records of Botany Division in particular. During this time he guided the construction of the glasshouses and shadehouses; the layout and planting of the grounds and experimental plots, including East Block; the plot irrigation system; internal roading and services piping; and many other essential projects. On the eve of his retirement he was intimately involved in the radical changes to the grounds, buildings and roading of the Lincoln research complex as a result of construction works for the now Canterbury Agriculture and Science Centre. Throughout his service Ivor had the added responsibility of managing the gardens staff, involving many people over the years. The Division's workshop and stores, equipment, machinery and vehicles were also his responsibility. In his earlier years of service Ivor often acted as the Division's quarter-master, helping staff to depart or return from major field trips.

Most of the Floras, bulletins and papers published by Botany Division staff have benefited from information gained from the thousands of plants Ivor Brown and his staff have grown and tended over the years. Above all Ivor was a practical person whose co-operation and reliability became a divisional password. Not only did he succeed in growing a wide range of plants, but he really looked after them and did much of the preparatory

and clean-up work. Further, he looked after the plant records with meticulous care and attention.

Ivor also built a solid reputation in the field of public relations, often acting as an important go-between with outside organisations and the general public. In particular he will be remembered for his efforts in the preparation and maintenance of special plant collections for shows and exhibits. Visitors and student groups were always made welcome and learnt a great deal from his experience and practical approach in growing both native and adventive plants.

In recognition of his personal contribution to botany and the affairs of the Division, Ivor was awarded the Allan Mere at a special ceremony in 1985. As a further tribute a well-attended seminar on "The use of experimental gardens for botanical research" was held at Lincoln in June 1986 to mark Ivor's retirement. A most enjoyable social dinner for Ivor and his wife Mary formed an integral part of the seminar programme. A special supplement of the *Botany Division Newsletter* (No. 5, 23 November 1987) records the proceedings of this seminar.

Ivor and Mary Brown now live in contented retirement at Lincoln.

MRS M.J.A. BULFIN

(Dr P. Wardle)

Margaret Bulfin (née Simpson) joined Botany Division on 29 November 1950, when the Division was based in Wellington, and retired in Lincoln on 7 June 1985. When appointed, she had completed a Diploma in Horticulture at Massey University College, and was studying for a B.Sc. at Auckland University which she completed shortly after her appointment. Her subsequent career reflects these dual qualifications in that she has combined botanical interests with the practical approach of a skilled gardener. Two further attributes have also shaped Margaret's career; her love of the mountains, that has allowed collecting and vegetation survey to fit happily with tramping and climbing, and her outgoing personality that has led to wide sharing of her knowledge and enthusiasm about plants, both wild and cultivated. It seems appropriate that a former director, C.M. Smith, persuaded the Public Service Commission to designate Margaret as a botanist; she was the last in Botany Division to have been thus designated!

Her first duties were to assist Miss (later Dr) Lucy Moore on research on tussock grasslands, and Miss Ruth Mason with the maintenance of the seed herbarium. She gradually adopted the last as her own project, and expanded it in various directions, including studies of viability, germination and seedling morphology. From 1952 to 1958 she collected seeds and prepared an annual Index Seminum which listed the accurately identified seed of native and exotic plants that the Division had available for local and international exchange. After the Index was discontinued, seed exchange remained an important part of Margaret's duties; the possibilities for horticultural exchange of plants and techniques were central themes of her travel to Europe in 1981 and to Canada and Europe in 1983.

Her first published paper, in 1952, discussed the role of the awn in establishing seed of *Rytidosperma penicillatum*; subsequent papers have dealt with seed dispersal and germination in a wide range of native genera, including *Drosera*, *Hebe*, *Pseudopanax*, *Euphrasia*, *Pachystegia* and *Myriophyllum* and several species of alpine plants. Controlled environment facilities developed by the Division have been indispensable in these studies.

Identification of seed has practical importance for animal diet studies, archaeology and forensic investigations, all of which have required Margaret's contributions. A data base of morphological descriptions and illustrations has been steadily compiled, and in recent years a scanning electron microscope at the University of Canterbury has been used with great effect to this end. By the mid nineteen-seventies it was apparent that the large amount of information being assembled about seeds needed to be brought together, and the project of a seed atlas was conceived. This is now at an advanced stage, and Margaret is completing it in her retirement.

Margaret's work in vegetation survey has filled in much detail about those parts of New Zealand that remain predominantly in native cover, especially in Nelson province and Fiordland. The information has appeared both in published papers, and in unpublished reports, including the environmental impact reports that became an increasingly important part of the Division's activities from the nineteen-sixties. Her eye for plants and her dedication as a collector have stood Botany Division in good stead, and it was appropriate that the late W.B. Brockie named one of her discoveries, *Epilobium margaretiae*, in her honour.

DR U.V. CASSIE-COOPER

(Dr M. Parsons)

Dr Vivienne Cassie-Cooper retired on September 29, 1986 and a seminar on Phycology and Water Quality was held in her honour on 14-15 October, 1986, at DSIR, Lincoln. With over 65 people attending this was the biggest phycological meeting ever held in New Zealand. Twenty five papers and nine posters covering all aspects of phycology and water quality were presented over the two days.

Vivienne Cassie-Cooper (as Vivienne Dellow) began her phycological career at the University of Auckland where she studied for her M.A. (first class honours) on the algal zonation at Narrow Neck, in relation to the tidal factor. Her Ph.D., completed in 1954, under the guidance of the late Prof. Val Chapman, was on the marine algal ecology of the Hauraki Gulf. In 1957 she was appointed to the New Zealand Oceanographic Institute, part of DSIR, in Wellington, to make the first studies on New Zealand marine phytoplankton. Later while raising a family of two children, Vivienne worked part-time at the Botany Department of the University of Auckland, on the marine phytoplankton in the Hauraki Gulf and she became interested in the phytoplankton of the Rotorua lakes.

On 8 September, 1975, after the sudden death of her first husband Dr Morrison Cassie in 1974, Vivienne was appointed to Botany Division, DSIR, but she remained in Auckland at the Botany Division Substation to continue

her studies on the freshwater algae. These include the important checklists and bibliography of the freshwater algae which provide a firm base on which further floristic studies can be built.

Vivienne was made a Research Associate of Botany Division in June 1987 and an Honorary Research Associate of the Botany Department, University of Auckland on her retirement. She continues to work on the freshwater algae, particularly those of the thermal waters and hot springs. She is ably supported in this task by her present husband, Dr Bob Cooper, who is also a botanist.

DR N.T. MOAR

(Dr M.S. McGlone)

On 1 December, 1987, Dr Neville Taylor Moar retired after 40 years of service to Botany Division. He was the last person to have served under all directors, from Dr H.H. Allan to Dr W. Harris.

Neville grew up in Pohangina Valley, just north of Palmerston North, on the family farm, a place he has always fondly referred to as 'the centre of the Universe'. During his boyhood he was keen on the natural environment and spent much time wandering the hills about the farm, pondering on such mysteries as the presence of gravels and shells high in the hills, far above present sea level. Thus his inclination towards historical science developed early, and was to be central in his subsequent career.

Neville attended Feilding Agricultural High School, an institution which has produced more than its share of Botany Division personnel: Dr H.H. Allan taught there at one time, and Victor Zotov and Arthur Healy are among the ex-pupils. Neville's school years (1940-1944) coincided with the Second World War, and it was at the end of war in 1945 that he enrolled at Victoria University in a double major degree in Botany and Zoology. It was an unusual move for a farmer's son to take a non-agricultural university course, and even more so at Victoria University, which was then regarded by much of the rural population (and city as well) as a hot-bed of 'Red Radicalism'. Neville boarded at Weir House, and his fellow students there, who have since gone on to fame and fortune (Alister Campbell, W.H. Oliver, Bob Stannard, Ron Trotter and Paul Vella), indicate that the fears of undue communist influence were exaggerated.

In December 1947, having obtained his B.Sc. degree, Neville was offered a position as assistant botanist at Botany Division, where he had worked as a vacation worker (along with Ross McQueen) for the two previous summers. His first job was to assist Dr Bill Harris, who at that time was developing the infant science of pollen analysis and studying peats. Neville also enrolled for a M.Sc. at Victoria University College, and began a part-time ecological and floristic study of the coastal peat swamps north of Wellington to Palmerston North, which he completed in 1949.

The early years at Botany Division were filled with a variety of work. In 1950 Neville spent three months surveying phormium flax swamps at Moutoa, Foxton. Flax had become a strategic material during and immediately after the war, and much effort was put into research on its

potential as a semi-cultivated crop. From 1949 to 1960, Neville was involved in a nation-wide survey of fresh-water plants headed by Ruth Mason, and assisted with surveys of Northland, Waikato, Nelson, Westland, and Southland. Independently he surveyed the Tarawera River in the Bay of Plenty, and wetlands on the Chatham Islands. While on the Chatham Islands, Neville took peat cores which he later pollen analysed. In 1950 he began what proved to be a 26 year involvement with Nassella Tussock Boards, serving on the North Canterbury and later Marlborough Boards. As well, there was a brief stint (1953–1954) as editor of the New Zealand Science Review. In 1954 Neville took part in an expedition led by Dr R.A. Falla to the Auckland Islands, taking peat cores which he later pollen analysed.

In 1954 Botany Division moved location from Wellington to Christchurch, shedding some members as it did so. Bill Harris came to Christchurch, but only stayed a year, moving to Soil Bureau in 1955, and subsequently to the New Zealand Geological Survey. As a result, Neville, despite maintaining other commitments, began increasingly to concentrate on pollen analysis and vegetation history as his major scientific work. Between 1956 and 1961 he published eight papers on vegetation history and pollen morphology, no small achievement given the major upheavals and continuing shortages of space and equipment which dogged the early post war years. It is also difficult to appreciate other factors which restrained scientific productivity during those years. Whereas now, publication is regarded as a duty, in those days it was seen more as a privilege, which took staff away from more important activities.

A further factor in Neville's early career was a long-standing, but undiagnosed, heart problem. He had always been limited in the amount of hard physical activity he could undertake, and on the various field trips he nevertheless undertook, was often close to collapse. Matters came to a head in 1955 when after a particularly serious breakdown of his health he was diagnosed as having a constricted aorta. Neville was one of the first group of patients to have open-heart surgery in New Zealand which was a particularly risky operation at that time. The operation was a complete success. For the first time in his life, he knew what it was like to have good health without a constant background of pain and exhaustion. His temperament, which until then he says had tended towards the irritable and short-tempered, improved remarkably also.

In 1961 Neville left for the University of Cambridge, England, to undertake a Ph.D degree in the Department of Botany. His thesis topic (under the supervision of Richard West) was the late glacial and post-glacial vegetation history of south-west Scotland, but he expanded its scope to include the Shetland Islands, and his ancestral home, the Orkney Islands. The Department of Botany at Cambridge at that time was a leader in Quaternary history, and attracted students and visitors from many countries. For the first time, Neville saw up-to-date techniques employed, and mixed with scientists for whom pollen analysis wasn't a sideline, but a full time research occupation. He managed also to travel widely both in Britain and Europe, attend conferences and take part in the life of a great University. Also, it was on his way home from Britain, in the passenger liner 'Southern Cross', that Neville met his future wife, Maria de Zwart, travelling from the Netherlands to New Zealand.

On his return, Neville enthusiastically began the task of applying the lessons which he had learnt in Britain. He saw the need for a systematic pollen analytical survey of one region, so that the complex interplay between climate, floristics and human disturbance could be better discovered. At around this time, Pat Suggate (later to be director of the Geological Survey) was busy extending the work both he and Maxwell Gage had done in the central and northern South Island on Quaternary glacial sequences. It was an ideal opportunity to combine both geological and botanical skills in a comprehensive history of landscape and flora. His work came to an early culmination with the publication in 1971 in the *N.Z. J. Botany* of post-glacial pollen diagrams from Canterbury, Nelson, and North Westland. This paper set new standards for pollen analytical work, and for the first time revealed just how complex and individual the vegetation histories of even a single region of New Zealand had been. With the framework of the post-glacial sequences firmly established, he, together with Pat Suggate, began to look at the older interglacial and glacial sequences from the west coast of the South Island. This work has continued through to the present day.

However much Neville would have liked to have concentrated solely on elucidating the vegetation history of the South Island, this was not possible. Early on, he had seen the need for a comprehensive work on the pollen grains of New Zealand plants. Lucy Cranwell had published a key to pollen and spores before the war, and after had produced an illustrated work on the monocotyledons. Bill Harris had published a volume on the fern spores of New Zealand (which Neville helped to edit). There was, however, no complete illustrated atlas to the pollen grains of the dicotyledons, and Neville began work on this in the early seventies. As well there was a constant stream of work concerned in some way or another with pollen and spores. Atmospheric pollen, pollen on insects, forensics, plant taxonomic applications, allergies, modern pollen rain, all claimed his time.

In particular, growing demand from the honey industry in the late seventies led Neville to begin a project to characterize the pollen content of New Zealand honeys. As export requirements became more exacting it was necessary to pollen type the honeys to ensure entry. In 1985, Neville reported his findings, and since then the Pollen Laboratory has serviced the industry on the basis of this pioneering work.

The early seventies were also a time of intense involvement in international science; New Zealand had offered to host the IX Congress of the International Union for Quaternary Research in Christchurch 1973. From 1971 to 1973 Neville was on the organizing committee for what proved to be a highly successful conference, and one which promoted an outburst of Quaternary work not equalled before or since.

Increasing seniority within Botany Division, and a willingness to take on rather onerous tasks, led to Neville undertaking more and more pure administrative work. Plant morphology, cytology, and the electron microscope unit came under his wing, as well as numerous other administrative duties. The electron microscope unit in particular took much of his time, as he fought for the concept of a comprehensive scanning/transmission electron microscope unit servicing not only Botany Division, but also the wider scientific community.

His vision of an integrated Lincoln-based unit with wide responsibilities

was never fully achieved, but we owe it to Neville that there is now a well-equipped up-to-date electron microscope unit on the campus. When Botany Division was reorganized into sections, Neville became leader of Palynology and Morphology Section, and in 1985 he was appointed leader of the Biosystematics Group, a position he held until his retirement.

Neville Moar's scientific career has by no means ended. He still has a large amount of work to write up, which the events of the last few years made impossible for him to complete. In his new position as Research Associate he has both the time and resources to devote himself solely to research. Characteristically, he has taken on new work in the northern South Island, and we look forward to seeing the completion of the vast task of providing a comprehensive overview of the vegetation and landscape history of this region. His interest in history has never been a narrow one and he has always taken a lively interest in human history as well, in particular the local history of the Lincoln area. At present he is attending University lectures in New Zealand history. We all wish him well in what is shaping up to be a promising second career.

RESEARCH ASSOCIATES

DR J. BEEVER

(Dr A.J. Fife)

Dr Jessica Beever, based at Mount Albert Research Centre, became a Research Associate of the Division in September 1987. Dr Beever's major interest is in the taxonomy of the New Zealand moss flora. Her current major project is a revision of the semi-popular 'The Mosses of New Zealand' by K.W. Allison and J. Child, for Otago University Press. Preparation of new illustrations is almost complete, and work is progressing on a greatly expanded text. Over the past several years a key to the genera of New Zealand mosses has been developed for this revision, with successive drafts tested by botanists throughout the country. A modified version has been accepted by the National Museum for publication in its Miscellaneous Series.

Dr Beever continues a programme of floristic studies, much of it under the auspices of the Offshore Islands Research Group, with financial support from Lottery Science. This programme has included studies on the Poor Knights Islands, North Cape, Three Kings Islands (herbarium study only) and, with Dr Brownsey of the National Museum, on Whale Island and d'Urville Island. Several interesting new floristic records have been made: from the Poor Knights Islands, *Campylopus catarractilis* has been recorded as new to New Zealand, and, at North Cape, the presence of *Ectropothecium* cf. *sandwichense*, a tropical moss previously known from the Kermadec Islands, has been confirmed on mainland New Zealand. A start has been made on a study of the moss genus *Fissidens* in New Zealand. Assistance is being given with the incorporation of the extensive bryophyte herbarium of the late J.K. Bartlett into the herbarium of the Auckland Institute and

Museum, and a moss identification service is provided to other "northern" botanists, particularly those at Auckland University and the Auckland Museum.

DR H.E. CONNOR

(Dr E. Edgar)

Dr H.E. Connor retired, as Director of Botany Division, in 1982, and is now a Visiting Fellow of the Centre for Resource Management, University of Canterbury, as well as a Research Associate of Botany Division. Dr Connor is collaborating with Dr E. Edgar in writing the grass volume of Flora of New Zealand. His long time research interest in the breeding systems and taxonomy of grasses continues unabated as may be seen from the list of his publications, joint papers with Botany Division colleagues apart. In 1985 he was invited to give the N.T. Burbidge Memorial Lecture at the Australian Systematic Botany Society Symposium at Thredbo, and in 1987 he was a guest speaker at the International Symposium on Grass Systematics and Evolution, held at the Smithsonian Institution, Washington, D.C.

MR A.P. DRUCE

(Dr C.J. Webb)

Tony Druce retired from the Botany Division's Regional Station at Taita in 1982 and is now a Research Associate. He continues his field work, particularly in the southern North Island and northern South Island, and deposits his extensive collections in the Herbarium at Lincoln (CHR). His checklist of the indigenous higher plants of New Zealand has now been placed on computer and ordered by families and genera. Mr Druce continues to revise this checklist in the light of his own and others observation and publications on the taxonomy of New Zealand plants. During the triennium Mr Druce has made progress toward publication of his work on the taxonomy of *Coprosma*.

DR E.A. FLINT

(Dr M. Parsons)

Dr Betty Flint graduated from Canterbury University College, Christchurch, New Zealand, B.Sc. (1935) and M.Sc. (1936) for which her thesis in Botany on the "Periodicity of Phytoplankton in Lake Sarah with consideration of some ecological factors" was supervised by Prof. E. Percival. To further her studies on freshwater algae she returned to London to work under Prof. F.E. Fritsch, Queen Mary College, University of London (of Structure and Reproduction of the Algae fame). The distribution in time

and space of algae in a London reservoir was the subject of her thesis for a Ph.D. degree awarded in 1940.

From 1939 until 1942 Dr. Flint worked in the Laboratory of the Metropolitan Water Board where London's water supply is tested for bacterial, biological and chemical content. Between 1943 and the end of the Second World War she worked in Operational Research Section of the Ministry of Aircraft Production. Later she held lectureships in Botany at Victoria University College, Wellington, N.Z., and in the Universities of Leeds and Hull, England.

Dr Flint returned to New Zealand in 1955; under the auspices of the Department of Scientific and Industrial Research, she joined a team investigating the fauna and flora of soils and confirmed that, as in other parts of the world, soil algae in New Zealand varied with the kind of soil. Similarly, studies in the composition of phytoplankton in lakes gave information about the level of plant nutrients in the water and a baseline for detecting changes in purity. Several of Dr Flint's taxonomic publications deal with new, and little known algae. Her ecological papers analyse the composition and succession of phytoplankton. She has grouped lakes according to the desmids and other algae that they contain and found that nutrient rich ponds are often inhabited by algae that may be poisonous.

Over the years Dr Flint sent New Zealand freshwater algae abroad for specialists to identify. Many samples of desmids went to Dr R. Grönblad in Finland. He planned to publish his results but died in 1962 while the work was in progress. Dr Hannah Croasdale was invited to finish and publish other manuscripts that Grönblad left and when asked by Dr Flint, she agreed to finish the New Zealand manuscript, to add to Grönblad's observations by examining more material, which was sent to her, and then to integrate the results with those already in the literature. By 1979 Dr Croasdale was ready to publish. She invited Dr Flint to join her as co-author and to contribute ecological data and details about the habitats where desmids had been collected.

After four years of seeking funds for publishing the Desmid Flora, Dr Flint approached Dr Harris, the Director of Botany Division, who decided to support the publication of the Desmid Flora in three volumes. The first Volume was published on 16 June 1986, the second on 23 September 1988. The third volume is being prepared at present.

On 18 May 1987 Dr Flint moved from her office in Christchurch to Botany Division at Lincoln and in June accepted a position as Research Associate.

DR E.J. GODLEY

(Dr C.J. Webb)

Dr Eric Godley retired from Botany Division in 1984 and returned to the Division as a Research Associate in 1986. Dr Godley's work continues to reflect his broad research interests. Proceedings of the Symposium which marked his retirement were published in *N.Z. J. Botany* 23: 611-810, and to this he contributed a paper bringing together our knowledge of the

morphology and development of seedlings and juvenile forms in indigenous New Zealand seed plants. He pointed out that seedlings are described for only 21% of our genera of seed plants and urged further effort in this area as well as providing much new information himself. One interesting fact pointed out in this review is that when epigeal cotyledons are present, as in most species, then these are immediately followed by foliage leaves, whereas hypogeal cotyledons are followed by cataphylls. As part of his work in the botany of the Subantarctic Islands, Dr Godley completed a paper which included his diary and field notes from the summer of 1962-63 as well as reporting his observations on nectar and nectar-feeding birds (*Tuatara* 28: 1-13). In the field of botanical history and biography, Dr Godley published a paper on James Dall and the discovery of *Pittosporum dallii* (*Natural Museum of New Zealand Records* 3: 1-12) and began work on an obituary of Dr L.B. Moore.

OVERSEAS VISITS

Dr I.A.E. ATKINSON attended a CONCOM (Commonwealth Conservation Ministers) technical workshop on island management held on Barrow Island, Western Australia, in November 1985, where he delivered a paper on the biological value of New Zealand's islands. In October 1986 he attended the "Conservation 2100 Conference" in New York where he presented a paper on the role of introduced animals in causing extinctions of animal and plant species. In April 1987 he visited the Galápagos Islands to take part in a conference on "Botanical research and management in Galápagos" where he gave a paper on the mapping and classification of revegetation on oceanic islands. This visit included about 2 weeks field work in the Galápagos Islands. In November and December 1987 he assisted Mr W.R. Sykes with a survey of the rare and endangered plants of Norfolk Island.

Dr U.V. CASSIE-COOPER attended the conference of the Australasian Society for Phycology and Aquatic Botany in February 1986 at Hobart, Tasmania (CSIRO), where she presented a paper on thermal algae.

Dr A.J. FIFE presented a discussion of the phytogeographic affinities of the New Zealand alpine moss flora at a symposium on Australasian alpine biota held at Thredbo, New South Wales in February 1985. In November of the same year he spent six days at the herbarium/library of the New York Botanical Garden while on a family visit to the United States. Time in the herbarium was spent examining historical specimens of Australasian and South American representatives of the moss family Funariaceae as well as New Zealand type specimens of the genus *Philonotis*.

Dr P.J. GARNOCK-JONES attended the International Botanical Congress in Berlin in July 1987 where he presented a poster paper on seed morphology in endemic New Zealand Brassicaceae. He also attended the preceding Nomenclature Session. Following the Congress he made brief visits to colleagues in England.

Dr D.R. GIVEN attended the Symposium on the Origin and Evolution of Australasian Alpine Biota (Thredbo) in February 1985, and also undertook fieldwork in New South Wales and Victorian alpine and lowland habitats. In November he attended the International Conference in Botanic Gardens

and the World Conservation Strategy (Las Palmas, Canary Islands) and also visited USA and the United Kingdom. In April 1986 Dr Given visited USA, United Kingdom and Switzerland to discuss a proposed book on principles and practice of plant conservation (World Wildlife Fund International Project 3329). This included visits to Missouri Botanical Garden, Kew, and to the IUCN and WWF Headquarters at Gland. In July he attended IUCN/WWF Plant Advisory Group and Latin American Botanical Congress in Medellin, Colombia; this visit included southern Colombia (La Planada Nature Reserve) and brief time in California, USA. In November and December he undertook further travel in connection with WWF Project 3329 to USA, United Kingdom, Italy and Australia to discuss and research aspects of a book on conservation principles. In April and May 1987 Dr Given visited South America (Argentina, Chile, Brazil, Ecuador, Peru) to discuss and research Project 3329. This included attendance at a Workshop on Botanical Management on Galápagos Islands, and a visit to the Minimum Critical Areas Project, Manaus.

Dr W. HARRIS attended the International Grasslands Conference in Kyoto, Japan, in August 1985 and presented a paper on pasture-grazing animals interactions. In Japan he visited the Botany Department, University of Kyoto and the Mat Research Institute, Fukuyama, which is involved in the evaluation of *Juncus* species, including New Zealand material in the takami mat industry. Following the conference Dr Harris visited The Peoples' Republic of China. There he made contact with the Botanical Institute, Academia Sinica, Beijing, the Nanjing Institute of Botany, the Fujian Institute of Subtropical Botany, Xiamen, the South China Institute of Botany, Guangdong, and the Guangxi Institute of Botany. Arrangements were made for the exchange of herbarium and plant materials with these institutes. Returning from China, Dr Harris visited the Botany Department, University of Hong Kong, the Singapore Botanical Garden, and the Botany Department, University of Singapore. In April 1987 Dr Harris attended an International Workshop on "Life Support Species" in New Delhi, India, organised by the Commonwealth Science Council as part of the Biological Diversity Genetic Resource Project. Here he presented a paper prepared in collaboration with Dr T.R. Partridge on the "Use of Life Support Species in New Zealand". Enroute to New Delhi, Dr Harris visited the Royal Botanic Gardens and NSW Herbarium, Sydney, Australia and the Singapore Botanic Gardens and took the opportunity to look at the administrative structures of these institutes and to examine *Leptospermum* material in their collections.

Dr W.G. LEE returned from 18 months study leave at the University of Cambridge, England, in September 1985. He completed comparative studies on the invasive capabilities, soil changes after establishment, growth patterns and frost resistance of twelve shrub species in different types of grassland on chalk soil in southern England.

Dr M.S. MCGLONE attended annual workshops of the COHMAP (Climates of the Holocene Mapping Project) Group in July/August 1985, July 1986, and July/August 1987, which were held in Madison, Wisconsin, USA. This group of ecological and atmospheric scientists are attempting to validate models of past climatic change. In addition to the 1987 COHMAP workshop, he attended the August 1987 INQUA (Quaternary Science)

conference in Ottawa, Canada, where he presented a paper on glacial climatic change in New Zealand.

Mr R.E. McNAUGHTON and Mrs L. NESBITT attended a CSIRO/DSIR joint workshop on information services in Melbourne, 29-30 August 1985, and the First Asian-Pacific Special and Law Librarians' Conference in Melbourne, 1-5 September 1985.

Dr C.D. MEURK attended a "Vegetational Structure" symposium in Utrecht, and the XIV International Botanical Congress in Berlin, in July, 1987. He presented poster papers dealing with impact of grazing on vegetation structure and floristic diversity at Utrecht and on the relationship between subantarctic vegetation and environment at Berlin.

Dr B.P.J. MOLLOY spent one month overseas in 1986 visiting north Queensland, Papua New Guinea, Vanuatu, New Caledonia, and the Solomon Islands. He visited botanical institutions and gardens, and gathered material on orchids, conifers and *Corynocarpus* related to New Zealand taxa. In 1987 he spent two weeks in Victoria, southern New South Wales and Canberra to obtain background information for preparing a "Checklist of New Zealand Orchidaceae" and to discuss its compilation with an Australian co-worker. This visit was supported by a grant from the New Zealand Orchid Foundation Trust Board.

Dr M.J. PARSONS attended the Second International Phycological Congress in Copenhagen, Denmark on 4-10 August 1985, where he delivered a paper on the "Taxonomic characters in *Dasya* and the Dasyaceae (Rhodophyta)". He also visited the British Museum (Natural History) and the Botanical Institute, University of Erlangen, West Germany, looking for New Zealand marine algae that were collected by Joseph Banks on Cook's first voyage to New Zealand 1769-70. At the Herbarium of the Botanical Museum, Copenhagen, a species of *Dasya* was studied. In February 1986 Dr Parsons attended the Conference of the Australasian Society for Phycology and Aquatic Botany of Hobart. He also spent a day looking at *Dasya* specimens in the Tasmanian Herbarium (HO). Dr Parsons represented the New Zealand Herbaria (CHAH) at the National Herbarium of New South Wales (NSW), Sydney, 26 September to 4 October 1986.

Mr W.R. SYKES spent two weeks on Norfolk Island in November-December 1987. In co-operation with Dr I.A.E. Atkinson and local people he undertook a survey of rare and endangered plants on the main island and on Philip Island. This was commissioned by the Australian National Parks and Wildlife Service.

Mr G.Y. WALLS attended the International Workshop on Biological Diversity and Genetic Resources of Plants held at Kew, London, in October 1986. He was the New Zealand-Pacific delegate to the workshop, which was organised by the Commonwealth Science Council, and presented a review of traditional plant use and current work in ethnobotany in the region. En route, visits were made to ethnobotanical institutions in Hawaii and Sri Lanka. Mr Walls had made a prior visit to the Cook Islands, in July-August 1986, as part of Botany Division's coordinating role in South Pacific ethnobotany.

Dr P. WARDLE presented a paper at the International Symposium on Mountain Vegetation, held at Beijing on 1-5 September 1986. This was followed by a post congress tour to Xian, Chengdn and Guangzhou, with

the highlight being a two day visit to the Wolong Nature Reserve. This reserve is famous for containing the main surviving population of the giant panda, and also offers the botanist a vegetation transect from the subtropics to the alpine zone.

Dr C.J. WEBB was an invited speaker at the "Origin and Evolution of Australasian Alpine Biota" symposium held in Kosciuszko National Park, Australia, February 1985. He was also invited to speak at the Boden Conference in Australia, January-February 1986 on "The Systematic Status of Large Flowering Genera." The opportunity was taken to visit herbaria in Canberra and Sydney. In 1987, he attended the Annual Meetings of American Society of Naturalists and Society for the Study of Evolution (Bozeman) and presented a paper on pollen size differences in male and hermaphrodite flowers of Apiaceae, visited Kew (UK) and then attended the International Botanical Congress in Berlin.

OVERSEAS VISITORS

Dr BOB BELCHER visited the Division in November 1986 to investigate the *Senecio lautus* complex.

Mr GARY CHAPPLE and Mr PETER HINDS, Royal Botanic Gardens, Sydney, based themselves at Botany Division in the Autumn of 1985 while collecting plants and seeds for a newly-established alpine garden in the Blue Mountains, New South Wales.

Monsieur LUC DECOURTYE, Director, Laboratoire des Arbustes Ornementaux, Station de Recherches d'Arboriculture Fruitière et d'Amélioration des Arbustes Ornementaux, was stationed at Botany Division, Lincoln, from December 1985 to May 1986. He used the visit to investigate the potential of New Zealand plants as ornamentals in France and collected material from locations throughout New Zealand to evaluate in France. A collaborative project to evaluate the cold hardiness of provenances of *Leptospermum scoparium* was established between M. Decourtye, Dr Harris and Mr I. Warrington, Plant Physiology Division, DSIR, Palmerston North.

Mr PETER GREEN, Royal Botanic Gardens, Kew, worked with Mr Sykes and examined the Herbarium's collections of Norfolk Island plants during January 1985.

Dr DIANA M.R. HARVEY formerly of the University of Sussex, England, spent six months (November 1986-June 1987) with the Electron Microscope Unit, collaborating in ryegrass endophyte research, and in the use of cryotechniques in specimen preparation.

Dr MICHAEL FENNER from the Biology Department, University of Southampton, England worked with Dr Lee from January to April 1987 on aspects of the seed ecology of *Chionochloa* species, and several introduced grasses and legumes.

Mr LI RUI GAO, Guangxi Institute of Botany, Yanshan, Guilin, Guangxi, People's Republic of China, worked in the Herbarium during February and March 1986 as part of an exchange agreement between Botany Division and the Guangxi Institute of Botany.

Dr NORIHISA KITAHARA, National Grasslands Research Institute,

Miyota, Japan, was located at Botany Division in November and December 1987. He was jointly hosted by Dr W. Harris and Grasslands Division, Lincoln, to further his knowledge of pasture species establishment.

Dr MARK McKONE now of Carlton College, USA, was based at the Department of Plant and Microbial Science, University of Canterbury from October 1985 to February 1987. During this time he collaborated with Dr Webb on reproductive biology projects.

Dr JUDY G. WEST visited Botany Division in November 1985 to further a joint study of *Scleranthus* with Dr Garnock-Jones.

Dr MARY WILLSON visited the Division in 1986 to study *Coprosma* ecology.

AWARDS

Dr R.B. Allen, Ph.D. (Otago), 1985.

Mr A.J. Healy, M.B.E. New Year Honours, 1982-83.

COMMITTEES AND APPOINTMENTS

Dr R.B. ALLEN: Council of the N.Z. Ecological Society; Otago Catchment Board.

Dr I.A.E. ATKINSON: Fauna Protection Advisory Council; Interdepartmental Steering Committee for *Clematis vitalba* Research; Interdepartmental Working Party for Kapiti Island Possum Control; N.Z. Ecological Society President; Wellington Land Settlement Committee; Protected Areas Scientific Advisory Committee; Wellington National Parks and Reserves Board.

Dr N.M.U. CLUNIE: Northland Forest Park Advisory Committee.

Dr P.J. GARNOCK-JONES: Kowhai River Reserves Scientific Advisory Committee.

Dr D.R. GIVEN: Sir Joseph Banks Memorial Lecturer, New Zealand Institute of Horticulture.

Dr W. HARRIS: Honorary Lecturer, Lincoln College; Committee of Management, Tussock Grasslands and Mountain Lands Institute.

Mr G.C. KELLY: Technical Advisory Group, Protected Natural Areas Programme; Technical Advisory Group for Land Allocation Criteria, Ministry for the Environment; Protected Area Legislation Review Working Group, Department of Conservation; Scientific Committee, Marlborough Sounds Maritime Park Board; Organising Committee, Second International Symposium for Cool Climate Viticulture and Ocnology.

Mr R.E. MCNAUGHTON: Christchurch Chapter of the Special Libraries and Information Services Section, New Zealand Library Association; DSIR Library Policy Working Group; DSIR Bibliographic Network Standards Committee.

Dr M.S. MCGLONE: N.Z. Journal of Botany Editorial Board; Royal Society of N.Z. Committee for Quaternary Research, Secretary; INS Radiocarbon Advisory Committee; N.Z. Ecological Society Newsletter, Editor; Australasian Quaternary Association Committee.

Dr C.D. MEURK: North Canterbury Land Settlement Committee; North Canterbury Catchment Board; N.Z. Ecological Society Council.

Dr B.P.J. MOLLOY: Honorary Botanist, Summit Road Society (Canterbury); Trustee, Riccarton Bush Reserve; Chatham Islands Permit Committee.

Dr M.J. PARSONS: Australasian Society for Phycology and Aquatic Botany, President -December 1985, Past President 1985-.; International Phycological Society Executive Council; International Organising Committee for Second International Phycological Congress, Melbourne, Australia.

Mr W.R. SYKES: Outlying Reserves Committee; Nomenclature Committee of the Royal N.Z. Institute of Horticulture.

Dr A.D. THOMSON: N.Z. Genetical Society, Secretary; Science and Technology Working Party (Dictionary of N.Z. Biography).

Dr C.J. WEBB: Council member, International Organisation of Plant Biosystematics; Editorial Board, Evolutionary Trends in Plants; Marlborough Nassella Tussock Board; Coordinator, N.Z. Botanical Society Steering Committee.

STAFF CHANGES

Staff numbers and finance

	1985/86	1986/87	1987/88
Permanent Staff Ceiling	52	55	55
Salaries	1 540 400	1 969 100	1 801 000
Other Expenditure	771 600	328 900	984 500
Total Expenditure	2 313 000	2 298 000	2 785 500
Income	2 248 100	2 323 300	2 889 200

RETIREMENTS AND RESIGNATIONS

Mrs K.J. Meyerhoff, Clerk from 4.12.80, resigned 28.6.85.

Mrs M.J.A. Bulfin (née Simpson), Scientist, from 29.11.50, retired 7.6.85.

Mr G.J. Brydon, Clerk from 3.7.85, resigned 24.12.85.

Mr G.S. Burnard, Finance & Planning Officer from 7.2.84, resigned 15.3.85.

Miss V.E. New, Illustrator from 5.3.84, resigned 31.1.86.

Mr I.C. Brown, Technical Officer, from 9.2.58, retired 20.6.86.

Dr U.V. Cassie-Cooper, Scientist from 8.9.75, retired 29.9.86.

Mr E.J. Beuzenberg, Technical Officer, from 21.1.54, retired 15.12.86.

Miss A.M. Hodgins, Illustrator from 23.11.81, resigned 9.1.87.

Mr L.W. Wilkinson, Clerk from 30.1.84, resigned 5.2.87.

Mrs S.J. Miller (née Gamble), Advisory Officer from 28.11.83, resigned 21.4.87.

Miss H. Rendle, Scientist from 27.5.87, resigned 8.7.87.

Mrs S.J. Taylor (née Eggleston), Library assistant from 25.2.80, resigned 31.8.87.

Miss J.M. Thomas, Clerk from 18.12.85, resigned 18.9.87.

Mrs C.M. Wilson (née Brown), Advisory Officer from 17.12.85, resigned 18.11.87.

Dr N.T. Moar, Scientist from 1.12.47, retired 30.11.87.

STAFF REPLACEMENTS

Mr R.H. Barton	4.6.85 Finance & Planning Officer	(vice Mr G.S. Burnard)
Mr G.J. Brydon	3.7.85 Clerk	(vice Mrs K.J. Meyerhoff)
Mr R.E. McNaughton	19.8.85 Librarian	(vice Mr R.W.J. Knox)
Mrs C.M. Wilson (née Brown)	17.12.85 Advisory Officer	(vice Mrs S.J. Miller, née Gamble)
Miss J.M. Thomas	18.12.85 Clerk	(vice Mr G.J. Brydon)
Mrs J.B. Cummack (née Francis)	7.7.86 Technician	(vice Ms J.E. Shand)
Ms C.L. Browne	19.1.87 Illustrator	(vice Miss A.M. Hodgins)
Mrs C.C. Thompson (née Tonks)	21.4.87 Clerk	(vice Mr L.W. Wilkinson)
Miss H. Rendle	27.5.87 Scientist	(vice Mr E.J. Beuzenberg)
Mr V. Chandra	31.8.87 Clerk	(vice Miss J.M. Thomas)
Miss T.A. Mitchell	4.12.87 Advisory Officer	(vice Mrs C.M. Wilson)

NEW POSITIONS

Dr A.J. Fife	20.9.85	Scientist
Mrs M.E. Rae	1.4.87	Typist
Miss H.M. Reid	9.3.87	Library Assistant/Clerk (Maori and Pacific Island Trust)

TEMPORARY APPOINTMENTS

Miss F.S. Liang (Library Assistant) from 25.3.85 to 30.8.85.
 Mrs B.R. Clarkson (Scientist) from 9.5.85 to 8.8.85.
 Mrs B.V. Patterson (Finance & Planning Officer) from 29.5.85 to 8.8.85, (Technical Assistant) from 26.9.85 to 24.12.85.
 Ms R.A. Hamilton (Library Assistant) from 29.10.85 to 17.12.85.
 Mr W.D. Burke (Technical Assistant) from 22.4.86 to 24.5.86.
 Mrs J.B. Cummack (née Francis) (Technician) from 7.7.86 to 25.9.87.
 Dr D.M.R. Harvey (Scientist) from 10.11.86 to 5.6.87.

SPECIAL CATEGORIES

Dr W.G. Lee	Overseas Study Award	23.3.84 to 1.10.85.
Miss A.M. Hodgins	Leave Without Pay (Overseas)	26.4.84 to 10.3.86.
Mrs S.J. Miller (née Gamble)	Leave Without Pay	11.12.85 to 21.4.87.
Ms J.E. Shand	Maternity Leave	9.7.86 to 9.7.87.

WAGE WORKERS

Mr A. Dodds	Gardener	2.10.79 to 17.10.86.
Mr E.D.W. Freemann	Laboratory Attendant	9.7.84 to 24.5.85.
Miss T.A. Williams	Technical Assistant	17.7.84 to 28.2.86.
Ms H.M. Chapman	Scientist	29.10.84 to 30.9.85.
Miss L. Hutton	Technical Assistant	4.11.84 to 28.2.85.

Mrs E.H. Woods	Laboratory Attendant	15.4.85 —
Mrs A.J. Ashton	Handyperson	1.7.85 to 19.12.86.
Mr J.A. De Goldi	Technician	23.9.85 to 9.5.86.
Mrs B.A. Matthews	Technical Assistant	7.1.86 to 18.3.86.
Mr Li Rui Gao	Fieldhand	24.2.86 to 27.3.86.
Mr J.H. Crossland	Gardener	6.10.86 to 7.11.86.
Mr S.N. Oliver	Gardener	20.10.86 —
Mrs H.J. Wallace	Handyperson	16.2.87 —
Ms K.A. Lloyd	Gardener	2.11.87 —

CONTRACTS

- Ms L.J. Mather, Noxious Plants Council Contract to study Spanish heath. 1.4.84 to 31.5.85.
- Mr N.J. Taylor, Noxious Plants Council Contract to study nassella tussock. 14.5.84 to 14.5.87.
- Dr C.J. West, Noxious Plants Council Contract to study *Clematis vitalba*. 10.9.84 to 29.5.87.
- Mrs C.M. Wilson (née Brown), N.Z. Lottery Board-funded position to prepare a Guide to Threatened Plants of N.Z. 29.10.84 to 14.12.85.
- Mr D.L. Bruce, Lands and Survey Contract for the reserve survey of Otago and Southland. 12.5.86 to 8.7.86.

PUBLICATIONS

(Compiled by T.A. Mitchell)

FLORAS

- Galloway, D.J. 1985: Flora of New Zealand. Lichens. Government Printer, Wellington. lxxiii + 662 pp.
- Croasdale, H.; Flint, E.A. 1986: Flora of New Zealand. Freshwater Algae, Chlorophyta, Desmids; with Ecological Comments on their Habitats. Volume 1. Government Printer, Wellington. xii + 187 pp.

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- Lloyd, D.G.; Webb, C.J. 1987: The reinstatement of *Leptinella* at generic rank, and the status of the 'Cotuleae' (Asteraceae, Anthemideae). *N.Z. Journal of Botany* 25: 99-105.
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- Markham, K.R.; Webby, R.F.; Whitehouse, L.A.; Molloy, B.P.J.; Vilain, C.; Mues, R. 1985: Support from flavonoid glycoside distribution for the division of *Podocarpus* in New Zealand. *N.Z. Journal of Botany* 23: 1-13.
- Philipson, M.N. 1985: *Rhododendron* subsection *Saluensia*. *Journal of the American Rhododendron Society* 39: 137-138.
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- Purdie, A.W. 1985: *Chordospartium muritai* (Papilionaceae) — a rare new species of New Zealand tree broom. *N.Z. Journal of Botany* 23: 157-161.
- Wardle, P. 1987: *Dracophyllum* (Epacridaceae) in the Chatham and subantarctic islands of New Zealand. *N.Z. Journal of Botany* 25: 107-114.
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ECOLOGY AND VEGETATION

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