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# CALMScience News

## FROM THE DIRECTOR

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Number 1/92  
November 1992

*I'm delighted to present CALM's new science newsletter. It is the vehicle for communicating the news of science within the Science and Information Division and with our colleagues in the Department. The aim is to produce a quality newsletter that aids communication and helps integrate the scientific work of CALM.*

*This first issue covers a wide range of topics:*

- *The staff profiles will be a feature of the newsletter, informing staff about the backgrounds of the science staff and their areas of expertise. The Management Council are under the spotlight in this issue; in future issues we'll get to hear about the Management Teams in each Science Group and about the work of the various Science Programs - my own profile will appear in the next issue!*
- *The Recent Staff Publications section highlights the papers recently submitted by science staff for publication - the 'plain English' summaries will help communicate the important work that our science staff have recently completed.*
- *The Q & A section provides information about the State and National Committees that science staff contribute to - in this issue the role of the Research Working Groups is discussed and an explanation given of how these Groups interact with CORD and the Standing Committee on Forestry.*
- *The forest science theme is continued with a section on forest research in New Zealand and an analysis of forest research expenditure in Australia.*

*The success of the newsletter, which we plan to produce three times a year, will depend on the support of the science staff in CALM. Your contributions and ideas are welcome - remember, its our newsletter so lets get behind it and make it something we're all proud of!*

*Newsletter of the Science and Information Division of the Department of Conservation and Land Management*

**Dr Jim Armstrong**

## Meet the Science and Information Division Management Council

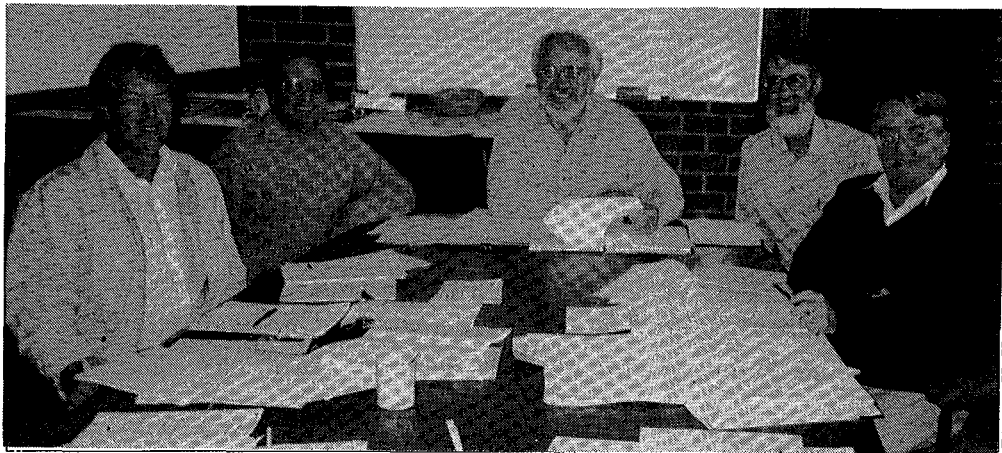


Photo: K. Kenneally

The Council in session.



Photo: K. Kenneally

### **Dr Per Christensen**

I started my career in forestry in Kenya in 1958 as a trainee forester working under a district forester. Much of the work involved softwood plantation establishment and management. After two and a half years I was appointed forester and continued with district work until joining research. I worked for a short while in pine silviculture and later as forester (pathology), doing the field work on the pine needle blight disease *Dothistroma pini*.

In 1964 my wife Helen and I moved to Grahamstown South Africa where I attended Rhodes University as a mature age student completing a BSc with double majors in Botany and Zoology and an Honours degree in Botany. In 1968 we moved to Western Australia and I took up a position as karri silviculturist

with the Forests Department. For the first two years I worked on karri silviculture and jarrah dieback.

From 1970 onwards my work increasingly involved me in fire effects studies in the southern forests. In 1974 I started a PhD study on the biology of the woylie (*Bettongia penicillata*) and the tammar (*Macropus eugenii*) in relation to fire. From 1977 onwards I have become increasingly involved with research management and administration. The Gibson Desert, Desert Dreaming project is currently my only involvement (15%) in active research.

Most of my time is spent managing the Forest Science Group. My views on research are essentially practical. I believe that research is one of CALM's essential functions if the Department is to carry out its job effectively. Pure research, in the sense of research for research's sake, has in my opinion no place in a land management agency. Research should be directed towards solving land management problems; it needs to be directed and cost

effective.

I believe that Forest Science should be closely linked with the Operations Division but that it should maintain a strong independent base. Funding should be linked with the management side of the Department so that research is seen as an essential part of CALM's functions. It is up to us to demonstrate that we not only are worth funding but are essential to the operations of the Department.

Scientists also need to achieve high standards of science and recognition in the national and international community. This is essential to keep at the forefront of knowledge and to build up and maintain credibility within the Department and outside amongst other scientists and the general public. Simply put, we need to come up with the goods in terms of useable management results whilst at the same time maintaining high scientific standards.

The present time is particularly challenging. We can no longer rely on a handout of CRF; what we are allocated already is too little to fund even essential research. We need to

be innovative and to 'sell' our skills. There are many buyers out there, not the least of which is Operations Division of CALM which needs our skills. To be successful however we must be willing to lose some of our independence, allow other people a real say in our priorities and get involved in real life management problems.

The reward is the satisfaction in being an integral part of the CALM management team and seeing your research results being put into practice for better management.

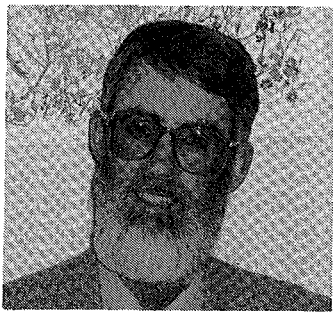


Photo: K. Kenneally

### *Dr Ian Abbott*

When at school I can recall being very much stimulated by the story of Galileo and Torricelli and the idea that the pursuit of Truth was a worthwhile way to spend one's life. I have since been fortunate to have come in contact with, and in some cases to have worked with, several mentors. The first, L.C. Birch, was a Professor of Biology at the University of Sydney and was my first contact with a first-rate mind. He was an eminent Australian ecologist who achieved success at a young age as the co-architect of a general theory of ecology. Very much influenced by the British philosopher Whitehead he taught me to look behind Appearance for Reality, the Big Picture. Perhaps rather foolishly I did not follow his recommendation that I pursue a career in ecological entomology; instead my great interest in birdlife led me to begin research in avian ecology.

Eventually the opportunity of working with P.R. Grant was taken. He is only about 10 years older than me and at that stage was a promising British scientist with a rising reputation in bird ecology. I proposed to solve some interesting perplexities in the Galápagos Archipelago and he arranged the financing of the expedition. It is from him that I learned about asking the right questions, attending to the necessary detail, and economy of research effort. Incidentally, both Birch and Grant could produce the most readable, lucid and unambiguous scientific prose and thereby unwittingly provided a model worth imitating.

My third influencing figure was O.W. Loneragan, a member of the Forests Department of Western Australia and with whom I collaborated closely in the early 1980s. He was the Sherlock Holmes of the jarrah forest. That is, on entering a stand he could within a few minutes deduce from uncanny observation of existing clues the whole history of European influence that stand had experienced. To me this was a wonderful revelation of how to penetrate the secrets of nature. This reinforced my great interest in understanding past events to explain the origin of present patterns. The book of nature can only be read with profit and understood if one cultivates this perspicacity.

In my research career I have been able to gain very broad experience, having worked on both simple systems (islands) and complex systems (soils and forests), at different scales (from small soil samples to whole archipelagoes), and on different organisms (from small soil insects to birds and trees).

In my present appointment as Science Adviser to the Director of Science and Information I will be addressing important and pressing scientific issues relevant to

CALM and providing recommendations and options for their resolution.



Photo: K. Kenneally

### *Dr Neville Marchant*

Currently I am Acting Head of the Plant Sciences Group and Acting Director of the Western Australian Herbarium. I have had a long association with the Herbarium and with the flora of WA.

Born in Perth, I began work as assistant to the Government Botanist, Charles Gardner, when I was 16. Later I gained entry to the University of WA and left the Herbarium to study for a BSc Hons degree in Botany. After graduating, the Professor of Botany, Professor Grieve, granted me a Graduate Assistant position, teaching taxonomy, plant anatomy and morphology and general botany. After three years, and then winning an Australian Legacy Scholarship, I moved to Cambridge University, UK, as a PhD student. At the beginning of my third and last year there I applied for a botanist position at the WA Herbarium, by this time under the directorship of Bob Royce. I was given the position and returned to the Herbarium in June 1970. Apart from two secondments to the University of WA, there I have remained.

My early association with the Herbarium gave me a chance to learn to recognise many plant species and to develop a deep appreciation of the wealth of the vegetation of the south west of WA. I have been able to gain a smattering of knowledge about liverworts, mosses, lichens and algae as

well as other groups. My broad interests made me sought after as a speaker to many conservation and plant enthusiast groups; I have always enjoyed sharing knowledge and stimulating appreciation in one of the most interesting floras of the world. The collaborative *Flora of the Perth Region*, published in 1987, was a product of my mission to spread knowledge and appreciation of part of the south western flora.

Over the last few years I have been involved in UNESCO work to raise herbarium standards and increase herbarium-based research output in the Asian region. WA botany shares many of the problems of Asian taxonomy; both regions are still in a flora inventory phase. Over recent decades, dwindling research funds and fewer trained taxonomists, coupled with competition from favoured high tech pursuits, meant little progress in documenting floras. Taxonomists needed to make themselves relevant to survive. What is exciting about CALM's Herbarium is that we have taken on board the best available technology to make the information we have collected about our flora increasingly available for conservation and land management. I believe that the Herbarium has made itself

relevant to present day WA and CALM needs and I am certain that the institution will become more and more able to underpin conservation in WA. Right now the collection vaults are bursting at the seams, we need lots more specimens but where can we house them? Where can we get funds for new building?

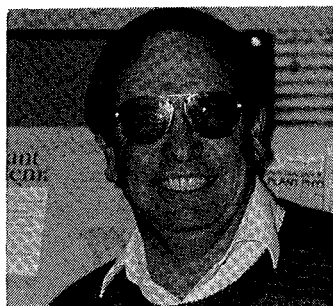


Photo: K. Kenneally

### *Dr Tony Start*

I am currently acting Head of the Wildlife Science Group. I was born and brought up on a farm in Kenya and was educated at the same high school as Per Christensen, albeit a few years later than Per. I completed an Honours BSc at the University of Aberdeen, Scotland where I was introduced to WA through lectures on Quokkas and Australian fleas by former UWA lecturer George Dunnett! After graduating I enrolled at Aberdeen as a PhD student. Aberdeen had a sister university relationship with Universiti

Malaya which enabled me to spend two years in Malaysia doing field work for my thesis on the diets of nectar-feeding bats and the relationship between bat-pollinated plants and their pollinators.

I came to Western Australia in 1974 where (after a stint as a labourer on a Cranbrook farm) I was employed as a temporary Research Scientist at Woodvale on an externally funded project to find living Potoroos in WA. After nine months and no Potoroos I became the first permanent biologist with the National Parks Authority, with state-wide responsibility for dieback management, fire protection, mining claims on National Parks and numerous other things. Three years later I moved to Karratha as the NPA's first Regional Manager, Northern Region from where I was responsible for National Parks from Exmouth to Kununurra.

"After CALM" I remained as Regional Manager, Pilbara until 1988 when I returned to Woodvale as a Principal Research Scientist on the Research Division Policy Group with responsibility for Divisional budgets and staffing issues but I have retained my interests in the Pilbara where I am studying fire in Mulga communities with Steve van Leeuwen.

## ***Woodvale Research Centre Staff News***

In recent weeks there has been considerable staff movement at Woodvale. We have recently welcomed the following staff to the Wildlife Research Centre:

**Alan Clark** has joined the Wetlands Program, from Land Information Branch, Como.

**Brent Johnson** has joined the Fire Ecology/Fauna Program, from Karratha.

**Paul van Heurck** transferred from Como Research to work on the Fire Program (desert invertebrates).

**Bill Muir** has joined the Biogeography Program, from Wanneroo.

**Hugh Clift** has joined the Threatened Species and Communities Unit, from Como Library.

**John Blyth** has joined the Threatened Species and Communities Unit, from Crawley.

**Paul de Tores** moved from Bunbury Central Forest Region, and will be working with Jack Kinnear in the Fox Program.

The Threatened Species and Communities Unit will soon occupy the lower floor of the library - this will happen as soon as the library is connected to the computer network. Unit members are **Andrew Burbidge, Hugh Clift, John**

**Blyth, Andrew Brown and Jill Pryde.** Andrew Burbidge and Jill Pryde will, however, remain in their present offices.

**Jeni Alford** is still working at Kelmscott but is expected back at Woodvale in early 1993.

**Dasha Minarovic** has moved from the Woodvale library to the Herbarium library.

**Lisa Wright** is now the Head Librarian at Woodvale.

**Bev Anza** is the Library Assistant at Woodvale.

**Karan Maisey** left Woodvale some time ago to take up a position in CALM at the Busselton Research Centre.

\*\*\*\*

## RETROSPECTIVE

*What do you say about five years out of your life? After reflecting a little, but not for too long, I find that I have enjoyed the majority of my time as Director of Research.*

*Of greatest importance to me is the fact that I have been privileged to lead a group of people, who with few exceptions, are outstanding scientists, technical officers and support staff. It is no idle boast to say that in CALM Research Division we have by far the best applied research group of its type in Australia; the challenge is to maintain this status.*

*I have been fortunate to make many new friends and new contacts. As well, during my time as Director, I believe there have been many positive achievements in and by the Division.*

*We think more as a team and less as disparate groups. We have conducted new and important areas of research while maintaining vital long term work and have made a number of outstanding breakthroughs. Many research projects have come to fruition and been implemented, influencing conservation and land management policy and practice. We have maintained a reasonable funding base in most areas in a time of shrinking State and Departmental budgets by keeping a share of internal money and attracting external funds. A good promotional system has been developed (even if in future we may have trouble paying for it).*

*Yes, there have been times when I have wished that I had spent less time dealing with problems (difficult people and issues), politics (external and internal) and paperwork, and more time doing the things I enjoy, such as working in the desert and island hopping. The little time available for 'hands on' research, writing and conservation was one of the factors that influenced me to move on. Furthermore, I am a strong believer in the principle that, especially in dynamic organizations such as Research Division, changes in leadership from time to time are advantageous. I am looking forward to new challenges, and preventing extinctions and maintaining biodiversity are two of the greatest problems currently facing our resource-hungry world.*

*I would like to thank the many people who have helped me over the past few years. Senior CALM Research Division staff such as RDPG members Per Christensen, Steve Hopper, Jim Armstrong, Ian Abbott, Tony Start and Neville Marchant, and all Program Leaders, have been particularly co-operative. I have also had considerable support from many colleagues on the Corporate Executive and other CALM managers (well, most of the time). Special thanks must go to my immediate support staff, particularly Jill Pryde, who has been my invaluable secretary, Jeanette Gilmour and Christine Farrell, Divisional Administrative Assistants and Phil Fuller, who has helped make my field work so enjoyable. The clerical support staff at Woodvale have all helped me at various times, as have John Dorlandt and the staff at the other Research Centres. Friends who drop into my office to talk about the real world have helped keep me sane (or as nearly sane as I was before taking up this job).*

*I offer my congratulations and best wishes to Jim Armstrong. I know that he will provide the highest level of leadership and I urge you all to support him to the maximum extent.*

*CALM's Science and Information Division will continue to be as good as the people in it. The future is in our own hands.*

**Andrew A. Burbidge**

## Newsbriefs...

### Overseas Travel

Neville Marchant attended a meeting in New Delhi from September 25 to 29 to establish a Board of Management for the Botany 2000-Asia network. To date Neville has been the Secretary of Botany 2000-Asia which is a UNESCO-sponsored organisation seeking to improve herbaria and herbarium taxonomy in the south east Asian region.

### The Flora of the Kimberley Region

The culmination of five years of hard labour by those involved in writing regional floras at the Herbarium has been reached. The *Flora of the Kimberley Region*, edited by Judy Wheeler, was published at the end of September. Congratulations Judy and all others involved for a sterling effort!

### Brent Johnson

Brent recently made the long haul down from Karratha to commence work as Technical Officer in the Fire Program at Woodvale. He will be assisting Gordon Friend in ongoing studies of the impact of fire on small vertebrates and invertebrates in the Wheatbelt and South Coast Regions. So far he has spent most of his time making drift fences for pitfall traps which will be used in a new study on small vertebrates and fire in the Jarrah forest, Collie District. If anyone feels like helping dig the pits in, please contact Gordon.

### VATPAS

Tim Birmingham has put in experimental plantings of *Acacia* species (including *A. mearnsii*) in wheatbelt areas where rainfall is too low for more traditional tree crops such as blue gums (*Eucalyptus*

*globulus*) or *Pinus radiata*. The *Acacia* species used have considerable potential for producing soluble fibres and tannins for adhesives and leather tanning. Such plantings combine the promise of substantial dollar returns for tree products with the indirect benefits of trees for salt control and minimizing stock exposure and soil erosion. This combination should encourage widespread adoption of tree plantings where single purpose forestry would not be economic.

### Space Crisis

The Herbarium is nearly completely full of specimens! Volunteers have been mounting the backlog of collected material at a steady rate and with new specimens being incorporated, the Herbarium vaults will soon reach their absolute maximum capacity.

All available space for specimen storage where researchers can access specimens will be filled by December 1.

Originally designed to hold approximately 300,000 specimens, shelves have been crammed so that the total is now approximately 500,000.

### New Staff

Two new staff members have recently arrived at Busselton. Karan Maisey transferred from Woodvale where she worked in the Fire Research Program and Keith Mungham transferred from Land Information Branch. Their arrival has been timely as the workload at Busselton has increased with the requirement to provide technical input to CALM's eucalypt sharefarming and timberbelt ventures.

### Dieback Research

Jocelyn Bathgate, Stan Bellgard and Barbara Komarek have recently been appointed, on ANPWS funding, to carry out research on the containment and control of dieback disease due to *Phytophthora* and *Diplodena*

fungi. They are in the Plant Sciences Group and based at the Forest Science Como laboratories, working closely with Bryan Shearer and Felicity Bunny.

### Karin Strehlow

Karin is currently peering down a microscope for most of each day in Gordon Friend's lab sorting spiders. She is undertaking an Honours project through Murdoch University on the impact of fire on spider communities in semi-arid shrublands, and is jointly supervised by Jenny Davis (Murdoch) and Gordon. She is making excellent progress, having overcome the "taxonomic impediment" through the generous assistance of Mark Harvey (WA Museum) and Barbara Main (UWA).

### Threatened Flora Surveys

Detailed surveys of rare and threatened flora have commenced in CALM's South Coast Region. Two consultants, Chris Robinson (Albany District) and Gill Craig (Esperance District), plan to survey 95 threatened and 445 rare or poorly known taxa over the next two years. Both consultants are funded by ANPWS and will produce a District based Wildlife Program for rare and threatened flora after the completion of the surveys.

Sue Patrick, Andrew Brown, Ray Cranfield and Phil Spencer are continuing to survey the ever increasing list of rare and threatened flora in CALM's Moora District. Sue expects to have a draft Rare and Threatened Flora Management Program prepared for this District by mid 1994, but that depends on how many new rare taxa are added to the list in the next twelve months.

### **Operation Foxglove**

Mick Dillon is conducting a trapping program in the Collie area to assess the effectiveness of removing introduced predators (mainly foxes) as a means of rebuilding populations of native mammals. Mick is also trapping in the Dwellingup area to locate sites for a similar study.

### **Small invertebrate database**

Richard Siemon has been busy the past 3 weeks developing a data-base on small vertebrate life histories and their predicted responses to fire and other disturbances. His work is funded by the NPNCA Trust account, and carried out under Gordon Friend's supervision. Once the system is up and running (on Paradox) we will need to input vast amounts of life history information and then promote its use by District and Regional staff. Collie District will be the guinea pigs.

### **Plantation Silviculture Research**

A meeting was held with the District, Regional and Silviculture Branch staff in early August to discuss research priorities and funding for operational aspects of plantation silviculture research. Research areas given a higher priority were plantation establishment techniques, tree breeding, pine and *E. globulus* nutrition, and eucalypt plantation entomology.

### **Regional Workshops**

Herbarium staff presented two workshops on plant identification in September and demonstrated how to identify plants and develop field herbaria. Sue Patrick and Ray Cranfield were at CALM Bunbury and Neville Marchant visited CALM Shark Bay. The main objective of these workshops was to assist CALM regional staff to cope with the incredibly rich WA flora. One of

the ways this can be done is through field herbaria where each specimen is represented by a databased voucher in the State collection, the WA Herbarium.

### **Southern Tree Breeding Association Meeting**

Trevor Butcher recently attended a meeting of the Southern Tree Breeding Association (STBA) in Melbourne. It is likely that the breeding information management system that has been developed in CALM will be adopted as a national standard. APM Forests are also interested in the system and may purchase it. The Queensland Forest Service are interested in the pollination control systems developed in W.A. (The Hedged Artificially Pollinated Seed Orchard and chemical emasculation of *P. radiata*).

### **The Census of Western Australian Plants**

The software for the census of Western Australian plants, WACENSUS, is finally complete. The data is in pretty good shape too!

WACENSUS is an ORACLE database that contains most of the published Western Australian taxonomic names as well as many manuscript and phrase names. Most importantly, it contains a unique numeric identifier for each name and means for tracking the history of names.

The data can be downloaded to an ASCII file through one of the menu options, the idea being to use the Taxon ID in species databases. This will allow you to more effectively maintain the currency of species names.

SEDIT, although already operational in  $\beta$ -test form, will soon be updated to more fully utilise the census on PCs.

WACENSUS is stored on the FISCAL VAX. To get access to it you need to ring Information Systems Branch who will send you the appropriate form. To start the system you enter the command

CENSUS at the FISCAL prompt.

Copies of the user manual can be obtained from Vicki Hamley at the Herbarium.

### **Dr Brad Gabor**

Dr Brad Gabor from the Research School of Biological Science at ANU visited the Como Research Centre in September. Dr Gabor has worked on the resistance of avocado to *Phytophthora cinnamomi* and was interested in the work being done by Mike Stukely and Trevor Butcher on the resistance of jarrah and pines to *P. c.*

### **More Canker**

Consultant Dr David Murray is working with Dr Ray Wills and Dr Giles Hardy (Lecturer in Forest Pathology, Murdoch University) to isolate and identify pathogens from diseased plants found in populations of rare, threatened and poorly known flora or from associated species at those sites. The project will concentrate on identifying canker fungi. Last year, canker fungi caused extensive damage to many species from large areas of the species-rich shrublands and *Banksia* woodlands on the south coast of WA. The cankers have a broad host range and have damaged large stands of vegetation. Ray examined 241 species from a range of families and found 46% appeared to have been damaged by canker fungi. Many plants in the Proteaceae were affected - 82% of species were damaged or killed by the fungi.

### **Congratulations**

Nicholas Lander was recently awarded the Graduate Diploma in Public Sector Management (with Distinction) from Curtin University of Technology. The course entailed two years part-time study, requiring 6 contact hours and some 12 hours additional study each week over four 12-week semesters. It included units in Australian



public administration, comparative public administration, policy analysis, constitutional politics, organizational behaviour, administrative leadership and entrepreneurship.

### Just Out

- Abbott, I. (1992). Records of outbreaks of defoliating insects in jarrah forest, south-west Western Australia, from 1960 to 1990. CALM Technical Report No. 28
- Abbott, I., Burbidge, T., Williams, M. and Van Heurck, P. (1992). Arthropod fauna of jarrah (*Eucalyptus marginata*) foliage in Mediterranean forest of Western Australia: Spatial and temporal variation in abundance, biomass, guild structure and species composition. *Australian Journal of Ecology* 17, 263-274.
- Abbott, I. (1992). Biogeography of grasses (Poaceae) on islands of southwestern Australia. *Australian Journal of Ecology* 17, 289-296.
- Algar, D. and Kinnear, J. (1992). Cyanide baiting to sample fox populations and measure changes in relative abundance. *Bureau of Rural Resources Proceedings No. 11*, 135-138.
- Burrows, N., Ward, B. and Robinson, A. (1991). Fire behaviour in spinifex fuels on the Gibson Desert Nature Reserve, Western Australia. *Journal of arid environments* 20, 189-204.
- Crombie, S. (1992). Root depth, leaf area and daytime water relations of jarrah (*Eucalyptus marginata*) forest overstorey and understorey during summer drought. *Australian Journal of Botany* 40, 113-32.
- Hall, G.P. (1992). Host preferences of Paropsini (Coleoptera: Chrysomelidae) in south-western Australia. *Journal of the Royal Society of WA* 75, 19-20.
- Keighery, G.J. (1992). Taxonomic review of the *Grevillea drummondii* Meissn. species group (Proteaceae). *Nuytsia* 8, 225-230.
- Keighery, G.J. (1991). Environmental weeds of Western Australia. *Plant Invasions: the incidence of environmental weeds in Australia*, 180-188, published by ANPWS.
- Keighery, G.J. (1992). A new species of *Guichenotia* (Sterculiaceae) from south western Australia. *Nuytsia* 8, 319-321.
- Keighery, G.J. (1992). The impact of *Phytophthora* species on rare plants. From *Dieback - what is the future?: papers presented at a seminar in Perth, 23rd Sept, 1992*. Published by Northern Sandplains Dieback Working Party.
- Lowrie, A. and Marchant, N. (1992). Four new *Drosera* taxa from south western Australia. *Nuytsia* 8, 323-332.
- Sharley, A.J., Best, L.W., Lane, J. and Whitehead, P. (1991). An overview of lead poisoning in Australian waterfowl and implications for management. *Proceedings of an International Waterfowl & Wetlands Research Bureau workshop*, 73-77.
- Short J., Bradshaw, S.D., Giles, J., Prince, R.I.T. and Wilson, G. (1992). Reintroduction of macropods (Marsupialia: Macropodoidea) in Australia - A review. *Biological Conservation* 62, 189-204.
- Turner, S.J. (1992). The egg capsules and early life history of the corallivorous Gastropod *Drupella cornus* (Roding, 1798). *The Veliger*, 35, 16-25.
- Williams, A.A.E., Hay, R.W. and Bollam H.H. (1992). New records for six lycaenid butterflies in Western Australia (Lepidoptera: Lycaenidae). *Australian Entomological Magazine* 19, 25-27.
- Williams, M.R., Williams, A.A.E., Atkins, A.F. (1992). The life history of the Sciron Skipper *Trapezites sciron sciron* Waterhouse and Lyell (Lepidoptera: Hesperiiidae: Trapezitinae). *Australian Entomological Magazine* 19, 29-32.
- Wilson, P.G. (1992). The *Lawrencella* complex (Asteraceae: Gnaphalieae: Angianthinae) of Australia. *Nuytsia* 8, 361-377.
- Wilson, P.G. (1992). The classification of Australian species currently included in *Helipterum* and related genera (Asteraceae: Gnaphalieae): Part 1. *Nuytsia* 8, 379-438.
- Wilson, P.G. (1992). The classification of Australian species currently included in *Helipterum* (Asteraceae: Gnaphalieae): Part 2 *Leucochrysum*. *Nuytsia* 8, 439-446.
- Wilson, P.G. (1992). The classification of some Australian species currently included in *Helipterum* and *Helichrysum* (Asteraceae: Gnaphalieae): Part 3 *Anemocarpa* and *Argentipallium*, two new genera from Australia. *Nuytsia* 8, 447-460.
- Wilson, P.G. (1992). The classification of the genus *Waitzia* Wendl. (Asteraceae: Gnaphalieae). *Nuytsia* 8(3): 461-477.
- Wilson, P.G. (1992). A new species of *Acomis* from the Northern Territory and a new combination of the genus *Thiseltonia* (Asteraceae: Gnaphalieae). *Nuytsia* 8, 479-483.

### Publications

The Wildlife Science Library at Woodvale has 5 copies of "Introducing Enable" by Evan Parker - 1st ed, 1989; and "Introduction to probability and statistics by H.L. Alder by B. Roessler - 5th edn, 1972.

If anyone is interested in having a copy of one or both of these publications - please telephone Lisa on 405 5132.



### **Bird breeding data**

This year has seen exceptional rain in most of the arid regions of Western Australia. Many of the birds of those climes breed after good rain so Phil Fuller took the bus north and spent two weeks gathering bird breeding data in our 24 plots in the Hamersley Range.

He returned with 160 records of 30 species with old nests, new nests or fledglings being fed by their parents. The rarest was a Grey Honeyeater building. This is his third Grey Honeyeater breeding record (on earlier trips he had found a nest with one egg and a fledgling being fed by an adult). There have been only eight published records of this species breeding - despite a range that stretches across the centre of WA and the NT and includes the far north of SA.

### **Richard Siemon**

Over the past months, the Division has been fortunate to have the services of an experienced PARADOX developer. His name is Richard Siemon and he has been attached to Woodvale since December 1991. Since then, he has developed and implemented a number of sophisticated PARADOX systems for Woodvale, Herbarium and Manjimup Research. He has also conducted training sessions for the Division.

Richard can be contacted at Woodvale (405 5100) or through Mike Choo, Paul Gioia or Mike Yung.

### **Paradox Update**

PARADOX users will be pleased to know that there are two new versions in the offing: Paradox/4 which has just been released in Australia and Paradox/Windows which will most likely be released by December '92. A number of us have previewed the products and have been suitably

impressed.

Paradox/4 is independently rated to be the most advanced and fastest relational database for PCs (10 times faster than version 3.5). It includes a windows-like interface, context sensitive speedbar, more sophisticated forms and an applications generator. For those who have had problems with algre text fields, version 4 supports variable length memo fields each of which can store up to 256K of data. Version 4 also allows for storage of BLObs (Binary Large Objects, include any type of data: graphics, sound, word processing documents, spreadsheets, multimedia etc.).

Paradox/Windows is under wraps at the moment and I have only previewed the beta test version. It will have all the features of version 4 and offers full windows compatibility (including Dynamic Data Exchange or DDE).

Both products will address colour printers (eg HP Deskjet 500c).

Recommended Retail Price:	
Paradox/4	\$1175.00
Upgrade costs:	
Paradox 3.5 - 4.0	\$295.00
Paradox 3.0 or less - 4.0	\$395.00
Paradox 4.0 - Windows	N/A

Research Techniques is negotiating with BORLAND for a special bulk upgrade to version 4.0 & Windows (incl.) for \$235.00 per copy.

For more information, contact Mike Choo or Paul Gioia.

### **Ray Wills**

Ray Wills has transferred from the Dwellingup Research Centre to the WA Herbarium.

### **States Co-operative Assistance Program (SCAP) 1992-3**

Science and Information Division was successful in attracting \$124 000 for four

projects from SCAP, which is funded by the Australian National Parks and Wildlife Service.

The projects are:

- Requirements for effective buffers for wetland conservation (\$20 000)
- Guidelines for monitoring Ramsar sites (\$24 000)
- Conservation of marine turtles (\$25 300)
- Drupella in Ningaloo and other WA reefs (\$54 700).

### **CHAH**

The Western Australian Herbarium hosted this year's annual Council of Heads of Australian Herbaria (CHAH) meeting in Perth on October 5th and 6th. The Heads of all State Herbaria attended as well as an observer representing New Zealand herbaria.

The Australian herbaria, many of which are national in that they house specimens originating from all Australian States, house over 5 million specimens. The extensive collections in the National Herbarium of Victoria are especially important as there are many which are vouchers for plant names, having been used by past Australian and European botanists to describe and publish new species.

The CHAH meeting provides a valuable forum for herbarium directors to assess standard methods of specimen preservation, formulate loan procedures and co-operate on the development of databases and exchange of databased information. The annual CHAH meeting also selects the Australian Botanical Liaison Officer who is chosen to work for a year at Kew Herbarium, UK, to do research and answer literature and taxonomic enquiries from Australian botanists. CHAH also organises workshops for technical staff on methods of herbarium curation.

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## Newsbrief

The Environment Minister recently announced the establishment in Dwellingup of a Forest Heritage and Fine Wood Foundation. The State Government and the fine wood industry have combined forces to create the independent, non-profit foundation. The Foundation aims to promote a better understanding of a forest ecosystem and the use of native timbers for fine wood products. It will be Australia's first Forest Heritage and Fine Wood Centre, and will be housed in CALM's former cadet school at Dwellingup.

The foundation will provide environmental education, industry training, and encourage both schools and tertiary institutions to undertake field studies based at the centre. Visitors will see examples of sustainable managed wood production as timber passes from the forest, to milling and seasoning in kilns, to its use in design and construction, and crafting of fine wood products.

An interim board will be formed with representatives from CALM, the Fine Wood Industry Project, Alcoa (Australia), the South West Development Authority, the Forest Industries Federation and the local community.

The Government will make available \$200,000 to build and equip a fine wood industry workshop, and corporate sponsorship will also be sought.

## Satellite Navigation Systems

### Co-ordination within CALM

An increased usage of satellite navigation technology, known as Global Positioning Systems or GPS, is occurring within CALM to assist in determining geographic locations. To improve the accuracy of these systems, the use of Differential GPS (DGPS) is now being considered as an option by users within CALM. However, implementation will need to be coordinated to ensure that the most cost efficient DGPS solution is achieved.

Although the individual costs for these units may be low, in the vicinity of several thousand dollars, collectively these costs and the necessary on-costs such as training, maintenance, technical support etc. can be significant if compatibility and standardisation aren't considered.

Dr Colin Pearce, Program Manager, Land Information Branch has been at the forefront of CALM's involvement in this technology and has taken on responsibility as GPS Coordinator. He will be a focus for GPS information within CALM; provide technical advice to potential users of GPS; represent CALM at State forums on GPS; be a contact for vendors; assist in sharing of GPS resources within CALM; and co-ordinate standardisation of GPS equipment.

## Financial Control Centres

There is still some confusion about FCCs. There are 4 of these in Science and Information Division, each corresponding to the 4 Science Groups:

FCC No.	Name	Location	Group	FC Officer
535	Wildlife Science	Woodvale	Wildlife Science	Peter Heslewood
556	Plant Sciences	Herbarium	Plant Sciences	David Brockwell
529	Science Services	Herbarium	Science Services	John Dorlandt
532	Forest Science	Manjimup	Forest Science	Michelle Pree

Pass all paperwork concerning accounts (LPOs, corporate cards etc.) to your Research Centre admin. officer, who will then direct it to the appropriate FCC.

Note that the previous Como Research, Busselton Research, Dwellingup Research, Narrogin Research, Wanneroo Research and library cost centres have been abolished.

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## Karijini - a blooming delight

During the month of August Bob Bromilow, Phil Fuller and myself spent 10 days working within the Karijini National Park resampling permanent quadrats as part of an ongoing Fire Ecology research project designed to investigate the effect of fire on mulga woodland communities. During this trip, while Phil was off chasing birds, Bob and I were resampling the twenty four 100 m<sup>2</sup> vegetation quadrats that we have established. This sampling period, our third, was most rewarding as we were able to collect flowering specimens of taxa that had previously been identified as either Genus sp. nov. or even Family sp. nov. We also confirmed the identification of several other taxa which we were having difficulty with determining in

their sterile state. These identifications were achieved as a result of the exceptionally good rains received in the Hamersley Range over the first six months of this year. During the trip 19 new taxa were recorded within the quadrats, all being annuals. This takes the list of plant taxa recorded within quadrats to approximately 350.

Apart from the abundance of flowering *Ptilotus* species, other interesting finds were a population of burrowing bees near Coppin Pool and perhaps a new species of *Indigofera* from the West Angelas area. Collections were also made from two new localities of a rare *Eremophila* species endemic to the Hamersley Range.

On our trip back to Karratha we stopped at Millstream and collected samples of a new *Papilidium* species which appears to be endemic to the Fortescue River in the vicinity of Millstream. This species has only been collected on two previous occasions, once in 1969 by Ian Brooker and again in 1976 by Greg Keighery. With the help of Ranger, Geoff Kregor and PhD student Launa Charlton, a population of several thousand plants was located in the 'couch paddock'.

Although the winds caused the daytime temperatures to drop far below what us northern researchers are accustomed to, the trip was very productive and the original goals were adequately fulfilled.

Steve van Leeuwen

## CHANGES TO MAINFRAME SAS

by Matthew Williams

SAS release 6.07 has recently been installed on COSMOS. At the same time, access to SAS has been restricted and if you wish to run SAS you will need to contact the help desk (on 367 0258) to get access. The restriction will enable operations to create a mailing list for SAS users, and also assist with their capacity planning.

A major improvement in release 6.07 is the addition of two procedures: MIXED and LATTICE. PROC MIXED fits generalised mixed linear models (i.e. those involving both fixed and random effects). The pre-existing generalised linear models procedure GLM fitted only fixed effects models (despite the RANDOM option!). MIXED therefore calculates the correct F-tests for mixed designs, in particular those involving blocking factors (see comparison below, and Research Methods note 13 in this issue).

### Comparison of the Specification of a Split-Plot Design in PROC GLM and PROC MIXED

GLM	MIXED
PROC GLM;	PROC MIXED;
CLASS A B BLOCK;	CLASS A B BLOCK;
MODEL X = A B A*B A*BLOCK;	MODEL X = A B A*B;
TEST H = A E = A*BLOCK;	RANDOM BLOCK A*BLOCK;

The major bonus in MIXED is the ability to calculate (using the LSMEANS option) Best Linear Unbiased Predictors (BLUPs). These are the "adjusted" means of incomplete block designs.

The LATTICE procedure is similar to MIXED but deals with the specific cases of square and (some) rectangular lattice designs.

A number of update manuals have been produced by SAS detailing changes and enhancements in release 6.07. A catalogue and order form are available from me.

## Update on Co-operative Research Centre, "Vertebrate Biocontrol"

This CRC was recently formed and represents a collaborative effort between scientists from CALM, Agriculture Protection Board and CSIRO. The Director of CALM's Science and Information Division, Dr Jim Armstrong, is on the CRC's Board of Directors. The research program underway for 1992/3 is as follows:

1. **Dispersal.** Radio-tracking technology is being used to determine the timing and frequency of baiting and the extent of buffer zones needed to minimize immigration of foxes into baited areas.
2. **Social organization.** Radio-tracking technology is being used to characterize the social structure of foxes. It is important to know this as it will influence the degree of contrast and hence the rate of transmission of the biological agent between individuals.
3. **Bait uptake.** Tetracycline-labelled baits are being used to study the optimal number of baits laid/km<sup>2</sup> and the percentage of foxes that take baits. These experiments are relevant to bait-delivery of an antigen designed to induce sterility by invoking an immune response.
4. **Cyanide baiting technique.** This is being refined (through use of additives, scent trials and food lures) to provide more detailed data about breeding status, genetic relationships and epidemiological status of foxes.
5. **Population density.** Measurement of fox density is crucial to control strategies as it influences the level of baiting required, the prevalence of a biocontrol agent and its rate of transmission, and the threshold density below which a biocontrol agent will not spread. Density estimates are essential for construction of a model of fox population dynamics.
6. **DNA micro-satellite probe.** Development of this will enable more cost-effective analysis of DNA samples. Sexual contact rate and percentage of fox litters will be worked out.
7. **Predator-prey relationships.** Although it is known that foxes can regulate prey at low numbers, their impact when prey species are present at high densities is obscure. Possibly, fox control may not be necessary when prey are abundant. This is being investigated using Woylies translocated to Boyagin.

For further information, contact Jack Kinnear, David Algar or Nicki Marlow at Woodvale, (09) 405 5100.

### THE WA THREATENED SPECIES & COMMUNITIES UNIT

WATSCU is now operational. It has been set up by CALM to co-ordinate and promote the conservation of threatened species and ecological communities. It is responsible to the Director of Nature Conservation Division, Keiran McNamara.

Three half-time research staff are attached to the unit; they are Andrew Burbidge (threatened vertebrates), Andrew Brown (threatened plants) and John Blyth (threatened ecological communities).

The functions and duties of WATSCU are currently being formulated, but the

main objective will be to improve co-ordination between scientists, managers and operations staff. There is already much work going on in CALM concerning threatened species and communities and it is envisaged that the Unit will provide a focus for these activities.

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## FORESTRY RESEARCH IN NEW ZEALAND

(based on a report by Dennis Lee, Ministry of Forestry, New Zealand)

The basis of science reforms in New Zealand is that research funds, skills and facilities are limited. The allocation of research funds, therefore, cannot be left merely to the "pursuit of exciting research". There is a need to ensure that research investment yields net economic benefits to the nation. However, there should be room for curiosity-driven research which can produce unexpected, and sometimes very valuable, impacts.

In New Zealand, science reforms started in the 1980s. This had a significant impact on Government's investment in science departments which were forced to bear an equal proportion of the overall State funding cut. To supplement the deficit, these departments were placed under a user-pays regime to recover some commercial revenues. This approach was recognised as being unsustainable given the importance of research to the economy.

The first science review was carried out in 1986. This led to the release of the report "Science and Technology: the Key to Prosperity". Two recommendations of the report were acted upon by the Government:

- \* create a "neutral" Ministry of Research for recommending strategic research priorities, and
- \* establish a Science and Technology Advisory Committee (STAC) to review Government's investment in science and technology.

The STAC was commissioned by the government in 1987 and was given a three year mandate

to do the work. The outcome was the release of a report "A New Deal for S&T". The key recommendations of the report were:

- \* to separate policy advice, the allocation of funds and the performance of research into different agencies;
- \* contestability of research funding based on scientific excellence, cost effectiveness and collaboration between researchers;
- \* establishment of national Science and Technology priorities based on wide consultation.

An integral part of the recommendations was the shift in Government funding emphasis which was previously based on input requirements to output of the investment. The recommendations received strong support from the wider community. This led to:

- \* the establishment of the Ministry of Research, Science and Technology (MoRST) responsible for provision of policy advice;
- \* the creation of the Foundation of Research, Science and Technology (FRST) responsible for allocating Government research funds, on behalf of the Crown;
- \* the transformation of science departments into 10 Crown Research Institutes (CRIs). Research funding previously provided through departmental votes is now aggregated and transferred to FRST. The pool has become known as the Public Good Science Fund (PGSF);
- \* the placing of research

activities on a more commercial basis where appropriate.

The process was finally completed in July 1992 with the transformation of Government science departments into 10 CRIs.

Around 10% of the PGSF will be a set aside and this will be allocated directly to CRIs for their own allocation of public good research. CRIs will have to bid for the other 90% of the PGSF.

The PGSF has been categorised into 40 science output classes. Those relevant to forestry are:

- Output 8: Arable and Other Plants
- Output 9: Plantation Forestry
- Output 15: Wood and Paper Processing (or Forest Processing)
- Output 19: Construction
- Output 31: Land use, Flora & Fauna

Output classes 9 and 15 are the major sources of funding for commercial forestry.

The total PGSF currently stands at \$260 million per annum. In March 1992, the Minister of Research, Science and Technology appointed a Science and Technology Expert Panel (STEP) to address the future priorities for the allocation of PGSF between the output categories. The final report has been released recently. It concentrates on the long term priorities for the next five years starting from 1993/94. The recommendations are likely to be accepted by Government. To provide some certainty to the science community, Government has guaranteed that the PGSF will

remain at \$260 million per annum at the minimum until 1997/98.

As a result of the science reforms the Forest Research Institute, which was traditionally a part of the Ministry of Forestry, has been transformed into two Crown Research Institutes; the New Zealand Forest Research Institute (NZFRI) and Landcare Research New Zealand (Landcare). Forestry and wood product research which come under Output classes 9 and 15, and to a lesser extent Output class 19, are now to be the responsibility of NZFRI. Its new mission is to conduct research and development to enhance New Zealand's advantage in plantation forestry and assist in the profitable production of quality, high-value wood products while protecting environmental values. It is based in the former FRI complex at Rotorua with a small South Island contingent based at Rangiora. The divisions of FRI at Rotorua have been transferred to the new NZFRI.

Landcare took over research on sustainable management of land resources which come under Output classes 8 and 31. The research was previously carried out by FRI, DSIR and Ministry of Agriculture and Fisheries. Areas of research include:

- weeds and pests,
- modelling of soil, water and plant interaction,
- native plants and animals,
- land management.

The Ministry of Forestry is also affected by the process. It has taken this opportunity to restructure its own operations. The Ministry now operates under a new and very clearly

focussed mission statement, "to facilitate the optimal contribution from forestry and forest products to New Zealand's sustainable development and economic growth". Greater emphasis is given to effecting the growth and development of the sector and consolidating the partnership which has already been forged with industry. This partnership has gone from strength to strength over the last few years particularly through the Forest Industries Strategy Study and the Forestry Insights school curriculum project.

Policy advice on the national benefit from Government Investment in forest research, as well as the overview of forest research in New Zealand, is now the responsibility of the Ministry of Forestry. The Ministry is a member of the Education, Science and Technology officials committee which advises the Cabinet Committee and Cabinet on science and technology in New Zealand.

The STEP's recommendations on long-term priorities for PGSF allocation have been particularly favourable to Output 15 of commercial forestry. The panel fully endorsed the Forest Industries Strategy Study's finding that forestry is a key New Zealand industry with significant potential to make a major contribution to the economy. The forest resource is already in the ground. The major challenge facing industry is realising the potential offered to the sector. The panel accepts that research and development have a critical role to play in lifting the overall performance. There is therefore an urgent need for a re-balancing of strategic research between Output classes 9 and 15. The

panel proposes a \$1 million reduction in PGSF on Output class 9 (Plantation Forestry) and a \$3.8 million increase in PGSF on Output class 15 (Wood Processing). This gives an overall increase in funding of \$2.7 million for the forestry sector. This re-balancing is supported by the industry.

### **Plantation Forestry**

#### **Output 9: New and Improved Trees and Plantation Management Systems**

New and improved forestry processes, products and management systems for tree improvement, propagation, establishment, silviculture, disease and pest protection and harvesting.

This output class includes research and development activities related to both softwood and hardwood plantations; the protection of the forest estate; species and provenance testing and tree improvement research; forest nutrition and site productivity; seed and other propagation methods associated with this output; economic and social science analyses connected to this output; development of systems for the evaluation of management alternatives; all forest operations and their environmental impacts.

### **Wood and Paper Products**

#### **Output 15: New and Improved Wood and Paper Processes and Products**

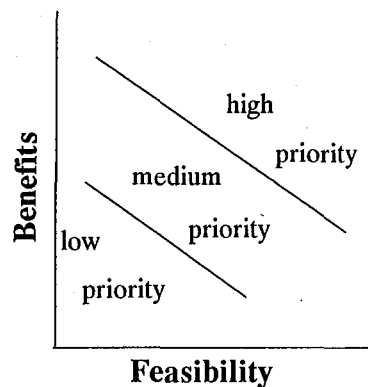
New and improved processing and quality management methods, storage, transport techniques, and products from wood and wood products, paper and paper products.

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## **FUNDING OF RESEARCH PROJECTS**

The Science Groups are in the process of finalizing their second round allocations of funds to their scientific staff.

For ease of use, the criteria used to assign priority are arranged under two headings, **Benefits** and **Feasibility**. The relationship between these two parameters and the allocation of priority for funding is as follows:



It is unlikely that any particular project would meet all the criteria listed. Should competing projects be otherwise equally matched, decisions will be made on the basis of an assessment of the quality of the proposals concerned, their timeliness, and the strategic advantage their adoption might impart to meeting CALM's Mission.

### **Benefits**

**Relevance** - Research must be relevant to CALM's goals and objectives.

### **Department priorities** -

Research priorities will reflect overall Departmental priorities as laid down by the Corporate Executive.

**Effectiveness** - Research should lead to significant improvement in the cost and/or quality of management of CALM-managed public lands or threatened taxa.

### **Scale of the problem** -

Research should relate to a problem or problems afflicting extensive areas, or important industries, or important species, or many ecosystems, and be of long duration or intensive impact.

**Demand for results** - Research proposals which aim to provide explicit information sought urgently by CALM managers will be favoured.

**Usefulness** - Proposals could demonstrate how they contribute to existing high priority projects.

**Innovative** - The project presents a radical advance.

**Regional impact** - The project contributes to documentation of the biodiversity of a geographic area, threatened process, ecosystem or taxon of special WA significance.

**Immediate benefit** - The proposal makes an immediate contribution to matters of high

public concern.

**Integration with research outside CALM** - It is desirable that research within CALM be co-ordinated and integrated with related work being conducted by other agencies. Thus priority will be given to projects which augment or stimulate relevant external research.

### **Feasibility**

**Budget** - How much money is needed to successfully complete the project?

**Time frame** - Will the proposal produce benefits within a certain time frame?

**Availability of results** - Can the benefits be readily captured or implemented?

**Performance** - Work proposed by individuals, project groups or programs who can demonstrate outstanding achievement in high priority research areas will warrant special consideration.

**Team-work** - Higher priority may be given to projects made feasible by involving team-based rather than solitary research.

**Speculative or theoretical research** - Speculative or theoretical research may be funded where there is sufficient promise of a substantial contribution to knowledge.



## Q & A

**Q:** What is CORD and how does it relate to SCF and RWGs?

**A:** CORD stands for the Committee of Research Directors, of which the Director of Science and Information Division is a member. CORD meets once a year and reports to SCF (Standing Committee on Forestry). SCF consists of the CEOs of State Government agencies charged with forest management, a similar New Zealand representative and a Commonwealth (including CSIRO) representatives. SCF meets biannually.

CORD is responsible for RWGs (Research Working Groups) of which there are 11. SID's representative on each is as follows:

1. Forest Genetics (Trevor Butcher)
2. Mensuration and Management (no SID representative)
3. Soils and Nutrition (John McGrath)
4. Silviculture of Indigenous Forests (Penni Hewett, Secretary)
5. Silviculture of Plantations (John McGrath)
6. Fire Management Research (Lachlan McCaw, Neil Burrows)
7. Forest Pathology (Bryan Shearer)
8. Forest Entomology (Janet Farr)
9. Forest Hydrology (Stuart Crombie)
10. Forest Wildlife and Habitat Management (Grant Wardell-Johnson)
11. Agroforestry (Richard Moore)

CORD's charter is to optimise the national benefit from investment in forest research, and to maintain an overview of forest research in Australia with particular reference to the efficiency of RWG activities and the effectiveness with which their research findings are implemented.

The objectives of CORD are to:

- \* identify gaps in current research which warrant attention and recommend to SCF appropriate action to have these filled by applying available funding and setting priorities in this regard.
- \* help to co-ordinate research carried out by different bodies, and foster co-operative research.
- \* identify subjects where further expertise is needed and recommend to SCF appropriate means to overcome these deficiencies.

To achieve these objectives CORD defines the scope of each RWG, makes recommendations to SCF about the formation, dissolution or amalgamation of RWG's, and ensures the most cost-effective operation of RWG's within established guidelines. CORD also takes advice from each RWG and formulates a statement of priorities for forest research for consideration by SCF.

Twelve RWG's were established in 1966 but there have been a number of changes since then. The terms of reference of each RWG are currently as follows:

- \* review the present state of knowledge;
- \* define gaps in present knowledge and identify topics on which new research is needed;
- \* indicate priorities for research;
- \* consider how to naturalize and co-ordinate the research of the various organizations involved;
- \* ensure that communication exists between scientists in the field and devise means for the dissemination of information;
- \* submit via CORD reports (including any recommendations) for referral where appropriate to SCF;
- \* undertake any other tasks requested by SCF or CORD.

RWG's usually meet biannually, and meetings may be attended by Observers who may take part in technical discussions but may not discuss or vote upon matters of policy or report to CORD. Each RWG has a Chairperson and Secretary.

Attendance by SID staff at RWG meetings permit regular interchange of ideas amongst peers. At each meeting there is usually a field inspection of research problems being tackled. Sometimes a workshop is held as part of the meeting. On some occasions two RWG's have met together and this has provided opportunities for synthesis across two broad fields of research.

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## Forest research expenditure in Australia

(based on a paper entitled ("Forest research expenditure in Australia" by MJ Lambert & J Turner, presented at the 1991 IUFRO conference)

Expenditure on forest production-based research by the State or Territory organizations in relation to their revenue income from forestry has been as follows:

State	Organization	% Research Revenue	
		1985/6	1989/90
NSW	Forestry Commission	5.1	3.9
VIC	Conservation & Env't	4.9	6.7
Q	Dept Forestry	20.5	11.6
WA	CALM	19.4	9.3
SA	Woods & Forests	5.3	7.5
TAS	Forestry Commission	7.5	5.0
ACT	Forests Branch	3.4	0.1

Mean % 8.9 6.3  
(calculated as total Research amount divided by total Revenue \$)

Government production-based forest research expenditure for 1989/90 between various countries was as shown below:

Country	% (Research) (Revenue)
Australia	11.0
Gt Britain	10.0
New Zealand	17.8
S Africa	4.9

Mean % 10.8  
(calculated as total Research amount divided by total Revenue \$)

Note that expenditure by universities and private companies has been excluded.

Conclusion: For the last few years at least, forestry research expenditure in relation to organizational revenue from forests has averaged 6-11%, reflecting a range from 0.1 to 20.5%.

## The role of trees in sustainable agriculture - Report of a National Conference held in October 1991

The recommendations of workshops held at this conference have recently been published in the above report, which was co-edited by Richard Moore, a member of the Forest Science Group of Science and Information Division. Richard has a national reputation in the field of agroforestry.

The report (published by the Bureau of Rural Resources) identifies barriers to agroforestry and ways of overcoming them. It provides a useful set of guidelines for agroforestry research and development in Australia during the 90s.

Two of the recommendations are particularly noteworthy:

1. Type of Research. "...there is a need to move to a parallel system where research and development feed and interact directly with the operation of the whole farm. This calls for a radical change in the way research is done and in the behaviour of scientists and the research organisations." (p. 44)
2. Funding of Research. "Research organisations should develop a coordinated approach to obtaining funds for research from agencies such as Rural Industries Research and Development Corporation, Land and Water Resources Research and Development Corporation and the Murray Darling Basin Natural Resources Management Strategy Program." (p. 41)

The topics covered by the workshops include: integrating trees into whole farm systems; direct products from trees on farms; ecological and environmental benefits of trees on farms; conservation and production from trees on farms; native vegetation management on farms; insect problems; incentives, disincentives and marketing; and agroforestry extension.

## Desert Dreaming Becomes a Wet Dream

*"Where The Creeks Run Dry or Ten Feet High"*

In May 1991 four CALM researchers sat around a camp fire in the Gibson Desert discussing details of the "Desert Dreaming" project. Sponsored by W.A. Petroleum, the project aims to shed light on the mysterious disappearance of medium sized desert mammals. A key element of this research is the planned reintroduction of two rare mammal species which were once common throughout the arid zone. Boodies (*Bettongia lesueur*) and Golden Bandicoots (*Isodon auratus*) were to be flown to the Gibson Desert Nature Reserve from Barrow Island in May 1992.

Camp fire conversation was full of concern about the poor condition of the country into which the animals were to be released. This part of the Gibson Desert looked terrible; we had dubbed it the "mother of all deserts". The three year drought had caused patchy death of desert vegetation including groves of mulga and plains of spinifex, hitherto assumed to be drought resistant. The succumbing of these plants lead us to believe that this drought was severe, even by the deserts standards.

We debated the wisdom of introducing animals to this drought stricken part of the Western Desert. The sort of comments circling the camp fire included; "It would be suicide", "They will perish for sure", "We'll have to wait for a couple of good seasons", "No, it's a good time to reintroduce them - the foxes, cats, dingoes and rabbits are in low numbers", "Boodies are adapted to arid environments", etc.

The group decided that the reintroduction would go ahead in May 1992, regardless of the

drought. Statistically, we could expect the drought to break by then. The 38 years of weather data from Giles showed that the last big drought in the early 1960s lasted 40 months. But, what if this drought we were now experiencing was "the severe once in fifty years drought?" The meteorological data were only for 38 years! We agreed that it would probably be necessary to provide supplementary feed and water, at least until the drought broke.

April 29th 1992 and the Desert Dreaming advance party of Graeme (Tub) Liddelow, Alex Robinson, Bruce Ward and I left Perth in two 4-wheel drives for the Eagle Bore study site in the Gibson Desert Nature Reserve. Per Christensen and Ray Smith were to meet us in the desert about a week later with the Islander aircraft and the animals from Barrow Island.

We were obviously aware that the Pilbara, Gascoyne and Murchison had experienced substantial rain over February, March and early April, but we had no way of knowing just how wet it was at the Eagle Bore study site. We discussed postponing the reintroduction, but decided to leave that decision until we had more accurate information about conditions at the release site. For several days before leaving the south-west, Tub rang authorities at Meekathara, Wiluna, Kalgoorlie and the caretaker at Carnegie station seeking information about road conditions. Up to the time of our departure, the roads were open, although there seems to be some confusion and conflicting reports about road conditions. There had been an enormous amount of preparation for this moment and we were reluctant to call it off unless we were certain.

The first tell tale signs of

what we were in for over the next few days appeared along the road between Paynes Find and Mount Magnet. The bush was lush and green, the mulga was a healthy blue-grey and large sheets of water glistened in the sunlight. As we travelled north-east towards Magnet, my home town, the country became noticeably wetter. The bush had that delightfully sweet aroma unique to wet mulga country; an aroma that filled me with nostalgia and revived memories of my childhood in the Murchison. Any rain in this parched landscape makes you feel good, but to see the country like this was just terrific. The wildflowers in the Paynes Find, Mullewa, Yalgoo area are going to be outstanding this year!

We drove on to Meekatharra and called at the Police Station to enquire about the condition of the Wiluna road (which is gravel). To our disappointment and surprise, we were told that the road was closed and would remain so for at least 2 days. Tub had rung from Manjimup the day before and was told that the road was open! We figured that we could, if necessary, delay the reintroduction for a couple of days if necessary and prepared ourselves for two days of thumb twiddling in Meekathara.

The following morning (April 30th) we killed 5 minutes by strolling the streets of Meekathara. We eventually wandered into the Meeka Royal Flying Doctor Base to chat with Val, one of the radio operators. During the course of conversation, the incredible amount of rain and the condition of the roads inevitably came up. Val was surprised to learn from us that the Wiluna road was closed. She had just received a fax from the Geraldton Regional office of the Main Roads Department and the official

word was that the Wiluna road was open to 4 wheel drive traffic! Without delay, we packed up and headed for Wiluna and Carnegie.

The 530 km or so of dirt road between Meeka and Carnegie station was wet and muddy, but passable. The worst section was between Wongawol station and Carnegie. There was some treacherous claypan country and a few deep creek crossings. All the low lying country was awash. We camped that night at Carnegie. Ken and Ronda Johnson, the caretakers, were very glad of some company. They had seen only 7 people in as many weeks! They informed us that there had been good rains in the desert, but a group of travellers had crossed the Gunbarrel Highway from the east about a week ago and there had not been much rain since then. Hearing this news raised our hopes of getting to the release site in the Gibson Desert Nature Reserve. If we could get in, and if the airstrip was in good shape, we were away!

As we headed east from Carnegie the next morning, the road became noticeably drier. On the high country we were actually kicking up dust. However, the low country was still very wet and we became bogged several times before reaching Mungilli claypan. The claypan was full. The gunbarrel Highway disappeared into the muddy waters of Mungilli and reappeared on a sand dune about 3 km away. It was a spectacular site but did not look good for the Desert Dreaming project.

We turned north along Eagle Road, but had travelled only 2 km when we were stopped by a large bog hole. We camped for two nights about 1 km from Mungilli claypan in hope that the bog would dry sufficiently for us to pass. On Sunday (May 3rd) we broke camp and travelled further north along Eagle Road. We were hoping to

get to Hussar airstrip to see if it was firm enough for the Islander to land with its precious cargo of animals. The Islander was due to leave Perth for Barrow on Monday, so we had to make a quick decision. We had arranged a midday radio sched with Ian Kealley at Kalgoorlie, at which time we would pass on our decision to go ahead with the reintroduction or to post-pone it.

About 4 km north of the Gunbarrel, Tub, who was in the lead vehicle, called Alex and me on VHF. "There's a stretch of water on the road about a kilometre long" he said. Alex and I assumed Tub was exaggerating and figured that there was another puddle across the road. Unfortunately, his estimate of the extent of water was accurate.

We had struck the claypan country which runs for several hundred kilometres along a fossil river system. The Eagle Bore study site where we were to release the animals was at the head of this system. As far as we could see, the fossil river, now a chain of claypans, was inundated. It was a spectacular site, but sealed the fate of any plans of reintroduction for at least two months. Tub made radio contact with Ian in Kalgoorlie and cancelled the project.

The bright side to the record breaking rains in the interior is that in September, the country will be in peak condition, giving the re-introduced animals then every opportunity to establish before the next inevitable drought. Unfortunately, the foxes, cats and rabbits will also increase in numbers, necessitating another aerial and ground baiting before the repatriation of Boodies and Golden Bandicoots to their home on the Australian mainland.

*Neil Burrows*

#### .....UPDATE

On Friday September 11 1992, an aircraft from Barrow Island touched down on Hussar airstrip in the Gibson Desert with a cargo of 40 Boodies and 40 Golden Bandicoots. Research Scientist Per Christensen and Wildlife Officer Ray Smith had managed only 7 hours sleep in three days as they prepared the animals on Barrow for their journey to the interior of Western Australia.

Meanwhile, Graeme Liddelow, Alex Robinson and Bruce Ward were finalising preparations to the release site in the Gibson Desert Nature Reserve; checking the compound, testing radio tracking equipment and baiting introduced predators. A large buffer area around the release site had been aerially baited with 1080 meat baits twice prior to the arrival of the animals from Barrow. Surveys had shown that the operation had successfully eradicated foxes and dingoes from the area, but had not affected the cat population. In fact the cat density had increased 7 fold in twelve months, mainly due to very good rains in the area. Since the inception of the Desert Dreaming project, we have been concerned about cats; it seems that our concerns are well founded. Cats could prove to be a serious threat to the survival of the re-introduced animals.

The animals were quickly unloaded from the aircraft and trucked the final 40 km to the release site. All had arrived in good health. Mr Hill, an elderly Aboriginal man who had travelled to the reserve with Dave Pearson, released the first Boodie into the Gibson Desert Nature Reserve as the sun set on an exciting and happy day.

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## Extracting correct F-tests from statistics packages

by Matthew Williams

In analysing ANOVA designs using general-purpose statistics packages such as SAS and Systat, it is usual for the package to report incorrect F values and associated probabilities, except in the case of the completely randomized design (CRD). This is because statistics packages are not smart enough to recognise the design of an experiment. The packages routinely use the "error" term in the denominator of the F ratio, whether this is appropriate for particular effects or not. Since the CRD is rarely used, it is usually necessary to persuade the package to work out the correct F tests. These must be artificially constructed by explicitly requesting the package to estimate the correct denominator terms in the model. How this is done varies, but in SAS and Systat at least, it is fairly straightforward. The method for each type of design is specified below:

### Randomized complete block (1 observation per cell (treatment/block) combination):

**SYSTAT**  
correct F-test reported

**SAS**  
correct F-test reported

### Randomized complete block over multiple sites (with one observation per cell):

**SYSTAT**

MGLH  
CATEGORY SITE BLOCK TREAT  
MODEL X = CONSTANT + SITE + BLOCK{SITE} + TREAT + SITE\*TREAT  
RUN  
HYPOTHESIS  
EFFECT = SITE  
ERROR = BLOCK{SITE}  
TEST

**SAS**

PROC GLM;  
CLASS SITE BLOCK TREAT;  
MODEL X = SITE BLOCK(SITE) TREAT SITE\*TREAT;  
TEST H=SITE E=BLOCK(SITE);  
RUN;

### Randomized complete block with split-plot arrangement (i.e. multiple observations per cell):

**SYSTAT**

MGLH  
CATEGORY BLOCK TREAT  
MODEL X = CONSTANT + BLOCK + TREAT + BLOCK\*TREAT  
RUN  
HYPOTHESIS  
EFFECT = TREAT  
ERROR = BLOCK\*TREAT  
TEST

**SAS**

PROC GLM;  
CLASS BLOCK TREAT;  
MODEL X = BLOCK TREAT BLOCK\*TREAT;  
TEST H=TREAT E=BLOCK\*TREAT;  
RUN;

**Split-plot with one observation per cell:**

```

SYSTAT
MGLH
CATEGORY BLOCK A B
MODEL X = CONSTANT + BLOCK + A + BLOCK*A + B + A*B
RUN
HYPOTHESIS
EFFECT = A
ERROR = BLOCK*A
TEST

SAS
PROC GLM;
CLASS BLOCK A B;
MODEL X = BLOCK A BLOCK*A B A*B;
TEST H=A E=BLOCK*A;
RUN;

```

**Split-plot with multiple observations per cell:**

```

SYSTAT
MGLH
CATEGORY BLOCK A B
MODEL X = CONSTANT + BLOCK + A + BLOCK*A + B + A*B + BLOCK*B + BLOCK*A*B
RUN
HYPOTHESIS
EFFECT = A
ERROR = BLOCK*A
TEST
HYPOTHESIS
EFFECT = B
ERROR = BLOCK*B & BLOCK*A*B
TEST
HYPOTHESIS
EFFECT = A*B
ERROR = BLOCK*B & BLOCK*A*B
TEST

```

**SAS**

2 runs required:

- (1) For main plot effect A, and to obtain the MS for blocks:
 

```

PROC GLM;
CLASS BLOCK A B;
MODEL X = BLOCK A BLOCK*A B A*B;
TEST H=A E=BLOCK*A;
RUN;

```
- (2) For sub-plot effects B and A\*B:
 

```

PROC GLM;
CLASS BLOCK A B;
MODEL X = A BLOCK(A) B A*B BLOCK*B(A);
TEST H=B A*B E=BLOCK*B(A);
RUN;

```

In general for designs involving blocks (or replicates) all possible interaction terms between treatments and blocks should be considered, and ascribed to a specific error term. To some extent this process can be simplified in SAS by specifying the block effect as RANDOM in either GLM or MIXED. GLM will not automatically perform the correct test when blocks are specified as random, but will provide expected mean squares which might be useful in determining the correct denominator for the appropriate F-test. The new SAS procedure MIXED (see SAS news in this issue) calculates correct F-tests, but still requires that the appropriate terms are specified as RANDOM.

## Networking Science and Information Division

by Paul Gioia

I suppose by now most people in the Division have heard that something funny has been going on at Woodvale.

Something about networks, something about cabling, something about a lot of money being spent on *them* 'puters when it could have been spent on a field trip to the Bungle Bungles or a third fuel tank for the Toyota. People probably said the same things about telephones when they were first installed.

So before people jump to any parochially inspired conclusion that Woodvale is getting more than its fair share of dollars let me fill you in on what has happened there and what will be happening in the rest of the Division.

Less than 12 months ago the then Research Division Policy Group approved a proposal from the Research Techniques Program to establish a local area network (LAN) in the four major research centres: Woodvale, the Herbarium, Manjimup and Como. One centre would be networked per financial year at roughly \$55,000 per centre.

To date Woodvale's LAN has been installed and the Herbarium's is on order and will be installed shortly. Specific costings for Manjimup will commence shortly.

SID's commitment to networking its PCs is in line with Information Systems Branch's (ISB) plan to network

the whole of CALM over a period of time.

Now I imagine some will say "*but we already have a network*" to which I would reply "*Yes, and doesn't it work well!*".

Our current "network" is antiquated not to mention flaky. Anyone in centre admin. (probably the biggest users of the network) will tell you how often it breaks down, how often the multiplexor needs to be reset while half a dozen other users are in the middle of a job.

The current system was designed for connecting dumb terminals to a mainframe. It cannot take advantage of the local processing power of PCs or other resources like printers.

To make matters worse the supply of spare parts for these multiplexor beasts is becoming a threatened species in itself.

In contrast, a true PC network allows far greater ability to share resources as well as providing electronic mail facilities, all at greatly higher speeds than the current network.

The move to install LANs in each of the major research centres within SID is being paralleled in other parts of CALM. The next major step will be to link each of these isolated LANs together to form a wide area network (WAN). This is dependent on funds being made available to ISB for this purpose.

In the not-too-distant future I

hope to see a researcher in the country being able to instantaneously mail a document to another researcher in the city. Memos could be sent to all staff throughout the division, the department or even outside the department - without a single sheet of paper being needed.

We could get different researchers in different centres doing analyses on data stored in one accessible computer, at the same time.

Yes, it does sound a bit like the mainframe environment. The difference is that data can be moved between PCs so much quicker and more accurately. If a network link falls over you will still have your own PC to be productive with.

There is no doubt in my mind that PC networks are the way to go. The days of the centralised, all-powerful all-encompassing computing centre, overlord at the helm, are numbered. And rightly so.

We need greater flexibility in utilising our existing PC base. A PC network can help provide that through quicker and easier communication between staff and more efficient usage of existing resources.

Not least we will be creating a career path for a new animal: *the network Administrator*.

If you have any queries regarding any aspect of the PC network feel free to contact myself or anyone else in the Research Techniques program.

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## PAPERS SUBMITTED FOR PUBLICATION

**I. Abbott & A.A. Burbidge**

**The occurrence of mammal species on the islands of Australia: a summary of existing knowledge**

This paper places on record all available information on the occurrence of species of mammals on Australian islands. 512 islands, 171 mammal species and 1768 authenticated insular records are included. The source of each record (320 references) is also provided.

This paper is intended as a factual summary; a second, more interpretive paper is in preparation.

**For publication in:** CALMScience

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**I. Abbott, P. van Heurck & T. Burbidge**

**Ecology of the pest insect jarrah leafminer (Lepidoptera) in relation to fire and timber harvesting in jarrah forest of WA**

Contrary to popular belief, prescribed burning of jarrah forest in spring or logging of jarrah forest does not promote infestations by jarrah leafminer (JLM). This conclusion rests on many studies carried out in jarrah forest since 1984.

A new theory to explain the origin and subsequent spread of JLM outbreaks since the late 1950s is presented. The key point of this theory is that reduction in scorching of jarrah crowns since the 1950s is responsible.

The paper concludes by recommending that extensive prescribed autumn burning should be operationally introduced in jarrah forest to test the theory and subdue JLM outbreaks.

**For publication in:** Australian Forestry

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**S. Curry**

**The first recorded hybrid of the plant *Calytrix* in Western Australia**

An exciting botanical find was

recently made at Southern River, Perth. It was the discovery of the first recorded hybrid between species of *Calytrix* in Western Australia. *Calytrix*, commonly known as Starflowers, are a member of the myrtle family.

The hybrid is a cross between the pink-flowered *C. fraseri* (Pink Summer *Calytrix*) and the yellow flowered *C. flavescens* (Summer Starflower). Lyn Craven, Australia's expert in *Calytrix*, confirmed its identification and commented that it was, in fact, only the fourth recorded example in Australia. In addition, its attractive habit and unusual apricot flower colour may prove of great interest to horticulturists.

**For publication in:** Landscape

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**S. Curry**

**Prickly Honeysuckle (*Lambertia echinata* subsp. *echinata*)**

Prickly Honeysuckle is one of Western Australia's rarest plants. Gazetted as Declared Rare Flora in 1980, it is known only from the Cape Le Grand National Park. Hopefully there may be other populations of the attractive species yet to be found. Belonging to the family Proteaceae, there are 10 species of *Lambertia* in WA.

**For publication in:** Landscape

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**B. Glossop**

**Drying behaviour of 50mm thick mature jarrah in a kiln heated by solar energy and wood waste**

One of the primary objectives of the Wood Utilisation Research Centre is to establish techniques for drying local timber with a minimum of degrade and develop commercially viable equipment to operate those techniques. The CALM Drying System developed here at the Centre reduces two major costs of drying; capital cost of the drying kilns and heating costs. This study is the first

examination of the system's drying performance, namely, drying time and final timber quality.

A 40m<sup>3</sup> charge of 50mm thick mature jarrah was dried in the system using heat from solar energy and wood waste. The jarrah dried from 65 to 12 per cent moisture content in 120 days - which compares favourably with 2 years for air-drying or 90 days for conventional kiln drying.

The quality was found to be good in a sample in which 60 per cent graded as Select material. The most common reasons for downgrading were twist and gum. Surface checking accounted for only 8 per cent of boards downgraded.

Thus the CALM Drying System successfully dried mature jarrah in a moderate amount of time.

**For publication in:** WURC Technical Report

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**G.J. Keighery**

**Boranup Bossiaea (*Bossiaea disticha*): Distribution and Biology**

Boranup Bossiaea is a very common understorey component of the Boranup Karri forest during spring. It has been thought to be confined to the forest, but this survey has shown that the species extends from Ellen Brook to Cape Leeuwin, a range of 55 kilometres, along the Leeuwin-Naturaliste Ridge. Although this is considerably longer than previously thought, it is still a very restricted range. However, most populations are within existing or proposed conservation reserves.

Despite this localised area of occurrence, Boranup Bossiaea is a variable species; plants in near coastal areas are prostrate, leafy shrubs, compared to the tall, erect shrubs of the forest. Plants in the northern region around Ellen Brook have brownish and red flowers, compared to the normally bright yellow and red flowers, compared to the normally bright yellow and

red flowers of plants south of the Margaret River. Again these distinct forms are well conserved. Boranup Bossiaea appears limited to areas of more than 1000mm rainfall, and to granitic or karri loam soils. The species is killed by fire, but reseeds and is found flowering in profusion by 5 years after the burn.

**For publication in:** WA Naturalist

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**G.J. Keighery**

**Additions to the Flora of the Recherche Archipelago**

This paper reports the botany of the 1991 Australian Geographic Expedition to the Recherche Archipelago. Complete flora lists were made for six previously unstudied islands. Six plant species were recorded for the first time from the Archipelago. Plants not previously recorded on the other four islands visited by the expedition are detailed.

**For publication in:** WA Naturalist

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**G.J. Keighery & B.J. Keighery**

**Re-discovery of *Schoenus natans* (Cyperaceae)**

This brief paper details the rediscovery of a small aquatic herb, which was last collected in 1911, in an area of suburban Perth. The plant has not been seen since, despite searches around this area, and because of subsequent development, was presumed extinct. During survey work to establish vegetation monitoring quadrats in the Pinjarrah area, we were fortunate to discover several large populations of this species on an uncleared remnant of bushland. The species will now be added to the list of specially protected plants (declared rare), and a report on the status of the area is being prepared to enable the continued survival of *Schoenus natans*. This discovery highlights how much we still have to discover in Perth's backyard.

**For publication in:** W.A. Naturalist

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**I.R. Dixon & G.J. Keighery**

**Stawellia, Arnocrinum, Hodgsoniola and Hensmannia**

A popular account of these four genera of native lillies, which comprise nine species, all only found in Western Australia. A brief description is given of each species, its response to fire, notes on cultivation, its natural range in the bush and flowering times.

**For publication in:** Australian Plants

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**I.R. Dixon & G.J. Keighery**

**Weeds and their Control**

This paper forms a chapter in a Manual for Managing Perth's Urban Bushland, to be edited and published by Greening Australia. All 260 species of weeds recorded in bushland in the Metropolitan region are listed individually, either as Major, Nuisance or Minor weeds. Each listing is given as a common and scientific name, the major effects of each weed are detailed and the habitats where the weed is most likely to occur are tabulated. The reserves most affected by these weeds are listed. Control measures available, both mechanical and chemical are suggested. Growth form of each species is also listed, and major references given. It is hoped that users of the manual will report back their successes and failures to help improve the management of Urban Bushland.

**For publication in:** Greening Australia; Manual for Urban Bushland

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**M.R. Fleming & N.L. McKenzie**

**Kimberley Rock-rat (*Zygomys woodwardii*)**

Restricted entirely to the North Kimberley, this large rock rat is common in the high rainfall country found along the district's north-west.

It lives in rainforest and open sandstone country, where it prefers the most rugged areas of rockscrees.

Breeding occurs through the year. It eats the seeds, both of

grasses and trees. *Terminalia* seeds show a characteristic hole when chewed open by this species.

Secure populations occur in the Prince Regent Nature Reserve and on island groups along the length of the Kimberley's north-western coastline.

**For publication in:** The Complete Book of Australian Mammals

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**J.A. Friend & A.A. Burbidge**

**Western Barred Bandicoot *Perameles bougainville***

This article summarises known information on the Western Barred Bandicoot for a semi-popular reference work on Australian mammals. The Western Barred Bandicoot was previously found in semi-arid areas from Shark Bay around the southern fringe of the continent and through the shrublands of the Murray-Darling river system in S.A. and N.S.W. It is now only found on Bernier and Dorre Islands in Shark Bay, where there are no exotic predators or rodents. The article gives details on the biology of the species gleaned from old accounts of the animals on the mainland and from recent research on the island populations by CALM biologists.

**For publication in :** Complete Book of Australian Mammals

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**A.E. Kelly, A.C. Napier & S.D. Hopper**

**Survey of Rare and Poorly Known Eucalypts of Western Australia**

158 taxa were targeted for survey, including thirty six Declared Rare Flora, many poorly collected and recently recognised taxa, and a number of widely cultivated species that are uncommon in the wild. An additional 23 taxa which had been listed by previous authors as rare but were known to be more common on the basis of recent survey were also included.

1081 records were made for 104 species, 66% of the total targeted for survey. Major achievements included discovery of five new taxa. Many species believed by

previous authors to be rare or threatened were actually poorly known.

**For publication in:** CALMScience

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**J. Kinal, B.L. Shearer & R.G. Fairman**

**Dispersal of *Phytophthora cinnamomi* at depth through lateritic soil by laterally flowing subsurface water**

*Phytophthora cinnamomi* was recovered from water flowing at the base of a lateritic soil typically less than 1m deep and overlying concreted duricrust on a severely diseased hillslope in the jarrah forest in south-western Australia. The water was collected by 20m long throughflow interception trenches dug down to the duricrust. Inoculum-bearing water was collected mostly in winter and early spring but also in autumn and summer following unseasonally heavy rainfall. Subsurface water flowed through the soil at least 120m down the hillslope following a moderately intense winter rain event. Propagule density averaged 60 propagules/litre on selected days in spring. At least half of the propagules were identified as zoospores. Although the highest inoculum recoveries coincided with the period when near-surface soil was coolest, the deeper soil was warmer because of a phase lag in the annual soil temperature wave. The consistent recovery of *P. cinnamomi* from subsurface water indicates that the soil is sufficiently coarse to transmit propagules at least the size of zoospores. It appears that long term downslope flow and eluviation over the duricrust has removed fine sand and silt which would otherwise impede rapid long distance zoospore movement and so has predisposed the site to disease spread.

**For publication in:** Plant Disease

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**N.L. McKenzie & J.A. Kerle**

**Golden-backed Tree-Rat (*Mesembriomys macrurus*)**

Slender and agile; 20 cm from nose to rump; tail 30 cm long with white brush.

Early records came from the Pilbara, Broome and Top End of the Northern Territory. Today the Golden-backed Tree-rat persists only in the north-western Kimberley where it occurs in a variety of wooded habitats, including rainforests, savannah woodlands, blacksoil plains and rugged sandstone rockscrees. Crepuscular and nocturnal, this arboreal rat scampers along the ground between trees with its tail held high. It feeds on flowers, fruits and termites.

They breed all year round. Females have a gestation period of 7 weeks, and litters of one to three young. Young are weaned at about six weeks and are fully grown by four months.

Secure populations persist in the vast and inaccessible Prince Regent Nature Reserve and on islands of the Bonaparte and Buccaneer Archipelagos.

**For publication in:** The Complete Book of Australian Mammals

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**N.L. McKenzie**

**Arnhemland Long-eared Bat (*Nyctophilus arnhemensis*)**

Frequents closed canopy vegetation throughout mesic areas of the Northern Territory and Kimberley. Outlying populations occur along the west coast as far south as Exmouth Gulf. Adults are about 9 cm long and weigh 7 grams.

Lives in monsoon forests, riverine fringes and mangroves, gleaning insects from the dense vegetation and forest floor. Its short, wide wings and slow fluttering flight are well adapted to confined spaces where manoeuvrability is preferable to speed. Roosts are in shaded foliage or under flaps of bark. Young, often twins, are raised during the "wet", the season when insects are plentiful.

Cryptic but common, there are secure populations in Prince Regent, Kakadu and other conservation reserves of the far north.

**For publication in:** The Complete Book of Australian Mammals

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**N.L. McKenzie**

**Mangrove Pipistrelle (*Pipistrellus westralis*)**

The Mangrove Pipistrelle occurs along Australia's northern coastline from Cape Bossut in Western Australia to Karumba in western Queensland. Marine mangrove communities are its primary habitat.

This tiny aerofoil, only 7 cm long and weighing just 3 grams, hunts the dark passages where tidal creeks incise the mangrove forests of Australia's north coast. Its fluttering, aerobic flight allows it to follow the irregular contours of the forest's outer foliage, foraging the airspace within two metres of the mangrove's sides and canopy. They catch flying insects such as small beetles and moths. Young are presumably born throughout the year.

Common but cryptic, secure populations occur in mangroves adjacent to the Prince Regent Nature Reserve, and the Keep River and Kakadu National Parks.

**For publication in:** The Complete Book of Australian Mammals

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**A.E. Orchard & G.J. Keighery**

**The status, ecology and relationships of *Meziella* (Haloragaceae)**

The genus *Meziella*, not seen since the only collection was made in 1840, was thought to be extinct. Its rediscovery in 1991 has made possible the preparation of a detailed description of the sole member of the genus (*Meziella trifida*), as the previous collection was fragmentary, and only in bud. We have been able to confirm that *Meziella* is indeed a distinct genus, and provide a revised key to the Australian genera of the family Haloragaceae.

The species is a red leafed, small, prostrate, semi-aquatic herb, flowering in late spring and early summer as the shallow pools, in

which it grows, dry. The flowers are insignificant, being wind pollinated, but the subsequent fruits are like miniature second world war mines. The majority of plants die after the habitat dries over summer, but some plants in moister sites are able to survive till the next winter.

*Meziella trifida* has now been listed as Declared Rare Flora.

For publication in: *Nuytsia*

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B.L. Rye & S.H. James

#### The relationship between dysploidy and reproductive capacity in Myrtaceae

The family Myrtaceae, which includes eucalypts, bottlebrushes and other well-known groups of trees and shrubs, has base chromosome numbers varying from 5 to 12. The primitive, and by far the most common, number is 11. Reduced chromosome numbers of 5-10 have arisen only in groups of small shrubs with critically reduced ovule and seed numbers, with the resulting benefit of greater genetic uniformity and less seed wastage. However, this has been at the expense of evolutionary flexibility, and the groups with low numbers have failed to colonise the arid zone of southern Western Australia. In contrast, groups with the primitive chromosome number and above (11 or 12), including some with severely reduced fertility, have colonised the arid zone. There is some evidence of a similar relationship between chromosome number and fertility in other woody Australian families.

The significance of reduced chromosome number has already been established by other workers studying groups of short-lived herbaceous plants. In the plant kingdom generally, the lowest known chromosome numbers occur in annuals, in which the production of viable seeds every year is essential for survival of the species. The relationship between base chromosome number, lifeform and fertility has not been examined in any detail in woody plant groups before this study, which shows the same principles to apply as in

herbaceous plants.

For publication in: Australian Journal of Botany

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G.L. Stoneman & B. Dell

#### Factors affecting the establishment of Jarrah (*Eucalyptus marginata*) from seed in the Northern Jarrah Forest of Western Australia: emergence in the forest

The effects of overstorey, type of site, seedbed, seeding date and seed harvesting by vertebrates and invertebrates on the emergence of jarrah (*Eucalyptus marginata*) seedlings were studied experimentally in the northern jarrah forest of Western Australia. Seed harvesting by small vertebrates substantially reduced emergence, whereas invertebrates only slightly reduced emergence. Seeds were removed rapidly when on the soil surface and in the open, whereas seed removal was insignificant when the seed was covered by soil. Vertebrates harvested seed more effectively when the understorey and litter were removed and the seed was more visible on the soil surface. Seed harvesting by small vertebrates had less impact on a site where there had been bauxite mining possibly because the surrounding area was being revegetated with large numbers of seed and the area afforded poor cover for vertebrates. Emergence was less where the overstorey was removed compared to where it was retained and on the rehabilitated bauxite mined site compared to the forest sites. There was no difference in emergence between the low and high quality forest sites and so the emergence phase could not explain the variation in abundance of *E. marginata* seedlings on different quality sites. Post emergence events are likely to be important in explaining this difference between low and high quality sites.

For publication in: Journal of Applied Ecology

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G.L. Stoneman & B. Dell

#### Factors affecting the Northern Jarrah Forest establishment of Jarrah (*Eucalyptus marginata*) from seed in the Northern Jarrah Forest of Western Australia: shade and soil temperature

The effects of shade and soil temperature of growth of jarrah (*Eucalyptus marginata*) seedlings were studied separately in glasshouse experiments. Growth of all plant parts except plant leaf area declined in response to shade, as did the root:shoot ratio. Specific leaf area increased with shade. Seedlings grown under no shade had a higher light saturated rate of photosynthesis, a higher light compensation point and a higher light saturation level than seedlings grown under 70% shade. *E. marginata* seedlings responded to shade in a very similar way to other eucalypts which naturally regenerate below an overstorey.

Soil temperature had a significant effect on the growth of all plant parts except the cotyledons. Total plant growth and shoot growth were maximal at a soil temperature of 30°C, but root growth had a slightly lower optimum such that the root:shoot ratio was highest at 20°C.

These glasshouse experiments support the conclusion from field experiments that greater light levels and warmer soil temperatures due to overstorey removal in the forest significantly increase the growth of *E. marginata* seedlings, but that these are relatively small components of the growth response due to overstorey removal.

For publication in: Tree Physiology

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S.J. Turner

#### The early life history and juvenile ecology of the corallivorous gastropod *Drupella cornus* (Röding, 1798)

At the beginning of July, I presented a paper on the early life history and juvenile ecology of *Drupella*, at the Annual Australian Marine Science Association

(A.M.S.A.) Conference, which was held in Mandurah and organized by the W.A. Branch of A.M.S.A. Two other papers on *Drupella* were presented, by Kelley Hollborn and Bob Black from U.W.A., and the work generated considerable interest and discussion. Dr John Keesing from the Australian Institute of Marine Science was particularly interested in the early life cycle work as he is working in a similar area with crown-of-thorns on the Great Barrier Reef.

**For publication in:** Australian Marine Science Conference Program

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S.J. Turner

**The spatial and temporal distribution and abundance of the corallivorous muricid gastropod *Drupella cornus* (Roding 1798) along Ningaloo Reef in Western Australia**

The distribution and abundance of the corallivorous gastropod *Drupella cornus* (Roding, 1798),

which has been responsible for extensive mortality on Ningaloo Reef, Western Australia, was documented at 4 reef flat and 2 back-reef sites along the Reef during 1990/1991. Significant differences were evident between the numbers of adult and juvenile *D. cornus* collected at the 6 sites, but not between the sample periods. The highest densities were recorded at the Coral Bay back-reef site. Lower numbers were found in the reef flat habitats and at sites at the northern end of the reef. Both adults and juveniles were found predominantly on *Acropora* spp. with a caepitose/corymbose growth form. Juveniles were found more frequently on colonies which were also occupied by adults. Examination of size-frequency distributions provides evidence for a recruitment peak in January/February, following major spawning periods in November/December.

**For publication in:** Coral Reefs

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A.A.E. Williams & G.P. Hall

**New records of Butterflies (Lepidoptera:Hesperioidea and Papilionoidea) from Bernier Island, Western Australia**

The butterflies *Anisynthoides argenteoornatus argenteoornatus*, *Junonia villida calybe* and *Zizina labradus labradus* are recorded for Bernier Island.

**For publication in:** Australian Entomological Magazine

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A.A.E. Williams & A.F. Atkins

**Notes on the life history of *Taractrocera papyria agraulia* (Hewitson) (Lepidoptera: Hesperidae)**

The larval and pupal stages of the Western Grassdart *Taractrocera papyria agraulia* are described. Three host foodplants are recorded. The relationship between *T. p. agraulia* and *T. p. papyria* from eastern Australia is discussed.

**For publication in:** Australian Entomological Magazine

## Research Project Plans

The following Research Project Plans have recently been approved.

No: 11/92  
Title: Impact of introduced predators on high density populations of *Bettongia penicillata*

Supervising Scientist: J. Kinnear

No: 80/91  
Title: Management of WA kangaroo populations

Supervising Scientist: R. Prince

No: 20/92  
Title: Fitzgerald River National Park Population Responses to Baiting

Supervising Scientist: J. Kinnear

No: 27/92  
Title: Fox Dispersal  
Supervising

Scientist: D. Algar

No: 28/92  
Title: The status, distribution and habitat requirements of the Western Mouse *Pseudomys occidentalis*

Supervising Scientist: K. Morris

No: 29/92  
Title: Investigation of *Reedia spathacea* communities of the Warren Botanical Subdistrict

Supervising Scientist: N. Gibson

No: 30/92  
Title: Investigation into using multimedia applications in research

Supervising Scientist: M. Choo

No: 31/92  
Title: Training of research personnel in the use of computers, software and experimental design

Supervising Scientist: M. Choo

No: 32/92  
Title: Investigation into electronic identification and recognition of sound frequencies of bats

Supervising Scientist: M. Choo

No: 33/92  
Title: Development of general purpose utilities for researchers

Supervising Scientist: M. Choo

No:	35/92	Supervising Scientist:	R. Prince	Supervising Scientist:	G. Friend
Title:	Conversion of existing Paradox systems to make them network aware	No:	40/92	No:	44/92
Supervising Scientist:	M. Choo	Title:	Conservation of Marine Turtles - Western Australian Region	Title:	Radio-tracking translocated noisy-scrub birds
No:	36/92	Supervising Scientist:	R. Prince	Supervising Scientist:	A.H. Burbidge
Title:	Biology of jarrah poles resistant or susceptible to jarrah leafminer (JLM) infestation	No:	41/92	No:	45/92
Supervising Scientist:	I. Abbott	Title:	Ecology of the Western Barred Bandicoot	Title:	The re-introduction of the Chuditch <i>Dasyurus geoffroii</i> to Julimar Conservation Park
No:	37/92	Supervising Scientist:	J.A. Friend	Supervising Scientist:	K. Morris
Title:	Numbat conservation: ecology and management	No:	42/92	No:	46/92
Supervising Scientist:	J.A. Friend	Title:	Performance and reinfestation of jarrah leaf miner (JLM) in ground coppice after crown scorch by an autumn controlled burn	Title:	Sawn recoveries from crown logs of radiata pine, grown under 'silviculture-70' schedules
No:	38/92	Supervising Scientist:	I. Abbott	Supervising Scientist:	G. Siemon
Title:	Quenda translocation methods	No:	43/92	No:	47/92
Supervising Scientist:	J.A. Friend	Title:	Effects of spring and autumn prescribed burns on small vertebrates in Jarrah forest	Title:	Improved presentation of karri poles
No:	39/92	Supervising Scientist:	G. Siemon	Supervising Scientist:	G. Siemon
Title:	Dugong Conservation - Northern Western Australia				

## PARADOX TIPS

### SPECIAL ADDON UTILITIES DEVELOPED BY RESEARCH TECHNIQUES

Most PARADOX users are now aware that there is a suite of functions developed by Research Techniques Program (RT) to enhance its performance. These can be installed by obtaining a copy of the scripts from RT, copying them into the PARADOX subdirectory and installing a copy of the INIT.SC file onto the directory from which Paradox is activated. Once this is done, the additional functions can be activated by holding down the control key and pressing the F1 key once. A brief description of the available functions is given below:

Partfield	Extract part of a nominated field (eg ACA from ACACIA)
Upper	Convert contents of a nominated field to upper case (eg acacia into ACACIA)
Lower	Convert contents of a nominated field to lower case (eg ACACIA into acacia)
Proper	Convert contents of a nominated field to 'proper' case (eg acacia to Acacia)
Sort	Sorts file in order based on a nominated field
Carry	Carries entire record forward as in dBASE
Incby1	Increase content of nominated field by 1 (applies to numbers, dates & alphas)
Decby1	Decrease content of nominated field by 1 (applies to numbers, dates & alphas)
Bottomby1	Add record to end of file & increase nominated field content by 1
Integer	Takes the integer portion of a number (eg 12 from 12.55)
Round	Rounds up a number to the specified number of decimals (eg 13 from 12.55)
RangeIns	Insert a range of records
Justify	Justify the contents of a nominated field from either LEFT or RIGHT, can be used to insert leading zeros into a field
Groups	Introduce new field into file to group data into either fix interval groups or variable intervals groups
Dates:	DayOfWeek: gives the day of the week of a nominated date (eg TUESDAY)
	MthOfYr: gives the month of the year of a nominated date (eg JANUARY)
	MthAndYr: gives the month and year of a nominated date (eg 92/12)
	YearOfDate: gives the year of the date (eg 1992)

For more information, contact Mike Choo or Paul Gioia.

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