RESEARCH NEWS

The newsletter of the Research Division of the Department of Conservation and Land Management

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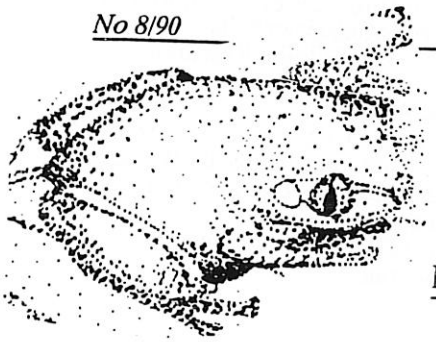


EDITORIAL

NATIVE FOREST RESEARCHERS MEET

Manjimup Research Centre recently hosted the biannual meeting of the Native Forest Research Working Group. Group members, who are representatives of various land management agencies and research organisations throughout Australia met for 4 days to discuss the meeting's theme: "Silviculture to meet the objectives of management: case studies of sub-systems to meet the objectives".

The agenda opened with a field trip through each of CALM's three forest regions where members visited several different forest types. These included Eucalypt Regeneration and Stand Development in the Wandoo and Jarrah forests, Silviculture for Water Production/Habitat in the Jarrah forest, and Tuart Regeneration Operations. The development of research in each state was reviewed. This was followed by members' presentations and discussions of papers based around the central theme.

Penni Hewett, meeting organizer confirmed that the opportunity to meet people who are doing similar work in other states was invaluable. As well as looking at options for silvicultural management of forests, it was possible to identify areas where further research is required and to discuss future directions on a national as well as local basis.

For those of you who are interested, copies of the meeting agenda and the discussion papers will be available early in the New Year.

	ISSUE	DEADLINE	DISTRIBUTION
DEADLINE FOR NEXT ISSUE	DECEMBER	LATE NOVEMBER	PRE CHRISTMAS

Information from the last RDPG meeting on the 8th November 1990 will be in the December issue of Research News.

Scientific and Technical Publications

The following have recently been approved for submission for publication:

Author(s):	N D Burrows
Title:	A simple and inexpensive method of estimating the moisture content of dead *Pinus pinaster* litter
For submission to:	Canadian Journal of Research
Author(s):	K J White
Title:	Growth stress evaluation of regrowth jarrah
For submission to:	WURC Technical Report No 24
Author(s):	R T Wills
Title:	The ecological impact of *Phythopthora cinnamomi* in the Stirling Range National Park, Western Australia
For submission to:	Australian Journal of Ecology
Author(s):	Wong *et al*
Title:	Defluorination of Sodium Monofluoracetete ("1080") by microorganisms in baits
For submission to:	Australian Wildlife Research
Author(s):	A E Williams
Title:	New locality records for six Lycaenid butterflies in Western Australia (Lepidoptera : Lycaenidae)
For submission to:	Australian Entomological Magazine

YOU ARE INVITED TO A

Christmas get together BBQ

on Friday 7 December commencing
12.00 at
Como Research Centre

BYO meat

$1.00 for salads

Drinks can be brought there on the day

Oh by the way wear your whites because the theme is "Challenge of the Research Centres"
Make up your own Volleyball team (8 to a side) perhaps smaller centres can combine and challenge the other Research Centres
So get your teams together, indicate your interest on the form below and hopefully we'll see you there for lots of fun and Christmas cheer.

CHRISTMAS BBQ 7/12/90

VOLLEYBALL CHALLENGE

Yes I will be coming and enclose a $1 for salads

Name and Centre _____

Return form to Deanne at Como Research or Christine at Woodvale

RESEARCH METHODS NOTE 8:

Comparison of linear regressions using SAS
By Matthew Williams

The statistical comparison of linear regressions involves two steps: testing slope (parallelism of regression lines), and testing height (or alternately intercept). In this note I demonstrate how to perform this analysis using the SAS procedure GLM (= General Linear Models).

The data used in this example were collected by Keith Morris on nesting female green turtles at Barrow Island. For each turtle curved carapace length and width were measured; data analysed here were collected over two seasons, 1986/7 and 1987/8. The data have been modified by removal of some values in order to better illustrate the method.

The analysis then proceeds as follows. For each season a regression of carapace width on carapace length is calculated using SAS procedure REG. We then test whether these regressions are significantly different between seasons using GLM. All tests are performed at the .05 level of significance.

It is necessary to test parallelism first, as comparison of heights is meaningless unless the regressions have common slope. In this case we then test the heights of each regression, not the intercepts. The intercept is the value of curved carapace width when curved carapace length = 0; the intercept is therefore of no practical significance in this case. Of primary concern is whether the separation between the two regression lines at a realistic value of carapace length is statistically significant.

Source program:

```
/* <---Comments are enclosed in these symbols ---> */
/* actual program statements are written in capitals */
TITLE 'BARROW ISLAND 1986/7 AND 1987/8';
TITLE2 'FEMALE GREEN TURTLES';
DATA A;
        INFILE 'A:TURTLE.DAT';          /* data file   */
        INPUT SEASON CCW CCL;           /* input format */
        LABEL CCW = 'CARAPACE WIDTH'
                CCL = 'CARAPACE LENGTH';
PROC SORT; /* sort the dataset in order to perform /*/
        BY SEASON; /* separate regressions for each season   */
PROC REG;     /* regressions - output not shown  /*/
        MODEL CCW = CCL; /* width is the dependent variable  /*/
        BY SEASON;    /* regress separately for each season */
        TITLE3 'REGRESSION OF CURVED CARAPACE WIDTH ON CURVED
        CARAPACE LENGTH';
PROC GLM;
        CLASS SEASON;       /* SEASON defines the 2 groups */
        MODEL CCW = SEASON CCL CCL*SEASON;
        TITLE3 'TEST OF PARALLEL SLOPES';
PROC GLM;
        CLASS SEASON;       /* SEASON defines the 2 groups */
        MODEL CCW = SEASON CCL;
        TITLE3 'COMPARISON OF HEIGHTS OF REGRESSIONS';
RUN;
```

The summarized SAS output is listed below. The procedure REG provides the parameter estimates and goodness-of fit statistics for each regression (output not shown). The first run of the procedure GLM tests the hypothesis of parallel regressions (called a homogeneity-of-slopes model in the SAS/STAT manual). This test is the F test based on the TYPE I sum of squares (SS) for the CCL*SEASON term in the model (denoted (1)). The resultant F value (0.73) supports the hypothesis of parallel regressions (p0.05). We therefore proceed with the test of heights of regressions.

The second run of GLM tests the significance of the pooled regression (CCL term, denoted (2)), and whether the regression lines differ in height (SEASON term, denoted (3)). As this design is unbalanced (unequal n for each season) the appropriate estimators are the TYPE III SS; these correspond to Yate's (1934) weighted squares of means. For a comparison of methods (weighted squares of means, a priori ordering, and the Appelbaum and Cramer strategies) see Barcikowski (1983); Searle (1987) gives a more complete though less readable account.

The TYPE III SS F-test compares mean carapace width for each season at the overall mean value of carapace length. The F value (4.57) leads to rejection of the hypothesis of equal heights (p.05). The LSMEANS statement (not shown here) in procedure GLM provides values of CCW for each season at the mean value of CCL. This showed that the difference in heights was 4cm (905cm vs. 909cm). Hence this statistically significant result may well be of no practical significance. However, this is for the researcher to judge.

(Extremely) Summarized program output:

BARROW ISLAND 1986/7 AND 1987/8
FEMALE GREEN TURTLES
TEST OF PARALLEL SLOPES
General Linear Models Procedure
Class Level Information

Class	Levels	Values
SEASON	2	1986/87 1987/88

Number of observations in data set = 1037

Dependent Variable: CCW

Source	DF	Sum of Squares	F Value	Pr > F
Model	3	2233825.632	797.94	0.0001
Error	1033	963955.468		
Corrected Total	1036	3197781.099		

Source	DF	Type I SS	F Value	Pr > F
SEASON	1	18239.568	19.55	0.0001
CCL	1	2214902.486	2373.55	0.0001
CCL*SEASON	1	683.577	0.73	0.3923(1)

Source	DF	Type III SS	F Value	Pr > F
SEASON	1	516.161	0.55	0.4572
CCL	1	2163294.758	2318.24	0.0001
CCL*SEASON	1	683.577	0.73	0.3923

BARROW ISLAND 1986/7 AND 1987/8
FEMALE GREEN TURTLES
COMPARISON OF HEIGHTS OF REGRESSIONS

General Linear Models Procedure
Class Level Information

Class	Levels	Values
SEASON	2	1986/87 1987/88

Number of observations in data set = 1037

Dependent Variable: CCW

Source	DF	Sum of Squares	F Value	Pr F
Model	2	2233142.054	1196.86	0.0001
Error	1034	964639.045		
Corrected Total	1036	3197781.099		

Source	DF	Type I SS	F Value	Pr F
SEASON	1	18239.568	19.55	0.0001
CCL	1	2214902.486	2374.16	0.0001

Source	DF	Type III SS	F Value	Pr F
SEASON	1	4265.386	4.57	0.0327(3)
CCL	1	2214902.486	2374.16	0.0001(2)

The analysis just performed is an example of a one-way analysis of covariance (ANCOVA), with dependent variable carapace width, treatment variable season, and covariate carapace length. The test of the homogeneity of slopes within each level of the treatment variable (first GLM run) is an integral part of ANCOVA, and should always be carried out prior to performing the ANCOVA (second GLM run). In ANCOVA parlance, the TYPE III SS F-test of season is a test of the season effect adjusted for the covariate (carapace length). This is a test of the equality of the carapace widths between seasons, holding carapace length constant (at its overall mean).

Purists may question a couple of points in this analysis: firstly, the ANCOVA model may not be appropriate, but here I have used the data merely to demonstrate the use of the SAS procedures; I do not suggest that this a correct or complete analysis. Secondly, t rather than F statistics may be more appropriate in 1-df comparisons; however the probability values remain constant in either case and $t = \sqrt{F}$.

References

Searle, S.R. (1987). Linear Models for Unbalanced Data. John Wiley & Sons, NY USA.

Yates, F. (1934). The analysis of multiple classifications with unequal numbers in the different classes. J. Amer. Stat. Assoc. 29:51-66.

Barcikowski, R.S. (1983). Two-way nonorthogonal (unequal n) analyses. In: Barcikowski, R.S. (ed.). Computer Packages and Research Design; Vol.2: SAS. Uni. Press of America, Lanham USA

COMPUTER VIRUSES - BEWARE!

Some individuals and groups, regrettably, are introducing "virus" programs into computer systems; sometimes with disastrous consequences.

Virus can move from computer to computer through the exchange of diskettes, back-up tapes, execution of infected network programs, bulletin board downloads. Each virus has a pre-defined purpose that may or may not be harmful.

There are various types of known viruses:

- boot block / record viruses, will deform the original boot sector by relocating it or overwriting with the viral code,

- executable file viruses, infect *.COM and *.EXE files,

- CMOS (integrated circuit) viruses reside in CMOS and are active on 286 and 386 machines only,

- system files viruses are memory resident and infect hidden system files (IO.SYS),

Terminology

- "Trojan Horse" is used to describe software (posing as legitimate) with a malicious piece of code (virus) in it,

- computer worm - program which will multiply itself.

Symptoms of infection:

- computer runs slower than usual,

- loading a program to memory takes longer,

- excessive disk access for simple tasks,

- programs or files disappear,

- viral messages or strange characters appear on the display,

- less memory available with no memory resident programs loaded,

- increased program sizes,

- bootable diskettes do not boot,

- keyboard becomes disabled or scrambled,

- increase in the number of bad blocks allocated.

Prevention.

A virus detection programs can be used (for example IBM Virscan). This virus scanning program does NOT remove viruses. It is designed to scan boot records and executable files looking for signatures of viruses known to IBM when the program was written. A signature is a bit pattern that is indicative of a particular virus. The virus signatures have been derived by performing "reverse engineering" on virus samples. There may be other viruses that currently exist, or will exist in the future, that this program will not detect. The latest viruses may even change their signatures!

Another good method of detection is by using memory map programs which monitors the computer memory.

Memory resident programs other than loaded by the user are questionable.

Viral computer antidotes / vaccines, usually targeted towards protecting against or removing particular viruses are also popular. Some viral remedies will constantly monitor computer and report unusual activities.

Perform regular back-ups! This is the best solution.

The Stoned Virus.

Traces of this virus were detected in Dwellingup around July using IBM Virscan program. The Stoned Virus is a boot record virus, occasionally displaying the message: "**Your PC is now stoned! Legalise Marijuana!**". This Virus places itself in the disk or diskette partition table (absolute sector, side 0, cylinder 0, sector 1, starting at offset 21 - hex 15H).

The infected diskettes were repaired by using the Norton Disk Doctor (NDD program detects invalid signature in the boot record). The hard disk of recently obtained computer was also infected. This was treated by first using Norton Utility (to erase the viral signature which was within partition table) and then using the NDD. the actions taken above is dangerous and does not always work. The best and only real solution that we know of is by reformatting the hard disk. Antidotes that are on the market have not been tested by us.

The hard disk Stoned Virus infects hard disks and diskettes when ordinary files are being copied!

We do not know of available, guaranteed solution to computer viruses, so we recommend regular back-ups of your data and caution in acquiring and using softwares (especially from the public domain).

Adam Wincza
Computer User Support Officer
Dwellingup Research

INTER-LIBRARY LOANS

Budget cuts have hit the library in common with every other section of CALM. The library has a commitment to maintain its journal subscriptions and this now accounts for almost all the money in the library budget. Unfortunately no money is available to continue to provide a free Inter-Library Loan service. The library staff wish to continue to provide as good a service as possible to members of the department and so the Library Committee have reluctantly decided that in future a $5.00 fee will be charged for all Inter-Library Loan requests. Please will you give your account number when ordering future Inter-Library Loans.

Elaine Davison
(Library Committee)

Seminar

Thursday 15th November 1990

Genetic variation in Karri and potential for gain from selection

presented by Richard Mazanec

Research into genetic variation in Karri began in 1972 with the establishment of a series of small provenance trials. Two major provenance trials were established in 1979. Subsequent work centred on the establishment of seed orchards and associated progeny trials in an attempt to supplement seed production for operational use.

Results from recent measurement of two provenance trials established in 1972 and 1979 and a progeny trial associated with the Perup seed orchard will be presented.

Estimates of heritability for growth and form traits indicates significant selection potential.

Implications for management will be discussed.

Venue:
Research Centre Auditorium
CALM Headquarters
Hayman Road
Como

Time:
3.00pm

A holiday on Lombok Island, Indonesia.

For the last three years, Darryl Kitchener has co-ordinated the Western Australian Museum survey of vertebrates on the Lesser Sundas, a picturesque chain of tropical islands between Timor and Java. They are re-assessing the Wallace Line, using more complete vertebrate data and modern understanding of sea-level variation.

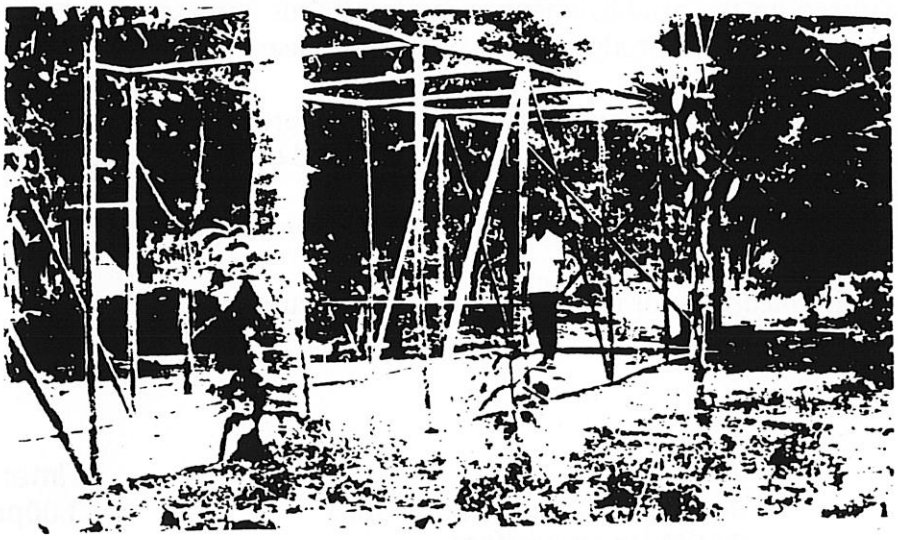
About twenty species of fruit and blossom bats occur on these islands, and pollinate or disperse many of the rainforest trees whose fruit are cruical to the region's economy: mangoes, parkia, durien, kombi, pawpaw, jambu, jack fruit etc. For Murdoch PhD student Andrew Gunnell, the opportunity to join the Museum project, and study the ecology of fruit bats on exotic Lombok, the island next to Bali, was too tempting. So, for me, was the opportunity to collaborate with Andrew on a study of the aerodynamics and sonar capabilities of the bats at his study site, a patch of lowland rainforest about 30 minutes drive from the University of Mataram.

Tourists go to Lombok to relax - coconut palms, sunshine, blue lagoons, picturesque villages and no telephones. So did the McKenzie family.

During two weeks in late July, we netted bats in Suranadi National Park, measured the aspect ratio and loading of their wings, and made recordings of their vocalisations to see if they could echolocate. The vocalisations were recorded after the captured bats were released into a tunnel made from mist nets stretched over a bamboo frame. The tunnel was 16 metres long and 2.5m high, but cost only $25 to have built.

Two sorts of bats were distinguished. Species such as *Macroglossus minimus* and *Cynopterus brachyotis* have low wing loadings. This means that they are slow fliers and could explain why they only forage locally and roost as small groups and individuals. Others such as *Rousettus amplexicaudatus*, *Eonycteris spelaea* and *Cynopterus titthaecheilus* roost in large centralised colonies and have greater wing loadings, allowing them to commute much greater distances to feed.

Colonial species are more vulnerable to predation by people and, throughout South-east Asia, are often sold in the local markets. *Eonycteris* and *Rousettus* are the only cave dwellers we captured and include the only species that use sonar. Cave roosting may be their downfall; in the one known roosting cave that we had time to visit, the entire colony had been trapped by hunters; the abandoned cooking rack was standing at the back of the main chamber.



The bat tunnel behind 'pa Affendi's house near Suranadi, Lombok.

A Word from the Scientific Editor

When writing a paper for publication an important point to consider is the audience - the 'whofor'.

Kohn provides some useful advice on this matter, concerning the title:

"Whoever the audience - the paper should have a traditionally established frame. It should start with a title. A paper without a title leads you nowhere (except perhaps to the House of Lords). The practice to indicate in the title what the article is about is now obsolete. Its main function nowadays is to keep librarians and indexers busy and to get the maximum number of citations and cross references possible. As an example, see the title of this paper. You may have gathered by now that there is no connection whatsoever between the title and the content of this presentation. Dr Emile van Handel said in this connection: "There has always been a much greater demand for my method papers than for my biological results except when I started the title of an article with the word "sex" (4)."

This quotation reprinted here, without permission, from the article *Sex and Money* by Alexander Kohn, Editor of the Journal of Irreproducible Results.

Marianne Lewis

REPORT ON INTERSTATE VISIT 19/9- 2/10/90

Gordon Friend
Senior Research Scientist, Woodvale

The primary purpose of this trip was to attend two ecological conferences which were being held sequentially in South Australia and Victoria. These conferences were (a) Australian Society of Herpetologists AGM, 21-23 September 1990, Coorong, South Australia; and (b) Ecological Society of Australia Biennial Conference, "Ecological Interactions", 25-28 September 1990, University of Melbourne, Victoria.

Prior to the Herpetological Conference I spent two days at the South Australian Museum with Dr. Cath Kemper. She gave me an outline of her current work on whales, and showed me the museum's excellent maceration facilities at Bolivar on the outskirts of Adelaide. I also assisted her with the preparation and photographing of the skull of a large specimen, giving me some insight into a field of research markedly different to my own.

We then spent an afternoon at the Museum looking through data we are currently analysing on the ecology of several species of tree-rats (*Mesembriomys gouldii, Mesembriomys macrurus* and *Conilurus penicillatus*) from the Mitchell Plateau in the Kimberley. We have now collated all available museum records for these species and intend using the BIOCLIM package to map their known distribution, and to predict other areas where these species may occur. Dr. Kemper showed me her recent morphometric analyses on *Conilurus* (carried out in conjunction with Dr. L. Schmidt from the W.A. Museum), which suggests there may be significant differences between the geographically isolated populations in northern Australia.

Whilst at the Museum I spent some time discussing our invertebrate studies with Dr. Eric Matthews, Senior Curator of Entomology. He outlined the Museum's system for curation of their vast collection, and gave me the specifications and suppliers of various products necessary for the long-term storage of such material. I was also given a demonstration of their computer-based system for making small labels for stored material; this produces excellent results and utilizes the "Excel" program on an Apple Macintosh computer in conjunction with a laser printer.

In Adelaide I also took the opportunity to catch up with some ex-CSIRO Darwin colleagues: Mr. Kevyn Cellier who co-authored several papers with me on the wetland ecology work I undertook in the Northern Territory, and Dr. Peter Scholefield who worked with the Division of Horticultural Research on tropical commercial fruits.

The Herpetological Conference was held on a sheep station ("Gemini Downs") in the Coorong area of South Australia, and occupied two and a half days including travel time. It was one of the best-attended meetings ever held by the Society, with about eighty people attending, a high proportion being University students doing Honours and post-graduate research. I presented a paper outlining a framework on which to base a model for predicting the impact of fire on reptiles and amphibians. The framework relies on categorizing species into "life form types" depending on their life history requirements, particularly those pertaining to shelter and food. The paper generated considerable interest, and, apart from a presentation by John Dell and Ric How (W.A. Museum) on the herpetofauna of urban bushland isolates in Perth, was one of the few papers addressing community conservation and management issues at the meeting (copies of the program can be obtained from C. Farrell).

I found the lack of synecological studies addressing critical conservation issues (eg. the apparent decline/disappearance of many frog species from seemingly pristine ecosystems) a most frustrating and disturbing feature of this Conference. Western Australia, and particularly CALM, are clearly well advanced in such relevant and broader management research, and we should strive to maintain this momentum. Admittedly, Universities are well placed to carry out these single species lab-based studies, and it is important that such work continues to be done; but I gained the distinct impression that few other State conservation organizations are including herpetofauna in their management orientated research programs.

A further frustrating aspect of the Conference was that we travelled 250km from Adelaide to be cooped up in an overcrowded, badly ventilated bungalow on a sheep station for nearly two days listening to papers, with no means or time to take in the biological delights of the surroundings before driving back to Adelaide. This is apparently the usual style for Herpetological Society meetings, but I think the format should be expanded to include some form of field tour/excursion to increase the benefits of such a meeting.

The Ecological Society Conference in Melbourne ran over four days, with the first two days devoted to the Biennial Conference theme "ecological interactions" (viz. "ecology"?!), and the last two to the Open Forum. Each day of the Biennial Conference comprised four invited papers in the morning addressing the sub-themes of parasitism and competition (day 1) and mutualisms and plant-animal interactions (day 2), with the afternoons comprising offered papers on the overall theme. I found Mike Austin's paper on the application of the continuum approach to the study of ecological interactions one of the most interesting at the conference (although it was more a methodological paper than one on parasitism and competition). There was a heavy and not unexpected bias towards studies on ant-plant interactions (particularly from Mark Westoby's large group at Macquarie University), but unfortunately very little on small vertebrates, no doubt reflecting a lack of work in this area.

The Open Forum provided a much more diverse, and I thought more interesting, range of papers on ecological research, although the need for concurrent sessions limited the scope somewhat. I presented an expanded version of the fire impact/modelling paper and received some very positive feedback on the ideas, spurring me to continue the development of this management orientated system.

Overall I found the E.S.A. meeting gave me some good insight into the current state of ecological research in Australia, and, as did the Herp meeting, pinpointed the

importance of the management orientated research being undertaken within CALM. I do feel, however, that a conference of this size warranted the official attendance of more than one researcher from a large organization like CALM. Given that such trips are debited against individual sub-program budgets, there should be more autonomy, at least at the Program level, to decide multi-attendance or otherwise at interstate conferences.

The final day in Melbourne was spent visiting colleagues in the Department of Conservation and Environment (DCE) at the Arthur Rylah Institute, Heidelberg.

The afternoon was spent talking to Dr. Andrew Bennett and Ms. Lindy Lumsden about our fire ecology research program in W.A. and showing them some relevant slides. Although facing very similar fire-related management problems in Victoria, DCE has little formal fire ecology research underway to address these issues. Instead, there is a very large amount of effort put into biological survey work (particularly in pre-logging surveys in East Gippsland and that associated with the requirements of the new Flora and Fauna Guarantee legislation), but little into ecological process/interaction research. Andrew and Lindy expressed a degree of surprise (and envy) at the high level of commitment in CALM to long-term management orientated research, and we spent some time discussing the markedly different promotional and organizational structures of DCE and CALM. I think CALM Research Division is well ahead in terms of (a) the scope and long-term nature of its research; (b) its organizational framework, based on Programs and Sub-programs; and (c) promotional and career structure, based on the concept of criteria progression. Andrew and Lindy said that DCE, by contrast, seems beset by constant structural reorganization and suffers under the old promotional system based on seniority and availability of vacancies.

It was good to get back to Woodvale!

Congratulations to Dr Neville Marchant, Senior Botanist at the Western Australian Herbarium, who has recently been elected to the position of Secretary of the South East Asian Botanical Program (SEABOP) and adviser to UNESCO. The nature of Dr Marchant's work with SEABOP and UNESCO will be integrated with research and curation in Australian Herbaria.

RESEARCH DIVISION SEMINARS FOR THE REMAINDER OF 1990

15 November **R Mazanec** **Como**

Genetic variation in Karri and potential for gain from selection

6 December **D Algar** **Woodvale**

Fox control: an overview

7 December **P Christensen** **Como**

Gibson Desert mammals and fire (to be confirmed)

PLAIN ENGLISH SUMMARY OF PUBLICATION

by Dr Stuart Crombie

Title: A comparison of water relations, visual symptoms, and changes in stem girth for evaluating impact of *Phytophthora cinnamomi* dieback on *Eucalyptus marginata*.

Canadian Journal of Forest Research 20: 233-240 (1990)

Scientists investigating jarrah dieback need to know if a tree is infected by the dieback fungus *Phytophthora cinnamomi* and if the tree is recovering or getting worse. Visible symptoms (leaf and branch death etc.) indicate tree health but develop over a long time (from months to years) and are a poor indicator of changes in tree health over shorter periods. This paper shows that measurements of tree "drought" stress (caused by *Phytophthora* destroys the water absorbing roots of the tree) are a very sensitive indicator of dieback damage. Drought stress changes as soon as *Phytophthora* damages the plant and before visible symptoms develop. Dieback infected trees can now be monitored and changes in dieback severity related to climatic events, e.g. heavy summer rain, or forest management practices such as *Banksia* knockdown.

Congraulations to Grant Wardell-Johnson and his wife on the birth of their baby boy