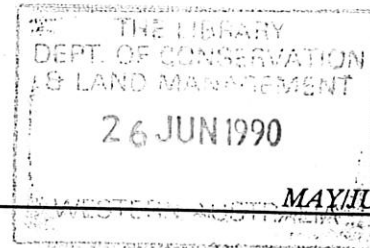


# RESEARCH NEWS

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

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*MAXI/INE 1990*

## EDITORIAL

This combined edition contains several contributions from staff. It is pleasing to see such a wide variety of articles.

May/June has been and is a very busy period for the Research Division staff with field trips, a Computer Program Review, the launch of the Herbarium Volunteer Program, Publication of the Rare Flora Book and a visit by two Professors of Entomology to Kirup and the Karri and Jarrah forests.

June is also time to finalise our 1990/91 Research Plan and I would like to thank all staff for their help in the preparation of the Plan.

Until our next edition

Christine.



	ISSUE	DEADLINE	DISTRIBUTION
DEADLINE FOR NEXT ISSUE	MAY/ JUNE	MID JULY	LATE JULY

## INFORMATION FROM THE RESEARCH DIVISION POLICY GROUP MEETING



The last meeting of the RDPG was held on the 30 May 1990 at the Como Research Centre.

The following is a summary of discussions from this meeting.

### BUDGET

With 88% of the financial year gone the Division is approximately 83% spent.

### RESEARCH PLAN 1990/91

We intend incorporating into the 1990/91 Research Plan a list of CALM publications from 1985-1989.

The cover of the Research Plan will be a geometric design.

### ENCOURAGING SCIENTISTS FROM INTERSTATE/OVERSEAS TO COME AND WORK IN RESEARCH DIVISION

RDPG is looking at a set of guidelines for interstate and overseas Scientists interested in working in the Research Division.

### CONSOLIDATION OF CERTAIN RESEARCH DIVISION PUBLICATIONS INTO A SINGLE JOURNAL

The idea of consolidating certain Research Division publications into a single scientific journal was agreed by RDPG as a good idea and a competition will be held through the Research Division Newsletter for an appropriate one word name. A bottle of Port will be donated by Andrew Burbidge to the winner of the competition.

### KARRI REGION FOREST ECOSYSTEM/MANAGEMENT RESEARCH SYMPOSIUM

The basic theme of the above Symposium will be talking on what there is in the Karri Forest Region and what's being done to manage it. It will be a public conference with external speakers. Final details and dates are yet to be finalised and approval from the Executive Director has not yet been sought.

### SCIENTIFIC COMMUNICATIONS AND REPORT WRITING COURSES FOR RESEARCH DIVISION STAFF

The meeting agreed to accept the offer to have Professor David Lindsay conduct a course in scientific communication for Research Division staff. Following this, the course could then be held on a yearly basis.

### NEXT MEETING

The next meeting of the RDPG will be held on 28 June 1990 at the Herbarium.

## Competition

### "WIN A BOTTLE OF PORT"

The idea of consolidating certain Research Division publications into a single scientific journal was agreed to by RDPG as a good idea and that a competition should be run to find a suitable title.

All you have to do to win the bottle of Port is come up with a one word name for the journal.

The closing date for the competition will be announced in the next Newsletter so come on lets have some suggestions, you've got plenty of time.

Send your entries to the Editor of the Newsletter.

## Please don't forget reprints for the CALM Library

Isn't it a relief: the planning and execution of a research project are things of the past; everything anticipated and unforeseen which could have gone wrong, has; the results have been analysed and actually mean something; the manuscript has been through internal and external referees and is still, more or less intact; and the paper is actually out, in print, for the world to read. The final ego-trip for most researchers is when the reprint requests start flowing (well trickling) in. Well the CALM Library would like, nay requests, three reprints of every paper published by members of the department. This is specified in the small print at the bottom of the CALM Submission Form for Approval for Scientific and Technical Publications. Have you remembered? If not why not reduce the numbers of reprints which were so optimistically ordered, by sending three copies of each to the CALM Library.

Elaine Davison  
Senior Research Scientist



THE EFFECT OF OUTLIERS ON PARAMETRIC TESTS

By Matthew Williams

Many parametric tests (e.g. t-test, ANOVA) are said to be *robust* to the assumption of normality; i.e. violating the assumption that the variable in question is distributed normally, does not *severely* effect the power of the test. Unfortunately, it is difficult to define the limits of robustness or quantify the severity involved. Serious violations of the normality assumption include bimodality and extreme skewness, or the presence of outliers (Day & Quinn, 1989). Outliers are of particular interest since biological systems seem prone to data of this type.

The only "treatment" available for outliers is removal, by trimming or winsorizing. These procedures permit the use of parametric tests, but invite the criticism that outlying values represent real information and should be retained. A practical alternative in many cases is to employ a non-parametric test, where the underlying assumptions are less stringent.

An example using real data collected by Tom Burbidge on Gum Leaf Skeletonizer at Manjimup, illustrates the effect of outliers on the t-test, and the use of a non-parametric alternative (Table 1). The alternative to the one sample or paired-sample t-test is the Wilcoxon one-sample signed-ranks test. For a two-sample t-test, the Wilcoxon rank sum test could be used. The Wilcoxon tests have proven to be almost as powerful as the t-test when the t-test assumptions are satisfied, and are likely to be more powerful when these assumptions are violated (Berenson & Levine, 1979). Note

that the parametric and non-parametric procedures test different hypotheses.

The difference between number of eggs in canopy and coppice is not significant by the t-test, but is by the sign-rank test. The t-test has failed, because the presence of outliers in the data violate the inherent normality assumption. This is an example of a TYPE II error, i.e. failing to detect a difference when one exists. Removing those values defined as outliers, results in a significant difference by both tests. However, many would regard the removal of outliers as "fixing" the data.

In conclusion, researchers should be wary of outliers, and consider using non-parametric tests where the assumptions underlying standard parametric tests may be violated. The possibility of outliers occurring in a dependent variable is also relevant in planning an experiment, as no alternatives exist for certain experimental designs (e.g. factorial ANOVAs with 2 levels).

References

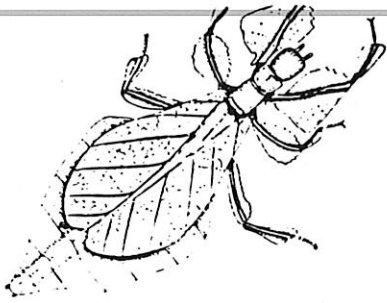
- Day, R.W. & Quinn, G.P. (1989). Comparison of treatments after an analysis of variance in ecology. *Ecol. Monog.* 59(4), 433-63.
- Berenson, M.L. & Levine, D.M. (1979). *Basic Business Statistics*. Prentice-Hall, London.

Table 1. Number of Gum Leaf Skeletonizer eggs in canopy and coppice of Jarrah trees near Manjimup. Difference between number of eggs in canopy and coppice is tested using parametric (t-test) and non-parametric (sign-rank test) procedures. Box and stem-leaf plots are SAS output showing the presence of outliers. (note: SAS defines outliers (symbol 0) as values 1.5 and 3 interquartile ranges (IQRs) from the mean).

Tree	#eggs in coppice	#eggs in canopy
1	626	462
2	881	499
3	453	3792
4	139	972
5	717	1249
6	0	832
7	4064	2377
8	0	1723
9	1659	736
10	163	1455
11	0	276
12	0	2053
13	135	1720
14	0	1507
15	0	952
16	835	1485
17	0	918
18	0	144
19	0	915
20	0	574
21	1776	197
22	490	1588
23	718	550
24	6088	2648
25	4267	144
26	56	2660
27	234	391
28	2386	706
29	1567	662
30	365	477
31	80	2295
32	1115	1146
33	469	771
34	1112	1313
35	50	752
36	869	3024

<b>PAIRED-SAMPLE T-TEST</b>		
H <sub>0</sub> : mean difference = 0		
t = -1.37327, df=35		
Prob.> t  = 0.1784		
i.e. accept H <sub>0</sub>		
<b>WILCOXON ONE-SAMPLE SIGNED-RANKS TEST</b>		
H <sub>0</sub> : median difference = 0		
S = -124, df=35		
Prob.> S  = 0.0499		
i.e. reject H <sub>0</sub>		
<b>DISTRIBUTION OF DIFFERENCE</b>		
Stem Leaf	Boxplot	#
4 1	0	1
3		
3 4	0	1
2		
2		
1 677		3
1		
0 99		2
0 224	+-----+	3
-0 3322110	+	7
-0 99887665	*-----*	8
-1 310	+-----+	3
-1 765		3
-2 221		3
-2 6		1
-3 3	0	1
-----+-----+		
Multiply Stem.Leaf by 10***3		



# SEMINAR

Thursday 21 June 1990

## What is the best measure of average damage caused by insect and fungi to leaves?

Presented by Mathew Williams

The average damage caused by insects and fungi to leaves can be calculated in a number of ways. Comparison of the two methods used in the literature showed that one was systematically biased: many authors had apparently fallen into the "fallacy of averages".

The fallacy of averages is discussed, and the correct method is given for calculating an average based on a set of samples of differing size.

## Impact of pest populations of Gumleaf Skeletonizer and Jarrah Leafminer on other invertebrates living in jarrah foliage.

Presented by Ian Abbott

One of the most vexatious problems in forest entomology is determining the most efficient method of sampling the arthropod fauna of tree crowns. The various trade-offs in time, labour, money and safety are discussed in relation to the size of the catch and the accuracy of mean estimates.

The data collected are used to examine the impact of the two major defoliators of jarrah forest on other co-occurring invertebrates.

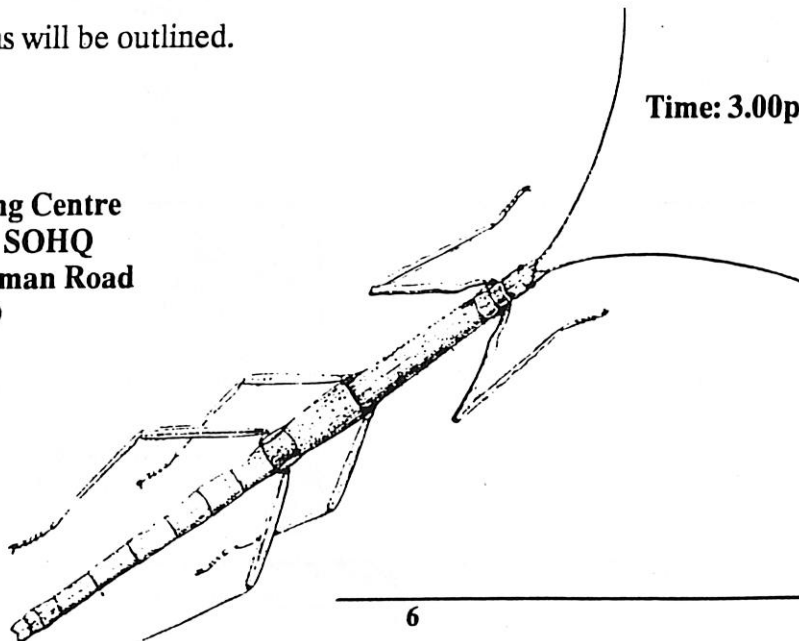
The prediction tested was that abundance/biomass/species richness of most invertebrate taxa would be inversely related to density/biomass of the two pest insect populations. The data do not support this prediction.

Possible reasons will be outlined.

### Venue

Training Centre  
CALM SOHQ  
50 Hayman Road  
COMO

Time: 3.00pm





## SEMINAR

Friday 6 July

### Regeneration strategies of vascular plants after disturbance

by Angas Hopkins

Increasing attention is being given to development of classification schemes based on ecological or functional characteristics. These will complement taxonomic classifications whilst facilitating ecological studies and management.

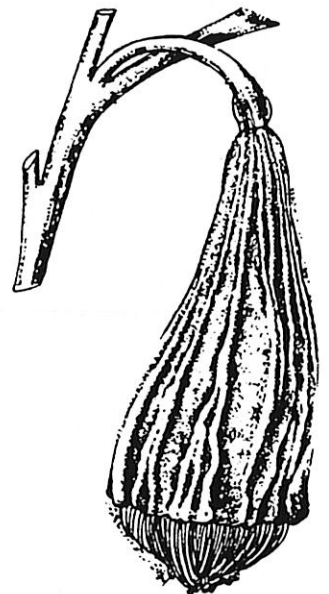
This talk will outline a classification scheme for vascular plant species which is based on mode and rate of regeneration after disturbance such as fire. The scheme has been used at a number of sites mainly in the species-rich shrublands.

The discussion will provide the opportunity to canvass approaches to classifications that relate to other functionally-important ecosystem components.

#### Venue

Western Australian Wildlife Research Centre  
Ocean Reef Road  
WOODVALE

Time: 3.00pm





## Fire and the Environment: Ecological and Cultural Perspectives. An International Symposium, Knoxville, Tennessee.

Neil Burrows  
Senior Research Scientist

I was fortunate enough to attend and present a paper at the above symposium held at the end of March. The symposium was sponsored by the University of Tennessee, Tennessee Division of Forestry, National Parks Service, USDA Forest Service, Society of American Foresters, Tall Timbers Research Station and the Association of American Geographers. The massive wildfires in Yellowstone National Park in 1988 were the catalyst for the symposium. As well as attending the symposium and associated field trips, I also took the opportunity to visit several National Parks and Forests to inspect fire management and research activities.

The standard of papers and posters was generally high and there were many new and young scientists presenting fire research findings. My impression was that there has been a resurgence in fire ecology research in the US in recent years. This has probably been brought about by a recognition of the importance of fire as a natural factor in many ecosystems and by events such as the Yellowstone wildfires. A paper by Dr N Christensen entitled "Tolerable fire regimes on complex landscapes: Ecological consequences, Policy implications and management strategies," summarised the fire management debate in the United States (abstracts are available from me).

Fire research in North America is concentrating on two major areas. Considerable effort is being spent on attempting to define and describe natural or pre-European fire regimes and much work is being done on long term fire regime ecological effects. My impression was that there are philosophical differences with regard to fire between the two major public land administrators in the U.S. In essence, the National Parks Service has a policy of allowing lightning caused fires to burn under certain conditions (prescribed natural fires). They are generally opposed to human ignited prescribed fires, except for burning off immediately adjacent to buildings etc. within the parks. The Yellowstone wildfires (lightning caused) of 1988 were accepted as being a positive thing for the park. The USDA Forest Service attempts to suppress all wildfires, except those which start in inaccessible country. If these cannot be attacked by aerial suppression, then the fires burn out to a point where they can be suppressed. Prescribed fire is being used increasingly in National Forests for fuel reduction as a silvicultural tool, and for wildfire (particularly for promoting grazing and browsing for deer).

Main benefits derived by my attendance at the symposium are summarised:

1. Fire ecology research around the world and the U.S. in particular is focussing more on the long term effects of fire rather than on one-off effects. The importance of maintaining long term research and monitoring projects was emphasised by a number of speakers and during the

discussion periods. Information resulting from research and monitoring was seen to be necessary for developing and selling credible fire management plans. I obtained useful information on methods of setting up field experiments and analysing data from long term studies. The difficulties of maintaining long term research and monitoring projects were common to all scientists.

2. I exchanged a considerable amount of technical information and established contacts with many fire scientists from around the world. It was re-assuring to know that research carried out by CALM's Fire Program Scientists is world class and in some cases, leading the field. The importance of publishing our (CALM's) finding in international journals also came home to me as very few scientists/managers were aware of what we are doing here in Western Australia.
3. From discussion I had with many fire operations staff (especially USDA Forest Service) it was clear that there is a rift between scientists and managers. Managers felt they were not benefiting from the considerable research being carried out in the U.S. They felt isolated from it and in some cases, excluded. Managers were generally cynical of the value (to them) of research scientists and were critical that research was being done for the sake of science and not for good management. On the ground, it was my impression that fire research and technology were well advanced by fire management was still floundering and well backward of the research. Many reasons were given for this, but the main problem seemed to be that the career pathway for scientists within the USDA Forest Service placed little emphasis on technology transfer or the "operationalizing" of research. Rather, funding and promotion of researchers was dependent of the quality and quantity of scientific publications. The application of findings appeared unimportant, much to the disgruntlement of managers and field practitioners.
4. Scientists and managers representing many institutions and organisations were greatly interested in fire research and management in W.A. I am sending literature on fire research and management in W.A. to these people.

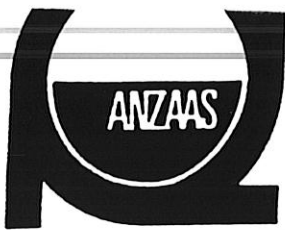
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### BIOTROPICA

Dr Richard Cowan of the Herbarium has very kindly presented the Woodvale Library with a long-term loan of back-issues of the journal published by the Association for Tropical Biology : BIOTROPICA. The loan comprises volumes 1-8 and 13-19, covering the years 1969-76 and 1981-87. On behalf of CALM, I wish to thank Dr Cowan and his wife, Roberta, for their generosity, which I am sure will be very much appreciated by the scientists concerned with tropical biology.

HUGH CLIFT  
LIBRARIAN-IN-CHARGE





## ANZAAS (Western Australian Division)

### Ross Memorial lecture

A highlight of our Division's activities this year will be the 12th Ross Memorial Lecture which commemorates the late Professor A.D. Ross and will be held at 8.00pm on Tuesday 26th June, 1990 at the Ross Lecture Theatre, Physics Building, University of Western Australia.

Our guest speaker will be Professor John de Laeter, who is Professor of Physics and Deputy Vice-Chancellor of Engineering and Science at Curtin University of Technology. The title of his lecture will be "Cosmic Coincidences".

The Lecture is free and open to the public.

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### PLANT PATHOGENS OR AGGRESSIVE SAPROPHYTES?

Ray Wills  
Research Scientist  
Plant Diseases Program

A three day workshop on the fungal genus *Fusarium* was held recently at the Department of Soil Science and Plant Nutrition at the University of Western Australia. The *Fusarium* workshop was conducted by Assoc. Prof. Lester Burgess from the Department of Plant Pathology and Agricultural Entomology in the University of Sydney and organised by the WA Branch of the Australasian Plant Pathology Society. It was attended by 23 people including six from CALM.

*Fusarium* is a cosmopolitan genus and is one of the most economically important groups of fungi in the world. The genus includes many species which cause a wide range of plant diseases such as wilts, root and crown rots, and head blights. They are some of the most common fungi isolated from healthy and diseased plant roots from both agricultural crops and native plant communities. Assoc. Prof. Burgess gave an overview of the genus and discussed the identification and ecology of 28 species.

In the final session of the workshop, participant tested their newly-gained knowledge by trying to identify some unknowns. The group from CALM set themselves an additional task by also identifying some isolates from pines from Nannup and from collar and root lesions from one year old pine seedlings. All isolates were identified as *Fusarium oxysporum*. This species can cause root rots, but it can also be an aggressive saprophyte ie - a secondary invader of diseased or damaged tissue.

## CONSERVATION COMPETITION

The following three quotations are from the well known philosophers Montaigne, Baron Paul d'Holbach, and Sir Joh Bjelke-Petersen, but not necessarily in that order. Match the philosopher to the quotation and send to the Editor. The sender of the first correct entry will receive a free bucket of coal from Mt Lesueur.

1. "Let us give nature a chance; she knows her business better than we do...."
2. "The unhappiness of man is due to his ignorance of nature"...
3. "Few people realise that I am a conservationist at heart"...

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#### ON SCIENCE

"You know, this applied science is just as interesting as pure science, and what's more it's a damned sight more difficult...."

Sir William Hardy to Sir Henry Tizard

(Recalled by Sir Henry in 1955 in the Haldane Memorial Lecture at Birkbeck College, University of London)

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#### ON STATISTICS:

"Gott wurfelt nicht...." (God does not play dice)

Albert Einstein 1973

"God not only plays dice. He also sometimes throws the dice where they cannot be seen...."

Stephen William Hawking 1975

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#### DAVE WARD

## "Philosophy Corner"

### A PARADOX

*It makes as little sense to search for what one does not know as to search for what one knows: that one knows one cannot search for, since one knows it already, and what one does not know one cannot search for, since one does not know what to search for.*

Kierkegaard

Famous Danish philosopher



## COMO GOSSIP

### ECOLOGICAL PRINCIPLES

Some years ago I was asked by a CALM bureaucrat to compile a list of the above. The idea was that operations staff could apply proven principles without having to disrupt hard-working scientists.

I duly put together my ideas but uncharacteristically failed to keep a photocopy. Worse still, the list produced no response and maybe reposes in a SOHQ file labelled "Ecological Principles to be followed by Operational Staff".

I invite Research Division staff to contribute their ideas for a list of the "ecological 10 commandments". One that comes immediately to mind is:

Animal predator populations introduced to islands should be exterminated as soon as possible. The ecological principle illustrated is that in simplified microcosm, introduced predators eliminate prey populations.

Let us see what many intelligent minds can add to this.

IAN ABBOTT

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Now for the latest in illicit liaisons and events at Como Research ....

All staff have been busy trying to impress fellow staff members with their "beautiful" baby photos (well amusing to be more to the point). The competition was judged by staff members, who voted in each of the 4 nominated categories.

The lucky winners were announced in coordination with a "formal wear" champagne morning tea and were presented with a umm.... trophy & sash?!

The winners were ....

**Most Improved - John Bartle**

**Most Regressed - Ian Abbott**

**Best Dressed - Neil Burrows**

and the Most Beautiful Baby of Como Research is Dave Ward

**Congratulations to all winners and thanks for all the enthusiasm.**

PS It was particularly interesting to note one long term member of Research with all those golden curls as a child.

Stay tuned for future events.

**Natalie and Deanne**