

CALM LIBRARY ARCHIVE
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RESEARCH NEWS

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

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OUTSIDE COVER



COMPUTER VIRUSES THEY HAVE STRUCK!!

The inevitable has happened - one computer virus has actually struck at Woodvale and another (Michaelangelo) was stopped in time!

We identified it as the Liberty virus which is a nasty little bug that infects and corrupts EXE, COM and data files and soon becomes rampant. It sits in memory, corrupts files and chews up memory until eventually you cannot run your software (eg. WORD).

This happened to a couple of nice guys (McKenzie & Start) who have been doing all the right things - they caught the bug from the centre's laptop which they borrowed for a field trip (Some !&*!&* had borrowed the laptop prior to this and abused the privilege).

The antidote (use McAfee's CLEAN) was easy to apply but unfortunately a lot of time was wasted in order to test the computers (and all diskettes), clean infected ones and reload software that had been infected by the virus. In addition to this, there is also the uncertainty factor as it is impossible to know if actual field data had been altered and corrupted!

The axiom "It only happens to someone else and not me" certainly does not apply to computer viruses which seem to target your own computer and not someone else's.

To protect against viruses:

1. Never introduce unauthorised software onto your PC or any laptop on loan.
2. Treat every diskette that you come across as suspect; scan for virus using the latest version of McAfee's SCAN (available from any RT member at each centre).
3. If you find a virus, STOP what you are doing and contact any RT member at your centre; do not pass any diskette that has been through the PC to anyone you regard as a friend (if you value the friendship).
4. If you find a colleague using unauthorised software, remind them of their responsibility to other PC users.

As an extra precaution, at each centre, the RT program is looking at allocating an old XT specifically for virus detection. This PC will be centrally located and any externally sourced diskette will have to be scanned using this PC.

Mike Choo



RDPG MINUTES

Extracts from RDPG Minutes of Meeting
No 1/92 held on 20 February, 1992

Budget

The budget report covers 65% of the year and the Research Division is currently 48% spent.

Overtime is looking good - on Budget.

Services offered by J Eygenraam (Herbarium)

John Eygenraam has offered his services to the Research Division and his expertise is typing tables. Further information can be obtained from Fang Chang Sha at the Herbarium.

US Sabbatical Worker on Forest Ecology

William McComb has enquired re the possibility of working with CALM as a visiting Scientist.

Wood Utilization Program - Change of Program Leader

RDPG agreed that Gary Brennan take over as program leader of the Wood Utilization Program.

RPP Guideline - clarification of Project Leader

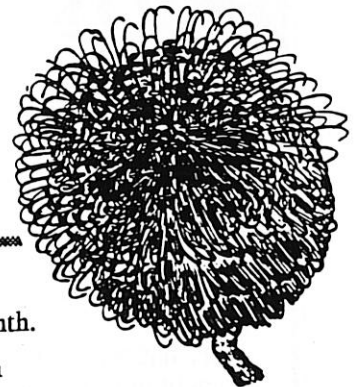
It was agreed that if a RPP is to be conducted by a Technical Officer, a Research Scientist must be nominated as co-project leader. New Staff Guidelines have been forwarded to all Research Scientists and a disk containing the modified RPP headings has been lodged with each Research Centre. Please draw the attention of technical staff to these changes.

RPP Completion Dates

There have been problems with RPPs that have continued past the nominated completion date without any advice to or approvals from senior staff. It was agreed that in future the completion date of a RPP can be extended only with written approval from the relevant SPRS.

Next Meeting

2 April, 1992 at Dwellingup Research Centre



Research Project Plans

The following Research Project Plans have been approved this month.

No:	2/92	Supervising Scientist:	GK Brennan
Title:	Stability of 30mm regrowth jarrah VALWOOD (R) coated with different exterior timber finishes when exposed to outdoor conditions		

Scientific Publications

The following have recently been approved for submission for publication.

Author:	R.A. Mazanec and M.L. Mason	Title:	Extreme wildfire behaviour in three year old fuels in a Western Australian mixed <i>Eucalyptus</i> forest
Title:	Genetic variation in <i>Eucalyptus diversicolor</i> F. Muell. in Western Australia and potential gain from selection	Authors:	L. McCaw, G. Simpson and G. Mair
For publication in:	Forest Ecology and Management	For publication in:	Australian Forestry
Authors:	I.J. Bennett, J.A. McComb, D.M. Cahill, M.J.C. Stukely and C. Crane	Title:	Prodromus of the occurrence and distribution of insect species in the forested part of South-west Western Australia
Title:	The role of tissue culture in the breeding of Jarrah, <i>Eucalyptus marginata</i> (Donn ex Sm.)	Author:	I. Abbott
For publication in:	Australian Journal of Botany	For publication in:	CALM Technical Report
Title:	Stability of furniture blanks manufactured from Jarrah	Author:	D.J. Pearson
Author:	P. Newby	Title:	Sandhill Dunnart
For publication in:	WURC Technical Report No 27	For publication in:	Complete Book of Australian Mammals

RESEARCH TECHNIQUES

NOTE 12:

Should the logarithmic transformation be used routinely for environmental data?

By Matthew Williams

In the data analysis process, most techniques (eg. t-test, ANOVA) require that certain assumptions concerning the nature of the data are satisfied. Violating these assumptions diminishes the reliance that can be placed on the conclusions of the analysis: specifically, reported probability (P) values will be inaccurate. Consequently, the use of transformations to modify the structure of data in order to meet these assumptions is widely advocated. Such transformations include:

- * The rank transformation, where quantitative data are sorted by magnitude and each value substituted by its rank order in the sorted list. This is the basis of many non-parametric tests.
- * The logarithmic transformation, where each value (x) is replaced with its logarithm. Since $\log(0)$ is undefined, minor variations have been proposed to permit transformation of data containing zeroes. These include $\log(x + 1)$, $\log(x + 1/2)$, $\log(x + 3/4)$ etc.
- * The Box and Cox(1964) "family" of transformations, where x is replaced by $(x-1)^c/c$. The value of c can be varied to achieve the desired degree of transformation.

Numerous other transformations have been proposed. However, a fair degree of conflicting advice exists about whether transformations are appropriate in particular circumstances, and how to determine those that are appropriate.

In order to understand this debate, it is necessary to review those assumptions which transformations have been developed to satisfy. I will consider a fairly narrow case, but one which is particularly relevant to the type of data commonly encountered in Research Division. This concerns "environmental data" (usually, but not exclusively, abundances) to be analysed using analysis of variance (ANOVA). The underlying assumptions in ANOVA are:

1. Normality: the sampling distribution of the measured dependent variable is normal;

2. Homoscedasticity: the variance of the dependent variable within each treatment group is approximately constant;

3. Independence: each observation is independent of all others; and

4. Additivity: effects are assumed to be additive, in the sense that the effect of a treatment is the addition of a constant value (the "effect" of the treatment) to the value of the dependent variable.

Of these assumptions, the last is the most important (Gilbert 1973). However, a transformation which renders effects additive will likely satisfy assumptions 1 and 2 as well. Additionally, the need to deal with outliers should also be considered.

Environmental data commonly violate one or more of these assumptions to varying degrees. Such data are characteristically skewed to the right, contain outliers, and heteroscedastic. Proposals on how to deal with these violations fall into three major categories: the "so what? - don't do anything" school of thought, the case-by-case approach, and routine use of the log transform. Each proposal, the proponents and their reasoning is given below:

1) Don't transform: A number of authors (e.g. Games and Lucas(1966)) suggest that maintaining the data in the original scale of measurement should be the dominant consideration. Reduced confidence in the reported significance of the ANOVA results is therefore accepted as a reasonable price to pay in order to compare the original numbers and not $\log(\text{counts})$ or other conceptually difficult quantities. If the objective of the analysis is to determine the best treatment (i.e. maximum value of dependent variable; also called "picking winners") this reasoning is quite persuasive, for two reasons. First, the best treatment will remain the best regardless of any transformation. Second, the statistical significance of differences in a picking winners exercise is largely irrelevant (e.g. Falkenhagen and Gibbons 1989:428, and refs.): the best treatment in the experiment is most likely to be the best in general, regardless of whether it is significantly better than the second best. This procedure suffers from the possibility that outliers will bias the results. Also, Gilbert(1973) refutes the argument for a need to maintain the original scale of measurement, and in any case the transformed data may be returned to the

original scale ("back-transformed") following analysis. However, this debate becomes irrelevant if the object of the analysis is simply to pick winners.

2) Determine a transformation appropriate to the particular experiment: Stoline(1991) and Stewart-Oaten et al.(1986) propose use of the Box and Cox family of transformations if heteroscedasticity is detected in the data, but for different reasons. Stoline(1991) advocates a procedure to maximise the normality of the data. Stewart-Oaten et al.(1996) endorse the procedure of Andrews(1971) in choosing c to minimise the significance of Tukey's one degree of freedom test for non-additivity. That this transformation would also likely resolve heteroscedasticity, achieve normality and nullify the effects of outliers is incidental though beneficial. The drawbacks of this approach have been addressed by Eberhardt and Thomas(1991): the downside of using the Box and Cox family of transformations is that a specific, probably unique transformation is chosen for each experiment. This will be so *even if the same variable is measured in two separate experiments on the same population of subjects*. That this case-by-case approach is unsatisfactory was argued by Scheffe(1959): the preferred approach is to establish a single correct transformation by extensive testing over a large body of data, rather than to tailor transformations to each individual case. Hence Eberhardt and Thomas argue that testing the normality of residuals (e.g. by Shapiro-Wilk statistic), homogeneity of variance (e.g. by Cochran's test), and/or additivity of effects (by Tukey's one degree of freedom test for non-additivity) is a waste of time if applied to an individual data set. They believe that the value of such tests is in determining the correct transformation for a particular variable, as determined from analysis of a large number of data sets. Day and Quinn(1989) indirectly support this argument by pointing out that if preliminary tests are used to determine how to analyze a particular set of data, the overall type I error rate of the analysis will be affected.

3) Routinely use the logarithmic transformation: This approach has been advocated by Eberhardt(1976) and Eberhardt & Thomas(1991). They argue that multiplicative effects have been adequately established for environmental data, and that the logarithmic transformation should therefore be applied

routinely. (Since $\log(AxB) = \log(A) + \log(B)$, the logarithmic transformation by definition renders multiplicative effects additive). They also observe that "a large fraction of ecological data can be adequately normalized by using a logarithmic transformation".

Discussion

There is general agreement of the need to transform environmental data. In certain circumstances (such as picking winners), the objectives of the analysis may make the use of a transformation unimportant, and hence the issue of transformation becomes immaterial. Eberhardt and Thomas(1991) provide a strong argument for routine use of the logarithmic transformation for environmental data: the case-by-case approach produces a unique transformation for each experiment, and will only serve to impede comparisons between experiments. This approach is also the most parsimonious, since it is considerably easier to apply in practice than the Box and Cox family of transformations. However, it requires acceptance of Eberhardt and Thomas's(1991) claim that the logarithmic transformation has been found to be adequate in most cases, a claim that seems likely to be true, but (as far as I know) is as yet unproven.

References

- Andrews, D.F. (1971ns) A note on the selection of data transformations. *Biometrika* **58**:249-254.
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Scheffe, H. (1959ns) *The Analysis of Variance*. John Wiley and Sons, NY.

Stewart-Oaten, A., Murdoch, W.W. and Parker, K.R. (1986) Environmental impact assessment: "pseudoreplication" in time? *Ecology* 67:929-940.

Stoline, M.R. (1991) An examination of the lognormal and Box and Cox family of transformations in fitting environmental data. *Environmetrics* 2:85-106.

Report on visit by Qiao Wang to the Department of CALM Western Australia

by Janet Farr (Economic Entomology)

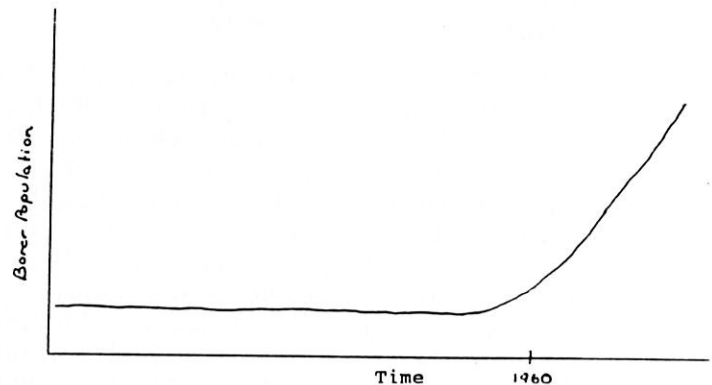
Mr Qiao Wang, a PhD student from La Trobe University, visited CALM January 20-30 1992. This visit was in response to my invitation and funded by Wood Utilization.

The purpose of this visit was to examine the increasing problem of cerambycid borers, particularly *Tryphocaria acanthocera*, in jarrah and karri and to facilitate an exchange of information between CALM and Mr Qiao Wang. Since Economic Entomology is initiating research into cerambycid borers it was considered worthwhile to invite someone with current knowledge on the Australian cerambycid fauna to Western Australia. Mr Wang is currently studying Australian cerambycids and in particular taxonomy of the tribe Phoracanthini to which the beetles of concern belong. Mr Wang has also investigated cerambycids of economic importance in areas other than Australia. He was therefore well qualified to meet our requirements.

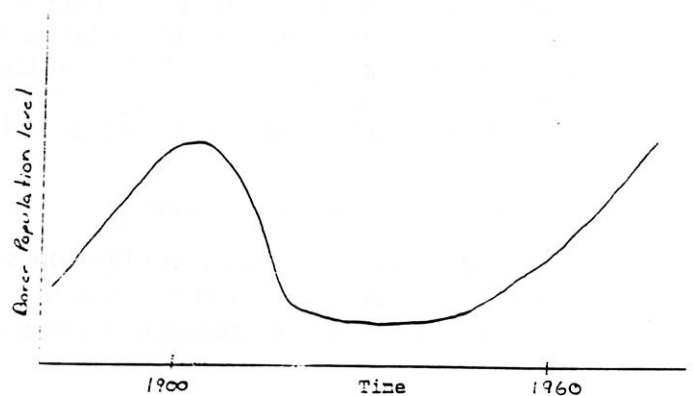
Discussions were held with Des Donnelly and John McKenzie on their work on borer damage in jarrah. Demonstrations were given at Harvey Mill on the work J McKenzie is doing on external symptoms versus internal damage, infestation estimates in the field and damage impact in timber. Visits to Wittaker's Mill at Greenbushes and the Pemberton mill were also made where jarrah and karri stockpiles were inspected for damage. From such visits the observation was made that incidence of borer attack has increased in the last 20 years. This is in accord with Abbott *et al.* (1991). However, it needs to be pointed out that some

mature growth karri and jarrah had evidence of borer attack at 50-80 years ago. Thus we can establish two hypotheses:

* 1. Borer populations have been low up to the 1960s after which their numbers have increased.



* 2. Borer populations fluctuate on a "natural" cycle of increase and decline (eg 30-50 years).



Alternatively tree age may be a function in the susceptibility to attack.

Discussions were also held with Elaine Davison on the possible fungal associations with cerambycid borers and Penni Hewett who assisted with the brown wood survey in karri in 1990-91.

Examination of CALM and Western Australian Department of Agriculture insect collections revealed a number of cerambycid specimens in the Phoracanthini which may be new species. Specimens of these were borrowed by Mr Wang for further study. Also present in the collections were a number of

hymenopterans which Mr Wang has verified as parasites of wood boring cerambycids, including *T. acanthocera*. Mr Wang kindly donated specimens of cerambycid parasitoids to the Manjimup insect collection. Specimens included the braconids *Callibracon capitator* (F.), *Doryctes* sp, and *Syngaster lepidus* Brulle. *S. lepidus* was present in all collections inspected including the canopy knockdown samples of Dr J Majer at Curtin University.

During inspection of field sites at Sutton and the Manjimup "cemetery" plot, known sites of borer infestation, the cerambycid *Coptocercus pubescens* (Pascoe) (identified by Wang) was captured. The dimensions of possible exit holes were consistent in size to the width of the pronotum of this species, suggesting that this insect may be responsible for such holes. Light trapping at Sutton, conducted by Manjimup Entomology during 1991-1992 summer (December-February) did not capture *T. acanthocera*, the insect thought to be primarily responsible for borer damage in karri. Species caught included *T. punctipennis*, *Uracantha* sp. and a Prioninae *Sceleocantha pilosicollis*. It is therefore Wang's and my opinion that borer infestations, particularly in karri (perhaps also jarrah) may be a complex of several species. P. Hewett, E. Davison and I are currently conducting a joint survey at the Sutton karri regrowth thinning trial. Cerambycid larvae discovered during this survey will be forwarded to Mr Wang for identification [current keys by Duffy (1963) and Carter (1929) are misleading, Wang pers comm].

This visit achieved the following:

1. It brought together a number of people who have been studying different issues of the one problem thus enabling exchange of ideas and experiences.
2. Mr Wang imparted knowledge and techniques which would have taken weeks of library research to uncover, plus knowledge of practical experience on working with cerambycids.
3. Mr Wang gained knowledge on cerambycid species and the problem of borer damage from a Western Australian perspective.



4. Most importantly this visit has established liaison between Mr Wang and CALM Economic Entomology which will be of future benefit for research into cerambycid borers.

Reference cited

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Carter, H.J. (1929). Revision of the Australian Phoracanthini (Fam. Cerambycidae) with notes and descriptions of new species of this group and of allied genera. Proc. Linn. Soc NSW vol liv, pt 3: 118-136.

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NEW STAFF GUIDELINE

Both Research Division *Guideline 6* (Criteria progression Feb 1992) and *Guideline 11* (Planning a research project, Feb 1992) have recently been amended and sent out to Research Scientists and Research Centre Managers. Technical Officers and administration staff who wish to access these should either refer to their supervising scientist or Research Centre Manager for a copy. If you are not able to obtain any of the guidelines, please ring Jill or Christine at Woodvale.

STAFF NEWS

Congratulations to Ian Abbott who has been awarded a Doctor of Science degree by the Faculty of Science of the University of Western Australia for his thesis "Studies of pattern and process in biogeography, community ecology and population ecology". Congratulations Ian.

Our good wishes go to David Mitchell who has left Research Division at Woodvale to move to greener?! pastures to Narrogin where he will be working as the District Ecologist under Ken Wallace.

DEADLINE FOR NEXT ISSUE

EARLY APRIL

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SEMINAR

Friday 27th March 1992

The early life history of *Drupella cornus*

by Stephanie Turner

Over the last decade high population densities of the corallivorous gastropod *Drupella cornus* have caused significant and conspicuous coral damage along the Ningaloo Reef Tract, North-West Cape. This seminar will report on the results of laboratory and field studies to investigate the early life history of *Drupella*.

The spawning behaviour and early larval development of *Drupella* have been studied in the laboratory. Female *Drupella* appear to be highly fecund, potentially producing thousands of planktonic larvae, which spend extended periods in the plankton. Field studies have documented the ecology and temporal and spatial occurrence of juvenile *Drupella* along the reef.

An explanation for the increase in numbers of *Drupella* along Ningaloo Reef has not yet been put forward. It is likely, however, that information on the early life history will contribute towards an understanding of the high population densities that are currently being observed. These issues will also be addressed in the seminar.

Venue: CALM
Wildlife Research Centre
Ocean Reef Road (near Joondalup Drive)
Woodvale

Time: 3.00pm

