

5. Monitoring in the Jarrah forest is not regarded by CALM as second rate science as evidenced by its commitment to programmes such as the Kingston study and fire impact studies. An important consideration in any forest disturbance study is that sound information is obtained in a timely manner using available financial and human resources. This places logistic constraints on any experimental design and any study that is designed to meet these limitations

is bound to be criticized as being less than perfect. The Kingston study, however, represents one of the best such compromises to be found anywhere, not just within Australia. The presence of pre-treatment data, internal and external controls, an examination of a range of fauna (and flora/vegetation) and a proposed retrospective study makes this work more comprehensive, integrated and better designed than many forest impact studies. That you were

able to single out the Kingston study for criticism, suggests that it is the first such study set up to meet an urgent need for information on the effects of forest disturbance.

Keith Morris
Manager,
Biodiversity Conservation Group,
CALMScience

Matt Williams
Biometrician,
CALMScience

REBUTTAL

THE comments on Kingston were not intended as a criticism of the Kingston study, but only as an illustration of the complexities of undertaking such studies. Unfortunately, there have been few such studies attempted in Australia and Kingston is the most recent. In reply to your response:

1. I am not aware of any concerns about the Kingston study being published in the scientific literature. However, concerns over the design of the study were expressed during the Kingston court action and have been aired in the media by environmental groups. It was these concerns that were referred to in the essay.
2. There are extraordinary difficulties in designing a logging study which operates at appropriate spatial and temporal scales. It is not so much the size of sampling grids, the number of grids or the dispersion of grids, but it is the problem of knowing the spatial scale at which logging effects operate on relatively mobile vertebrates. In the absence of any reasonable metapopulation data on forest birds and mammals, it is hard to specify the scale of studies required. While I will be the first to acknowledge the practical problems, it may be that multiple replicates of the (entire) Kingston study are required to adequately assess impacts on mammals and birds.

At Kingston, it does not seem unreasonable to suggest that the

logged and unlogged blocks together constitute the treatment and than one cannot control for the other.

The difficulty with sampling grids as small as 2.6 ha is that they are unlikely to contain the entire home ranges of many individual birds or mammals. As there are unlogged areas, as well as unlogged buffers, nearby, the impact of logging may be masked by virtue of the fact that few individuals rely solely on the area logged. If this is the case, then the impact of logging may not be evident until well into the logging cycle, as more of the forest is affected by logging.

3. Without question, the control of foxes results in significant increases in the abundance of mammals, and probably of ground-dwelling birds and reptiles as well. Given the issues of scale discussed above, a depression of animal numbers as a result of logging may therefore be masked by the response of populations to reduced predation.

I do concede that the design of the experiment at Kingston allows the impact of logging to be assessed in an environment where fox control is practiced. However, it is not possible to determine the interactions between fox predation and logging. This is unfortunate as observations in eastern Australia and Europe suggest that logging and the roading associated with logging facilitates the movements of foxes, allows them to penetrate into the forest, and probably allows

them to hunt more efficiently. As there are no guarantees that either a permanent control of foxes will be found or that broad area baiting of foxes will continue indefinitely, it is important to understand the effects of logging on native fauna in an environment where foxes are not controlled. The Kingston study will not do this.

4. Twelve months of pre-treatment surveys are not adequate. Population variation between years for birds and mammals is large and subject to regional influences. While jarrah forest appears uniform and lacks some of the topographical diversity of forests in eastern Australia, there is no basis for assuming that all populations within the forest experience the same seasonal and annual variations in numbers. This needs to be established before one can be confident that "controls" are "controls". Recognizing that there are practical limitations to the amount of time that can be devoted to pre-treatment surveys, without a solid basis for understanding "background" year to year variation in numbers, it is very difficult to attribute any change, or lack of change, in numbers to treatment effects. Regrettably, there are few, if any, long-term data on populations of forest animals in Australia and fewer still from Western Australia (see the articles by Calver and Dell in this issue).
5. The comments on monitoring were not directed (except by proximity

in the text) against CALM. The comments on monitoring related to two issues. Firstly, there is inadequate monitoring of forest biota in Australia (including in Western Australia). Secondly, the scientific (academic) community views monitoring (as opposed to experimental studies) as second

rate. This dissuades many scientists (particularly at university) from initiating or participating in such work.

It is encouraging that CALM places such importance on monitoring. I look forward to the publication of the studies from Kingston and other CALM

forest monitoring programmes. As Calver and Dell (this issue) demonstrate, there is a serious lack of such (published) data on which to develop plans for the conservation and management of forest biota in Western Australia.

Harry F. Recher

CORRESPONDENCE

Jarrah Forest Birds

IN 1974 I began a project lasting seven years in which I recorded wildlife sounds in Western Australia's south-west forests. Twelve years later, in 1993, I began a second project with new equipment for the purpose of upgrading the sounds of my first project.

The procedure in both projects was to select an area of forest where birds and bird song were plentiful. I then placed microphones in trees and bushes before sundown and camped nearby. At day break I put on headphones to monitor the bird calls. If they were of good quality I began recording.

It was not easy to find healthy forest where bird-life was vibrant. I found that birds were only numerous in areas which had remained unburnt for several years. In the early project I obtained no useful recording in areas which had been burnt within five years. It was only worthwhile placing microphones in patches of forest which had remained unburnt for six years or more. Nevertheless, by persevering for seven years, I succeeded in obtaining a satisfactory representation of the bird calls of the Jarrah and Karri forests¹. The work was much easier in the Karri forest than in the Jarrah forest because little burning had been done in the Karri areas at that time.

I commenced the second project armed with a knowledge of good bird spots from the previous project. The new project, I thought, would be easy and take only a fraction of the time which the first project took. I was sadly disappointed. The good areas were good areas no more. For six months I crisscrossed approximately half of the accessible Jarrah forest, testing many prospective areas by camping, looking and listening. Areas which in the early project were useful if unburnt for six years were consistently short of

bird-life in the second project. To obtain worthwhile recordings it was necessary to find areas unburnt for more than 10 years. I found one area which I estimated had not been burnt for 15 years. The bird-life there was vibrant; the forest was healthy. It was the only area which satisfied me for my project. Areas burnt between 10 and 15 years were too hard to work in.

The reason for areas unburnt for six years giving satisfactory results in the first project and not in the second project is understandable on the basis that the humus-related food in the frequently burnt forest was depleted. I found that healthy, unburnt forest patches had a thick ground layer of leaves and litter at various stages of decomposition. By digging down through this layer numerous insects were found which were instrumental in the decomposition process and which I assumed obtained their sustenance from the leaves and litter. Birds, small mammals and reptiles consumed the insects for food for themselves and their off-spring. Some birds also ate the reptiles.

Where the forest was repeatedly and frequently burnt the leaves and litter were destroyed before they contributed to the decomposition mechanism, resulting in the forest having a declining ability to support wildlife. Whereas the ground in unburnt forest contained a thick layer of decomposing material, the ground in the frequently burnt areas had little or no decomposing layer and consisted principally of bare ground with a freshly fallen leaf cover. The difference in bird numbers between 6 and 15 year unburnt areas I believe to be directly related to the decline of the soil litter ecosystem and thus directly related to forest burning.

During the second project I did a week's recording in the Goldfields, then made my way back through the agricultural areas to the forests again. There had been good rains in the Goldfields which enabled me to find some excellent areas of wildlife. After leaving the Goldfields and returning through the agricultural areas I investigated areas of untouched bush where wildlife was again good. On heading towards Collie I reached the fringe of the Jarrah forest. Immediately the character of my surroundings changed. Whereas I had been travelling for a week through areas of natural, unburnt bush in the Goldfields and agricultural areas, I was now in the midst of burnt forest. There was a corresponding sharp decline in bird-life. This experience was a shock and left me frustrated and depressed. The suddenness of the change was a clear indication that the heavily timbered forest, not the lightly timbered bush, was the focus of maltreatment.

My six months comparative study of Jarrah forest wildlife has spanned portions of both winter and summer seasons. I claim that this study is sufficient to show that in the 19 years since the commencement of my first project, the bird-life of the Jarrah forest has dramatically decreased. I also claim that frequent burning of the forest is responsible for this decrease.

¹Editor's note: Jarrah *Eucalyptus marginata* and Karri *E. diversicolor*, along with Marri *E. calophylla*, are the dominant trees over most of the forest area of southwestern Australia.

John N. Hutchinson
Village Green, Balingup,
Western Australia, Australia 6253