Progress Report to the Roadside Conservation Committee
The conservation biology of the gazetted rare species, Banksia goodii, with emphasis on roadside populations

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Work completed or in progress (May - November 1990).

Geographic and climatic range of ***B. goodii.***

Banksia goodii is a prostrate shrub that grows in sand or sand over laterite, generally in woodland or forest habitats of South-western Australia between Albany and the Porongurup Range.

Most information relating to the geographic distribution of this species has been presented in **The Banksia Atlas** (Taylor & Hopper 1988). According to this source, there are ten separate populations: four of these are on road verges and only one is on a nature reserve (Millbrook Nature Reserve). Investigations during the course of the current project have indicated, however, that there are at least two populations within Millbrook Nature Reserve. One of these comprises at least three hundred plants, although the other is relatively small and has probably less than fifty plants.

All sites known to contain this species (confidential records obtained from the Department of Conservation and Land Management in Como) were visited in May and October 1990. At all except two of these sites a number of measurements and observations were undertaken to determine the habitat preferences of this species. (The remaining two populations will be assessed in December 1990). These were:

(a) No. of ***B. goodii*** clumps
(b) Size of clumps
(c) Nearest neighbour distance between clumps
(d) Leaf length and width
(e) No. of fertile and infertile cones
(f) No. of follicles per cone
(g) Overstorey and understorey shading*
(h) Degree and type of litter cover.

Our survey of all known populations of *B. goodii* indicates that roadverges are extremely important. Four populations are restricted to roadverge sites, whereas a further 4 populations have some of their individuals on roadverges. Thus 8 of the 10 originally described populations have individuals on roadverges. Of the 4 populations which are entirely confined to roadverges, 1 consists of a single plant and is the northernmost known occurrence of this species. The other three consist of 4, 13 and 31 clumps (assumed to be separate plants). Thus the question of minimal viable population size is again of great importance.

* A third-year student has been enlisted to work on some aspects of this project including the effects of shade on seedling growth and vigour (see Appendix 1).

Distribution records (include longitude, latitude and altitude) of all known sites of occurrence of ***B. goodii***, together with those of the closely related conspecifics, ***B. gardneri*** var. ***gardneri***, var. ***hiemalis*** and var. ***brevidentata*** are currently being collated for bioclimatic modelling using Bioclim (Busby 1986). Dr Dave Richardson is undertaking these analyses in Canberra. Results obtained will provide the climatic range within which ***B. goodii*** occurs, based on its current range. If the distribution of ***B. goodii*** is restricted by that of ***B. gardneri***, then the climatic range of ***B. gardneri*** would indicate other areas in which ***B. goodii*** could survive in the absence of ***B. gardneri.*** The analysis will also provide maps of equivalent climates in which ***B. goodii*** should be able to occur.

Size and clonal structure of ***B.goodii*** and ***B.gardneri*** var. ***gardneri*** populations.

A site has been selected where both these species co-occur in relatively large numbers (Alex. Negri's farm, Millbrook Road, King River). Preliminary work has shown extensive below-ground stem development, as well as evidence of fairly recent seedling establishment of ***B. goodii***. A major field trip involving four staff and four research assistants is planned for early December 1990.

Age structure and dynamics of seed reserves

Seed reserves are low in both species in all populations studied, but particularly so in ***B. goodii*** . Preliminary results reveal that ***B.goodii*** has 15.4± 4.6 follicles per cone. As far as seed reserves are concerned, 41.3% of the seeds had matured, of which 32.1% were still apparently viable (firm), 6.6% had recently died and 2.5% had been eaten. Thus, the expected average number of seeds per cone is 12.7. ***Banksia gardneri*** var. ***gardneri*** had 7.84 ± 3.27 follicles per cone. Intact seeds made up 22.9% of the total, 2.3% had been aborted, 0.3% decayed and 74.5% had been eaten. Consequently, only 3.6 seeds are produced per cone. Finally, for ***B. gardneri*** var. ***brevidentata***, follicles per cone equalled 9.8. Intact seeds made up 60% of the total, 13.5% had been aborted, 2.1% had decayed and 24.2% had been eaten. Thus seeds per cone were 11.8. A weevil, ***Cechides*** aff. ***amoenus*** (Curculionidae), which is itself preyed on by a beetle, ***Eleale aulicodes*** (Cleridae), appeared to be mainly responsible for the destruction of seed for all ***Banksia*** species.

Germination of intact seeds in the field averaged for the five field sites (see below) were only 6.7% for ***B. goodii***, 39.7% for ***B. gardneri*** var. ***brevidentata***, and 23% and 0.3% for ***B. gardneri*** var. ***gardneri*** populations from King River and Stirling Ranges, respectively.

Transplant studies

Seeds of ***B. goodii, B. gardneri*** var. ***gardneri*** and var. ***brevidentata*** were sown in five roadside sites situated along a broad climatic gradient running a distance of 300 km from 20 km west of Katanning on the arid extreme, through to the edge of Walpole National Park on the moist extreme. At each site, seeds were planted in subplots, each consisting of three concentric rings. In each ring, two seeds of each species and subspecies were planted in a hexagonal pattern. An additional 24 seeds of each species and subspecies were also planted in monospecific subplots at each site. All vegetation was cleared from the plots and seeds were sown in June 1990. Germination and seedling establishment were monitored in August and October. These will be monitored through the summer/autumn period.

REFERENCES

BUSBY, J.R. (1986). Bioclimate predication system (BIOCLIM). User's Manual Version 2.0. Bureau of Flora and Fauna, Canberra.

Appendix 1

THIRD YEAR PROJECT 1991

Conservation Biology of a Gazetted Rare Species. Banksia goodii

Supervisors: Dr. Byron Lamont & Dr. Ed Witkowski

BACKGROUND

Banksia goodii is a prostrate species only found on acid sandplains in a restricted area between Albany and the Porongorup Ranges. These are mostly found growing in clumps as part of the understorey of *Eucalyptus* woodland. Seed production has been found to be low and seed predation is often high. In addition, seed viability also appears to be low. Therefore, this species probably reproduces most frequently vegetatively. In addition, preliminary observations suggest that shade influences its vigour, because plants growing in the open under full sunlight are often in better condition than those in the shade.

TASKS

Field work will involve determining the clonal growth pattern of clumps of *B. goodii* in comparison with that of a widespread species, *B. gardneri* that grows with *B. goodii*. *B. gardneri* has a similar growth form and is closely related to *B. goodii*. To test for the effects of shade, seedlings of the two species will be grown in pots at various levels of sunlight, namely full, 80%, 60%, 40% and 20%. Survival and growth will be monitored and compared between species and treatments. These data, together with the other information we are collecting on this species, will help in the formulation of recommendations for its management and conservation.

All field and laboratory expenses for the study will be met.

Lamont.doc.Banksia goodii(nov)