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VIABILITY AND PERSISTENCE OF SMALL ISOLATED POPULATIONS OF RARE AND THREATENED FLORA. IS THERE HOPE?

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THE capacity for flora to survive and persist in small isolated populations, particularly narrow road reserves and in small vegetation remnants is generally viewed pessimistically, given theoretical ecological and genetic predictions and current documented declines in so many of these populations. Present data indicates that 25% of WA threatened flora populations are on road reserves and that the vast majority of these populations are small and declining. Yet recent genetic and ecological studies suggest that these small populations are reproductively viable and potentially capable of persisting if provided with appropriate conditions for seedling recruitment such as soil disturbance or fire and most importantly that they are free from competition with environmental weeds. Studies also suggest that a moderate increase in population size may place these populations over size thresholds that may allow for longer term persistence. Following are two examples of threatened flora that have populations on road reserves where genetic (*Banksia cuneata,* matchstick banksia) and ecological (*Verticordia fimbrilepis*, shy featherflower) studies provide some encouraging signs for the survival of small roadside populations.

Banksia cuneata *site, Bruce Rock Road, Quairading.*

Banksia cuneata is a rare and endangered species found in 10 small isolated populations covering a range of about 100km in the central wheatbelt. Several populations are subject to habitat degradation and loss associated with weed invasion and rising water tables. One of these populations east of Quairading occurs as a narrow linear strip along a road reserve and currently totals 65 plants. Genetic studies carried out on this population in 1989 showed significant levels of inbreeding compared with other *B. cuneata* populations. Theoretical and empirical studies of small plant populations indicate that increased inbreeding in normally outcrossing species can have significant negative effects on the viability and persistence of small plant populations. Thus the initial diagnosis for this population in 1989 was not promising. From 1989 to 1996 the population was increased in size by the planting and establishment of plants from seed collected on site. This work was coordinated by the *Banksia cuneata* Recovery Team and was carried out with the help of volunteers from the Quairading area.

Subsequent genetic studies in 1996 revealed that the increase in population size from 31 to 61 was associated with a significant reduction in inbreeding in the population (Fig 1). In conjunction with this genetic study an investigation was also carried out on the activity of bird and insect pollinators. Although bird and insect pollinator activity was low in this population, compared with the other *B. cuneata* populations, there were still reasonable levels of activity over the flowering period. It was speculated at that time that, apart from the increase in plant numbers, reduced inbreeding may be due to improved, albeit still low, bird pollinator activity.

In 2000 genetic and pollination studies were again carried out on this and other *B. cuneata* populations with preliminary findings encouraging. There was a significant increase in bird pollinator activity compared with 1996 and initial results suggest a marked reduction in the level of inbreeding to a level comparable to other larger and less disturbed *B. cuneata* populations.

The increased pollinator activity over the last few years is probably not only due to the increase in plant numbers in the road reserve (now 69) but perhaps more importantly to the establishment of a further 123 plants (Fig 1), using the road reserve population seed, on land adjacent to the road reserve. Associated with the establishment of this new sub-population was also the planting of

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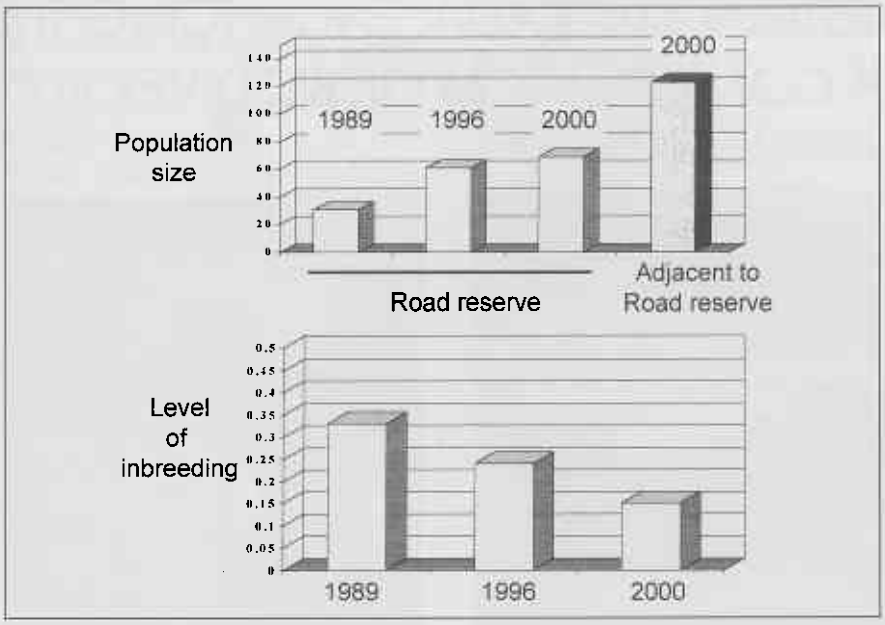

Fig 1. Population size and levels of inbreeding from 1989 to 2000 in a *Banksia cuneata* road reserve population

local native species.

Although we are still investigating this population's capacity to survive on the road reserve it is encouraging to see that, by artificially increasing population size both on the road reserve and on adjacent land, there appears to be a significant improvement in genetic factors that may be important in population persistence.

Verticordia fimbrilepis ssp. *fimbrilepis* is another rare and endangered plant that occurs in a number of small isolated populations on road reserves and in larger remnants of native vegetation vested for conservation in the Brookton- Narrogin-Katanning districts. Research being undertaken into the relative importance of factors which constrain population growth has revealed that these small isolated populations on road verges show equal or greater diversity of insect flower visitors, rates of pollination and seed production compared to larger populations in conservation reserves.

Contrary to what is often thought to be the case, pollinator abundance and diversity, rates of pollination and seed production appear to be independent of population size and landscape context. In relation to pollinator activity this seems to contrast somewhat with the findings for *Banksia cuneata*. A significant outcome of this is that seed production in small road reserve populations of *Verticordia fimbrilepis* ssp. *fimbrilepis* is unlikely to be limiting population growth and therefore responsible for population decline. A more likely explanation is the availability of regeneration niche and competition with environmental weeds. Ongoing studies suggest that the taxon may undergo cyclical fluctuations with time since fire. The taxon forms a persistent soil seed reserve and seeds are smoke responsive. Plants are killed by fire but mass recruitment from soil stored seed reserves occurs in the first winter following fire. Some seedling recruitment occurs between fires but whether this is enough to replace older plants as they die, and thereby sustain stable populations is unknown and probably varies with landscape context. In road verge populations where environmental weeds are abundant, competition with the invasive plants almost certainly will result in death of the Verticordia seedlings. However survival rates of inter-fire recruits in populations where weeds are not abundant are probably higher.

Experiments in a roadside population have shown that massive recruitment of *V. fimbrilepis* spp. *fimbrilepis* and co-occurring common Verticordia species can be initiated through the application of aqueous smoke solution and control of invasive weeds.

Both these studies indicate that management regimes which could involve planting seedlings to increase numbers of the target species, controlling weeds and the use of seed germination stimulants such as aqueous smoke solution can lead to the longer term persistence of small isolated plant populations.

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Taxon

Nb: 'taxon' (plural 'taxa') = a term used to denote any scientifically-named group of organisms, eg subspecies, species, genus. It has been derived from the word 'taxonomy', the science of classifying organisms.

Found

You may remember that in April this year we noted that *LFW* sign no. 346 had gone walkabout. Well, it has reappeared! A CALM staffer working on the Bibbulmun Track found it on the roof of the sleeping hut in the Nullaki Peninsula! Amazing! Its now been returned to its original owners.