FLORA

CLIMATE CHANGE, DISPERSAL MECHANISMS AND REVEGETATION WITH WA PLANTS

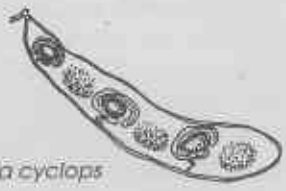
by Stephen Hopper

ODILE Pouliquen-Young's recent article (Western Wildlife 4/2 pp 8-9) highlighted the vulnerability of species of *Dryandra* in south-western Australia to minor climate change of up to 2°C. I would like to expand on two aspects of this important issue – is it likely that south-western plants might disperse across the landscape to track the climate? And, secondly, what does the answer mean in terms of best practice approaches to natural revegetation and restoration in the south-west?

Dispersal capabilities

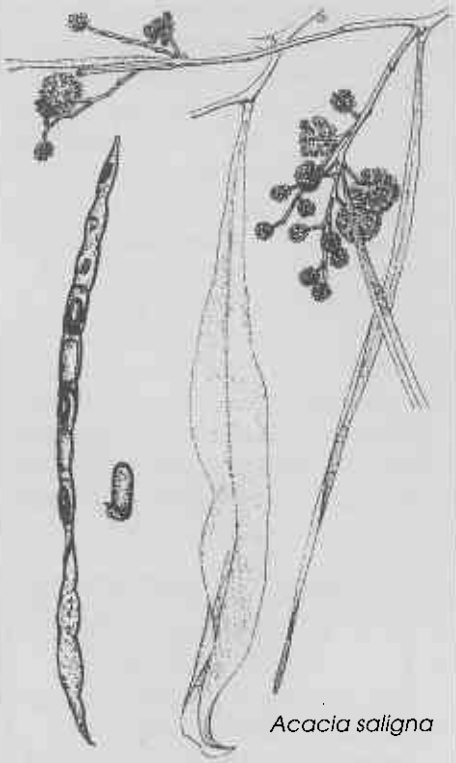
Effective dispersal involves transport of seeds or vegetation propagules some distance from the mother plant, followed by germination and successful establishment to form a breeding population at a new site.

One striking aspect of the majority of the south-west's 8000 native plant species is the absence of obvious means of seed dispersal. Very few species have large wings or light-weight seeds for wind dispersal – orchids, daisies, some native grasses and sheoaks come immediately to mind as exceptions. But look at the seeds of eucalypts, kangaroo paws or most shrubs and perennial herbs that dominate south-western plant communities and you will see that they are unlikely to move away from the maternal plant more than a few metres unless picked up by cyclonic winds, firestorms, sheet flooding or animals.



Acacia cyclops

Another significant deficiency in the flora are berries, drupes and other fleshy fruits encasing seeds as an enticement for birds and mammals to consume and disperse seeds in their droppings. Exceptions are quandongs, mistletoes and many southern heaths (Epacridaceae). Legumes, including wattles, may carry a fleshy structure attached to individual seeds called an aril or elaiosome. These seeds are usually gathered by ants and dispersed short distances, often to underground caches. In a few species, such as the coastal wattle *Acacia cyclops*, the aril is big and bright red, attracting mobile birds as dispersal agents. But, again, the vast majority of south-western plants lack such enticements.



Acacia saligna

Indeed, it is predominantly in relatively new or open habitats that obvious adaptations for seed dispersal are found – aquatic environments, coastal dunes, margins of rivers and salt lakes, recent dunes or granite outcrops are places to look. The habitats that dominate the south-west display the converse – plants of woodlands, forests, kwongan heaths and mallee country for example usually lack any obvious means of dispersal other then gravity.

This situation contrasts strikingly with that seen in most places elsewhere. Rainforests, for example, are replete with fleshy-fruited species that attract animals as dispersers. The woodlands and forests of eastern Australia have far more such species than do those of the south-west. The vast conifer forests of the northern hemisphere are dominated by widespread fast-growing species with seeds readily dispersed by the wind or by fruit-eating animals. Even the fynbos heathland vegetation of South Africa, so similar to the south-west kwongan in many ways, has a predominance of berry fruits and seeds adapted for wind dispersal.

Why is the dominant south-western flora so different? The explanation is likely to be found in the great antiquity and continuous presence of land in the south-west above sea level and without major disturbance from mountain-building or massive glaciers for more than 200 million years. Such conditions are almost unique on earth. They explain why so much of the south-west is so flat, why soils are so highly leached of nutrients, why such a complicated mosaic of different soil types sits on the gently undulating terrain of the wheatbelt, and why so much salt sits in the landscape.

The native flora, during its evolution over vast periods, has faced quite different selection pressures to that of places where massive glaciers covered vast areas during the ice ages of the past two million years, or where mountain building has rejuvenated soils through accelerated erosional processes (e.g. eastern Australia down the Great Dividing Range). In the south-west, staying close to the maternal plant has been the safest bet for seeds and propagules for tens of millions of years. In many landscape positions, moving even tens of metres away increases the likelihood of striking a different

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soil type and therefore being at a competitive disadvantage to species of the alternative soil preference.

Contrast this with being a plant in a coniferous forest on the edge of a retreating ice-age glacier in North America or Eurasia. Vast areas of rejuvenated bare fertile soil beckoned to those species able to disperse their seeds long distances. Little wonder that adaptations such as prominent wings on seeds or berry fruits are so prevalent in these habitats.

Implications for climate change

An appreciation of the limited seed dispersal capabilities of most south-western plants suggest that tracking climate change is an unlikely option. Perhaps along coastal dunes, riverlines and salt lake systems some movement might occur. For plants of most other habitats, however, much more likely under a drying climate scenario is that populations would die out in marginal habitat and persist in the landscape only in refugial wetter habitat.

Evidence for this is all around us in the south-west. Many rare relictual species are found in locally wet habitat such as on granite outcrops, on the southern slopes of breakaways, on seeps and in ephemeral swamps. This becomes clear in a cursory read of habitats covered in CALM's book on WA's threatened flora (see ref.). Conservation of such seasonally wet habitats will be a key strategy as the climate warms.

I would venture to suggest that Dr. Pouliquen-Young's conservative models for species of *Dryandra* are overly optimistic as they assume that species are capable of colonising most patches of preferred soil within a given climatic envelope. Years of searching for