SPACE INVADERS

OF A WEEDY KIND!

by Penny Hussey

Roads, railways, rights-of-way and other transport corridors are ideal for the spread of plant invaders. They are open, disturbed areas, cleared of their local inhabitants and just waiting for the arrival of an army of colonists. Aided and abetted by humans, the aliens take over and soon come to rule...

Any human construction - buildings, bridges, roads and railways - inevitably leads to soil disturbance and areas of bare ground. However, it will not lie waste for long. Plants capable of living in these harsh conditions will move in and establish a foothold on the ravaged soil. Ecologists call them 'disturbance opportunists', 'pioneers' or, as I have done here, 'space invaders'.

Wherever humankind moves around, creating a disturbance and laying waste, camp followers trail behind, invading the space created. One group of plants that are very successful at doing this we call 'weeds'.

Although there are disturbance opportunists and pioneers in nature, there are no weeds. Only when we come along to decide what should grow where, will we have plants that defy our edict and grow despite us. These are the weeds - plants growing where they are not wanted. To a farmer, anything that competes with the crop, or is unpalatable in the pasture, is a weed. Many farm weeds originated in northern Europe, growing on the bare soil left by the retreating glaciers, but they appreciated the bare soil of ploughed fields just as much and have travelled with Europeans all around the globe. North American Indians called ribwort plantain (*Plantago lanceolata*) 'White Man's Footprint' because it appeared as soon as Europeans started to use a trail. It can be found in Western Australia too, on better soils and in the higher rainfall areas; in fact it is now cosmopolitan. Many of the worst weeds in south-west Western Australia originated in South Africa, where the climate is very like ours.

Turnip from an adjoining paddock smothers a roadside in Dandaragan.
Photo - Penny Hussey

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Natal redtop in the Helena Valley.
Photo - Penny Hussey

Apart from our farms and gardens, where we have definite plans for what we wish to grow, nature reserves and national parks are established to protect the native plants, so anything introduced becomes a weed. Plants that can be useful in their right place, such as tagasaste (*Cytisus proliferus*), an excellent fodder shrub, are a nuisance and have to be eliminated from nature reserves. In Western Australia, most people would prefer to see local trees, shrubs and wildflowers along rural roads and railways, so introduced plants, again, are weeds.

WHERE DO THE ALIENS COME FROM?

Records at CALM's Western Australian Herbarium show that about 10 per cent of the plants currently growing wild in Western Australia have been introduced to this continent by humans. In many cases the introduction has been deliberate. The plant may have been considered potentially useful for food or fodder - like doublegee (*Emex australis*, introduced as a salad vegetable) or tagasaste - or else as an ornament for our gardens, like watsonia (*Watsonia* spp.) and cape tulip (*Homeria* spp.). Other plants have been introduced accidentally, having hitched a ride on - or in - something we do consider useful.

We must also remember that our present feeling that only native plants should be growing in our bush has only recently become the prevailing view. Many people believed the bush should be livened up a bit and acclimatisation societies were formed in the early years of the colony. These mainly brought in animals, but several prominent people deliberately spread plants. In the early nineteen hundreds, a well-known horticulturalist considered banksia woodlands to be visually boring, so carried seed of the pink gladiolus (*Gladiolus caryophyllaceus*) in his pockets. As he rode around, he scattered handfuls of the seed. No wonder the plant is so widespread! It is attractive too, and now rare in its native South Africa.

Watsonias - weeds deliberately introduced from Europe as garden plants.
Photo - Penny Hussey

Capeweed is so well established in WA that it is often featured as a native wildflower. Here, in Mingenew, it covers the paddocks and forms an attractive border for the native lilac hibiscus.
Photo - Penny Hussey

Introduced plants will only survive unaided here if they find conditions to their liking. For example, a seed of bonduc (*Caesalpinia bonduc*) was found washed up on Penguin Island. It is an attractive shrub, widespread throughout the tropics; it might well have survived if it had landed in a suitable place in the Kimberley, but not in Perth. The South West of Western Australia has a Mediterranean climate of hot dry summers and cool wet winters and so it is not surprising that most of our weeds come from similar areas: South Africa and the Mediterranean itself.

Having arrived, if a plant is to become a weed it must have as many as possible of the following features:

- no special requirements for germination
- no predators in the native fauna
- rapid growth rate
- strong competitive ability
- efficiency at absorbing water and nutrients, and utilising energy
- very efficient dispersal mechanisms, and
- a good seed set, often facilitated by self-pollination.

African love grass (*Eragrostis curvula*) has all of these features. It produces huge numbers of small, light seeds which are easily blown along. It germinates wherever the seed lodges and grows very quickly, setting seed within four months. It forms a dense tussock with a mass of fibrous roots which out-compete surrounding seedlings. Most importantly, it grows during summer when most other plants are dormant and so has all the available water and nutrients for itself. As a C4 plant (see box), the wet summers of 1989 and 1990 were ideal for it, and many observers commented on its rapid spread, luxuriant growth and long flowering season in 1990.

ROADSIDES - SPACE FOR INVADERS

As the Indians noted in North America, weeds follow roads and tracks. The reasons for this are obvious - roads and railways are deliberately designed as transport corridors, carrying people, their goods and their weeds ever further into the wilderness. In addition, maintenance keeps the edges of the track clear and open, creating ideal landing beaches along the invasion route.

Roadsides have all the features necessary for successful weed establishment: disturbed soil; relatively high water and nutrient levels; an open

Flower and fruit of a caltrop.
Photo - Jiri Lochman

Stinking Roger - common weed of roadsides and waste places, from South Africa.
Photo - Jiri Lochman ▼

Bridle creeper is making a takeover bid for WA roadsides. Watch this plant! It could well be the greatest ecological winner of the next decade.
Photo - Penny Hussey ▼▼

and exposed character; and a continual source of weed seeds, carried by people, their stock or their vehicles.

Not all soils, however, are easy to colonise. Laterite (gravel), for example, is an inhospitable, nutrient-poor soil and without some help from humans (such as extra fertiliser or too frequent burning) it is quite difficult for weeds to get established. Undisturbed clay soil is sealed with a crust of lichens and algae which inhibits weed germination. On the other hand, sandy soil is easily disturbed and the loose sand particles move in the wind, preventing the re-establishment of all but the toughest plants - the weeds.

Road managers are beginning to appreciate that the best way to retain their roadside remnants of native vegetation is to minimise soil disturbance. Clearance should be kept to a minimum and gravel pits located away from the road reserve. A grader clearing out a table drain can push seeds, corms and whole plants along with it, and then, if care is not taken, heap them up on top of good bush. A plant with tough seeds such as Patterson's curse (*Echium plantagineum*) or caltrop (*Tribulus terrestris*) can easily be spread in this way, as can plants that reproduce vegetatively. Plants with corms, like watsonias or woodsorrels (*Oxalis* spp.), or grasses with rhizomes like couch grass (*Cynodon dactylon*), are ideal. One plant which is increasing rapidly along wetter South West roads is wavy gladiolus (*Gladiolus undulatus*), which every year forms up to 30 tiny cormels, each of which is capable of growing into a new plant.

But roads are not just used for transport. Power lines, telephone lines and pipelines may use the same corridor. They also cause disturbance during installation and maintenance, which the authorities in charge of them are taking steps to minimise. Thoughtless people also contribute to the roadside's woes, dumping garbage such as exotic plants, herbicides or sheep carcasses among otherwise well-conserved bush.

Fire is a major form of disturbance. In agricultural areas weed seeds are usually abundantly available along roadsides, and establish readily in the open areas left after a fire. The weeds often out-compete native plant seedlings and, if the fires are frequent, will come to dominate the ground layer to the exclusion of all else. Firebreaks, which may be installed on the roadside, are a major site for weed invasion. The weeds then become a much greater fire hazard than the original native bush. To minimise weed invasion, CALM's Roadside Conservation Committee recommends that firebreaks should only be permitted where the roadside strip is wider than 20 metres, and then only when the break is needed to protect the roadside vegetation.

Arum lilies were introduced as garden plants from South Africa.
Photo - Jiri Lochman ▶

Kangaroo grass - in Chittering. These grasses are Australian natives, but they take over disturbed sites just as efficiently as any alien.
Photo - Penny Hussey

ROADS CAN BE WIND TUNNELS

Large vehicles moving at speed lift and carry light objects long distances. Many of the composite (daisy family) weeds that infest roadsides have seeds with a parachute of hairs especially designed for wind transport, and they produce many thousands of them. Occasionally in summer, people in Perth notice clouds of tiny parachutes floating across the city. They are the fruits of stinkweed (*Dittrichia graveolens*) and the various fleabanes (*Conyza* spp.). These, together with flatweed (*Hypochaeris glabra*), compass lettuce (*Lactuca serriola*), sow thistles (*Sonchus* spp.) and bushy starwort (*Aster subulatus*), are spreading rapidly along rural roads. Capeweed (*Arctotheca calendula*) is now so common that people are photographed among it to advertise wildflower tourism in WA!

Skeleton weed (*Chondrilla juncea*) is well known for its success in reaching WA by stowing away on trains from the East, but other plants can hitchhike too. In the past, docks were the places to look for vagrants like this (called 'adventives'

Foot transport - doublegees (and capeweed) encrust a shoe.
Photo - Penny Hussey ◄

Natal redtop was planted by a nurseryman as a 'filter' for flower bunches. Now it lines the roadsides and the nurseyman's widow fights the relentless battle among the roses.
Photo - Penny Hussey

by ecologists), but now chemical control of plants at docks and railway marshalling yards is so effective that they are rather barren places. Instead, you have to find a road junction where huge road trains judder to a halt, shaking off seeds onto the receptive roadside. You'll spot all sorts of odd things!

ROADSIDE WEED PROBLEMS

The roadside weeds in the South West fall into five main groups:

Woody weeds: These are trees and shrubs growing where the road manager doesn't want them, in the line of sight, for example. They are usually native plants, wattles, sheoaks or eucalypts. York gums (*Eucalyptus loxophleba*) are a prime offender, germinating prolifically in table drains after a wet summer.

Perennial grasses: These break up the shoulders, choke drains, degrade native bush and create a fire hazard. African love grass, perennial veldt grass (*Ehrharta calycina*), tambookie (*Hyparrhenia hirta*), fountain grass (*Pennisetum setaceum*) and Natal redtop (*Rhynchelytrum repens*) are but a few in this group.

Annual grasses: These invade the bush and create a fire hazard when they die down each summer. Wild oats (*Avena fatua*) is the most problematical, but bromes (*Bromus* spp.), canary grass (*Phalaris* spp.) and blowfly grass (*Briza maxima*) are also significant.

Broad-leaved annuals and perennials: These invade the native bush and inhibit the regeneration of native plant seedlings. They include capeweed, fleabanes and Paterson's curse, as well as turnip, lupins, caltrop and doublegee.

Annually renewed plants: These die down to a bulb, corm or tuber during summer, and include watsonias, cape tulip, Guildford grass (*Romulea rosea*), thread iris (*Gynandriris setifolia*), bridle creeper (*Asparagus asparagoides*), baboon flowers (*Babiana* spp.) and gladioli.

Specific control strategies have to be worked out for each type.

ROADSIDE WEED CONTROL

For the Main Roads Department, African love grass is 'Public Enemy Number One' in the South West. Not only is it unsightly, but it clogs table drains, impeding drainage, invades the native bush, creates a fire hazard, and more than doubles the cost of road shoulder maintenance. This is because when it is removed the dense root mass breaks up the shoulder formation, needing several passes of the grader to reform the shoulder. Also, the mass of weed debris has to be disposed of. Nobody loves love grass!

Weeds can be controlled in four ways:

- physically, by hand-pulling, mowing, slashing or grading
- biologically, by introducing a specific predator
- ecologically, by creating conditions that are unsuitable for weed establishment and growth, and
- chemically, using various types of herbicides.

On roadsides, grading is the most common method of weed control, but it has its disadvantages. Not only does it spread the weeds, but it creates an ideal seed-bed for weed re-establishment. Biological control was used very successfully to control prickly pear in Queensland, but the research needed to apply it is lengthy and expensive, and roadside weeds are unlikely to be economically significant enough to warrant it.

The best control is prevention of establishment through careful roadside management. If the soil is not disturbed, weeds will find it difficult to get a hold. If disturbance is inevitable - for example during road re-alignment - then the disturbed ground should be sown thickly with native species which will crowd out the weeds.

This has been done very sucessfully by the Main Roads Department in various parts of Western Australia. If the topsoil has a store of weed seeds and fertiliser, it is scalped off to a depth of 6 cm. The subsoil is then tilled lightly - if compacted it will have been ripped first. A native seed mix is sown directly onto the soil. With luck, if the weather co-operates, you will get a spectacular display which prevents erosion and helps to create a wildlife corridor.

Where weeds are already established, chemical control can be very effective. But care has to be taken to use exactly the right chemical, at the right time, and in the right place, or else desirable plants could also be killed. Regrettably, this has been the case with some mature trees, especially salmon gums (*Eucalyptus salmonophloia*) which have been killed by chemical applied over several years. Plants can also develop resistance to herbicide, and Westrail, which must keep the track clear for safety purposes, is having trouble with ryegrass (*Lolium perenne*), some populations of which have developed tolerance to certain herbicides. But there are some bright hopes. Newly developed selective herbicides are showing great promise for grass control without harming native plants.

In any weed control program, however, there must be a concurrent plan for filling the space vacated by the weeds with native species. Otherwise those space invaders will come right back! ⊡

Ribwort plantain.
Photo - Penny Hussey

Couch - grows well in higher rainfall areas and can tolerate shade.
Photo - Penny Hussey

Penny Hussey is a botanist currently employed by CALM to develop guidelines for the management of bush on private land. She is the executive officer for CALM's Roadside Conservation Committee and can be contacted on 367 0438.

Dew glistens on tambookie flowers.
Photo - Penny Hussey

Feathertop forms large, quite attractive clumps. Photo - Penny Hussey

C_4 PLANTS

Plants manufacture food by photosynthesis. They take in carbon dioxide (CO_2) and water and, with the help of light energy, convert them into sugar which is then used for other purposes. Most plants start off this photosynthetic cycle by making carbon dioxide into a compound with three carbon atoms. They are C_3 plants.

Some tropical plants, of which sugar cane is the most well-known example, behave differently. They convert the CO_2 first into a four-carbon compound. This C_4 process is much more efficient than the C_3 one, and gives these plants a great competitive advantage.

African love grass, tambookie, Natal redtop, feathertop and paspalum are introduced examples of C_4 grasses, while silkyheads, matgrass and kangaroo grass are native examples.

LANDSCOPE

VOLUME SEVEN NO. 1 SPRING EDITION 1991

A wave of colour is spreading from Shark Bay to Jurien and inland to Meekatharra. Our story on page 10 takes you into Wildflower Country.

The WA Museum is 100 years old. It houses a staggering four million specimens of insects, marine animals, fish, birds, reptiles and frogs. Page 22.

Seven species of microscopic dieback-disease fungi are attacking WA's unique wildflowers. See page 28.

The rugged Pilbara landscape has some hidden delights. On page 16, go up hill to Hamersley Range, then down Dales and other spectacular gorges.

How does WA's conservation heritage look to the people who look after it? Turn to page 26 for some great photographs from a recent competition run for CALM staff.

COVER

Out now! Wildflowers are blooming in the vast tracts of country north of Perth, especially in the northern sandplains and Murchison, which is experiencing a bumper wildflower season following heavy winter rains. Philippa Nikulinsky's illustration shows some of the wildflowers for which WA is justly famous: the splendid everlasting, buttercup, red leschenaultia, Sturt's desert pea, catspaw, wattle, native wisteria, black kangaroo paw, flame pea, and scaevola - all covered in the newly released book Wildflower Country. *See page 10.*

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