Land use and feral olives in the Adelaide Hills

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Summary Olives *Olea europaea* L. subsp. *europaea* are recognised as a valuable tree crop and an increasingly important industry in South Australia. However, their naturalised descendants become woody weeds with negative impacts on biodiversity, increase fire hazards, and harbour pests that may cause losses to the olive industry.

Feral olives are especially conspicuous in the Adelaide Hills Face Zone because this area includes much unproductive land where neither development nor native revegetation is now occurring. Woody weeds are a symptom of land degradation on these idle blocks.

New natural resource management legislation provides opportunities to address infestations of feral olives and other woody weeds in the context of improved land management. A risk assessment process is in place to guide planning for the location of new olive groves.

Keywords Olive, woody weeds, periurban.

INTRODUCTION

The domestic olive is a group of cultivars and semi-wild forms of olive, developed from populations of *Olea europaea* L. native to the Mediterranean basin as a major source of edible oil and table olives.

Compared to other tree crops, olives have been little modified by selective breeding. Up to 2600 named cultivars are recorded, but these are either heterozygous clones selected from spontaneous, uncontrolled crosses or are at most a few generations removed from land races. Gene flow has continued between cultivated and wild olives to the extent that original wild *O. europaea* genotypes persist only as localised relicts (Lumaret and Ouazzani 2001). The scientific breeding of olives began only in the late 20th century, and there remains great potential to improve the agronomic characters of this crop (Zohary 1994).

Olives were first introduced to South Australia in 1836 and planted in the Adelaide area by settlers who recognised the similarities of climate to the olive-producing regions of Europe. The South Australian Company imported five selected cultivars from Marseilles in 1844, and later accessions arrived from Portugal, Spain, Provence and northern Italy.

FERAL OLIVES

Because the southern part of South Australia has similar climate and soils to the Mediterranean basin, olives readily became naturalised. Feral olive trees can be shown genetically to be the offspring of nearby cultivated olive trees (Mekuria *et al*. 2002). They generally produce smaller fruits than trees in cultivated orchards, both because the trees are unpruned and because they are no longer under selection for maximum fruit size. The endocarps of these fruits are more easily dispersed by birds, facilitating their further spread.

Olives are wind-pollinated and predominantly outbreeding; those naturalised in SA all appear to be self-compatible. Seeds are spread from planted trees by foxes and emus, which swallow the whole fruit and defecate the endocarp hours later. Many other birds also remove olives from the trees (Paton *et al*. 1988). Those that do not swallow the endocarp will disperse it no more than 100 metres, but starlings swallow whole fruit into their crop and may regurgitate endocarps at their roosts up to 40 km away (Mladovan 1998).

The majority of feral olive infestations are found in areas of former woodland vegetation (Figure 1). These areas were the first to be cleared and settled,

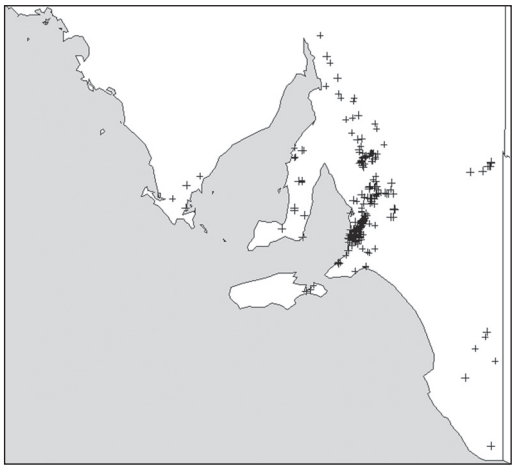

Figure 1. Herbarium records of feral olives in South Australia.

and also provide an optimum environment for olives with 400–600 mm annual rainfall on generally well-drained soils. Major olive infestations occupy the drier foothill slopes of the Adelaide Hills, forming a distinct olive zone in former woodlands of *Eucalyptus leucoxylon* F.Muell. and *E. microcarpa* (Maiden) Maiden. They are commonest on fertile and slightly acidic soils but will also tolerate alkaline and mildly saline soils. However, olives are not completely absent from uncleared forest and woodland and can survive with an annual rainfall of less than 250 mm. Areas with an annual rainfall over 700 mm are less susceptible to invasion, partly because they typically have higher watertables and may suffer transient waterlogging within the root zone.

Feral olives spread and establish on a slower time scale than many other weeds. Their seeds are long-lived in the soil and slow to germinate, due to both the resistant endocarp and an endogenous dormancy of the embryo that varies widely between cultivars (Rinaldi 2000). In time, self-sown seedlings establish on roadsides, in bush and abandoned pasture. If not removed they eventually form a dense tree canopy that prevents other vegetation from re-establishing. Individual olive trees can live for many centuries (Lumaret and Ouazzani 2001) as they retain the ability to regenerate from stumps after felling or burning, as well as forming a large seedbank in the soil.

Feral olives infestations reduce the abundance and diversity of native plant species, altering the canopy structure of the woodland and preventing native regeneration. Native canopy cover may be reduced by up to 80% and native plant species diversity by 50% (Crossman 2002).

THE HILLS FACE ZONE

The Adelaide Hills Face Zone is the western slope of the Mount Lofty Ranges where they abut the suburbs of Adelaide. It is a mosaic of low-density residential development, remnant or regrowth native woodland and small orchards/vineyards. Its amenity value as a green backdrop to the city has led to its designation as a special Zone for planning purposes with restrictions on new subdivision.

The feral olive infestations here are a symptom of the land management problems facing the zone, which formerly supplied horticultural and agricultural produce directly to the adjacent city. It has lost this function due to encroachment of the suburbs and the large-scale nature of modern agribusiness. Many allotments too small to support viable enterprises have been acquired by speculators and hobby farmers lacking expertise in land management. Consequently, much of the land is idle and vulnerable to invasion by woody weeds, including blackberry (*Rubus fruticosus* L.) boneseed (*Chrysanthemoides monilifera* (L.) Norlindh.) and Cape broom (*Genista monspessulana* (L.) L.Johnson). The removal of sheep from the Hills Face Zone in the 1970s led to a sudden appearance of olives over paddocks where their seedlings had formerly been controlled by grazing.

Olives are a special case among the woody weeds present in the area as they are a climax species with a dense evergreen canopy 10–15 metres high. They now form a new, stable vegetation on some sites and may continue to dominate these sites until there is a change in land use. If feral olive spread continues unchecked, much undeveloped land in the Hills Face Zone will be dominated by a dense canopy of olives within fifty years, compromising the open woodland environment, biodiversity and amenity values it was established to protect.

DISCUSSION

Olives will remain a significant industry in South Australia because local climates are ideal for olive growing and there is a growing demand for the products. Feral olives are a consequence of olive growing, but their existing populations are already self-sustaining and the major source of seed for further spread.

A risk assessment process is in place to guide planning for the location of new olive groves. This is valuable in other parts of the State, such as Eyre Peninsula where olives are still rare, but new groves make a minor contribution to the problem in the Adelaide Hills.

The *Natural Resources Management Act, 2004*, provides for the removal of declared weeds, including feral olives, under enforceable action plans negotiated between landowners and the regional Natural Resources Management Board. However, such plans are limited by the owners' resources: clearing established olive infestations carries an initial cost of up to $15,000 per hectare with annual maintenance costs of about $500 per hectare after native vegetation has been planted to replace the olives. The new Act is integrated resource management legislation, unlike previous Acts that treated weed control in isolation, and gives the state and regional authorities wide powers to prescribe measures to prevent or reverse environmental degradation.

A new approach to the management of woody vegetation on the urban fringe must be found. It is unfortunate that such habitats were traditionally regarded as 'natural', needing no management beyond protection from clearance. But periurban lands are already subject to the impacts of human settlement including an influx of introduced plant and animal species and, consequently, require planned management.

It may be more realistic to consider the analogy between native vegetation and a tree crop. Like a crop, native vegetation has a value. Like a crop, it requires investment in ongoing maintenance and replanting on sites where it has been lost.

The best outcome may be for the Hills Face Zone to become an intensively managed wooded landscape, as has been achieved on periurban land in Europe and Japan, by planting and maintaining native vegetation and/or parklands for recreational use.

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REFERENCES

Crossman, N.D. (2002). The impact of the European olive (*Olea europaea* L. subsp. *europaea*) on grey box (*Eucalyptus microcarpa* Maiden) woodland in South Australia. *Plant Protection Quarterly* 17, 140-6.

Lumaret, R. and Ouazzani, N. (2001). Ancient wild olives in Mediterranean forests. *Nature* 413, 700.

Mekuria, G.T., Collins, G.G. and Sedgley, M. (2002). Genetic diversity within an isolated olive (*Olea europaea* L.) population in relation to feral spread. *Scientia Horticulturae* 94, 91-105.

Mladovan, L. (1998). Avian dispersal of the European olive *Olea europaea*, especially by the common starling *Sturnus vulgaris*. BSc Honours thesis, Department of Zoology, University of Adelaide, South Australia.

Paton, D.C., Tucker, J.R., Paton, J.B. and Paton, P.A. (1988) Avian vectors of the seeds of the European olive *Olea europaea. South Australian Ornithologist* 30, 158-9.

Rinaldi, L.M.R. (2000). Germination of seeds of olive (*Olea europaea* L.) and ethylene production: effects of harvesting time and thidiazuron treatment. *The Journal of Horticultural Science and Biotechnology* 75, 727-32.

Zohary, D. (1994). The wild genetic resources of the cultivated olive. *Acta Horticulturae* 356, 62-4.