WEEDS OF NATIONAL SIGNIFICANCE

GORSE

(*Ulex europaeus* L.)

Strategic Plan

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Supporting information about the National Weeds Strategy, Weeds of National Significance and progress to date may be found at www.weeds.org.au where links and downloads provide contact details for all species, their management committees and copies of the strategy.

This strategy was developed under the leadership of the Department of Primary Industries, Water and Environment, Tasmania with full cooperation of all the States, Territories and Commonwealth of Australia.

Comments and constructive criticism are welcomed as an aid to improving the process and future revisions of this strategy.

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Gorse as commonly seen along roadsides

EXECUTIVE SUMMARY

Gorse (*Ulex europaeus* L.) favours areas where the mean daily minimum temperature of the coldest month is above 2^0C and where rainfall is evenly distributed throughout the year and in the range 650-900mm.

Gorse occurs in all States except the Northern Territory and its importance as a weed is related to latitude; thus it is more troublesome in Tasmania and southern Victoria than anywhere else in Australia. Gorse typically occurs on creek banks, roadsides, neglected areas, forest margins, hedges and mine dumps. However, in Tasmania, unimproved and semi-improved pastures are also infested.

Gorse grows particularly well on fertile soils as well as light sands, heavy clays and disturbed soils. Being a legume, it is not dependent on soil nitrogen. It colonises disturbed areas such as mine dumps where little else grows and, by building up soil nitrogen levels, allows the establishment of other species.

The challenge is to marshal a community based strategy with all participants playing their part. This will require considerable coordination over a 20 to 30 year period and incentives for on-ground works.

The vision of the strategy is that:

Gorse will be managed in Australia through collective action to minimise its social, economic and environmental impacts.

The strategy aims to deliver five desired outcomes:

1 Gorse management will be undertaken according to best management practice principles

- Appoint State Strategy Coordinators.
- Determine current knowledge.
- Determine environmental, social and economic impacts.
- Gain stakeholder commitment.
- Improve efficiency of WONS strategy delivery.

2 All areas currently free of infestations are subject to long-term management, leading to continued freedom

- Regulatory support to prevent importation of *Ulex sp*.
- Conduct public awareness campaign.
- Target rural producers for special campaign.
- Refine and extend best management practices.

3 Gorse is prevented from spreading

- Introduce best practice protocols for sourcing road construction and maintenance materials.
- Introduce biological control agents.
- Develop integrated control protocols in riparian areas and other areas subject to erosion or flooding.

4 All isolated and scattered infestations are eradicated

- Identify target areas for eradication.
- Determine best practice eradication methods.
- Provide assistance and resources.
- Undertake strategic follow-up surveillance and control of treated areas.

5 The strategy for gorse control is effectively managed at the national level

- Appoint a National Strategy Coordinator within the National Gorse Task Force.
- Monitor and evaluate implementation of the strategy.
- Develop & coordinate applications for external funds to achieve identified strategic plan outcomes.
- Confirm potential distribution of gorse within Australia.
- Integrate National Gorse Strategic Plan into other WONS strategies.

The extent to which these outcomes are met will be evaluated as part of a five-year cycle of review.

THE CHALLENGE

Gorse has potentially detrimental effects on native flora, particularly understorey species, and is becoming increasingly a threat as an environmental weed in national parks, reserves, riparian areas and around the edges of natural bushland. In pastoral areas, it provides excellent shelter for pests such as rabbits, increases the risk of wildfires because of its flammability, reduces access due to the formation of impenetrable thickets and dramatically reduces stocking rates.

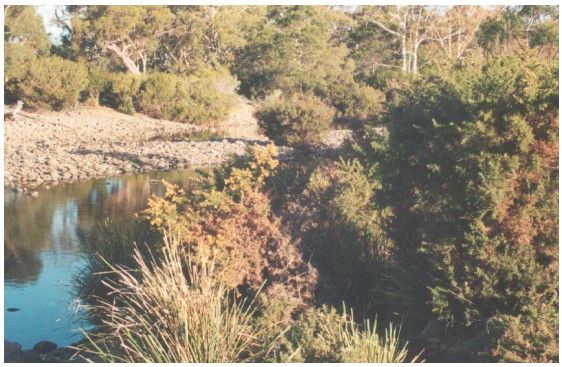
Gorse is a perennial, leguminous, evergreen shrub which, if left undisturbed, will grow to a height in excess of 3 metres. All stems and leaves are prickly, ending in a sharp spine, making plants impenetrable to animals and unpalatable to all stock except goats, and sheep to a lesser extent. Gorse is a prolific seeder resulting in rapid expansion of affected areas.

The most recent study indicates that gorse was costing Tasmanian primary producers around $1M in lost production. New Zealand estimates (1985) put this figure at $NZ150M.

Control is expensive, not only because of the methods used and rehabilitation costs but also due to the time required. Estimates vary from $700-$1,500/ha (2001), depending on the age and severity of the infestation, the methods used and nature of the terrain Often the costs of control exceed the value of the land. In pastoral areas, control costs are a major impediment to action.

Successful control of gorse often requires cooperation between neighbours, including State agencies and local government, for a considerable period. This can often lead to social conflict if not all parties are willing to participate.

This strategy requires a commitment from stakeholders for an extended period, up to 20 to 30 years. It was developed with the belief that all stakeholders must, first of all, recognise gorse as an insidious environmental and economic threat and then commit themselves or their organisations to participating in a control strategy that is best for particular property or area. The challenge is to marshal a community based strategy with all participants playing their part. This will require considerable coordination and incentives for on-ground works. The vision of this strategy will not be achieved in the next ten years. It is a vision that looks 20 to 30 years ahead to a point where gorse will no longer threaten the environmental diversity or the agricultural viability of our inland areas due to the combined efforts of the Australian community.



A gorse infestation alongside a stream on Tasmania's East Coast

1 BACKGROUND

Although the genus *Ulex* contains around 20 species worldwide, only one has become naturalised in Australia.

Gorse is a native of central and western Europe and the British Isles. In these regions, it is used as an ornamental and a forage crop and rarely achieves weed status due to the action of a range of natural predators.

It was deliberately introduced into Australia as a hedge plant in the early 1800's. A lack of predators in Australia and New Zealand, combined with a suitable climate and the plant's ability to withstand very low rainfall conditions, has enabled gorse to quickly develop into a troublesome weed.

Gorse occurs in all States except the Northern Territory and its importance as a weed is related to latitude; thus it is more troublesome in Tasmania and southern Victoria than anywhere else in Australia. On mainland Australia, gorse occurs predominantly on creek banks, roadsides, neglected areas, logging loading areas and forest margins, hedges and mine dumps. However, in Tasmania, unimproved and semi-improved pastures are also infested.

It is now recorded as a serious weed in Hawaii and New Zealand, a principal weed in Australia and Chile and a common weed in Iran, Italy and Poland.

1.1 The biology of gorse

Gorse is a perennial, leguminous, evergreen shrub which, if left undisturbed, will grow to a height in excess of 3 metres. It produces an extremely deep and extensive root system, giving it access to water at depth in the soil.

New Zealand studies have established that establishment of a native canopy and the subsequent demise of a gorse infestation would take around 50-60 years.

All stems and leaves are prickly, ending in a sharp spine, making plants impenetrable to animals and unpalatable to most stock. The dark green leaves are rigid and covered with a waxy cuticle to help minimise water loss. Together with its deep root system, this feature gives gorse the ability to proliferate in areas with very low rainfall.

Flowers are bright yellow, pea-like, approximately 20mm long, and are borne all over the plant. Although buds develop in the late summer and early autumn period, flowers appear in two distinct seasons, spring and autumn. However, flowering can be highly variable and may occur at slightly different times from year to year at the same location. In cool climates, gorse may flower only once a year. A small number of flowers may be present at other times if climatic conditions are favourable. Pollination is mostly by bees.

Gorse is a prolific seeder. Large quantities of brown to black seed, around 4mm long, are borne in grey hairy pods, each pod holding three to four seeds.

Most seeds fall around the parent shrub. However, pods are also capable of splitting open explosively and catapulting seeds for a distance of up to 5 metres. Seeds have a hard, water resistant coating, enabling them to remain dormant in the soil for more than 20 years. These seeds are often stimulated into germination after burning or mechanical disturbance. Gorse seed germinates most readily at temperatures of 15^0 – 19^0C. Viability of dormant seed can still exceed 85%.

Seed dispersal is the main method of gorse spread. However, seeds can be also spread by water (drains or floods), in mud on animals and possibly by wind. Although it is generally thought gorse does not propagate vegetatively, cultivation and spread of the root system can permit some fragments to regenerate.

Climatic and soil requirements

Little information is available on the climatic requirements for gorse. However, it is known that the plant is cold limited with a preference for areas where the mean daily minimum temperature of the coldest month is above 2^0C. The mean temperature of the warmest month where the plant grows in Europe is 18^0 - 20^0C.

Gorse usually grows where rainfall is evenly distributed throughout the year and in the range 650-900mm. However, the adaptability of the plant to rainfall is illustrated by the presence of dense infestations along roadsides on Tasmania's West Coast where the mean annual rainfall exceeds 2,400 mm.

Gorse grows particularly well on fertile soils as well as light sands, heavy clays and disturbed soils. Being a legume, it is not dependent on soil nitrogen. It colonises disturbed areas such as mine dumps where little else grows and, by building up soil

nitrogen levels, allows the establishment of other weedy species. It generally does not flourish on highly calcareous soils and germination is lower and seedling growth less pronounced on these soils.

There is also marked acidification of soil under gorse caused by the retention of bases (mainly calcium) in the plant and litter.

Gorse burns very readily and whilst fire can be an effective control measure, dense infestations of gorse can be a considerable fire hazard, particularly on days of low humidity.

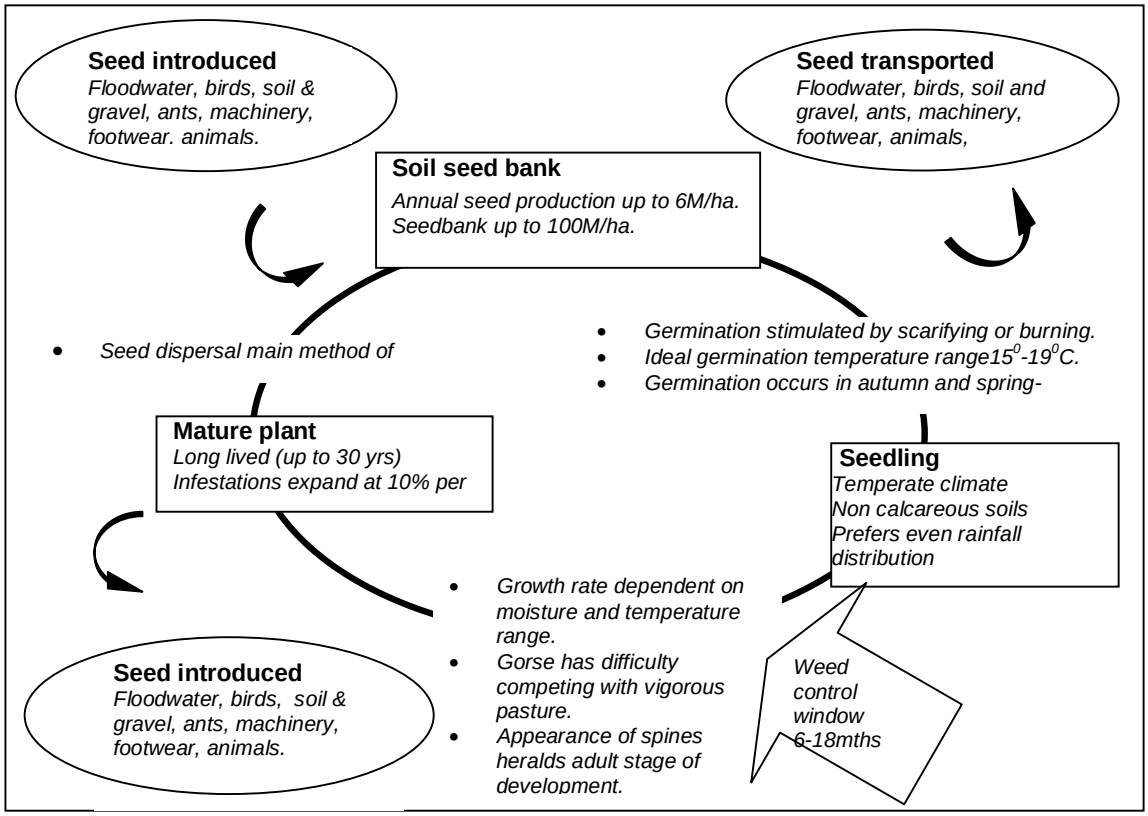


Figure 1. *The life cycle of gorse*

1.2 Extent of spread

After being introduced into Australia soon after European settlement as an ornamental hedge plant, gorse has spread to all States. It is not present in the Northern Territory.

A map showing the recorded gorse infestations in Australia is included as Appendix 1.

Relatively small infestations occur in south-eastern Queensland and in Western Australia around Albany. New South Wales are not troubled by gorse in the majority of the agricultural areas but have significant problems in national parks and reserved areas in the State's south-east and in the Blue Mountains. In South Australia, gorse is restricted to the higher rainfall areas, being most abundant on the Fleurieu Peninsula, Adelaide Hills and Clare Valley. It also extends to other parts of the Mount Lofty Ranges to Hallett in the north, Mannum in the east and Victor Harbour in the south. Other infestations occur around Naracoorte, Millicent and Mt Gambier, Port Lincoln and on Kangaroo Island.

Victoria and particularly Tasmania have the most extensive areas of gorse reflecting the more favourable climatic conditions for the species in those states. In Tasmania, large infestations of gorse occur throughout the state with only Flinders Island and the remote south-west being free of the weed. As in other states, gorse has established along roadsides and other non-agricultural ares such as rail lines, electricity easements, quarries and mine sites and in riparian zones. Infestations are spread from the west coast with over 2000mm annual rainfall to the drier east coast where rainfall is as low as 500mm per year. Of significance in Tasmania, however, is the invasion of native and semi-improved pastures with gorse. This is particularly evident in the midlands and eastern areas.

Infestations across Victoria are widespread with all land protection regions with the exception of Mallee in the north west of the State affected. The most extensive infestations are centred around the regions of North Central, Glenelg, Corangamite, Port Phillip, Goulburn and West and East Gippsland.

Huge potential for further spread

Of concern is the huge potential for gorse to spread well beyond its current range. Fig 2 illustrates the areas of potential spread based on climatic adaptability.

Without a successful control program gorse has the potential to become one of Australia's worst environmental and agricultural weeds.

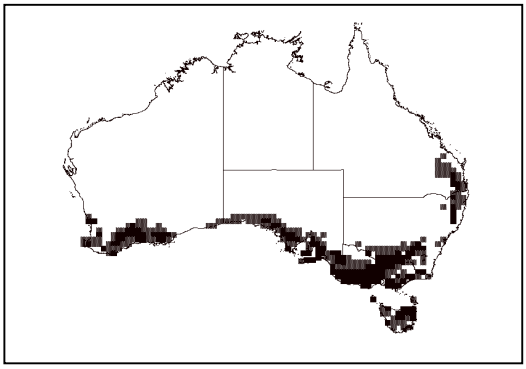


Figure 2. *Predicted distribution generated by Agriculture WA for the National Weeds Strategy Executive Committee (1999)*

1.3 A weed of national significance

Despite the potential for gorse to spread well beyond its present boundaries, the species is already responsible for significant costs to the environment and agriculture.

Environmental:

- Formation of thickets that out-compete other native species through competition for light, water and nutrients. Native understorey plants are thus lost.
- Open grasslands are vulnerable to being changed to thorny shrublands, with potentially large effects on native flora.
- Gorse provides excellent shelter for environmental pests such as rabbits.
- The ease at which seeds can be included in introduced soils and road gravel, giving rise to new infestations that may go undetected for some time.
- Gorse is highly flammable and hence is a dangerous weed in power line and pipeline easements.
- Infestations result in the acidification of soils due to the concentration of bases, particularly calcium, within the foliage.

Primary Production and Forestry:

- Reduced pasture production and hence reduction in carrying capacity leading to lower livestock production.
- The most recent study indicated that gorse was costing Tasmanian primary producers around $1M in lost production. New Zealand estimates (1985) put this figure at $NZ150M.

- In difficult terrain, control measures are often restricted to the application of selective herbicides by helicopter, thereby increasing the risk of spray drift and impacting on agriculture's image.
- Impeded movement of stock and stock managers across properties.
- Gorse interferes with establishment procedures in forestry operations and can compete very strongly with young tree seedlings.
- Thorns damage to vehicle tyres; animals and primary producers from deep puncture wounds.
- Grazing by sheep is moderately effective for controlling gorse seedlings before spines are formed. However, a change in management technique is required over a period for control to be successful. High stocking rates are needed to force sheep to graze on gorse rather than other pasture species.
- Expensive to control. Estimates vary from $700-$1,500/ha (2001), depending on the age and severity of the infestation, the methods used and nature of the terrain. Often the costs of control exceed the value of the land.
- Successful control of gorse may require cooperation between neighbours for a considerable period. This can often lead to social conflict if not all parties are willing to participate.
- The flammability of gorse exacerbates the danger of bushfires and grassland wildfires during dry summer periods.

Tourism:

- Remote bushlands, wilderness areas and waterways of southern and eastern Australia are key attractions for tourists. The value of the tourism, particularly eco-tourism, industry is increasing, however gorse infestations alongside remote roadways reduce the natural attraction similar to blackberry.

Benefits:

- Significant benefits from gorse are derived from its ability to colonise in areas of poor nutrition and disturbance. Its role in minimising soil erosion, in land reclamation and stabilising river banks in these circumstances is recognised. Its control would require the substitution of more environmentally friendly alternatives.
- The value of gorse as a stock-proof hedge plant and for stock shelter was recognised in the early days of European settlement in Australia and was the reason for its original importation.
- Goats are one species that will selectively graze gorse. Tasmanian trials some years ago showed that Angora goats were ideal for gorse control. Depending on markets for goat products, opportunities may exist to create a new enterprise at the same time as achieving satisfactory control of gorse.
- Beekeepers claim gorse is an important source of pollen for their hives in autumn and spring. Despite the lack of an amino acid profile of gorse pollen, the availability of flowers in autumn and spring is seen as a very useful supplementary pollen source. In spring, gorse is one of the first species to flower. Gorse pollen at this time helps sustain the queen's activities and produce a stronger hive. In autumn, gorse is important in promoting the development of young bees. The higher the number of strong bees going into winter the stronger the hive would be expected to be in spring. During the cooler months, apiarists usually artificially feed hives due to the absence of natural sources of pollen. Gorse flowers are considered a useful supplement to this feed either side of the winter period. Many apiarists are hiring hives for pollinating crops including apples, stone fruits, clovers, canola and seed vegetables. Such uses require strong hives. No information is available, however, to measure the contribution of gorse to the ability of bees to pollinate or to produce honey. It might be possible for a longer period of supplementary feeding to produce the same result as gorse pollen. Herbicide applications to gorse are also a concern for apiarists. Contaminated pollen being returned to the hive can result in high bee mortality. Consequently, sprays should not be applied in full flower or when bees are active.

1.4 Legislative controls

Gorse has a declared status in 5 States.

- Western Australia: P1 - prevention of trade, sale or movement, P2 - eradicate – serious weeds which are not yet widely established; P3 - control - serious weeds that cannot be eradicated in the short term but must be kept under control. (Note: P2 and P3 not prescribed for whole State).
- New South Wales : Category W2 - plants to be fully and continually suppressed and destroyed (applies to a minority of government areas of the State).
- South Australia: Proclaimed plant – for enforced control throughout the State. Sale and movement of gorse plants or produce containing their seed are also prohibited.
- Victoria: P2 Regionally Prohibited Weed – are not widely distributed throughout the region, are capable of further spread and it is reasonable to expect that they can be eradicated from the region (relevant to 2 catchment regions), C8 Regionally Controlled Weed – occur in a region, are capable of spreading further and continuing control measures are required to prevent their spread (relevant to 8 catchment regions).
- Tasmania: II – Declared Weed. A Statutory Management Plan being developed will detail measures required to be taken in respect of management. Priority will be given to managing sites free of gorse and areas of environmental significance.

1.5 Control to date

Chemical and mechanical methods, grazing management and fire can be used in an integrated control program for gorse. All methods may be useful in particular situations, depending on the infestation density, landform, cost/resources, area covered and management objectives. However, gorse control to date has been hampered because of the time required (up to 20 to 30 years) and the cost (up to $1,500 per hectare). Consequently, effective control of gorse will only be achieved if it is driven at the State or local government level and with appropriate incentives for landowners to participate. Appendix 2 outlines previous activities to control gorse in Tasmania and South Australia.

In pastoral areas, sheep and goats can be managed to selectively graze gorse. This is often combined with burning the infestation resulting in the proliferation of young seedlings. These are initially spineless and more palatable to stock. Burning should not be undertaken unless it is part of an overall strategy employing other complimentary management practices. Mechanical clearing is a useful method of controlling large infestations. However, follow up management by establishing a vigorous pasture with appropriate stock management is essential for lasting control. Regular slashing or mowing is ineffective in eradicating gorse. Herbicides can be effectively applied either as a foliage spray when plants are at least 500mm high or as a cut stump method. Foliage applications can be made with a range of registered chemicals with best results occurring when treatment coincides with active growth. The choice of method and chemical will be determined by the proximity to nearby sensitive trees, horticultural crop plants and pasture species. Care must be taken with all chemical treatments to avoid spraying when gorse is in full flower or when bees are active; also to ensure that sufficient time is left for the gorse to reach 'brown out' status when gorse bushes can be replaced by more vigorous cover species. Given a thorough coverage one application will usually give good control with little or no regrowth.

Fig.3: Cherry picker style spray equipment being used in Tasmania's midlands.
(Courtesy Drew Fitzgibbon Photography)

As a general rule, integrated management involving herbicides, burning, cultivation, pasture establishment and grazing will achieve superior longer-term results. In wasteland areas, herbicides are often the only practical method when combined with encouragement of native species regrowth. In bushland, mechanical methods, herbicides and revegetation can be successfully combined to control gorse with minimal damage to surrounding species.

Biological Control

The longevity of plants and seeds and often the inaccessibility of infested terrain make gorse control an expensive exercise for land managers. Biological control methods have the potential, when used in conjunction with more conventional control methods, to substantially contribute to the successful control of gorse. Its more environmentally friendly nature, combined with its ability to work in difficult and inaccessible terrain makes the search for effective biological control agents very important.

The gorse seed weevil, *Exapion ulicis* (Forster), the larvae of which attack gorse seeds, was introduced into Tasmania from New Zealand in 1939. Despite successfully establishing throughout Tasmania and in areas on the mainland, it has had no significant impact on gorse. New Zealand studies have since revealed that the effectiveness of *E. ulicis* has been limited by gorse's ability to set seeds in both autumn and spring, with the autumn set escaping weevil attack.

A new biological control program was initiated in New Zealand in 1978. As a result, six additional agents have been released. These included the gorse spider mite (*Tetranychus lintearius*), which feeds on mature foliage, gorse thrips *(Sericothrips staphylinus*) which attack new growth and seedlings, gorse soft shoot moth (*Agonopterix ulicitella*), which are new foliage feeders, and the gorse pod moth (*Cydia succedana*) which destroys seeds in both autumn and spring and is expected to complement the effects of the gorse weevil.

In Australia, the Standing Committee on Agriculture and Resource Management declared gorse a target for biological control in 1995.

Tetranychus lintearius was identified as one of the most damaging agents of gorse in Europe. After establishing that this mite was host specific to the genus *Ulex*, six strains were introduced from New Zealand into quarantine in Tasmania and Victoria during 1998. These strains had originally been imported into New Zealand from the United Kingdom (Cornwall), Spain (Hio, O Grove, Cambados) and Portugal (Sao Pedro, Viana do Castelo). Since then, 4 strains had been released at a total of 80 properties throughout Tasmania and 6 strains into 50 properties in Victoria and 2 properties in New South Wales.

Fig. 4: Gorse bush covered with spider mite webs on Tasmania's East Coast near Swansea.

Monitoring of releases indicates that populations *T. lintearius* have increased, have dispersed rapidly and have begun to cause as significant weakening of gorse plants. Overseas experience warns that spider mite colonies may not remain long enough on host plants in order to kill them. Adult migration, as their food source dwindles, and the activity of predators may limit the effectiveness of this particular mite in controlling gorse. Predation by coccinellids (*Stethorus* spp.) and a phytoseiid mite (*Phytoseiulus persimilis*) has been recorded in Tasmania and Victoria on species similar to the spider mite.

In order to boost the biological control arsenal, plans are already in place to introduce gorse thrips, the gorse pod moth and the gorse soft shoot moth as soon as host specificity tests are complete. Whilst the full effect of biological agents in gorse control is difficult to predict, it is hoped that they will at least reduce the vigour of gorse growth, rendering plants more susceptible to other measures as part of an integrated control program.

1.6 Socio-economic factors affecting management decisions

Landholders often quote the high cost of herbicides and associated labour as an obstacle to control. All control programs require several years of follow-up treatments and many years of vigilance, which may increase the cost, several fold. In areas of large infestations, creative funding sources should be explored to develop management programs aimed at containment and impact reduction. This is extenuated by the relatively low financial performance of pastoral industries for at least the past 10 years. In order to illustrate the cost of not controlling gorse infestations, a cost:benefit analysis for pastoral areas should be undertaken and the results extended to pastoralists.

Gorse infestations have the habit of crossing property boundaries and will often require the cooperation of neighbours, including State agencies and local government authorities. An acknowledgment of the responsibilities of all land managers in controlling the problem of gorse is a crucial initial step in community ownership of the problem.

1.7 Principles underpinning the plan

The strategic plan is based on the recognition and acceptance of four principles of the National Weeds Strategy:

1. Weed management is an essential and integral part of the sustainable management of natural resources and the environment, and requires an integrated multidisciplinary approach.
2. Prevention and early intervention are the most cost-effective techniques that can be deployed against weeds.
3. Successful weed management requires a coordinated national approach that involves all levels of government in establishing appropriate legislative, educational and coordination frameworks in partnership with industry, landholders and community.
4. The primary responsibility for weed management rests with landholders/land managers, but collective action is necessary where the problem transcends the capacity of the individual landholder/land manager to address it adequately.

1.8 Process followed

The National Gorse Strategy was developed after a stakeholder workshop held in Launceston, Tasmania on 9th August, 2000. This meeting involved representatives from Tasmania, Victoria with correspondents from Western Australia. A draft of the strategy was distributed to all relevant States, plus the Tasmanian Beekeepers Association. This strategy takes into account the feedback received as well as input from the management group and interested parties.

1.9 Relevance to other strategies

The National Gorse Management Strategy has been established to provide a framework for coordinated management across the country. To date most infestations of these plants are limited to isolated pockets in southern Western Australia, the higher rainfall areas of South Australia, small infestations in south-eastern Queensland, and national parks and reserved areas in the south-east of New South Wales and in the Blue Mountains. Victoria and particularly Tasmania have the most extensive areas of gorse.

The strategy is linked to other national and State resource plans and groups already involved in gorse management at the regional and local level, as displayed below.

Scope Scale	Natural Resource Management	Pest Management	Weed Species Management
National	National Strategy for Conservation of Australia's Biological Diversity National Strategy for Ecological Sustainable Development	National Weeds Strategy	Gorse WONS Strategic Plan
State	Queensland Biodiversity and Natural Resource Management Strategy Forest, River, Estuary and Wetland Policies	Queensland Weed Strategy Northern Territory Weed Management Strategy Western Australia Weeds Strategy New South Wales Weeds Strategy South Australia Weeds Strategy Tasmanian Weed Management Strategy Weedplan, 1996 Victoria Weeds Strategy	State Gorse Management Strategy
Regional	Regional NRM Plans	Regional Pest Management Strategies	
Catchment	Catchment Management Strategies	ICM Pest Management Strategies TVWMS	
Local	Landcare and Roadside Conservation Plans	Local Government Pest Management Plans (Qld)	
Property	Property Management Plans	Property Pest Management Plans	

2 STRATEGIC PLAN

VISION

Gorse will be managed in Australia through collective action to minimise its social, economic and environmental impacts.

2.1 Scope the problem

Desired Outcome

Gorse management will be undertaken according to best management practice principles.

Background

Despite work by State government agencies and environmental groups throughout Australia, gaps still exist in the knowledge of the distribution of gorse. The resources required to eradicate small infestations and to eradicate established infestations in the long term are large. Also large are the potential costs and impacts of the weed, especially in Tasmania, where it is already recognised as a significant weed in the drier agricultural pastoral areas. Its increasing importance as an environmental weed in protected areas, national parks and reserves justifies resources to obtain a better understanding of the distribution of gorse throughout Australia. Ideally, this should be undertaken on a catchment management basis rather than a state or local government area basis.

Estimates for gorse control vary from $700-$1,500/ha (2001), depending on the age and severity of the infestation, the methods used and nature of the terrain. Often the costs of control exceed the value of the land. This has a large influence on the extent to which some landowners perceive gorse as a problem. To overcome this perception, studies are required to substantiate the economic costs of gorse as an environmental and agricultural weed. Such a cost:benefit analysis is considered important in marshalling landowner support for control measures.

Strategy	Actions	Responsibility	Rank
2.1.1 Appoint State Strategy Coordinator	Establish a state strategy coordinator (SSC) to provide link with National Coordinator and National Gorse Task Force and State based community organisations.	State agencies, local gov't, catchment management authorities	1
2.1.2 Determine current information	Collect and collate existing State information re classification & severity using protocols confirmed with NGTF.	SSC, State agencies, local gov't, catchment management authorities	1
	Identify gaps and establish priorities for action.		1
	Mapping and database development.		1
	Review treatments and effectiveness.		1
2.1.3 Determine environmental, social & economic impacts	Benefit: cost analysis.	NGTF, Research organisations	1
2.1.4 Gain stakeholder commitment	Create community awareness.	SSC, State agencies	1
	Development and promotion of best management practices.	SSC, State agencies, local gov't, catchment management authorities	1
	Coordinate formation of community groups and landowners to undertake on-ground works.	SSC, State agencies, local gov't, catchment management authorities	1
2.1.5 Improve efficiency of WONS strategy delivery	Investigate linkages with other WONS strategies at the state level.	WONS Project Manager, NGTF, SSC, State agencies,	3

2.2 Protecting clean areas

Desired Outcome

All areas currently free of infestations are subject to long-term management, leading to continued freedom.

Background

It is already known that infestations can increase in size at a rapid rate from the dispersal of seed. More insidious, however, is the spread of gorse into areas currently free of the weed. This is likely to have resulted from seed movement by floodwaters, soil, machinery, footwear, animals and birds. Consequently, prime locations for new infestations include roadsides, mine dumps and other disturbed sites and riparian areas. Control measures in new locations is dependent on the early identification of the weed and the adoption of appropriate control measures. This, in turn, is very dependent on commitment and support from State and local government, community organisations, landowners and the general public.

As gorse is mainly spread by seeds, maintaining clean areas can be achieved by preventing the introduction of seed. Seed is usually carried from infested areas in soil, gravel and mud, either as a consequence of erosion, disturbance of soil (as in road repair works, land developments or mining sites), and road building operations. Procedures should be instituted to thoroughly clean items of machinery and footwear after use in gorse infested areas.

Complacency on the need for early control of a new infestation of gorse needs to be specifically targeted. This is very important in pastoral areas where the need for control is not perceived as a priority. At the same time landholder input to refining control methods and adapting them to local situations is essential to establish best practice management. Most major populations of gorse on pastoral properties coincide with relatively low returns. This represents a major challenge in developing economically effective long-term management practices.

Strategy	Actions	Responsibility	Rank
2.2.1 Regulatory support to protect clean areas	Prevent importation of all *Ulex* species into Australia.	AQIS	1
2.2.2 Conduct public awareness campaign	From maps of known gorse distribution (2.1.2), identify locations for clean area status.	SSC	1
	Assist local authorities in improving public awareness of gorse to local government and catchment management authorities, schools, and community groups.	SSC, State agencies, local gov't, catchment management authorities	1
	Disseminate appropriate information packages.	NGTF, SSC	1
2.2.3 Target rural producers for special awareness campaign	Evaluate the results of the cost:benefit study (2.1.3).	SSC, State agencies, local gov't, catchment management authorities	1
	Working with landowners, review cost:benefit study results & determine best strategy for extension to farmers.	SSC, , State agencies, landholders	1
	Incorporate gorse control within overall weed management in whole farm planning courses, property planning, including Government lands.	State agencies Landholders	2
	Adopt direct extension of results to farmers, along with appropriate methods of control.	SSC, State agencies, local gov't, catchment management authorities	1
	Monitor results of control methods.	SSC, local gov't, catchment management authorities, landowners	2
2.2.4 Refine and extend best practice management	Produce segment of State best practice manuals for gorse management relating to the maintenance of clean areas.	SSC, State agencies	2
	Extend best practice procedures to all land managers.	SSC, State agencies, Community groups	1

2.3 Prevent Spread

Desired Outcome

Gorse is prevented from spreading.

Background

No one method alone will give total control of existing gorse plants and subsequent seedlings. A combination of methods must be employed to maximise the chances of long term success.

The key to prevention of gorse spread lies with the ability to prevent flowering or at least to reduce the set or viability of pods. Gorse is a prolific seeder, setting seeds in autumn and spring. A mature infestation annually produces up to 6 million seeds per hectare, many of which are hard-coated with the ability to remain viable for up to 30 years. It is clear that, once viable seeds have been shed, the commitment to control by stakeholders spans many years. Under these circumstances, the chance of full eradication is very low.

Seed can readily be transported in water. Removal of gorse growing on the edges of water-courses is important in preventing dispersal of seed downstream.

Strategy	Actions	Responsibility	Rank
2.3.1 Introduce best practice protocols for sourcing materials for road construction & maintenance	Identify clean areas for source materials.	SSC, State agencies, local gov't	2
	Develop plant, machinery and footwear wash down procedures for use in gorse infested areas.	SSC, State agencies, local gov't	2
	Monitor use and evaluate effectiveness of hygiene procedures.	Local gov't	3
	Integrate best practice procedures for gorse with other WONS relevant in the area.	SSC, State agencies, local gov't, catchment management authorities Community groups	3
2.3.2 Introduce biological control agents	Support and facilitate the introduction of biological control agents where potential success has been identified.	SSC, State agencies, local gov't, catchment management authorities Community groups, landholders	1
2.3.3 Develop integrated gorse control protocols in riparian areas and other areas subject to erosion or flooding	Identify key target areas for on-ground control measures.	SSC, State agencies, local gov't, catchment management authorities Community groups, landholders	1
	Identify best practice control measures applicable at each site (2.2.4), including biological methods.	SSC, State agencies, land owners	2
	Monitor progress and evaluate effectiveness.	SSC, State agencies, land owners	2
2.3.4 Provide assistance & resources	Provide assistance and resources to stakeholders for effective control & follow-up.	State agencies	1

2.4 Eradication

Desired Outcome

All isolated and scattered infestations are eradicated.

Background

Once gorse becomes established, it becomes very difficult to eradicate. Early detection of new infestations is therefore crucial to successful eradication measures. We know that young gorse seedlings in pastoral situations are palatable to stock particularly sheep and goats. However, once producing the characteristic spines, only goats show any inclination to selectively graze gorse. The success of such grazing methods will depend largely on the availability of goats, stock management, the availability of other feed and the gorse seed bank already in the ground.

Biological control agents have arguably the most to offer, with potential to significantly reduce plant vigour and hence the number of seeds set or to reduce the number of viable seeds by direct attack on seed pods.
However, biological agents will need to be supplemented by more conventional control measures in an integrated approach. These

will include herbicide application, mechanical treatment, burning, pasture establishment and grazing. The most effective long-term control will result from a planned management program that uses a combination of these methods.

Of importance in any control program is to obtain cooperation with neighbouring landholders, which may include local councils and government agencies.

Strategy	Actions	Responsibility	Rank
2.4.1 Identify target areas for eradication	Identify new or strategic locations for eradication (from 2.1.2).	SSC, local gov't, catchment management authorities, Community groups, landholders	3
	Seek cooperation of relevant landowners.	Local gov't, catchment management authorities, Community groups,	3
	Develop adaptive eradication plans for each infestation.	SSC, local gov't, catchment management authorities, Community groups, landholders	3
2.4.2 Determine best practice eradication methods	Develop best practice control measures for riparian areas.	SSC, State agencies	1
	Conduct training in eradication techniques.	State agencies	2
	Monitor and refine control practices for eradication.	SSC, State agencies	2
	Enforce the use of land tenure conditions in support of eradication.	State agencies	3
2.4.3 Provide assistance & resources	Provide assistance and resources to stakeholders for eradication and effective follow-up.	State/Territory agencies	1
2.4.4 Undertake strategic follow-up surveillance and control of treated areas	Undertake regular surveys of previously treated areas.	Local gov't, catchment management authorities, Community groups	1

2.5 National Gorse Task Force

Desired Outcome

The strategy for gorse control is effectively managed at the national level.

Background

The resources required to prevent gorse spread, eradicate small infestations and to eradicate established infestations in the long term are large. In contrast, the potential costs and impacts of the weed justify commitment of these resources. There is a need to ensure that all available resources are utilised and that all achievements and actions are documented as a measure of progress and success. This is also part of accountability requirements on government and private industry managers to ensure efficient use of resources.

There is also a need to maintain uniform protocols in relation to gorse, be it in description of infestations, use of mapping software, reporting and applications for funding.

Gorse control should not be considered in isolation from other management activities in a property, region or catchment. Attention should be given to the total requirements of landscape restoration rather than for weed control *per se*. Gorse eradication should be considered along with control and management of other weeds. Further, weed management should be considered as part of property management planning and coordinated with other management activities to maximise the benefits of control and seasonal fluctuations. The Task Force would be instrumental in initially coordinating state, regional or catchment-based on-ground works programs then delegating responsibility for these measures after a specified period.

There may then be scope to integrate activities with other national WONS bodies to achieve synergies and efficiencies of operation. In this way, all WONS problems in an area could be managed according to the identified priorities on a more local level.

Strategy	Actions	Responsibility	Rank
2.5.1 Appoint Strategy Coordinator	Appoint a strategy coordinator within the National Gorse Task Force (NGTF) for 5 years to coordinate the routine activities of the Task Force.	States	1
2.5.2 Monitor and evaluate implementation of the strategy	Develop an operational protocol and milestones consistent with the National Gorse Strategy.	NGTF	1
	Identify stakeholders and produce and distribute communication plan.	NGTF, State agencies	1
	Report on progress and results annually to all stakeholders.	NGTF	2
2.5.3 Funding	Develop and coordinate applications for external funds to achieve identified strategic plan outcomes.	GMG, State agencies	2
2.5.4 Potential distribution	Climate modelling	Research organisations	2
2.5.5 Integration of Gorse management into other WONS activities	Determine mechanism for integrating national gorse management into other WONS strategies at state, regional or catchment level.	NGTF, other WONS organisations, NWS, State agencies.	2

3 MONITORING AND EVALUATION

This strategic plan is subject to a 5-year review. The Gorse Task Force will monitor the implementation of the plan. Annual reports will be made available to interest groups in a cost efficient manner, possibly a web page. Monitoring will include review of actions outlined and undertaken by groups implementing plans:

- State weed strategies
- Local government pest management plans
- Catchment and regional management plans
- Project plans developed from the strategic plan.
- State of the Environment reporting processes.

Performance indicators for the plan include:

- Increased awareness of gorse as a weed of national significance.
- All infestations are mapped at a property level.
- No expansion in current gorse distribution.
- Clear understanding of the social, economic and environmental impacts of gorse.
- Increased delivery of extension material specific to target groups and sites.
- Integration of gorse management into relevant plans and actions.
- Adoption of hygiene protocols by industry and landholder groups.
- Increased resources for on-ground actions.
- Increased action on gorse at all levels - property, catchment and regional.
- Long-term strategies are put in place for eradication of all non-core areas and containment leading to ultimate control of core areas.
- Increased awareness of best management practices.
- Greater understanding of the cost:benefit of gorse control in pastoral areas.
- Increased survey of the conservation status and health of riparian and floodplain areas.
- Increased management of core infestation areas and decreased impact.
- Widespread adoption of biological control measures.
- Integration of gorse management systems with other WONS throughout Australia.

4 STAKEHOLDER ROLES AND RESPONSIBILITIES

Private landholders

To control gorse on their own lands and eliminate spread to surrounding lands including:

- Being able to identify gorse and other economic and environmentally damaging weeds.
- To be aware of the potential for gorse to spread onto their own lands.
- Property management plans to include gorse control or eradication.
- Implement best practice management for gorse.
- Eradicate isolated infestations over time.
- Control soil and water movement to restrict seed distribution.
- Work with neighbours and community groups to implement gorse control programs.

Local Governments

To ensure gorse infestations are reduced and not spread further throughout the local government area by:

- Ensuring that pest management plans include ongoing gorse control or eradication activities.
- Ensuring that ongoing gorse control or eradication is undertaken on all lands under the local authority's control.
- Adopting best management practice for sourcing materials for road construction and maintenance.
- Provide input into weed mapping.
- Ensuring that all private landholders engage in ongoing gorse eradication or control activities.
- Actively participating with government agencies and community groups to undertake ongoing gorse control activities
- Administering and enforcing the provisions of relevant Acts, including notices.
- Recognise need for resource allocation on determined priorities for gorse control.
- Train other sections of local authority on weed identification and control.

Community groups

- Landcare and other community groups to encourage local involvement in the management of gorse on private and public land, under the supervision of the land manager concerned.

Utility companies /Agribusiness / Industry

- Assist in developing best practice management protocols.
- Assist in creating awareness of the weed.
- Become involved in management plans in service regions.
- Alert agencies of new infestations.
- Provide input into mapping exercises.

QDNR / DPIWE / AgWA / NSWAg / APCC / NRE

To ensure that gorse is strategically controlled throughout each State by:

- Continuing to develop efficient, effective, and appropriate control techniques.
- Providing extension and education services to both rural and urban communities.
- Developing best practice management protocols.
- Support local government enforcement of control of gorse.
- Liaising with coordinators, community and industry groups and LGs to facilitate on-ground gorse control activities.
- Assisting achievement of State outcomes by providing personnel and resources.

Other State Government Departments

- To assist in development of codes of practice and ensure uptake by departmental staff.
- To ensure gorse control or eradication is undertaken on all State managed lands.

Other States and Territories

- To ensure awareness and early detection programs are put in place.
- To eradicate all plants when detected.

Federal government departments and corporations

- Ensure quarantine controls on entry of gorse (AQIS).
- To ensure adoption by Departmental staff in restricting movement of weeds (agencies that manage land and travel on non-government land).
- To ensure gorse control is undertaken on all federally managed lands.
- Oversee and manage federal funds including Natural Heritage Trust and National Weed Program (Environment Australia, Agriculture, Forestry and Fisheries – Australia).

- Promote the inclusion of weed management principles in school curricula.

5 ADDITIONAL READING

Ireson, JE; Gourlay, AH; Kwong, RM; Holloway, RJ and Chatterton, WS 1999 Progress on the rearing, release and establishment of the gorse spider mite for the biological control of gorse in Australia. 12th Australian Weeds Conference, Wrest Point Convention Centre, Hobart, Tasmania.

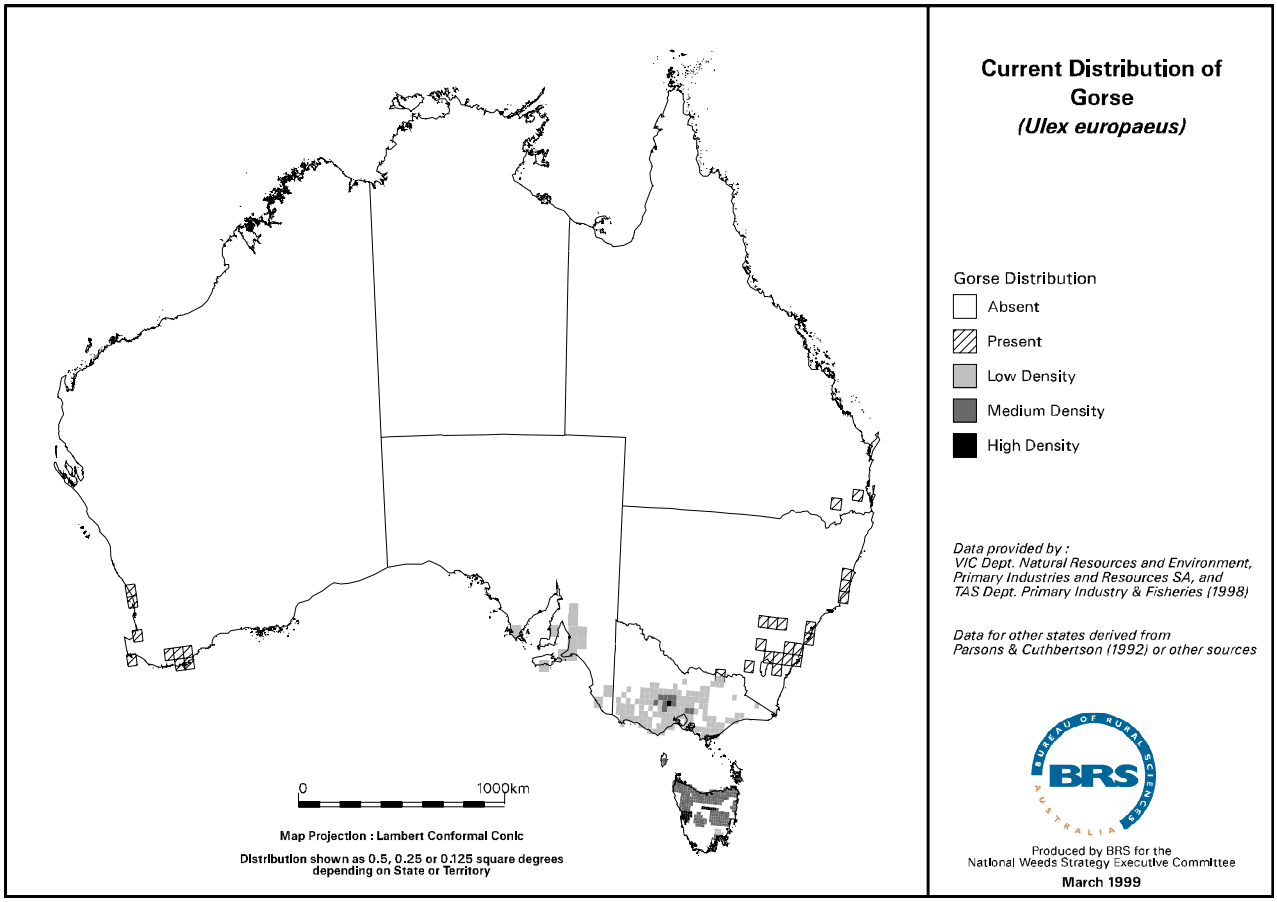
Parsons WT and Cuthbertson EG 2001 Noxious Weeds of Australia, Second Edition. CSIRO Publishing.

Panatta, FD; Groves, RH and Shepherd, RCH 1998 The Biology of Australian Weeds Vol 2. Published by RG & FJ Richardson, Meredith.

6 GLOSSARY

AgWA	Agriculture Western Australia
APCC	Animal and Plant Control Commission of South Australia
AQIS	Australian Quarantine and Inspection Service
CLIMEX	A simulation modelling system developed by CSIRO
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EI	Ecoclimatic Index
DL&WC	New South Wales Department of Land and Water Conservation
DPIWE	Tasmanian Department of Primary Industries, Water and Environment
ICM	Integrated Catchment Management
LG	Local Government
NSWAg	New South Wales Agriculture
NRE	Victorian Department of Natural Resources & Environment
NRM	Natural Resource Management
NWAP	National Weeds Awareness Project
NWSEC	National Weed Strategy Executive Committee
QA	Quality Assurance
QDNR	Queensland Department of Natural Resources
QDPI	Queensland Department of Primary Industries
SWEEP	Strategic Weed Eradication and Education Program
TIAR	Tasmanian Institute of Agricultural Research
WONS	Weeds of National Significance

Appendix 1 - Location of recorded gorse infestations in Australia.



Appendix 2 Outline of Previous Activities to Control Gorse throughout Australia

Tasmania

Many community Weed Strategy groups in Tasmania indicate that gorse is a priority weed. Consequently, their mapping, communication and coordination activities have provided some impetus to gorse management, supplementing the on-going efforts on many private landowners and Councils. The DPIWE and TIAR have been conducting research on biological control agents, particularly over the past 5 years, with the successful release of gorse spider mites. Parks and Wildlife Service and the Department of Roads and Transport and a number of Councils have programs to spray roadside infestations of gorse.

South Australia

Gorse has been proclaimed for enforced control in South Australia since 1956. Control actions have been directed toward containing or removing infestations on pasture and road reserves by herbicides or a combination of firing and grazing management. Most of the major remaining infestations are on land of low value, where control is restricted by available funding.