Application for WoNS candidacy

Genista monspessulana –

Montpellier Broom, Cape Broom, Canary Broom

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Introduction

Genista monspessulana (L.) L.A.S.Johnson (Fabaceae), also known more commonly as Montpellier Broom, Cape Broom and Canary Broom, is a woody legume weed with significant current and potential impacts on forestry production, biodiversity of natural ecosystems, grazing systems, access to amenity areas and fire risk. Infestations occur in all temperate states of Australia, with particularly severe infestations in the Adelaide Hills, southern Tasmania, central and southern Great Dividing Range of NSW, central Victoria and south west WA. *G. monspessulana* was ranked 37th in the initial evaluation of weeds nominated for Weeds of Natural Significance (WONS) (Thorp and Lynch 2000), with a particularly high impact score due to its formation of dense, impenetrable thickets arising from a long-lived soil seed bank (source: Henry *et al*. 2010).

Species description: *G. monspessulana* is an erect, perennial slender shrub which grows up to 5-6m. It has trifoliolate petiolate leaves which are more or less glabrous. This species has yellow flowers which are produced from August to January. *G. monspessulana* occurs in loamy soil through to lateritic and peaty sand and is commonly found along rivers and roadsides (Parsons and Cuthbertson 2001; FLORABASE DEC 2010).

G. monspessulana is native to the Mediterranean region that has become established, and is considered a persistent and deleterious plant, in several other regions of the world, including the Americas, Australia and New Zealand. It is considered deleterious because of its ability to form dense almost mono-cultural stands, which replace and suppress native flora and economically valuable timber plants (Lloyd 2000).

The closely related weed, Scotch (or English) Broom (*Cytisus scoparius* (L.) Link), is also a member of tribe Genisteae, a group of shrubs predominantly native to the Northern Hemisphere. No members of this tribe occur naturally in Australia. However, several species are naturalized here, with those of greatest concern (so far) being Scotch broom (*C. scoparius*), Montpellier broom (*G. monspessulana*) and gorse (*Ulex europeus* L.) (Hosking *et al..* 1998). The biology of both Scotch broom and Gorse species is generally better understood than that of Montpellier broom (Lloyd 2000).

Any reference to ‘Cape broom’ ‘Montpellier Broom’ or ‘Canary Broom’ in this nomination is specific to *Genista monspessulana*; however, when the generic reference to ‘brooms’ is utilized, the evidence provided will have been based on statements relevant to Scotch broom (*C. scoparius*).

In Australia, *.G monspessulana* is found in Western Australia, South Australia, Victoria, Tasmania, New South Wales and Queensland. Due to the identified potential ecological and economic impact of this species within these jurisdictions this species is being nominated for consideration as a new Weed of National Significance (WONS). This report will aim to provide evidence of the invasiveness, distribution and impact of *G. monspessulana* as per the criteria established by the Australian Weeds Committee (AWC) and ABARE-BRS WONS candidate assessments – Data requirements.

Invasiveness

1.1. What is the weed's ability to colonise and establish amongst existing vegetation?

Score HIGH: G. monspessulana occurs predominantly in extensive monocultures or mixed with other invasive species; has strong ability to nitrogen fixation; and germinates rapidly after fire.

Comments *G. monspessulana* has features of a coloniser and early successional species (Lloyd 2000). *G. monspessulana* has the potential to become a serious environmental weed because of its spread, and the promotion of its germination by management activities such as road maintenance, roadside slashing and burning. Seeds are initially dispersed by explosive dehiscence, but subsequent dispersal of seeds by ants increases the potential of the species to invade relatively undisturbed vegetation (Adams and Simmons 1991).

G. monspessulana has the ability to invade areas of tall native trees, low trees, low sclerophyll heath and shrub-lands, and grasslands. It can also grow on gravelly soil, sand, loam, and wet soil, and it can occupy swamps, riverbanks, road verges and disturbed natural vegetation. (FLORABASE DEC 2010). Emms (2007) found that *G. monspessulana* seed germinated and seedlings established readily in both disturbed and undisturbed soils. Brooms form dense stands that spread into areas of native plants (McClintock 1985). Brooms can form monocultures or dense thickets, especially in early stages of invasion (Coutts-Smith and Downey 2006).

G. monspessulana has a strong ability to colonise woodland and forest areas of the South West of Western Australia. The plant germinates rapidly after fire and as a result has the ability to establish monocultures in natural environments (Keighery 2010, pers. comm.).

When sunlight and water are plentiful, productivity or community compositions are determined by nutrient levels, the most important being nitrogen (Bray 1983). *G. monspessulana* has the ability to fix high levels of nitrogen into soil (Lloyd 2000; Crawley 1997). There is growing evidence that nitrogen-fixing invaders and in some cases nitrogen-fixing residents of invaded communities change the nutrient dynamics of a community, resulting in reduced species richness and an enhanced susceptibility to weed invasion (Vitousek 1990, 1994, Maron and Conners 1996, Mack and D'Antonio 1998).

Local spread is very efficient when pods burst open on hot days (Parsons and Cuthbertson 2001). Most broom seeds are dormant at the time of their explosive release from the pods, which flings them up to 5 m. They may then be collected by ants attracted to an oily caruncle which acts as an elaiosome, and carried by them a further 1 m (Smith and Harlen 1991). That the great majority of seeds are dispersed initially within a few metres of parent plants is confirmed by Robertson *et al.* (1999) who have mapped seedlings only up to about 10 m from burned, mature broom stands on the Bogong High Plains. Dispersal on this scale, together with growth and the sideways lean of shrubs

within the stand, leads to stand expansion into surrounding, previously un-colonised habitat.

References Lloyd 2000; (Adams and Simmons 1991); (Emms 2007) (McClintock 1985) (Parsons and Cuthbertson 2001) (FLORABASE DEC 2010); (Keighery 2010, pers. comm.); (Smith and Harlen 1991); (Robertson *et al.* 1999); (Vitousek 1990, 1994, Maron and Conners 1996, Mack and D'Antonio 1998); (Coutts-Smith and Downey 2006).

Data quality MEDIUM

1.2. What is the weed's ability to compete for resources (light, water, nutrients) once it is established (i.e. ability to persist)?

Score HIGH: *G. monspessulana* has many morphological traits for competitive success.

Comments When sunlight and water are plentiful, productivity or community compositions are determined by nutrient levels, the most important being nitrogen (Bray 1983). *G. monspessulana* has the ability to fix high levels of nitrogen into soil (Lloyd 2000; Crawley 1997). There is growing evidence that nitrogen-fixing invaders and in some cases nitrogen-fixing residents of invaded communities change the nutrient dynamics of a community, resulting in reduced species richness and an enhanced susceptibility to weed invasion (Vitousek 1990, 1994, Maron and Conners 1996, Mack and D'Antonio 1998).

Brooms are recognised as having an 'open' nitrogen cycle and communities with brooms are amongst those having the highest inputs of nitrogen for non-agricultural ecosystems (Lloyd 2000: Nilsen pers. comm.). Legumes have the potential to alter a supporting cycle for a natural ecosystem. They also have the potential to maintain a population unlikely to be limited by nitrogen and finally they may exacerbate weed problems by making conditions more favourable for invasion (Lloyd 2000). Seedlings of *Cytisus* are able to fix atmospheric nitrogen (Dancer *et al.* 1977; Wheeler *et al.* 1979)

Brooms have a reasonably long lifespan which includes plants that live 30yrs and more. Brooms, at a height of up to 6m, have ecological dominance in the mid and understoreys of forests and woodland environments (Downey and Smith 2000). Individual plants grow quickly and shade out other plants so that the understorey of broom stands is almost barren (Alexander and D'Antonio 2003)

Brooms have photosynthetic stems that enable it to remain photosynthetically active during its deciduous stage in periods of low temperatures (Downey and Smith 2000; Sheppard *et al.* 2002).

Brooms can alter disturbance regimes, particularly fire and soil disturbance (Downey 2000; Robertson *et al.* 1999; Hughes 2008)

References (Bray 1983); (Crawley 1997); (Lloyd 2000: Nilsen pers. comm.); (Vitousek 1990, 1994, Maron and Conners 1996, Mack and D'Antonio 1998). (Dancer *et al.* 1977; Wheeler *et al.* 1979). Downey and Smith 2000); (Sheppard *et al.* 2002). (Downey 2000; Robertson *et al.* 1999; Hughes 2008); (Alexander and D'Antonio 2003).

Data quality MEDIUM

1.3. What is the species' average viable seed-set and what is the potential for the seed to persist in the soil bank?

Score HIGH: *G. monspessulana* has a high average viable seed set per square metre per year and seed persistence in soil bank is for prolonged periods (>10 yrs)

Comments *G. monspessulana* is a prolific seed producer and vulnerable areas are overrun very quickly (Parson& Cuthbertson 2001).

Annual seed rain can reach about 5000 seeds m^2 setting up seed banks of between 30,000 – 100,000K m^2 (Sheppard 2000).

Lloyd (2000) measured soil seed banks from *Genista monspessulana* in the range of 4,800 – 30,297 seeds/m^2. Adams and Simmons (1991) recorded an average of 3,774 seed/m^2 in soil under *G. monspessulana* stands in Victoria.

Broom seeds have a hard seed coat that delay germination for months or years and enable seeds to survive in the soil seed bank for at least 5 years and possibly as long as 30 years (Bossard & Rejma'nek 1994; Bossard 2000). *Genista monspessulana* has a seed bank that persists >10 years. Fire stimulates germination of soil-stored seed. (DEC FLORABASE 2010).

Most of the seed requires heat or scarification to break seed dormancy, although 18% of seeds were capable of germinating without scarification or heat treatment. This small proportion of seeds without dormancy is likely to maintain recruitment germination in the absence of fire (Adams & Simmons 1991).

References (Sheppard 2000); (Parsons & Cuthbertson 2001); (Adams and Simmons 1991); (Lloyd 2000). (DEC FLORABASE 2010); (Bossard & Rejma'nek 1994); (Bossard 2000).

Data quality MEDIUM

1.4. What is the minimum generation time for the species? (Minimum generation time relates to the time from germination to by a plant)

Score MEDIUM: *G. monspessulana* has a moderate generation time of 2 years before the production of viable propagules.

Comments *G. monspessulana* seeds germinate in both autumn and spring with plants producing the first flowers when about 2 years old (Parsons and Cuthbertson 2001; DEC FLORABASE 2010).

Gonzales-Andres & Ortiz (1996) tested seed germination success and seedling survival in a number of broom species (Genistae). *G. monspessulana* stood out because it had significantly higher germination success (70 -100% at 16°C); exceptional winter foliage health, 100% survival success and was the tallest plant at the end of the first growing season.

References (Parsons and Cuthbertson 2001); (DEC FLORABASE 2010) ; Gonzales-Andres & Ortiz (1996);

Data quality MEDIUM

1.5. What reproductive system does the species use?

Score MEDIUM: *G. monspessulana* utilises seed for reproduction.

Comments *G. monspessulana* reproduces by seed (DEC FLORABASE 2010). Its pollinators have not been studied.

Broom reproduces from sexual seed production only. The main pollinators of broom are honey bees *Apis mellifera* (Parker 1997) and bumble bees *Bombus terrestris* (Stout 2000, Simpson *et al.* 2005).

References (DEC FLORABASE 2010); (Parker 1997); (Stout 2000, Simpson *et al.* 2005).

Data quality LOW

1.6. (a) What is the likelihood of long-distance dispersal by water?

Score MEDIUM: *G. monspessulana* seed is moderately likely to be spread by water.

Comments The most rapid spread of Broom has occurred along waterways, where the seed is distributed by water (Hoshovsky 1986; Le Blanc 2001).

References (Hoshovsky 1986; Le Blanc 2001).

Data quality MEDIUM

1.6. (b) What is the likelihood of long-distance dispersal by wind?

Score LOW: *G. monspessulana* seed has a low likelihood of being spread by wind

Comments *G. monspessulana* seeds are rounded and somewhat flattened, 2 mm in diameter, smooth and shiny (Parsons and Cuthbertson 2001). It is unlikely that these seeds are able to be dispersed long distances by wind.

References (Parsons and Cuthbertson 2001)

Data quality MEDIUM

1.6. (c) What is the likelihood of long-distance dispersal by flying birds and/or wild terrestrial vertebrates?

Score MEDIUM

Comments Dispersal of *G. monspessulana* is primarily by explosive dehiscence then secondarily by ants (Zeven 1992; DEC FLORABASE 2010).

Broom seeds may be dispersed locally by a variety of seed vectors including

birds and animals, although seed predation by birds and other animals is considered negligible (Hoschovsky 1986; DiTomaso 1998).

Broom seeds may also be dispersed in the faeces of a variety of animals such as horses and sheep (Hoschovsky 1986).

References (Zeven 1992); (DEC FLORABASE 2010); (Hoschovsky 1986; DiTomaso 1998)

Data quality MEDIUM

1.7. What is the likelihood of long-distance dispersal by accidental and/or intentional human movement, human transport, produce contaminant, domestic terrestrial vertebrates?

Score HIGH: *G. monspessulana* has a high likelihood of being accidentally spread by human activities and can be spread by terrestrial vertebrates.

Comments *G. monspessulana* was originally spread within Australia as an ornamental a hedge or a garden plant and is still found in many home gardens. Nowadays, most dispersal is through seed movement by road graders and earth moving equipment, particularly in forest areas (Parsons and Cuthbertson 2001; Adams and Simmons 1991; DEC FLORABASE 2010). Seed can also contaminate agricultural products, farm machinery, mud, etc. (Parsons and Cuthbertson 2001).

Cattle have been deemed to be the main vector for the spread of broom seeds in the Australian Alps (McDougall *et al.* 2005).

References (Parsons and Cuthberthson 1992); (Adams and Simmons 1991); (DEC FLORABASE 2010),

Data quality HIGH

1.8. What is the resistance of seedlings/juveniles of the weed to routine weed control practices?

Score LOW: *G. monspessulana* seedlings have a low resistance to control by herbicide application.

Comments Young plants can be controlled relatively easily because they have a low resistance to herbicides. Where possible, an infestation should be cut with a rotary slasher and burnt, then cultivated several times to destroy seedlings. When chemical control is required, picloram, either alone or in a commercial mixture with triclopyr, is effective if plants are in full leaf. Follow-up spraying is necessary to treat seedlings and regrowth which will occur from particularly large plants. Glyphosate is recommended in some situations (Parsons and Cuthbertson 2001).

References Parsons and Cuthbertson 2001

Data quality Medium

Impacts

2.1. To what degree could the weed reduce the biomass/yield of desired plants?

Score HIGH: *G monspessulana* has the capacity to greatly reduce biomass / yield particularly in timber plantations and native vegetation environments.

Comments *G*. *monspessulana* has become a weed of forest margins and poor pasture in areas receiving more than 500mm annual rainfall. It is considered weedy when it forms dense thickets which exclude most other vegetation and thus affects the carrying capacity and utilization of land. The plant is a prolific seed producer and vulnerable areas are overrun very quickly. Dense seedling growth occurs after fire when dormancy is broken and competing vegetation removed. Once established the extensive root system allows *G. monspessulana* to withstand long periods of drought. Additionally, *G. monspessulana* causes concern in forest areas by forming an inflammable understorey at the edge of forests where fires are most likely to start (Parsons and Cuthbertson 2001).

A study has found that three year old *Pinus radiata* (D. Don) stem volumes can be reduced by up to 51% when grown in the presence of broom (Richardson *et al.* 1996). See also picture below of *G. monspessulana* filling in rows between planted *Pinus radiata.*

References (Parsons and Cuthbertson 2001); (Richardson *et al.* 1996); (DECCNSW 2007).

Data quality MEDIUM

G. monspessulana filling rows between planted *Pinus radiata*, Kuitpo SA.

(Photo courtesy of John Virtue, DWLBC)

2.2. Does the weed form thick infestations which physically restrict the movement of humans, animals, vehicles or water?

Score	HIGH: *G. monspessulana* has the strong ability to form thick infestations and physically restrict movement of humans, animals and vehicles.
Comments	Broom is very aggressive, spreads rapidly, growing so dense that it is often impenetrable to humans (Hoschovsky 1986; Wearne and Morgan 2004) Broom forms thick stands that seriously impede movement (DECCNSW 2003).
References	(Hoschovsky 1986; Wearne and Morgan 2004); (DECCNSW 2003).
Data quality	MEDIUM

2.3. Does the weed adversely affect the health of humans and/or native/domestic animals due to physical injuries, poisoning or allergic reactions?

Score	MEDIUM: *G. monspessulana* has toxic properties and has the ability to moderately affect stock.
Comments	*G. monspessulana* is believed to be toxic if grazed excessively (Parsons and Cuthberton 2001; DEC FLORABASE 2010).
References	Parsons and Cuthberton 2010; DEC FLORABASE 2010
Data quality	MEDIUM

2.4. To what degree does the weed reduce the quality of products and services?

Score	MEDIUM: *G. monspessulana* has the moderate ability to reduce biodiversity richness through formation of mono-cultures and impact on the quality of ecosystems in providing harbourage for feral animals.
Comments	*G. monspessulana* reduces biodiversity richness in forests and woodlands through creation of dense monocultures and provides harbourage for invasive animals. *Genista monspessulana* usually forms dense thickets which exclude most other vegetation and thus affects carrying capacity, the utilization of the land and affords cover for pest animals such as rabbits (Parsons and Cuthbertson 2001). Broom is capable of totally transforming invaded habitats. It simplifies the structure and diversity of the ground flora, and crowds or shades out shrubs and tree seedlings, eventually preventing over-storey regeneration. Dense stands seriously impede movement and act as harbour for feral pigs.

(DECCNSW 2003)

References (Parsons and Cuthbertson 2001); (DECCNSW 2003)

Data quality MEDIUM

2.5. What is the rate and scale of ecosystem change caused by the weed (i.e. what degree could the weed affect ecosystem services)?

Score HIGH: *G. monspessulana* can rapidly modify ecosystems on a widespread and intensive level in a number of ways including: increasing fire frequency and intensity; change in vegetation structures through overshadowing of understorey; fixation of nitrogen and change in soil chemistry; provision of harbourage for invasive animals.

Comments *Genista monspessulana* can increase frequency and intensity of fire. This species causes concern in forest areas by forming an inflammable understorey at the edge of forests where fires are most likely to start (Parsons and Cuthbertson 2001). Additionally, adult plants have the ability to re-sprout after fire (DEC FLORABASE 2010).

Broom is capable of totally transforming invaded habitats. It simplifies the structure and diversity of the ground flora, and crowds or shades out shrubs and tree seedlings, eventually preventing over-storey regeneration. Dense stands seriously impede movement and act as harbour for feral pigs. (DECCNSW 2003).

Once established, broom fixes nitrogen in the soil, which may inhibit the growth of native species adapted to nutrient poor soils (Wheeler *et al.* 1979; Hosking *et al.* 1998; Caldwell 2006; Dewar *et al.* 2006). The ability of broom to fix nitrogen and increase soil carbon content establishes soil conditions that are beneficial to its seedlings, enabling dense monocultures to occur (Fogarty & Facelli 1999; Coutts-Smith & Downey 2006; Dewar *et al.* 2006).

References (DEC FLORABASE 2010) (Parsons and Cuthbertson 2001). (DECCNSW 2003) (Wheeler *et al.* 1979; Hosking *et al.* 1998; Caldwell 2006; Dewar *et al.* 2006) (Fogarty & Facelli 1999; Coutts-Smith & Downey 2006; Dewar *et al.* 2006).

Data quality MEDIUM

Current distribution

3.1. What is the weed's current distribution?

Score MEDIUM: *G monspessulana* has a moderate distribution across Australia and predominantly in temperate environs.

Comments Refer to distributional data provided as an attachment to this nomination. The Bureau of Rural Sciences has indicated that they will undertake this analysis with the data provided in the MCAS-S system if required (Hennecke 2010 pers. comm.).

G. monspessulana originated in the Mediterranean Region. It now occurs in many temperate areas of the world; for example, it is established as a weed

on the west coast of north America, in Hawaii, the higher rainfall areas of New Zealand, Chile and the forest areas of South Africa (Parsons and Cuthbertson 2001).

In Victoria, *G. monspessulana* is in the top 30 most widespread weeds with at least 1 000 ha of dense infestation, 50 000 ha of medium infestation and 550 000 ha of scattered infestation (Lane, Riches & Combellack 1980). It is widespread with the largest infestations in the Australian Alps National Park, Central Highlands and the Wonangatta Valley. It is highly likely that the area of infestation has increased substantially since the time of this study (see figure below), and is predicted to increase significantly into the future (see figure below).

G. Monspessulana is widely distributed in Tasmania's north, north-east and in the south. This plant tolerates a variety of soil types but generally prefers areas with relatively high rainfall. It is found mostly in disturbed bushland bordering urban areas, along roadsides and in neglected areas. Significant populations of this weed occur around Bagdad, the Central Highlands and in many southern areas. *G. monspessulana* It is a serious problem in a number of reserves and affects a number of state listed forest types. It is a declared weed in Tasmania.

In NSW, infestations are expanding rapidly along roadsides: it occurs on the coast, the Tablelands, the Western Slopes and South-western Plains. There are scattered infestations totalling 1 200 ha in 26 local government areas or shires and seven reserves in five districts of the New South Wales National Parks (Leys 1998). Significant areas infested are in the Illawarra
District and New England Tablelands.

In South Australia, *G. monspessulana* is widespread in the Mt Lofty Ranges and Fleurieu Peninsula, extending to the Clare Valley, with smaller infestations on Kangaroo Island and the lower South-East. In total, approximately 5 – 10% of the Adelaide and Mt Lofty Ranges Natural Resource Management Board is infested including Morialta, Black Hill, The Knoll, Humbug Scrub and Anstey Hill Recreation Park, in addition to Belair and Cleland National Parks (P Cramond, pers. comm.).

In Western Australia, *G. monspessulana* is currently found in forest and woodland areas surrounding Margaret River, Manjimup, Collie, Karridale and Walpole town sites. Some 30+ Forest National Parks in South West of WA have the potential to be invaded by *Genista monspessulana*. These National Parks occur in the Jarrah Forest and Warren IBRAs.

References See below figures and attached documents for current distributional data. (Parsons and Cuthbertson 2001); (Lane, Riches & Combellack 1980).

Data quality HIGH

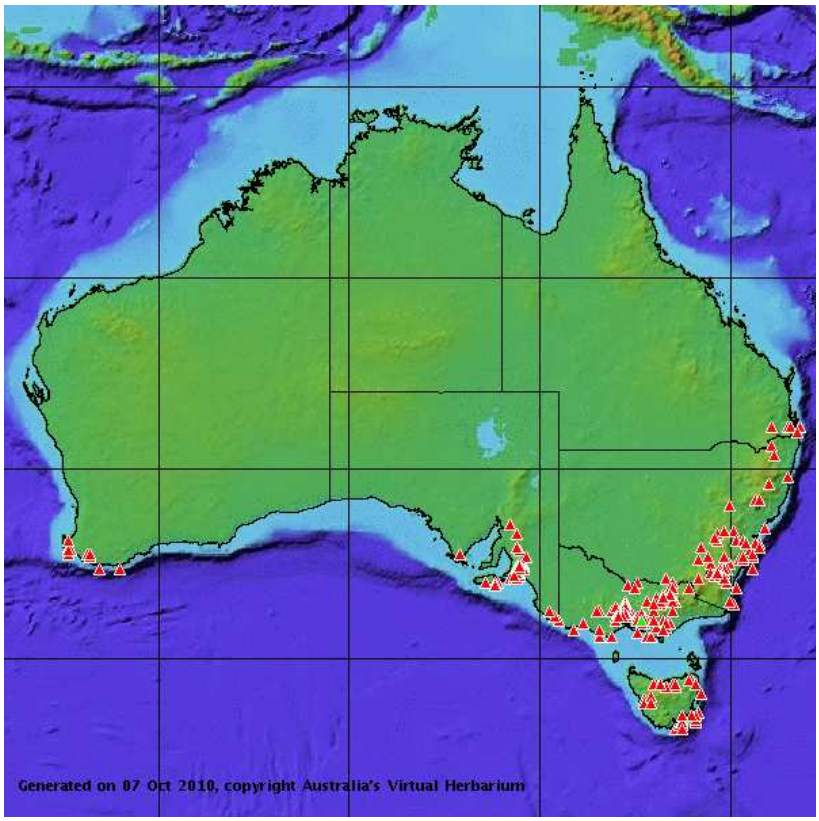
3.2. In how many jurisdictions are populations of the weed currently present?

Score HIGH: *G monspessulana* is distributed in the temperate environs of WA, SA, VIC, TAS, NSW and QLD.

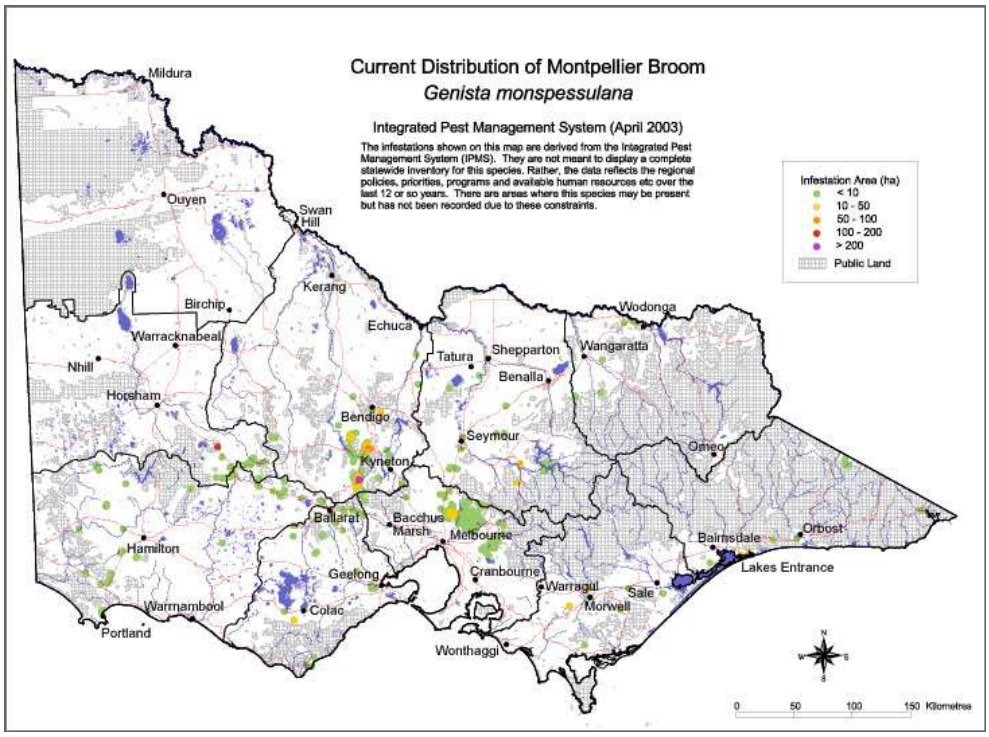
Comments *G. monspessulana* is currently found in Western Australia, South Australia, Queensland, New South Wales, Victoria and Tasmania. See distribution data attached.

References DEC FLORABASE 2010 and AVH

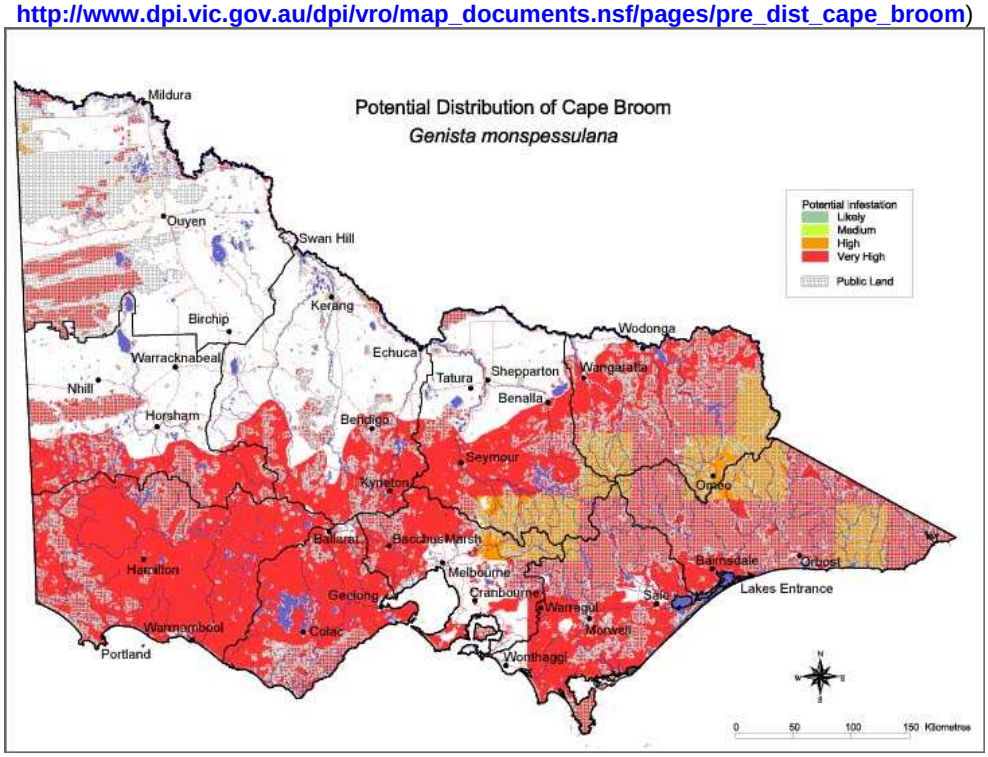
Data quality HIGH



Current distribution of *Genista G. monspessulana* (source Australian Virtual Herbarium, Oct 2010)



Current distribution of *G. monspessulana* in Victoria
(Source:
http://www.dpi.vic.gov.au/dpi/vro/map_documents.nsf/pages/pre_dist_cape_broom)



Potential distribution of *G. monspessulana* in Victoria

(Source:
http://www.dpi.vic.gov.au/dpi/vro/map_documents.nsf/pages/pot_dist_cape_broom)

Economic, environmental and social values

Economic data

4.1. What is the economic impact of the target weed?

Score

UNKNOWN: While economic impact of *G monspessulana* on timber, tourism industry is anticipated to be high, the total costs are not quantifiable and there limited research literature on this subject specifically exists. Control costs of *G monspessulana* are provided.

Comments

G. monspessulana forms dense thickets that can exclude other vegetation including pasture species and native plants. While sheep, cattle and goats can graze on young *G. monspessulana*, mature plants are relatively unpalatable and these can reduce the amount of grazing land available if thickets form (DPIWE 2002).

Roadside thickets of *G. monspessulana* can impact on the vision of motorists, and control of *G. monspessulana* in this situation can increase road maintenance costs (DPIWE 2002).

In pine plantations of the Mt Lofty Ranges, *G. monspessulana* management costs are in the order of $50 000 per annum (Don McGuire pers. comm.). In areas of native vegetation, control of *G. monspessulana* can reach $10 000 per hectare.

Current control methods within the Forestry industry generally consist of herbicide applications and the cost associated with these applications is estimated at $132/ha (W Richardson, P Yardley, pers. comm.). This can be broken down into the following components:

Cost/ha

Work item	**$$**
Tractor use	$21.09
Labour	$14.55
Herbicide -Glyphosate	$19.36
-Additive Pulse	$77.00
TOTAL	$132

Control methods are generally more expensive in areas of native vegetation, and are dependant on the control methods used. Cost estimates for a variety of circumstances are as follows (P Cramond, pers. comm.):

Cost/ha

Work item	**$$**
1 m high plants of medium density (spray)	$500-$750
2 m high plants, medium-high density (spray)	$1 500
Hand pulling in sensitive areas $2 000 - $5 000	$10 000

Source for above mentioned control costs for forestry and areas of native

vegetation: (Henry *et al.* Jul 2008)

Costs for post control monitoring and rehabilitation in natural environments are not available, however, these are anticipated to be considerable. The economic losses associated with *Genista monspessulana* on timber and agricultural systems have not been quantified, although it is anticipated that the cost to the timber industry would be of most concern where *Genista monspessulana* can outcompete timber seedlings in the early stages of rotation It has been estimated that the total cost to control Broom inclusive of chemical and application of the chemical is ~ $1700/hectare (see *Cytisus scoparius* WONS nomination). Given the widespread distribution of Broom across forest and woodland areas of Australia, control costs for *Gentisa monspessulana* and other broom species are anticipated to be significant.

References (DPIWE 2002); (Henry *et al.* Jul 2008); (Don McGuire pers. comm.); (P Cramond, pers. comm.).

Data quality MEDIUM

Environmental values

5.1. Maximum potential number of threatened species, threatened ecological communities and migratory species affected by the weed?

Score UNKNOWN: While the impact of *G. monspessulana* on threatened species and ecological communities is anticipated to be moderate – high, there is limited research literature on this subject.

Comments There is limited specific data available on the direct threat of *G. monspessulana* to impact on a wide range of threatened flora and fauna species; however, broom is capable of totally transforming invaded habitats. It simplifies the structure and diversity of the ground-flora, and crowds or shades out shrubs and tree seedlings, eventually preventing over-storey regeneration. Dense stands seriously impede movement and act as harbour for feral pigs. (DECCNSW 2003).

G. monspessulana has been estimated to have invaded at least 600 000 ha (http://www.ento.csiro.au/weeds/frenchbroom/index.html).

G. monspessulana forms dense thickets that can exclude other vegetation including pasture species and native plants. While sheep, cattle and goats can graze on young *G. monspessulana*, mature plants are relatively unpalatable and these can reduce the amount of grazing land available if thickets form (DPIWE 2002)

Downey *et al.* 2010 list *G. monspessulana* as being a high priority species, based on the threat imposed to biodiversity in NSW

G. monspessulana, amongst other weeds, is identified as a threat to the only known large populations of the leafy green-hood orchid, *Pterostylis culcutta* (Davies 1995)

Some 30+ Forest National Parks in South West of WA have the potential to be invaded by *Genista monspessulana*. These National Parks occur in the Jarrah Forest and Warren IBRAs and have a high number of endangered fauna and flora species, but no specific data is available on the direct threat of *G. monspessulana* on these species (Keighery 2010, pers. comm.).

A survey of small mammals in Belair National Park revealed that *G. monspessulana* amongst other weeds occurred in trapping locations of small mammal species which were threatened. Regel *et al.* 1996

There are records which indicate the *G. monspessulana* is located on the following conservation estate areas of NSW: Wallumatta Nature Reserve; Berowra Valley Regional Park; Garigal National Park; Dalrymple Hay Nature Reserve and Lane Cove National Park (DECC NSW 2007). Additionally, Broom species are found scattered throughout Kosciuszko NP and Scabby Range NR and is found in proximity to Brindabella NP, Bimberi NR, Yanununbeyan NP, NR & SCA and Tallaganda NP & SCA (DECC NSW 2003).

G. monspessulana poses a direct threat to remnant habitats occupied by rare and endangered native species including *Pultenaea involucrata* Benth., *Boronia edwardsii* Benth., *and Correa decumbens* F. Muell. *G. monspessulana* is present at the site of the only known large population of *Pterostylis cucullata* R. Br. in the South Australia (APCC 1996).

References (Davies 1995) (Keighery 2010, pers. comm.); (DECCNSW 2003); Regel *et al.* 1996; Downey *et al.* 2010; DECC NSW 2007); (APCC 1996). (DPIWE 2002); Regel *et al.* 1996; (http://www.ento.csiro.au/weeds/frenchbroom/index.html).

Data quality LOW - MEDIUM

Social values

6.1. How could the weed reduce the tourism/recreational use of the land?

Score MEDIUM – *G. monspessulana* has the ability to moderately affect tourism/recreation largely due to impact from dense impenetrable thickets and simplification of diversity through formation of monocultures.

Comments *G. monspessulana* has the potential to moderately reduce tourism and recreational use of the land due to the following reasons: infestations can be thick and impenetrable, formation of monocultures; increase in fire frequency and intensity, promotion of invasive animals through provision of harbourages.

G. monspessulana can increase frequency and intensity of fire. Adult plants also have the ability to re-sprout after fire (DEC FLORABASE 2010). Additionally, *G. monspessulana* causes concern in forest areas by forming an inflammable understorey at the edge of forests where fires are most likely to start (Parsons and Cuthbertson 2001).

Broom is capable of totally transforming invaded habitats. It simplifies the structure and diversity of the ground-flora, and crowds or shades out shrubs and tree seedlings, eventually preventing over-storey regeneration. Dense stands seriously impede movement and act as harbour for feral pigs. (DECCNSW 2003).

References (DECCNSW 2003); (DEC FLORABASE 2010); (Parsons and Cuthbertson 2001).

Data quality MEDIUM

6.2. How much damage is done to Indigenous or European heritage/cultural sites?

Score UNKNOWN – *G. monspessulana* is likely to impact on Indigenous or European heritage/cultural sites through alteration of fire regime, however, research literature on this subject is limited.

Comments It is likely that *G. monspessulana* would impact on Indigenous and/or European heritage/cultural sites particularly through an increase in fire intensity, however data on this specific subject are lacking.

References Unknown

Data quality N/A

Feasibility of control

7.1. How detectable is the weed?

Score HIGH – *G. monspessulana* is very well detected in the natural environment due to it rapid growth after a fire by comparison to native species and through the formation of dense monocultures.

Comments

Height at maturity in relation to other vegetation:

G. monspessulana is considered mature after 2 years and can grow to 5 metres in height (DEC FLORABASE 2010).

Period of shoot growth presence each year:

Unknown. Gonzales-Andres & Ortiz (1996) tested seed germination success and seedling survival in a number of broom species (Genistae). *G. monspessulana* stood out because it had significantly higher germination success (70 -100% at 16°C); exceptional winter foliage health, 100% survival success and was the tallest plant at the end of the first growing season.

Distinguishing features:

G. monspessulana is a readily detectable weed because of it size, distinct bright pea shaped yellow flowers, its trifoliate leaves, and its bean-like pods. (Parsons and Cuthbertson 2001; Keighery, pers. comm.). This, together with the monocultures which it produces, makes the plant/infestations easy to detect in a forest and woodland ecosystem (Keighery, pers. comm.).

Pre-productive height in relation to other vegetation (prior to seed set of bulb formations

In a study looking at the competition between *G.monspessulana, Eucalyptus leucoxylon, Acacia pycnantha* and *Themeda triandra* in a raised soil bed, G. monspessulana was initially the fastest growing species. Throughout July and August it grew vigorously and was the tallest plant for three months (Lloyd 2000).

References (DEC FLORABASE 2010); (Parsons and Cuthbertson 2001); (Lloyd 2000); (Keighery, pers. comm.).

Data quality MEDIUM

7.2. What is the general accessibility of known infestations?

Score UNKNOWN – Accessibility to G*. monspessulana* infestations across Australia has not fully been established although many are likely to be accessible given invasion from roads/tracks.

Comments *G. monspessulana* has a tendency to invade from the margins of forested areas (Parsons and Cuthbertson 2001). Presumably most sites infested with *G. monspessulana* are readily accessible by road access tracks, since this is

where the weed usually invades from.

References (Parsons and Cuthbertson 2001).

Data quality MEDIUM

7.3. How effective are the realistic targeted control options for the weed (chemical, biological and mechanical)?

Score MEDIUM – HIGH: *G. monspessulana* is relatively easily controlled through a combination of mechanical and chemical means; biological control options have and are being explored.

Comments MECHANICAL/CHEMICAL CONTROL – A combination of rotary slashing, then burning of infested areas, spraying new germination with herbicide over repeat cultivation seems a reasonably effective control regime for *G. monspessulana* (Parsons and Cuthbertson).

In experiments conducted to determine the potential reduction of *G. monspessulana* seed banks using controlled burning, 80-90% of the seed bank was killed or stimulated to germinate by fire. A herbicide treatment, closely following burning (within 6 months) is required to remove the dense flush of germinating seedlings (Lloyd 2000). Burning is an effective means in reducing Broom cover and initially reducing seed bank (Parker and Kersnar 1989; Adams and Simmons 1991; Alexander D'Antonio 2003).

Young plants can be controlled relatively easily because they have a low resistance to herbicides. Where possible, an infestation should be cut with a rotary slasher and burnt, then cultivated several times to destroy seedlings. When chemical control is required, picloram, either alone or in a commercial mixture with triclopyr, is effective if plants are in full leaf. Follow-up spraying is necessary to treat seedlings and regrowth which will occur from particularly large plants. Glyphosate is recommended in some situations (Parsons and Cuthbertson 2001).

The long-lived seed bank means that ongoing control is necessary, which can make chemical costs high. *Cytisus* control using Grazon has issues with off target damage, however, it is thought that this may be less of an issue for *G. monspessulana* because this species has bigger leaves.

BIOLOGICAL CONTROL

The Animal and Plant Control Commission (APCC) of South Australia proposed *G. monspessulana* as a target species for biological control. The Australian Weeds Committee approved it as a target species in 1996.

Henry *et al.* (2008) made application for the approval of the release of the Cape Broom Psyllid, *Arytinnus hakani*, a potential biological control agent for the Cape Broom, *G. monspessulana* . Both nymphs and adults of *A. hakani* insert their mouthparts into *G. monspessulana* buds, leaves and pods, inject saliva and suck sap and cells. Large populations of this psyllid often occur on *G. monspessulana*, especially on young actively growing foliage (Sheppard 2000). Damage by *A. hakani* in the broom garden at CSIRO's European

Laboratory in Montpellier France has been impressive, with heavily attacked plants exhibiting shoot-blackening, reduced growth and reduced flowering (Sheppard 2000).

Results from host testing showed that *Arytinnis hakani* is considered an agent worth redistributing to other states of Australia as a biological control agent for *G. monspessulana*. The benefits to these communities and the forestry industry of *G. monspessulana* biological control are substantial, and outweigh the low to moderate risk to non-commercial and weedy lupin varieties. Native Australian flora is not at risk of attack from *A. hakani (*Henry *et al.* Sept 2008)

Additionally, three fungal pathogens have been reported on *G. monspessulana* and a further eight fungi funguses were identified as part of research conducted by (CSIRO Entomology 2006). Further investigation is required into the effectiveness of these fungi as pathogens for *G. monspessulana* and the potential to utilise them as effective biological control agents.

References (Parsons and Cuthbertson); (Lloyd 2000) (Parker and Kersnar 1989; Adams and Simmons 1991; Alexander D'Antonio 2003) (DEC FLORABASE 2010); (Shepherd and Thomann 2006) (APCC); (Henry *et al.* Jul 2008); (Henry *et al.* Sept 2008); CSIRO website (2007). http://www.csiro.au/science/CapeBroomBiocontrol.html; CSIRO website (2007a). http://www.ento.csiro.au/weeds/frenchbroom/biocontrol.html

Data quality MEDIUM

7.4. What is the likely level of cooperation from landholders, gardeners and farmers within the land uses/industries at risk?

Score HIGH – *G. monspessulana* has no economic use and is listed as a noxious plant in many of the states and territories where it is currently distributed.

Comments It is likely that there would be cooperation from landholders, gardeners, farmers and land management groups in the control of *G. monspessulana*. While current knowledge of and control of this species is low, there is no identified economic use for this species and there is not likely to be any opposition to control of this species.

G. monspessulana is relatively easily controlled in a range of ways which doesn't solely rely on the use chemicals. The species is easy to recognise, map and therefore community groups could be easily engaged to assist with mapping and controlling it (Keighery 2010, pers. comm.).

G. monspessulana is listed as a noxious weed in the following jurisdictions (Parsons and Cuthbertson 2001) :

- ACT – pest plant
- NSW – declared in 10 council areas. Needs to be reviewed with one likely outcome being that the weed will be declared in further areas (Stephen Johnson pers. comm.).
- Vic – Controlled Weed in 8 regions
- SA – declared plant

- TAS – State declared weed

These legislative measures provide further authority to the control of *G. monspessulana* in most States where it currently occurs.

References (Parsons and Cuthbertson 2010); (Keighery 2010, pers. comm.).

(Stephen Johnson pers. comm.).

Data quality MEDIUM

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