

Eyre Peninsula Landscape Board

PEST SPECIES REGIONAL MANAGEMENT PLAN

Solanum elaeagnifolium

Silverleaf Nightshade

This plan has a five year life period and will be reviewed in 2027.



INTRODUCTION

Synonyms

Solanum dealbatum Lindl., *Solanum elaeagnifolium* var. *angustifolium* Kuntze, *Solanum elaeagnifolium* var. *argyrocroton* Griseb., *Solanum elaeagnifolium* var. *grandiflorum* Griseb., *Solanum elaeagnifolium* var. *leprosum* Ortega Dunal, *Solanum elaeagnifolium* var. *obtusifolium* Dunal, *Solanum flavidum* Torr., *Solanum obtusifolium* Dunal, *Solanum dealbatum* Lindley, *Solanum hindsianum* Benth., *Solanum roemerianum* Scheele, *Solanum saponaceum* Hooker fil in Curtis, *Solanum texense* Engelman & A. Gray, and *Solanum uniflorum* Meyer ex Nees.

Silver nightshade, silver-leaved nightshade, white horse nettle, silver-leaf nightshade, tomato weed, white nightshade, bull-nettle, prairie-berry, satansbos, silver-leaf bitter-apple, silverleaf-nettle, and trompillo, prairie berry

Biology

Silverleaf nightshade *Solanum elaeagnifolium* Cav. is a seed-or vegetatively-propagated deep-rooted summer-growing perennial geophyte from the tomato family Solanaceae [1].

This multi-stemmed plant grows to one metre tall, with the aerial growth normally dying back during winter (Figure 1B). The plants have an extensive root system spreading to more than two metres deep. These much branched vertical and horizontal roots bear buds that produce new aerial growth each year [2], in four different growth forms (Figure 1A):

- from seeds germinating from spring through summer;
- from buds above soil level giving new shoots in spring;
- from buds at the soil surface; and
- from buds buried in the soil, which regenerate from roots (horizontal or vertical) [1].

The life cycle of the plant is composed of five phases (Figure 1B). Vegetative regeneration and germination occurs in spring and is followed by vegetative development through spring and summer. Flowering generally occurs in late spring with fruit formation in late summer / early autumn. Fruits ripen through autumn and winter [1]. Flowers are cross-pollinated by insects [3].

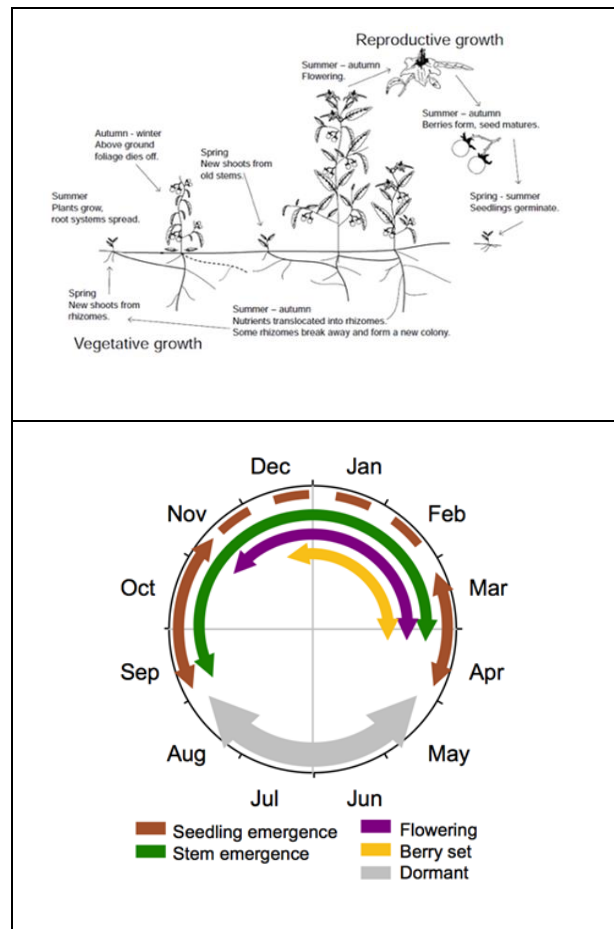


Figure 1: A. Summary of silverleaf nightshade growth patterns. Source: [4]. B. Typical silverleaf nightshade growth cycle. Source: [5].

Origin

Silverleaf nightshade is native to northeast Mexico and southwest USA [6]. It also occurs in South America but it is not clear if it is native or has recently been introduced [1]. It is a weed in Mediterranean and temperate areas throughout Europe, Africa, Asia, the Americas and Australasia [1].

Silverleaf nightshade was first recorded in Australia in New South Wales in 1901, in Victoria in 1909 [7] and in South Australia in 1918. It was first identified as a weed, and not a native in 1947 [8].

Distribution

Silverleaf nightshade inhabits warm temperate areas of Australia with 250 to 600 mm annual rainfall. It has naturalised in southeastern Queensland, western slopes and southern plains

of New South Wales, Victoria, southern South Australia and southwestern Western Australia with occasional records in southern Northern Territory (Figure 2). It is estimated to infest over 350,000 ha in Australia [9].

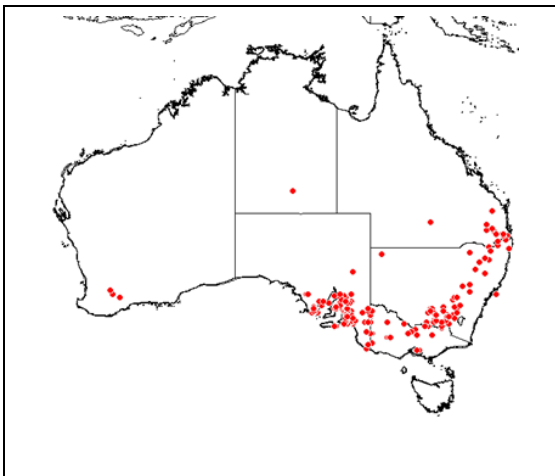


Figure 2: Australian distribution of silverleaf nightshade, presence records 2011. Source: [10].

In South Australia, silverleaf nightshade occurs in all regions with the largest infestations in the Mid-North and eastern Eyre Peninsula (Figure 3 and 4) [8].

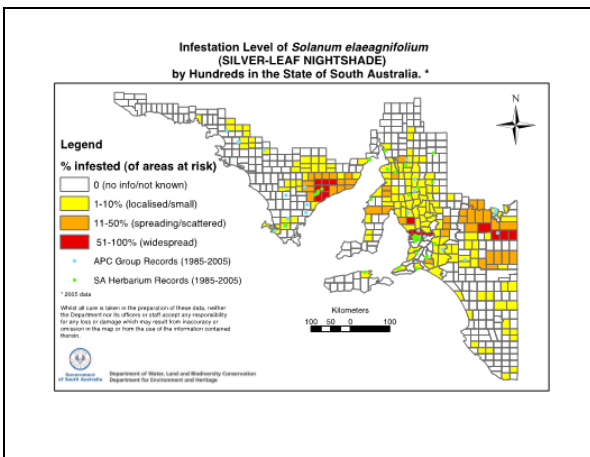


Figure 3: Silverleaf nightshade distribution by hundreds and percentage infestation of area at risk in South Australia, 2005 data. Source: former DWLBC.

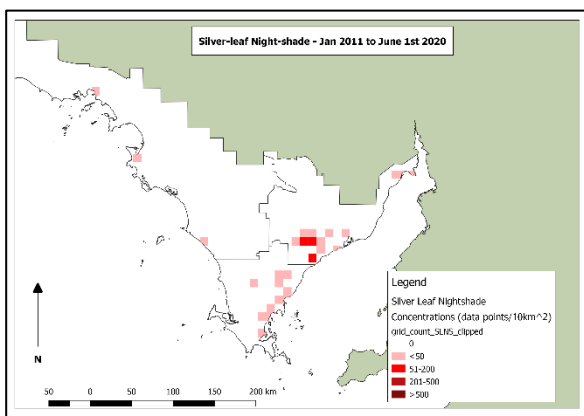


Figure 4: Distribution of silverleaf nightshade on Eyre Peninsula using BDBSA data and EPLB control data.

Modelling of climatic suitability indicates that silverleaf nightshade has a considerably larger potential distribution within Australia (Figure 5) [11], of up to 398 million ha [9].

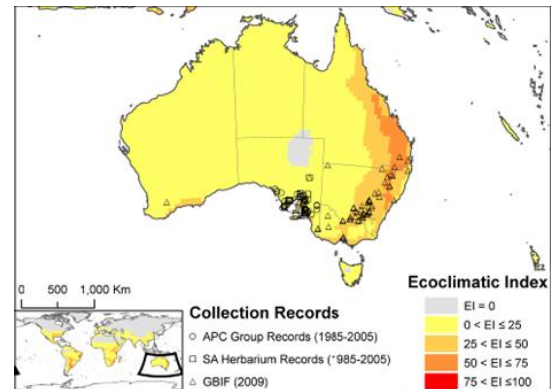


Figure 5: Climate suitability for silverleaf nightshade in Australia, as indicated by the CLIMEX Ecoclimatic Index (EI) using climate averages at 0.5 degree resolution from 1961–1990 [12]. The CLIMEX model for *Solanum elaeagnifolium* was developed by D. Kriticos. Source: [11].

Modelling of change in climate suitability for silverleaf nightshade in South Australia (CLIMEX Ecoclimatic Index using CSIRO Mk3 projections for 2080 based on the A1B SRES emissions scenario) indicates that there is likely to be an increase in climate suitability in the south and the east of the state (Figure 6) [11].

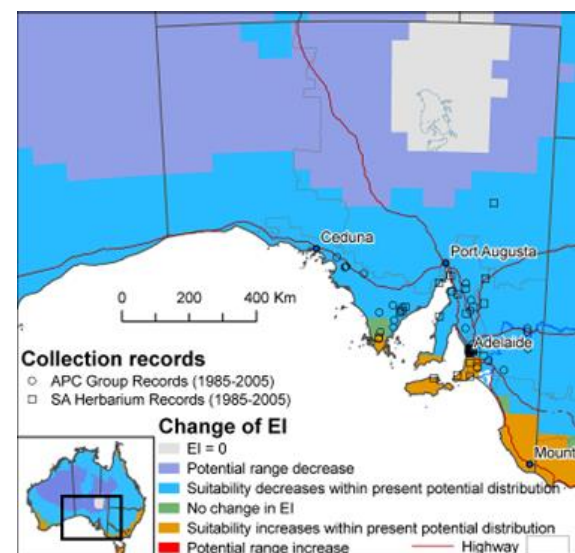


Figure 6: Change in climate suitability for silverleaf nightshade in South Australia as indicated by the CLIMEX EI using CSIRO Mk3 projections for 2080 based on the A1B SRES emissions scenario.

There is likely to be a substantial contraction in the potential weed distribution through the north

of South Australia, but all presently known populations are projected to remain climatically suitable [11]. The reduction in potential range is due to increasing drought stress that will also result in a shift of cropping activities into more southerly locations where rainfall is likely to remain sufficient. There may be an opportunity to try to exclude this weed from cropping systems that are translocating to Kangaroo Island and the South East region [11].

RISK ASSESSMENT

Pest risk

Silverleaf nightshade has a negative impact mainly on crop production but also on livestock production, on the environment and on trade [1].

Once established plants are tolerant of a range of environmental extremes, being highly resistant to drought and tolerant of saline conditions. Shoots and leaves are sensitive to frosts and water logging, although frosts do not impact on roots [13].

Silverleaf nightshade is mainly a weed of cultivated land, orchards, managed grasslands and associated man-made habitats such as natural grasslands, riverbanks / canal sides, rail / roadsides and wastelands [1]. The plant competes strongly with cereals, and perennial pastures do not check its growth [2]. It competes for moisture and nutrients with many crops [1]. It does not severely affect orchards and vineyards but competes with cover crops grown in these situations [2].

Silverleaf nightshade can be poisonous to stock, with cattle more susceptible than sheep, and goats relatively tolerant [2]. The green or ripe fruit is more toxic than other parts of the plant [2].

Silverleaf nightshade mainly reproduces vegetatively, from buds on underground fragments [1]. Root fragments are very hardy with fragments as small as 0.5 cm long, buried up to 20 cm in the soil, able to successfully regenerate under ideal conditions [1]. Excised taproot sections maintain their viability for up to 15 months [14]. Ten-day-old seedlings are able to regenerate, and sprouting is enhanced by the removal of the aerial parts of the parent plants or by cultivation [1]. This aggressive vegetative growth from deep rootstocks makes silverleaf nightshade very difficult to control, both mechanically and chemically.

In silverleaf nightshade reproduction by seed is secondary, though seeds are highly viable and last at least 10 years in soil [1]. A single plant generally produces 40–60 fruits, each containing

60–120 seeds, 2–3 mm in diameter, closely resembling those of tomatoes [1]. High levels of dormancy and infrequent germination can lead to the establishment of extensive viable seed banks, with seed bed densities between 5 million to 100 million seeds / acre recorded [15]. Seeds require fluctuating temperatures to germinate [1].

Seeds may be dispersed by wind, water (In some areas fruit have been spread over 40 km's by flood waters [8]), machinery, agricultural produce or animal faeces, and dried plants may also blow like tumbleweeds, spreading seed along the way [1, 2, 16]. Ten percent of seed is still viable after passing through the digestive tract of sheep [17]. Plants can rarely be killed once established [8]. Movement in contaminated fodder and in crop seed are major sources of new infestations.

Based on these data, definition of an effective dispersal distance for silverleaf nightshade from an infestation over dryland habitat is problematic as it is dependent on highly variable factors including: the temporal and spatial movement patterns of stock, machinery and humans that have been in infested areas, the movement of water out of infested areas, and wind direction. An effective dispersal distance to define a dispersal zone to prevent vegetative spread of silverleaf nightshade from affected properties across property boundaries, is 20 m. Where silverleaf nightshade occurs in association with streams or areas subject to sheet movement of water, effective dispersal distance may be anywhere along the flow path downstream of the infestation. Dispersal corridors associated with the movement of human, stock or machinery must be monitored across the region.

On Eyre Peninsula, the main method of spread has been through contaminated livestock and with proper hygiene protocols in place the spread can and has been reduced (I. Honan *Pers. Comm.* 20/09/2014).

Feasibility of control

Due to the difficulty in eradicating silverleaf nightshade, good hygiene strategies should be followed to reduce the risk of a new infestation starting. But where it is already present, the ultimate goal is to eradicate the infestation over time by reducing the density and the size of the infestation [5].

A long-term strategy, using an integrated approach with a range of chemical and non-chemical methods, needs to be developed based on site-specific requirements. Chemical control works only on the aerial component of the plant, and regrowth can occur later in the same season or in the next season from the same rootbank [5].

Consequently, an ongoing herbicide program over several years is required to run down an established infestation.

Timing of herbicide treatment is important [5]. Seedlings and small patches (one to five shoots) are the most susceptible stage of plant growth to chemical control. Control at flowering provides better seedbank control than after berry formation, as viable seed can be present 28 days after flowering. Effective long-term control programs need to include tactics that deplete below-ground propagules. Herbicide absorption and translocation to roots is lowest during the middle of summer when the plant is in the reproductive phase, with the greatest amount of herbicide translocation occurring in spring and autumn. Where foliar growth is present in autumn, opportunity exists for a late season herbicide application for rootbank control. Herbicides applied late in the season can significantly decrease stem emergence the following season.

Additional strategies include [5]: the use of competitive crops and pastures to suppress the plants in spring and summer; grazing by sheep and goats in particular (avoiding the risk of seed dispersal through faeces by not grazing when seeds present or by quarantining for 14 days after removal); slashing during flowering and before seed set; avoiding fragmentation of roots with cultivation; thoroughly cleaning equipment prior to moving from an infected area; and establishing tree belts using allelopathic Eucalypt species in the vicinity of infestations.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a national framework for environmental management (including the recognition of nationally threatened species and ecological communities), thereby directing resources towards the delivery of improved environmental protection. The EPBC Act applies where silverleaf nightshade threatens any listed species or ecological community or where its control may have adverse effects on matters of national environmental significance on Commonwealth land.

Status

Within the EP Landscape region a risk management assessment shows that silverleaf nightshade merits (Table 1): protect sites action in southern perennial pasture landuse and manage weed in cropping land use areas.

Table 1: Regional Assessment

Land Use	Pest Risk	Feasibility of Control	Management Action
Southern Perennial Pasture	Very High	Low	Protect Sites
Cropping	Very High	Negligible	Manage Weed

REGIONAL RESPONSE

Special considerations / Board position

Consider climate driven shifts in silverleaf nightshade distribution resulting from climate change and associated changes in land use across the region.

Action on individual properties will significantly reduce the level of risk to an asset.

Effective monitoring may involve local surveys along potential dispersal corridors across the region in addition to surveys associated with known infestations.

Encourage / facilitate tertiary research to address identified data shortfalls and knowledge gaps.

Outcome

To prevent the spread of silverleaf nightshade from affected land and reduce its impact on primary production.

Objectives

To:

1. locate and destroy small/new silverleaf nightshade infestations; and
2. contain and reduce the impact of large silverleaf nightshade infestations.

Area/s to be protected

Uninfected primary production areas and disturbed or open native vegetation particularly grasslands.

Actions

Land managers to:

1. survey and control infestations near key sites/assets annually and supply survey and control information on request to Landscape Board staff; and
2. prevent the spread of silverleaf nightshade by searching annually for outlier infestations near known infestations.

Landscape Board staff to:

3. monitor silverleaf nightshade distribution within areas of known infestation and along dispersal corridors associated with movement of such vectors as stock, soil, fodder and machinery between properties;
4. facilitate, encourage or compel control of small infestations, containment of large infestations and maintenance of effectively controlled protection zones beyond the perimeter of uninfected properties;
5. control all high priority infestations on road reserves and recover costs from adjoining landholders where necessary;
6. develop localised annual action plans to achieve the objectives and actions of this management plan
7. monitor control areas to ensure control action is effective;
8. implement targeted community education to avoid vector dispersal and restrict potential dispersal pathways across the region; and
9. undertake systematic data collection (control and survey numbers, location and date information) and storage in a central spatial database.

Evaluation

Evaluation of success will be based on:

- annual analysis in November of monitoring data to evaluate the success of pest plan actions (including the update of spatial layers) objectives;
- identify any gaps in delivery and action as soon as possible; and
- review of this pest management plan every five years.

Declarations

In South Australia silverleaf nightshade *Solanum elaeagnifolium* is a declared weed under the *Landscape South Australia Act 2019* Provisions: 186(2), 188(1)(2), 192(2), 194 for the whole state) (Table 2). Meaning that the movement or transport of the plant on a public road by itself or as a contaminant, or its sale by itself or as a contaminant, is prohibited. Landscape authorities may require land owners to control silverleaf nightshade plants growing on their land; Landscape authorities are required to control plants on road reserves and may recover costs from the adjoining land owners. Silverleaf nightshade is declared in category 2 under the Act for the purpose of setting maximum penalties and for other purposes. Any permit to allow its

movement or sale can only be issued by the Chief Executive pursuant to section 197.

Table 2: Relevant sections of the *Landscape South Australia Act 2019*. Provisions for the whole of state for silverleaf nightshade *Solanum elaeagnifolium*.

Section	How the section applies
186 (2)	Cannot transport the plant or anything with the plant in it
188 (1)	Cannot sell the plant
(2)	Cannot sell any produce/goods carrying the plant
192 (2)	Land owner must control the plant on their land
194	Landscape authority may recover costs for control of weeds on roadsides from adjoining land owners

More information

Contact your local Eyre Peninsula Landscape Board office

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REFERENCES

1. EMPPPO, *Solanum elaeagnifolium*. Bulletin OEPP, 2007. **37**: p. 236-245.
2. Parsons, W.T., *Noxious Weeds of Victoria*. 1981, Melbourne: Inkata Press.
3. Buchmann, S.L. and J.H. Cane, *Bees assess pollen returns while sonicating Solanum flowers*. Oecologia, 1989. **81**: p. 289-294.
4. Kidston, J., R. Thompson, and A. Johnson. *Silverleaf nightshade (Solanum elaeagnifolium)*. 2007 June 2007 [cited 2011 03/05/2001]; Available from: <http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/silverleaf-nightshade/>.
5. EH Graham Centre for Agricultural Innovation. *Silverleaf Nightshade Best Management Practice Guide*. 2010; Available from: http://www.dpi.nsw.gov.au/data/assets/pdf_file/0/011/363539/SLN-BMP-guide-web.pdf.
6. Robinson, A.F., C.C. Orr, and C.E. Heintz, *Distribution of Nothanguina phyllobia and its potential as a biological control agent of silverleaf nightshade*. Journal of Nematology, 1978. **10**: p. 361-366.

7. Heap, J., I. Honan, and S. E., *Silverleaf Nightshade: A Technical Handbook for Animal and Plant Control Boards in South Australia*. 1997, Primary Industries South Australia, Animal and Plant Control Commission: Naracoorte, S.A.
8. Minister for Environment and Water 2021 Declared Plant Policy Silverleaf Nightshade https://www.pir.sa.gov.au/__data/assets/pdf_file/0009/137277/silverleaf_nightshade_policy.pdf
9. Kwong, R.M., et al. *Feasibility of biological control of silverleaf nightshade in Australia*. in *Proceedings of the 16th Australian Weeds Conference*. 2008. Cairns, Qld: Queensland Weed Society.
10. Australasian Virtual Herbarium. *Solanum elaeagnifolium distribution map*. 2011 [cited 2011 03/05/2011]; Available from: <https://avh.chah.org.au/>
11. Kriticos, D.J., et al., *Climate change and invasive plants in South Australia*. *CSIRO Climate Adaptation Flagship, Canberra, Australia*. 2010, Report for the South Australian Department of Water, Land and Biodiversity Conservation.: Adelaide, Australia.
12. Mitchell, T.D., et al., *A comprehensive set of climate scenarios for Europe and the globe: the observed record (1900-2000) and 16 scenarios (2000-2100)*. 2004: University of East Anglia. 30.
13. Wassermann, V.D., H.G. Zimmermann, and S. Naser, *The Weed Silverleaf Bitter Apple ('Satansbos') (Solanum elaeagnifolium Cav.) with special reference to its status in South Africa*. 1988, Technical Communication no. 214. Department of Agriculture and Water Supply: Pretoria (ZA).
14. Molnar, V.M. and D.N. McKenzie, *Progress Report on Silverleaf Nightshade Research*. Pamphlet no. 61. . 1976, Keith Turnbull Research Institute,: Frankston, Victoria.
15. Cooley, A.W. and D.T. Smith, *Silverleaf nightshade (whiteweed) establishment from seed and clipped seedlings*. *Progress Report of Texas A&M University, Texas Agricultural Experiment Station, PR-3198*. 1971.
16. Boyd, J.W., D.S. Murray, and R.J. Tyrl, *Silverleaf nightshade, Solanum elaeagnifolium, origin, distribution, and relation to man*. *Economic Botany*, 1984. **38**: p. 210-216.
17. Washington State Noxious Weed Control Board. *Written findings of the Washington State Noxious Weed Control Board, (December 1999)*. *Solanum elaeagnifolium Cav.* 1999; Available from: [\[http://www.nwcb.wa.gov/weed_info/Solanum_elaeagnifolium.html\]](http://www.nwcb.wa.gov/weed_info/Solanum_elaeagnifolium.html).