

Weed Management Plan for Neem (*Azadirachta indica*)

2015



Weed Management Branch

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ISBN 978-1-74350-058-3

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Cover photo: Neem infestation

Executive summary

This Weed Management Plan forms part of a strategic approach to neem (*Azadirachta indica*) management in the Northern Territory (NT), with the overall aim being to mitigate the damage caused by neem in relation to production, environmental and cultural values.

A comprehensive weed risk management assessment found neem to be a very high risk weed where potential exists for successful management. There is also a high level of community support to manage neem. On the basis of this assessment neem has been declared under the *Weeds Management Act* as:

Class B: **Growth and spread to be controlled** (All Class B weeds are also classified as Class C.)

Class C: **Not to be introduced into the NT**, in all areas of the NT.

This plan establishes the objectives and outcomes to be achieved by all land managers and the minimum actions to be taken to achieve these outcomes. Conducting land management practices in accordance with this plan will secure compliance with the requirements of the *Weeds Management Act*. As this is the first plan to be prepared for neem, the outcomes and options identified represent a first step towards reducing the impacts and threats of this weed. It is acknowledged that the range of capabilities for managing weeds vary between land managers and that in the first instance some will need time to build knowledge and capacity to adjust to new requirements. Accordingly, this plan will be monitored for its efficiency and amended as required.

This plan also incorporates *best management practice goals* which will ultimately contribute to strategic weed control at a Territory scale. Information on a range of management techniques and control methods, including physical and chemical control, controlled burning and hygiene procedures is included.

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1. Introduction

1.1 Background

Neem is a medium sized tree growing to a height of 15 metres. It has dark red-brown bark that cracks and flakes when aged and small white honey scented flowers. Adult leaves are dark green and serrated, and red-green when young. They also have a pungent smell and insecticidal properties.

In the Northern Territory (NT), neem was deliberately planted to produce shade for cattle and is found as far south as Tennant Creek. Believed to be first introduced into Darwin in the 1940s and more widely planted as a street tree in Darwin in the 1960s, neem remains a common garden plant in Darwin, Katherine and the rural areas. It was also grown for the production of azadirachtin, a broad spectrum insecticide.

Between 1965 and 1988, trial neem timber plantations were established in Darwin. Plantations were also established in Queensland and Western Australia. Neem continues to be promoted as a multi-purpose plantation species by some advocates in Queensland. Despite this, a viable neem industry does not seem to have developed in Australia and many plantations have since been abandoned.

Neem has become naturalised in many areas across northern Australia, where the expansion of unmanaged populations has demonstrated neem's capacity to compete with native plant species in intact environments. Neem infestations are developing in riparian areas across the Top End including the Katherine, Wickham, McArthur and Roper river systems. In these areas neem is proving to be highly invasive and competitive. Mature neem trees produce a prolific amount of seed, which are readily dispersed by birds, bats and humans. Plants are capable of establishing in relatively undisturbed vegetation. Suckers can also be produced following damage to the roots.

Modelling predicts that up to 58% of the Territory is climatically suitable for the establishment of neem. Neem's preferred habitats include tropical savanna woodlands and riparian areas.

1.2 Period and application of plan

This Plan has been approved under section 10 of the *Weeds Management Act* and specifies the minimum requirements for managing neem in the NT. It applies to all landholders, including the Northern Territory Government.

The Plan takes effect from the 17 July 2015. It must be reviewed within three years of this date and will cease ten years from this date, unless replaced by a revised plan.

During the first three years of this plan, the NT Government will monitor the efficacy of the plan to determine the most appropriate management obligations of landholders for future planning and control.

Meeting the objectives set out in this plan is important for long term effective management of neem in the NT. Landholders must meet the management requirements outlined in the plan in order to comply with the Act. Penalties of between 77 and 770 penalty units (\$11 781 and \$117 810) for individuals and between 385 and 3850 penalty units (\$58 905 and \$589 050) for a body corporate apply for failure to comply with this plan*.

* Penalty units are determined by the *Penalty Units Act*. At the time of publication the Penalty Units Regulations prescribed the monetary value of a penalty unit as \$153.

1.3 Coordinated management

This Weed Management Plan has been developed with extensive stakeholder consultation. It aims to address the concerns of all stakeholders by providing strategic management directives which are intended to mitigate the economic and environmental risks posed by neem. The Department of Land Resource Management will work closely with stakeholders, including other government departments, to implement and monitor the performance of the plan. Continued improvement will be made possible through a commitment to regularly review the plan and make changes where necessary. It is recognised that the initial three year period of implementation will be extremely important with respect to informing and supporting landholders and managers and gauging the costs and effectiveness of actions taken pursuant to the plan. Feedback will be sought from landholders executing their own control plans; a process which will be greatly assisted by maintaining good records of management actions undertaken and the results of those actions.

2. Aim and objectives

2.1 Aim

To prevent any further introduction of neem into the Northern Territory and to control its growth and spread in order to protect production, environmental and cultural values by:

- providing clear and measurable management actions and targets (refer section 5 and Appendices A and C);
- defining the management requirements applicable to all land users in the NT, which form an integral part of the strategic management of neem across the Territory; and
- providing recommendations and information on actions required to meet management obligations.

2.2 Management objectives

1. To prevent further introduction of neem into the Northern Territory by:

- a) Ensuring that the public and relevant industry members are aware that it is illegal to import (including for sale) or transport neem to or within the Northern Territory; and
- b) Ensuring that the public and industry can identify neem and understand the risk it poses to the Northern Territory.

2. To control the growth and spread of neem by:

- a) Controlling seedlings, saplings and, where feasible, mature trees;
- b) Implementing early detection and management programs outside known established plantings and infestation areas;
- c) Developing programs and partnerships to contain strategic outlier infestations;
- d) Designing and implementing a weed spread prevention program; and
- e) Prohibiting the production, sale or purchase and transport of neem, seed and plant products.

3. To apply an adaptive approach to weed management by:

- a) developing and maintaining ongoing monitoring programs;
- b) maintaining accurate records of control methods applied and results achieved for analysis at regional and Territory-wide scales; and
- c) evaluating the efficacy of control and containment programs over time.

2.3 Targets

Neem management is an ongoing process. This Plan outlines a number of targets to assist all land users measure the effectiveness of the management objectives over the life of the plan (refer Appendix C).

3. Neem declaration status

3.1 Declaration

Neem is declared under section 7 of the Act as:

- **Class B (growth and spread to be controlled);** and
- **Class C (not to be introduced)** in all areas of the NT.

3.2 Northern Territory Weed Risk Management System

The NT Government uses the NT Weed Risk Management System to identify and prioritise plants to be declared as weeds in accordance with the Act and to determine the appropriate management requirements for those plants. The neem declaration status is consistent with the results of the risk assessment process.

While neem has been assessed as a high risk weed, its high levels of establishment, particularly around Katherine and Mataranka mean that it has a low feasibility of control. Eradication in these areas is not considered feasible from technical or economic perspectives.

Seedlings that can be easily and cheaply removed, as well as isolated plants and infestations are the focus of management required in this Plan.

For management to be effective, the restriction of spread must be prioritised. All of the NT is classified as Class C, therefore neem is not to be introduced into any area within the NT.

4. Current distribution

Neem infestations are developing in riparian areas across the Top End including the Katherine, Wickham, McArthur and Roper river systems. In these areas it is proving to be highly invasive and competitive. Plants have also been identified as far south as Tennant Creek.

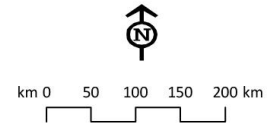
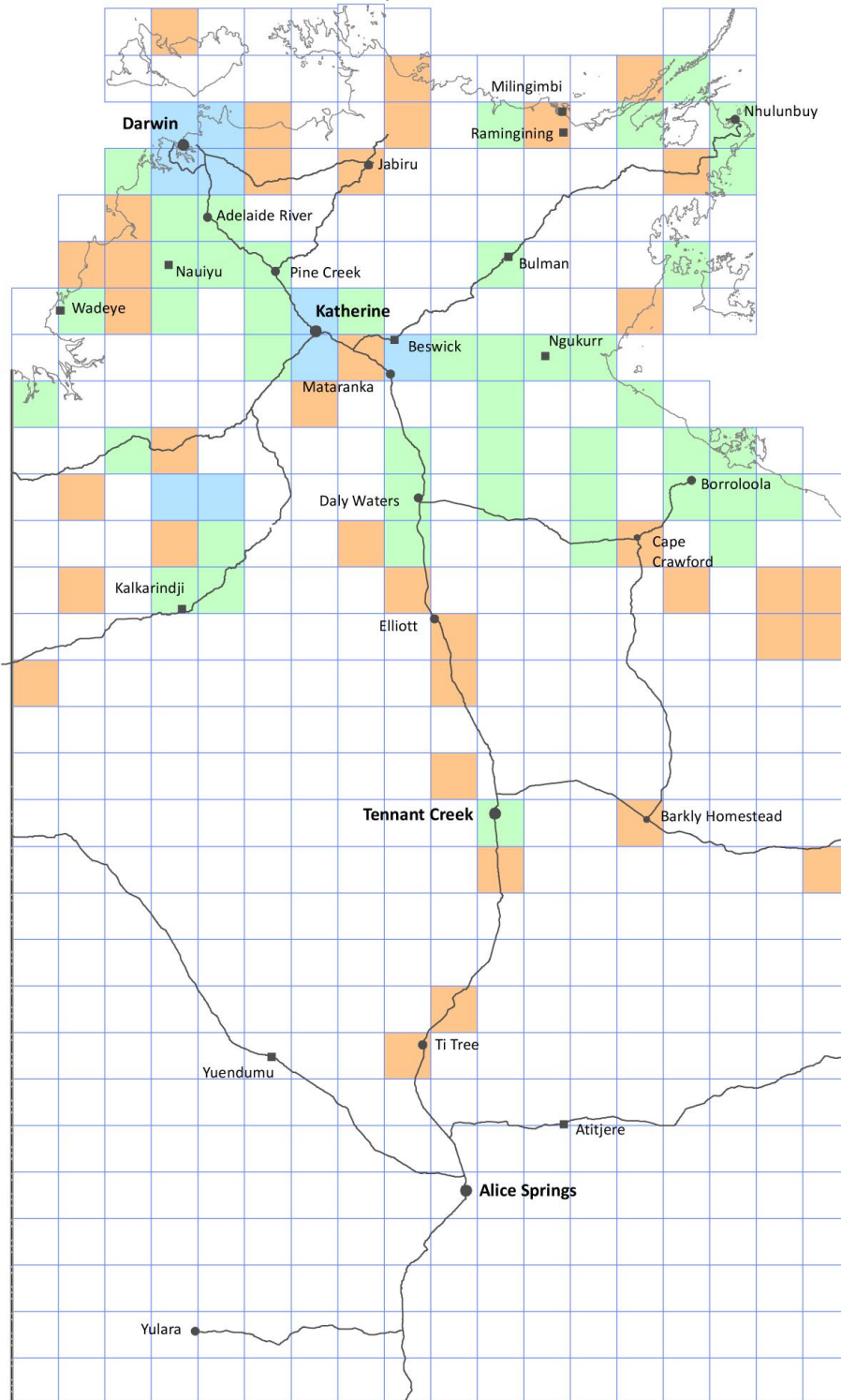
Modelling predicts that up to 58% of the Northern Territory is climatically suitable for the establishment of neem. Neem's preferred habitats include tropical savanna woodlands and riparian areas. A strong root system with a deep tap root and extensive lateral roots enable neem to establish and flourish in areas affected by seasonal drought. Neem grows best between 450-1200mm annual rainfall (optimum around 1100mm/year).



For more information, contact
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Department of Land Resource Management
Phone (08) 897 38829
www.nt.gov.au/weeds

**NORTHERN TERRITORY
DENSITY AND DISTRIBUTION OF WEEDS
JULY 2014**

**Neem
*Azadirachta indica***



Map created: 7 July 2014
© Northern Territory of Australia

- Weed Density and Distribution Description**
- Present, Density Unknown ■
 - Occasional and Localised ■
 - Occasional and Widespread ■
 - Common and Localised ■
 - Common and Widespread ■
 - Abundant and Localised ■
 - Abundant and Widespread ■
 - Unknown Occurrence ■
 - Eradicated and Monitored ■
 - Absent ■

Caution:
Weed distribution displayed on this map may not be limited to this representation.

DATA SOURCE:

Species Distribution Data
Weed Management Branch
Dept Land Resource Management

Grid Cells
1:100,000 topographic map sheet index, Geoscience Australia
Each grid cell is 0.5° x 0.5° (approximately 50km x 50km)

Figure 1: Distribution of neem in the NT (Weed Management Branch 2014).

5. Management requirements

5.1 Introduction

Successful weed management may require significant investment over an extended period of time. The control of large, established infestations will require careful planning, prioritisation and budgeting. Results may not be immediately apparent and repeated effort may be required to produce obvious reductions in distribution and density.

The actions detailed below are the minimum acceptable requirements needed to achieve compliance with this Plan. Landholders may choose to implement a higher level of management than is required by this plan e.g. a landholder may seek to remove mature trees from urban plantings, a solution which is highly beneficial from a strategic management perspective as it removes a seed source.

A summary of management requirements for neem is provided in *Appendix A*.

5.2 Preventing introduction (Class C)

This includes all of the NT. All land users must ensure there is no further introduction of neem into the NT or into areas which are not currently infested. Under the Act:

1. It is illegal to transport, sell, buy or propagate neem plants or seeds within or into the Northern Territory.

5.3 Controlling growth and spread (Class B)

Land managers and land users are required to control the growth and prevent the spread of neem. To achieve this, the following must be undertaken:

1. Inspect the property (including previously treated areas) to identify any neem seedlings, saplings, mature trees and infestations. This should be done at least annually prior to flowering and seeding (refer section 6.1.3 – flowering generally starts early in the wet season, however this may vary depending on the environment and amount and timing of rain);
2. Develop and implement a control program using methods detailed in section 6;
3. Use best endeavours to prevent the spread of neem within or from the property using control methods detailed in sections 6;
4. Design and implement a weed spread program which will help minimise new neem infestations establishing as a result of seed transfer or spread (refer section 7); and
5. Monitor the results of neem management. In order to evaluate the success of a management program, it is recommended records be kept of the methods used and results achieved (which is consistent with the example provided at Appendix B).

5.4 Adaptive management

1. Develop and maintain monitoring programs;
2. Maintain accurate records of control methods applied and results achieved for analysis at regional and Territory-wide scales; and
3. Evaluate the efficacy of control and containment programs over time.

5.5 Permits

Section 30 of the *Weeds Management Act* enables people to apply to the Minister for a permit to use a declared weed. The Minister may refuse or grant a permit subject to a range of conditions.

6. Eradication and control methods

6.1 General

Effective weed management is dependent on an integrated natural resource management approach. Weed control will be more successful where land managers are also implementing appropriate grazing regimes, managing feral animals and controlling erosion and fire on their properties. It is recognised that, in some instances, successful weed management outcomes may take time and repeated effort to become clear due to the complexities associated with integrated natural resource management and level of investment requirement.

6.1.1 Integrated weed control

Integrated weed control involves using a combination of control techniques to manage weeds. Integrated control generally results in more effective, longer term successful weed management outcomes. This plan describes the control methods which can be used to control neem. Spread prevention is the most successful and cost effective way of managing weeds.

6.1.2 Property management planning and mapping

It is recommended that all land holders who have declared or problematic weeds on their land develop a property weed plan, which includes a detailed assessment of all infestations on the property. The assessment will enable consideration of the current distribution of the weed, the potential for spread (along water courses, access tracks/roads, animal movement etc) and potential impacts on land use and other values such as biodiversity. Once this information is collated, priority control areas and suitable control methods can be identified.

A property weed plan should detail exactly what needs to occur in order to meet or exceed all requirements of this statutory weed management plan, and any other weed management requirements which may be applicable to a certain property. Weed planning guides can be downloaded from http://www.lrm.nt.gov.au/weeds/property_planning

The Department has produced the *Northern Territory Weed Data Collection Manual*. This manual describes what information to collect when mapping, controlling and monitoring weed infestations in the NT. The supply of weed data to the Weed Management Branch, in accordance with this manual, will contribute to the collection of accurate data fundamental to planning and delivering strategic and coordinated weed management across the NT. The manual can be downloaded from <http://www.lrm.nt.gov.au/weeds/resources>

The growth and reproductive cycles of a weed species must be taken into account when developing a management program. Implementing control measures at the wrong time of year can significantly reduce both the short and long-term success of the management action.

Table 1 provides an overview of neem growth and reproduction and identifies corresponding optimal treatment times for different control methods. It should be noted that peak growth, flowering and seeding times can vary according to seasonal conditions; these will influence the optimum timing of control.

Table 1: Guide to the management of neem

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Flowering | | | | | | | | | ▨ | ▨ | ▨ | |
| Seed drop | ▨ | ▨ | ▨ | ▨ | | | | | | | ▨ | ▨ |
| Germination | ▨ | ▨ | ▨ | ▨ | ▨ | | | | | | ▨ | ▨ |
| Foliar spray | | ▨ | ■ | ■ | ■ | ▨ | | | | | | |
| Basal bark/hand held burners | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Cut stump | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

- Striped cells (▨) Approximate times for reproductive events
- Black cells (■) Months most suitable for control option specified
- White cells (□) Months that are unsuitable for control option specified
- Shaded cells (▨) Months that are less suitable for control option specified

6.2 Chemical control

There are four herbicides registered for use in the NT for the management of neem. Further herbicide trials are being undertaken at the time of writing to identify greater cost-effective chemical control options for neem.

6.2.1 Disclaimer

In the Northern Territory, a registered product must only be used in situations consistent to those appearing on the label, unless authorised under a permit; and a person:

- must not have in their possession or use a chemical product unless the product is registered in Australia (exemptions apply);
- may use a registered product at a concentration, rate or frequency lower than that specified on the label unless this is specifically prohibited on the label. This does not apply to herbicide use occurring under an APVMA permit;
- may use a registered product to control a pest not specified on the label provided the pest is in a situation that is on the label and use on that pest is not specifically prohibited on the label; and
- may also use a registered product using a method not specified on the label unless this is specifically prohibited on the label.

Users of agricultural (or veterinary) chemical products must always read the label and any permit, before using the product and strictly comply with the directions on the label and any conditions of any permit. Users are not absolved from compliance with the directions on the label or conditions of the permit by reason of any statement made in or omission from this publication.

Table 2: Herbicide management options for neem infestations

| Chemical and concentration | Rate | Situation and method |
|---|--|---|
| Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra | 350 mL / 100 L | Seedling (individuals and infestations under 2 m): Foliar spray when actively growing. Non-ionic wetting agent required. |
| Triclopyr 300 g/L and Picloram 100 g/L Various trade names | 350 mL / 100 L | Seedlings (individuals and infestations up to 2 m): Foliar spray when actively growing. Non-ionic wetting agent required. |
| Triclopyr 600 g/L Various trade names | 1 L / 60 L (diesel) 1 L / 60 L (diesel) | Seedling (individuals): Basal bark < 5 cm stem diameter, treat up to 45 cm from ground Adult (individuals or infestation): Cut stump > 5 cm stem diameter |
| Fluroxypyr 333 g/L Starane™ Advanced | 1.8 L / 100 L (diesel) 1.8 L / 100 L (diesel) | Seedling (individuals): Basal bark < 15 cm* stem diameter, treat up to 45 cm from ground Adult (individuals or infestation): Cut stump > 15 cm stem diameter |
| Triclopyr 240 g/L + Picloram 120 g/L Access™ | 1 L / 60 L (diesel) 1 L / 60 L (diesel) | Seedling (individuals): Basal bark < 15 cm* stem diameter, treat up to 45 cm from ground Adult (individuals or infestation): Cut stump > 15 cm stem diameter |
| Picloram 20 g/Kg Tordon™ granules | 35 to 45 g / m ² | Apply granules over an area extending from the main stem to 30 cm outside the dripline to cover the main part of the root system |

Non-chemical applications: Hand grubbing of small plants may be a viable option when the soil is moist however it is important to remove the entire tap root to prevent suckering. Mechanical control or burning can be used to improve access to infested areas for follow up chemical control.

* It is noted that basal barking can be effective on trees of larger diameter. Basal barking, being less labour intensive than cut stumping, may be a preferable option for sparse or remote infestations. Cut stump applications may be the best management option for trees in urban or landscaped situations where the dead tree material will be removed to retain aesthetics.

6.2.2 When to apply herbicide

Foliar herbicides should only be applied when the plant is actively growing to enable efficient uptake of herbicide by the plant. In the NT neem generally actively grows from January to May, although this may vary depending on water availability and rainfall. The recommended time of year for spraying therefore coincides with the wet season. When applying herbicides using a foliar spray the addition of a wetting agent is essential.

Basal bark and/or cut stump herbicide application techniques can be used year round; however the effectiveness will improve when applied to actively growing plants. It should be noted that basal barking can be effective on trees of larger diameter. Basal barking, being less labour intensive than cut stumping, may be a preferable option for sparse or remote infestations. Cut stump applications is the only suitable option for control of mature trees in urban and landscaped situations, as tree material will be removed avoiding hazardous situations associated with trees dying and becoming unstable.

Plants which are undergoing heat or water stress may not uptake the herbicide as effectively, resulting in lower kill rates. Avoid spraying plants when temperatures are extremely high or when plants are in standing water.

An effective management program based on herbicide use will require at least two to three treatments. The initial treatment of existing mature plants and any seedlings should ideally occur following the onset of initial wet season rains, when there is active growth. A follow up treatment in approximately two to four weeks after the initial treatment will be necessary to treat plants which may have been missed or newly germinated.

Continual maintenance is imperative as the introduction or production of any new seeds will enable the infestation to persist.

Any application of herbicides to trees growing in association with a watercourse or water body (i.e. on the banks or in the dry bed, but not growing in the water itself) must comply with the herbicide manufacturer's specifications. The same applies to herbicide application in a backyard situation; always ensure that herbicide manufacturer's specifications are complied with.

6.2.3 How to apply herbicide

Herbicide should be applied in a fine spray at a low application pressure to enable good coverage of the whole plant. A range of dyes are available where herbicides are sold, which can be used to identify where herbicide has been applied to the plant(s).

Basal bark treatment involves spraying around the whole stem up to 45 cm from the ground.

Cut stump treatment involves applying herbicide to a newly cut stump immediately following chain sawing. The cut should be horizontal and as close as possible to the ground. To treat large infestation areas, start at the edges and work inwards, gradually reducing infestation size.

6.2.4 Further Information

Information on the eradication and control methods described in this Plan can be found in the *Northern Territory Weed Management Handbook*. Copies are available by phoning the Weed Management Branch in Darwin on (08) 8999 4567 or online at <http://www.lrm.nt.gov.au/weeds/manage>

6.3 Non-chemical control

6.3.1 Physical removal

Individual plants (seedlings and juveniles) can be removed by hand or by using a mattock. The entire root mass should be removed and excess soil shaken off the root system to ensure regrowth does not occur. Physical removal is very laborious and may therefore only be effective and/or feasible where plant numbers are limited.

Due to the potential for high seedling emergence associated with a water course, the risk of soil erosion and other catchment protection issues, mechanical control is not recommended in these situations. Mechanical works within a watercourse may require authorisation in accordance with the *Water Act*.

6.3.2 Slashing, mulching or cutting

Slashing or mulching will not eradicate neem, however will provide easy access for other treatment options and create opportunities for more desirable species to establish. Many seedlings may emerge after these treatments, however removal of the mature plants can help achieve complete herbicide coverage of the seedlings; reducing costs and increasing control effectiveness.

Slashing, mulching or cutting can be undertaken at any time of year, but ideally should occur prior to flowering or seeding. Ensure equipment and machinery is cleaned after use. All cuttings need to be disposed of appropriately.

6.3.3 Stick-raking

Stick-raking can be used to kill plants and to clear access paths and fire access trails. It should be recognised that this level of soil disturbance will facilitate extensive seedling recruitment and follow up treatments with either fire or herbicide application will be necessary.

The removal of vegetation and disturbance of soils may lead to erosion if large areas are left bare. In particular, wet season rain events pose a risk to exposed soils. The Department recommends that, in the Top End of the NT, any soil disturbance activities do not commence prior to the 1st May and are completed and/or stabilised prior to 30th September. Information on erosion controls can be downloaded from the Department website www.lrm.nt.gov.au/soil/management

Management activities should only be attempted with clean machinery. Ensure equipment and machinery is cleaned prior to moving to new sites. All cuttings and lopped material should be disposed of appropriately.

6.3.4 Monitoring results and follow up

The physical removal of plants can result in prolific seedling germination. Follow-up control (chemical or non-chemical) must be undertaken as part of an ongoing maintenance program.

6.4 Fire management

6.4.1 Burning

Fire can be used to help provide access to infested areas for follow up chemical control or used as part of an integrated control program to kill young neem seedlings.

Hand held burners can be used to control neem in areas where chemical or mechanical control is not appropriate or possible. Flaming for at least 10 seconds around the base of each plant is required to kill mature plants.

6.4.2 When and how to burn

Fires can be highly destructive and hard to control making careful planning and a cautious approach essential.

Early burning (late wet /early dry season) will produce low intensity “cooler” fires, which are easier to control and less likely to damage native vegetation.

Well maintained and strategically located fire breaks or access trails can help to contain fires and provide access to control fires.

Any management incorporating burning must be in accordance with the *Bushfires Act* and *Fire and Emergency Act*. Please contact your local Volunteer Fire Brigade Captain or local fire station for permits to burn if you live within a Northern Territory Fire and Rescue Service Emergency Response Area (NTFRS ERA). If you live outside a NTFRS ERA, contact your local area Fire Warden through the Bushfires Council.

7. Developing a weed spread prevention program

Spread prevention is the most successful and cost effective way of managing weeds. As previously described neem seeds can be readily spread through a number of natural and non-natural means, in particular by birds, bats and humans.

Long distance spread can be very problematic from a management perspective. Spread facilitated by water flow (rain, floods), birds, bats and humans can result in distribution to environments which may be highly suitable for germination and establishment (such as other areas close to a water source).

Neem is a prolific seeder. Controlling neem prior to seeding is essential in preventing the spread of neem via seed distribution. Challenges for neem weed spread prevention include:

- the enormous amount of seed that can be produced from a mature tree each year with trees producing fruit after five years;
- the seeds are swallowed by birds and bats for their sweet pulp and seeds are passed out of the body undigested because of the hard endocarp of the seed. The seeds may be dropped far away from the parent tree;
- control needs to target the tap root. If this is not removed or treated, the plant will sucker and regenerate from the existing root stock;
- the difficulties in controlling large trees due to the costs of removal and their close proximity to large natives;
- many neems have been deliberately planted close to infrastructure which can be difficult to remove; and
- neem is considered by many to be a valued shade tree and for its broad spectrum insecticide properties.

7.1 Natural weed spread

The spread of neem seeds by natural means (birds and bats) is problematic as it is difficult to control their movement and eating habits. In some cases seeds can be carried in floodwaters further down the catchment. The focus must be on reducing the source of seed available to be spread.

Neem seedlings should be removed while they can still be easily sprayed or manually removed. This will stop thousands of neem trees reaching sexual maturity and prevent considerable further spread. Isolated plants close to water courses near the top of a catchment are a priority.

Ongoing follow up monitoring and control of seedlings is paramount to reducing the spread of neem.

7.2 Non-natural weed spread

The spread of neem by humans can result in neem seeds being located where they would not naturally spread to. This includes deliberate plantings.

It is illegal to transport, sell, buy or propagate neem plants or seed within or into the Northern Territory.

All lopped material should be chipped or disposed of appropriately.

7.2.1 A focused public education and awareness communication strategy was developed to compliment this Weed Management Plan as an integral part of neem management. The Strategy aims to:

- ensure the public and nursery industry understands the implications of neem establishment and spread in the NT and are prepared to undertake measures required to manage and control neem;
- enlist the public as the „eyes and ears“ to aid early identification of any spread or new outbreaks and remove neem seedlings;

Extension material, attendance at shows and field days and website information has been used to promote the declaration of neem and the public’s awareness and ability to identify and manage neem. These should continue to be published as necessary to ensure the risk of spread is minimised.

7.2.2 It is illegal to transport declared weeds. You must dispose of any weed material on site. Burning will destroy vegetative plant material and also render most seeds unviable and prevent prunings from growing roots. As some hard coated seeds may survive, on-site deep burial may also be required.

Seed transfer can also occur through the transport and sale of contaminated products. Care must be taken to ensure that any gravel, sand or other product moved between properties is free of neem seeds. Seeds are often also used by children in games which can result in the neem spread.

7.3 Hygiene procedures

Contaminated vehicles and machinery used in neem control, may be a source of neem spread. The following actions are recommended for inclusion into prevention programs to reduce neem spread:

- a) map and monitor isolated infestations;
- b) always work from clean areas back toward infested areas;
- c) schedule control works to occur prior to seed set;
- d) designate wash down areas (see below);
- e) ensure contractors and machinery operators are familiar with hygiene protocols and weed identification; and
- f) ensure machinery entering and leaving your property is clean.

7.4 Wash down facilities

Wash-down facilities should be established on all affected properties. These facilities may incorporate high pressure wash-down, compressed air blast, vacuuming and/or physical removal (e.g. hand brush).

Wash down facilities:

- a) must be located in an area(s) which will minimise the risk of spread (on or off site);
- b) must be regularly checked for weed seedlings which may have germinated from seeds washed off vehicles etc. Any weeds should be controlled immediately; and
- c) should be sited in cleared or developed areas to minimise the risk of undetected weed establishment and spread.

Where it is impractical to establish a wash-down facility, consideration is to be given to adopting alternative options and solutions to manage seed transfer.

7.5 Integrated natural resource management

Weed management should be closely linked to broader natural resource management at the property and catchment levels. Weed spread and germination can be enhanced in degraded areas, such as those impacted by erosion, wild fire, overgrazing and feral animals. Large feral animals, such as buffalos and pigs, can facilitate germination through behaviours such as roaming, wallowing and rooting.

These issues must be addressed in a weed spread prevention program if they are present in the area being managed.

Revegetation should also be considered in areas of large scale neem removal, particularly in the river corridor where erosion can occur.

8. Tracking progress and judging success

Tracking progress and judging success, through accurate record keeping, can achieve better long term management results. Previous management actions, whether successful or failed, can be critically analysed, reviewed and improved over time. Improved management actions can generally be determined with the help of a property management plan (refer Appendix B). A property weed management plan should include realistic time frames and goals, recognising that achievements, particularly with regard to established weed populations, may only become evident in the long term.

8.1 Local level

8.1.1 Follow up control

A key element in any weed management program is inspecting and, if necessary, re-treating eradication areas, buffers and containment areas. Areas where herbicide has been applied must be revisited after spraying but prior to seed set to ensure that the plant is dead.

8.1.2 Maintaining records

It is important to keep track of what is happening in “the bigger picture” i.e. is the weed control being undertaken contributing to the objectives of this plan? To accurately determine if, and what, progress is being made, records must be maintained that show weed control activities (outputs) and the results of the activities (outcomes).

Improvements relating to efficiency and expenditure are dependent on knowing exactly what is happening. A monitoring and management record may be requested at any time by the Weed Management Branch. An example of an appropriate format is at Appendix B.

8.1.3 The supply of neem distribution data

The supply of weed data to the Weed Management Branch by individuals and groups is fundamental to planning, prioritising and coordinating strategic weed management. The positive identification of neem in an unexpected area should be reported directly to the Weed Management Branch, as immediate action may be deemed necessary.

A more detailed description of neem on a property can be submitted in accordance with the *Northern Territory Weed Data Collection Manual*. This level of information collection and transfer is more important for large scale land owners, however all data received will be collated and recorded.

8.2 Territory level

8.2.1 How will we know if this Weed Management Plan is working?

Full compliance with a Weed Management Plan can require a great deal of effort, commitment and investment from land managers, particularly from those who are already affected by declared weeds. For this reason it is essential that the NT Government monitors whether the stipulated management actions are contributing towards the identified outcomes at a Territory level.

8.2.2 Adaptive management

Each Weed Management Plan has been drafted using the best information available at the time of writing. However, new information may become available which should be included in, or influence the structure and content of this plan. Allowing for this flexibility enables an adaptive management approach.

The NT Government is committed to applying an adaptive management approach to weed management across the Territory. Specifically it will use data and feedback gathered from land managers and other stakeholders to refine and improve future management decisions and ultimately, the weed management plans.

Continuous improvement can only be achieved if the following can be determined:

- if investments in weed management are resulting in progress towards the identified objectives; and
- if the recommended management actions are achieving the most effective and efficient control outcomes.

8.2.3 Performance indicators

A performance indicator is something which can be used to assess performance. The following indicators will provide a way to measure the performance of this plan against its objectives. This Plan also sets annual review targets against the stipulated management requirements (refer Appendix C).

Table 3: Performance indicators

| Performance indicator | What will be measured? | How will it be measured? |
|----------------------------|--|--|
| Increased awareness | Knowledge of issues and management Compliance | <p><i>Quantitative</i>; the following will be recorded:</p> <ul style="list-style-type: none"> • number of enquiries to weedinfo@nt.gov.au; • number of hits on internet site www.nt.gov.au/weeds; • number of reported breaches of the Act; and • number of major awareness raising events held and number of attendees. <p><i>Qualitative</i>; the following will be undertaken:</p> <ul style="list-style-type: none"> • key land managers to be questioned about their knowledge of relevant Weed Management Plans; and • liaison and consultation with land managers from a range of land tenures will continue. |
| Better information | Distribution data | Amount of data submitted by the public Strategic and targeted survey programs developed and implemented |
| | Density data | |
| | Areas under active management | |
| Better management | Eradication | Strategic and targeted monitoring programs developed and implemented |
| | Containment | |
| | Spread reduction | Reporting |

8.2.4 Government commitments and accountability

The Weed Management Branch will work with other Divisions from Department and other Government landholders to design and implement a monitoring program that allows this management plan, the management actions contained within it and the outcomes to be evaluated. The monitoring program should have sufficient resolution to allow management outcomes at a local through to regional management scale to be evaluated.

The Minister will consider advice from the public, community and industry stakeholder groups and the NT Weed Advisory Committee prior to approving, or making changes to, any statutory weed management plan.


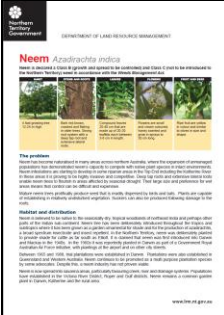
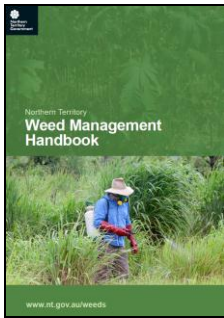
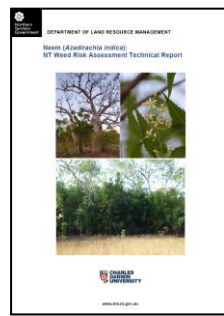
8.3 Communication

Effective and cooperative neem management can only be achieved if all stakeholders understand the risks posed by neem and the control methods needed to strategically manage these risks. The NT Government, through the Department, has an obligation to develop a communication strategy to ensure all stakeholders understand the risks posed by neem, have access to the most appropriate control methods for their situation and have a full understanding of their legal obligations with respect to neem control.

It is recognised that effective communication is always a two way process. The NT Government is dependent on receiving feedback from those who are involved in on-ground neem management so that this weed management plan and the communication strategy can be continually assessed, and subsequently improved. Please contact the Weed Management Branch with any information which could be used to refine the approach to managing neem and other declared weeds in the NT.

9. Support and information for land managers

The Weed Management Branch (DLRM) can provide training, advice and extension materials related to support improved neem management. The following documents are available by contacting your local Weed Management Branch or accessing the internet site www.nt.gov.au/weeds.

| | | |
|---|---|--|
|  | <p>Neem Weed Identification Table</p> | <p>Contains photos and written descriptions to assist with identification.</p> |
|  | <p>Neem Weed Note</p> | <p>Provides information on the neem identification, impacts, habitat, distribution and management.</p> |
|  | <p>NT Weed Management Handbook</p> | <p>Provides information on strategic and planned approaches to weed management, including integrated weed control methods. Specific information is provided on herbicides registered for use in the NT. The 46 „Weed control option tables“ include a colour photo of the weed in question, list which herbicides are registered for use, indicate optimum treatment times and which method/s can be employed for maximum effectiveness.</p> |
|  | <p>Northern Territory Weed Risk Assessment Report: <i>Azadirachta indica</i></p> | <p>Details the information used by an assessment panel to determine the level of risk posed by neem. Included references describe the environmental, economic, cultural and social impacts of neem and the feasibility of neem control.</p> |

The following documents are also available:

- Weed Risk Management System for the NT (Fact Sheet);
- Northern Territory Weed Data Collection Manual;
- Grow Me Instead: A Guide for Gardeners in the Northern Territory, Nursery & Garden Industry Northern Territory
- The Bush Book: A manual for managing native vegetation across northern Australia (2009), Maria Kraatz, Peter Jacklyn and Mike Clarke, Greening Australia (NT) Ltd.

This plan is consistent with the:

- *Weeds Management Act* and the *Weeds Management Regulations*
- National Weed Strategy; and
- The National Weed Spread Prevention Action Plan
- Integrated Natural Resource Management Plan

Appendix A: Summary of management requirements and related actions – neem

| Class B Objectives | Management Requirements | Management Actions |
|--|---|--|
| To prevent further introduction of neem into the Northern Territory | Ensure that the public and relevant industry members are aware that it is illegal to import or transport neem to or within the Northern Territory | Design and implement information and awareness resources and campaigns to raise the awareness to prevent the further introduction of neem to or within the Northern Territory. |
| | Ensure that the public and industry can identify neem and understand the risk it poses to the Northern Territory | Design and implement information and awareness resources and campaigns for the public and industry to identify neem and understand its risk to the Northern Territory and control options. |
| To control the growth and spread of neem. | Control seedlings, saplings and where feasible, mature trees. | Design and implement an annual control and containment program for neem that will assist you to contain and reduce infestations on your property. A property management plan should be used to determine areas of priority and establish the most appropriate control methods: <ul style="list-style-type: none"> • Chemical control (refer section 6.2); and • Non-chemical control (refer section 6.3). |
| | Implement early detection and management programs outside known established plantings and infestation areas | Regularly monitor/survey land, including previously treated areas, to identify new or re-establishing neem infestations at an early stage. |
| | Design and implement a weed spread prevention program. | If you have neem on your property, design and implement a weed spread prevention program (refer section 7), to ensure: <ul style="list-style-type: none"> • The removal of all neem seedlings and regular on-going monitoring; • Removal of isolated trees where possible; |
| | Prohibit the production, sale or purchase and transport of neem, seed or products. | Neem can reproduce vegetatively (from cuttings) and from seed, therefore transport of any viable plant material is not permitted. There should be no trade of plants for ornamental use. <ul style="list-style-type: none"> • It is illegal to transport, sell, buy or propagate neem plants or seed within or into the Northern Territory. |
| To apply an adaptive approach to weed management. | Develop and maintain an ongoing monitoring program. | It is suggested that a monitoring program be developed in accordance with the Monitoring Report Template attached at Appendix B. A Monitoring Report should record the type and location of all management actions undertaken, including active control, spread prevention and survey works. The result of these actions should be recorded, even if the desired result was not achieved. |
| | Maintain an accurate record of control methods applied and results achieved for possible collation at a Territory level. | A monitoring and management record, which includes current and past neem locations, may be requested by the Weed Management Branch. |
| | Evaluate the efficiency of control and containment programs over time. | Determine the success of various management actions employed and use this information to fine tune the performance of your management program. |

Appendix B: Suggested neem monitoring report template

- Your monitoring report should follow the format provide below.
- Digital versions of the form are available at www.nt.gov.au/weeds or by e-mailing weedinfo@nt.gov.au.
- Please contact your nearest Weed Management Branch if you need assistance.

| | |
|-----------------------|--|
| Property owner | |
| Mailing address | |
| Email address | |
| Phone | |
| Fax | |
| Mobile | |
| NT Portion/Lot number | |
| Region/Hundred | |
| Period of report | |

EXAMPLE ONLY

| Management Requirements | Management Actions | Neem location (scale map or GPS points to be provided) | Action taken (outputs) (include date and control technique) | Result of action (include observation notes) | Are any management changes necessary? | Outcomes |
|---|--|---|---|---|---|--|
| Eradication of isolated plants and outbreaks. | Design and implement an annual control and containment program for neem. A property management plan, including a weed management map should be developed. | Brumby paddock Scattered plants establishing along creek. Scattered plants at cattleyards. | 07 January 2014 Sprayed Brumby paddock. 14 February 2014 Sprayed Bullock paddock. 14 February 2014 Plants in creekline treated using cut stump and basal bark methods. | Poor results. Excellent results 100% kill. Excellent results 100% kill. | Late start to wet season, plants not very active: need to wait for rain. No change required. | 20 January 2015 Delay start of control program until rain commenced and plants active. |
| Seed spread prevention. | The design and implementation of a weed spread prevention program. | Whole of property | 11 September 2014 Installation of wash down bays and procedures. Weed ID manuals placed in shed/ vehicles. | No new neem infestations were identified. | No. | 20 January 2015 No new neem infestations were identified in clean areas. |

Appendix C: Targets

Objective 1: To prevent the further introduction of neem into the Northern Territory

| Management requirement | Target | Priority | Responsibility | Completion Timeframe | | |
|---|---|----------|----------------|----------------------|----------|-----------|
| | | | | Yr 1 - 3 | Yr 3 - 5 | Yr 5 - 10 |
| <ul style="list-style-type: none"> Prohibit the production, sale or purchase and transport of neem, seed or products. Ensure that the public and industry can identify neem and understand the risk it poses to the Northern Territory. | Design and implement information and awareness resources and campaigns to raise awareness to prevent the further introduction of neem to or within the Northern Territory | 1 | NT Government | √ | √ | √ |
| | Design and implement information and awareness resources and campaigns for the public and industry to identify and understand the risks. | 1 | NT Government | √ | √ | √ |

Objective 2: To control the growth and spread of neem

| Management requirements | Target | Priority | Responsibility | Completion Timeframe | | |
|--|--|----------|-----------------------|----------------------|----------|-----------|
| | | | | Yr 1 - 3 | Yr 3 - 5 | Yr 5 - 10 |
| <ul style="list-style-type: none"> Eradicate isolated plants and outbreaks. Implement early detection and eradication programs. Active containment of priority infestations. Prevent/minimise further seed production. Design and implement a seed spread prevention program. Prohibit the production, sale or purchase and transport of neem, seed or products. | Identify location, extent and density of infestations of neem. | 1 | All land users | √ | | |
| | Prioritise areas for control by identifying isolated and small infestations which are easy to treat, significant seed sources or areas with a high probability of seed spread and/or infestations in high value, neem free catchments or vulnerable areas. | 1 | All land managers | √ | √ | √ |
| | Programs and partnerships developed and implemented to manage infestations of neem in urban/townships. | 1 | All land managers | √ | √ | √ |
| | Programs and partnerships developed and implemented to manage infestations in remote localities (including outstations, communities and stations). | 1 | All land managers | √ | √ | √ |
| | Programs developed and implemented to prevent the spread of neem through pathways of spread by using best practice management. | 1 | All land users | √ | √ | √ |
| | Programs developed and implemented to control and/or eradicate (where feasible) neem on all NT Government and Defence controlled lands. | 1 | NT Government/Defence | √ | √ | |
| | Results of management activities are obtained from land holders. | 2 | NT Government | √ | √ | √ |
| | The number and size of infestations of neem is reduced. | 1 | All land users | | | √ |
| | Neem is actively managed. | 1 | All land managers | √ | √ | √ |

Objective 3: To apply an adaptive approach to weed management:

| Management requirements | Target | Priority | Responsibility | Completion Timeframe | | |
|---|---|----------|--------------------------------------|----------------------|---------|-----------|
| | | | | Yr 1 - 3 | Yr 3 -5 | Yr 5 – 10 |
| <ul style="list-style-type: none"> • Develop and maintain an ongoing monitoring program. • Maintain an accurate record of control methods applied and results achieved for possible collation at a Territory level. • Evaluate the efficacy of control and containment programs. | Results of successful eradication or control activities or trials are shared. | 3 | NT Government/Research organisations | √ | √ | √ |
| | Information and awareness resources and campaigns are developed and implemented to raise awareness and capacity of landholders to control and contain the spread of neem. | 2 | NT Government/Community Groups/NGOs | √ | √ | |
| | Information and advice on alternative appropriate shade trees is developed and provided to landholders. | 2 | NT Government | | √ | √ |
| | Review the effectiveness of Year 1-3 targets of the Weed Management Plan | 2 | NT Government | | √ | |

WEED MANAGEMENT BRANCH CONTACTS

For more information or advice in relation the identification, management or monitoring of weeds please contact the Weed Management Branch:

Phone: (08) 8999 4567 (Darwin)
(08) 8973 8857 (Katherine)
(08) 8962 4314 (Tennant Creek)

Email: weedinfo@nt.gov.au

Website: <http://www.nt.gov.au/weeds>

The NT Herbarium can also provide plant identification advice

Phone: (08) 8999 4516