Integrated Mexican Thorn Control Plan for Ascension Island

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Executive Summary

Ascension Island, a UK Overseas Territory in the equatorial South Atlantic Ocean, has faced significant ecological challenges due to the invasive Mexican thorn (*Neltuma juliflora*). Introduced in the 1960s to combat soil erosion during the construction of the Two Boats settlement, this species has since spread across the island, forming dense, impenetrable stands that threaten infrastructure and local wildlife and plant species.

The Mexican thorn, originating from Central America, thrives in Ascension's arid environment due to its extensive root systems, and resilience to drought. With no natural predators on the island, it has become the most damaging invasive species, adversely affecting nesting sites for green turtles (*Chelonia mydas*) and seabirds like the sooty tern (*Onychoprion fuscatus*). Mexican thorn offers rats and mice temporary or permanent refuge. Endemic plants such as the Ascension Spurge (*Euphorbia origanoides*) are threatened by grazing pressures from these pests.

In response to this ecological threat, the Ascension Island Government Conservation and Fisheries Directorate (AIGCFD), with funding from the Darwin Plus Initiative, has implemented the DPLUS134: Repelling the invader: turning the tide on Ascension's Mexican thorn Project. This project employs an integrated approach, utilizing chemical, mechanical, and biological control methods to manage and reduce the spread of the species. The key objectives of this project include:

- Controlling and managing the spread of Mexican thorn.
- Protecting ecologically important and aesthetically valuable sites from invasive species.
- Preventing the encroachment of invasive species on sites for infrastructure and operations.
- Establishing monitoring programs to detect and manage invasive species effectively.
- Provide recommendations on the most effective treatments in different situations.

The project aims to build local capacity and ensure the long-term contraction of Mexican thorn, leading to habitat restoration and improved ecological balance on Ascension Island.

Background

What is Mexican thorn?

Mexican thorn is a perennial deciduous thorny shrub or tree that can grow up to 12 m tall, with a trunk of 1.2 m in diameter, and often forms dense thickets. They are fast-growing, nitrogen-fixing, allelopathic, and very salt and drought-tolerant (Belton, 2008).

Mexican thorn is highly adaptable and has invaded numerous habitat types on Ascension: from lava fields, volcanic deserts, beaches, volcanic cones and craters, gullies, hillsides, and urban areas, particularly at lower altitudes. It is present up to around 500m altitude on the western side of the mountain around Middleton's Ridge (Belton, 2008).

Mexican thorn can change the landscape characteristics of invaded areas significantly, transforming bare ground and rock into dense vegetation. With increased leaf litter, the soil structure and nutrient levels change, providing opportunities for other invasive plants to establish. Mexican thorn provides a habitat and food resources for introduced vertebrate pests; donkeys, sheep, rabbits, rats, mice, and myna birds (Belton, 2008). These transformed areas also provide improved habitats for invasive invertebrates such as non-native ant species.

It has tentatively been concluded that there is only one species of *Neltuma* on the island. However, the Plant Protection Research Institute (PPRI) in South Africa has suggested that the *Neltuma* sp. on Ascension is likely to be the result of hybridisation with the most likely other species to be parents of a range of hybrids being *N. glandulosa* (Honey mesquite) and *N. velutina* (Velvet mesquite), both of which are very closely related to *N. juliflora* (Mesquite) (White, 2009).

Growth Habits

Mexican thorn generally has a weeping habit, with branching stems, long thorns, and bi-pinnate leaves. Trees start flowering at 3 – 4 years of age and the yellow-coloured flowers hang in clusters. These flowers develop into seedpods after about three months; initially bright green in colour, but turn pale yellow to brown and become 'S'-shaped as it ripens. The fruiting times of the individual plants on the island are staggered which is common in environments with relatively stable climates (White, 2009).

Seedpods were noted on trees in Waterside and Mars Bay Nature Reserves from November 2022 to January 2023, while in August 2023 seedpods were seen along NASA road, Pan Am, and North East (around Goat Hole) but were not present at Waterside or Mars Bay Nature Reserves.

Neltuma species are difficult to identify with several species looking very similar. Additionally, trees of the same species may adopt different habits or tree shapes depending on the site, or if they are cut or browsed. Also, leaves from a single tree or species can vary considerably in size. The leaf and stem morphology of Mexican thorn on Ascension is quite varied and appears to depend on the age of the plant and/or on how rapidly it has grown. Conditions such as temperature, rainfall, soil quality, salinity, wind, pH, and absence of pollutants are also contributing factors to consider.

In more favourable conditions, Mexican thorn trees can grow into 'proper' trees – meaning that these trees have relatively straight stems and some distinct branches that divide from the main stump (Figure 1). However, many mature specimens on Ascension have large twisted branches that divide from the main stump. Also, some mature specimens do not gain much in height but form very wide and very low thickets (usually less than 1m in height) (Figures 2 and 3). This growth form is more common in poorer quality, rockier, and windswept habitats close to the coastline.

Figure 1: The stem is usually exposed, relatively straight, and easily accessible © C. Visser

Figure 2: Mexican thorn shrub with creeping branches © C.Visser

Figure 3: Low thicket growth type common in barren rocky areas © C. Visser

The tree in Figure 1 represents the most common global growth habit, with an easily accessible stump and minimal need for branch removal, unlike the trees in Figures 2 and 3. The specimen in Figure 2 has low, spreading branches forming a wide carpet around a taller, shrubby center, likely due to wind, salinity, or rocky terrain.

Waterside Nature Reserve hosts many of these low-growing specimens, as shown in Figure 3. Despite being mature and well-established, these trees are difficult to remove. Their extensive branches may indicate multiple rooting points, each requiring herbicide treatment during cut stump application.

What is its history on Ascension Island

Introduction

Mexican thorn was deliberately introduced to Ascension Island in the mid-1960s during the construction of the Two Boats settlement to help consolidate soil. In the late 1980s, it became noticeably widespread across the majority of the island with dense stands forming around Two Boats and Donkey Plain (Belton, 2008).

Figure 4: Photos taken of Donkey Plain showing how Mexican thorn has encroached on this area since its introduction © AIGCFD

Mexican thorn has invaded most habitats on the island – it is present in lava fields, volcanic deserts, beaches, volcanic cones and craters, gullies, hillsides, and urban areas (Mexican Thorn SAP, 2015). Dense stands of Mexican thorn trees are present in the areas surrounding Traveller's Hill and in the central drainage basin running west from the Two Boats settlement towards Georgetown. Thinner stands are spreading along the valley that runs from Two Boats settlement to North East Bay and south towards the Wideawake Fairs and Mountain Red Hill (Belton, 2008).

Assessments done by Alan Mills Consulting suggest that 58% of the island was covered by Mexican thorn in 1996. This assessment was repeated in 2006 and suggested that approximately 20.6 km² of the island was covered with 7.1 km² classified as dense (Alan Mills Consulting, unpublished data). In 2008, the number increased to 72% (Mexican Thorn SAP, 2015). The density of cover varies from just a few trees present in areas like Hummock Point to impenetrable thickets in Donkey Plain near Travellers Hill. Further spread is likely without improved management actions (Mexican Thorn SAP, 2015).

Spread

Mexican thorn is spread through:

- Dumped garden waste
- Natural dispersal (gravity, wind, or water)
- By animals (donkey and sheep manure; rodents and birds)
- Transportation of gravel or soil from sites containing Mexican thorn seed
- Intentional plantings

*(*Ashmole, 2000*)*

Reproduction occurs primarily through seed. Seeds have a hard-outer layer that requires damage in the form of fire or ingestion from animals to stimulate germination. It is also a coppicing plant and has the ability to propagate through cuttings made of roots or stems. (Mexican Thorn SAP, 2015).

Uses

Mexican thorn was previously introduced to Ascension to aid in soil erosion control efforts. However, without proper control and continuous intervention, it has spread across the island and is now difficult to remove. Some community members have used Mexican thorn wood to make craft items on a small scale. Other people also use it as firewood.

Some inquiries were made in the past on the production and possible sale of charcoal. A kiln was purchased by AIG but was only used for a very short while as it was too labour-intensive and costly to keep the kiln operational (pers. comms. Ms. V. Knight, 2021).

Conflicts

1) Habitat modification

Mexican thorn is a pioneer species moving into barren landscapes where many other plants are unable to grow. It can form impenetrable thickets that significantly alter the physical structures of habitats, prevent human access, and impact native species. The leaf litter trees create can lead to the development of soil in previously rocky habitats. Signs of this early soil development are evident on Ascension. Reducing the cover of Mexican thorn would slow or halt the development of soil, making it more difficult for other invasive species to colonise these areas.

2) Impact on endemic and native species

Mexican thorn is efficient at monopolising available resources such as groundwater, light, and nutrients and has the potential to dominate vegetation across coastal lowlands, including former strongholds of the Critically Endangered endemic Ascension Island spurge. It has the potential to outcompete Ascension spurge in its native range *(*Mexican Thorn SAP, 2015).

Mexican thorn also poses a significant threat to:

- Habitat availability for nesting seabirds, green turtles, and Ascension Island spurge.
- Seabird chicks and eggs which are predated by rats and myna birds harbouring in these trees.
- Ascension spurge which can be grazed by rats harbouring in these trees.
- Green turtle eggs and hatchlings which are predated by rats harbouring in these trees.
- Geological formations and unique volcanic landscapes.
- Endemic and native invertebrate populations as non-native resource competition was elevated in habitat degraded by Mexican thorn (Chin *et. al.,* 2024).

*(*Belton, 2008*)*

3) Impacts on historical features, infrastructure, and human health

- Mexican thorn encroaches on infrastructure and recreational areas, including the football grounds at MUGA and the Letterbox hikes.
- Roots damage foundations and surfaces; above-ground parts block access and obscure structures.
- Historical sites like Deadman's Cemetery, Fort Hayes, and Jubilee are overgrown and damaged by the roots and branches.
- Control efforts, including chemical and mechanical treatments, are labour-intensive and costly.
- The plants support high densities of rodents while the flowers attract mosquitoes.
- Recent evidence shows its pollen is highly allergenic and can cause cross allergies to various foods.
- The thorns are poisonous and can lead to secondary infections.

Ascension's endemic species, including the land crabs and endemic invertebrates, became established on the island and evolved in the absence of Mexican thorn. Land crabs may, however, use the shade of Mexican thorn trees on their spawning migration routes, but do not require it for their survival.

The only endemic invertebrate that may be affected by the loss of Mexican thorn cover is the psocid (*Indiopsocus mendeli)*, which has been found in areas of Mexican thorn, though it has also been recorded from other plant species and so Mexican thorn is unlikely to be significant for its survival. Of the native invertebrate fauna, only very generalist species such as two species of bark fly, have a loose association with Mexican thorn. They will all have established and survived on Ascension in the absence of Mexican thorn and so will not be reliant on it. The only invertebrate species that show a strong association with Mexican thorn are abundant non-native ants, web spinners, and sac spiders. Mexican thorn would likely make Ascension more vulnerable to invasive species such as fire ants and disease-carrying mosquitoes if they got past Biosecurity.

4) Impact on feral mammals

Figure 5: Mexican thorn seedling growing in donkey dung © C. Visser

Feral donkeys and sheep present on Ascension are known to eat the seed pods of Mexican thorn, which are nutritious and used as livestock feed in some areas. They have other sources of food and it is usually only the seed pods of Mexican thorn that they eat during the periods when these are available. The donkey population is feral and unmanaged meaning it will expand up to the limit imposed by food resources. An ephemeral food resource such as Mexican thorn seed pods will not result in fewer hungry donkeys or support a larger population size in this long-lived species. The Mexican thorn trees do provide shade for donkeys, but there are other areas of shade available to them.

5) Interactions between invasive species

The spread of Mexican thorn on the island is facilitated by problematic invasive alien species such as rats, mice, rabbits, donkeys, sheep, and Indian myna birds (Belton, 2008). Rats consume seeds, flowers, bark, and shoots. Their presence around seabird colonies and sea turtle nesting beaches may therefore exacerbate predation of chicks, eggs, and hatchlings. Ascension Spurge plants, including their seed, are threatened by grazing pressures from these pests. It is also a possibility that Mexican thorn encourages soil formation which may harbour large populations of introduced invertebrate pests, predators, and parasites that could threaten the island's native flora and indigenous invertebrates. Mexican thorn has allelopathic capabilities that prevent other plants from growing in their vicinity (Mexican Thorn SAP, 2015).

6) Fire risk

Ascension Island has no natural fire regime. Large stands of Mexican thorn increase the risk of wildfires which can be dangerous due to smoke inhalation and as a threat to military installations, commercial sites, and settlements. It also poses an environmental risk to native and endemic fauna and flora (Mexican Thorn SAP, 2015).

Figure 6: Mexican thorn interacting with infrastructure and pests © C. Visser

History of Control

Methods used

1) Biological control

In 1997, two seed borer bruchid beetles, *Algarobius prosopis* and *Neltumius arizonensis*, were released on Ascension Island to control Mexican thorn. Additionally, sap-sucking insects such as psyllids, mirid bugs, and aphids, likely introduced accidentally from the Caribbean, were found attacking the thorn. The mirid bug *Rhinocloa* causes significant damage and tree mortality, while the psyllid *Heteropsylla reducta*, presumed to have arrived with the thorn, severely affects the growth of *Neltuma* species (White, 2009).

Table 1: Summary of biological control agents on Ascension Island

Biocontrol agent	Date introduced	Type	Mode	Degree of control
Algarobius prosopis	1997	Beetle	Seed borer	Insubstantial
Neltumius arizonensis	1997	Beetle	Seed borer	Insubstantial
Heteropsylla reducta (Psyllids)	Accidental	True bugs	Sapsucker	Substantial
Rhinocloa sp. (Mirids)	Accidental	True bugs	Sapsucker	Substantial
Aphids	Accidental	True bugs	Sapsucker	Substantial

(White, 2009)

Figure 7: *Algarobius prosopis* still present in samples collected on Ascension © J. Hoffman

Figure 8: *Neltumius arizonensis* is believed to have died out since its release © J. Hoffman

Algarobius prosopis (Figure 7) has spread widely through the Mexican thorn on Ascension, potentially destroying around 50% of the plant's seeds, while *Neltumius arizonensis (*Figure 8*)* has died out (Belton, 2008). White (2009) found that rats and mice cause significant seed damage across nearly 50% of the thorn's range. She also observed that 98% of sampled Mexican thorn trees showed stunting, with 30% experiencing heavy dieback. High insect damage became apparent in 1997 (White, 2009).

Despite substantial damage from introduced herbivores reducing new seedling recruitment, the Mexican thorn continues to spread on Ascension, albeit more slowly. Therefore, additional manual, chemical, and mechanical control methods are needed to manage its growth (Mexican Thorn SAP, 2015).

2) Mechanical Control

Cut Stump Application

Since the Conservation Directorate began clearance efforts within the Nature Reserves, the cut stump application has been a commonly used treatment method. Due to the often inaccessible nature of these sites, hand tools such as secateurs, loppers, silky saws, and reciprocating saws are typically employed. Chainsaws are used only when necessary and operated exclusively by licensed staff.

Heavy Machinery

Various organizations, including Encompass, Mitie, Yang Enterprises Inc., and the AIG Operations Department, occasionally engage in the removal or control of Mexican thorn when it encroaches on their operations. These organizations utilise bulldozers, particularly for clearing road verges, water tanks, pipelines, and areas involved in the Runway Project. However, the use of heavy machinery often results in trees being uprooted incompletely, leaving some roots intact and prone to regrowth. In such cases, exposed roots are sometimes treated with Garlon® Ultra herbicide, though the consistency of application remains difficult to ascertain.

Hand tools are necessary at certain sites, especially where delicate and sensitive installations are present. For instance, Encompass uses loppers and silky saws to access water pipelines for annual inspections that cannot be reached by larger machinery. Similarly, Babcock (CSO) may choose to manually weed seedlings from their installations.

Case study: Mars Bay Clearance 2015 to present

Mars Bay Nature Reserve, located along Ascension Island's southwest coastline, is an active seabird colony and a crucial breeding site for sooty terns. Declared a Protected Area in 2003, it has challenging terrain that limits the use of both hand tools and heavy machinery to avoid disturbing the birds.

The trees, with long thorny tendrils, required loppers and secateurs to remove thinner branches before accessing the stump. Thicker branches and stumps were cut using silky and reciprocating saws. For extremely thick stumps, the Park Warden team used chainsaws to reduce them to ankle height, still requiring hand tools for access.

Mexican thorn was cut to ankle height, and herbicide was applied to the stump and base. Seedlings were hand-pulled or uprooted with mattocks. Cut branches were stockpiled away from the stump and seed bank for easy inspection and to prevent obstruction. These piles dried out and provided shelter for sooty tern chicks without supporting invasive fauna.

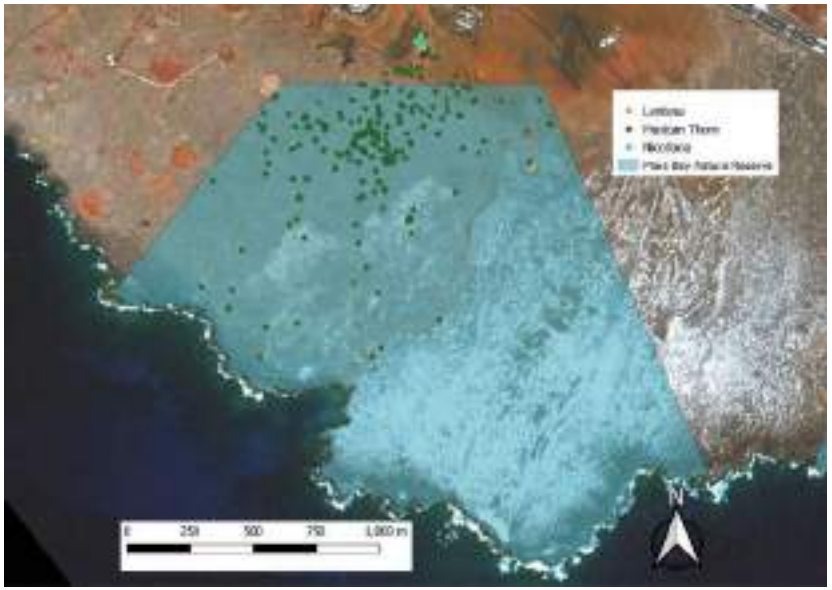


Figure 9: *Species managed within Mars Bay Nature Reserve* © AIGCFD

Herbicides used

When the clearance of Mexican thorn began on Ascension Island, Garlon® 4 Ultra herbicide was the sole herbicide utilised. In 2018, the standard mix for treating Mexican thorn was 120 ml of Garlon® 4 Ultra combined with 1 liter of used engine oil. This followed tests conducted in 2016 by a previous Conservation Fieldworker to determine the most effective adjuvant for mixing with this herbicide. The tests compared used engine oil, neat Garlon® 4 Ultra, 'clean' vegetable oil, and used vegetable oil. Although the sample size was small, neat Garlon® 4 Ultra was found to be the most effective, followed by the used engine oil mix, which balanced cost and effectiveness. Additionally, eco plugs filled with Garlon® 4 Ultra were drilled into the cut stumps of large trees as part of the treatment.

By 2018, however, there was consistent regrowth from many trees treated with the engine oil mix. Initially, it was suspected that the Garlon® 4 Ultra herbicide was expired, but trials with neat Garlon® 4 Ultra proved more effective, leading to the discontinuation of the used engine oil adjuvant in favor of neat Garlon® 4 Ultra until mid-2020.

In 2020, diesel was used as an adjuvant for Garlon® 4 Ultra. On Ascension, the mixture used was 40 ml of Garlon® 4 Ultra per 500 ml of diesel.

Successes achieved (or not)

Mars Bay Clearance 2015 – 2021

Mexican thorn was successfully removed from the Mars Bay Nature Reserve through clearance efforts completed between 2015 and 2021. However, the seed bank within the site remains viable for many years, and the potential for new infestations from outside the cleared area persists. To prevent Mexican thorn from re-establishing, ongoing maintenance and vigilant monitoring are essential. The site is inspected every 6 to 12 months, as well as a month following significant rainfall events.

Figure 10: *S*pecies clearance by volunteers within Mars Bay Nature Reserve © AIGCFD

Figure 11: Mars Bay were divided into sections of priority for management © AIGCFD

Previous biological control efforts

Following the initial monitoring of the 1997 biological control release on Ascension Island, there has been minimal assessment of the impacts of the bruchid release on Mexican thorn. This lack of monitoring has hindered a comprehensive evaluation of both the intentional and incidental effects of the biocontrol agents.

The bruchid release program was discontinued after residents reported that the bruchids were damaging garden leguminous plants similar to Mexican thorn, such as seed-work acacia (*Acacia farnesiana*) and *Leucaena leucocephala*. It was later determined that the damage was caused by *Acanthoscelides suramerica*, an accidental introduction unrelated to the biological control program (White, 2009).

Initial observations indicated that both species of bruchids had established populations. However, subsequent research suggests that *N. arizonensis* may have died out, while *A. prosopis* appears to have spread throughout most of the Mexican thorn range (White, 2009).

Critique of methods/chemicals used in the past

The cut stump method, when combined with the appropriate herbicide, is recognised as one of the most effective and rewarding ways to manage Mexican thorn. The selection of the correct herbicide is crucial for the success of this control strategy.

1) Environmental risk

Trials from 2016 indicated potential environmental issues. Herbicides used incorrectly can cause resistance in plants. Using herbicides in their concentrated form may damage plants and hinder herbicide absorption as it can potentially 'burn' the application surface, preventing absorption through the plant. The use of engine oil poses pollution risks, especially in sensitive areas like Nature Reserves. Foliar application should only be done in suitable weather conditions to prevent drift and leaching, with cone nozzles recommended to minimise drift. Ascension's coastal winds often do not meet the calm conditions required for effective spraying and as set out according to UK Standards.

2) Health and Safety risk

Adjuvants such as used engine oil and vegetable oil can interact negatively with herbicides, potentially causing long-lasting environmental damage. Foliar application in windy or rainy conditions can also pose health risks to applicators and the environment through leaching and drift to non-target species.

3) Financial and Resource risk

One could argue that staff time and resources such as vehicles, herbicides, tools, and equipment were not optimally used from 2018 to 2020. Ineffective treatments led to regrowth issues, as noted in the Mars Bay Clearance Report. The use of 'neat' herbicides and 'clean' vegetable oil is expensive, though used engine oil and vegetable oil were sourced for free.

4) Failure to monitor biocontrol releases

Monitoring of biocontrol agents was abandoned, leading to the loss of crucial data. This data could have informed very important Mexican thorn control efforts for the island. Multiple releases of *A. prosopis* and *N. arizonensis* were likely needed to establish a strong population on Ascension.

Mexican thorn Control Project Trials 2021—2023

The Mexican Thorn Control Project, funded by Darwin Plus, aimed to develop and test integrated methods — chemical, mechanical, and biological — for controlling the invasive Mexican thorn on Ascension Island. Mexican thorn is tough and often requires multiple, labour-intensive interventions to eliminate. Mechanical control involves physically removing or damaging plants, while chemical control uses herbicides. Biological control introduces specific natural enemies from the plant's native range to establish long-term, self-sustaining control.

The control methods trialled can be split into three different categories:

- Mechanical – the use of physical force to remove plants or damage plants to such an extent that it dies.
- Chemical – Killing plants by using a registered herbicide.
- Biological – using the plants' natural enemies to control host plant populations.

Figure 12: Mexican thorn clearance in Pan Am Nature Reserve © L. Shearer

Table 3: Summary of methods and herbicides included in the trials.

Control method	Types being trialled	Feedback or comments
Mechanical	**Bark stripping** • Remove bark from the trunk up to 1m above ground.	The tree is left standing after treatment. This method can only be used in areas where there is no risk of dead trees falling and causing damage to infrastructure or causing health and safety risks. It is labour-intensive and requires follow-up treatment for regrowth.
	Ring barking • Used on trees with stem diameters greater than 150 mm diameter. • Remove the bark and cambium in a 25cm wide band around the trunk.	The tree is left standing after treatment. This method can only be used in areas where there is no risk of dead trees falling and causing damage to infrastructure or causing health and safety risks. This method is time-consuming and labour-intensive to perform.
	Uprooting • Remove the entire plant and root system.	This method is effective but labour-intensive and challenging to perform in dense stands of Mexican thorn.
	Bulldozing road verges • Use heavy machinery to uproot or break trees down.	Follow-up treatment after mechanical removal is important as regrowth can occur from broken-off roots or stumps. Cut stump application with the addition of a registered herbicide can be used, or foliar application can be applied once fresh leafy growth is present.
Mechanical and Chemical	**Cut stump** • Cut the stump as low down to the ground as possible and apply herbicide. • The cut surface needs to be smooth and flat to ensure optimal herbicide absorption.	This is considered to be one of the most effective and rewarding control methods to use when dealing with Mexican thorn, although it is labour-intensive.
	Foliar application • Herbicide is applied directly to the leaves with a knap-sack sprayer. • Best results are expected in the growing season of the plant.	Environmental conditions such as wind and season play a role when using Sendero™ 336 SL herbicide during foliar application.

Control method	Types being trialled	Feedback or comments
Mechanical and Chemical	**Chemical frilling** • Make downward cuts to the bark and cambium layer and apply herbicide around the trunk. • The entire circumference of the trees needs to be treated.	As in the case of bark stripping and ring barking, chemical frilling is a method where trees are left standing. This method should only be considered where there are no health and safety risks involved. It is very time-consuming and labour-intensive and hard on your hands and wrists.
	Basal stem treatment • Herbicide is sprayed with a knapsack sprayer onto the whole circumference of the stem from ground level to 30 cm height. • Every stem arising from the ground must be treated.	Basal stem treatment has shown promising results thus far. The correct cone nozzle must be used during application. Weather conditions such as wind and temperature should also be considered. Turbodor®29 MPA is a ready-to-use (RTU) herbicide that is registered for basal stem treatment.
Herbicides tested	AIGCFD used Garlon® Ultra, Sendero™ 336 SL, and Turbodor® 29 mpa during the trials. AIG Operations Department and other organisations on Ascension use Garlon® Ultra for their clearance and control efforts.	
Biological	AIGCFD and our partners CABI put together a comprehensive risk assessment for the release of the *Evippe* moth (*Lepidoptera: Gelechiidae*). The moth has been introduced to parts of South Africa and Australia. In Australia, it has greatly reduced the growth and canopy size of Mexican thorns at release sites.	A batch of circa 300 caterpillars and pupae hidden in *Neltuma* leaf-ties were shipped to CABI in August 2022 for host range testing, from South Africa. Four separate releases were done on Ascension between April to September 2024. A number of caterpillars, larvae and pupae hidden in *Neltuma* leaf ties were shipped from CABI UK to Ascension and released at sites around Donkey Plain and St Mary's Grotto.

Proposed Way Forward

Proposed methods

Following the trials completed by the Mexican Thorn Control Project, the subsequent methods are recommended for all stakeholders to control Mexican thorn on Ascension. This section is designed as a guide for best practice recommendations.

Cut stump application

This method is still considered to be the most effective and delivers more consistent results. Ensure that the stump is cut to at least ankle height with a saw, lopper, or chainsaw (depending on the size of the tree). Apply a registered herbicide directly to the cut surface and around the base of the stem as soon as possible after cutting (within one hour of cutting), either with a handheld sprayer with a nozzle set to the correct spray width or by paintbrush.

a  b  c  d 

Figure 13: (a) Thorny tendrils are removed with loppers to gain access to the main stump. (b) The reciprocating saw cuts the stump down to at least ankle height. (c) Herbicides are applied to all the cut surfaces and around the base of the stump. (d) Chainsaws are used to remove large trees © C. Visser

Foliar application

This method is recommended for use in areas where it would be too labour-intensive to gain access to the tree stump by cutting away all the dense foliage. Take weather conditions such as wind speed, direction, and temperature into consideration before application. Ensure the knapsack and lance are clean and dry. Spray all the leaves of the trees to the point at which the herbicide starts to run off the leaves.

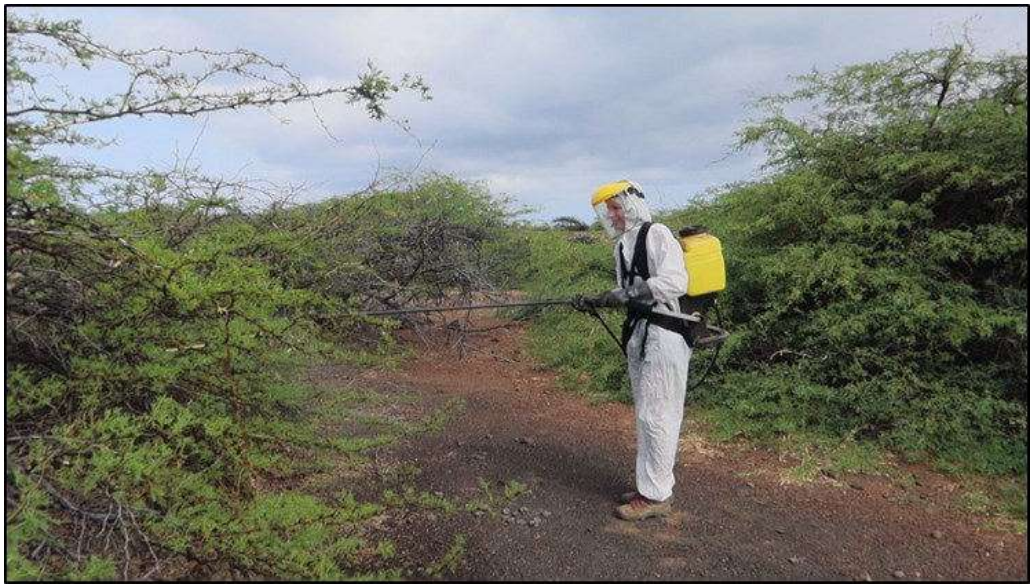


Figure 14: A registered herbicide is applied through a pressurised knapsack and sprayed on the leaves © C. Visser

Basal stem treatment

This method is recommended, but it is important to consider weather conditions such as wind (speed and direction) and temperature as this can cause spray drift and prevent the herbicide from working effectively. Ensure that the knapsack and lance are clean and clear of any trace amounts of bleach or water as this will dilute the RTU herbicide and prevent it from working effectively.

Figure 15: The registered herbicide is sprayed on the base of the stem down to the root crown © C. Visser

Uprooting

This should preferably only be considered and done where the whole root system of the tree can be removed. If some roots break off in the removal process, it must be treated with a registered herbicide. This is also only recommended where the plants are small enough to be successfully pulled out with the roots intact. The application of mattocks may also provide the necessary leverage.

Figure 16: Seedlings are uprooted by hand © C. Visser

Mechanical control (by using heavy machinery)

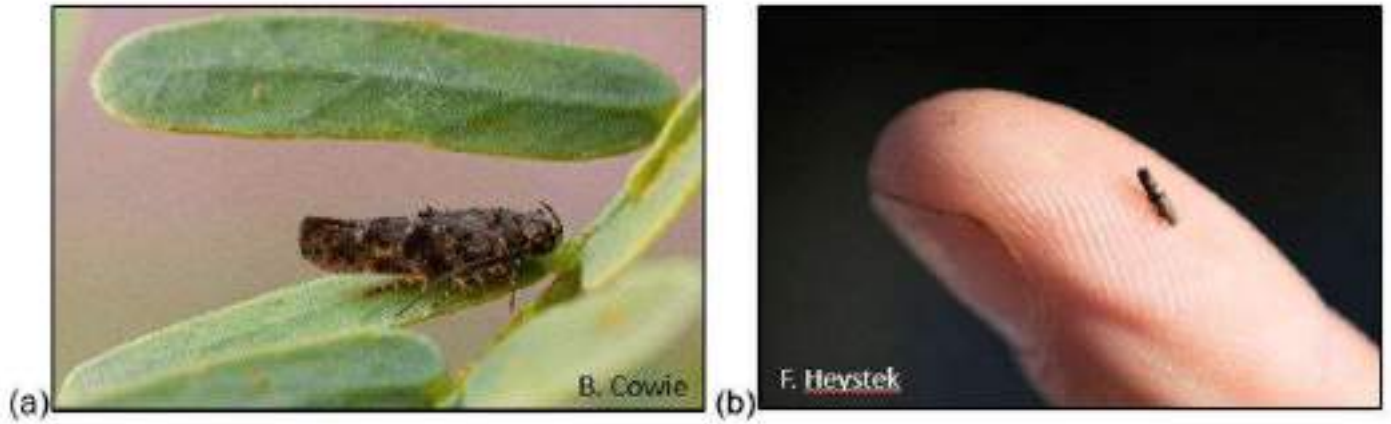
The bulldozing of road verges and any other operational needs can continue with the addition of a registered herbicide during their operations. Any exposed or broken-off roots must be treated with a registered herbicide. Any regrowth from these clearance efforts must be treated with foliar application as soon as regrowth is visible.

Figure 17: Machinery is used to clear Mexican thorn along road verges © L. Shearer

Introducing a new biological control agent, the *Evippe* sp. #1 moth

On Ascension Island, biological control, as part of an Integrated Control Plan, represents the only viable option for limiting the spread of Mexican thorn and has already been successful in slowing its advances through the introduction of the bruchid beetles in the past.

Recently, an additional biocontrol agent has been identified as suitable for introduction to Ascension Island. This agent, the *Evippe* sp., a leaf-tying moth from Argentina, has caused spectacular damage to *Neltuma* species in dry tropical parts of Australia and South Africa. Where it has become established it maintains high densities, resulting in greatly reduced growth rates and seed production of *Neltuma* species. The moth also causes defoliation of the plant over time and weakens it, making it more manageable by herbicides (Maczey and Tanner, 2013). Introduction of a biocontrol agent requires very careful consideration, comprehensive testing and community consultation prior to release. This process can take a period of years to gain enough confidence to risk the release of a biocontrol agent. The timeline for the introduction of this species is outlined below in Table 4.



Figures 18 (a) & (b): *Evippe sp.#* 1 in the quarantine facility in South Africa © CBC

AIGCFD has released *Evippe* sp. #1 moth to help control the highly invasive Mexican thorn, and a non-native shrub to the island. Under Section 40 of the Biosecurity Ordinance, 2020, the release of a biocontrol agent on Ascension was authorised by the Governor on the recommendation of the Chief Biosecurity Officer on 22 February 2024.

A public consultation period ran from 10th to 31st May 2023 followed by a meeting with Councillors on 01st June 2023. Conservation has sought to answer all questions and concerns through the Government Response to Consultation document published on the AIG website and the *Evippe* moth consultation meeting note circulated to the Council.

Following completion of the lettuce testing, a Risk Assessment was finalised using a modified version of the Department for the Environment, Food and Rural Affairs (Defra), UK, form for the application to licence the release of an invertebrate biological control agent (IBCA) in England. This document was reviewed by an independent expert from Fera Science and found to be comprehensive and clearly shows that the benefits of releasing the *Evippe* moth to manage Mexican thorn in Ascension Island will far outweigh the risks or any anticipated negative indirect effects. The *Evippe* Risk Assessment is available on the AIG website at: www.ascension.gov.ac.

Cultured moths were transported from the UK to Ascension in April 2024 for the first release to a culture facility in One Boat. Moths were released at suitable sites around Donkey Plain and St Mary's Grotto. Three other releases were done between April and September 2024. The DPL00084 project, BELEAF – Biocontrol: Evaluating Leaf-folding *Evippe* Activity on Flora, started a monitoring program in April 2024 that measures the impact of the moth around the release sites.

The release of the *Evippe* moth will benefit all organisations who have to undertake repeated control efforts to clear it from roads, buildings, pipelines, and installations. It will also prevent the damaging encroachment of Mexican thorn into globally important turtle and seabird nesting sites.

The *Evippe* release aims to establish a self-sustaining population of the moth on Ascension that will suppress the growth and vigour of Mexican thorn and form part of an Integrated Control Plan alongside mechanical and chemical methods. The presence of the moth should result in lower regrowth and regeneration of Mexican thorn following other treatments, enabling more effective and efficient clearance over the long term. The *Evippe* release will not result in the eradication of Mexican thorn from Ascension, but rather the control of the population.

How fast will it spread after its release?

Natural spread

The dispersal rate on Ascension will probably be rapid. *Evippe sp*. #1 is a small flying insect that can easily be carried by wind. In Australia, rates of increase were greatest at sites with warm winters and hot summers, possibly allowing a greater number of generations per year (van Klinken et al., 2009). The species is also an excellent disperser. It spread 1.3 to 3.6 km/year following release, and in one case spread ca. 115 km from a release site within three years (van Klinken et al., 2003), and over 1,300 km between isolated mesquite populations, presumably by wind (van Klinken et al., 2009).

Based on the published rates of spread from Australia, it is predicted that *Evippe sp. #1* should reach all parts of Ascension within two years of its release (Annexure 1). The natural spread of *Evippe* sp. #1 is likely to be restricted to areas where its target host *Neltuma* occurs.

Artificial spread

Based on the experience gained in Australia and South Africa, it is recommended to directly release any imported *Evippe* sp. #1 into a small number of suitable naturalised *Neltuma* stands. A small culture will be maintained in controlled conditions to allow for any unexpected events around the primary release and to allow for introductions to be made in other areas at later dates if seen as beneficial.

Cut branches of *N. juliflora* hosting *Evippe* sp. #1 leaf ties have been transported in contained boxes directly from the UK quarantine facility to Ascension. These branches were then placed into polystyrene boxes with holes cut for moth emergence and at the base of the box to allow water egress. These boxes were placed directly into a healthy *N. juliflora* trees, with sufficient shade to stop the boxes from overheating and with exclusionary measures against rats. Additional small releases have been made inside mesh sleeves along *N. juliflora* branches which would allow for monitoring of moth emergence, which may otherwise be hard to detect.

The control of non-native ants and rats at the release sites is important and would aid establishment.

a 

b 

c 

d 

e 

f 

Figure 19: (a) Rearing *Evippe* in controlled conditions at the CABI facility in the UK; (b) *Evippe* release at SKA in South Africa by ARC; (c) A polystyrene box is fastened to the tree which allows the adult moths to emerge safely and protected from heat and predators; (d) First release of *Evippe* on Ascension in April 2024; (e) Preparations of a release in a polystyrene box; (f) Preparations of a release in a sleeve (c) CABI, CBC and M. Morgan.

Table 4: Timeline of *Evippe*-related activities.

Action	Timeframe	2021				2022				2023				2024			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Seeds from eight endemic or valued plant species and Mexican thorn from Ascension were sent to CABI. The plants are currently being cultivated in the CABI quarantine facility in the UK.	October 2021 – March 2022																
Corin Pratt, a representative from CABI UK, collects specimens from Rhodes University in South Africa. CABI starts building an *Evippe* culture in the laboratory. Breeding starts to take place, but initially, there was female bias in the population with practically no males present. This phenomenon corrected itself as culturing continued.	August 2022																
Host range testing begins. Host range testing is a long and time-consuming process as each test needs to be replicated at least five to six times to ensure that the host range testing is successful. The aim is to complete all host range testing on all species by May 2023.	September 2022 – May 2023																
AIGCFD and CABI start with a draft RA. Host range testing is almost finalised. The results from the host range testing will inform the RA. The public presentation took place on 10 May 2023 at Saints Club. The public consultation period ends on 31 May 2023	May 2023																
Councillors request that lettuce be tested as part of the host range testing. CABI buys seeds and starts cultivating lettuce for host range testing. The Government Response document is published on the AIG website and shared on social media for input or feedback.	June 2023 – November 2023																

Action	Timeframe	2021				2022				2023				2024			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
The final RA is sent to CABI from AIGCFD. CABI / AIGCFD to send this to FERA and DEFRA for independent evaluation. Address any concerns DEFRA has and provide final recommendations for the use of *Evippe* on Ascension.	July 2023 – November 2023																
The independent review from Fera Science found that the risk assessment is detailed and comprehensive. The evidence provided shows that the benefits of releasing *Evippe* sp. #1 to manage the highly invasive weed *Neltuma juliflora* in Ascension Island far outweigh the risks or any anticipated negative indirect effects.	January 2024																
The Governor approved application to the release the *Evippe* moth as biocontrol.	February 2024																
Establish a small culture facility (net structure around Mexican thorn trees) and identify suitable release sites at Donkey Plain. Initiate rat and ant control around culture facility and release sites. Notify CABI of the decision and agree on a date for the transport of cultured *Evippe* to be transported from the UK to Ascension. Circulate public notice and articles in the local press and social media.	October 2023 – March 2024																
CABI to transport approximately 300 – 500 *Evippe* to Ascension. They will arrive as pupating larvae on the cut branches of Mexican thorn. Transfer approximately 100 *Evippe* larvae to the culture facility. Release the remaining larvae from release sites.	April 2024 – September 2024																
Monitor the presence of *Evippe* in the wild and its impact on Mexican thorn following the protocols established in the M&E strategy. Monitor the incidence of moths along transects around release sites. Consider further transport of *Evippe* from the UK to the Ascension culture facility as required depending on the success of establishment.	April 2024 – March 2025																

Proposed herbicides

The project proposes that the following herbicides be used for all control of Mexican thorn on Ascension. Contact details of suppliers are attached as Annexure 2. The MSDS and labels of these herbicides are added as Annexures 3 and 4.

Table 5: List of proposed herbicides

Herbicide	Description
Turbodor® 29 mpa **(L4920)**	It is a ready-to-use, low-volume, systemic herbicide for the selective control of problem plants as listed in conservation, grass pastures, forestry, and industrial areas. An increase in insect activity (borer beetles and termites) as well as saprophyte growth which is directed specifically at the treated areas, are recorded. The net effect is the promotion and acceleration of natural biological decay of the treated plants and a knock-on benefit of stimulating the local ecosystems.
Methods of application	Cut stump treatment (at least ankle height), basal stem application for which treatment should take place from knee height down to soil level. Low-volume foliar application for mostly cacti species.
Active ingredients	Triclopyr (Pyridyloxy Compound) (Acid equivalent) 29g/l (As butoxy ethyl ester) 40g/
Mixing ratio	Ready to use, no mixing required.
Sendero™ 336 SL **(L10569)**	It is a water-soluble concentrate herbicide for the selective control of woody plant species. This is the new standard in Mesquite control. This herbicide does not harm grasses and many desirable brush species. Controlling mesquite with Sendero™ 336 SL results in increased grass production and improved wildlife habitat.
Methods of application	Foliar application through a pressurised knapsack sprayer and suitable cone nozzle.
Active ingredients	Aminopyralid (acid equivalent) 60 g/L (as potassium salt), Clopyralid (acid equivalent) 276 g/L (pyridine compound)
Mixing ratios	For a knapsack with a **16L** capacity: Full knapsack sprayer: 128ml of Sendero 80ml of H&R crop oil 15L, 792ml of water Half knapsack sprayer: 64ml of Sendero 40 ml of H&R crop oil 7L, 896ml of water

Recommendation:

The AIGCFD strongly recommends the use of Turbodor® 29 mpa for future Mexican control efforts on Ascension Island.

- It contains the same active ingredients, (Triclopyr (Pyridyloxy Compound) (Acid equivalent) 29g/l (As butoxy ethyl ester) 40g/) as Garlon™ 480 EC herbicide.
- Turbodor® 29 mpa is sold as a ready-to-use (RTU) triclopyr-based herbicide. This will allow applications to occur with fewer incidences of human error.

Roles and Responsibilities

All land on Ascension Island is owned by the government. Therefore, responsibility for control generally falls with government agencies in particular AIGCFD. Some leasers or occupiers of government land may have a vested interest in controlling IAPs to protect their assets.

AIGCFD

The Directorate will take responsibility for overall project management, delivery, and public engagement of the project. The Project Leader has extensive project management experience and AIG has a financial and procurement team who will assist with project budgeting and ordering.

CABI

With a long history of implementing biological control programmes globally (including the release of the seed-eating beetles on Ascension, CABI is well placed to carry out the required work on Mexican thorn and to undertake both laboratory and greenhouse evaluation, as well as field trials, to determine the host specificity and efficacy of control agents.

CABI can conduct the necessary research on *Evippe*, including cultivation, additional host plant testing and release, as well as post-release monitoring of establishment by delivering the following:

- Carry out the collection of *Evippe* sp. #1 from successful release sites in South Africa and transport, under license, to the specialist quarantine facility for further assessment and cultivation in Egham, UK.
- Conduct any remaining host specificity studies on key non-target species using our high-level containment infrastructure in the UK.
- Application to the appropriate bodies for the eventual release of *Evippe* sp. if appropriate and subsequent monitoring.
- The production of an in-depth report on the feasibility of *Evippe* sp. as a natural control agent for *Neltuma juliflora* and the success of establishment after release on Ascension

(Maczey and Tanner 2013)

Centre of Biological Control (Rhodes University)

- Written information and or website links to access information on *Evippe* moth.
- Photographs of the *Evippe* moth itself, impact at release sites and culture facilities.
- Stakeholder engagement information – are farmers or local communities supportive of biocontrol; do they show interest or hesitation in *Evippe* being released on their farms? Are there any interviews or questionnaires available to access?

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- Consultation and initial planning of the Integrated Mexican thorn Control Plan and Monitoring and Evaluation Plan.
- Recommendations on herbicides to test or use in the Mexican thorn Project.

Other role players

AIG, Mitie, Yang Enterprises Inc., Babcock, Encompass, Sure, and MET Office will prioritise clearance efforts based on their current need. Most companies leasing land from the Government may have a vested interest in controlling invasive species, such as Mexican thorn, to protect their assets (Belton, 2008). These companies are however encouraged to develop clear monitoring objectives and plans to ensure continuous control. Each stakeholder will keep their work areas clear of Mexican thorn and prevent encroachment on infrastructure.

Where to start

Manageable Units of Ascension Island

The island can be divided into seven (7) manageable units (Table 5). This will assist in effectively controlling all invasive alien plants (IAPs) present within these distinct boundaries. Each Manageable Unit has a distinct purpose and will have its own set of objectives and goals to achieve within a pre-determined timeframe. All IAPs present per unit are listed in order of priority for clearance in Table 6. A description of IAPs and the recommendations for control are listed in Annexure 9.

Table 6: Manageable Units for Ascension Island

Manageable Units	Description	Who is responsible?	Details
AI001	Nature Reserves and Green Mountain National Park (including buffer zones)	AIGCFD	Manageable Unit AI001 consists of the Nature Reserves (Long Beach, South West Bay (also known as Pan Am), North East, Mars Bay, Waterside, Letterbox, and Boatswain Bird Island Sanctuary) as well as Green Mountain National Park. The newly declared Nature Reserves; South Coast Nature Reserve and Hummock Point also form part of this list. AIGCFD is responsible for the maintenance and control of highly invasive species such as Mexican thorn within these areas. Mexican thorn poses a threat to these habitats as it competes with endemic plants for resources. These areas were declared as important protected areas they provide: • Important strongholds for endemic Ascension spurge *(Euphorbia origanoides).* • Strongholds for endemic plants on Green Mountain. • Important seabird and turtle nesting sites within the South Atlantic. • Protection for Ascension's unique invertebrates. • Protection of important Landcrab (*Johngarthia lagostoma*) habitat and main spawning locations. **Priority:** Management efforts should start within our Nature Reserves which is aimed at protecting our green turtle and seabird populations. Action Plans have been developed for each Management Plan and are included in Annexures 6, 7, and 8.
AI002	Outliers		Clearance of Mexican thorn beyond their current range. • NASA road • Portuguese Trail • (Oates's) Cricket Valley • Hummock Point Valley • Beyond Echo Canyon • Middleton's trail **Priority:** Prioritise walk-throughs at least once a year (as capacity allows).

Manageable Units	Description	Who is responsible?	Details
AI003	Infrastructure maintenance	AIG, Mitie, Yang Enterprises Inc., Babcock, Encompass, Sure, and MET Office	Several role players are responsible for infrastructure maintenance on their work sites. Mexican thorn poses a threat to their daily operations as its thorny branches and roots encroach and damage their infrastructure. The different role players include: • AIG Operations Directorate • Encompass (Water and electricity supplier) • Mitie (contractor for MOD) • Babcock (contractor for CSO) • Yang Enterprises Inc (contractor for USAF) • Sure (Internet service provider) • MET Office The following infrastructure needs regular maintenance and management: • Road safety • Water pipelines • Electricity stations • Buildings • Water treatment areas • Fuel station • Military installations (including Wideawake Airfield) • Earth station • Seismographic monitoring sites Priority: Each stakeholder will keep their work areas clear of Mexican thorn and prevent encroachment on infrastructure.
AI004	Road safety	AIG OPS Department, Yang Enterprises Inc., and Mitie	AIG Operations Department, Yang Enterprises Inc., and Mitie use heavy machinery such as bulldozers and trucks to remove vegetation within the area adjacent to the road surface which promote drainage, provides a run-off area for traffic and improves visibility (Invader Plant Specialists, 2017). Keeping the road shoulders and reserves clear from vegetation also allows for improved visibility and safe run-off for traffic (Invader Plant Specialists, 2017). Priority: AIG Operations Department, Yang Enterprises Inc., and Mitie remove vegetation along road verges for road safety and improved visibility as required.

Manageable Units	Description	Who is responsible?	Details
AI005	Geological features	**None	Ascension Island is a geologically young formation. Due to low rainfall and geologically recent eruptions, its soil consists mostly of clinker. Roots from Mexican thorn have the ability to transform the physical characteristics of the island. Sites that need intervention to remove or prevent Mexican thorn invasion includes: • South Gannet lava flow to the southeast • Devil's Ashpit • Devil's Cauldron • Sister's Peak and lava flow to the north • Lava lakes • Devil's Riding School • St Mary's Grotto • Command Cave • Bird Cave • Broken Tooth and Hollow Tooth Priority: Prioritise walk-throughs at least once a year (as capacity allows). Assistance from volunteers will be needed to achieve this output.
AI006	Historical heritage	**None	Mexican thorn forms impenetrable thickets and threatens to transform the landscape. These trees have the ability to encroach and will ultimately engulf unique historical sites found across the island namely: • Hydroponics area in Donkey Plain • Heritage forts • Scouts Beach hut and campsite • Golf course behind Georgetown and One Boat golf course • 'God be thanked' water tank and pipeline • Dampier's Drip • Ahmadiyya Mosque • The Lizard • Firing ranges (along North East road and close to wind turbines) • Priority: Prioritise walk-throughs at least once a year (as capacity allows). Assistance from volunteers will be needed to achieve this output.

Manageable Units	Description	Who is responsible?	Details
AI007	Inaccessible areas	** None	These areas are classified as inaccessible for management as the sharp rocky outcrops and poor underfoot conditions make it near impossible for machinery or people to reach these sites. Heavy machinery will possibly damage the lava flows that often provide suitable habitat for endemic invertebrates, however, little to no endemic or native plant species are found in these areas. This area can be considered as an ecological corridor for wildlife and a source of natural plant material (Invader Plant Specialists, 2017). The expectation is that the *Evippe sp*. #1 moth will reach and control Mexican thorn growing in these difficult-to-reach areas. Priority: • Visit these sites to determine whether the moth has spread here after its release. • Monitor the establishment of the *Evippe* moth as well as the health status of the culture and the trees after one month of release. • Take drone images at three-month intervals before and after the release. One year after the moth's introduction, yearly drone images can be taken.

**The management of these sites is not achievable within the current capacity and resources of AIGCFD. All land on Ascension is owned by the Government, therefore responsibility for control of alien invasive species generally falls with Government agencies. Some occupiers of Government land may have a vested interest in controlling invasive plants to protect their assets (Belton, 2008).

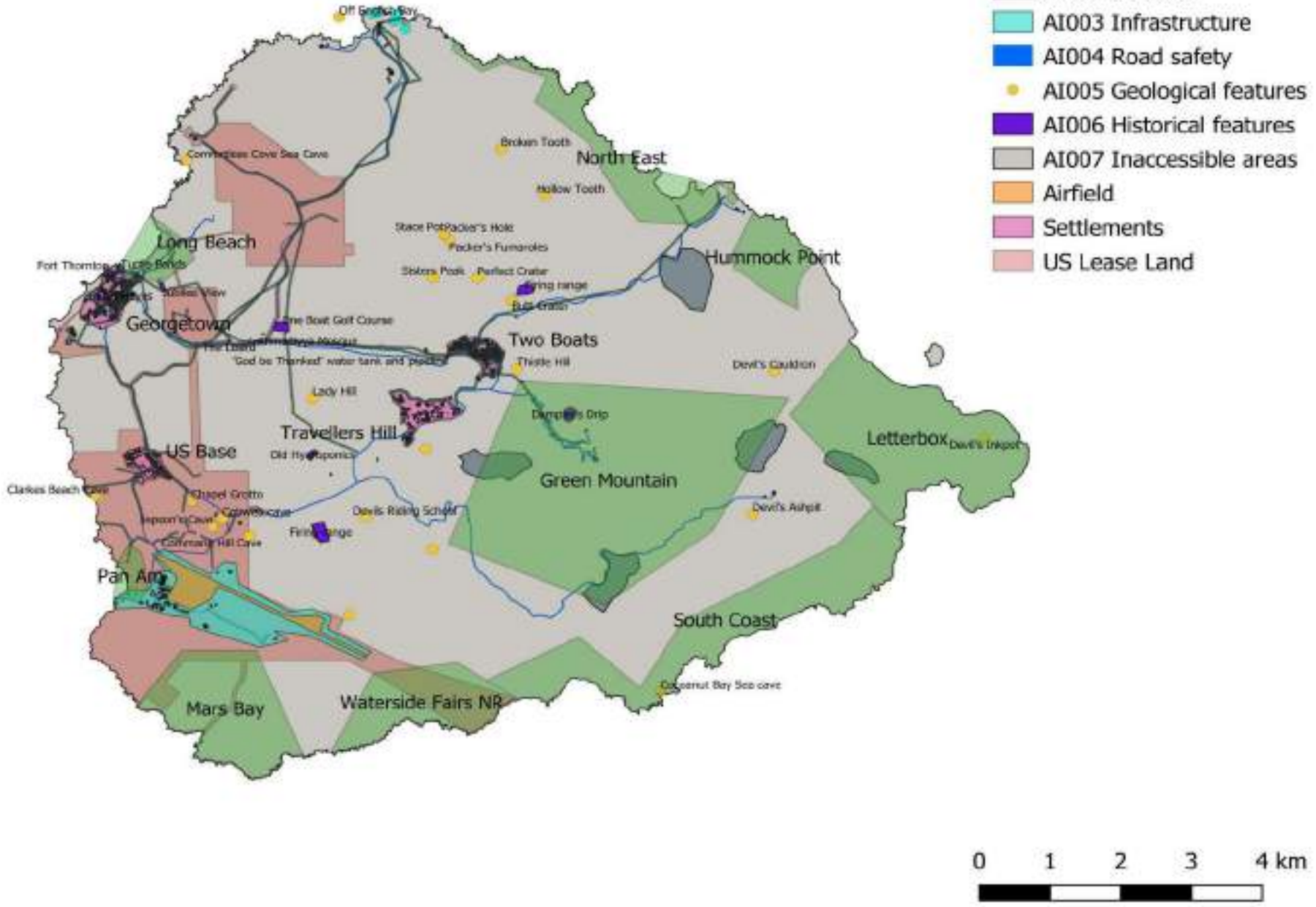

Figure 20: Manageable Units for Ascension Island

Species present on Ascension Island

The IAP species present within these Management Units are recorded in Table 6 and listed according to priority for control. It is important to note that the Integrated Control Plan only lists species co-existing with Mexican thorn in their shared environment. This Plan also only proposes methods for the control of Mexican thorn. The proposed methods, herbicides, and monitoring program is discussed in Section 4. The IAP species list will be updated regularly to include any new infestations once detected within these Management Units.

Table 7: Presence and absence of IAPs within each Management Unit on Ascension Island

All IAPs present within each Unit are summarised in Table 7. The level of priority is indicated through the colour-coding system (Low – green), (Medium - yellow), and (High - red).

Species per Management Unit									
Management Unit	Mexican poppy	Australian pine tree	Black lantana	Tree tobacco	Red-flower prickly pear	Guava	Mexican thorn	Wild mango	Yellow boy
AI001									
Beach NRs									
Wideawake Fairs NRs									
Letterbox NR and Boatswain Bird Island Sanctuary									
Hummock Point NR									
South Coast NR									
Green Mountain NP									
AI002									
Outliers									
AI003									
Infrastructure maintenance									
AI004									
Road Safety									
AI005									
Geological features									
AI006									
Historical features									
AI007									
Inaccessible areas									

Handling Biomass

Cut material from mechanical or chemical clearance efforts should be dragged away from the original cut stump and leaf litter. This will allow for easy inspection of seedlings possibly growing from the existing seed bank and monitor possible regrowth on the cut stump. Cut branches can be stockpiled into stacks approximately 2m high and 3m wide nearby, allowing easy access to sites, especially in areas where Mexican thorn forms dense stands.

The cut material is left to dry out and decompose *in situ* to not disturb surrounding vegetation. These stockpiles can provide shelter for sooty tern chicks similar to living trees, but without providing the resources used by invasive fauna such as rats, mice, and myna birds. Outside of bird nesting areas, the community of Ascension can collect cut material to use as firewood or timber.

During clearance efforts, the seedpods are removed from all the cut branches and collected in bin bags. These bags are taken to the dump to burn at the end of the work day. AIG Operations Directorate usually transports all cut material by truck from their work sites to the dump as well to be burned.

Figure 21: Stockpiles of Mexican thorn material on North East Bay Nature Reserve © AIGCFD

Monitoring and Evaluation

Monitoring and Evaluation can be defined as a continuous management function that assesses if progress is made in achieving expected results, spots possible hold-ups in implementation, and highlights whether there are unintended effects, either positive or negative, from a project and its activities. The monitoring outcome is also intended to adaptively guide management decision-making. The goal of these activities is to improve outputs, outcomes, and impacts.

Complete eradication of Mexican thorn may no longer be possible on Ascension due to the extent of the infestation; however, the threat could be minimised through implementing monitoring and control interventions. Mechanical and chemical control efforts are deployed as direct and immediate action against Mexican thorn, while the release of the biocontrol agent, *Evippe sp.* #1 will provide a long-term control technique to help keep Mexican thorn numbers in check (White, 2009). Therefore, the recording of new species or newly invaded areas should be immediately adopted into the Control Plan.

The desired state for all Manageable Units of Ascension Island is to prevent adult trees from setting seeds and ultimately prevent the recruitment and establishment of seedlings in these Management Units. The seed bank will remain active for several years, so regular monitoring will be necessary to control regrowth and seedling growth. For AIGCFD, monitoring is essential to ensure that management actions are making a positive contribution towards protecting the natural features of the Nature Reserves and achieving the Management Plan objectives. These monitoring actions are reviewed annually and linked to the Management Plan objectives. The Action Plans for the Nature Reserves and Green Mountain National Park are attached as Annexures 6, 7, and 8. Monitoring activities will largely be delivered by the AIGCFD, though volunteers and external partners will also be involved.

Monitoring objectives

The objectives of monitoring Mexican thorn control are to determine the change in number, size, maturity, and density of infestations and to assess the presence and extent of any re-growth from treated plants or recruitment from seed. This can be achieved by monitoring a representative sample of sites before and after control (Belton, 2008).

1) Monitoring the Mexican thorn population on Ascension

Monitoring of invasive species such as Mexican thorn is important as it provides an initial starting point for the Control Plan, as well as allowing for Adaptive Management.

The first step of monitoring comprises before and after photos of areas where clearance efforts have taken place. Fixed-point photography is useful as visual change over time can be monitored easily. This will allow the tracking of clearance progress and may help to calculate regrowth which can inform future follow-up interventions if seedlings or regrowth is recorded. The efficacy of current clearance methods and herbicide usage can be accessed as well. This involves repeated field surveys to track progress or success and to determine the efficacy of control methods implemented.

A) Monitoring for Early Detection

Early detection monitoring is implemented before unwanted species arrive in an area. In this case, this will apply to Management Unit 002 – Outliers, as we want to prevent Mexican thorn from moving into areas where no trees have been recorded before and to prevent a seed bank from establishing. It is important to prevent trees from moving into these sometimes difficult-to-reach areas.

This is considered to be the most effective form of monitoring because rapid eradication takes place as soon as Mexican thorn seedlings or saplings are recorded; therefore, future control efforts are minimal.

- These activities are aimed at finding seedlings or saplings when they first appear within areas such as NASA road, Portuguese Trail, Cricket Valley, Hummock Point Valley, Echo Canyon, Middleton's trail, or, other sites where Mexican thorn has not spread to yet.
- Walk-throughs of these sites should take place at least every six months.
- The number of seedlings, location, clearance methods, and/or herbicides used should be recorded.
- GPS coordinates of treated plants should also be recorded.

B) Monitoring for the Effect of Management Actions on Mexican thorn

The Mexican thorn Control Project trialled new methods which needed to be assessed for efficacy by conducting regular walk-throughs within treatment sites. The number of trees, treatment methods, and herbicides used were recorded. GPS coordinates were also recorded at each site. Signs of death (the browning or yellowing of leaves in the case of basal stem and foliar application were recorded and how long it took to show these signs.

Through this form of monitoring, the Project could determine which methods would be the most cost-and labour effective methods to implement on Ascension.

C) Monitoring for the Status and Trends of Mexican thorn

Mexican thorn is present across most of the island landscape. Terrain and weather conditions do not deter or prevent trees from moving into different areas. There is a persistent seedbank which requires constant monitoring and the removal of seedlings or saplings. The trees on Ascension display staggered seeding patterns across the island which is common in environments with relatively stable climates.

The trees on Ascension display different growth forms across the island. Some form distinctive and relatively straight stems which would be easy to cut down with a chainsaw or reciprocating saw. Other mature specimens do not gain much height but form very wide, dense, and low thickets which are more difficult to treat. This form is more common in the poorer quality, rockier, and windswept habitats close to the coastline.

2. Monitoring the biocontrol agent, *Evippe sp*. #1 itself, and the effect on the Mexican thorn population (tree health).

Monitoring to confirm the establishment of *Evippe* sp. #1 should be conducted at least once a week after the release and once a year thereafter. Most of the beneficial impacts such as the dieback of Mexican thorn may not be detectable for several years.

A) Monitoring establishment and efficacy

Monitoring should focus on the documentation of larval activity, namely defoliation and the presence of leaf-ties. Their presence and density can be evidenced by simply taking a series of photographs. It is then easy to complement these with photographs of caterpillars and pupae after opening a number of leaf-ties. The presence of adult moths will be more difficult to demonstrate but this is not necessary.

The extent of establishment and spread can easily be documented through a selection of monitoring points covering the majority of Mexican thorn stands before the start of the monitoring. At each monitoring point, photographs should not only be taken of individual branches but also of whole trees or stands and should repeatedly be taken from the same place throughout the monitoring programme so that changes in tree health and cover can be documented.

Additional small releases could be made inside mesh sleeves along Mexican thorn branches which would allow for monitoring of moth emergence which may otherwise be hard to detect. This may however not be feasible as the mesh may get ripped by the thorns when placed over the branches which will defeat its original purpose.

Sticky traps or no-kill moth bucket traps could also be placed in surrounding trees to assess emergence and dispersal, but could risk excess moth mortality and may be surplus to monitoring requirements. Given good establishment and spread, the leaf mining and tying by *Evippe* sp. #1 should be suitable for assessing the moth's progress on Ascension.

B) Environmental impact

To assess the environmental impact, it is proposed to use earth observation satellite imagery and drone photography, to establish baselines prior to the release of the IBCA and measure cover by Mexican thorn over subsequent years. This should be complemented by an assessment of potentially increasing cover by other non-native woody plant species. Before and after photos of the release sites and surrounding areas will be taken with the drone for monitoring the success of the moths' establishment on Ascension, but also the health of the trees and how they respond to the continuous defoliation facilitated by the biocontrol agent.

Action Plans for the Nature Reserves are attached as Annexures 6 to 8. For a more detailed report on the monitoring actions for Ascension Island, refer to the Monitoring and Evaluation Plan for managing Mexican thorn (*Neltuma juliflora*) on Ascension Island, 2023.

Proposed Resources and Timelines for 5 years of controlling and monitoring the spread of Mexican thorn

Action	SMART Indicators	Priority	2023				2024				2025				2026				2027			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Document Invasive Alien Plants (IAPs) present per Management Unit	List of IAPs with coordinates.	Before clearance efforts commence.																				
		Walk-throughs to take place every 3 months to ID new species.																				
	Drone images of Management Units.	Take drone images of all Management Units every 6 months.																				
Document IAP distribution	Maintain an updated map of IAPs.	Once every year																				
Clearing of vegetation should be undertaken as a phased process as work progresses at priority sites.	Keep a record of all clearing and control activities with detailed information on the season during which the control measures were implemented, the herbicide used, and the successful application method. GPS the treated trees.	Weekly																				
Document and record control measures implemented.		Annual Year reports - after 1 year.																				
Monitor and treat regrowth when seen on work sites.	Walk-throughs to monitor and record regrowth or seedlings present.	Every 3 months																				
Review control measures and success rates.	Decline of IAPs abundance reported over time.	Once every year																				
Ensure appropriate equipment and PPE is available and replaced as necessary.	Keep inventory of equipment with detailed information and store electronically.	Once-off purchase																				
	Check equipment regularly and record if faulty.	Check condition every 9 months or as needed.																				

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MSDS – Sendero™ 336 SL herbicide

MSDS – Turbudor® 29 mpa herbicide

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Photo credits:

P.1: Corin Pratt; P.3: AIGCFD; P.4: Chrisna Visser; P.8: Chrisna Visser & Toby Hunt; P.9: Chrisna Visser; P.10: Jo. Hoffman; P.11: AIGCFD; P.12: Toby Hunt; P.13: AIGCFD; P.14: AIGCFD; P.16: Chrisna Visser; P.17: Laura Shearer; P. 20: AIGCFD; P.21: Chrisna Visser; P.22: Chrisna Visser; P.23: Chrisna Visser & Laura Shearer; P.24: Blair Cowie & Fritz Heystek; P.26: CABI, CBC & Mel Morgan; P.29: Chrisna Visser; P.31: AIGCFD; P.33: AIGCFD; P.38: Phil Lambdon; P.40: AIGCFD; P.41: AIGCFD; P.44: AIGCFD; P.45: AIGCFD; P.48: AIGCFD; P.49: Rebecca Nightingale; P.75: Toby Hunt; P.76: Toby Hunt; P.77: Toby Hunt; P.78: Chrisna Visser & Phil Lambdon; P.79: Toby Hunt; P.80: AIGCFD

Acknowledgments

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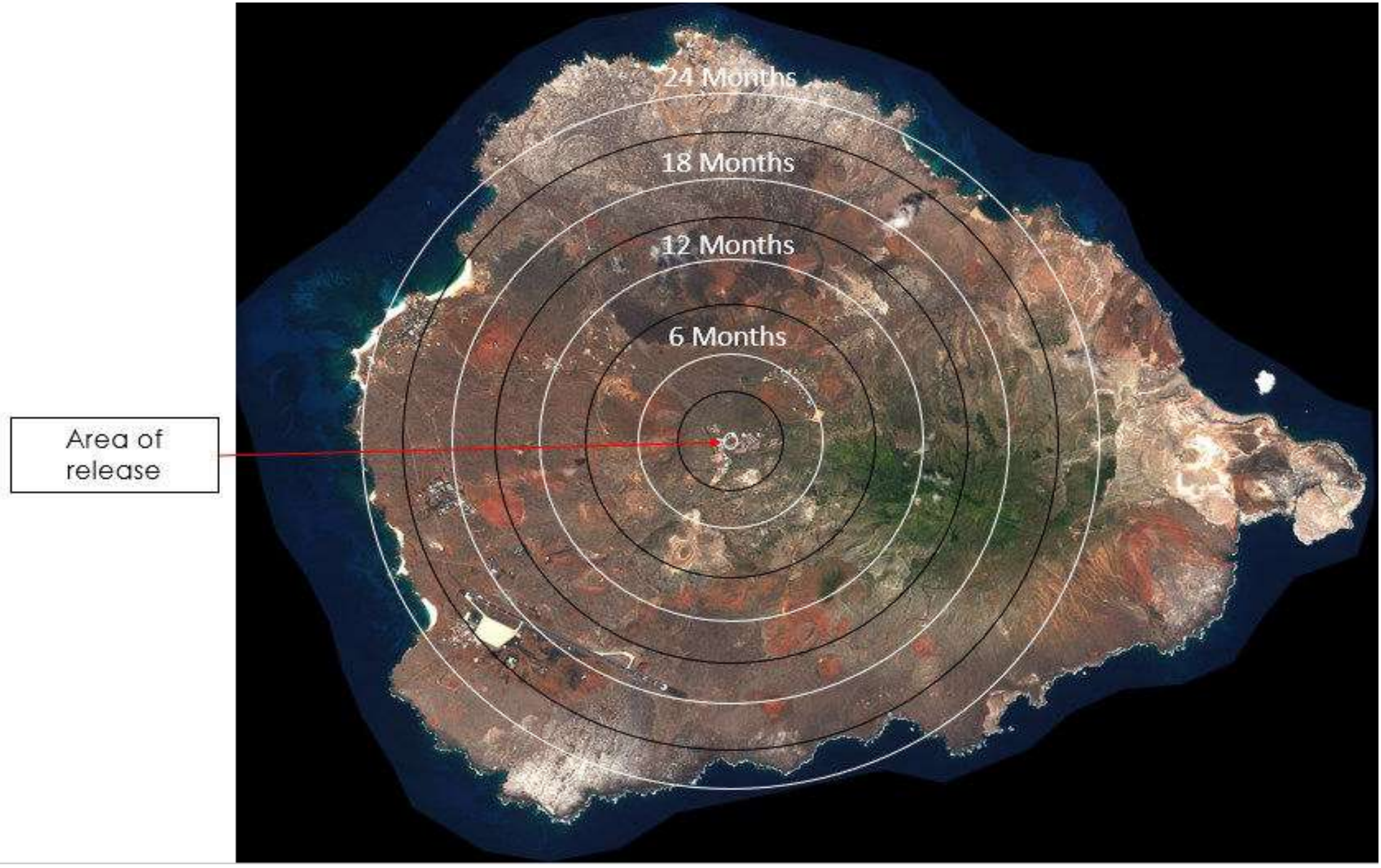
Annexures

Annexure 1: Theoretical Spread of *Evippe sp. #1* on Ascension.



Annexure 2 – Contact details of external role players and herbicide suppliers

Company name	Contact person	Contact information	
CABI	Norbert Maczey (Senior Ecologist/Entomologist)	n.maczey@cabi.org	
	Corin Pratt (Research Scientist - Invasive Species Management)	C.Pratt@cabi.org	
Centre of Biological Control (CBC), Rhodes University	Martin Hill (Director: Centre for Biological Control (CBC))	m.hill@ru.ac.za	
	Philip Ivey (Researcher)	p.ivey@ru.ac.za	
Invader Plant Specialists (Pty) Ltd	Dr Graham Harding	harding@pixie.co.za	
	David Harding	david@invaderplantspecialists.co.za	
Herbicide suppliers			Product
Ecoguard Biosciences (Pty) Ltd 22 Eiland Street, Eiland Park, Paarl, 7646	Abie Theron (Regional Technical Sales Manager)	paarl.sales@ecoguard.co.za	Turbodor® 29 mpa
	Lisa Garcia (Office Administrator)	admin.paarl@ecoguard.co.za	
InteliGro	Derek Nicholson (Crop Solution Specialist (CSS)	DerekN@inteligro.co.za	Sendero™ 336 SL
	Chantelle Juretic (East London Depot)	eastlondon@inteligro.co.za	
	Chantelle Adoons (East London Depot)	EastLondonAdmin@inteligro.co.za	

Annexure 3 - Sendero™ 336 SL Label and MSDS

Dow AgroSciences

SENDERO™ 336 SL

HERBICIDE

REG. NO. L10569 ACT/WET NO. 36/1947

SPECIALITY HERBICIDE

A WATER SOLUBLE CONCENTRATE HERBICIDE FOR THE SELECTIVE CONTROL OF WOODY PLANT SPECIES AS LISTED IN GRAZING, GAME RANCHES, CONSERVATION AREAS, FORESTRY, INDUSTRIAL AREAS AND ON NON-CROP LAND.

A WATEROPLOSBARE KONSENTRAAT ONKRUIDDODER VIR DIE SELEKTIEWE BEHEER VAN HOUTAGTIGE PLANT SPESIES SOOS AANGETOON IN GRASWEIDINGS, WILDPLASE, BEWARINGS AREAS, BOSBOU, NYWERHEIDSGEBIEDE EN OP LANDE WAAROP GEWASSE NIE VERBOU WORD NIE.

HERBICIDE GROUP CODE **O** **ONKRUIDDODERGROEPKODE**

Active ingredients/Aktiewe bestanddele:

Aminopyralid (acid equivalent) (as potassium salt)	60 g/ℓ	Aminopiralied (suurekwivalent) (as kalium sout)
Clopyralid (acid equivalent) (pyridine compound)	276 g/ℓ	Klopiralied (suurekwivalent) (piridien verbinding)

NET VOLUME _____L **NETTO VOLUME**

REGISTRATION HOLDER / REGISTRASIEHOUER
DOW AGROSCIENCES SOUTHERN AFRICA (PTY) LTD / (EDMS) BPK
REG NO 1967/007147/07
MAXWELL OFFICE PARK, MAGWA BUILDING
GROUND FLOOR, MAGWA CRESCENT
WATERFALL CITY, MIDRAND, 1686 SOUTH AFRICA
™Trademark of/ Handelsmerk van Dow AgroSciences

Batch No. ..... Lot No.

Date of Manufacture ....Datum van Vervaardiging

UN NO: N/R

Poison Centre (Cape): +27(0)21-689-5227
Poison Centre (Pretoria): +27(0)800-111-9900
Poison Working Group: +27(0)82-446-8946
24 Hour Emergency Tel No: +27(0)83-123-2911
Information Hotline Tel No: (012) 683-5700

SENDERO™336 SL/2018-06-00

WARNINGS:

- Do not swallow. Very low toxicity when swallowed.
- Essentially non-irritant to eyes.
- Essentially non-irritant to skin.
- Store in a cool place.
- Store in original container.
- Store away from food, feedstuff, seeds, and other agricultural chemicals and out of reach of children, uninformed persons and animals.
- In case of poisoning, call a doctor and show this label.

RE-ENTRY:

Do not enter treated area until spray deposit has dried unless wearing protective clothing.

GRAZING POISONOUS PLANTS: Herbicide application may increase palatability of certain poisonous plants. Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock.

DO NOT APPLY SENDERO™ 336 SL TOGETHER WITH GARLON™ MAX 270 EW (L8511) **AS A TANK MIX BY MEANS OF AERIAL APPICATION WITHIN THE PROVINCE OF KWAZULU NATAL.**

Although this remedy has been extensively tested under a large variety of conditions the registration holder does not warrant that it will be efficacious under all conditions because the action and effect thereof may be affected by factors such as abnormal soil, climatic and storage conditions; quality of dilution water, compatibility with other substances not indicated on the label and the occurrence of resistance of weeds against the remedy concerned as well as by the method, time and accuracy of application. The registration holder furthermore does not accept responsibility for damage to crops, vegetation, and the environment or harm to man or animal or for lack of performance of the remedy concerned due to failure of the user to follow the label instructions or to the occurrence of conditions which could not have been foreseen in terms of the registration. Consult the supplier or registration holder in the event of any uncertainty.

PRECAUTIONS:

- Keep out of reach of children
- Wear protective gloves and face shield or safety glasses when handling the concentrate.
- Do not breathe in fumes or spray mist.
- Wash contaminated clothing daily after use.
- Wash with soap and water after accidental skin contact.
- Avoid eye contact. In case of eye contact, flush eyes with clean water.
- Do not eat, drink or smoke whilst mixing, applying or before washing hands, face and contaminated skin, and a change of clothing.
- Prevent spray drift onto other crops, grazing, rivers, dams, any other water sources or areas not under treatment.

- Clean application equipment thoroughly after use and ensure that all traces of **SENDERO™ 336 SL** and, if applicable, **GARLON™MAX 270 EW** (L8511) are removed. (See "Sprayer Cleanup" section of this label).
- Prevent contamination of food, feedstuff, drinking water and eating utensils.

SYMPTOMS OF HUMAN POISONING:

- There are no specific signs of poisoning.
- The concentrate may cause moderate eye irritation.
- Prolonged or repeated skin contact may cause allergic reactions with local redness in some individuals.
- Ingestion of large amounts may cause gastro-intestinal irritation.

FIRST AID TREATMENT:

Description of first aid measures

General Advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing.

Inhalation: Move person to fresh air. If person is not breathing, call an emergency responder or ambulance, then give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask etc.). Call a poison control center or doctor for treatment advice.

Skin contact: Take off contaminated clothing. Wash skin with soap and plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Eye contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

Ingestion: No emergency medical treatment necessary.

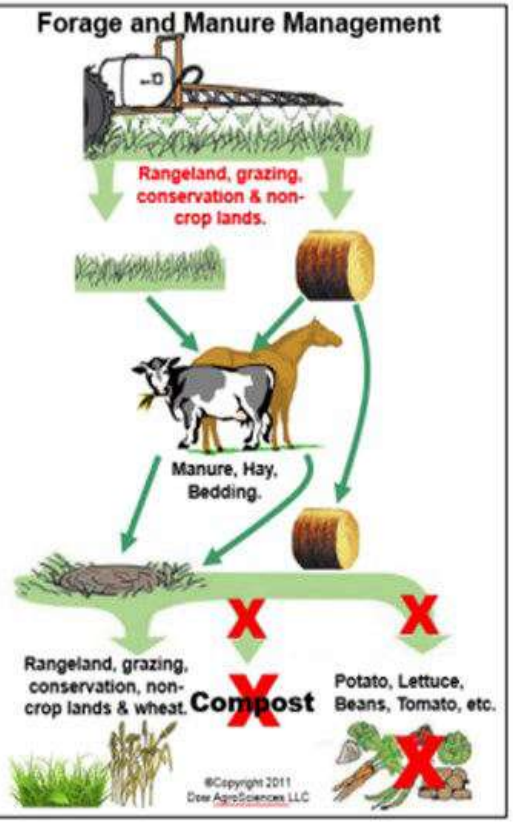
Indication of any immediate medical attention and special treatment needed
Notes to physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Have the Safety Data Sheet, and if available, the product container or label with you when calling a poison control center or doctor, or going for treatment.

USE RESTRICTIONS:

- **Do not apply SENDERO™ 336 SL** together with **GARLON™ MAX 270 EW** (L8511) as a tank mix by means of aerial application within the province of KwaZulu Natal.

IMPORTANT USE PRECAUTIONS AND RESTRICTIONS TO PREVENT INJURY TO DESIRABLE PLANTS

- Carefully read the section ***"Restrictions"***
- It is mandatory to follow the ***"Restrictions"*** section of this label.
- Manure and urine from animals consuming grass or hay treated with this product may contain enough aminopyralid to cause injury to sensitive broadleaf plants.
- Consult with a Dow AgroSciences representative if you do not understand the "Use Precautions and Restrictions".



Precautions for avoiding injury to non-target plants are:

- **Do not use hay or straw from areas treated with SENDERO™ 336 SL within the preceding 18-months or manure from animals feeding on hay treated with SENDERO™ 336 SL in compost.**
- **Do not use grasses treated with SENDERO™ 336 SL in the preceding 18-months for seed production.**
- **Avoiding Injury to Non-Target Plants:** Do not allow spray drift to come in contact with, any broadleaf crop or other desirable broadleaf plants, including, but not limited to, alfalfa, cotton, dry beans, flowers, grapes, lettuce, potatoes, radishes, soybeans, sugar beets, sunflowers, tobacco, tomatoes or other broadleaf or vegetable crop, fruit trees, ornamental plants, or soil where sensitive crops are growing or will be planted. Avoid application under conditions that may allow spray drift because very small quantities of spray may seriously injure susceptible crops.
- **SENDERO™ 336 SL is highly active against certain broadleaf plant species.** Do not use this product on areas where loss of broadleaf plants, including legumes, cannot be tolerated.

- **Chemigation:** Do not apply this product through any type of irrigation system.
- **Do not contaminate water intended for irrigation or domestic purposes.** Do not treat inside banks or bottoms of irrigation ditches, either dry or containing water, or other channels that carry water that may be used for irrigation or domestic purposes.
- Do not apply this product to lawns, turf, ornamental plantings, urban walkways, driveways, tennis courts, golf courses, athletic fields, commercial sod operations, or other high-maintenance, fine turfgrass areas, or similar areas.
- Trees adjacent to or in a treated area can occasionally be affected by root uptake of **SENDERO™ 336 SL**. Do not apply **SENDERO™ 336 SL** within the root zone of desirable trees unless such injury can be tolerated. Use special caution near roses, and leguminous trees.
- When used in Forestry do not apply **SENDERO™ 336 SL** within or near compartments or on open areas that are planned for tree establishment at a later date.
- Applications made during periods of intense rainfall, to soils saturated with water, surfaces paved with materials such as asphalt or concrete, or soils through which rainfall will not readily penetrate may result in runoff and movement of **SENDERO™ 336 SL**. Injury to crops may result if treated soil and/or runoff water containing **SENDERO™ 336 SL** is washed or moved onto land used to produce crops.
- Exposure to **SENDERO™ 336 SL** may injure or kill susceptible crops and other plants, such as grapes, soybeans, tobacco and sensitive ornamentals.
- **Grazing and Haying Restrictions:** There are no restrictions on grazing or grass hay harvest following application of **SENDERO™ 336 SL** at labelled rates. Cutting hay too soon after spraying weeds will reduce weed control. Wait 14 days after herbicide application to cut grass hay to allow herbicide to work. Do not transfer grazing animals from areas treated with **SENDERO™ 336 SL** to areas where sensitive broadleaf crops occur without first allowing 3 days of grazing on an untreated pasture. Otherwise, urine and manure may contain enough aminopyralid to cause injury to sensitive broadleaf plants.
- **Grazing Poisonous Plants:** Herbicide application may increase palatability of certain poisonous plants. Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock.

Restrictions in Hay or Manure Use:

- Do not use treated plant residues, including grass, woody plants, trees, hay or straw from areas treated within the preceding 18-months, in compost, mulch, wood chips, or mushroom spawn.
- Do not use manure from animals that have eaten treated forage or hay within the previous 3 days, in compost, mulch or mushroom spawn. Livestock must have 3 days of eating non-treated materials in order to clear their system of herbicides. Do not use treated plants in areas where commercially grown mushrooms or susceptible broadleaf plants may be grown.
- Do not spread manure from animals that have consumed treated forage or eaten hay within the previous 3 days on land used for growing susceptible broadleaf crops.
- Manure from animals that have consumed treated forage or hay within the previous 3 days may only be used on areas used for pasture, grass grown for seed, wheat and corn.
- Do not plant a broadleaf crop (including soybeans, sunflower, tobacco, vegetables, field beans, peanuts, and potatoes) in fields or areas treated with aminopyralid or manure from animals that have grazed forage or eaten hay harvested from

aminopyralid-treated areas until an adequately sensitive field bioassay is conducted to determine that the aminopyralid concentration in the soil is at level that is not injurious to the crop to be planted.

- Do not plant a broadleaf crop in fields or areas treated in the previous year with manure from animals that have consumed treated forage or hay until an adequately sensitive field bioassay is conducted to determine that the aminopyralid concentration in the soil is at level that is not injurious to the crop to be planted.
- To promote herbicide decomposition, plant residues should be evenly incorporated in the surface soil or burned. Breakdown of aminopyralid in plant residues or manure is more rapid under warm, moist soil conditions and may be enhanced by supplemental irrigation.

Crop Rotation:

- Do not rotate to any crop from rangeland, permanent pasture or conservation areas within one year following treatment. Cereals and corn can be planted one year after treatment. Most broadleaf crops are sensitive to aminopyralid residues in the soil and prediction of crop safety by field bioassay is the BEST way to determine planting options. Broadleaf crops such as canola, flax, and alfalfa can require at least 2 to 3 years depending on the crop and environmental conditions. More sensitive crops such as soybeans, tobacco, peanuts, potatoes, and peas may require a longer plant back interval and should not be planted until a field bioassay shows that the level of aminopyralid present in the soil will not adversely affect that broadleaf crop.

- **Do not move treated soil** to areas other than sites for which **SENDERO™ 336 SL** and, if applicable, **GARLON™ MAX 270 EW** (L8511) is registered for use.
- **Do not apply through a mist blower.**

Apply the product strictly in accordance with the application directions.

Resistance Management Guidelines:

- Development of plant populations resistant to this herbicide mode of action is usually not a problem on rangeland, permanent grass pastures, conservation areas, or non-cropland sites since these sites receive infrequent pesticide applications.
- In croplands, use an effective integrated pest management (IPM) program, integrating tillage or other mechanical methods, crop rotation or other cultural control methods into weed control programs whenever practical.
- Similar looking biotypes of a given weed species occurring in a treated area may vary in their susceptibility to a herbicide. Application of a herbicide below its labeled rate may allow more tolerant weeds to survive and a shift to more tolerant biotypes within the treated area.
- Where identified, spreading of resistant weeds to other fields may be prevented by cleaning harvesting and tillage equipment before moving to other areas and by planting weed-free seed.
- Contact your extension specialist, certified crop consultant, or Dow AgroSciences representative for the latest resistance management information.

COMPATIBILITY:

SENDERO™ 336 SL is compatible with **GARLON™MAX 270 EW** (L8511) and **H&R Crop Oil** (L6802) as a tank mix.

When mixing **SENDERO™ 336 SL** in combination with **GARLON™MAX 270 EW** (L8511) as a tank mix, the warnings, precautions, use restrictions and directions for use, of both agricultural remedies concerned, must be fully adhered to.

Do not mix **SENDERO™ 336 SL** with any other products other than those recommended on this label.

DIRECTIONS FOR USE:

Use only as directed

Mixing Instructions:

For aerial applications - When using **SENDERO™ 336 SL** & **GARLON™MAX 270 EW** (L8511) as a tank-mix. Half fill the spray tank with clean water and add the required quantity of **SENDERO™ 336 SL** & **GARLON™MAX 270 EW** (L8511). Add **H&R Crop Oil** (L6802), or similar emulsifiable mineral oil at a rate of 2 liters per hectare. Finally fill the spray tank to the desired level whilst maintaining constant agitation.

For aerial applications - When using only **SENDERO™ 336 SL**. Half fill the spray tank with clean water and add the required quantity of **SENDERO™ 336 SL**. Add **H&R Crop Oil**(L6802), or similar emulsifiable mineral oil at a rate of 2 liters per hectare. Finally fill the spray tank to the desired level whilst maintaining constant agitation.

For foliar spot applications - Half fill the spray tank with clean water and add the required quantity of **SENDERO™ 336 SL**. Add **H&R Crop Oil** (L6802), or similar emulsifiable mineral oil at a rate of 0.5% final spray mix volume. Finally fill the spray tank to the desired level whilst maintaining constant agitation.

Timing or Season of Application - General:

Herbicidal response is strongly influenced by foliage condition, stage of growth and environmental conditions. For optimum control treat when new growth foliage has turned from light to dark green and when soil moisture is adequate for plant growth. Product performance may be adversely affected if application is made before the plant foliage has turned from light to dark green or if foliage has been injured or removed by a late frost, insects, animals, hail or plant diseases.

Do not spray target plants when drought signs are evident or showing signs of stress, such as leaf chlorosis or drop. After a drought some plant species remain under stress and require a recovery period following rainfall. Signs of stress may not be evident during this recovery period. Allow time for plants to fully recover after rainfall before applying foliar treatments.

Should plants have been treated during times of stress, provision must be made for follow-up treatments.

Satisfactory control will NOT be obtained if spraying earlier in spring, when most of the new growth present consists of recently emerged stems with immature leaves. Similarly, do not treat if plants exhibit new (light green) terminal growth in response to recent heavy rainfall during the growing season.

Additional Application Guidelines* - Prosopis *spp.

The herbicidal response of *Prosopis* spp. is strongly influenced by foliage condition, stage of growth and environmental conditions.

For best results, apply when;

- New growth foliage has turned from light to dark green, about 40-45 days after bud break.
- When the soil temperature is above 24°C at a depth of 30 to 46 cm, and soil moisture is adequate for plant growth.

Rate of soil warm-up at the 30 cm depth may vary with soil texture and drainage. Coarse-textured (sandy) soils warm up faster than fine textured (clay) soils and dry soils warm up more quickly than wet soils.

Apply but before pod elongation, or once pod elongation is complete.

Avoid spraying trees in autumn when the waxy layer on the leaves has accumulated.

Similar to other arid land plants, *Prosopis* spp. responds quickly to available soil moisture from late season rains (February - March). Thus, in certain early season drought years with late summer rains there is an opportunity for spraying. This occurs when mid to late summer rains provide sufficient soil moisture that allows *Prosopis* spp. foliage to recover from drought and develop healthy and robust leaf growth. After a major rain event *Prosopis* spp. will grow new, light green foliage that will later (2 to 3 weeks) mature to a uniform dark green color suitable for spraying.

Indicators of *Prosopis* spp. foliage suitable for spraying includes a uniform dark green color and leaf growth that is near normal. Foliage must not be damaged from drought stress, insect or animal feeding, or other weather-related causes (especially hail damage).

Foliage health should be evaluated at least 1 week prior to application.

RATES AND METHODS:

SENDERO™ 336 SL may be applied:

- as an Aerial Foliar tank-mix application together with **GARLON™MAX 270 EW** (L8511) and **H&R Crop Oil**(L6802), or similar emulsifiable mineral oil.
- or as an Aerial Foliar application together with **H&R Crop Oil** (L6802), or similar emulsifiable mineral oil.
- or as a Spot Foliar treatment together with **H&R Crop Oil** (L6802), or similar emulsifiable mineral oil.

as indicated per individual species recommendations (see tables below).

Best results are obtained when spray volume is sufficient to provide uniform coverage of treated plants.

A. AERIAL FOLIAR APPLICATION:

Aerial application of **SENDERO™ 336 SL** or **SENDERO™ 336 SL** & **GARLON™MAX 270 EW** (L8511), may only be done by a registered Aerial Application Operator using a correctly calibrated, registered aircraft according to the instructions of SABS Code 10118 (Aerial Application of Agricultural Pesticides).

Ensure that the spray mixture is distributed evenly over the target area and that the loss of spray material during application is restricted to a minimum. It is therefore essential that the following criteria be met:

- Volume: A spray mixture volume of 40 liters per hectare is recommended. As this product has not been evaluated at a reduced volume rate, the registration holder cannot guarantee efficacy, or be held responsible for any adverse effects if this product is applied aerially at a lower volume rate than recommended above.
- Droplet coverage: 30 to 40 droplets per cm^2 must be recovered at the target area.
- Droplet size: A droplet spectrum with a VMD of 350 to 450 microns is recommended. Limit the production of fine droplets less than 150 microns (high drift and evaporation potential) to a minimum. A significant percentage of droplets >500 microns could also result in reduced overall efficacy.
- Flying height: Maintain the height of the spray boom at 3 to 4 meters above the target. Do not spray when aircraft dives, climbs or when banking.
- Use suitable atomising equipment that will produce the desired droplet size and coverage, but which will ensure the minimum loss of product. The spraying system must produce a droplet spectrum with the lowest possible Relative Span.
- Position all the atomisers within the inner 75 % of the wingspan to prevent droplets from entering the wingtip vortices or 85% of rotor diameter to prevent droplets from entering the rotor tip vortices.
- Nozzles should be pointed backward parallel with the air stream or not pointed downwards more than 45 degrees.
- The difference in temperature between the wet and dry bulb thermometers, of a whirling hygrometer, should not exceed 8 °C.
- Stop spraying if the wind speed exceeds 15 km/h.
- Do not spray when ambient air temperature is above 25°C.

- Stop spraying under turbulent, unstable and dry conditions during the heat of the day.
- Spraying under temperature inversion conditions (spraying in or above the inversion layer) and/or high humidity conditions (relative humidity 80 % and above) may lead to the following:
  - Reduced efficacy due to suspension and evaporation of small droplets in the air (inadequate coverage).
  - Damage to other sensitive crops and/or non-target areas through drifting of the suspended spray cloud away from the target area.
- Ensure that the Aerial Spray Operator knows exactly which area to spray.
- Obtain an assurance from the Aerial Spray Operator that the above requirements will be met and that relevant data, including GPS log files, will be compiled in a logbook and kept for future reference.
- Notify all inhabitants in the immediate vicinity of the area to be treated and issue the necessary warnings.

THE WIND SPEED AND DIRECTION AT THE TIME OF APPLICATION WILL DETERMINE THE DISTANCE WHICH MUST SEPARATE THE CLOSEST EDGE OF THE AREA TO BE SPRAYED FROM SUSCEPTIBLE PLANTS AND CROPS.

WIND SPEED km/h	GROUND APPLICATION	AERIAL APPLICATION
2-15	2.0 km downwind 2.0 km crosswind 1.0 km upwind	5.0 km downwind 5.0 km crosswind 2.0 km upwind
Above 15	**Prohibited**	**Prohibited**

RATES OF APPLICATION:

AERIAL FOLIAR APPLICATION		
PLANT	**RATE. L/ha**	**REMARKS**
Prosopis spp. (Mesquite)	2.0 L **SENDERO™ 336 SL** + 2.0 L **GARLON™MAX 270 EW** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	**SENDERO™ 336 SL** is compatible with **GARLON™MAX 270 EW** (L8511) as a tank mix suitable for mono-species *Prosospis* spp., infestation aerial treatments where little preservation of desirable tree species is required. Peripheral infestations not treated during aerial application may be controlled using a registered foliar spot treatment (Sendero™ 336 SL) or stump treatment (Garlon™ 480 EC & Diesel or Confront™ 360 SL). Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL) or stump treatment (Garlon™ 480 EC & diesel or Confront™ 360 SL) may be required but should not take place within the first year after the initial application.

PLANT	RATE. L/ha	REMARKS
Prosopis spp. (Mesquite) (cont.)	2.0 L **SENDERO™ 336 SL** + 2.0 L **GARLON™MAX 270 EW** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	Ensure all label directions for *Prosopis* spp., aerial application are carefully followed as per label above. In the event of any doubt please contact your local DOW AgroSciences representative.
Prosopis spp. (Mesquite)	4.0 L **SENDERO™ 336 SL** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	**SENDERO™ 336 SL** is suitable for *Prosospis* spp., infestation aerial treatments where a broader preservation of desirable tree species is required. Peripheral infestations not treated during aerial application may be controlled using a registered foliar spot treatment (Sendero™ 336 SL) or stump treatment (Garlon™ 480 EC & diesel or Confront™ 360 SL). Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL) or stump treatment (Garlon™ 480 EC & diesel or Confront™ 360 SL) may be required but should not take place within the first year after the initial application. Ensure all label directions for *Prosopis* spp., aerial application are carefully followed as per label above. In the event of any doubt please contact your local DOW AgroSciences representative.

PLANT	RATE. L/ha	REMARKS
Sengalia mellifera (*Acacia mellifera*) (Black Thorn)	2.0 L **SENDERO™ 336 SL** + 2.0 L **GARLON™MAX 270 EW** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	**SENDERO™ 336 SL** is compatible with **GARLON™MAX 270 EW** (L8511) as a tank mix suitable for mono-specie *Vachellia mellifera* infestation aerial treatments where little preservation of desirable tree species is required. Peripheral infestations not treated during aerial application may be controlled using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K). Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K) may be required, especially on shallow calcrete soils, but should not take place within the first year after the initial application. Ensure all label directions for *Vachellia mellifera* aerial application are carefully followed as per label above. In the event of any doubt please contact your local DOW AgroSciences representative.
Senegalia mellifera (*Acacia mellifera*) (Black Thorn)	2.0 - 4.0 L **SENDERO™ 336 SL** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	**SENDERO™ 336 SL** is suitable for *Vachellia mellifera* infestation aerial treatments. The lower rate is prescribed where a broader preservation of desirable tree species is required. The higher rate is prescribed where little preservation of desirable tree species is required. Peripheral infestations not treated during aerial application may be controlled using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K) Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K) may be required, especially on shallow calcrete soils, but should not take place within the first year after the initial application.

PLANT	RATE. L/ha	REMARKS
Senegalia mellifera (*Acacia mellifera*) (Black Thorn) (cont.)		Ensure all label directions for *Vachellia mellifera* aerial application are carefully followed as per label above. In the event of any doubt please contact your local DOW AgroSciences representative.
Dichrostachys cinerea (Sickle Bush)	2.0 - 3.0 L **SENDERO™ 336 SL** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	**SENDERO™ 336 SL** is suitable for *Dichrostachys cinerea* infestation aerial treatments. The lower rate is prescribed where a broader preservation of desirable tree species and a lower rate of target specie mortality is required. The higher rate is prescribed where little preservation of desirable tree species and a higher rate of target specie mortality is required.is required. Peripheral infestations not treated during aerial broadcast applications may be controlled using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K). Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K) may be required but should not take place within the first year after the initial application. Ensure all label directions for *Dichrostachys cinerea* aerial application are carefully followed as per label above. In the event of any doubt please contact your local DOW AgroSciences representative.

PLANT	RATE. L/ha	REMARKS
Vachellia karroo (*Acacia karroo*) (Sweet Thorn)	2.0 - 3.0 L **SENDERO™ 336 SL** + 2.0 L **H&R Crop Oil*** (or similar emulsifiable mineral oil)	**SENDERO™ 336 SL** is suitable for *Vachellia karroo* infestation aerial treatments. The lower rate is prescribed for infestations with a mean height of <2.0m and where a broader preservation of desirable tree species is required. The higher rate is prescribed for infestations with a mean height of >2.0m and where little preservation of desirable tree species is required. Peripheral infestations not treated during aerial application may be controlled using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K). Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL, Mezavue™ 250 EW, Pastar™ 300 EW) or stump treatment (Tordon™ 22K) may be required but should not take place within the first year after the initial application. Ensure all label directions for *Vachellia karroo* aerial application are carefully followed as per label above. In the event of any doubt please contact your local DOW AgroSciences representative.

* The trademark **H&R Crop Oil®** is the property of **H&R South Africa Sales (Pty) Ltd.**

B. FOLIAR SPOT APPLICATION (INDIVIDUAL PLANT TREATMENT):

Use only on actively growing plants with full leaf cover

- Apply only when the trees are in the correct stage of development, as indicated below.
- Do not apply to foliage wet from rain or dew etc.
- Irrigation or rainfall shortly after application may negatively influence results.
- Do not spray following a late frost.
- Prevent spray drift onto desirable, non-target plants.
- Use a knapsack sprayer with a solid cone nozzle (e.g. Spraying Systems TG-1, Delavan CE 1 or equivalent type) that will ensure an even coverage of the target area. Maintain a constant pressure of between 100 – 250 kPa.

RATES OF APPLICATION

FOLIAR SPOT APPLICATION		
PLANT	**RATE/100L WATER**	**REMARKS**
Prosopis spp. (Mesquite)	800 ml (0.8 % v/v mixture)	Add **H&R Crop Oil***(L6802), or similar emulsifiable mineral oil at a rate of 0.5% final spray mix volume. Apply to young actively growing trees (saplings) up to 2 meters in height. Ensure sufficient coverage of all foliage. Follow-up treatments using a registered foliar spot treatment (Sendero™ 336 SL) or stump treatment (Garlon™ 480 EC & Diesel or Confront™ 360 SL) may be required but should not take place within the first year after the initial application.
Sengalia mellifera (*Acacia mellifera*) (Black Thorn)	600 ml (0.6 % v/v mixture)	Add **H&R Crop Oil***(L6802), or similar emulsifiable mineral oil at a rate of 0.5% final spray mix volume. Apply to young actively growing trees (saplings) up to 2 meters in height. Ensure sufficient coverage of all foliage.
Dichrostachys cinerea (Sickle Bush)	600 ml (0.6 % v/v mixture)	
Vachellia karroo (*Acacia karroo*) (Sweet Thorn)	600 ml (0.6 % v/v mixture)	
Acacia mearnsii (Black Wattle)	600 ml (0.6 % v/v mixture)	

* The trademark **H&R Crop Oil®** is the property of **H&R South Africa Sales (Pty) Ltd.**

SENDERO™ 336 SL and **GARLON™MAX 270 EW** (L8511) control woody plant species. Any other trees and shrubs that were present during the development trials with the product/s may also be controlled to a certain degree. The registration holder does not accept any responsibility for unlisted trees and shrubs.

SOIL DISTURBANCE:

The treated area should be left undisturbed for at least one (1) year after application. If any disturbance occurs during this period, it may result in poor efficacy.

SPRAYER CLEANUP:

To prevent any damage to non-target plants, all traces of **SENDERO™ 336 SL,** and if applicable **GARLON™MAX 270 EW** (L8511), must be removed by thorough cleaning of the mixing and spraying equipment. Proceed as follows:

a) The spray tank should be drained immediately after spraying.
b) The inside of the spray tank should be rinsed with clean water and flushed with at least one tenth of the spray tank volume through the hoses and nozzles. Drain the tank completely.
c) Half-fill the tank with clean water and add the correct quantity of cleaning agent – per 100 liters of final tank volume, add 350 ml household ammonia (9,5 % ammonia) to the water, e.g. in the case of a 1 000 liters spray tank, fill with 500 liters water and add 3,5 liters (=10 x 0,35 L) household ammonia. The initial solution now prepared which is double strength, should be mixed thoroughly by turning on the agitation. This solution is now used for flushing the hoses and nozzles for approximately 1 minute. The remainder is now filled up to the final volume of the spray tank and allowed to stand for 15 minutes with the agitation running. After this 15 minute interval, flush the boom and hoses again and drain the tank completely.
d) Remove the nozzle and filters and allow to soak in a bucket containing 40 ml of household ammonia per 10 liters of water.
e) Rinse the tank again with water and flush at least one tenth of the tank volume through the boom and hoses.
f) Dispose of the wash water safely, away from water supplies. Do not spray onto or otherwise dispose of onto sensitive crops or land intended for planting with sensitive crops.
g) Wash any contamination off the outside of the sprayer with clean water.

STORAGE AND DISPOSAL:

Storage conditions

Store away from sun, in original tightly closed containers, in a cool, dry, well-ventilated area apart from food and feed under lock and key.

Container disposal

- Empty plastic pesticide containers must be rinsed three times in succession with one quarter of the container volume clean water (this is triple rinsing) and rinse water must be decanted into the spray bowser.

- Triple rinsed containers must be dried out and preferably cut into four quarters to reduce transport volumes.

- Farmers should use the services of preferred recyclers on the AVCASA list. It is the duty of the farmer to contact the recycler of choice and arrange for the disposal of empty triple rinsed containers.

- Triple rinsed, dried out containers are not considered to be hazardous waste and may be transported by normal means.

- Containers that have any pesticide residues may not be transported by normal means and may not be recycled. They are treated as hazardous waste.

- Triple rinsed empty containers may not be stored for longer than three months at any given site unless that site is registered as a hazardous waste collection and storage site. It is therefore imperative that farmers dispose of their empty triple rinsed containers at least once every three months.

EMPTY PESTICIDE CONTAINERS MAY NOT BE GIVEN AWAY OR SOLD AS CONTAINERS FOR ANY OTHER COMMODITIES. IT MAY NOT BE INCINERATED OR BURIED ON THE FARM. IT MAY ONLY BE RECYCLED BY REPUTABLE RECYCLERS.

Disposal of obsolete, redundant, left over and unwanted herbicide

- Ensure that such herbicides are in containers with their original labels attached to them. If labels are damaged, spray over with clear varnish to secure labels for future reference. Once dried out, paste polyethylene plastic sheets over such labels to prevent further degradation thereof.

- If containers are perished and/or leaking, place such containers with their labels attached as in paragraph 1 above, into overdrums (preferable plastic). Seal the lids of overdrums

- Mark all such pesticides with a red cross and the words TOXIC GIFTIG with red paint.

- Put the marked containers on palettes in a secluded spot in a store that can be locked. Use a site in the store that has a concrete floor. Cover beforehand with thick plastic sheeting.

- Compile an inventory of the pesticides with trade names, active ingredients, formulation, quantity (mass or volume), container type and container condition. Acquire MSDSs for all products via manufacturer websites.

- Call EnviroServ on 0800 147 112, or A-Thermal on 011 316 1800 or Rapid Spill Response on 0861 113 467 and request a quotation for the disposal of the pesticides. They will give further instructions regarding their requirements.

- Ensure that the pesticides are not accessible to unauthorised individuals.

OBSOLETE, REDUNDANT, LEFT OVER AND UNWANTED PESTICIDES MAY NOT BE INCINERATED OR BURIED ON THE FARM. IT MAY ONLY BE DISPOSED OF BY LICENSED HAZARDOUS WASTE MANAGEMENT COMPANIES.

Local Emergency No: +27(0)82-895-0621 (SA only)

24 Hour Emergency Tel No: +32-3-575-5555

Information Hotline Tel No: +27(0)12 683-5700

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Annexure 4 - Turbodor® 29 MPA Label and MSDS

Turbodor 29 mpa

Reg. No./Nr. L10365 Act/Wet 36/1947

A ready-to-use, low volume, systemic herbicide for the selective control of problem plants as listed in conservation, grass pastures, forestry and industrial areas.

'n Gereed om te gebruik, lae volume, sistemiese onkruiddoder vir die selektiewe beheer van houtagtige plante en onkruide soos aangetoon in bosbou, grasweidings, bewarings areas en nywerheids gebiede.

HERBICIDE GROUP CODE	0	ONKRUIDDODER GROEPKODE

ACTIVE INGREDIENT / AKTIEWE BESTANDDEEL

Triclopyr (Pyridyloxy Compound)		Triklopir (Piridiloksie verbinding)
(acid equivalent)	29g/ℓ	(suurekwivalent)
(as butoxy ethyl ester)	40g/ℓ	(as butoksie-etielester)

NET VOLUME ℓ **NETTO VOLUME**

REGISTRATION HOLDER/REGISTRASIE HOUER:
Future Farm & Forest
Services & Supplies (Pty) Ltd.
Reg. 1998/014639/07
P.O. Box 98165
Sloane Park
2152

DISTRIBUTED BY/ VERSPREI DEUR:
Ecoguard Biosciences (Pty) Ltd.
Reg. 1988/001616/07
Tel: 011 - 463 6057
Fax: 011 - 463 6462

Sukuma Distributors (Pty) Ltd.
Reg. 2001/018329/07
Tel: 011 - 463 7025
Fax: 086 608 6328

UN NUMBER	3082	UNNOMMER
BATCH NUMBER		LOTNOMMER
DATE OF MANUFACTURE		DATUM VAN VERVAARDIGING

165 x 120 CYAN MAG YEL BLK

WARNINGS
- Carrier may cause temporary burn to grass.
- Handle with care.
- Poisonous when swallowed. May cause eye and skin irritation.
- Store in a cool place.
- Store away from food, feeds, seeds and other agricultural chemicals.
- Keep out of reach of children, uninformed persons and animals.
- Wear protective gloves and face shield or safety glasses when handling.

Although this remedy has been extensively tested under a large variety of conditions, the registration holder does not warrant that it will be efficacious under all conditions, because the action and effect thereof may be affected by such factors as abnormal soil, climatic and storage conditions, compatibility with other substances not indicated on the label and the occurrence of resistance of the weed against the remedy concerned as well as by the method, time and accuracy of application. The registration holder furthermore does not accept responsibility for damage to crops, vegetation, and the environment or harm to man or animal or for lack of performance of the remedy concerned due to failure of the user to follow the label instructions or to the occurrence of conditions which could not have been foreseen in terms of the registration. Consult the supplier in the event of any uncertainty.

PRECAUTIONS
- Do not inhale spray mist.
- Avoid contact with eyes. In case of such contact, flush eyes with clean water for at least 15 minutes.
- Wash with soap and water immediately after accidental skin contact.
- Wash contaminated clothing daily.
- Do not eat, drink or smoke whilst mixing and applying or before washing hands and face and change of clothing.
- Clean applicator with a household ammonia solution (1%) before using with other material. Let solution stand for several hours, preferably overnight.
- Rinse applicator at least twice with clean water.
- This applicator must not be used for applying chemicals other than herbicides.
- Dispose of wash water where it will not contaminate food, grazing, rivers or dams.
- Prevent contamination of food, feeds, drinking water and eating utensils.

SYMPTONS OF HUMAN POISONING
- May cause skin irritation and sensitization.

FIRST AID TREATMENT
- Inhalation: Remove patient to fresh air. Consult a physician.
- Ingestion: Do not induce vomiting. Consult a physician immediately.
- Eye Contact: Immediately wash with clean water for at least 5 minutes.
- Skin Contact: Immediately wash skin with soap and plenty of water. Remove and wash contaminated clothing.

NOTE TO PHYSICIAN
- No specific antidote. If lavage is performed, endothracheal and/or oesophageal control is suggested.
- Treat symptomatically.

USE RESTRICTIONS
Precautions for avoiding injury to non-target plants are:
- **Do not permit spray mist to drift** or come into contact with sensitive broadleaf crops, including but not limited to lucerne, beans, melons, potatoes, soybeans, sunflower, tobacco, tomatoes, cotton, fruit trees, grape vines, ornamentals, soil containing roots of these plants, soil in which such plants are to be grown, grain varieties in a susceptible stage of growth or grazing or any other area not under treatment.
- **Increasing ambient temperatures** may result in the volatility and potential for vapor drift of this herbicide thus increasing the risk for off-target injury to sensitive crops such as but not limited to grapes and tomatoes.
- **Do not contaminate water** intended for irrigation or domestic purposes. To avoid injury to crops or other desirable plants, do not treat or allow spray or spray drift or spray run-off to fall onto banks or bottoms of irrigation ditches, canals, streams, dams, rivers, either dry or containing water that may be used for irrigation or domestic purposes or may carry water to an irrigation facility.
- **Do not apply to areas** that may be rotated to any broadleaf crop.
- **Do not use manure** from animals grazing treated areas on land used for growing broadleaf crops, ornamentals, orchards or other susceptible crops. Manure may contain enough herbicide to cause injury to susceptible plants.
- **Do not use grass or sprayed plants** from treated areas for composting or mulching of susceptible broadleaf plants or crops.

- **Do not transfer livestock** from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated grass pasture. Otherwise, urine and manure may contain enough herbicide to cause injury to sensitive broadleaf plants.
- **Do not use on flood irrigated land or fields.**
- **Do not apply through a mist blower.**
- **Do not apply to land NEAR desirable broadleaved plants** or land onto which such plants are to be grown or grain varieties in a susceptible stage of growth. Product may however, be applied in the VICINITY of desirable broadleaved plants, or soil or land onto which such plants are to be grown, or grain varieties in a susceptible stage of growth, PROVIDED THAT ADEQUATE PRECAUTIONARY MEASURES ARE TAKEN TO AVOID SPRAYDRIFT OR CONTAMINATION OF RUN-OFF AREAS.
- **Apply the product** strictly in accordance with the application directions.

DIRECTIONS FOR USE - USE ONLY AS DIRECTED

MIXING
- A **ready-to-use** herbicide.
- Apply as supplied.
- **DO NOT** mix or dilute product.

RECOMMENDED APPLICATION EQUIPMENT
- Apply using a Knapsack **Sprayer with a suitable lance.**
- **For Basal Bark and Cut Stump treatment** apply a coarse, low-pressure spray using narrow angle solid cone nozzle.
- For **Low Volume Full Cover Spray** (Cacti species) **& Low Volume Full Cover Foliar Spray** treatment *(Leptospermum laevigatum)* use a knapsack sprayer with a solid cone nozzle (Spraying Systems TG1 or equivalent). Maintain a constant pressure of between 200 and 300 kPa.

TIMING OF APPLICATION
(A) BASAL BARK TREATMENT
- Apply **Turbodor 29 MPA** on actively growing plants and when soil moisture is favorable to plant growth.
- Spray only on healthy and vigorously growing plants.
- Do not apply to stems wet from rain, dew or snow.
- Do not spray following a late frost.
- Deciduous plants may drop their leaves when under stress.
- Do not spray target plants when drought signs are evident or plants are showing signs of stress.

(B) CUT STUMP TREATMENT
- **Turbodor 29 MPA** is suitable for both **SUMMER & WINTER** cut stump application.
- Apply as soon as possible after felling, at least within 1 hour.
- **Turbodor 29 MPA** must not be applied to stumps if surface is wet from rain, dew or snow.

(C) LOW VOLUME FULL COVER SPRAY TREATMENT (Cacti species)
- Apply Turbodor 29 MPA only on actively growing plants and when soil moisture is favorable for plant growth.
- Spray only on healthy and vigorously growing plants.
- Do not apply to cladodes or stems wet from rain, dew or snow.
- Do not spray target plants when drought signs are evident or showing signs of stress.
- After a drought some plant species remain under stress and require a recovery period following rainfall. Signs of stress may not be evident during this recovery period. Allow time for plants to fully recover after rainfall before applying cover spray treatments. Should full cover spray treatments be applied during this recovery period, provision must be made for follow-up treatments.

(D) LOW VOLUME FULL COVER FOLIAR SPRAY TREATMENT
(Leptospermum laevigatum)
- Apply **Turbodor 29 MPA** only on actively growing plants and when soil moisture is favorable for plant growth.
- Spray only on healthy and vigorously growing plants.
- Do not apply to foliage wet from rain, dew or snow.
- Do not spray target plants when drought signs are evident or showing signs of stress.
- After a drought some plant species remain under stress and require a recovery period following rainfall. Signs of stress may not be evident during this recovery period. Allow time for plants to fully recover after rainfall before applying cover spray treatments. Should full cover spray treatments be applied during this recovery period, provision must be made for follow-up treatments.

METHODS OF APPLICATION

(A) BASAL BARK TREATMENT
- **Turbodor 29 MPA** must not be applied to stems if surface is wet from rain, dew or snow.
- Apply by knapsack as a coarse, low-pressure spray using narrow angle solid cone nozzle.
- Apply all around the basal stem or trunk of the woody plant from a height of 50 cm (knee height) down to soil level. As well as to any exposed roots.
- In order to obtain satisfactory results entire circumference area must be treated.
- Spray with nozzle at a distance from stem so as to maximize stem wetting and to minimize off target spraying and waste.
- In the case of multi-stemmed plants, each stem must be treated separately.
- Apply **Turbodor 29 MPA** as Basal Bark Treatment according to directions as per species listed in the table below.

(B) CUT STUMP TREATMENT
- **Turbodor 29 MPA** must not be applied to cut stumps if surface is wet from rain, dew or snow. Stump cutting must not be performed when wetting of stem is expected shortly before cutting operation.
- Apply as soon as possible after felling (within 1 hour).
- Apply by knapsack as a coarse, low-pressure spray using narrow angle solid cone nozzle.
- Wet top and sides of cut stump and any exposed roots down to soil level
- In the case of multi-stemmed plants, each stump must be treated separately.
- Spray nozzle height must be approximately 20 cm from target.
- Apply **Turbodor 29 MPA** as Cut Stump Treatment according to directions as per species listed in the table below.

(C) LOW VOLUME FULL COVER SPRAY TREATMENT (Cacti species)
- **Use only on actively growing plants.**
- Apply to cladodes and stems as a **low volume full cover spray.**
- Use a sufficient volume of the spray mix to ensure a light, full and even coverage of Cacti plants stem and cladodes.
- Irrigation or rainfall shortly after application may negatively influence results.
- Do not apply to plants wet from rain, dew of snow.
- Avoid spray drift from contaminating susceptible non-target plants.
- Use a knapsack sprayer with a solid cone nozzle (Spraying Systems TG1 or equivalent). Maintain a constant pressure of between 200 and 300 kPa.
- Maintain a distance of approximately 20-30 cm from the target for best coverage.
- The objective of a **LOW VOLUME FULL COVER SPRAY** on Cacti species is a fine low volume application covering the entire stem and all cladodes, including cladodes lying on the ground.
- **ENSURE ALL CLADODES LYING ON THE GROUND ARE FULLY TREATED.**
- Cladodes that may have been accidentally untreated will regenerate if they make contact with the ground in the process of the plant decomposition!!! It is therefore very important to plan and execute follow up treatments.
- Apply **Turbodor 29 MPA** as **Low Volume Full Cover Spray** according to directions as per species listed in the table below.

(D) LOW VOLUME FULL COVER FOLIAR SPRAY TREATMENT
(Leptospermum laevigatum)
- **Use only on actively growing plants.**
- On Leptospermum laevigatum apply to foliage as a **Low Volume Full Cover Foliar Spray.**
- Use a sufficient volume of the spray mix to ensure a light, full and even coverage of all foliage.
- Irrigation or rainfall shortly after application may negatively influence results.
- Do not apply to plants wet from rain, dew or snow.
- Avoid spray drift from contaminating susceptible non-target plants.
- Use a knapsack sprayer with a solid cone nozzle (Spraying Systems TG1 or equivalent). Maintain a constant pressure of between 200 and 300 kPa.
- Maintain a distance of approximately 20-30 cm from the target for best coverage.
- The objective of a **LOW VOLUME FULL COVER FOLIAR SPRAY** on Leptospermum laevigatum is a fine, low volume, application covering all foliage.
- Apply **Turbodor 29 MPA as Low Volume Full Cover Foliar Spray** according to directions as per species listed in the table below.

RATES OF APPLCATION
(A) BASAL BARK TREATMENT

TREE / BUSH / SHRUB SPECIE	RATE	REMARKS
Prosopis spp. (Mesquite) ***Acacia mearnsii*** (Black Wattle) ***Acacia melanoxylon*** (Blackwood) ***Acacia saligna*** (Port Jackson) ***Psidium guajava*** (Guava)	Ready-To-Use. Apply as supplied.	**Do not** apply to stems if surface is wet from rain, dew or snow. **Apply by** knapsack as a coarse, low-pressure spray using narrow angle solid cone nozzle. **Apply all** around the basal stem or trunk of the woody plant from a height of 50 cm (knee height) down to soil level. As well as to any exposed roots. **In order** to obtain satisfactory results the entire circumference of target area must be treated. **Spray with** nozzle at a distance from stem so as to maximize stem wetting and to minimize off target spraying and waste. **In the case** of multi-stemmed plants, each stem must be treated separately. **Insect Activity:** It has been commonly observed in basal bark treatment, that insects such as borer beetles and termites become active in attacking the treated areas of the target trees. The insects are unharmed and play an important role in natural biological decomposition. **Saprophyte Activity:** It has also been observed that treated areas are subject to Saprophyte activity e.g. Bracket fungi

(B) CUT STUMP TREATMENT

TREE/ BUSH / SHRUB SPECIE	RATE	REMARKS
Prosopis spp. (Mesquite) ***Acacia mearnsii*** (Black Wattle) ***Acacia melanoxylon*** (Blackwood) ***Acacia saligna*** (Port Jackson) ***Litsea glutinosa*** (Indian laurel) ***Psidium guajava*** (Guava)	Ready-To-Use. Apply as supplied.	**Must not** be applied to cut stumps if surface is wet from rain, dew or snow. **Stump cutting** must not be performed when wetting of stem is expected shortly before operation. **Apply as** soon as possible after felling (within 1 hour). **Apply by** knapsack as a coarse, low-pressure spray using narrow angle solid cone nozzle (Spraying Systems TG1 or equivalent). **Wet top and sides** of cut stump and any exposed roots down to soil level. **In the case** of multi-stemmed plants, each stump must be treated separately. **Spray nozzle** height must be approximately 20 cm from target. **Insect Activity:** It has been commonly observed in cut stump treatment, that insects such as borer beetles and termites become active in attacking the treated areas of the target trees. The insects are unharmed and play an important role in natural biological decomposition. **Saprophyte Activity:** It has also been observed that treated areas are subject to Saprophyte activity e.g. Bracket fungi

(C) LOW VOLUME FULL COVER SPRAY TREATMENT (Cacti species)

CACTI SPECIE	RATE	REMARKS
Opuntia aurantiaca (Jointed Cactus) ***Cylindropuntia fulgida*** (Boxing Glove Cactus) ***Opuntia humifusa*** (Creeping Prickly Pear) ***Opuntia imbricata*** (Imbricate Prickly Pear) ***Opuntia stricta*** (Australian Pest Pear) ***Opuntia monacantha*** (Drooping Prickly Pear) ***Echinopsis schickendantzii*** (Torch Cactus) ***Tephrocactus articulatus*** (Paper Spine Cholla) ***Agave sisalana*** (Sisal) ***Agave Americana*** (American Sisal)	Ready-To-Use. Apply as supplied.	**Use only on actively growing plants.** **Apply to** cladodes and stems as a low volume full cover spray. **Use sufficient** volume of the spray mix to ensure a light full and even coverage of target plant. **Irrigation or rainfall** shortly after application may negatively influence results. **Do not** apply to wet plants. **Avoid spray** drift from contaminating susceptible non-target plants. **Use a** knapsack sprayer with a solid cone nozzle (Spraying Systems TG1 or equivalent). Maintain a constant pressure of between 200 and 300 kPa. **Maintain a** distance of approximately 20-30 cm from the target for best coverage. **The objective** of a **LOW VOLUME FULL COVER SPRAY** on Cacti species is a fine low spray covering entire stem and all cladodes, including cladodes lying on the ground. **Cladodes that** may have been accidentally untreated will regenerate if they make contact with the ground in the process of the plant decomposition!!! It is therefore very important to plan and execute follow up treatments. **ENSURE ALL CLADODES LYING ON THE GROUND ARE TREATED.** **FOLLOW UP TREATMENT MAY BE REQUIRED WHERE DENSE STANDS OF ADULT PLANTS SHIELDED YOUNG PLANTS AND CLADODES ON THE GROUND DURING INITIAL APPLICATION.**

(D) LOW VOLUME FULL COVER FOLIAR SPRAY TREATMENT

TREE / BUSH / SHRUB SPECIE	RATE	REMARKS
Leptospermum laevigatum (Australian Myrtle)	Ready-To-Use. Apply as supplied.	**Use only on actively growing plants less than 1.5 meters high or at a height which is suitable for a complete light overall spray.** **Apply to** foliage as a **low volume full cover foliar spray.** **Use sufficient** volume of the spray mix to ensure a light full and even coverage of target plants foliage. **Irrigation or rainfall** shortly after application may negatively influence results. **Do not** apply to wet plants. **Avoid spray** drift from contaminating susceptible non-target plants. **Use a** knapsack sprayer with a solid cone nozzle (Spraying Systems TG1 or equivalent). Maintain a constant pressure of between 200 and 300 kPa. **Maintain a** distance of approximately 20-30 cm from the target for best coverage. The objective of a **LOW VOLUME FULL COVER SPRAY** on *Leptospermum laevigatum* is a fine low volume application covering all foliage.

Other trees and shrubs that are not yet registered on this label may also be controlled.
The registration holder does not accept responsibility for any off-label usage.

Griffon Poison Info Centre: 082 446 8946 • INFORMATION HOTLINE: TEL. NO.: (011) 463-6057

Species registered for

Turbodor 29 mpa

Prosopis species

Acacia mearnsii
Acacia saligna
Acacia melanoxylon

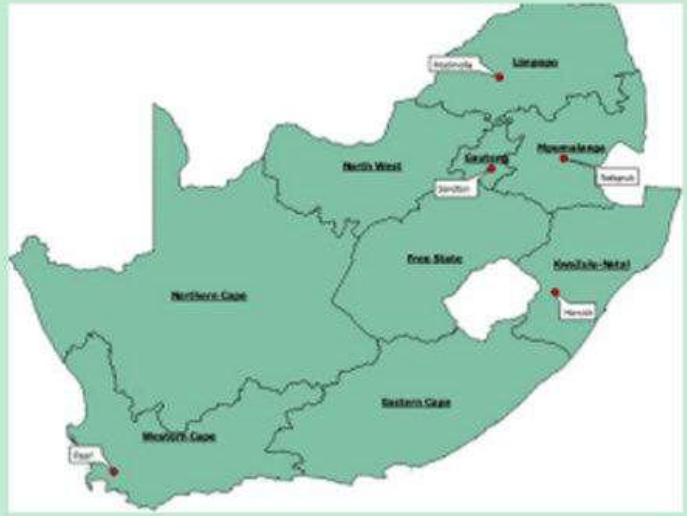
Opuntia aurantiaca—*Jointed cactus*
Opuntia imbricata - Imbricate Prickly pear
Opunita humifusa - Creeping prickly pear
Opuntia stricta - Australian pest pear
Opuntia monocantha - Drooping prickly pear
Tephrocactus articulates - Paper spine cholla
Echinopsis schickendantzii - Torch cactus
Cylindropuntia fulgida - Boxing glove cactus

Psidium guajava - Guava
Litsea glutinosa - Indian laurel
Leptospermum laevigatum - Australian myrtle
Agave Americana - American

	BEFORE	AFTER
Prickly pear *Opuntia humifusa*		
American sisal *Agave americana*		
Honey mesquite *Prosopis*		

ECOGUARD Branches:

Locality:	Details:
KwaZulu Natal **Howick**	033 330 6985 kznsales@ecoguard.co.za 25 Laurel Rd, Merrivale
Mpumalanga **Nelspruit**	013 752 2507 nelsales@ecoguard.co.za 6 Christie Crescent
Limpopo **Modimolle**	083 679 7775 lp.sales@ecoguard.co.za Oktaan Street
Gauteng **Sandton**	011 463 6057 ecoinfo@ecoguard.co.za 13 Sloane Street, Bryanston
Western Cape **Paarl**	021 871 1921 paarl.sales@ecoguard.co.za 22 Eiland Street, Eiland Park



Turbodor 29 mpa

"THE PRODUCT WHERE NATURE GIVES A HELPING HAND"




ECOGUARD
ECOGUARD BIOSCIENCES (PTY) LTD

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Turbodor 29 mpa

Turbodor 29 MPA is a ready to use formulation containing Triclopyr BEE in a propriety blend of raw natural and processed plant oils for LOW VOLUME basal, cut stump and foliar treatment of various species.

How to apply Turbodor

Foliar

Foliar application requires a light full cover spray of the foliage of the target plant

For cacti species, a low volume full cover spray is required on all cladodes and stem, essentially covering the entire surface of the plant

Be wary of spray drift, especially near crops

Cut stump

Clear around the circumference of the cut-stump to expose the root-crown

Spray onto the exposed surface of the cut-stump and base of the stem

Do not apply Turbodor 29 MPA to stumps that are wet

Basal

Clear grass, twigs and other obstacles from around the base of the stem

Spray the base of the stem down to the root crown

Apply a low volume of Turbodor 29 MPA to the circumference of the stem

Features of Turbodor 29 mpa

Highly effective systemic herbicide for the control of a broad range of species

Is an ready to use (RTU) which provides an easy application and requires no mixing with water

Is highly effective on certain invader plant species which are currently difficult to control with conventional herbicides

Ultra low volume application, meaning minimal volumes needed to effectively kill target plant species

Natural oil blend designed to spread and stick onto the target plant material for effective penetration

Can be used in the conservation, forestry, agricultural, and bush encroachment sectors

Turbodor 29 MPA is Tipwig registered

Turbodor 29 MPA can be applied throughout winter and the dry season, if the application is done correctly and if the plant is not entirely dormant

Acacia mellifera dead after a basal application with Turbodor 29 MPA in the dry season in Pienaarsrivier

Dead *Prosopis* tree 3 months after a basal application in Winter in Beaufort West

Working with nature

The propriety natural oil blend has been observed to enhance biological activity including both insect and microbial activity

Turbodor 29 MPA also has a low toxicity to animals and can be used on grazing lands with livestock and game

Bryophyte growth on treated cut-stump of *Psidium guajava* treated with Turbodor 29 MPA

Beetle larvae nesting within the Turbodor 29 MPA treated area of the stem of a *Solanum mauritianum* tree

Termite nesting in Turbodor 29 MPA treated area of *Acacia tortillis* tree

Extended lances

- Light-weight fibre-glass extended lances available in 1m or 1,5m lengths
- Increases reach and penetration through thorns, multiple stems and other obstacles to get to the hard to reach target stems
- Prevents operator fatigue (less bending) and lessens injuries by thorns and branches.

Knapsack

- Make sure you have a good quality knapsack for generating your spray
- Both Swissmex and Enviro Weed Solution (EWS) knapsacks are available from Ecoguard Biosciences

Personal Protective Equipment (PPE)

- Do not forget PPE clothing and appropriate safety gear when doing any herbicide spraying

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Go to our website to learn more:

www.ecoguard.co.za

Turbodor 29 mpa

"THE PRODUCT WHERE NATURE GIVES A HELPING HAND"

Precision application achieved with Ecoguard Specialised Spray Equipment

Specialised spray equipment

Precision application is crucial for a successful clearing operation. Precision application not only improves efficacy, but minimises volume wastage when spraying and therefore saves costs

Specialised spray equipment is important for achieving a precision application

Application methods that can be achieved with specialised spray equipment:

- Full-cover foliar (for cactus)
- Cut-stump
- Basal—multi-stem
- Basal—single-stem

Turbodor 29 MPA Spray Kit

The Turbodor 29 MPA spray-kit is available from Ecoguard Biosciences and includes the following:

- 80˚ Low volume Flat-fan nozzle
- 1 Bar pressure-regulator
- 100-mesh Strainer

OR

- 80˚ Low volume Flat-fan nozzle
- 1 Bar pressure-regulator (new black and yellow design)
- 100-mesh Strainer

80˚ Flat-fan nozzle

- This nozzle produces the best droplet size at 1 bar for effective product delivery with minimal spray-drift.
- Highly effective nozzle for ensuring low volume spray output
- The nozzle has a stainless steel insert which ensures increased longevity

1 Bar pressure regulator

- Pressure regulator standardises pressure at 1 bar throughout spray application which is crucial when applying Turbodor 29 MPA
- A consistent low-pressure will significantly minimise spray-drift
- The one-way valve will prevent drip and wastage from the lance spray tip immediately after you've stopped the spray trigger

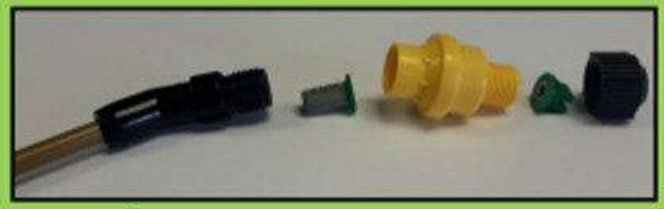
100-Mesh Strainer

- Acts as a filter / strainer for the volume of herbicide sprayed to prevent debris in the spray-tank from blocking the aperture of the nozzle spray tip.

How to assemble a spray kit

1. The 100-mesh Strainer fits into the elbow of the lance.
2. Screw the 1 Bar Pressure Regulator onto the lance, after the Strainer.
3. The 80˚Flat-fan nozzle fits into the nozzle cap and this is attached to the front of the pressure regulator (ensure the rubber washer is in place to prevent product wastage).

Design 1



(Assembled)

Design 2

(Assembled)

Annexure 5 - Wideawake Fairs Action Plan

- Mars Bay Nature Reserve
- Waterside Nature Reserve

Threats:

- Mexican thorn (*Neltuma juliflora*)
- Tree tobacco (*Nicotiana glauca)*
- Black lantana (*Lantana* spp.)
- Prickly pear (*Opuntia* spp.)

This section describes the number of actions to be achieved in the next five years (2023-2027). Actions are prioritized (High, Medium, or Low) according to the positive changes they will make to the reserves. Actions are arranged according to the threats that they address. Each is numbered for identification with clear targets and suggested timeframes to measure success.

Clearance of invasive flora

Proposed: Removal of all invasive plant species from Mars Bay and Waterside Fairs NRs plus 200m buffer zone.

Purpose: Protect the NR and relevant species from the threats of invasive species.

Outcome: No invasive plant species remain on the Nature Reserves or in surrounding buffer zones.

	Description	Target	Priority
1a	Monitor the Mars Bay NR for new recruits of Mexican thorn. Visit previously marked trees to check for regrowth. Where necessary, cut and treat with herbicide mix.	100% of NR checked every 3 months. All regrowth treated.	HIGH PRIORITY Every quarter
1b	Removal of all Mexican thorn, *Nicotiana*, and other invasive plant species from Waterside Fairs NR using best practice mechanical and chemical methods.	No invasive plant species within Waterside Fairs NR by Year 5.	HIGH PRIORITY Completed by Year 4
1c	Removal of all Mexican thorn in the 200m buffer zone around Mars Bay NR boundary using best practice mechanical and chemical methods	No Mexican thorn plants within Mars Bay NR 200m buffer by Year 5.	LOW PRIORITY Year 2
1d	Removal of all Mexican thorn, *Nicotiana*, and other invasive species in a 200m buffer zone around Waterside Fairs NR boundary using best practice mechanical and chemical methods.	No invasive plant species within Mars Bay NR 200m buffer by Year 5.	LOW PRIORITY

Annexure 6 - Beach Nature Reserves Action Plan

- Long Beach Nature Reserve
- South West Bay Nature Reserve
- North East Coast Nature Reserve

Threats:

- Mexican thorn (*Neltuma juliflora*)
- Heliotrope
- Mexican poppy (*Argemone mexicana*)

This section describes the management actions that will be undertaken in the next five years to protect the natural features of the Beach Nature Reserves. These actions are designed to address the threats identified and to build support and resilience in the Nature Reserves so that the objectives of this plan are met.

South West Bay, also known as Pan Am Nature Reserve, sits within the US Airforce (USAF) Base Area, and management of the land is the responsibility of USAF and its contractors. They manage a beach hut at the south of the beach that is accessed via a dirt track that runs behind the beach. The end of the runway and buildings associated with the military base lie just outside of the reserve boundary at the top of the slope behind the beach. A pipeline carrying aircraft fuel runs roughly parallel to the reserve's eastern boundary.

All of the actions will be led by the Ascension Island Government Conservation and Fisheries Directorate, but many will require the support of other organisations and volunteers from the Ascension Island community to be successful. Targets have been identified for all of the actions to ensure they are on track and are completed within the lifespan of the management plan.

Action	Description	Targets
Non-native shrub removal	Remove all non-native shrubs such as Mexican thorn and tree tobacco through best-practice mechanical means such as cutting and applying herbicide to the cut stumps, ring barking, and bark stripping. Control efforts will focus on the beach habitat and buffer zones around them. Maintenance checks will be carried out at a minimum of six-month intervals to identify and remove new seedlings and regrowth.	All non-native shrubs removed from beaches by 2023. Buffer zones cleared by 2026.
Clearance of annual weeds from beach habitat	Annual weeds will be hand-pulled from the beaches at least every six months preferably before they set seed. This is likely to be an ongoing process because of the large source of wind-blown seeds present across the island. Where possible, weed clearance will be incorporated into community beach cleans to allow members of the public to assist with protecting the Nature Reserves.	Annual weeds are cleared from beach habitat in all the nature reserves every six months.

Annexure 7 - Letterbox Nature Reserve and Boatswain Bird Island Sanctuary Action Plan

- Letterbox Nature Reserve
- Boatswain Bird Island Sanctuary

Threats:

- Wild tomato (*Solanum* spp.)
- Guava (*Psidium* spp.)
- Tree tobacco (*Nicotiana* spp.)
- *Casuarina* spp.
- Mexican poppy (*Argemone mexicana*)
- Lantana spp. (*Lantana camara*)
- Swamp flat-sedge (*Cyperus* spp.)

The following section describes a number of actions to be achieved in the next five years. Actions are prioritised (High, Medium or Low) according to the positive changes they will make to the Letterbox and South Coast NRs. Actions are arranged according to the threats that they address. Each is numbered for identification with clear targets and suggested timeframes to measure success.

Clearance of invasive flora

Proposed: Removal of key invasive plants from designated boundaries within the NR.

Purpose: Protect the NR and relevant species from the threats of invasive species

Outcome: No invasive plant species found in seabird nesting or Ascension spurge habitat.

	Description	Target	Priority
1a	Monitor and remove new recruits within the watershed above Razors Edge.	Watershed cleared of invasive plants	HIGH PRIORITY Twice annually
1b	Monitor and remove new recruits encroaching onto Wig Hill from the western edge towards the Ascension spurge sites on Little White Hill and Little White Horse Hill.	Wig Hill remains free of invasive flora	HIGH PRIORITY Area checked every quarter
1c	Remove *Waltheria* and swamp flat-sedge within 200m boundary of Ascension spurge area.	Boundary of 200m around spurge sites free of non-native plants	MEDIUM PRIORITY Ongoing
1d	Clearance of guava from White Horse Hill	Plateau of White Horse Hill free of invasive guava	MEDIUM PRIORITY Cleared by Year 5

Annexure 8 - Hummock Point Nature Reserve Action Plan

Threats:

- Whistling pine (*Casuarina equisetifolia*)
- Mexican thorn (*Neltuma juliflora*)
- Tree tobacco (*Nicotiana glauca*)
- Guava (*Psidium guajava*)

The following section describes a number of actions to be achieved in the next five years. Actions are prioritised (High, Medium or Low) according to the positive changes they will make to the Nature Reserve. Actions are arranged according to the threats that they address. Each is numbered for identification with clear targets and suggested timeframes to measure success.

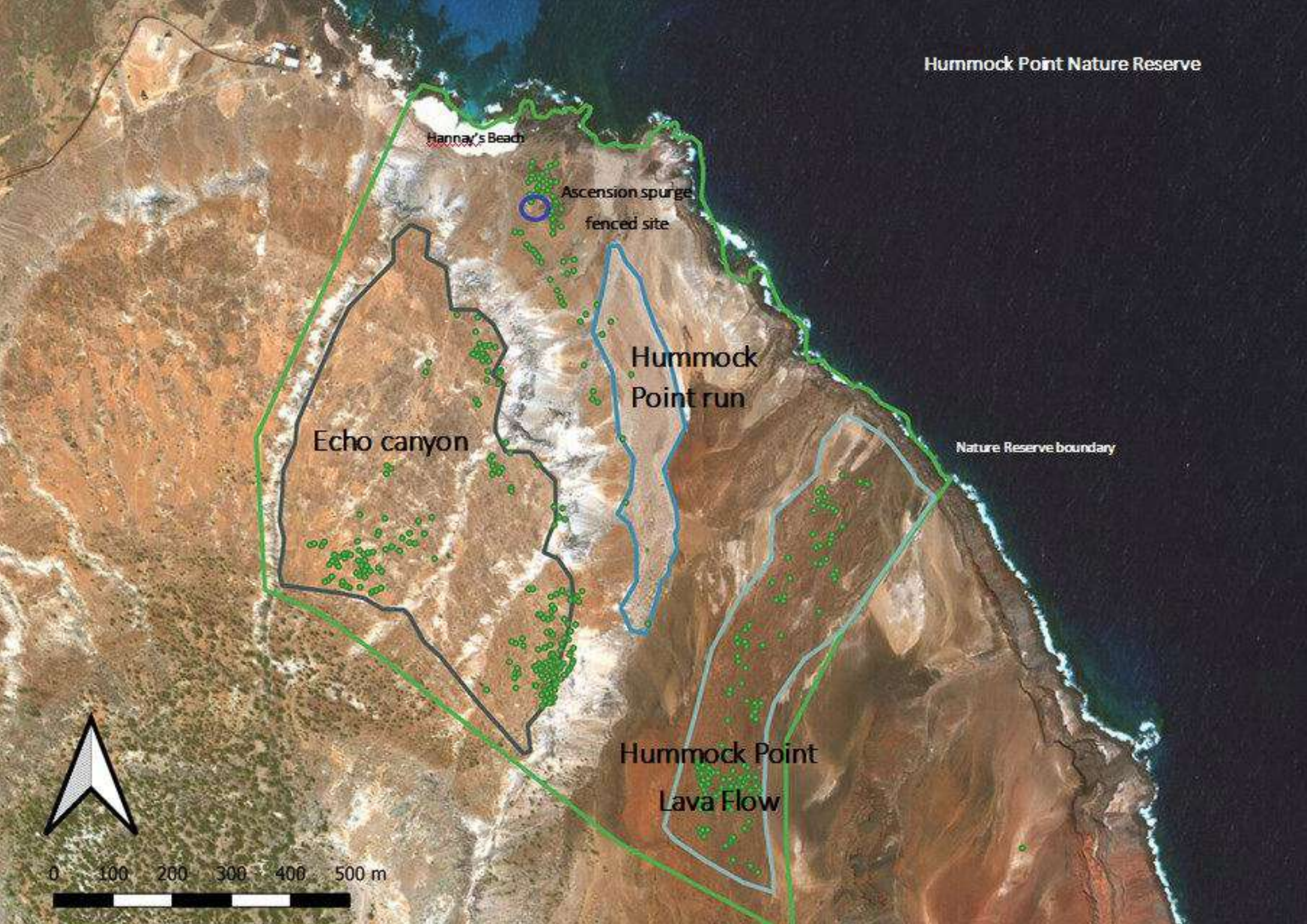
Clearance of invasive flora

Proposed: Removal of key invasive plants from designated boundaries within the NR.

Purpose: Protect the NR and relevant species from the threats of invasive species

Outcome: No invasive plant species found in seabird nesting or Ascension spurge habitat.

	Description	Targets	Priority
2a	Remove encroaching whistling pine and other invasive species from the Hummock Point lava flow (see overleaf).	No mature whistling pine in lava flow	HIGH PRIORITY Completed by Year 5
2b	Monitor the Echo Canyon (see overleaf) area for new recruits of whistling pine. Visit previously marked trees to check for re-growth. Where necessary, cut and treat with herbicide mix. All	Echo canyon area clear of whistling pine	HIGH PRIORITY Annually
2c	Treatment of mature Mexican thorn in the critical Ascension spurge habitat within the NR (see overleaf, green dots highlight spurge plants recorded in Sept 2024).	No Mexican thorn in NR	HIGH PRIORITY Completed by Year 5
2d	Removal of tree tobacco in the Echo Canyon section of the NR (see overleaf).	No tree tobacco in Echo Canyon area of NR	HIGH PRIORITY Completed by Year 5
2e	Removal of all invasive flora encroaching onto Hannay's Beach.	No invasive flora on Hannay's Beach	HIGH PRIORITY Annually


Hummock Point Nature Reserve
Hannay's Beach
Ascension spurge
fenced site
Hummock
Point run
Echo canyon
Nature Reserve boundary
Hummock Point
Lava Flow
0
100
200
300
400
500 m

Threats:

- Mexican thorn (*Neltuma juliflora*)
- Tree tobacco (*Nicotiana glauca*)

The South Coast NR is the most remote part of Ascension Island so reserve maintenance is not extensive due to access constraints. The following section describes a number of ambitious actions which may be feasible for the five-year period of this Management Plan.

Clearance of invasive flora

Proposed: Removal of key invasive plants from designated boundaries within the NR.

Purpose: Protect the NR and relevant species from the threats of invasive species

Outcome: No invasive plant species found in seabird nesting or Ascension spurge habitat.

	Description	Targets	Outcome
1	Annual site visits to the South Coast NR to monitor the spread of invasive vegetation reaching reserve boundary.	Where possible, remove invasive vegetation encroaching onto reserve.	• Preservation of barren habitat preferred by reserve species. • Prevention of further spread of non-native invasive species and their impact on the habitat and reserve species. • Hiking trails remain accessible for reserve visitors.

Annexure 10: Summary of control methods per species

<table>
<tr><th>Species</th><th>ID</th></tr>
<tr><td>
Scientific name: Argemone mexicana
Common name: Mexican poppy
Chemical control:
<table>
<tr><th>Chemical and concentra-</th><th>Rate</th><th>Comments</th></tr>
<tr><td>Glyphosate® 360 g / L

(Various trade names and formulations)</td><td>7.5 – 10 ml / L</td><td>Foliar spray when actively growing.
Treatment for seedlings or adults (individuals or infestations).</td></tr>
</table>
Non-chemical control:
Hand pull seedlings before seeds ripen.
Recommended for small isolated infestations.
</td><td>  </td></tr>
<tr><td>
Scientific name: Casuarina equisetifolia
Common name: Australian pine tree
Mechanical and chemical control:
<table>
<tr><th>Chemical and concentra-</th><th>Rate</th><th>Comments</th></tr>
<tr><td>Triclopyr® 480 g/L EC</td><td>Garlon™ 480 EC
100 ml / 10 L diesel or 150 – 300 ml / 10 L water</td><td>Cut stumps 15 cm above ground and apply to cut surface and all exposed parts.</td></tr>
</table>
Non-chemical control:
Hand-pull seedlings
</td><td>  </td></tr>
</table>

Species	ID
Scientific name: Lantana camara Common name: Black lantana <u>Mechanical and chemical control:</u> **Chemical and concentration** / **Rate** / **Comments** Imazapyr® 100 g / L SL (Eco-Imazapyr®; L8202) / 200 ml / 10 L water / Cut stump. Apply to the sapwood region of the freshly cut stump surface. Imazapyr® 100 g / L SL (Eco-Imazapyr®; L8202) / 200 ml / 10 L water / Foliar application. Apply as a full cover spray to the point of run-off to coppicing plants. Trees should be 0.5 – 1 m in height. <u>Non-chemical control:</u> Hand pull seedlings and saplings.	
Scientific name: *Nicotiana glauca* Common name: Tree tobacco <u>Mechanical and chemical control:</u> **Chemical and concentration** / **Rate** / **Comments** Use of an herbicide containing Picloram (Access® 240 SL). / Not specified / Foliar application Herbicides containing Glyphosate (Roundup®) / 1–2% v/v Roundup® ProMax in water. 50% v/v Roundup in water. / Spot treatment. Cut stump treatment <u>Non-chemical control:</u> Hand pulling can be used to remove seedlings and small saplings, especially before seeds ripen.	

Species	ID
Scientific name: *Opuntia elatior* Common name: Red-flower prickly pear <u>Mechanical and chemical control:</u> **Chemical and concentration / Rate / Comments** Glyphosate (450g/L) (Roundup CT®) — Not specified — Stem injection; Used while actively growing.; Inject a measured dose into the pad using a drill or drenching needle. Turbodor® 29 MPA — Low-volume full-cover spray.; Use a knapsack sprayer with a solid cone nozzle.; Maintain a constant pressure of between 200 and 300 kPa. — Maintain a distance of approximately 20-30 cm from the target.; Apply herbicide to the entire stem and all cladodes, including cladodes lying on the ground. <u>Non-chemical control:</u> All fragments must be removed and burned at the dump.	
Scientific name*: Psidium guajava* Common name: Guava <u>Mechanical and chemical control:</u> **Chemical and concentration / Rate / Comments** Turbodor® 29 MPA — RTU — Cut stump treatment Fluroxypyr/picloram 80/80 g/L ME — 150 ml/10 L water + 50 ml mineral oil — Foliar application <u>Non-chemical control:</u> Hand-pulling seedlings and saplings.	

Species	ID

Scientific name: *Neltuma juliflora*

Common name: Mexican thorn

Mechanical and chemical control:

Chemical and concentration	Rate	Comments
Turbodor® 29 MPA	RTU	Cut stump application
Turbodor® 29 MPA	RTU (using a knapsack)	Basal stem treatment
Garlon® 4 Ultra	40 ml to 500 ml	Cut stump application
Sendero™ 336 SL	Rate/100 L water: 800 ml (0.8 % v/v mixture) + 0.5% mineral oil	Foliar application

Non-chemical control:

Hand pull seedlings.

Notes:

Treatment needs to take place before the first flowering.
Clearance areas needs to be monitored annually.

Scientific name: *Schinus terebinthifolius*

Common name: Brazilian pepper (also known as Wild mango)

Mechanical and chemical control:

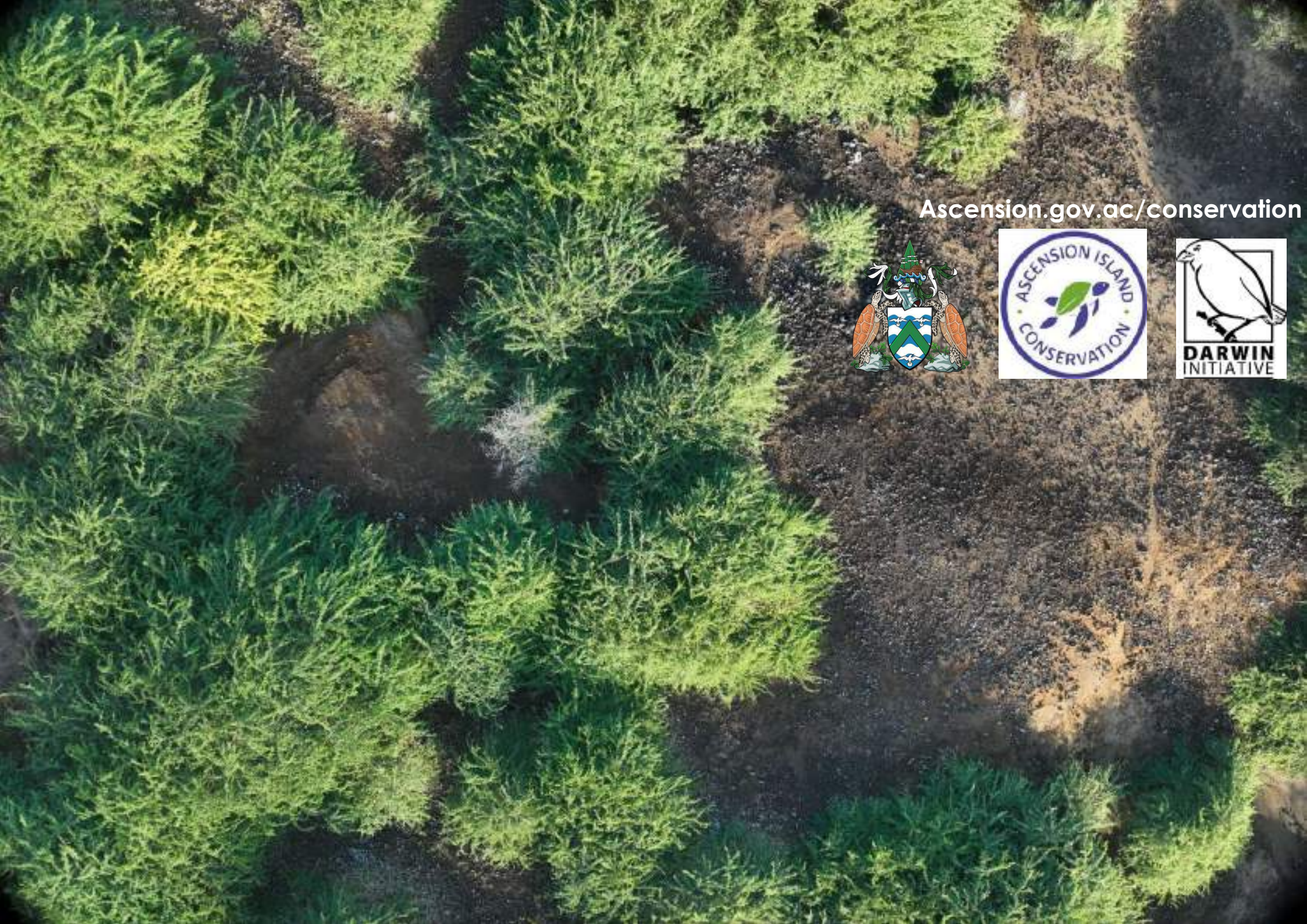
Chemical and con-centration	Rate	Comments
Triclopyr-butoxy ethyl ester (Garlon®)	5% mix in water + dye + wetting agent	Cut stump treatment
Triclopyr 480 g/L EC (Garlon™ 480 EC)	200 ml/10 L diesel	Basal stem treatment Ensure thorough wetting of the root crown, exposed roots, and stem up to a height of 0.25m.

Non-chemical control:

Hand pull during the seedling stage (before seeds ripen).

Species	ID
Scientific name: *Tecoma stans* Common name: Yellow boy Mechanical and chemical control: Non-chemical control: Hand pull seedlings and saplings.	

Chemical and concentration	Rate	Comments
Glyphosate 360 g/L (Various products)	1.0 L in 50 L of water	Spray seedlings
Triclopyr 240 g/L + Picloram 120 g/L (Access®)	1.0 L in 60 L of diesel (or biodiesel such as Biosafe).	Basal bark application for stems up to 5cm in diameter. Cut stump application for plants with a diameter up to 5 cm at the base.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