Ascension Island Biodiversity Action Plan

MEXICAN THORN (*Prosopis juliflora*)

Photo: Kevin Schafer

SUMMARY

Taxonomy: Kingdom: Plantae; Phylum: Tracheophyta; Class: Magnoliopsida; Order: Fabales; Family: Fabaceae; Genus: Prosopis; Species: *Prosopis juliflora*

Nativeness: Introduced, naturalised

Description: Thorny, leguminous, drought tolerant shrub or small tree, usually up to 5m tall but occasionally up to 18m under favourable conditions. Produces small greenish-cream flowers and long, flattened brown or yellowish seedpods 10-25 cm in length. Grows in arid or semi-arid environments, producing deep tap roots up to 30m long.

Local trend: Increasing

Impacts: Outcompetes native vegetation in the area that it invades, forming dense impenetrable thickets that limit access and provide food and habitat for high densities of rats. May reduce availability of seabird and sea turtle nesting habitat if allowed to spread further.

Citation: Ascension Island Government (2015) Mexican thorn species action plan. In: *The Ascension Island Biodiversity Action Plan*. Ascension Island Government Conservation Department, Georgetown, Ascension Island

2. Distribution

Global

Native to Central and South America and the Caribbean but is now pan-tropically distributed as an invasive weed in Africa, Australia, the Middle East and India, amongst others [1].

Local

Prosopis juliflora is predominantly distributed across the low-lying semi-desert area on the western half of the island, at altitudes below 400 m. It is densest in the area surrounding Traveller's Hill and in the central drainage basin running west from Two Boat's Village towards Georgetown, where it often forms impenetrable thickets. Thinner stands are also spreading along the valley that runs from Two Boats Village to North East Bay and south towards the Wideawake Fairs and Mountain Red Hill. A conservative assessment based on satellite imagery suggested that in 2006 Mexican thorn covered an area of 20.6 km2, with 7.1 km2 classified as "dense" (Alan Mills Consulting, unpublished data).

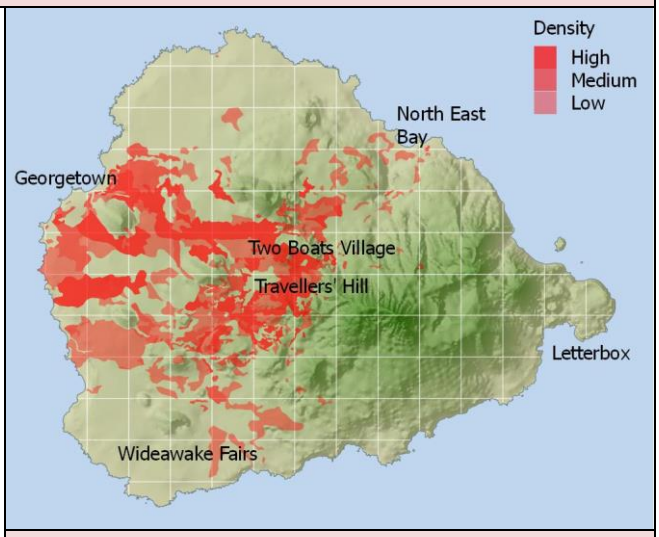

Figure 1. Approximate distribution of Mexican thorn in January 2006. Shaded areas are minimum convex polygons drawn around the positions of individual trees digitised by eye from satellite imagery and manually assigned to one of three density classes (Alan Mills Consulting, unpublished data) [2].

3. Status

Population estimate:	>31,500 individuals	Trend:	Increasing

Mexican thorn was not recorded on Ascension Island during the botanical surveys of Duffey (1964) and Packer (1967) [3,4]. It is believed to have been first introduced in the late 1960's with the aim of helping to consolidate soil around the newly constructed Two Boats Village [5]. This is supported by anecdotal accounts attributing its introduction to David Stokes, the Estates Manager on the Island between 1968 and 1971 [6](AIG Conservation, unpublished data). Prosopis apparently only became conspicuous as an invasive weed during the late-1980s [7], which may have prompted suggestions that it was introduced in a consignment of organic material from South Africa around this time [8]. It has since naturalised and spread rapidly across much of the low-altitude semi-desert area on the western half of the island. Based on visual counts from satellite imagery the total population in 2006 was estimated at 31,500 individuals (Alan Mills, unpublished data), although this is likely to be conservative as trees growing in more crowded habitats may have been overlooked. There is some evidence that the advance of Mexican thorn may have been slowed in recent years due to damage by invertebrate pests. In particular, a mirid bug (*Rhinocloa sp*) and a psyllid (*Heteropsylla reducta*), thought to have been introduced accidently from the Caribbean, are causing widespread defoliation in many parts of the species range and have been credited with substantially reducing seedling recruitment [2,9]. White recorded stunting from these insects on 98% of trees sampled, with 30% showing heavy dieback [9]. Seed predation and stem gnawing by introduced ship rats (*Rattus rattus*) is also having a significant impact on fecundity and growth [9] (AIG Conservation unpublished data). However, while herbivory may have slowed the rate of spread it has not halted it altogether. Damage from *Heteropsylla* and *Rhinocloa* was reported as early as 1997 [2] but Mexican thorn has continued to expand its range in the years since. In 1996 it was present in 58% of 1 km grid cells [8] and this had increased to 72% by 2008 [7]. Further spread is likely to occur without management.

4. Ecology

Habitat

Mexican thorn is a dryland specialist growing in arid to semi-arid environments in many tropical areas. They have extensive lateral root systems to capture surface water after rain and deep tap roots (up to 30m) allowing them to survive prolonged drought by accessing the water table [1]. They are fast-growing, nitrogen fixing and very salt and drought tolerant [1]. On Ascension Island, Mexican thorn predominantly occurs on low-lying lava and ash plains below 400m with soils composed of weathered volcanic scoria. Annual rainfall in these habitats typically ranges from 40-700 mm (Met Office unpublished data) and rainfall events are episodic meaning prolonged periods of drought are not uncommon.

Reproduction & life history

Prosopis produce small greenish-cream flowers which are pollinated by insects [1]. They generally fruit once per year, although mature trees may still produce thousands of seeds annually (Global Invasive Species Database 2014). Seedpods are yellowish-brown when ripe and contain up to 30 seeds [1]. The seeds have a hard outer layer, or exocarp, which require damage to stimulate germination. The seedpods are palatable to animals and are often dispersed by livestock. Feral donkeys and sheep are thought to be major vectors on Ascension Island [10], although rodents and birds are also potential seed vectors. Seeds dropped on the ground are also dispersed by water in the drainage flows of the irregular torrential rains which hit Ascension [8]. Seeds may remain viable for up to 50 years [11].

Taxonomy & population structure

Some doubt has been cast on the taxonomy of Mexican thorn on Ascension Island, with suggestions that it may be the result of hybridisation between closely related *Prosopis* species such as *P. juliflora*, *P. velutina* and *P. glandulosa* [2].

4. Impacts*

1. Competition with native species	**Magnitude:**	MODERATE

Prosopis is extremely effective at monopolising available groundwater, light and nutrients and easily outcompetes native vegetation, quickly replacing the original semi-desert flora of grasses, sedges and succulents in the areas that it has invaded. Its favoured habitat is the same as that of the endemic Ascension spurge, *Euphorbia origanoides*, and its spread into the remaining strongholds of this species would likely force *E. origanoides* into extinction.

9. Chemical, physical or structural impacts on ecosystem	**Magnitude:**	DATA DEFICIENT

Prosopis forms impenetrable, thorny thickets that significantly alter the physical structure of the habitats that it invades, impeding human access and potentially impacting on native species. Without on-going management, encroachment on important sea turtle nesting beaches and seabird colonies would almost certainly occur, reducing the extent of suitable nesting habitat for these species. Its current distribution already includes some putative former seabird nesting colonies and its continuing spread may limit further re-colonisation of the main island following the eradication of feral cats in 2004. The impacts of *Prosopis* on habitat suitability for other native species are less clear. However, it seems likely that its spread across the lowland ash and lava plains has profoundly affected their physical characteristics (e.g. edaphic properties, groundwater hyrology and microclimates) and may pose a threat to the small but important populations of endemic invertebrates that they support [8,2]. Preliminary results suggest that invertebrates are less diverse and less abundant at sites infested with *Prosopis* than at uninvaded sites [7], although this requires confirmation.

10. Interaction with other invasive species	**Magnitude:**	DATA DEFICIENT

The colonisation of many previously barren areas by *Prosopis* appears to have facilitated the spread of several other problematic invasive alien species, including rats, mice, rabbits and mynas [7]. Rats consume seeds, flowers, bark and shoots and are ten times more abundant in *Prosopis* thorn scrub than in the native habitats it has replaced [12]. Its presence around seabird colonies and sea turtle nesting beaches may therefore exacerbate predation of chicks, eggs and hatchlings by sustaining large rodent populations that would otherwise be constrained by seasonal access to food and water. It has also been suggested that *Prosopis* may facilitate the spread of other, introduced weeds by encouraging soil formation [7] and that it may harbour large populations of introduced invertebrate pests, predators

and parasites that could threaten Ascension Island's native flora and indigenous invertebrates [8,2]. However, neither of these threats has been confirmed.

11. Other impact - Fire risk

Ascension Island has no natural fire regime. However, *Prosopis* burns readily and the considerable biomass of that now surrounds many human settlements, military installations and commercial sites poses a potentially significant fire risk [8,2].

*Impacts are classified and scored according to the IUCN Global Invasive Species Database scheme [13]

6. Management notes

Several management plans have been produced previously for Mexican thorn [7,8,2], although the majority of recommendations have yet to be fully implemented. A complete eradication is generally considered to be unfeasible and potentially unnecessary [7]. Instead the favoured control option is site-based management to manually remove thorn trees from key conservation areas, combined with biological control to effect a long-term reduction in fecundity and rates of spread at broader scales [7,8,2].

Immediate priorities for site-based management are seabird colonies, turtle nesting beaches and *Euphorbia origanoides* strongholds, and would be best approached through the establishment of exclusion zones for a range of woody invasives, including Mexican thorn, *Nicotiana glauca*, *Casuarina equesitifolia* and *Psidium guajava*. Longer term targets include remaining fragments of native grassland and certain geological features, such as areas surrounding lava cave systems. As recommended by Belton [7], site-led management should consist of two distinct phases: an intensive 'knockdown phase' to remove the majority of mature individuals followed by a 'maintenance phase' in which cleared areas are monitored periodically to check for recruits and treat any recovering plants. Most woody species grow relatively slowly in Ascension's semi-desert habitats and young plants are easily controlled by hand pulling, so on-going maintenance should be light provided that it is sufficiently regular. It is important to note that several previous management plans have proposed exclusion areas for Mexican thorn that never subsequently materialised [7,8,2], so it is vital that these objectives are now implemented and sustained. Mapping exclusion zones in the Conservation Department GIS and erecting physical markers may help to establish them as distinct geographical entities, while setting up recurring monitoring visits under the Biodiversity Action Plan should provide the continuity of action needed to prevent re-invasion.

At broader scales, biological control represents the only viable option for limiting the spread of Mexican thorn and has already been successful in slowing its advance [2,9,14]. Four biocontrol agents have been introduced to the Territory, either intentionally or inadvertently. Two seed-boring bruchid beetles (*Algarobius prosopis* and *Neltumius arizonensis*) were deliberately introduced in 1997 [2] and two sap-sucking species, one a psyllid (*Heteropsylla reducta*) and the other a mirid bug (*Rhinocloa sp*.), appear to have arrived accidently from the Caribbean. Although the bruchids have had limited impact, the mirid and the psyllid are causing significant dieback [9]. Recently, an additional biocontrol agent has been identified as potentially suitable for introduction to Ascension Island [14]. This agent is a tiny and as yet undescribed gelechiid moth, *Evippe* sp. from Argentina, which has caused spectacular damage to *Prosopis* spp. in dry tropical parts of Australia. Where it has become established it maintains high densities, resulting in greatly reduced growth rates and seed production. Further host range testing would be necessary before sanctioning an introduction to Ascension Island and the conservation benefits would need to be properly considered. Indeed, it is debateable whether the presence of Mexican thorn in areas where there are few obvious conservation values is a concern or if having some vegetation is preferable to none at all (e.g. in terms of erosion control, dust suppression, carbon sequestration and a general 'greening' of the environment) [7]. There is also the possibility that retreating Mexican thorn would be quickly replaced by other equally noxious weeds, such as tree tobacco (*N. glauca*). Further research into the ecology of Ascension's lava and ash plain habitats, in particular the invertebrate communities, is needed to assess their biodiversity value and understand the possible benefits of removing Mexican thorn. A reassessment of the distribution and effectiveness of existing biological controls and a detailed analysis of the spread and future invasion potential of Mexican thorn would also be valuable to determine whether releasing *Evippe* is desirable.

References

1. Pasiecznik N, Felker P, Harris P, Harsh L, Cruz G, Tewari J, Cadoret K & Maldonado L (2001) *The Prosopis juliflora - Prosopis pallida complex: A monograph*. HDRA, Coventry, UK.
2. Duffey E (1964) The terrestrial ecology of Ascension Island. *Journal of Applied Ecology* **1**, 219–251.
3. Packer J (1968) *A Concise Guide to Ascension Island*. Ascension Heritage Society.
4. Packer JE (2002) *A concise guide to Ascension Island, South Atlantic.* Ascension Heritage Society.
5. Anon (1971) David the Island Tamer. *Works World* , 7.
6. Belton T (2009) *Management Strategy for Mexican Thorn (Prosopis juliflora) on Ascension Island*. RSPB.
7. Pickup AR (1999) *Ascension Island Management Plan*. RSPB. 110 pp.
8. Fowler SV (1998) *Report on the invasion, impact and control of 'Mexican thorn', Prosopis julifera, on Ascension Island*. CABI Bioscience, Ascot, UK.
9. White L (2009) *Survey of Biocontrol Agents of Mexican Thorn (Prosopis juliflora) on Ascension Island*. Undergraduate Dissertation. University of Exeter, UK.
10. Ashmole NP & Ashmole MJ (2000) *St Helena and Ascension Island: a natural history*. Anthony Nelson, Oswestry.
11. R. B. G. Kew (2008) *Seed Information Database (SID). Version 7.1.* <Available from: http://data.kew.org/sid/ >.
12. Dawson E (2013) *The diet and distribution of invasive ship rats (Rattus rattus) on Ascension Island*. MSc Thesis. University of Exeter, Exeter, UK.
13. Blackburn TM et al. (2014) A Unified Classification of Alien Species Based on the Magnitude of their Environmental Impacts. *PLoS biology* **12**, e1001850.
14. Maczey N & Tanner R (2013) *Concept Note: Biological Control of Mexican thorn on Ascension Island*. CABI.