

PROGRESS OF THE NATIONAL TROPICAL WEEDS ERADICATION PROGRAM

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INTRODUCTION

The nationally cost-shared National Tropical Weeds Eradication Program (NTWEP) targets infestations of *Miconia calvenscens* DC., *Limnocharis flava* (L.) Buchenau, *Mikania micrantha* Kunth, *Miconia racemosa* (Aubl.) DC. and *Miconia nervosa* (SM.) Triana. All target weeds are native to tropical and subtropical areas of Central and South America, and the Caribbean. The program commenced in late 2003 and recently received endorsement for a national Response Plan from 2024 to 2028.

Survey and control operations for NTWEP are predominantly on-ground and conducted by NTWEP field crews in Queensland and Rous County Council in New South Wales. The New South Wales and Northern Territory governments also assist with coordinating and conducting various NTWEP related activities in their respective jurisdictions. Queensland Parks and Wildlife Service and several local governments also provide on ground support to the Program.

As a long running program, the NTWEP has developed various sources of field data to measure the progress towards eradication and reporting progress as indicators to nationally cost-sharing partners. This eradication data, progress and issues differ for each target weed and are discussed below.

ERADICATION PROGRAM DATA

Field crews conduct surveys covering areas of suitable habitat within prescribed dispersal buffers around plant records (waypoints). Field control records for each waypoint are converted into presence or absence records for 100 x 100m (1 ha) management areas on a static grid. The management areas are reporting tools that have had at least one plant once and are not field survey units.

Where the last record is a presence record the management area is in a 'control' phase. Where the last visit record was an absence record and is more than a year after the last presence record then a 'monitoring' status is allocated. Areas in a monitoring phase are also by the number of years since last plant. This process of allocating a control or monitoring status is similar for all target species and was documented for *M. micrantha* (Brooks and Jeffery 2018), *M. calvenscens* (Brooks and Erbacher 2022) and *L. flava* (Brooks *et al.* 2022). This process yields the allocation of management areas into the categories in Figure 1. The rates of 'progression' of management areas from 'control' to 'monitoring' and 'reversion' where plants are found in 'monitoring' areas are calculated from this categorisation process.

Many other parameters are summarised every 6 or 12 months for internal and external program reporting. A selection of these, as of June 2024, are mentioned below and summarised in the sections about each target weed.

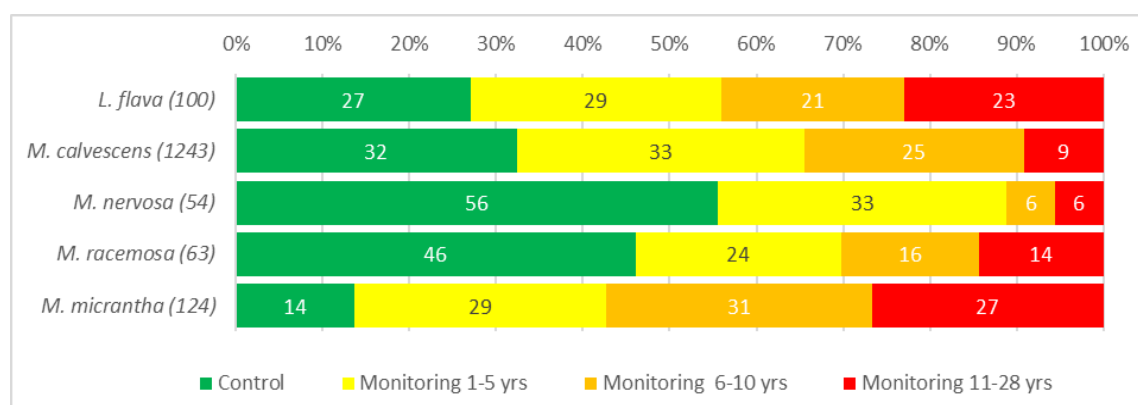


Figure 1. Allocation (%) of each NTWEP weeds management areas to control and monitoring categories (total management areas per weed), as of June 2024.

The time since last mature plant or discovery is a useful tool and generates data of a similar type to the ‘time since last detection’ (e.g. Brooks and Jeffery 2018). However, there are spatial limitations using small, arbitrary areas for this summary data as some *Miconia* sp. and *L. flava* management areas have only had seedlings recorded from seed dispersal. Mature plants have not been recorded in every management area.

Other important trends and figures used as program reporting indicators to cost-share partners relate to the occurrence of mature plants. Mature, and potentially mature plants are incorporated into the search areas of suitable habitat within the prescribed dispersal buffer. The plants include those with reproductive material present or, in the case of *Miconia* sp., of a size that may have had past reproductive episodes (e.g. Brooks and Erbacher 2022). Mature plants are noted as a ‘reproductive relapse’ where they occur in ‘known’ management areas, where there was a plant present in a previous financial year (Table 1). Search area expansions, and a 5-year rolling mean of mature plants in known management areas (relapses) (Table 1) are used as indicators in NTWEP annual reporting.

Table 1. The % of known management areas with mature plants in each of the last three financial years and the 5-year mean for financial years 2019-20 to 2023-24.

Weed	2021-22	2022-23	2023-24	5-yr mean
<i>L. flava</i>	0.0	0.0	0.0	0.3
<i>M. calvenscens</i>	0.3	0.0	0.1	0.2
<i>M. nervosa</i>	0.0	0.0	7.0	4.3
<i>M. racemosa</i>	1.8	1.8	1.6	1.4
<i>M. micrantha</i>	3.6	2.4	0.0	1.6

The process leading to the discovery of each infestation (loci) is placed in one of four categories (Brooks and Galway 2008). As of June 2024, detection by officers who have or are working in a weed related field remains the most common method (46%) of finding new loci. Specific searches (7%) have only detected a couple of older *M. micrantha* loci along water courses. Public awareness (35%) through extension

activities (including social media) are an important source of new loci, particularly for the more recognisable *M. calvenscens* and *L. flava* which may originate from cultivated situations. Encouragingly, public reports are often for plants in known loci. Tracing activities including recent detections online have found 17% of new loci.

In addition to the discovery of new loci, the rate of discovery and distance to new management areas within loci are calculated each financial year. Most new management areas share a boundary or are close to known areas and reflect local dispersal and seedling emergence, not long-distance dispersal. The discovery of more remote management areas can suggest issues with local delimitation or containment.

The search areas (in hectares) and recorded field effort (in days) are analysed per financial year. From ground surveys conducted by field crews in 2023-24, 5311 days of field worker effort were recorded. *Miconia calvenscens* accounted for 72.3% of this effort, *M. micrantha* 12%, *M. nervosa* 10.1%, *M. racemosa* 3.5% and *L. flava* 2%. The overwhelming majority of resources used by the NTWEP relate to field surveys. The search areas are determined by dispersal buffers from mature plants and areas of suitable habitat. The total search area also reflects the different frequencies for each target species. In 2023-24, the NTWEP and collaborators searched 5007 ha for *M. calvenscens*, 1176 ha for *M. micrantha*, 295 ha for *M. nervosa* and 328 ha for *M. racemosa*. The search areas for *L. flava* are not reported as a formal indicator.

Most surveillance is conducted in tropical rainforests, year-round, in the wettest places in Australia. The NTWEP considers safety a key factor in eradication efforts and regularly summarises data related to categories, timing and injury type of reported safety events. This analysis assists the program to continually invest in improving safety outcomes for the field officers that undertake operations across challenging tropical terrains.

LIMNNOCHARIS FLAVA

Limnnocharis flava is an anchored aquatic herb. Due to the potential for short maturity times throughout the year, field sites are visited monthly (Brooks *et al.* 2022). Despite a high re-visit frequency, *L. flava* has the lowest proportion of field worker days. Loci of *L. flava* are classified as 'free flowing' where they occur in creeks, dams and drains through which water can flow. Twenty-four free flowing loci occur between Cairns and Townsville in northern Queensland. They are small and discrete with one to nine management areas. The small infestations result from downstream establishment which is limited by higher water flows, rockier substrates, and salt water. The occurrence of mature plants at known locations is very low (Table 1), often zero annually. Pre-discovery seed input has formed a persistent soil seed bank requiring more than ten years of control and twenty years of monitoring at free-flowing loci.

Loci can also be classified as 'contained' where the plants occur in domestic water features, ponds or are otherwise cultivated in an area where water does not readily flow. Twenty-seven contained loci are a single management area each. They have a wider occurrence from Proserpine to Cape Tribulation in northern Queensland and two suburbs in south-east Queensland. Another two loci of *L. flava* cultivation have been detected in the Northern Territory. One site of past cultivation in Lismore in New South

Wales was identified from seed samples. Recent discoveries of cultivated plants have been through sale on social media sites as this plant is widely used as an edible vegetable throughout Southern Asia (Brooks *et al.* 2022).

The potential for cultivation and online sale of *L. flava* is high and extends to jurisdictions across Australia (Brooks *et al.* 2022). While the frequency of mature plants within known infestations is very low, the overall eradication progress of *L. flava* is suppressed by the discovery of small discrete loci (both types) and a persistent soil seed bank at free-flowing loci.

MICONIA CALVESCENS

Miconia calvenscens is an invasive shade tolerant small rainforest tree which takes four or more years to mature. There are three large *M. calvenscens* loci in far North Queensland, each over 100 management areas, and with more than 38 naturalised loci (Brooks and Erbacher 2022). Despite a re-visit frequency of one to three years for portions of loci, the search effort is by far the largest component of NTWEP field operations. There are also separate search areas for *M. nervosa* and *M. racemosa* at a higher frequency within *M. calvenscens* loci. As *M. calvenscens* is a small tree, the program continues to collect imagery of the rainforest canopy from remotely piloted aircraft. The NTWEP is developing means to automatically process this imagery to automate remote detection (Jeffery and Brooks 2016, Brooks and Erbacher 2022).

Over the last decade the only new *M. calvenscens* loci have been discovered in northern New South Wales; these include naturalised populations and single garden specimens. Further historical, botanical garden and non-naturalised sites have been found in Queensland, New South Wales and Victoria (Brooks and Erbacher 2022).

Despite the limited discovery of new loci, there is still sporadic emergence in new management areas around known loci. Whilst *M. calvenscens* can have a high growth rate, seedling growth can be slow and has resulted in protracted discovery close to previously known management areas. Local discovery and reversion to 'control' status have largely offset progression to monitoring and resulted in slow progress to 32% control (Figure 1). The rate of reproductive relapses is low, at <0.3% (Table 1) of 1200+ known management areas, which implies that emergence is from the 'pre-discovery' soil seed banks rather than recent inputs. The eradication of *M. calvenscens* is suppressed by the local discovery from sporadic and long-term seedling emergence showing variable growth over a range of rugged rainforest habitats.

MICONIA RACEMOSA

The only known occurrence of *M. racemosa* outside of South America and the Caribbean is near Kuranda, inland from Cairns. This locus overlaps with a larger *M. calvenscens* infestation (Jeffery and Brooks 2016), but ground survey and control activities for the shrub *M. racemosa* are conducted twice a year. In recent years, extended ground surveys have detected new management areas to the west of, but within 400 m of, the original location. New management areas and mature plants in

known management areas have resulted in the second highest percentage of management areas in the control phase (Figure 1).

MICONIA NERVOSA

The only known occurrence of *M. nervosa* outside of Central and South America is in the Whyanbeel Valley near Mossman in the wet tropics of Queensland. Part of this infestation occurs within the Daintree section of Wet Tropics World Heritage Area and is surrounded by a larger *M. calvescens* infestation (Jeffery and Brooks 2016). Surveys for *M. nervosa*, a frugivore-dispersed, shade-tolerant shrub, are conducted 2-3 times a year. The last NTWEP response plan (2021-24) addressed the highest occurrence of mature plants in known management areas for *M. nervosa*. This was through more intense and frequent surveys reflecting the occurrence of plants within a 400 m radius, (not on the margins), and resulting in a relatively high proportion of recorded field effort for a single infestation. The 5-year mean of mature plants in known management areas fell over the previous 2021-24 Response plan (Table 1).

Both single location *Miconia* sp. shrubs show high populations and persistent seed banks, particularly in the oldest known management areas, with fresh input from mature plants, and they are highest control percentage of the target weeds (Figure 1).

MIKANIA MICRANTHA

In June 2024, there was one *M. micrantha* locus with plants present. This infestation was discovered near South Mission Beach in 2018, after the update by Brooks and Jeffery (2018). Despite the addition of 29 management areas at South Mission Beach, and three new disparate management areas along the Herbert River near Ingham, *M. micrantha* had the lowest percentage of management areas in control (14%, Figure 1). This progress also comes despite recent reproductive relapses (Table 1) recorded within the South Mission Beach locus. This is the most advanced of the weeds in the program with various data sources mostly indicating a less persistent seed bank. Reversion to monitoring data shows plants are less likely than the other target weeds to re-occur after five years of absence. With plants absent from 58% of management areas for six or more years (Figure 1), *M. micrantha* data is being used to develop criteria for declaring loci eradicated.

2024-28 RESPONSE PLAN DIRECTION

The NTWEP recently commenced a new national cost-shared response plan for 2024-28. As well as maintaining safe field crew survey and control activities, the NTWEP is developing several other areas discussed below.

The NTWEP will continue to investigate remote (aerial) and genetic detection methods, where applicable to the multi-site weeds. The program also plans to have a greater internal capacity to undertake program specific spatial analysis and collect and process more aerial imagery via remotely piloted aircraft. Additional activities include combining the age to maturity research with calculations of field detection

probabilities. The detection and research activities will serve to increase confidence that the extent of each locus is known, being managed to prevent seed input and run down the persistent soil seed banks.

The NTWEP is also planning to increase documentation of the risks of input to known locations and the introduction to yet unmanaged locations. Risks of introduction include potential for cultivation of *L. flava* as an edible vegetable, and other target species as accidental contaminants, or for aesthetic, phytoremediation or medicinal reasons. In addition to maintaining the existing process of detection (Brooks and Galway 2008), the program is also using online detection processes and metrics to increase confidence that the extent of each incursion is known.

A further priority for the 2024-28 response plan is the development of eradication declaration criteria tailored to each incursion. The criteria are based around the topics of a period of monitoring after which plants are unlikely to occur (reversions), the time since last mature plant, the proximity of mature plants, and the recency, frequency and extent of searches during the monitoring phase.

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