

The National Four Tropical Weeds Eradication Program: a case study for future weed eradication projects in the wet tropics

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Summary The national cost shared Four Tropical Weeds Eradication Program has been operating since 2001. This program targets *Clidemia hirta*, *Limnocharis flava*, *Mikania micrantha* and *Miconia* spp. This paper presents an overview of the procedures and challenges associated with undertaking an eradication program in a tropical environment, including: survey, treatment, operational constraints, data collection, research, extension and collaborative arrangements.

Keywords *Mikania micrantha*, *Limnocharis flava*, *Miconia* spp., *Clidemia hirta*, eradication, tropics.

INTRODUCTION

The Four Tropical Weeds Eradication Program (4TWP) is a nationally cost shared program that commenced in late 2001. The 4TWP species are *Clidemia hirta* (L.) D. Don., *Limnocharis flava* (L.) Buchenau., *Miconia calvescens* DC., *Miconia nervosa* (J.E. Smith) Triana., *Miconia racemosa* (Aubl.) DC. and *Mikania micrantha* (Kunth). All species originate from tropical America and have the potential to cause significant environmental, social and economic impacts in Australia. All known active infestations of these species on mainland Australia are confined to the wet and dry tropics on the north east coast of Queensland.

FIELD SURVEILLANCE

Field surveillance is undertaken to monitor for presence or absence of the six species as well as determine the control area (the area that is active due to

the presence of plants) around known infestations. Surveillance activities incorporate intensive surveys of the control area, extended surveys and passive surveillance.

For intensive survey, prescribed dispersal buffers are applied to all known infestation areas (Table 1). These are the minimum radii of surveys around each mature plant. Extended surveys incorporate additional areas that are outside of the prescribed dispersal buffer areas. Additional areas are determined for individual species, based on the potential risk of spread by birds or other dispersal agents, contour and drainage lines, floods, soil disturbance, machinery movement, vegetation loss and human or animal activity.

Intensive field surveys are conducted on foot. To maintain the effectiveness of these surveys, often in dense vegetation and on steep slopes, marked parallel lines are used to systematically survey an area in an 'emu parade' which is a single line with staff spaced at set intervals. Survey frequency and dispersal buffers can be determined on the basis of age to reproduction or dispersal research (Table 1).

Extended surveys are undertaken to delimit the infestation purely by determining presence or absence. Areas that are considered as high risk (such as creeks) are targeted. Extended surveys often incorporate helicopter surveys. The habitats for many of the program's species render helicopter surveys ineffective due to the closed rainforest canopy. In March 2006 Cyclone Larry presented an opportunity for aerial surveys to be conducted with greater confidence. These surveys will

Table 1. Details of 4TWP species as of July 2007 and field survey procedures.

Weed species	Life form	Survey frequency	Prescribed dispersal buffer (m)	Number of infestations
<i>Clidemia hirta</i>	Bushy perennial shrub	10–12 weeks	500	1
<i>Limnocharis flava</i>	Anchored aquatic herb	3–4 weeks	500	19
<i>Mikania micrantha</i>	Scrambling perennial vine	3 months	200	14
<i>Miconia calvescens</i>	Shade tolerant rainforest tree	6 months	500	37
<i>Miconia nervosa</i>	Scrambling shrub	10–12 weeks	500	1
<i>Miconia racemosa</i>	Scrambling shrub	10–12 weeks	500	1

target *M. calvescens* and *M. micrantha* in the Innisfail and Tully areas and have been incorporated into the 2008 and 2009 4TWP operational plan.

Passive surveillance is enhanced by targeted communication strategies (Brooks and Galway 2008).

TREATMENT

Best practice treatment methodologies have been implemented in the 4TWP. Species density and environmental factors such as access, proximity to native vegetation or waterways, and predicted rainfall events determine the treatment methodology used at sites. The primary method of treatment for all species is manual removal. Other methodologies that are utilised include foliar spraying, cut stump, fire and flame weeding. With the exception of some leaf node re-shoots from *M. micrantha*, all species rarely require a second treatment; therefore effective control measures are implemented for each species. Trials of physical or chemical seed bank depletion treatments are being conducted to aid infestation containment and reduce long term control and monitoring costs and risks.

WEED SPREAD PREVENTION

Weed spread prevention activities are a component of the 4TWP operational activities. This comprises three main components: awareness, vehicular weed hygiene and personal weed hygiene (Bocking *et al.* 2008).

CHALLENGES

These species are generally located in environments that are very difficult to access due to the topography, climatic conditions, density of the vegetation as well as the presence of hazardous flora and fauna (Sydes and Galway 2008). The topography consists of steep inclines and ravines for many of the sites. This, combined with the climatic conditions of the monsoon season (January – March) having an average maximum temperature of 30.8°C, an average 9 a.m. relative humidity of 85%, as well as an average monthly rainfall of 587 mm (Bureau of Meteorology 2007), not only makes access difficult but also presents occupational health and safety risks. These risks are addressed by undertaking risk assessments before the commencement of operations and the seasonal scheduling of some field tasks.

The impacts of Cyclone Larry on the 4TWP and individual species were discussed by Galway and Brooks (2007). Short term impacts include safety risks and reduced infestation accessibility from damaged vegetation. The longer term impacts stem from the increased risk of spread due to soil and canopy disturbance. Clean up operations involving machinery also increased the risk of spread. The widespread

canopy disturbance brought by the cyclone has enabled increased mapping and aerial surveillance of several *M. calvescens* infestations.

DATA COLLECTION

In order to provide consistent and reliable information and to demonstrate progress towards eradication, the 4TWP collects data in accordance with the Field Manual for Surveying and Mapping Nationally Significant Weeds. All 13 mandatory core attributes as well as two optional core attributes are included with additional site information on data sheets (McNaught *et al.* 2006). The database also allows for recording and extracting information on multiple revisits to infestations. All information is collated into the Tropical Weeds Database and forwarded to the Queensland weed mapping database (Pestinfo). External agencies and stakeholders complete data sheets and forward all information to the 4TWP so that it can be entered into the database. Information from the database is used to plot the discovery of infestations over time, new treated areas and time since last emergence or reproduction for each species. This data is used to assign a control, monitoring or eradicated status to each infestation and produce indicators of eradication progress for publication in annual and scientific reports (Brooks and Galway 2006).

RESEARCH

Research staff from the Commonwealth Scientific Industrial and Research Organisation (CSIRO), CRC for Australian Weed Management and Biosecurity Queensland have become increasingly involved in the 4TWP since 2003. Projects have aimed to improve operational techniques by investigating age to maturity, (relevant to frequency of surveys), seed dynamics (viability, germination, longevity and seed bank depletion) and biological indicators of progress towards eradication. CSIRO is undertaking several research projects to gain a better understanding of invasive Melastomataceae in the local environment, including: avian dispersal and modelling recruitment in tropical rainforests (Murphy *et al.* in press (a)), the ecological role and spread of weeds following large-scale disturbance (Murphy *et al.* in press (b)) and gene dispersal through the landscape.

EXTENSION ACTIVITIES

A communication strategy has been developed for the 4TWP. Stakeholder groups targeted for communication products are ranked in order of priority towards the overall running and success of the 4TWP for each species. A variety of communication methods, including annual reports, print media mail outs and

Codes of Practice are targeted at specific stakeholder groups. The goals of these activities (such as raising awareness, improving identification, implementing effective control practices and disseminating research findings) are incorporated into the program's business objectives.

Extension activities have run throughout the program and include formal presentations (conferences and workshops), displays (posters and live plant specimens), print media (fact sheets, brochures and identification cards), taskforces, targeted meetings, annual reports, web pages, media campaigns and letter drops. Such activities maintain and spread the ability to detect species amongst stakeholders (Brooks and Galway 2008).

COLLABORATIVE ARRANGEMENTS

Collaborative parties of Department of Primary Industries and Fisheries include Department of Natural Resources and Water, Queensland Parks and Wildlife Service (QPWS), Local Government (Cairns, Cardwell, Douglas, Eacham, Hinchinbrook, Johnstone, Mareeba, Thuringowa and Townsville), CSIRO and landholders. Formal Property Pest Management Plans (PPMP) and many informal arrangements between 4TWP and collaborative parties have been implemented. These arrangements define the responsibilities of each party in regard to survey and treatment works. Formal PPMPs – such as those with QPWS – magnify the resources of the eradication program, provide linkages to intra agency planning and funding processes and address weed threats on adjacent land parcels.

SUMMARY

The 4TWP is one of three current national cost shared weed eradication programs, and faces a unique set of challenges to eradicate these six species. Environmental factors such as climatic conditions, varied species biology, habitats and dispersal mechanisms make tropical infestations difficult to manage. However, 4TWP personnel are able to implement effective survey methodologies, containment protocols, treatment regimes and run down the soil seed bank to manage all six species towards eradication. An external review of the program was conducted in 2006, with the findings confirming that the program's long term goal of eradication remained feasible.

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