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NEW ZEALAND'S BIOSECURITY RESPONSE SYSTEM - A CASE STUDY ON THE RESPONSE TO *Passiflora apetala*

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ABSTRACT

New Zealand's Ministry of Agriculture and Forestry (MAF) is responsible for leading the country's biosecurity system. In July 2008, MAF introduced a single system to respond to all organisms or goods that pose a biosecurity risk to the values of New Zealand (economic, environmental, human health and socio-cultural). This system is used for responses from all sectors, of all sizes, resulting from a new incursion or an established risk organism. One such example is MAF's response to an emerging threat, the bat-wing passion flower (Passiflora apetala) in December 2009. This plant is believed to have been introduced into the country around the mid 1990s for its ornamental value. P. apetala is currently known from discrete populations in the Northland and Auckland regions. Its spread is attributed to subtropical plant enthusiasts and avian vectors. A weed risk assessment indicates the potential for P. apetala to be as invasive as other established Passiflora species in New Zealand. There is a reasonable likelihood of management success for local elimination as P. apetala is in the early stages of naturalisation. A summary of response actions undertaken to date is discussed.

Keywords: Biosecurity system, emerging threat, management, naturalisation, *Passiflora apetala*, weed.

INTRODUCTION

New Zealand's Ministry of Agriculture and Forestry (MAF) is the lead government agency for agriculture, food safety, biosecurity and forestry matters. MAF's focus is on enhancing the integrity and performance of the biological value chain, which covers animals, plants, food and related sectors, and their contribution to New Zealand's economy, environment and social well-being.

Biosecurity Response System

In July 2008, MAF introduced a single system to respond to all organisms or goods that pose a biosecurity risk to the values[1] of New Zealand (Ministry of Agriculture and Forestry 2008). This generic management approach covering all sectors applies to both new-to-New

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Zealand and established risk organisms. The response system can be scaled up or down as appropriate for almost any situation.

The response system is aligned to the response policy, *Preparing for and responding to risk organisms* (MAF Biosecurity New Zealand (2) 2008), and sets out what the Crown will do and what people can expect in respect of responses to pests and diseases (risk organisms). It reaffirms MAF's leadership role, while anticipating that there are other stakeholders who will participate in a response.

Underpinning Principles

The key underlining principles of MAF's biosecurity response system include:

- *Risk-based decision making*: decisions made based on risks to the values[1] of New Zealand at each stage of the response;
- *Whole-of-government approach:* follows New Zealand's Coordinated Incident Management System (CIMS) management structure, terminology and processes for interagency co-ordination and planning;
- *Scalable and consistent:* response phases (Figure 1) and core management approach are the same for a large response as for a small response (3-3,000 person response);
- *Project management:* underpins the approach with a focus on planning the work and working to the plan;
- *A response organisation structure dictated by the work:* organisation charts are based on response activities, not on role-holders. This allows responses to be easily scaled up or down;
- *Activities:* defined by the work that is required to be completed, not by the responsibilities of role-holders.

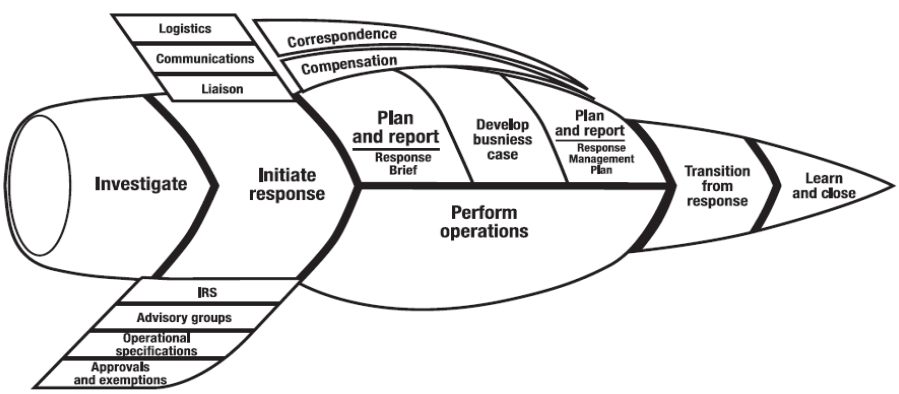

Figure 1. A diagram representing MAF processes and procedures for responding to all organisms or goods that pose a biosecurity risk to the values of New Zealand.

Maf's Response to *Passiflora Apetala*

Investigate Phase

MAF was notified of this previously undetected plant in September 2009 and initiated an investigation following concerns of vines of an unknown *Passiflora* sp. growing prolifically in a council-owned, regenerating native reserve in Kamo, Whangarei in northern New Zealand. The vines were strangling and generally smothering other plants.

A rapid assessment report was produced as a biosecurity issue was confirmed and the biosecurity risk remained. Following formal identification as *Passiflora apetala*, MAF initiated a response in December 2009 due to the invasive properties *P. apetala* exhibited.

Initiate Response Phase

A Planning and Intelligence workstream was established with an Intelligence Portfolio to provide information required to make initial decisions on the response options. MAF undertook tracing activities to determine the history and extent of the *P. apetala* spread in New Zealand by interviewing residents in the immediate area of the infested reserve. These investigations revealed that *P. apetala* may have been present in New Zealand for up to 20 years, and had been distributed widely amongst sub-tropical plant enthusiasts.

With the assistance of Auckland Council, Northland Regional Council and the Department of Conservation, eight locations in the Northland, Auckland and Waikato regions of New Zealand were identified as having *P. apetala* present. Initial delimitation surveys at each location revealed varying states of infestation. The plant has been found in regenerating native forests and scrub, home gardens and amongst hedges and fence lines. Seedlings are usually found under places where birds perch. Only seven of these sites (Figure 2) in the Northland and Auckland regions currently have *P. apetala.* The site in Waikato, a butterfly farm, had *P. apetala* plants growing in pots in a secure environment; these have subsequently been destroyed (Pearson *et al.* 2011). The presence of *P. apetala* at each of the seven locations can be attributed to present or former property owners who introduced and cultivated this species.

In November 2009, *P. apetala* was given the legal status of an Unwanted Organism under New Zealand's Biosecurity Act 1993. Under this status it is an offence to breed, knowingly communicate, exhibit, multiply, propagate, release, or sell an Unwanted Organism unless permission is obtained from a Chief Technical Officer e.g. MAF (Pearson *et al.,* 2011).

P. apetala is seen as an emerging threat to New Zealand's environment, with the potential to smother regenerating forests and forest margins. *P. apetala* may also impact upon the native flora and

fauna that are culturally significant to New Zealand's indigenous Māori, and impact on people's recreational experience.

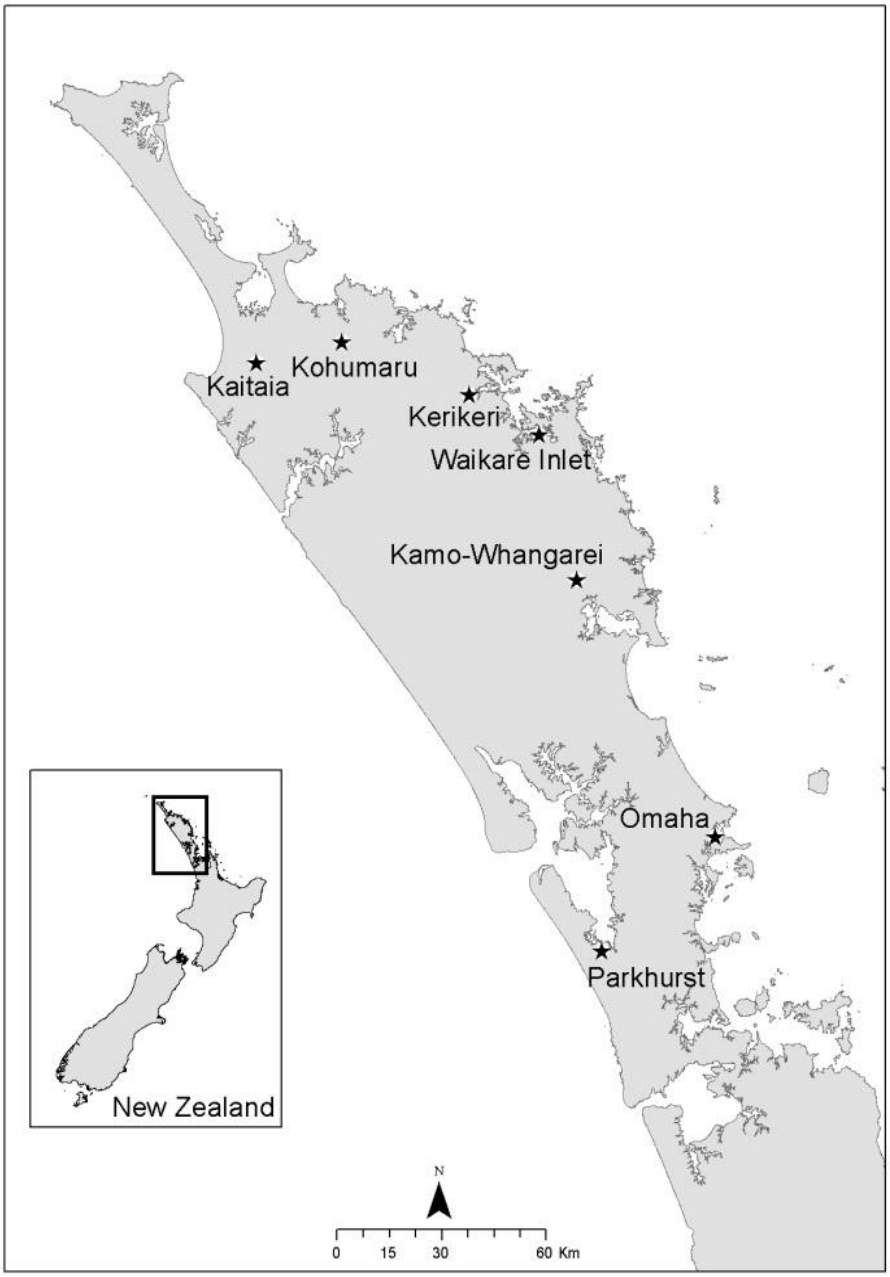

Figure 2. Locations of *P. apetala* infestations in New Zealand.

Intelligence gathered on the biology of *P. apetala.* revealed that it is native to central Costa Rica and Panama, where it grows at elevations of 1300-2200 m (Ulmer and MacDougal, 2004). In New Zealand it appears to be shade tolerant and grows at lower altitudes. The deeply cut two lobed leaves have the appearance of a bat's wing. As the specific epithet suggests, the flowers of this plant do not generally have petals. Flowers are yellow/light green in colour, 1.2–2 cm diameter (Ulmer and MacDougal, 2004). Fruit are purplish black, subglobose, 0.7-1.5 cm diameter (Ulmer and MacDougal, 2004) and are attractive to birds and suitable to feed on. The minimum temperature for growing *P. apetala* is 5°C (Ulmer and MacDougal, 2004). Flowers and fruit have been found all year round in New Zealand. A mature *P. apetala* vine 2-3 years old produces > 3000 fruit with an average of 15 seeds per fruit (Pearson, 2010).

Plan and Report

A response brief was produced based on the intelligence collected, which outlined three management strategies for the management of *P. apetala* in New Zealand. These included the 'do nothing approach'; 'eradication from New Zealand' and 'local elimination' from known areas.

Eradication is defined as the "removal of every individual and propagule of a species from New Zealand so that only reintroduction from beyond New Zealand's borders would enable the re-emergence of the species. Achievement of eradication would be demonstrated by surveillance" (MAF Biosecurity New Zealand, 2008). This response option was dismissed and considered unlikely to be feasible due to the unknown extent of the *P. apetala* infestation in New Zealand. Tracing activities into the distribution of *P. apetala* have been difficult due to the lack of records kept and a reliance on the memory recall of key persons, along with a reluctance to provide the relevant information. A public awareness campaign has resulted in no further locations being discovered, and undertaking a national surveillance strategy for this pest was considered uneconomical.

The preferred option of local elimination from known areas is currently being pursued by the Response Team. Local elimination is defined as "the removal of all known propagules of a population from an area, including a period of observation (monitoring) to see if the pest re-occurs" (Knegtmans, 2007). This definition is similar to that of Panetta (2007) for the term 'extirpation' to denote local, as opposed to global, elimination of a species.

As for other weed management programmes, understanding the seed dynamics of *P. apetala* is seen as an important determinant for setting response goals and objectives, to determine the duration of an eradication management programme, and determine the total

effort required to achieve the objectives (Panetta 2004). Further intelligence projects were initiated to inform a business case, which is being prepared, to make a final commitment to the local elimination option. These projects included a pilot treatment programme, a cost benefit analysis and research into seed dynamics (viability, longevity and time to maturity of *P. apetala* in New Zealand).

Pilot treatment programme

Pearson *et al.* (2011) describes the one-off pilot treatment programme which took place in March 2011, at two of the seven locations where *P. apetala* is present. The objectives of the pilot treatment programme were to test the feasibility, effectiveness and costs of local elimination attempts, by locating and destroying all *P. apetala* plants within a 500 m radius from previously known mature *P. apetala* plants at Parkhurst (North of Auckland) and Kerikeri (Northland).

P. apetala plants at Parkhurst and Kerikeri were found in the same vicinity of plants recorded during previous delimiting surveys (Pearson *et al.,* 2011). Approximately 88 kg of plant material was removed from the heavily infested Parkhurst location; whilst the infestation at the Kerikeri location was considerably smaller, with only c. 3-5 kg of plant material removed (Coates, 2011).

Follow-up monitoring performed one month later revealed the presence of three undetected mature fruiting vines at the Parkhurst site, and a single mature fruiting vine at Kerikeri (Pearson *et al.,* 2011). At both locations, seedlings and juveniles were also previously undetected or had sprouted since completion of the pilot treatment programme.

Seed dynamics study

Pearson *et al.* (2011) describes the early results of a two year seed dynamics study, which commenced in 2010. Preliminary research results of the programme have shown that seeds collected from Northland, New Zealand had a viability of around 90%. Two accelerated aging experiments using Kew Gardens Protocols (Newton *et al.,* 2009) were run. Results were similar between the two experiments (Fig. 3A & 3B) showing that seed persisted in the high humidity, high temperature environment for between 30 and 50 days, with germination dropping off more rapidly in the second experiment (Fig. 3B). Extrapolation of the data shows that seeds are likely to remain viable in the natural environment for more than 10 years (Dowsett and James, 2011).

The time for *P. apetala* seeds to reach maturity was assessed in both glasshouse and secured outdoor environments where plants grew vigorously and were trained up on stakes (Pearson *et al.* 2011). By January 2011 (24 weeks) the outdoor plants were flowering, followed

by the glasshouse plants about a month later. By early March 2011, the fruits on the outdoor plants were maturing. As of 18 April 2011 plants in the glasshouse were still flowering vigorously and fruiting (Dowsett and James 2011).

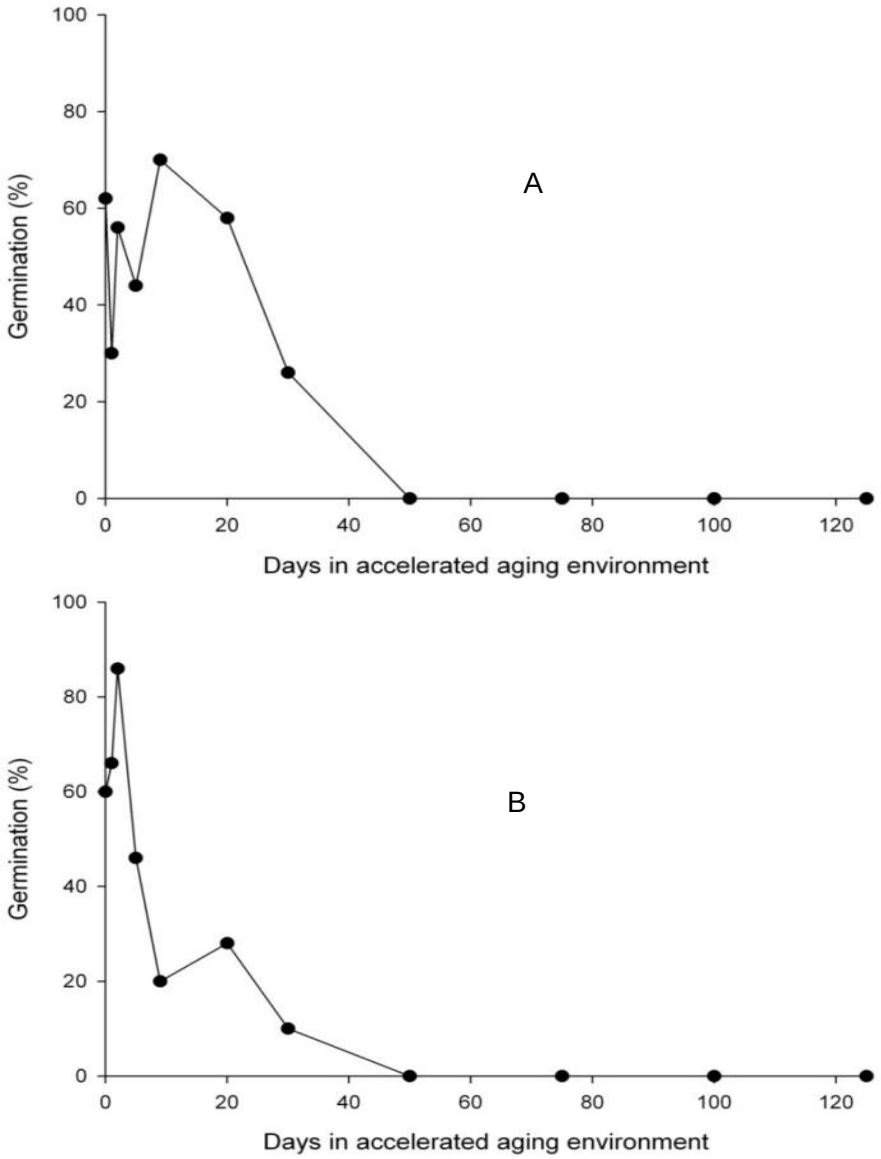

Figure 3. Germination of *Passiflora apetala* seed after various durations in the Accelerated Aging environment – First experiment (A) and Second Experiment (B)

DISCUSSION

The response to *P. apetala* is following MAF's generic response framework that is used for responses in all sectors covering both new to New Zealand and existing risk organisms or goods. A structured approach has been followed in accordance with the MAF response model (see Ministry of Agriculture and Forestry, 2008).

The response to *P. apetala* is an example of an active response that has successfully progressed through three phases of the response system. The investigation phase allowed the relevant information to be collected to determine whether or not a response should be initiated. The response initiation phase then provided further information through activities such as tracing of movement of *P. apetala* within New Zealand as well as information on the biology and ecology of the plant.

The response brief prepared under the planning and reporting phase contained sufficient information to develop different response options as well as to highlight areas where extra research was required (e.g. seed dynamics study and pilot treatment programme). At present, the information obtained is being used to develop a business case for the next phase of a response based on the preferred management strategy of local elimination from each of the seven known areas.

To assist in the preparation of a business case, an analysis of potential economic impacts of *P. apetala* establishment as an invasive weed in New Zealand is in development. The analysis will include the evaluation of the economic feasibility of the preferred management strategy.

Other eradication programmes for weeds that develop long-lived seed populations require longer-term funding and institutional commitment (Panetta and Timmins, 2004). Such programmes typically require 10 years or more to complete (Panetta, 2007). Preliminary results of the research programme currently underway suggest that the seed is quite resistant to the aging process and therefore is likely to remain viable in the natural environment for more than 10 years (Dowsett and James, 2011). The seed longevity results will determine the length of the proposed local elimination programme which is currently planned to run for 15 years. The current proposal is similar to the two operational phases of the extirpation criterion described in Panetta (2007).

The discovery of new locations of *P. apetala* will result in a review of the local elimination programme. The final results of the seed dynamics research may also require a reassessment of the duration and effort required for the proposed programme, as the research has only been underway for one year of the two year

programme. It is still to be determined how environmental conditions in New Zealand trigger plant growth and affect fertility (Dowsett and James, 2011).

The MAF response system has provided a structured process which has enabled a consistent, transparent approach based on project management principles, to the management of an emerging pest plant in New Zealand.

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