

Public consultation and risk assessment for the proposed introduction of *Colaspis argentinensis* as a biological control agent for moth plant

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Summary

The scope of consultation

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Summary

The steps taken to consult with Māori and other stakeholders nationwide about the proposed biological control programme against moth plant are described, and their responses are summarised. Significant relevant issues that have been raised by Māori in previous consultations are presented. A workshop brainstormed the potential beneficial and adverse effects of the proposal, and the results of this analysis are tabled. As the current distribution of the weed is limited, only stakeholders north of Marlborough were consulted. All matters raised during pre-application consultation are either addressed here, or there is a reference to the formal application.

The scope of consultation

Moth plant (*Araujia hortorum*) threatens conservation and amenity values in northern New Zealand. The first releases for this agent will occur in the Waikato region, but it is assumed that *Colaspis argentinensis* will establish wherever moth plant populations persist in New Zealand. Currently moth plant occurs sporadically north of Blenheim and is abundant north of Tauranga.

The Waikato Regional Council is the nominal applicant, acting on behalf of the National Biocontrol Collective, a consortium of organisations responsible for biosecurity that comprises the Department of Conservation and all regional councils. This proposal is sanctioned by their Regional Pest Management Strategies. The Biosecurity Act 1993 requires councils to consult with local communities on the preparation of RPMSs. North Island regional councils and Marlborough District Council were asked for comment on this proposal.

A total of 169 Iwi, hapū, and Māori organisations and individuals making up the ERMA (now EPA) Māori National Network were contacted on 29 June 2011 and invited to enter dialogue on the proposal to introduce *C. argentinensis*. The message described how the applicant intended to assess the risks, costs and benefits surrounding the proposed introductions in the application, and respondents were asked to identify any issues that were inadequately, or not covered in those plans. Recipients were given the option of responding by form letter (a SAE was included), by email, by phone, preferably before mid August.

The responses obtained recently are summarised below. The main beneficial and adverse effects identified here and in previous consultations are addressed in the application form. All organisations consulted will be informed when the application has been submitted and is open for public submissions.

Waikato Regional Council is the applicant. Six Iwi have manawhenua in this region, but the main infestations of moth plant occur in Tainui and Hauraki rohe. A meeting with Tainui discussed opportunities for greater consultation within the release area.

Before preparing this application meetings were held to discuss issues with ERMENZ and the Department of Conservation staff. As preparation of the application proceeded, the following additional organisations were asked to comment on Waikato Regional Council's intention to apply for permission to introduce this control agent. Each was asked to raise any issues that should be addressed in the application. Their responses are summarised.

Federated Farmers of New Zealand
Royal Forest and Bird Protection Society of New Zealand
Department of Conservation
Queen Elizabeth II National Trust
Horticulture New Zealand
Housing New Zealand Corporation
Hamilton City Council
Waikato Biodiversity Trust
Northland Regional Council
Community weed management groups
Monarch Butterfly NZ Trust

Entomological Society of NZ

Individuals who responded to previous applications were contacted and invited to participate in early dialogue
Dr Cliff Mason Cliff.mason@hotmail.com

The responses obtained from these correspondents were either provided to EPA, or are captured amongst the following communications.

Responses from Iwi, Hapū and other Māori organisations

Email or written responses were received from these five sources. The originals of these responses have been supplied to EPA. Two respondents made detailed responses or requested further information.

Te Runanga-a-Iwi o Ngati Kahu,
Awatuna Homestead
Tai Tokerau Organic Primary Producers Society (Inc)
Tanenuiarangi Manawatu Inc
Ongarahu Environment Care
Raukawa Charitable Trust

The issues abstracted from those submissions are provided below, and are addressed in the application:

1. On a personal level I don't mind that biological controls are used to combat such as these. My reservations will be what potential impacts will they have on our native fauna/flora. Are there such already in our indigenous arsenal and if so can we bolster their numbers?

2. does not oppose these applications...but urges caution when introducing foreign organisms; blackberry/gorse, weasels/rabbits etc come to mind. We are aware these organisms are put through rigorous tests but sometimes many years pass before these things break out of their natural cycle and become further pests and equally as bad as their host plant.

3. I do not have a problem with your proposal, there are much worse things happening that I am dealing with.

4. 'Will the root feeding beetle be introduced in the Waikato Region? What measures are in place if this beetle becomes prolific?
What is the one garden species at risk?
If the beetle is successful at eradicating the moth plant, what other food sources would it eat? Could it impact another native species...
Does it have the potential to degrade the land when it lays eggs and hatchlings emerge. If infestation occurs how will they be controlled?
If Maori resources are affected so are the people – loss of flora and fauna, loss of cultural identity, loss of clothing for Papatuanuku, Loss of native vegetation, and increase of runoff if not filtered.
Te Taiao ki au, ki au te Taiao
Ongoing management by Maori of our cultural and natural resources relies on Kaitiakitanga/protection. We must be certain of the potential impacts on our resources.'

5. We see that both of these plant pests pose a threat to our native ecosystems and are happy for the release to go ahead. Containment or eradication in the north is preferable to actions later in the south

6. We appreciate your communication on this matter however, due to capacity issues we are unable to engage further with you on this issue.

Relevant responses from Māori organisations to previous new organism applications

These are addressed directly in the application

Other responses by subject

Subjects covered

Possible effects on tweedia as a garden ornamental
Possible effects on food for monarch butterflies, and distrust of exotic insects
The poisonous nature of moth plant
The impact of moth plant on biodiversity values
The threat of moth plant to regional values
The threat of moth plant to other businesses and organisations

Possible effects on tweedia as a garden ornamental

The prospect of possible attack by *Colaspis argentinensis* on the roots of the garden ornamental tweedia (*Oxypetalum caeruleum*) was raised in a message to the weekly 'Get Growing' newsletter associated with the 'New Zealand Gardener' magazine. The views expressed in emailed responses were mixed :

'I am torn both ways - I hate moth plant, but I can get rid of it. And I love Tweedia not only for its lovely blue flowers but because the butterflies like it.

My garden is specifically designed to attract both butterflies and bees. I would not like to lose my Tweedias.'

'I live in Otaki on the Kapiti Coast. Do we have moth plant in this area? I can't say that I have seen Moth Plant but I have recently purchased a Tweedia plant and hope to grow more from the seeds I have just collected.'

'Moth vine is a real problem where I live (Waiheke Island) – we have it on a steep cliff with impossible access, so biological control would be fantastic. Waiheke is too dry in summer for the sort of garden that is likely to feature Tweedia, so for me, and I suspect my fellow Waiheke Islanders, the sacrifice of Tweedia in order to get rid of the moth vine is a no-brainer.'

'I work in conservation/riparian margin restoration in Waitakere City and so know all about the moth plant and how damaging it can be to native regrowth and vegetation. So I welcome any way to control this invasive weed that doesn't harm the natives.'

'I love Tweedia - my mother grew it in abundance in her very beautiful Waikato garden - so I would prefer it not to be so vulnerable to attack - however if this would definitely be the only casualty in the proposed biological control of the moth plant - then protection of the native plants must come first'.

'I have tweedia in my garden from a planting when I first put my garden in at least 15 years ago. It just keeps self-sowing and producing no matter. It's pretty but of no consequence. Haven't noticed any obvious monarchs around it!'

'I read with great interest the article regarding Tweedia and its close cousin the Moth Plant vine. I believe you will be presenting a paper on a beetle to use as a biological control. After an **enormous** problem with the moth plant vine entwined over and around a huge and very old plum tree at our section at Waiheke I seem to see this vine everywhere and I am alarmed at what is happening! I do appreciate that Tweedia is a very attractive small plant and although it would be a shame to lose it, this sacrifice would be well worth it

Possible effects on food for monarch butterflies and distrust of exotic insects

Moth plant and tweedia are likely to be damaged by *Colaspis argentinensis* in the field. Although monarch butterflies do not lay eggs on these species, and cannot normally complete development on these species alone, harvested foliage of these plants can be used to feed mature larvae if swan plant is not available. Discussion of potential attack on tweedia was initiated in the public forum of the Monarch Butterfly NZ Trust website, and issues were addressed as they arose.

<http://www.monarch.org.nz/monarch/forum/topic/threat-to-tweedia>.

The issues raised on the forum were:

'In 1933 the wasp *Pteromalus puparum* was introduced to control the Cabbage White Butterfly. It also attacks our native Yellow Admiral and Red Admiral butterflies. The Red Admiral Butterfly is only found in New Zealand...I am extremely concerned about any plans to import another exotic pest, particularly one which attacks foodplants of the beloved Monarch Butterfly.'

'I believe the scientists have got the research right! But then again, I Believe the earth is flat, the majority of politicians are honest and I was sent here on a hyperspace bypass from planet Zog!'

'I vote for Best moth plant control: *Danaus erippus*.'

'I will not agree about beetles as there are NO beetles with low risk of become pests in NZ. Exotic beetles are NO-NO to import to NZ. They have high risk of become pests here. Butterflies are low risk animals to import as long as they are healthy & free of diseases and parasitoids.'

'There are numerous reasons why people cannot and must not bring in new species whenever they feel like. For example the Cat, Dog, Deer, Ferret, Goat, Hedgehog, Mouse, Pig, Possum, Rabbit, Rat, Stoat, Himalayan tahr, Weasel, German wasp, Common wasp, Asian paper wasp, Varroa destructor, Sea squirt, Grass carp, Gambusia, Rudd, Catfish, and Trout might have been "healthy & free of diseases and parasitoids" when they were imported, but that didn't stop them becoming an invasive species once they got here!'

'I am not anti *Colaspis* per se, and to me biological control is preferable to the usual "kiwi way", which is to dump tons of 2,4,5-T, or 10-80 on any problems. But one can always stop spraying, once a new species is released it is usually here to stay. So my first response is to urge extreme caution.'

'We have to be very cautious & careful in importing insects as *colaspis* beetles which might eat swan plants & tweedias once they run out of moth plants.'

'I am agree with ... about *colaspis* beetles would be trialed on moth plants, tweedias, and swan plants and milkweeds and be studied on their willing or not willing to eat swan plants & tweedias

& milkweeds, pine, soybean. I had researched about colaspis beetles and found the colaspis beetles are pests and had caused damages to pine trees and grapes and banana plants and sugarcanes, beans, peas, soybeans, tomatoes and potatoes, corns. Larvae (grubs) of colaspis beetles eat roots of plants above, cause plants to fell or have stunted growth.'

The poisonous nature of moth plant

Jenni Jones, Poison Information Officer, National Poisons Centre

Thank you for your enquiry regarding poisoning exposures to these plants. The National Poison Centre has been contacted about exposures to both these plants. Ingestion of *Araujia sericifera* can cause gastrointestinal symptoms such as nausea, vomiting and diarrhoea. The sap from this plant can also cause skin or eye irritation.

(From 1 June 2002 – 15 July 2011 there have been 16 calls, concerning eyes (2), ingestion (7), and skin (5) involving 14 human exposure, plus one cow and one dog)

The impact of moth plant on biodiversity values

Motutapu Restoration Trust

The Trust was established in 1993 to support the Department of Conservation in restoring the 'natural and cultural' landscapes of the island of Motutapu in the Hauraki Gulf Marine Park....The major pest plant, tackled by volunteers is moth plant.... The Trust learnt many years ago that moth plant is not easily eradicated. Its seed bank remains viable for many years and unless the root is completely removed the plant continues to regenerate year after year.

Volunteers from the Trust spend a great deal of time collecting pods from mature plants as each pod can contain about 500 viable seeds! Over a year several hundred onion sacks of moth pods are collected and destroyed. Just last week 40 sacks of 100 pods each were collected from a new area added to our weed control area. That's 2,000,000 potential moth plants nipped in the bud!"

Nan Pullman, Whangarei regional representative, QEII National Trust

'I have ongoing battles with moth plant at a number of sites within the Whangarei district. Several sites have been targeted for a number of years, even receiving funding from the Biodiversity Condition Fund. Most recently I collected 7 large rubbish bags of pods from the roadside opposite a QEII area where we had spent hours over a number of years dealing with moth plant and other weeds. So I guess I can provide some detail on how relentless the battle appears to be if you would like some info. '

Heather Taylor, Guardians of the Bay (Bay of Islands)

'The Guardians of the Bay is a community group working with DOC to restore (using this word very loosely) the Eastern Bay of Islands aka ipipiri. One thing they do is control weeds on the islands, the most well known island being Urupukapuka in the ipipiri group and they are under the umbrella of weedbusters. They target moth plant on several islands where they can reach it. You might want to speak with Fleur Corbett who is part of this group and also works for Doc in Kerikeri (Bay of Islands Area) office. She can put you in contact with one of the operational leaders of the group who bust the weeds.

Cynthia Roberts, DOC, Waikato Conservancy

'Moth plant is a huge concern on the Coromandel with DOC only able to focus on the conservation estate. Places such as Cathedral Cove has a huge infestation with no easy solution for the management of this weed.

For example, when mature plants are removed allowing light in, the moth plant seed bank is such that 1000 seedlings per square metre quickly cover the ground outcompeting native seedlings impacting on native regeneration and biodiversity values of the site. Without this ongoing work the area over time would become covered in moth plant. Steve estimates approximately 10% i.e. \$10,000 of his weed budget would be spent on controlling moth plant in the Coromandel region (not including Cuvier Island) where it is found in most conservation areas of significance including Moehau. ...'

'The project recently obtained some funding from Doc for spraying weeds so that the seeds are not blown across the sea to Little Barrier Island.'

Moira Cursey, Waikato Biodiversity Forum, c/o DOC

'I can't give any estimates of expenditure to manage moth plant. The Waikato Biodiversity Forum is in touch with a variety of community groups doing weed pest management but I am not sure how many groups are controlling. If there was a safe biological control that did not have any potential damaging effects on native flora and fauna or fruit trees and exotics for that matter then the Waikato Biodiversity Forum would welcome the beetles introduction to control this invasive weed.'

Monica Valdes, Department of Conservation, Whangarei

'Moth plant is currently too wide-spread in Northland to consider it a weed-led project, so it has been controlled as site-led project on the Poor Knights and Hen & Chickens Is, Bream Head and Manaia Scenic Reserves (part of Whangarei Area Office).

The weed control on the off-shore islands started in 1994 and we have kept a database containing location of sites, number of plants pulled (adults and juveniles). Over time we have been able to plot this numbers and see how the numbers have shown an steady decline. However the threat of new incursions is alive as the mainland (coastal areas) are abundant in moth plant, therefore the risk of seeds been constantly blown over is high. We don't have an exact figure for the costing of the operation as moth plant is only one of the species we target (together with pampas, mexican devil, mist flower, and purple groundsel amongst others).

In terms of the general impact, on the islands fortunately hasn't been major as we started early and we've been able to control it since. There are areas on the mainland however (parts of Bream Head Scenic Reserve for example) where we have found extensive areas covered with seedlings and many adult vines growing on top of natives.

Currently I'm compiling the report for the weed control done in the last financial year on the islands. Back in 08/09, 6% of the existing sites were moth plant, and 10% of the sites visited were moth plant....'

Graeme LaCock, DOC, Wanganui

We don't have major infestations of either of these. ...We have 4 records of moth plant for Tongariro/Whanganui/Taranaki Conservancy (basically combined old Wanganui and T/T, One was in New Plymouth in 2006 (treated), the other 3 in Wanganui, although I've personally passed on details of another couple of urban sites to Horizons Regional Council. The closest to a natural area would have been Virginia Lake. Normally just one or two plants. So not really an issue for us. But I do see it as a problem in warmer areas, and we'd be worried about it getting out to the Sugar Loaf islands in New Plymouth.

Kevin Matthews, The Bushland Trust, Kaitaia

'I'm Chair of The Bushland Trust and we mainly do restoration work on Aupouri Pen wetlands closer to Kaitaia. We're undertaking moth plant control at Lake Heather trying to stop its spread north.....and not without its pitfalls! NRC are trying to draw a line in the sand at Houhora or there about. '

The threat of moth plant to regional values

John Mather, Environment Bay of Plenty

Moth plant is a Restricted Pest Plant in our proposed RPMS. This is an advisory type category where we may also assist the community with approved programmes. We didn't undertake a CBA for the Restricted Pests.

Moth plant is widespread in the coastal BOP. It especially infests kiwifruit orchard shelterbelts, estuary margins, road and rail reserves and coastal back-dune areas. It is a significant problem to the kiwifruit industry. It especially slows down the work of shelter trimmers when they run into large entanglements in the shelter hedge. It also causes a dermatitis type reaction in people handling the plant without protective gear. The plant is difficult to control organically as it snaps off just below the surface if hand-pulling. It then coppices and regrows from this point. It is very difficult to control with herbicides in the orchard situation. Moth plant is also well established in urban areas. Our Tauranga office takes about 20 calls per year specifically seeking advice on how to control moth plant. Regionally about 60 calls per year. Regional field officers would receive about 200 enquiries per year on this plant.

Holly Cox, Auckland Council

There is a large programme on Waiheke supported by both the ex ARC and ACC, now AC. Here are the estimates from our Biosecurity Officer on Waiheke

"Biosecurity currently spends \$8000 per year on moth plant on Waiheke. We do have the records for 300+ properties on Waiheke but I am currently having problems with my contractor in getting the final data for 2010-2011. This work covers both surveillance and control (this is just contractor hours not Biosecurity hours).

Additional to this we have the annual campaigns through Weedbusters, free vigilant supply and as you mention we have the day to day site visits and treatment recorded in the PDA's and enquiry forms.

According to Gary, AC on local parks on Waiheke spends approximately \$25,000 on moth plant in public land.

We have several dedicated moth plant spotters who work on both private and public land for free I would estimate this time to be 8hrs per week , 416hrs per year of volunteer time. We pay contractors 40- 50 per hour so equivalent would be \$18,720.

The amount the general public spend on moth plant is very difficult to gauge I would guess at least 4 times what we (AC spend), \$132,000.00+.

Moth plant is definitely a problem in our road reserves and a cost to businesses here, many of whom struggle in this economic climate to cope with the additional expense of control. Commercial sites, vineyards and other lifestyle block owners are ones that come to mind. Rob Fenwick and Kerry Tichener are examples of landowners coping with large scale problems. Robs would probably be a \$30-50,000.00 annual cost if being done successfully. I have also recently been dealing with Watercare services who will need to invest a substantial amount into moth plant control on a wastewater site in Matiatia."

Waitakere Biosecurity Officers spend about 520 hours a year following up complaints on moth plant. So this would be equivalent \$23,400.

In terms of Regional Parks, \$11,000 is spent per year on moth plant control and surveillance on Regional Parks by contractors. This is an under estimate given the fact that we pay contractors for their travel, overnight allowances and reporting, and also they report on a range of plants during those hours not just solely moth plant. This would have been greater in the past as moth plant is targeted for zero density on all the parks and we are mainly treating seedlings.

Tawharanui is one of our regional parks that has regular volunteer effort for weed control.

"Roughly vols/staff invest about 5 person days/year of dedicated moth plant work (follow ups on known sites) or dealing to incidental discoveries. (So this would be equivalent \$1800)

The less easily definable figure is the opportunistic work (the 'search effort') as most recent moth sites have been found coincidentally in the course of other work. In a way they are the result of 100's if not 1000's of hours on the ground from observant eyes."

And local Biosecurity Officer's efforts:

"I would spend about 5 days per year on moth plant control along Bethells road, Bethells beach and Muriwai beach near the end of Rimmer road." (So this would be equivalent \$1800)

Hunua Biosecurity Officer spends roughly 12 days per year independently controlling moth plant sites. (So this would be equivalent \$4320)

Volunteer efforts:

North Shore volunteer spends roughly 5 hours a week controlling solely moth plant. Biosecurity supplies her with herbicide and equipment. This is 260 hours a year- So this would be equivalent \$11,700.

Auckland Central volunteer (connected to Motutapu Restoration Trust) has in the last 3 months handed in 21 rubbish sacks full of moth plant pods. He spends 3 hours a week with another volunteer so this adds up to 312 hours a year on moth plant- so this would be equivalent \$14,040.

\$8000 of Biosecurity money was spent on Sir Doug Myer Robinson Park directly supporting his volunteer effort as this park is located on Auckland's waterfront within distance of Motutapu.

So summing it all up

Enquiries, complaints, education etc (AC Biosecurity)-	\$300,000 pa
Local Biosecurity Officer projects-	\$6120 pa
Gen public (est)-	\$600,000 pa
Parks (+parks volunteers)-	\$12,800 pa
AC Local Parks (Waiheke)-	\$25,000 pa
Waiheke gen public (est)-	\$162,000 pa
Known volunteer effort-	\$25,740 pa
TOTAL OF ESTIMATE	\$1,131,660 per year.

Catherine Law, Taranaki Regional Council

'Because I have seen moth plant "all over" Auckland, we control it when we become aware of an infestation & as time permits. We have 16 records of moth plant, 15 in New Plymouth city but not all in gardens & one in a Stratford garden. This is certainly NOT all the moth plant in the province. The climate is quite suitable for moth plant in much of Taranaki, especially the coastal zone.

I think there is little public awareness in Taranaki of moth plant's bad points so is not generally perceived as a problem (& probably rarely recognised) except by a few folk on whose properties we have controlled the plant and they let us know when it reappears. We control it simply because of its potential as it is not in our RPMS for Plants. There is potential for significant infestation of riparian areas & other public amenity areas currently vegetated with desirable species, to be invaded and adversely affected by moth plant. Some of the infestations we control are close to Pukekura Park and to the Waiwhakaiho River.

I estimate we would get about 3-5 enquiries a year about moth plant.....We spend perhaps a day in total/year controlling moth plant, so only 8 hours excluding travel.'

Richard Grimmett, Darryl Kee, Greater Wellington Regional Council

'We have completed delimit surveys around each of our known Total Control sites, now completed, during 7 years to June 2011. Average of around \$7000 annually to control 187 sites, currently 104 active this season, 17 monitored and 10 eradicated - probably our best performing eradication species. Overall controlling seedlings with very few mature plants found. DoC has a few sites in their estate.'

Sara Brill, Biosecurity Officer, Northland Regional Council

'We have a Community Pest Control area that has been battling moth plant ... as one of their serious pests. Initial contractor knock down costs were \$3937.50 on 22/6/2007happy to fill you in on what the group has been doing on this plant. has spent 1-3 days per year spraying this plant for the group from 2007 – 2010'.

The threat of moth plant to the public, other organisations and businesses

Tom Barber, Queen Elizabeth II National Trust

'When it comes to hard numbers, unfortunately I can't give you a dollar value on how much is spent controlling these species as most of the work is generally carried out by our landowners. As our covenants are on private land there is also a limited amount of data I can give you without consent from each of the landowners. However, I can tell you that moth plant is recorded as a threat in 80 of our registered covenants, and that lantana is recorded as being a threat in 13.'

Royal Forest and Bird Protection Society, North Taranaki Branch

I do not recall having ever seen either plant in the wild here.....

I have no knowledge of either of these plants in our region.

Ngairie Tyson, New Zealand Landcare Trust

I have forwarded your email on to the Poroti Landcare Group who may be of interest to your project. They are a weed led, or more specifically, moth plant led community group operating up here in Northland near Maungatapere. Their goal is remove moth plant that has invaded hedgerows in a horticultural area. Ross Johnson in the Biosecurity Team at the Northland Regional Council has had more recent dealings with them than I. He could be another good source of info.

There are of course many other landcare groups who target moth plant, but this is usually tackled as part of an integrated animal and plant pest program.

Sam Middlemass, Rayonier Forests, Northland

I haven't noticed any Moth plant in our forests in Northland yet. It may be..... around the Whangarei Heads area though as it is reasonably common along public roadsides in the area. Cost to Matariki forests to date = Nil.

.....if we could rid seeing "the vine" smothering hedges in Remuera (ripe with the pods)! Entwined around and in amongst hydrangea bushes. Overtaking, and I mean really overtaking a rented property in Te Atatu. Overwhelming a vacant section. The list goes on and on! When I see this all around me as I walk along the roads I would dearly love to knock on doors or post information in letterboxes to let people know what a timebomb they have at their back or front doors but of course I just carry on, my step a little heavier that I did not have the courage to do something. I believe it is an offence to have this growing in private property on Great Barrier. The longer it is left to grow, the more it spreads and the harder it is to get rid of it. We can no

longer have bonfires and it is not wanted at the green waste stations. The only solution is landfill, and really that is no solution!

As you can see the information provided in the Get Growing email I received from NZ Gardener has hit a raw nerve! If this little beetle can eradicate the Moth Vine plant and be proven to be safe to all other plants not related, I think it would be wonderful to have this brought in to NZ.'

Identification of beneficial and adverse effects of the proposed introduction

The potential risks, costs and benefits of the proposed introduction of *Colaspis argentinensis* to New Zealand and the possible reduction in the abundance and vigour of moth plant were identified by literature review, by public consultation and by formal brainstorming involving personnel from Landcare Research, Waikato Regional Council, Monarch butterfly NZ Trust, and Auckland Council. Department of Conservation staff could not attend but contributed later.

The effects identified are as follows (significant effects are highlighted):

Possible beneficial effects

Beneficial effects on the environment

Source of potential benefit	Comments
Maintenance of habitats	
Reduced competition from moth plant leads to increased survival and diversity of native and other desirable plants in affected habitats.	This is major expected benefit of the biological control programme. Moth plant scrambles over short stature native vegetation in many habitats, killing plants, replacing vegetation and halting regeneration. Moth plant overtops taller plants in forest margins, and can break down trees. Successful biological control will reduce those adverse effects wherever the weed occurs, acting far beyond the reach of existing management efforts. Control will reduce the future development adverse effects of the weed as it spreads.
Reduced cover for pests on dunes	Back dunes support heavy moth plant infestations that harbour rabbits and predators of shore-nesting birds, such as mustelids. Successful biological control would reduce the effects of predators and pests by reducing cover.
Sustainability of flora and fauna	
Reduced competition with native seedlings including vines	Moth plant scrambles over the ground and short stature native vegetation in many habitats, killing plants, replacing vegetation and halting

	regeneration. Successful biological control will reduce competition wherever the weed occurs.
Reduced mortality of seedlings and improved succession of vegetation Reduced incidence of trapping by flowers of valued insects such as bees	Ditto As part of its pollination strategy, moth plant flowers traps some foraging insects by the proboscis. Some die, reducing the number of pollinators in the environment. This probably does not significantly reduce overall pollination services.
Reduced damage to underlying foliage from spraying	Moth plant commonly grows like a curtain using valued vegetation as a framework. Spraying this moth plant damages both. Successful biological control will reduce the need for such spraying.
Improved access to underlying resources for birds	Moth plant curtains hide flowers and fruits on underlying vegetation. Benefit limited because probably not a significant proportion of overall resource.
Ecosystem processes	
Benefits to parasitoid, predator and disease relationships in trophic webs	Increased plant diversity as moth plant monocultures break up will increase the diversity and complexity of trophic webs, but effects will vary locally, spatially and temporally. Moth plant monocultures are not yet common, so this benefit (though real) is not regarded as significant.
Increased nutrient turnover in the soil beneficially affects natural nutrient cycles, increasing the growth rate and survival of valued forest seedlings.	Leaf and root consumption will increase turnover under moth plant infestations, slightly enriching soil and aiding establishment of alternative vegetation. Effects limited to soil beneath the weed, and is temporary. Replacement vegetation will also aid cycling so net benefit obscure and probably not large
Reduced contamination of air, soil and water from reduced moth plant spraying	Although a likely real local benefit of successful biological control, infested sites make only a small part of overall estate.
Intrinsic value of ecosystems	
Improved look and feel of native bush for visitors	Successful control limits the development or reduces the occurrence of unsightly monocultures of moth plant. Not a widespread effect
Increased C accumulation in affected trees	Reduced shading following control increases tree health, but benefit limited because the number of severely affected trees currently limited.
Further spread south following climate change avoided	Successful control will reduce seed production and

the development of new serious infestations

Inherent genetic diversity in New Zealand

Loss of endangered species slowed.	Not significant. No species known to be at risk primarily because of moth plant.
New Zealand's biodiversity is increased	Nor significant. Species increases by one.
Reduced cover by moth plant improves cross-pollination	Not significant. Moth plant curtains unlikely to be limiting cross-pollination at present.
Reduced cover by moth plant improves availability of nest spaces for birds	Not significant. Moth plant curtains unlikely to be limiting cross-pollination at present.

Beneficial effects on human health and safety:

Source of potential benefit	Comments
Reduced abundance of moth plant reduces incidence of skin burn by latex and allergic effects	This benefit is likely, but NZ Poisons Centre reports few such allergic reactions nationally (this report)
Reduced abundance of moth plant reduces incidence of human poisoning	This benefit is likely, but NZ Poisons Centre reports that incidents are relatively rare and are not severe.(this report)
Reduced frequency of control operations, lowers the incidence occupational health issues for gardeners and conservation workers	No significant benefit. Current situation unknown, but such benefits are likely to be rare nationally.
Reduced importance of moth plant reduces use and adverse effects of herbicide	A real but not a significant benefit. Herbicide use against moth plant in New Zealand is not currently extensive or notably hazardous.

Beneficial effects on the relationship of Māori and their culture and traditions with the environment

See separate section and the application.

Beneficial effects on society and communities

Source of potential benefit	Comments
Successful biological control reduces costs of moth plant management to regional and territorial authorities	A significant benefit (this report)
Successful control reduces the need for moth plant control operations, leading to better targeting of community resources and use of conservation volunteers.	A significant benefit. Many community projects focus on moth plant control; see commentary in this report
Reduced abundance of moth plant reduces nuisance value to householders (including safe disposal, damage to clothes, skin irritation), reducing time allocated to control, and reducing non-target damage from backyard herbicide application. .	Lifestyle benefits to householders are real; see this report.
Successful control leads to fewer instances of dermal allergies in dogs.	A likely benefit, but NZ Poisons Centre reports that cases are not frequent, see this report

Beneficial effects on the market economy

Source of potential benefit	Comments
Reduced control costs to businesses required to control moth plant (shelterbelts frames, other	Control would mitigate costs to businesses of complying with RPMS, as well as production costs to shelterbelts and cropping frames
Reduced control costs to infrastructure managers required to control moth plant	Biological control could mitigate costs to infrastructure companies such as Ontrack and Transit (Hill 2011)
Reduced control costs/increased production in forests	Not a significant effect. Moth plant is not seen as a limitation to forestry (Hill 2011)
Reduced contamination of export fruit by pappus hairs and seeds	Contamination of kiwifruit by seeds is an issue for kiwifruit exporters requiring control by growers
Reduced machinery maintenance costs for contractors	Not likely to be a significant effect
Damage to tweedia leads to greater sales in nurseries	Web search indicates that tweedia is an old fashioned garden species that is not widely available in garden centres and so is not a major revenue earner for nurseries
Management of control agents creates business opportunities for Landcare Research	A real effect, but a small contribution to Landcare Research revenue

Possible adverse effects or risks

Adverse effects on the environment

Source of potential adverse effect	Comments
Maintenance of habitats	
Value of moth plant as a nurse crop adversely affected	Not significant. Weed not widely acknowledged as a nurse crop
Reduced ability of moth plant to stabilise cliffs	Not significant. Weed not widely acknowledged as a stabiliser
Reduced protection of dunes from wind and water erosion	Not significant. Weed not widely acknowledged as protection against erosion. Moth plant control likely to be gradual, with natural replacement of vegetation.
Sustainability of flora and fauna	
Non-target feeding by newly established control agents significantly reduces native plant populations.	Experimentation indicates no such effect is likely. Native plants are not at risk; see Hill & Gourlay (2011).
Non-target feeding by newly established control agents significantly reduces the usefulness of the ornamental tweedia.	Laboratory experimentation indicates that damage to tweedia in New Zealand gardens is possible
Sub-lethal grazing by the control agent reduces leaf area, leading to reduced efficacy of herbicides, and higher rates of herbicide application.	Even if this theoretical effect was real, herbicide is applied to only a small proportion of moth plant nationally. No significant effect nationally
Reduced habitat quality for some native fauna.	Not significant. Replacement vegetation will also support invertebrate fauna. No fauna of special significance found on moth plant in surveys (Winks et al 2006).
Ecosystem processes	
Food web interactions are adversely affected by the introduction of new prey species.	Adverse effects are conceivable but not expected. Increased plant diversity as moth plants monocultures break up will increase the diversity and complexity of trophic webs, but effects will vary locally, spatially and temporally.
The process of control increases nutrient turnover in the litter, adversely affecting nutrient cycles.	af and root consumption will increase turnover under moth plant infestations, slightly enriching soil and aiding establishment of alternative vegetation. Effects limited to soil beneath the weed, and is temporary.

Intrinsic value of ecosystems	
No significant effects have been identified	
Inherent genetic diversity	
Indirect competition causes extinction of native insects	Not a significant risk. No indication that vulnerable or endangered species are associated with moth plant infestations (Winks et al. 2006), and any measurable indirect competition would be restricted to the immediate vicinity of the host plant.
<i>Colaspis</i> hybridises with native chrysomelid beetles	Not a significant risk. No beetle populations or species present in New Zealand that are sufficiently related to enable hybridisation.

Adverse effects on n human health and safety

Source of potential adverse effect	Comments
Beetles bite or sting	No significant risk. Mouthparts of adults minute, and beetles have no sting
Beetles generate allergic response	No significant risk. Literature search reveals no such cases in <i>Colaspis</i> beetles
Public phobia to new beetle	No significant risk. Any response would be rare or non-existent, beetles less than 4 mm long, and only abundant on moth plant
Beetles need spraying with adverse effects to humans	No significant risk. No predicted attack on non-target plants. Mass beetle populations impossible.

Adverse effects on the relationship of Māori and their culture and traditions with the environment

See separate section and the application
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Adverse effects on society and communities

Source of potential adverse effect	Comments
Fear and distrust of exotic species and their possible non-target effects.	Firmly held opinion in a proportion of the population.

Less moth plant foliage available to feed monarch butterflies.	No significant risk. Moth plant foliage unlikely to become rare.
Control reduces the aesthetic values of moth plant	No significant risk. Moth plant is not strongly valued by the public.

Adverse effects on the market economy

Source of potential adverse effect	Comments
Successful biological control reduces revenue for contractors and suppliers	Not a significant effect. Revenues directly related to moth plant management are not a key revenue source for many or any contractors or supplies.