Environmental Protection Authority
Te Mana Rauhī Taiao

Staff Assessment Report

APP202663: import and release the moth, *Lathronympha strigana*, and the beetle, *Chrysolina abchasica*, as biocontrol agents for the weed tutsan (*Hypericum androsaemum)*

21 March 2016

Purpose	An application to import and release the moth, *Lathronympha strigana*, and the beetle, *Chrysolina abchasica*, as biocontrol agents for the weed tutsan, *Hypericum androsaemum*
Application number	APP202663
Application type	To obtain approval to release new organisms
Applicant	Tutsan Action Group
Date formally received	20 November 2015

New Zealand Government

Executive Summary and Recommendation

In November 2015, Tutsan Action Group made an application to the Environmental Protection Authority (EPA) seeking to introduce a moth and a beetle (*Lathronympha strigana* and *Chrysolina abchasica* respectively) as a biological control agents for the weed tutsan (*Hypericum androsaemum*).

We examined the beneficial and adverse effects to the environment, market economy, human health and society and communities, in addition to the effects on Māori and their relationship to the environment in our assessment of the application.

The applicant presented evidence to show that the biological control agents will only attack members of the *Hypericum* genus. There is no significant risk that damaging populations of *L. strigana* could develop on native species as native plants could not support larval survival of the moth. The beetle, *C. abchasica*, was able to oviposit onto native *Hypericum* species and a few of those larvae were able to complete development in the laboratory. However, when combined risk scores were calculated using larval survival of the beetle on native species they indicated that likelihood of non-target attack in the field is very low.

Therefore, we consider that the introduction of the two biological control agents for tutsan is very unlikely to have adverse effects on native species or on valued ornamental varieties.

We note that the introduction of the two biological control agents are unlikely to reduce the intrinsic value of our ecosystem as we consider it unlikely that they will displace native and valued fauna and flora, rapidly alter ecosystems or reduce the enjoyment of valued ornamental plants.

We note that reduction in the vigour and spread of tutsan by *L. strigana* and *C. abchasica* is likely to provide relief to farmers in the central North Island and lead to the restoration of native ecological process and functions which will improve biodiversity and conservation values.

We consider that the benefits that may follow the introduction of *L. strigana* and *C. abchasica* will outweigh the identified risks and costs.

We also consider that *L. strigana* and *C. abchasica* meet the minimum standards set out in section 36 of the Hazardous Substance New Organisms (HSNO) Act.

We recommend that the application be approved.

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1. Purpose of this document

1.1. On 20 November 2015, Tutsan Action Group applied to the Environmental Protection Authority (EPA) to introduce the moth *Lathronympha strigana* and the beetle *Chrysolina abchasica*.

1.2. This document has been prepared by EPA staff to advise the Decision-making Committee on our risk assessment for the release of *L. strigana* and *C. abchasica*. The document discusses the information provided in the application, information readily available in scientific literature and information submitted to the EPA during the public notification process.

2. Application process

2.1. The Tutsan Action Group lodged an application with the EPA on 20 November 2015 seeking approval to release *L. strigana* and *C. abchasica* under section 34 of the Hazardous Substances and New Organisms (HSNO) Act (the Act).

2.2. The application was publicly notified, and open for submissions for 30 working days on 1 December 2015 as required by section 53(1)(b) of the Act. The submission period ended on 10 February 2016.

3. Submissions

3.1. The EPA received 13 submissions which are summarised in Appendix 1. All submitters supported the release of *L. strigana* to control tutsan infestations in New Zealand. Two submitters, Northland Regional Council and the Department of Conservation do not support the release of *C. abchasica* until further research is carried out to confirm *C. abchasica* will have an insignificant impact on native Hypericum species. DOC and Te Rūnanga o Ngāi Tahu wish to be heard in support of their submissions.

Submissions from DOC and MPI

3.2. As required by the Act and the Hazardous Substances and New Organisms (Methodology) Order 1998, the Ministry for Primary Industries (MPI) and the Department of Conservation (DOC) were notified of the application and provided with the opportunity to comment.

3.3. MPI did not make any comments on the application.

3.4. DOC submitted that tutsan is widely distributed on public conservation land and that tutsan occurs where native *Hypericum* species are present. DOC support the introduction and release of *L. strigana* given it is unlikely to have an adverse effect on native *Hypericum* species. DOC do not support the release of *C. abchasica* until further research shows the beetle does not exacerbate the current threat status of native *Hypericum* species. Their full submission is included in Appendix 2.

4. Tutsan as the target weed

Pest status and distribution in New Zealand

4.1. Tutsan is a small perennial shrub that prefers cool, damp areas in full light or light shade with moderate to high rainfall. Tutsan is prevalent in depleted pasture, wasteland and road verges (New Zealand Plant Conservation Network, 2013). Table 1 presents the taxonomic classification of tutsan.

Table 1: Complete taxonomic description of tutsan:

Taxonomic Unit	Classification
Order	Malpighiales
Family	Hypericaceae
Genus	*Hypericum*
Species	*androsaemum* L.
Common names	Tutsan, sweet-amber

4.2. The native range of tutsan is extensive, covering Europe, North West Africa and temperate Asia. Tutsan has naturalised in many other parts of the world including Australia, Southern Africa, Chile, and New Zealand where it was first recorded in 1870 (Groenteman, 2011; James and Rahman, 2015).

4.3. Tutsan is an unwanted organism under the Biosecurity Act 1993 and is listed on the National Pest Plant Accord. It is an offence to knowingly propagate, distribute, spread, sell, offer for sale or display tutsan in New Zealand. It is also listed in the Consolidated List of Environmental Weeds in New Zealand published by DOC (Howell, 2008).

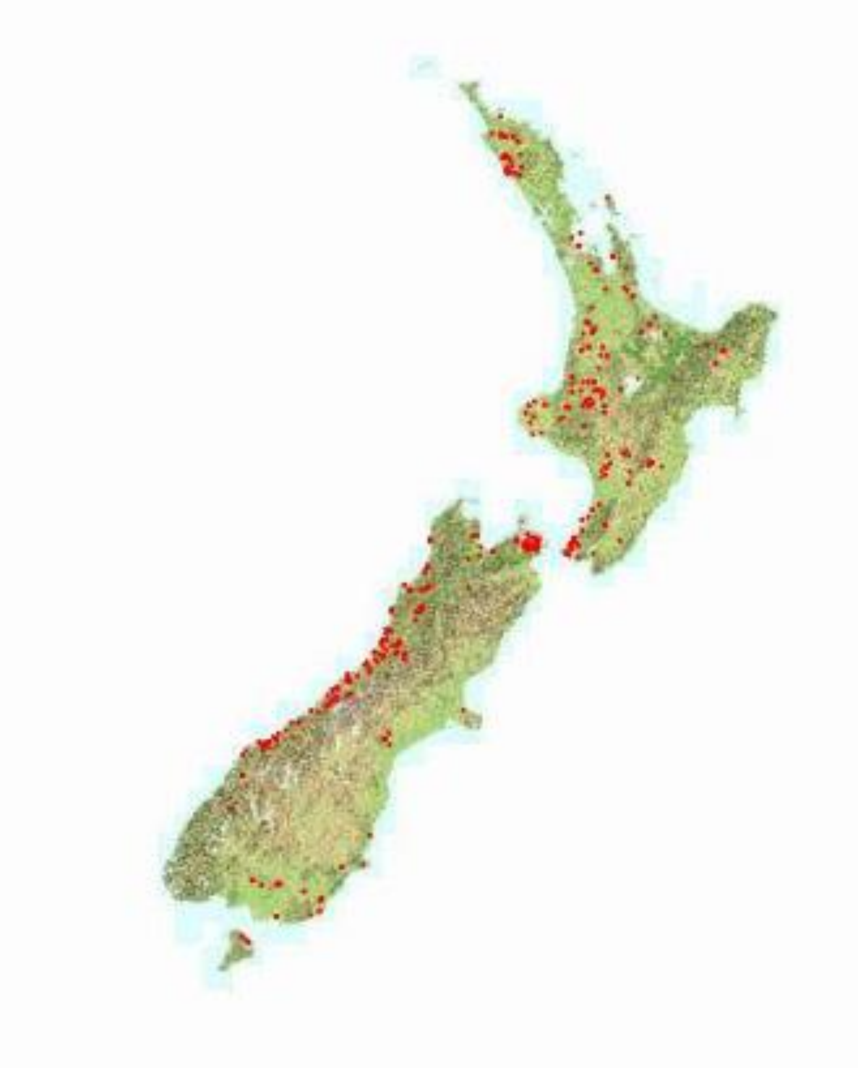
4.4. Tutsan is well established in New Zealand, including on the Stewart, Chatham and Campbell Islands. It is locally abundant in the central North Island with the worst infestations occurring in Taumarunui. It was estimated in 2008 that 1500 ha in Taumarunui was infested with tutsan. Tutsan has invaded pasture and roadsides in Eastern Bay of Plenty with high infestation levels on farmland in Opotiki and Whakatane. Tutsan appears to be a common plant in Northland and Auckland where it is found scattered along roadsides and riverbanks. In the South Island, tutsan grows in much lower densities with most sites only consisting of a few individual plants. The Hokitika River and Dunedin have moderate infestations (Rendell and Gourlay, 2012).

4.5. The biological success of tutsan can be attributed to the high seeding per plant, seed bank persistence of more than five years and its ability to tolerate a wide range of temperatures and light intensities. Tutsan is resistant to grazing damage as it is unpalatable to stock (Shepherd, 2004). Tutsan is dispersed by birds, possibly goats, and possums that feed on the fleshy fruit. Wind, soil and water movement are also effective dispersal mediums (James and Rahman, 2015).

Pest status on conservation land

4.6. DOC submitted to the applicant that tutsan is widely distributed within New Zealand on public conservation land (Havell, 2015; Figure 1). There are over 100 sites where tutsan is present on public conservation land including at least 30 high priority biodiversity sites.

Figure 1: Tutsan distribution in New Zealand



4.7. There are DOC control programmes for tutsan in the Manawatu Gorge, Rangitoto Island Summit and boundary control in Waitomo. DOC noted that the extent of tutsan in some areas means that only boundary control and control in high priority biodiversity sites is possible. DOC also note that long distance seed dispersal from road sides, unmanaged areas, and birds make controlling tutsan difficult (Havell, 2015).

4.8. A survey carried out in 2013 to determine the economic cost of tutsan to New Zealand contacted various DOC conservancies to get an estimate of the costs DOC spends on tutsan control. Of the seven conservancies that responded, none could attach dollar amounts specific to tutsan control but Waikato, Northland and Kauri Coast noted that there are isolated patches of tutsan in their area. Coromandel noted more serious infestations on DOC land. Stewart Island/Rakiura have no budget for tutsan control but are pulling tutsan plants out by hand and marking tutsan populations with GPS coordinates. The Whanganui DOC Conservancy have had significant involvement in the Tutsan Action Group projects and are concerned about the increasing spread of tutsan and associated cost to control the weed along the Whanganui River valley (Burton, 2013).

4.9. DOC evaluates weeds using several ranking systems. These include ‘Biological Success’ and ‘Effect on System’ scores. When these scores are combined they give a ‘Weediness Score’. The Biological Success score looks at the maturation rate, seed set, persistence of seed bank, vegetative reproduction, establishment and growth rate, effectiveness of dispersal and maturation rate of the weed. Tutsan has a Biological Success score of 13 out of 18. The Effect on System score looks at effects of the weed on the composition and structure of the native community and the weed’s persistence over time. Tutsan scored 7 out of 9.

4.10. The Weediness Score is calculated by taking the Biological Success score and adding two times the Effect on System score. For tutsan this is calculated as: 13 + 2(7) = 27 out of a total of 36. To put this in perspective, old man’s beard (*Clematis vitalba*) has a Weediness Score of 33, boneseed (*Chrysanthemoides monilifera*) scores 28 and buddleia (*Buddleia davidii*) scores 26 (Timmins and Owen, 1999). All three of these weeds are on DOCs Consolidated list of environmental weeds in New Zealand and biological control agents for boneseed and buddleia have been approved by the EPA (EPA, 2015).

Pest status on productive land

4.11. The area of productive land occupied by tutsan in New Zealand is unknown and cannot be accurately quantified. However, Burton (2013) analysed data provided from seven tutsan affected farms in the Ruapehu district and found that 889 ha or 40% of the total farmable area of the seven farms was affected by tutsan. Heavy tutsan infestations covered 11% of the total farmable area and the proportion of the farmable area significantly affected by tutsan on average was 51%. Horizons Regional Council and Ruapehu District Council have indicated that there are 910 farm properties in the Ruapehu district occupying an area of 361,722 ha. Assuming tutsan occupies 2% of the total farming area conservatively estimates that 7,200 ha of productive land is adversely affected in the Ruapehu district alone.

4.12. Tutsan Action Group (the applicant) was formed in 2007 and has over 100 contributing farmer members who are concerned about the increasing spread of tutsan in the Ruapehu area. This group has support from Horizons Regional Council, DOC, Beef + Lamb New Zealand, the MPI Sustainable Farming Fund and the National Biocontrol Collective.

Management of tutsan by regional councils

4.13. All regional councils recognise tutsan as an unwanted organism as it is listed on the National Pest Plant Accord (NPPA). The NPPA is cooperative agreement between the Nursery and Garden Industry, regional councils and government departments with biosecurity responsibilities. This prevents the sale, distribution, or propagation, within New Zealand, of specified pest plants and requires councils to carry out surveillance and inspections. The management and control of tutsan is governed by regional pest management strategies of the various councils (MPI, 2015).

4.14. Northland Regional Council have submitted that a survey of tutsan populations in Northland in December 2015 and January 2016 found widespread populations on roadsides in the higher rainfall areas of Northland but that tutsan does not generally invade pasture (submission 111601; Appendix 1).

4.15. Auckland Regional Council list tutsan under their *Surveillance* pest plant category. *Surveillance* pest plants have been identified as having significant impacts on the biosecurity values of the Auckland region. The Council identified production land, urban/open spaces, human health and offshore islands as areas where tutsan will potentially impact (Auckland Regional Council, 2007).

4.16. Waikato Regional Council note that tutsan produces a dense cover of branches and rotting leaves that smother existing low growing plant communities, inhibiting regeneration and infesting forest communities under light shade. In their Regional Pest Management Plan (RPMP) tutsan is listed as a production and environmental threat requiring progressive containment. Waikato Regional Council require occupiers to destroy all tutsan located on land occupied up to 100 m or less from the property boundary (Waikato Regional Council, 2014).

4.17. The Bay of Plenty Regional Council identified tutsan as an increasing biosecurity issue in the region (submission 111602; Appendix 1).

4.18. Taranaki Regional Council note that tutsan is restricted to waste areas and road cuttings and is not presently posing a threat to agricultural production or biodiversity. They note that while the Council does not engage in direct control, tutsan has the potential to cause significant effects on a local scale (Taranaki Regional Council, 2013).

4.19. Horizons Regional Council has included tutsan on their Regional Pest Plant Management Strategy (RPPMS) noting that it is a highly aggressive pest plant which is especially invasive on marginal production land. Tutsan also establishes in riparian margins, forest margins and roadsides. They note that dense infestations of tutsan are present within the Ruapehu district and are starting to spread down the Whanganui River. Horizons' management regime requires every occupier to control all tutsan located within 20 m of the boundary of any adjoining property. Roading authorities are also required to destroy any plants identified as tutsan (Horizons Regional Council, 2011).

4.20. Greater Wellington Regional Council submitted that tutsan currently has very limited distribution in the Wellington region. They note that any reduction in the reproductive abilities of tutsan will slow its spread into the Wellington region (submission 111594; Appendix 1).

4.21. Environment Southland list tutsan as an *Eradication* plant on Stewart Island/Rakiura. *Eradication* plants have limited distribution and density in the region but have the potential to have serious negative impacts on the economic, environmental, social and cultural values of Southland. Control of tutsan on Stewart Island/Rakiura is undertaken by DOC with the support of Environment Southland. For the rest of the Southland region (mainland and offshore islands) tutsan is listed as a *Risk Assessment* plant (Environment Southland, 2013). This indicates tutsan is a potential concern to the region.

Current Control Methods

4.22. Tutsan is currently controlled either by mechanical removal, chemical treatment or a combination of the two. Biological control has also been attempted in New Zealand in the past, with variable results.

Mechanical removal

4.23. Mechanical removal is particularly hard as tutsan tends to grow in inaccessible hill country and potentially hazardous areas such as roadsides and river banks. This method is effective for small infestations of young plants but impractical and expensive for large infestations. Success depends on removing as much of the root material as possible and following up every few months to prevent re-infestation (James and Rahman, 2015). After removal, applying fertiliser, over-sowing with other pasture species and grazing with stock is required to successfully manage tutsan. Philippa Rawlinson of Federated Farmers of New Zealand noted in her submission (111603, Appendix 1) that '*physically pulling or spot spraying tutsan on hilly country, on difficult or inaccessible locations, also poses a number of health and safety risks for farmers'*.

Chemical control

4.24. Picloram, triclopyr and glyphosate based herbicides are most commonly used to control difficult to kill perennial/pasture weeds like tutsan. A survey of farmers, council staff and contractors from the Waikato and Manawatu region found that Tordon Brushkiller XT (containing picloram, triclopyr and aminopyralid) is the most widely used herbicide to control tutsan (James and Rahman, 2015). Picloram is a systemic herbicide that has long residual life in the soil and is toxic to clovers, which are commonly used as fodder plants. The timing of herbicide application is important as mature tutsan plants develop a waxy coating on the leaves making it harder for the herbicide to penetrate (Horizons Regional Council, 2009). Lyn Neeson of Ruapehu Federated Farmers submitted that tutsan requires expensive chemicals to kill it and the most effective method is aerial application which is a costly practice (submission 111598, Appendix 1). Other control methods include painting the stumps of plants with a herbicide mixture immediately after cutting, and injecting the roots of the plant with herbicides.

Biological control

4.25. There have been two attempts at biological control of tutsan in New Zealand.

4.26. In the late 1940s the beetle *Chrysolina hyperici*, originally used for the biological control of St John's Wort, was released in areas where tutsan was considered a problem. Beetles that were released in areas containing both tutsan and St John's Wort failed to attack tutsan. Other areas with only tutsan present showed some initial success but *C. hyperici* populations died out by 1950 (James and Rahman, 2015).

4.27. Biological control of tutsan by the rust *Melampsora hypericorum* has been successful in Australia after the fungus was self-introduced in the state of Victoria in 1991. Subsequent attempts to use the rust to control tutsan in Australia had mixed results. It was found that genetic variation between populations of tutsan gave rise to variable rates of infection in the field. This rust was first identified on tutsan populations in New Zealand in the Wellington region in 1952 (James and Rahman, 2015) and is believed to have some success controlling tutsan populations in the South Island. It is currently distributed throughout New Zealand; a 2012 survey found the rust present at 13 out of 37 sites across the North and South Islands (Rendell and Gourlay, 2012). The rust is not currently providing sufficient control in the North Island. This is hypothesized to be a result of genetic variability between plants in the North and South Island and contrasting susceptibility to rust infection. It has also been postulated that a strain of tutsan developed resistance and populated the North Island (James and Rahman, 2015).

5. Organisms proposed for release

Moth

Table 2: Taxonomic description of the moth

Taxonomic Unit	Classification
Class	Insecta
Order	Lepidoptera
Family	Tortricidae
Genus	*Lathronympha*
Species	*strigana* Fabricius 1775
Common names	Red piercer

5.1. Moths that reside in the Tortricidae family are known as tortricid moths or leafroller moths (Gilligan *et al.* 2014). The larvae of tortricid moths spin leaves together to make a protective structure. Larvae will then feed on the inner surface of the leaf as they mature. It is this action that gives the moth the 'leafroller' epithet. This mode of feeding can cause defoliation and leave plants more susceptible to disease (Lo and Murrell, 2000).

5.2. Not much is known about the life cycle of *L. strigana*. Depending on the climate and conditions, *L. strigana* is thought to have two generations per year. There are several different biotypes observed by the different feeding preferences depending on the region in its native range across Europe. In Georgia, *L. strigana* larvae were observed boring into fruit to feed on the flesh and undeveloped seeds of tutsan (Olsen *et al.* 2012). In Spain and Switzerland the moth has a different feeding niche, both generations preferring to feed on young shoots and the second generation additionally tying together buds and fruits.

5.3. The Georgian biotype was selected for host range testing in New Zealand. It can complete a generation in 54 days in the laboratory at 25ºC and is expected to have at least two generations per year in New Zealand. The second generation is expected to bore into the fruit that tutsan sets from November to February (James and Rahman, 2015).

Beetle

Table 3: Taxonomic description of the beetle

Taxonomic Unit	Classification
Class	Insecta
Order	Coleoptera
Family	Chrysomelidae
Genus	*Chrysolina*
Species	*abchasica* Weise 1892
Common names	Tutsan leaf-feeding beetle

5.4. *Chrysolina* is a large and diverse genus of leaf beetles. They are most commonly distributed in Europe, Asia and Africa (Bienkowski, 2001). *Chrysolina* species typically attack plants within the same genus or family making them good candidates for biological control (Weed and Casagrande, 2011). Both larvae and adults heavily defoliate plants which can suppress flowering and seed production. *Chrysolina* species have been used as biocontrol agents to great effect in controlling St John's Wort (*Hypericum perforatum*) in New Zealand. The Lesser and Greater St John's Wort beetles (*Chrysolina hyperici* and *C. quadrigemina* respectively) were first introduced in the 1940s to control the weed which was spreading in high country pastures in the South Island. By the 1980s the beetles were successfully controlling St John's Wort with little to no other control needed in most areas (Hayes *et al*. 2013).

5.5. *Chrysolina abchasica* has only been recorded in West Caucasus (Olsen, 2012) and very little is known of its biology. It is thought that the life history of *C. abchasica* is very similar to *C. hyperici* and *C. quadrigemina* (Groenteman et al. 2011). This beetle would have one generation per year in New Zealand, overwintering as an adult in the ground before emerging in spring to lay eggs on tutsan.

Using the two agents together to control tutsan

5.6. The applicant has selected these two biocontrol agents because they believe they will work synergistically, targeting different parts of the plant at different times of the year to cause maximum damage. The introduction of multiple biological control agents is often required to increase the likelihood of successful weed control (Landcare Research, 2015b).

5.7. It is possible that both agents will not be able to establish in all areas that tutsan is present for a variety of reasons, (ie. heavy parasitism in the field or poor seasonal synchrony). If only one agent is released and it performs poorly this may result in only partial control of the target weed (Hayes *et al.* 2013).

5.8. We consider that the moth and beetle will complement each other. The larvae of the moth will feed on stems and leaves in spring, and inhabit the fruit when it becomes available over summer. The applicant has indicated that the life history of *C. abchasica* will be very similar to that of the two St John's Wort beetles. If this is the case it is expected that *C. abchasica* adults will feed until early summer, hibernate until March, then emerge to feed again and lay eggs. The eggs hatch in autumn and larvae feed on foliage in autumn and spring (Landcare Research, 2014). This will provide temporal and spatial damaging effects on tutsan populations to effectively suppress the weed.

6. Risk assessment

Risk assessment assumptions

6.1. Our assessment of the benefits and risks associated with the release of *L. strigana* and *C. abchasica* to control tutsan is based on the assumption that the biocontrol agents will successfully establish in the New Zealand environment and develop self-sustaining populations.

6.2. We note that the agents may take some time to establish and build self-sustaining populations; therefore, the overall effect on tutsan populations will be gradual at first. We also note that *L. strigana* and *C. abchasica* infestations will need to reach high levels to cause optimum damage to tutsan populations to be beneficial. Therefore, an assessment made on full establishment (i.e. optimum damage) allows us to adequately weigh benefits against the risks. If either or both agents do not fully establish, then the risks and benefits will correspondingly diminish.

6.3. We identified the benefits and risks associated with *L. strigana* and *C. abchasica* from the information provided by the applicant, scientific evidence that was collected during a literature review, and additional information provided by submitters.

6.4. We did not identify any potential effects associated with human health and safety.

7. Assessment of benefits

7.1. The applicant identified potential beneficial effects on the environment, the market economy, society and communities, and Māori culture and traditions that can be associated with the release of the *L. strigana* and *C. abchasica* to control tutsan in New Zealand. We have assessed all benefits and discuss the elements that we considered to be significant. Therefore, those effects where the likelihood and magnitude of the effects are considered to be low or speculative were not assessed.

Assessment of potential environmental benefits

7.2. The applicant identified the following benefits of the moth *L. strigana* if feeding causes significant damage to tutsan fruits:

- limit the spread of tutsan via bird mediated dispersal
- reduced capability of tutsan to seed

7.3. The applicant identified the following benefits of the beetle *C. abchasica* if feeding causes significant damage to tutsan vegetation:

- reduction in shading caused by tutsan, allowing native and valued species to regenerate
- reduction in the abundance and vigour of tutsan
- reduction in herbicide use

7.4. Our assessment considers whether the ultimate benefits following the release of the moth and beetle may follow. These benefits are the reduced spread and containment of tutsan plants to existing sites, and the restoration of native ecological processes and improving biodiversity values.

Destruction of tutsan fruit by the moth limits the spread and persistence of tutsan in the environment

7.5. Tutsan has large yellow flowers that are followed by green berries that are around 1 cm in diameter, which turn red, then black as they ripen. Flowers and fruit are present on the plant from November to February (James & Rahman, 2015). Tutsan fruits are consumed primarily by birds, which allows for effective dispersal and establishment of new infestations.

7.6. Seeds falling beneath plants or dispersed by wind can form seed banks which support the persistence of tutsan in the environment. Deliberately sown pasture species are vulnerable to weed invasion once they become stressed and become unable to compete against the number of weedy seedlings that emerge from the seed bank (Tozer *et al.* 2010).

7.7. In a literature review, Howell (2012) found that seed longevity played the biggest role in the ability of a weed to persist in the New Zealand environment. A key benefit of the moth *L. strigana* is that it will feed on the fruit of tutsan, reducing seeding potential and, as a result, limit seed distribution.

7.8. We consider it **likely** that feeding by the moth larvae will reduce fruit production and as a result limit seed persistence and spread. The magnitude of this effect is uncertain due to the lack of field studies and could range from **minimal** to **minor**.

Reductions in tutsan abundance by the actions of the moth and beetle are expected to allow regeneration of native species and improve biodiversity values

7.9. We consider that tutsan is already a problem in conservation areas and has the potential to extend its range. Tutsan is shade tolerant and can tolerate a wide range of temperature and soil types. Large parts of New Zealand untouched by tutsan would provide a suitable habitat for the weed to thrive (Groenteman, 2009).

7.10. There is strong evidence in the scientific literature demonstrating the adverse impacts that invasive plant species have on ecological processes and functions, and the natural diversity of native flora and fauna (for example, Randall,1996; Vitousek *et al*. 1997; Van Kleunen *et al.* 2015). Weedy plant species, such as tutsan, degrade biological systems by using resources that would normally be available to support native species and their functions in food webs.

7.11. Therefore we consider that reductions in the abundance of tutsan populations, facilitated by damage to foliage by the moth and beetle and destruction of seeds by the moth, may lead to restored ecosystems where native species flourish, and deliver better biodiversity and conservation outcomes.

7.12. We consider it **likely** that native ecological processes will be restored and improvements in biodiversity and conservation values will follow when tutsan populations are controlled by *L. strigana* and *C. abchasica.*

7.13. We consider the consequences of releasing *L. strigana* and *C. abchasica* will have **minor** to **moderate** beneficial impact on native ecological processes which will underpin restoration of biodiversity values. Therefore we consider the effects to be **significant**.

Reductions in tutsan abundance is unlikely to lead to significant reductions in herbicide use

7.14. DOC submitted that they manage tutsan in at least 20 sites around New Zealand (Appendix 2). Management techniques include control with herbicides such as glyphosate, triclopyr, picloram, aminopyralid and metsulfuron. Herbicides are applied as sprays, basal sprays, gels and granules. DOC note that current herbicide control methods kill other plants as well as tutsan which limits their use.

7.15. A submitter from Oparau in the Waikato noted that they now have to focus their chemical control on tutsan instead of other weeds, such as gorse and blackberry, on their farm. This indicates that tutsan is just one of many plants that infest farm land and herbicide use will continue to control other weeds on private properties. They also note that there is an ‘*astounding increase*’ in the amount of tutsan growing along the banks of the Oparau River (submission 111599). This results in a ‘*delicate’* spraying situation as many readily available herbicides cannot be used near waterways (Waikato Regional Council, 2012), however the Waikato District Council require all occupiers to remove tutsan growing within 100 m of the property boundary.

7.16. We consider that it is **unlikely** that control of tutsan by the biological control agents will lead to significant reductions in overall herbicide usage in New Zealand. We note that reductions in herbicide use are more likely to occur once tutsan is successfully controlled by the biological control agents where it is the primary weed (e.g. on farm land). On a national level, significant reductions in herbicide use will only occur after a long period of time when biological control has successfully led to suppression of a range of weeds.

7.17. We consider that the consequences of releasing the moth *L. strigana* and the beetle *C. abchasica* will have **minimal** impact on herbicide usage nationally to reduce environmental damage. We do note that there may be localised beneficial environmental impacts where tutsan populations exist that are the most common, or only, invasive species and they can be effectively targeted with herbicides. The control of those populations by the moth and the beetle may lead to contained reductions in local herbicide usage and may have **minor** beneficial impact on reducing incidental herbicide contamination of the environment. We consider that the effects of reducing localised herbicide usage may have low beneficial effects on the wider environment.

Assessment of potential benefits to the market economy

7.18. Control of tutsan is considered to be a measurable cost to DOC, regional councils, territorial authorities and private land owners/occupiers. However, actual costs directly attributed to tutsan control are difficult to determine since tutsan may be managed as part of a site-led control programme, instead of a weed-led programme. That is because most funded weed control programmes target a number of weeds including tutsan across an area and a significant proportion of control is performed by private landowners. As a result, dollar amounts can only be estimated.

7.19. Farm management consultant Geoff Burton surveyed different stakeholders to assess the economic costs of tutsan to New Zealand in 2013 (Burton, 2013). DOC, regional councils, forestry management companies, and KiwiRail provided indicative costs to control or mitigate the effects of tutsan infestations to Burton. In addition, Burton surveyed the state of tutsan infestations on seven farms in the Ruapehu district. A summary of costs that align most strongly with control and management of tutsan directly follows below.

7.20. DOC estimated that the cost of spot spraying on difficult terrain in the Whanganui area costs around $80-200 per hectare totalling $7000 per annum (Burton, 2013). Tutsan is also managed by DOC to zero density in the Manawatu Gorge. There is surveillance and control of small patches of tutsan on Rangitoto Island and expenditure on '*good neighbourly control'* (ie. controlling pests that occur on DOCs boundaries) in Waitomo. Other DOC conservancies noted that there are isolated patches of tutsan but that there is no budget for tutsan specific control (Havell, 2015).

7.21. Burton (2013) approached four forestry organisations about tutsan control expenditure and found that most are aware of the weed but did not have any specific strategies for its management. New Zealand Forest Managers in Turangi noted that tutsan control expenditure is included in the budget for all weeds sprayed. Greenplan Forestry Management in Te Kuiti noted that tutsan is present in at least four of their forests but they are not currently spending any money on control. Hancock Forest Management in Tokoroa are aware of tutsan but are not spending anything on control as they are unconcerned about it at this stage. PF Olsen Ltd in Ohope are spraying tutsan with other weeds and estimate they spend $1000-2000 per annum on control.

7.22. The cost of tutsan control to the forestry industry is expected to increase due to the enforcement of existing or new tutsan control requirements in the various RPMS around New Zealand. For example, Waikato Regional Council will require forestry organisations to comply with the RPMS by eradicating all tutsan on their land. Other predicted costs could include the cleaning of logs and machinery before moving from tutsan-infested areas (Burton, 2013).

7.23. KiwiRail noted that tutsan is not a big problem at the moment but estimate spraying tutsan would cost $3000 per kilometre which would be carried out annually.

7.24. The report found that Horizons Regional Council, Waikato Regional Council, Ruapehu District Council and Auckland Regional Council spent a total of $94,000 in 2012 managing tutsan. Waikato Regional Council estimated that tutsan occupied 500 ha in 2012 and estimated the cost of control over the next 10 years to be $4.15 million (Burton, 2013).

7.25. Many tutsan infestations occur on farm land, indicating that the greatest benefits of the biological control of tutsan will be associated with lower control costs for farmers. Burton (2013) concluded that the total direct annual costs to contain and control tutsan were $990,660 to farmers based on an estimation that 2% of the total farm area in the Ruapehu district is affected by tutsan and estimations made on other farming areas affected by the weed. Lyn Neeson of Ruapehu Federated Farmers submitted that, after consulting with their members, the average cost to each farmer to manage tutsan on private land is $15,000 per annum (submission 111598, Appendix 1).

7.26. As a result, we consider that it is **likely** that the release of the two biological control agents for tutsan will lead to local/regional beneficial economic effects, such as the Ruapehu, Waikato and Taumarunui regions, where tutsan is particularly problematic. This will be accomplished by reducing control and management costs for land owners, regional councils and other territorial authorities that control tutsan as part of a regional pest management strategy. The degree of local and regional economic benefits will depend on the abundance of tutsan and current control strategies that are used to manage the weed. Therefore, we consider that there will be **minimal** economic benefits, notably to farmers in those regions where tutsan is abundant.

7.27. We consider it **unlikely** for the biological agents to have economic benefits at a national level. Any national benefits will be **minimal** because tutsan is not a target weed throughout the country. Money previously allocated to control tutsan will be allocated to projects that target other weeds once tutsan abundance has decreased. We therefore consider that any economic benefits from the introduction of the moth and beetle as biological control agents for tutsan on a national scale will be **negligible**.

8. Assessment of the potential adverse effects on the environment

8.1. The EPA and the applicant considered that the introduction of the moth *L. strigana* and the beetle *C. abchasica* may adversely affect our environment if the insects attack native plants and interfere significantly with trophic webs.

8.2. The applicant further considered that the biological control of tutsan would have adverse effects if it facilitated the establishment of worse weeds or significantly reduced the food supply available for native birds. We considered the magnitude of the effects to be low, therefore they were not assessed.

Assessment on the risk to native populations

8.3. Host range testing was conducted in containment on plant species that are closely related to tutsan to determine whether the proposed biological control agents will cause significant non-target damage (Landcare Research, 2015a).

Host range testing protocol

8.4. The original host range testing method prescribed by Wapshere (1974) relied on phylogenetic relationships between a weed and other plants to identify those that are closely and more distantly related. This methodology assisted with putting together a plant species list to test for off-target effects. The centrifugal phylogenetic method has since been updated due to the rapid development of molecular tools that led to new understandings of the phylogenetic relationships between species (Ketch and McClay, 2003). This has created new levels of certainty in establishing strict relationships between species, and has meant that not as many species from related taxa need to be included in a test species list as was proposed by Wapshere in 1974 (Briese 2005).

8.5. Tutsan (*Hypericum androsaemum*) is a member of the Hypericaceae family and in New Zealand this family is represented by the genus *Hypericum*. There are four native *Hypericum* species in New Zealand: *H. involutum* (indigenous), *H. pusillum* (indigenous), *H. rubicundulum* (endemic) and *H. minutiflorum* (endemic, not tested) (New Zealand Plant Conservation Network 2015). A further 12 exotic *Hypericum* species have naturalised in New Zealand including the weed *H. perforatum* (St. John's Wort) and the ornamental *H. calycinum* (Rose of Sharon).

8.6. The Hypericaceae family belongs to the order Malpighiales. In New Zealand there are 9 families that represent this order. Three of these have no native species (Ochnaceae, Putranijvaceae and Salicaceae). Five are represented by very few native species (Elatinaceae, Euphorbiaceae, Linaceae, Passifloraceae and Phyllanthaceae). Lastly, the family Violaceae has 14 native species.

8.7. None of the families in New Zealand are closely related to the Hypericaceae; the closest is the Elatinaceae (one aquatic species, not tested) and the next closest is the Violaceae (two species, both tested). The two native species in the Phyllanthaceae family were unable to be obtained for testing. The applicant considers the other test plants selected for host range testing are adequate representatives of families outside the Hypericaceae and will demonstrate the host ranges of the beetle and moth appropriately. See Table 4 for plants chosen for host range testing of *L. strigana* and *C. abchasica*.

Table 4: Plants in the order Malpighiales selected for host range testing

Family	Number of species in NZ	Number of native species	Test species selected	Status
Hypericaceae	19	4	*Hypericum androsaemum*	Target weed
			H. involutum	Indigenous
			H. rubicundulum	Indigenous, endemic
			H. pusillum	Indigenous, endemic
			H. calycinum	naturalised
			H. perforatum	Weed, St John's Wort
Violaceae	23	14	*Melicytus ramiflorus*	Indigenous, endemic
			Viola lyallii	Indigenous, endemic
Passifloraceae	10	1	*Passiflora tetrandra*	Indigenous, endemic
Euphorbiaceae	34	2	*Euphorbia glauca*	Indigenous, endemic
Phyllanthaceae	3	2	nil	Not tested
Linaceae	6	1	*Linum monogynum*	Indigenous

8.8. In order to determine the host range of the two agents proposed for control of tutsan, oviposition and larval starvation testing was carried out in containment. These tests were conducted with tutsan both present and absent. No choice oviposition tests in the absence of the target were also used to identify all species that could potentially support the life cycles of the moth and beetle. The assumption of the oviposition test is that there is very low risk to a non-target plant if an agent does not select the plant to lay its eggs on. Larval starvation tests investigate whether larvae can survive and complete development on non-target host plants.

Results of host range testing of *Lathronympha strigana* on native species

8.9. The host range testing of *L. strigana* found that the moth would only utilise plants in the *Hypericum* genus for oviposition. *L. strigana* showed a strong preference for oviposition on tutsan over all other *Hypericum* species tested. *Lathronympha strigana* laid eggs on two native species, *H. involutum* and *H. pusillum,* in choice tests with tutsan plants present and laid eggs on *H. rubicundulum* in tests where tutsan was absent.

8.10. To determine whether eggs laid on native species could develop, three larval starvation tests were carried out. These tests assessed the survival of larvae that were transferred to whole plants; the development of naturally deposited eggs on *Hypericum* species; and host selection of wandering larvae.

8.11. Newly hatched larvae were transferred to whole plants and larval survival was recorded after 25 days. All larvae placed on native *Hypericum* species were dead by day 25.

8.12. Eggs that were deposited naturally on *Hypericum* plants were monitored. The larvae were then removed from deteriorating plants and fed on leaves, fruits and flowers in petri dishes until they completed development or died. Larvae on native *Hypericum* species were unable to complete development and none survived past day 30.

8.13. To determine whether later stage larvae could move from defoliated tutsan plants and begin feeding on native *Hypericum* species, third instar larvae that had been reared on tutsan were placed on whole plants and monitored. No larvae were able to complete development on native *Hypericum* species and all larvae placed on native *Hypericum* plants were dead by day 35.

8.14. We consider that native species outside the *Hypericum* genus are not at risk of damage by the moth *L. strigana* because no feeding or oviposition was observed on those plants. We also consider that the likelihood of *L. strigana* forming self-sustaining populations on native *Hypericum* species is **highly improbable**, because larvae were unable to complete development without tutsan plants.

8.15. As a result, we consider the magnitude of any adverse effects of the moth on native species to be **minimal** and for such effects to be **negligible**.

Results of host range testing of *Chrysolina abchasica* on native species

8.16. The host range testing of *C. abchasica* found that the beetle would only utilise plants in the *Hypericum* genus for oviposition and did not lay eggs on the native *H. involutum*. Statistical analysis found that oviposition preference varied significantly between plant species and *C. abchasica* strongly preferred to lay eggs on tutsan.

8.17. Larvae that had fed on tutsan for up to a week were transferred to test and control plants in no-choice trials and monitored for survival and development. Again, larvae were unable to survive on *H. involutum* and survival on *Hypericum* species was significantly lower than survival on tutsan.

8.18. In a second no-choice larval starvation test, larvae that emerged from naturally deposited eggs on tutsan and other *Hypericum* plants were monitored for survival and development. Survival on *H. pusillum* and *H. rubicundulum* was low compared to the tutsan controls and many of the adults that were raised on native plants died soon after emergence.

8.19. To further describe the level of risk the beetle may have to the three native *Hypericum* species that supported low levels of oviposition and larval development (*H. pusillum, H. rubicundulum* and *H. minutiflorum*), the applicant used relative performance scores for no-choice larval starvation and oviposition tests to calculate a combined risk score. This score predicts the risk of *C. abchasica* causing serious non-target damage to native *Hypericum* species to be very low and is discussed in more detail below.

Combined Risk Scores for Chrysolina abchasica

8.20. The ability to quantify the relative performance of a potential biocontrol agent on test plants and target weeds is a useful tool to help inform risk assessment. A survey of historical data for New Zealand weed biocontrol programmes by Paynter *et al*. (2015) found that there was a clear threshold below which non-target attack is extremely unlikely.

8.21. The combined risk score multiplies together the relative performance scores for no-choice starvation and oviposition tests to give a clear threshold for non-target attack. Paynter *et al.* (2015) hoped that by comparing combined risk scores for a number of agents that had been released, and for which there is data available demonstrating their host specificity in the field, new agents proposed for release may be classified according to their relative risk profiles. They found that there were no cases of weed biocontrol agents attacking non-target plants where combined risk scores were less than 0.2. Where scores were 0.21 and above, all weed biocontrol agents attacked non-target plants and full utilisation of a plant occurred when the combined risk score was above 0.57.

8.22. Combined risk scores help address some of the issues with interpreting no choice starvation and oviposition tests in a restrictive caged environment. The biggest problem with testing in containment is that, in the field, insects can migrate to other plants rather than being forced to feed and develop (or starve and die) on sub-optimal hosts. Oviposition tests are prone to false positives because a restrictive environment interrupts pre-alighting cues and females may dump eggs in absence of their normal host (Paynter *et al.* 2015).

8.23. The combined risk scores for the native *Hypericum* species are much lower than the predicted threshold for non-target attack in field conditions (0.21 for guaranteed non-target attack; Table 5). Therefore we consider that native *Hypericum* species are not at risk of significant damage by the beetle *C. abchasica*.

Table 5: Combined risk scores for Chrysolina abchasica

Species	Status	Risk score
Hypericum androsaemum	Target weed	1.00
H. perforatum	St. John's Wort/ exotic weed	0.17-0.21
H. calycinum	Rose of Sharon/ exotic ornamental	0.02-0.06
H. involutum	Native	Not assessed
H. pusillum	Native	0.01-0.06
H. rubicundulum	Native	0.01-0.06

Combined risk scores above 0.57 indicate full utilisation of the host. Scores between 0.21-0.33 indicate certain attack. Scores under 0.21 indicate potential for attack is close to zero.

8.24. We consider it **highly improbably** that the beetle *C. abchasica* will cause damage to native plant species outside the *Hypericum* genus if it is released in New Zealand and that the likelihood of attack on native *Hypericum* species is **very unlikely**. We consider that non-target attack may only occur where other *Hypericum* species grow in close proximity to tutsan populations, therefore there is a minor risk of spill-over attack. Any attacks that may occur on non-native species are not considered to have any discernible population level effects on native *Hypericum* species because the beetles will not be able to successfully complete life cycles on these plants to form self-sustaining populations.

8.25. Accordingly, we consider that the magnitude of any adverse effects of *C. abchasica* on non-target *Hypericum* species to be **minor** and therefore those risks are considered **negligible**.

The impact of biological control agents on existing trophic webs

8.26. Surveys of pathogenic fauna on tutsan at 13 sites in New Zealand were conducted between November 2011 and March 2012. The surveys were conducted to identify possible insect and fungal biocontrol agents of tutsan that already exist and to determine the range of insects that are associated with the weed in New Zealand (Rendell and Gourlay, 2012).

8.27. This survey found fauna from 64 invertebrate groups and two fungal species inhabiting tutsan plants around New Zealand. Overall damage to tutsan plants that could be attributed to herbivory was less than 4% at most sites. A range of exotic and native invertebrates attack tutsan but there were no specialised tutsan associated insects present at the study sites, and damage to tutsan populations by insects and fungal pathogens in New Zealand was minimal. The leaf beetle, *Eucolaspis brunnea* and leaf rolling caterpillars are responsible for most of the herbivore damage to tutsan in New Zealand. There was also a low abundance of parasites associated with tutsan, indicating that an introduced biocontrol agent is unlikely to be hindered by parasitism. As none of the herbivory niches on tutsan are well utilised, a host specific biocontrol agent is unlikely to face competition from the existing tutsan related fauna (Rendell and Gourlay, 2012).

8.28. We consider that there are no specialised or valued insects found to be associated with tutsan plants and any insect species affected by declining tutsan populations will find other sources of food or shelter in neighbouring vegetation. We consider the possibility of the biological control agents for tutsan adversely affecting tropic webs to be **unlikely**, therefore those risks are considered **negligible**.

9. Assessment of the potential adverse effects on society and communities

9.1. Biological control of tutsan could have adverse effects on society and communities if the proposed biological control agents attacked plants that are enjoyed for their ornamental value. Host range testing strongly indicates that *L. strigana* and *C. abchasica* will only attack plants in the *Hypericum* genus. Therefore, ornamental plants outside the *Hypericum* genus are not at risk of attack.

9.2. Dr John Liddle, Chief Executive of the Nursery and Garden Industry New Zealand (NGINZ), submitted to the EPA that ornamental *Hypericum* species are grown by nurseries and cut flower growers in New Zealand and that some dwarf forms are of interest to rock gardeners. However the total value of the annual crop is estimated to be very low (submission 111605, Appendix 1).

9.3. There are 12 exotic Hypericum species that are fully naturalised in New Zealand. Three of these exotic species (*H. androsaemum,* the target; *H. perforatum*, an unwanted weed; and *H. calycinum*, an ornamental species) were included in the host range testing for *L. strigana* and *C. abchasica*. As indicated by John Liddle, very few *Hypericum* species are cultivated in New Zealand. Cultivated plants are spatially rare and any damage to plants by biological control agents can be mitigated with insecticide.

Results of host range testing of *Lathronympha strigana* on ornamental/exotic species

9.4. This testing indicated that the moth *L. strigana* showed a very strong preference for oviposition on *H. androsaemum* over other *Hypericum* species. Larval survival of *L. strigana* was confined to *H. androsaemum* and *H. perforatum*. It has been noted that *H. calycinum* is occasionally grown as an ornamental plant, particularly as ground cover. In starvation tests larvae that had been naturally deposited as eggs on *H. calycinum* were found in the flowers of *H. calycinum* but none were able to complete development.

9.5. This indicates that not all *Hypericum* species are at risk from *L. strigana.* However, host range testing carried out by the applicant did not define what exotic *Hypericum* species present in New Zealand may be at risk of attack. The applicant noted that *L. strigana* can feed on foliage but prefer to inhabit the fruit of *Hypericum* plants. Destruction of the seeds inside the fruit would not impact the ornamental value of the plant and may stop exotic species from becoming problem weeds in the future (Trueblood *et al.* 2010). Therefore the risk to other exotic *Hypericum* species is uncertain but any adverse effects are considered to be low.

Results of host range testing of *Chrysolina abchasica* on ornamental/exotic species

9.6. Host range testing of *C. abchasica* found that the beetle was able to oviposit on both exotic *Hypericum* species (*H. perforatum* and *H. calycinum*). However, significantly fewer eggs were laid on non-target *Hypericum* species and larval survival on these species was significantly lower compared to the tutsan control. The risk of *C. abchasica* causing serious non-target attack to *H. calycinum* is very low, due to it being assigned a combined risk score of 0.02-0.06 which is below the threshold of attack.

9.7. The applicant noted that these results cannot define the risk to all valued exotic *Hypericum* species. However it is unlikely that self-sustaining populations could persist on isolated ornamental species given the high mortality rate of emerging *C. abchasica* adults that fed on non-target *Hypericum* species.

9.8. We consider it **very unlikely** that the introduction of *L. strigana* and *C. abchasica* will adversely affect ornamental *Hypericum* species, as plants are grown in home gardens or nurseries away from tutsan infestations occurring on farm land and in conservation estates. Any attack on ornamentals will occur incidentally and localised damage to foliage can be managed by insecticide.

9.9. We consider that any consequences from the introduction of *L. strigana* and *C. abchasica* will have **minimal** effects on the enjoyment of ornamental plants by home gardeners. Therefore we consider any adverse effects to be **negligible**.

Adequacy of host range testing

9.10. We consider that the host range testing carried out on *L. strigana* and *C. abchasica* has been performed according to best practice and can reliably predict possible off-target effects of new biocontrol agents.

9.11. The test species selection and testing methodology were considered to meet current best practice by an independent reviewer, Dr Simon Fowler. The work carried out on combined risk scores by Paynter *et al.* (2015) clarifies the predicted risk of non-target attack in the field.

9.12. Northland Regional Council have reservations about the introduction of the beetle and believe that a study on the population phenology of endemic *H. minutiflorum* and *H. rubicundulum* should be undertaken (submission 111601, Appendix 1). This would determine the degree of overlap in time and space of the endemic *Hypericum* species with tutsan. DOC also submitted that they do not support the release of *C. abchasica* until the impact of *C. abchasica* on the growth and seed production of native *Hypericum* species is confirmed as insignificant (Appendix 2). Northland Regional Council also submitted that self-sustaining populations of *Chrysolina hyperici* and *C. quadrigemina* (the St John's Wort beetles) have been documented in Central Otago on *H. involutum*. Northland Regional Council believe that the fact that populations of *Chrysolina* spp. can be sustained on an alternative, low density, non-target host is significant.

9.13. We consider that field surveys and anecdotal observations of *Chrysolina* spp. feeding on native *Hypericum* species indicate the impact on native *Hypericum* species at the population level is low to absent. This indicates that native *Hypericum* species are not supporting self-sustaining populations of previously introduced *Chrysolina* beetles (Groenteman, 2011).

9.14. We consider that non-target attack by *C. hyperici* and *C. quadrigemina* on *H. involutum* was retroactively predicted using the combined risk score developed by Paynter *et al.* (2015) and these same predictions can be applied to *C. abchasica*. Scores for the St John's Wort beetles ranged from 0.566 - 1.354 (predicting a certainty of attack) on *H. involutum* whereas *C. abchasica* did not oviposit on *H. involutum*. Similarly, scores for non-target attack on *H. pusillum* by the St John's Wort beetles ranged from 0.307 - 0.537 (predicting a certainty of attack) whereas *C. abchasica* scored 0.01 - 0.06 (very low risk of attack; Table 6).

Table 6: Combined risk scores for Chrysolina species on native Hypericum species

Plant species	Beetle species	Combined Risk Score
H. involutum	*C. hyperici*	0.566 - 0.631
	C. quadrigemina	0.781 - 1.354
	C. abchasica	0
H. pusillum	*C. hyperici*	0.307 - 0.330
	C. quadrigemina	0.408 - 0.537
	C. abchasica	0.01 - 0.06

10. Conclusion on benefits and risks assessment

10.1. After completing our risk assessment and reviewing the available information, we consider that the adverse effects of releasing *L. strigana* and *C. abchasica* to control tutsan are negligible and the environmental benefits are significant (Table 7). Therefore, our assessment is that the benefits from the release of *L. strigana* and *C. abchasica* outweigh the risks.

Table 7: Summary of our assessment of the benefits, risks and costs associated with the release of the moth L. strigana and the beetle C. abchasica to control tutsan

Potential outcomes	Likelihood	Consequence	Conclusion
Potential beneficial effects on the environment			
Restoration of native ecological process and functions which will improve biodiversity and conservation values	Likely	Minor to moderate	Significant
Significant reductions in herbicide use nationally, and thus reducing collateral environmental damage	Unlikely	Minimal	Negligible
Potential beneficial effects to the market economy			
Significant economic benefits that follow the introduction of the moth *L. strigana* and the beetle *C. abchasica* on a national scale	Unlikely	Minimal	Negligible
Potential adverse effects on the environment			
Adverse effects on the native *Hypericum involutum*	Highly improbable (moth); Highly improbable (beetle)	Minimal (moth); Minimal (beetle)	Negligible (moth); Negligible (beetle)
Adverse effects on the native *H. pusillum*	Highly improbable (moth); Very unlikely (beetle)	Minimal (moth); Minor (beetle)	Negligible (moth); Negligible (beetle)
Adverse effects on the native *H. rubicundulum* (also representing *H. minutiflorum*)	Highly improbable (moth); Very unlikely (beetle)	Minimal (moth); Minor (beetle)	Negligible (moth); Negligible (beetle)
Reducing the intrinsic value of our ecosystem from the introduction of the two biological control agents, including displacing native and valued fauna and flora, and disturbing ecosystems	Unlikely	Minor	Negligible
Potential adverse effects on society and communities			
Attacks on ornamental plants and associated adverse effects on home gardeners	Very unlikely	Minimal	Negligible

11. Relationship of Māori to the environment

11.1. The potential effects on the relationship of Māori to the environment have been assessed in accordance with section 6(d) and 8 of the Act. Under these sections all persons exercising functions, powers and duties under this Act shall take into account the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, valued flora and fauna and other taonga, and the Treaty of Waitangi.

11.2. The applicant invited feedback on this application from Māori via the EPA's national Te Herenga[1] network. No response was received via this route. Regional consultation was carried out by the applicant when the Tutsan Action Group was established. The EPA convened a Māori Reference Group (MRG) to discuss issues relating to biological control that may be of significance to Māori. The MRG's report is appended in Appendix 3.

Building on previous knowledge

11.3. This type of application, to introduce biological control agents for weeds, is not novel. The applicant has incorporated comments from Māori consultation on previous applications to inform the assessment of the current application to introduce *L. strigana* and *C. abchasica* as biological control agents for tutsan. The response to key issues are addressed in Table 8.

Table 8: Summary of actions and responses to key issues brought up in consultation with Māori in previous biocontrol applications as they apply to APP202663

Key Issue	Action or Response
Possible direct effects on native plant species	Host range testing includes native plant species
Possible indirect effects on native flora and fauna	Addressed in application (Section 5.1.2): discussion on potential adverse effects on existing trophic webs, invasion by worse weeds and fitness of native birds
The need to monitor future effects	The applicant is supported by the National Biocontrol Collective (NBC) and Horizons Regional Council. It is their practice to monitor release sites for establishment of biological control agents (BCAs). If BCAs become abundant then the NBC will measure their effects using the National Assessment Protocol (Landcare Research, 2015c)
Predictability of effects	The development of the combined risk score which is based on host range testing. This tool uses relative performance scores for no-choice starvation and oviposition tests to enhance the ability to predict non-target attack

[1] Te Herenga is made up of Māori resource and environmental managers, practitioners, or experts who represent their iwi, hapū, or Māori organisation on matters of relevance to the activities and decision making of the EPA.

Key Issue	Action or Response
Specific benefits to Māori	No specific benefits identified, however the Tutsan Action Group includes several Māori farmers and entities who would benefit from successful biological control
Effects on cultural and spiritual values	Incorporation of the principals identified by the Māori Reference Group in relation to Kaitiakitanga and Manaakitanga
Integration of control methods, and indigenous solutions	None of the invertebrate herbivores associated with tutsan were found to have the potential for biological control. The tutsan rust has failed to control all genotypes of tutsan causing problems in New Zealand
Herbicides and biological control	There are no tutsan specific herbicides and most herbicides for tutsan management are applied to high country pastures
Aversion to the introduction of new organisms	Exotic species make up half of all wild plant species in New Zealand (Howell, 2008), and MPI deal with 30 to 40 incursions at the border a year (Controller and Auditor-General, 2013). The deliberate and legal introduction of biological control agents that have been through rigorous host range testing is an effective and sustainable way to deal with weedy invasive species
Lack of capacity precludes comment	Regional consultation along with invitations to participate and comment on the use of biological control agents was carried out by the Tutsan Action Group for this particular application. The ongoing use of iwi liaison networks will help to circulate knowledge

Consultation with the Māori Reference Group

11.4. The MRG is made up of four members with expertise and experience relevant to biological control applications. The MRG was established to facilitate consultation with Māori interests that may be impacted by the release of new weed biocontrol agents. The MRG noted that they do not represent their individual iwi or hapū nor represent a unifying voice for Māori interests. The MRG also noted that they will not comment on every application for a new pest control agent but consider the principle level impacts of new biocontrols and provide guidance that should be covered in individual applications.

11.5. The MRG noted that the broad cultural principles that apply to considerations on the introduction of new biological control agents, pest management and environmental protection are Kaitiakitanga[2] and Manaakitanga[3]. The MRG considered that new biocontrol agents pose the potential to both have a positive impact by aiding in the restoration of balance and reduction in environmental degradation, and a negative impact by leading to further disturbance. This, the MRG considered, influence iwi or hapū's ability to 'manaaki' for their whanau and visitors.

11.6. The applicant noted that with reference to the cultural principles identified in the group's report (Appendix 3), the MRG recognised that the proposed introduction of biocontrol agents to control weeds may have significant direct beneficial effects on taonga, and indirectly on the wider native ecosystem. The MRG recommended that applicants should identify the beneficial role that particular biocontrol agents have for iwi and hāpu that may be most directly impacted by the weed and the proposed biocontrol programme. In addition, the MRG recommended applicants to consider how habitat restoration plans and monitoring will be undertaken to determine the long-term effects of new agents.

11.7. The reference group specifically commented that weeds like tutsan adversely affect the appreciation of the forest environment. In other instances at the bush margins, weed species were providing valuable nurseries for regenerating native species, though there is now evidence that the regenerating ecosystem will be different to the native predecessor.

11.8. Members were concerned that these indirect effects required closer scrutiny to identify whether pest weed species had replaced native habitats in supporting native species. However members also noted a clear preference for native habitats rather than relying on exotic replacements, particularly recognising that the exotics posed the risk of complete displacement over time.

11.9. The applicant did not identify economic and environmental benefits specific to Māori.

11.10. The applicant noted that there are no known indigenous solutions to combat tutsan. We note that there are a range of exotic and native invertebrates that attack tutsan in New Zealand, but none are specific to tutsan and overall damage is minimal (Rendell and Gourlay, 2012).

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[2] The responsibility of Māori to manage the natural resources within and beyond their hapū and iwi boundaries for the benefit of future generations.

[3] The ability of iwi, hapū or whanau to 'manaaki' (support and provide for) their people and visitors, which is central to the maintenance and enhancement of 'mana'. It is noted as a key cultural principle and practice, and extends to physical, spiritual and economic wellbeing.

Regional Consultation

11.11. The applicant invited those affected by tutsan in Taupo, Waikato, King Country, Whanganui, Waimarino and Rangitikei to participate and comment on the initiative to find an effective and safe control method for tutsan. The consultation process took many forms, involving public meetings, field days, discussions with farm consultants and educational presentations on biological control.

11.12. Māori have considerable investment in farming and forestry in New Zealand and we consider the applicant has taken positive steps to ensure Māori are informed and consulted during the application process.

Te Rūnanga o Ngāi Tahu Submission

11.13. Gerry Te Papa Coates of the Ngāi Tahu HSNO Komiti submitted on behalf of Te Rūnanga o Ngāi Tahu. They generally support the application and are pleased that the applicant has recommended using a monitoring programme to assess the effectiveness of the introduction of the biocontrol agents. Their biggest issue is the unquantified risk to native *Hypericum* species by the biological control agents. However they believe that the application has sought to remedy the perceived lacks in previous applications (mapping weeds, broader trophic impacts, monitoring programmes etc.) to a major extent. They acknowledge the expertise of Landcare Research in the biological control field and encourage the EPA Decision-making Committee to make a wise and sensible decision as the eradication of either biological control agent once established would not be possible if the effects of the organisms proved undesirable.

12. Minimum Standards

12.1. Prior to approving the release of new organisms, the EPA is required to determine whether the organisms meet the minimum standards set out in section 36 of the HSNO Act.

Can *L. strigana* and *C. abchasica* cause any significant displacement of any native species within its natural habitat?

12.2. The applicant provided evidence that *L. strigana* and *C. abchasica* will only attack plants in the *Hypericum* genus. There are four native *Hypericum* species in New Zealand. *Lathronympha strigana* strongly preferred *H. androsaemum* (tutsan) but did lay a few eggs on native *Hypericum* plants. Larvae hatching from eggs laid on native *Hypericum* could not survive on the foliage of native *Hypericum* species and did not complete development. We conclude that native species will not be at risk of attack by the moth *L. strigana*.

12.3. The applicant provided evidence that *H. involutum* does not support *C. abchasica.* The other three native *Hypericum* species can be considered fundamental hosts. *C. abchasica* was able to complete development on *H. pusillum* and *H. rubicundulum* (also used to represent *H. minutiflorum* as this species was unobtainable). However, significantly lower numbers of eggs were laid compared to the *H. androsaemum* control and overall larval survival was low. When taking into account the combined risk score for *H. pusillum* and *H. rubicundulum* we consider that *C. abchasica* is very unlikely to have adverse effects on native species and will not cause significant displacement of native species.

12.4. Therefore we consider that the reduction in vigour and abundance of tutsan populations in New Zealand will not displace native species since invertebrates will be able to use other plant species for food, shelter and reproduction. We conclude that *L. strigana* and *C. abchasica* will not cause any significant displacement of any native species within its natural habitat.

Can *L. strigana* and *C. abchasica* cause any significant deterioration of natural habitats?

12.5. We consider that the effects on tutsan will be gradual at first since it will take time for *L. strigana* and *C. abchasica* to build to large levels of infestation that will cause significant population level suppression of tutsan abundance. Therefore it is not likely to cause significant deterioration of natural habitats. Ecosystem changes will be adaptive and compensatory to reductions in tutsan abundance and vigour.

Can *L. strigana* and *C. abchasica* cause any significant adverse effects on human health and safety?

12.6. *Lathronympha strigana* and *C. abchasica* are not known to cause any adverse effects on human health and safety.

Can *L. strigana* and *C. abchasica* cause any significant adverse effect to New Zealand's inherent genetic diversity?

12.7. It is not expected that *L. strigana* and *C. abchasica* will cause any significant adverse effect on New Zealand's inherent genetic diversity. Inherent genetic diversity can be adversely affected if hybridisation events were to occur between native and non-native species. However, most insects use chemical signalling to attract mates and these systems often underlie sexual isolation between closely related insect species (Merrill *et al.* 2007).

12.8. In a survey of invertebrates associated with tutsan in New Zealand (Rendell and Gourlay, 2012) four endemic leaf rollers belonging to the Tortricidae family were identified. The overall abundance of these species were rare (between one and three individuals across 13 sites) and none of these moths share the same genus as *Lathronympha strigana.* Therefore we consider the likelihood of hybridisation to be very low.

12.9. The same survey found the native bronze beetle (*Eucolaspis brunnea*) common on tutsan plants in New Zealand (31 individuals across 13 sites). This beetle belongs to the same family as *Chrysolina abchasica* (Chrysomelidae) but as they relate to each other at a higher taxonomic level we consider the likelihood of hybridisation to be very low.

12.10. We therefore conclude that *L. strigana* and *C. abchasica* will not cause any significant adverse effect on New Zealand inherent genetic diversity.

Can *L. strigana* and *C. abchasica* cause disease, be parasitic, or become a vector for human, animal or plant disease?

12.11. *Lathronympha strigana* and *C. abchasica* are not known to cause disease or become a vector for animal, plant or human disease in their native ranges. We therefore conclude that *L. strigana* and *C. abchasica* are not known as a possible vectors of disease.

Conclusion on the minimum standards

12.12. We consider that *L. strigana* and *C. abchasica* meet the minimum standards as stated in the HSNO Act.

13. Can *L. strigana* and *C. abchasica* establish undesirable self-sustaining populations?

13.1. Section 37 of the Act requires EPA staff to have regard to the ability of the organism to establish an undesirable self-sustaining population and the ease with which the organism could be eradicated if it established such a population.

13.2. We note that the purpose of the application is to release *L. strigana* and *C. abchasica* and to allow for the organisms to establish, develop self-sustaining populations and disperse to attack their host, tutsan, in our environment. This is the foundation of a classical biological control strategy and therefore we consider that any population of *L. strigana* and *C. abchasica* will not be undesirable.

14. Recommendation

14.1. Our assessment has found that the benefits of releasing *L. strigana* and *C. abchasica* outweigh any identified risks or costs. We therefore recommend that the application be approved.

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Appendix 1: Summary of submissions

#	Submitter	Moth	Beetle	Summary of submission
111593	Walter Kingi The Proprietors of Hauhungaroa 1C Incorporation	Support	Support	To publically support the excellent work of the Tutsan Action Group. I wish for the EPA to introduce biological control agents outlined in the application ASAP.
111594	Davor Bejakovich Biosecurity Manager Greater Wellington Regional Council	Support	Support	The Greater Wellington Regional Council (GWRC) supports this application as an effective biocontrol agent for tutsan will help slow the spread and impact of this highly invasive species. GWRC supports the processes of EPA and MPI for the importation and release of new organisms, and trusts that due diligence will be followed in the assessment of risk by these agencies. GWRC is a contributor to and participant in the National Biological Control Collective, and supports the establishment of biocontrol species. A successful biocontrol agent for tutsan would ease the reliance on manual removal and herbicides. With finite resources to control the growing number of pest species, and growing expense and public resistance to chemical control, biocontrol is a cost effective and largely publically acceptable technique.
1111595	Grant and Sheryl Fraser	Support	Support	I have lived in the Ruapehu District for over 70 years and have seen tutsan become a very aggressive and fast spreading weed. It is now growing on much of the road and river reserves, ungrazed land, and establishing in farmland. I have found tutsan very difficult to kill with chemicals and can only hope to contain rather than eradicate it. My personal view is that it is now so well established within the district, it would be impossible to eradicate by chemical means and the only answer will be to use biological control.
111596	Chris Houston Technical Policy Manager Beef + Lamb New Zealand	Support	Support	Tutsan is a serious pasture pest and invasive environmental weed with significant and growing impacts on farm production and the environment. In recognition of this Beef + Lamb has supported the Tutsan Action Group in its endeavours to reduce or eliminate the damage tutsan causes on hill country farms. We believe the potential benefits of biocontrol of tutsan are considerable and that the risks are negligible. Beef + Lamb, on behalf of the sheep and beef farming sector, support APP202663.

#	Submitter	Moth	Beetle	Summary of submission
111597	Warren Furner Ruapehu District Council	Support	Support	The Ruapehu District Council supports the work of the Tutsan Action Group. Tutsan is considered a pest on rural road reserve land holding, however, sustained plant pest control programmes are beyond the means of our community to fund. I wish for the EPA to approve the application with appropriate conditions to ensure risk to the environment is minimised.
111598	Lyn Neeson Ruapehu Federated Farmers	Support	Support	As President of Ruapehu Federated Farmers and a local farmer, I have been involved in this application. Most of my members (169 farmers, 75% of farmers in Ruapehu) have contributed in kind and with financial support to this application. Tutsan is an invasive weed. If it gets established it is extremely hard to get rid of. I personally spent many hours and dollars spraying it trying to keep it off my hills. After consultation with my members, found that the average cost of tutsan control is $15,000 annually. It requires an expensive chemical to kill it, which can also damage native fauna. Tutsan establishes in very difficult to access areas which makes it difficult to eradicate or manage and it is well established on the banks of the Ohura and Whanganui rivers. A biological management tool would be much more efficient and with much less impact on surrounding plants. It is the only solution that will have any real impact.
111599	Cushla Chubb	Support	Support	We have seen an astounding increase and spread of tutsan in the Oparau district. Tutsan is having a huge impact on our business as we farm with a minimal use of chemicals policy. Our spraying costs are increasing annually and we have had to focus our efforts on tutsan, allowing gorse and blackberry to re-establish on our land. We have definitely seen a marked increase of tutsan throughout many parts of the North Island where previously there was no tutsan growing.
111600	Gerry Te Kapa Coates Ngāi Tahu HSNO Komiti	Support	Support	Tutsan is prevalent in some parts of Ngāi Tahu takiwā, although the North Island is the principal site of main concern. We believe that this application has sought to remedy the perceived lacks of past applications to a major extent, although there is still an area of risk that is unquantified. Ngāi Tahu supports the application since it appears that our major concerns of monitoring of the outcomes of the long term effects of the successful introduction of these two insects will be carried out.

#	Submitter	Moth	Beetle	Summary of submission
111601	JJ Dymock and DS McKenzie Northland Regional Council	Support	Oppose	Tutsan is widespread on roadsides in the higher rainfall areas of Northland but rarely invades pasture. Northland Regional Council supports the application to release the moth *L. strigana* but has reservations about the introduction of the beetle, *C. abchasica*. We are not comfortable with the level of risk to endemic and native *Hypericum* species indicated by the results of the host specificity tests undertaken for *C. abchasica*.
111602	Kataraina Belshaw Bay of Plenty Regional Council	Support	Support	Tutsan has been listed as an increasing biosecurity risk in the Bay of Plenty. Its distribution and density continues to increase to the point where it is fairly common around the region and in some sites it dominates the landscape. Landowners in the region are currently having to invest significant time and effort to control tutsan often with varied results. The Bay of Plenty Regional Council feel the benefits of approving both agents are potentially significant and the risks are near negligible. We feel the testing involved in ensuring the agents pose no risk to desirable species is rigorous and feel that these agents are very important to add to the potential management options for tutsan where few other effective methods exist.
111603	Philippa Rawlinson Federated Farmers of New Zealand	Support	Support	After consultation with its membership Federated Farmers supports the application to introduce the moth *L. strigana* and the beetle *C. abchasica* as biological control agents for tutsan. Estimates for controlling tutsan vary between $10,000 and $30,000 per annum, per farm in the central North Island depending on farm location and how close the farm is to a waterway or forest. Federated Farmers supports the application provided the biological control agents are managed in such a way that resistance and over population does not become a problem.
111604	David Havell Department of Conservation	Support	Oppose	In general DOC supports the introduction of biocontrol agents where robust research shows agents will not have an adverse impact on natural heritage. Tutsan is widely distributed on public conservation land and there are over 100 sites where tutsan is present. Tutsan does occur where native *Hypericum* species are present and is a significant threat to natural heritage and agricultural systems. DOC support the introduction and release of the moth, *L. strigana*, but do not support the release of the beetle, *C. abchasica*, until further research shows that it will have insignificant impact on native species and does not exacerbate the current threat status of native *Hypericum* species.

#	Submitter	Moth	Beetle	Summary of submission
111605	John Liddle Chief Executive Nursery and Garden Industry New Zealand	Support	Neither support nor oppose	Does not anticipate any significant impacts on nursery production in New Zealand as a result of releasing the two biocontrol agents. NGINZ does have concern regarding the potential localised spill-over effect on native *Hypericum* species under high population densities of *C. abchasica* on its preferred host, tutsan.

Appendix 2: Submission from Department of Conservation

Submission on Application APP202663 to approve Release of *Lathronympha strigana* and *Chrysolina abchasica* for the biocontrol of Tutsan (Hypericum androsaemum)

Statutory Role of the Department of Conservation

The Department of Conservation (DOC) has a statutory role under various acts to protect and advocate for natural heritage which includes native species and ecosystems. Under this role the department carries out control of pest species and supports the development of additional management tools to reduce the impact of pest species and improve management outcomes.

In addition where the introduction and release of new organisms may have an adverse impact on natural heritage, the Department will make submissions on proposed release of new organisms and their potential adverse impacts on natural heritage.

DOC and the National Biocontrol Collective

The Department of Conservation is a member of the National Biocontrol Collective and provides funding support to the collective. The Biocontrol Collective works with Landcare Research to develop biocontrol agents for pests, of which the application to introduce biocontrol agents for tutsan is one. DOC also provides information on the impacts of plant pests and departmental weed programmes which may be used in applications to the EPA for the release of biocontrol agents. In general DOC supports the introduction of biocontrol agents where robust research shows the agents will not have an adverse impact on natural heritage and there are benefits for natural heritage from the release of a particular biocontrol agent.

Tutsan

Tutsan is regarded as more invasive and damaging to natural heritage than either tradescantia or Chinese privet, and slightly less damaging than gorse or pampas in DOC weed prioritising systems. Tutsan can form dense patches in forest understorey and can also form patches on stream banks and along forest edges and roads.

Tutsan is widely distributed on public conservation land, there are over 100 sites where tutsan is present including at least 30 high priority biodiversity-ecological sites where threatened species and ecosystems at risk from tutsan are present. Tutsan occurs in areas where native hypericums species are present. Tutsan is widely adapted to the New Zealand environment, occurring from Northland to Stewart Island.

DOC manages tutsan in at least 20 sites for both regional pest management strategies and protection of biodiversity values. Management varies from ongoing surveillance in old control sites, manual control, and control with herbicides such as glyphosate, triclopyr, picloram, aminopyralid, and metsulfuron, applied as sprays, basal sprays, gels and granules.

Successful control of tutsan is limited by:

- ongoing persistence of tutsan patches for over 10 years despite intensive management,

- widespread distribution of tutsan patches and long distance dispersal of seed from those patches for over 700 metres,
- tutsan resistance to fungal biocontrol agents, and
- that herbicide control methods kill other plant species besides tutsan .

James and Rahman further discuss limitations of current tutsan management methods, (https://www.nzpps.org/journal/68/nzpp_681240.pdf)

Biocontrol agents

Tutsan biocontrol agents should improve tutsan management by extending control to more tutsan sites than currently managed, and should reduce the spread of tutsan by reducing seed production. Biocontrol agents should also reduce the competiveness of tutsan by reducing tutsan growth and opening up tutsan patches to invasion.

Lathronympha strigana

Lathronympha strigana is a common moth species in Europe. Larvae and adults have been recorded on St John's wort, tutsan and other hypericum species. Landcare testing indicates that *Lathronympha strigana* has low risk to native hypericum species as while eggs were laid on native hypericum species, larvae did not survive or develop on native species. In Landcare Research trials Tutsan was the preferred host for egg laying over St John's wort and more larvae developed to maturity. As St John's Wort is a common host for *Lathronympha strigana* in Europe, the strain of *Lathronympha* collected from tutsan in Georgia would appear to better adapted to tutsan than other hypericum species.

Chrysolina abchasica

Testing by Landcare Research indicates that female *Chrysolina abchasica* will lay eggs on native hypericums and that larvae will reach maturity but not survive to produce offspring. Given that some *Chrysolina abchasica* can survive to maturity on native hypericum by consuming hypericum plant material there is some risk to native hypericums. The risk is not that *Chrysolina abchasica* will form self-sustaining populations on native species but that Chrysolina will disperse from adjacent tutsan and St John's wort and damage native hypericum by reducing their competiveness and ability to produce seed. This is most likely to occur in areas where tutsan and native hypericums occur together such as in the central North Island and Rangitoto Island.

Most native hypericums are threatened in New Zealand; *Hypericum minutiflorum* is nationally critical, *Hypericum involutum* is declining, and *Hypericum rubicundulum* is nationally vulnerable. *Hypericum pusillum* which is not threatened, is not dominant in the plant communities in which it occurs. In comparison to tutsan, native hypericums are small herbs and may be susceptible to heavy grazing. Compared to the biocontrol agents introduced to control tradescantia and privet, the potential impact of *Chrysolina abchasica* on native flora is much higher. Threatened species are related to the target species, though in a different section and with different plant traits, and the control agents will target native species, though not in preference to the target species. Chrysolina species have been effective in reducing St John's wort in New Zealand so it is possible that a biocontrol agent could have a serious impact on a native hypericum if the biocontrol agent is as well adapted to native hypericums as *Chrysolina abchasica* is to tutsan. Landcare research has undertaken research to rank the threat of *Chrysolina* species to non-target hypericums. *Chrysolina abchasica* ranks below Chrysolina biocontrol agents already in New Zealand as a threat to native hypericums. In addition, the impact of current Chrysolina biocontrol agents on some native *Hypericum* species was also evaluated and determined as insignificant. Thus it is possible that *Chrysolina abchasica* will have low impact on native hypericums.

However, given that:

- not all native hypericums were used in feeding and other research, (*H. minutiflorum* and *H. involutum* were not included);
- most native hypericums are threatened species;
- in the second feeding trial over 20% of C*hrysolina* larvae reached maturity on *H. rubicundulum, and over 10% of larvae on H. pusillum;*
- there is no information on the effect of *Chrysolina abchasica* on the growth and seed production or health of native hypericums;

the Department does not support the release of *Chrysolina abchasica* until the impact of *Chrysolina abchasica* on the growth and seed production of native hypericums is confirmed as insignificant. We consider this approach is consistent with the precautionary section 7 of the HSNO Act 1996, which advocates caution in the face of scientific and technical uncertainty.

Native hypericums classified as nationally critical and nationally vulnerable are already at risk of extinction and we would not wish to increase the risk of extinction through addition pest burden from biocontrol agents such as *Chrysolina abchasica*.

Conclusion

Tutsan is a significant threat to New Zealand natural heritage as well as the agricultural systems. The introduction of biocontrol agents will have benefits in reducing the impact of tutsan, if the effect of biocontrol agents is similar to the impact of biocontrol agents on St John's wort. The Department supports the introduction and release of *Lathronympha strigana* given it is unlikely to have adverse impacts on native hypericum species and if successful will enhance current tutsan management. *Chrysolina abchasica* is also likely to be a successful biocontrol agent, however we do not support its release until further research shows the species has insignificant impact on native hypericums and does not exacerbate the current threat status of native hypericum species.

Appendix 3: Māori Reference Group Report

Introduction

This document summarises some key Māori cultural principles identified by a Māori reference group compiled to consider the suite of proposed biological control agent applications made on behalf of the National Biocontrol Collective by Manaaki Whenua Landcare Research Ltd (Manaaki Whenua). This is not an exhaustive set of principles, and may be developed further as a result of subsequent discussions or applications.

This document may therefore be a source of reference material for future biocontrol applications.

Background

The National Biocontrol Collective includes representatives from 12 regional councils and unitary authorities, and the Department of Conservation. Manaaki Whenua is the primary science provider to the Collective and coordinates many of its application proposals.

As the reference group is considering several potential applications, they will be providing principle level comment on the Māori interests potentially impacted by the release of the biological control agents. Therefore the reference group will not be providing substantive or detailed comment on the issues raised by each application, but rather identifies issues the applicants should aim to address in each application. In addition the reference group has provided some guidance or recommendations to the Collective on how to approach such applications in future in terms of their engagement with Māori and the way they address potential impacts on Māori interests.

Opening statements

The reference group notes that the overall aspiration of its members is to restore native ecosystems, and in the context of biocontrol proposals that aspiration relates to an active reduction in pest plant species. Its members also recognise that only iwi can define what a restored native ecosystem means within their respective rohe or takiwa (tribal area), noting that some exotic species now provide considerable value to different communities (including exotic commercial species).

Reference group members also note that exotic (including pest) species have and continue to arrive in New Zealand as a result of natural migration, accidental introduction and purposeful release. Some of the species that have become pests are the result of purposeful releases allowed either through the absence of regulation, or through inadequate regulation.

In addition, members acknowledge that historically Māori were alienated from significant tracts of land, which were subsequently cleared of native vegetation in favour of alternative land uses often involving exotic commercial and other species. A portion of those alienated lands has now been either returned to iwi or placed under joint management arrangements through Treaty of Waitangi Settlements. Reference group members noted from their own settlement experiences, that often lands are returned in a poor state placing significant burden (financial, cultural and spiritual) on Māori.

Members note that although as Treaty partners both the Crown and Māori have a responsbility to work together to address the impacts of pest species, it is the Crown as the partner responsible for setting regulatory policy, who is obliged to resource such measures.

Finally members acknowledge that established pests cause significant economic, environmental, cultural and social impacts to our unique environment and natural advantage. As one of the tools for pest management, biological control aims to reduce risk and reverse harm from damaging organisms. The reference group fully supports this aim and has provided its comments below in the hope of further advancing continuous improvement across the pest management regime.

Principles

Tiaki - Kaitiakitanga

The reference group acknowledged the well recognised kaitiakitanga responsibility of Māori to manage the natural resources within and beyond their hapū and iwi boundaries for the benefit of future generations.

Members also noted the reciprocal relationship of kaitiakitanlagarga, highlighting the primary principle of ‘tiaki’. This principle is expressed as the responsibility of the atua (spiritual guardians) for supporting their offspring or elements within the environment, including tangata whenua (literally meaning people of the land). Some noted the atua provide for their children (including people), rather than people taking from the atua. This reciprocal responsibility is an intergenerational one, that recognises the enduring and interdependant relationship between the environment and its component parts (including people). Unnatural changes (e.g. artificially dispersing species in new areas) disrupt this delicate relationship though if allowed the tiaki – kaitiaki relationship returns to balance where enabled. It could also be argued that the introduction of biocontrol species aims to support enabling the tiaki relationship by dampening down the negative impacts of pest or weed species on ecosystem health.

Recognising this relationship requires Māori to take an extraordinarily long term view, including of making changes to the environment that may have unanticipated implications well beyond our current and foreseable needs. This long term view is difficult to reconcile in terms of individual biocontrol applications. However members consider the work of Manaaki Whenua as primary science provider to many of the introductions, important in terms of maintaining a repository of information and monitoring data in a form accessible by kaitiaki Māori. Such information can inform future introductions, and enable Māori to better understand potentially uncertain disruptions to the tiaki – kaitiaki relationship.

Manaakitanga

Tangata whenua continue to observe their cultural rights and ownership over taonga within the boundaries of each iwi or hapū. One of the key outcomes of kaitiakitanga (explained above) is to ensure the maintenance of balance in the environment to provide for everyone within their region. The ability of iwi, hapū or whanau to ‘manaaki’ (support and provide for) their people and manuhiri (visitors), is central to the maintenance and enhancement of ‘mana’. Often noted as a key cultural principle and practice, manaakitanga extends to physical, spiritual and economic wellbeing.

Members noted that the actions of others (including Crown agencies – who are themselves considered manuhiri or visitors) impact on the ability of tangata whenua to manaaki by modifying and disturbing the balance within the environment. This includes impacting on the ability of Māori to continue to access taonga, or to manage their resources which in turn degrades their wellbeing and inhibits their physical ability to manaaki.

On considering the principle of manaakitanga, members agreed that biocontrol agents pose the potential to both positively impact by aiding in the restoration of balance, and negatively impact by disturbing it further. The recommendation noted above will aid in enabling tangata whenua to monitor this, but will have particular relevance at a regional level. The reference group agreed if appropriate for regional councils and the Department of Conservation to work with iwi and hapū in their areas on pest management strategies that include monitoring impacts in terms of manaakitanga.

Broad biophysical considerations

Kaitiakitanga exists within a mātauranga Māori framework, founded on whakapapa which is a system of ordering and outlining the relationships and interconnections between elements within the natural environment. In accordance with this framework Māori will be concerned to know the anticipated and unanticipated potential impact of the introduction of biocontrol agents across the breadth of trophic and ecosystem levels.

For example.....

The group will expect the applicants to consider these impacts at their broadest level, and to provide comment and/or data to inform that comment. In addition, members felt it important for the applicants to clearly outline the regional existence and extent of each pest weed species. This would more effectively enable hapū and iwi in those regions to consider the potential risks, costs and benefits of specific relevance to them. The absence of this information is likely to inhibit the ability of iwi to provide comment because of the local nature of their kaitiakitanga responsibilities.

Specific impacts to culturally valued species

The reference group recognises that standard host range testing and taxanomical analysis has been conducted, or is in progress, for each of the proposed agents. To date this data provides some assurance that any direct adverse effect from the non-target feeding and hybridisation of native species is likely to be minimal.

In addition, the results indicate there is likely to be significant direct beneficial effect to culturally valued species arising from the reduced health of the weed species. For example in some cases the feeding of biocontrol agents on canopy smothering weed species (e.g. Privet) will lead to significant damage and defoliation opening up the canopy for native regeration beneath. This also has indirect beneficial effects to the wider native ecosystem.

However the research methodology and results do little to address indirect impacts to culturally valued species. In particular the group noted examples of pest weed species now filling potentially beneficial niches for native species arising from the decline or absence of native habitats.

Relevant to the current proposals, reference group members noted that Tradescantia had in some regions replaced native habitats for inanga spawning. Members also noted that at a local level (e.g. Waikato region) that mullet were observed to have been feeding on *Lagarosiphon major.* Reference was also made to the biocontrol agent application previously lodged to manage broom where Te Rūnanga o Ngāi Tahu noted in their submission that broom had become a food source for Kereru. In other instances at the bush margins, weed species were providing valuable nurseries for regenerating native species, though there is now evidence that the regenerating ecosystem will be different to the native predecessor.

Members were concerned that these indirect effects required closer scrutiny to identify whether pest weed species had replaced native habitats in supporting native species. However members also noted a clear preference for native habitats rather than relying on exotic replacements, particularly recognising that the exotics posed the risk of complete displacement over time. With this in mind members noted that without committment to targetted native restoration plans, the viability of local populations of culturally valuable species such as inanga and mullet could be placed at risk.

Recommendations:

1. That Manaaki Whenua and/or other research providers, maintain information and monitoring data in an accessible form for kaitiaki Māori.
2. That regional councils and the Department of Conservation work with iwi and hapū in their areas in the development and implementation of pest management strategies that include the identification and monitoring of impacts to manaakitanga.
3. That the applicants map the existence and extent of each pest weed species in each of the applications so Māori are able to consider impacts at their specific rohe level.
4. Section 36 of the HSNO Act requires decision makers to consider a set of minimum standards which includes consideration of any displacement of native species from their natural habitat, or cause any significant deterioration of natural habitats. In accordance with this requirement, the reference group considered the need for applicants to provide comment on, or model the potential broader trophic impacts of introducing each biological control agent. This is consistent with a kaitiakitanga framework and would better enable Māori to provide comment from that perspective.
5. That applicants continue to provide information in each of the applications about the potential beneficial role each pest weed species may have for local populations of native species.
6. That applicants provide comment on any native habitat restoration plans of relevance that would manage the depletion or removal of weed species providing beneficial effects to native species.

Regional / rohe based priorities informing national decision making

Reference group members were clear from the outset of this process that they are not participating in the group as 'representatives' of their individual hapū or iwi. Instead they were appointed because of the skills and experience they bring to the discussion. However, as locally and regionally based kaitiaki it became apparent through the course of discussion that bringing local and regional issues and priorities to a national forum could be both beneficial and challenging.

Benefits arise from the provision of information based on the intergenerational observation of the natural environment at a local level. These observations are valuable to decision makers to ensure they have the best available information, and are fully informed of the potential impacts to Māori interests. Challenges arise when you bring that locally based information together and then assess and weigh it through a national lens.

This is problematic because iwi and hapū provide their experience and knowledge in good faith on the assumption that it will be assessed and weighed in a manner consistent with their tikanga and their locally based priorities. For example Waikato iwi may give greater weight to indirect adverse effects to Tradescantia which provide inanga spawning grounds than other iwi or Councils who give greater weight to the adverse effects posed by Tradescantia.

The reference group acknowledged that most of the Regional Councils would have specific relationships with hapū and iwi in their regions (some required by settlement statute). The Councils should also have some understanding of the interests and concerns of those iwi of relevance to the weed species and biocontrol agents subject to the proposed applications. Members requested that the applicants include available information of this nature in the applications, in order that at a local level hapū and iwi can more readily comment through submissions. The reference group also noted that the Council and Department members of the Biocontrol Collective recognise the value of their individual relationships with iwi and more proactively work with them to prioritise its work programme moving forward.

Recommendations

7. That the applicants consider including information about hapū and iwi interests and priorities relating to the proposals at a regional level to provide context for decision makers so appropriate weight can be attributed to risks, costs and benefits. The reference group is aware that some iwi have planning and pest management priority agreements or relationships with Councils that could provide a useful source of this information.
8. That the Biocontrol Collective, through their Regional Council members, work more proactively with hapū and iwi in their regions to better understand their interests and priorities so they can be effectively incorporated in future work programmes and applications.

Treaty Issues & Settlement Principles

Reference group members noted frustration at the use of Court defined Treaty principles in risk assessments, rather than mutually agreed principles between the Crown and iwi in Settlement negotiations. Given the increasing number of Treaty settlements it is difficult to assess each application at a national level against regionally defined and agreed Treaty principles so members accepted the need to use well defined and nationally referenced principles in national decision making. Applicants will need to consider collating those principles through their engagement with applicants.

However members also noted that many Treaty settlements include or result in agreements with local pest management agencies including councils and Department of Conservation. Members were keen that when engaging with Māori on future applications, the members of the biocontrol collective work with the iwi and hapū in their area to ensure recognition and assessment of impacts against appropriate Treaty principles and provisions.

Recommedation:

That biocontrol collective members work with the iwi and hapū in their respective areas on the development of future biocontrol applications to ensure recognition and assessment of impacts (both positive and negative) against appropriate Treaty principles and provisions.

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Environmental Protection Authority
Te Mana Rauhī Taiao

New Zealand Government