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Improving Management of Invasive Species

New Zealand's approach to pre- and post-border pests

Biological invasions are a ubiquitous global concern. Invasive species are non-native species that arrive in a new area, establish and increase in density and distribution to the detriment of the recipient environment. Such species that become invasive are a major threat to biodiversity (Vitousek and D'Antonio, 1997). Unlike inanimate risks, living things establish, reproduce and often spread, leading to enormous environmental and economic effects (Vilà et al., 2010).

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Invasive species have been implicated in large-scale changes in ecosystem composition and function (Vitousek et al., 1987), nutrient cycles (Ehrenfeld, 2003) and agricultural productivity (DiTomaso, 2000). Economic costs are significant. One early study estimated the broad cost of invasive species to the United States as US$120 billion annually (Pimentel, Zuniga and Morrison, 2005). New Zealand is particularly vulnerable because of its unique island ecosystem biota and strong primary sector. Early introductions of rats, mustelids and rabbits have driven extinctions of native species and damaged ecosystems historically (Druett, 1983) and continue to do so. More recently, the accidental introduction of the kiwifruit disease Psa has had large economic impacts and even prompted court action against the Crown.[1] In 2003 the Reserve Bank estimated that a foot-and-mouth outbreak could cost the economy $10 billion (Reserve Bank and Treasury, 2003).

During the last 50 years global trade has been the primary cause of the introduction of non-native species (Hulme, 2009). Introductions may be intentional or unintentional. Intentional introductions are when species are deliberately introduced, legally or illegally, to a new region. Unintentional introductions are of non-native species that are associated with commodities for import: for instance, insects associated with fresh fruit and vegetables. Other unintentional introductions include hitchhiker species, such as those attached to the hull of or in the ballast water of vessels.

The most effective and cheapest method of preventing trade-associated introductions is pre-border risk assessment and management (Springborn, Romagosa and Keller, 2011; Kumschick and Richardson, 2013). Management of pests post-border is a much more expensive and difficult process. Risk assessment characterises the likelihood and severity of potential adverse effects of biological invasion. Risk management is the process of evaluating, selecting and instituting actions designed to reduce that risk. The processes of assessing and managing invasion risk are related, but functionally separate risk analysis activities (Andersen et al., 2004).

Internationally, approaches and policies with regard to pre-border risk assessment and management of invasive species have been described as inconsistent and piecemeal (Secretariat of the Convention on Biological Diversity, 2001; Lodge et al., 2006; Ward et al., 2010). Global trade is largely governed by the rules of the World Trade Organization (WTO). Members of the WTO can impose restrictions on imports based on trade-linked risks associated with invasive species. Such restrictions are permitted provided they are consistent across similar risks and based on scientific risk assessment. Following arrival and establishment of non-native species, domestic agencies may or may not begin pest management. The type of pest management initiated depends on several factors, including the risk posed by the pest to the domestic environment and economy, as well as whether there is a realistic chance of control or eradication.

New Zealand's current regulatory and legislative approach towards pre-border invasive species risk associated with trade is precautionary compared with those of other developed jurisdictions. Leading invasion biologists have cited New Zealand's management and assessment of pre-border invasive species risk as the 'gold-standard' (Simberloff, 2013). Relative to the rest of the world this may be true. However, gaps exist in the current management regime that could be productively addressed to ameliorate the challenge of invasive species in New Zealand. The aim of this article is to highlight these potential gaps. We do this in two ways. First, we illustrate the benefits of New Zealand's risk assesment-based pre-border approach, but highlight its potential conservation failings. Second, we compare the inconsistent post-border approach to the management of invasive species between regions within New Zealand and suggest potential improvements.

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New Zealand's pre-border controls

New Zealand's pre-border framework: legal intentional species introductions

In 2007 the WTO governed 96.4% of global trade (WTO, 2007, ch.1). Under the WTO, invasive species risk associated with international trade is largely regulated by the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement). The SPS Agreement imposes requirements on import regulations implemented at a domestic level that are concerned with animal, plant and food safety and health. These requirements are in part aimed at preventing or limiting the establishment and spread of pests (Annex A definitions 1(d)). The SPS Agreement attempts to ensure that any protective regulations in trade are non-discriminatory, transparent and scientifically justified. WTO members are free to determine what the SPS Agreement labels an 'appropriate level of protection', which may be defined as: 'where the politically acceptable benefits produced by any increase in quarantine effort will be insufficient to offset the increased costs' (Cook et al., 2008). Domestic measures implementing a nation's appropriate level of protection, such as import restrictions based on the risk of non-native species, must be founded on risk assessment and scientific justification. An appropriate level of protection is permitted to provide a higher level of protection than relevant international standards, provided there is scientific justification and a risk assessment is undertaken (articles 3.3, 5.1; WTO, 1997, p.173).

A common international approach presupposes that only an organism or commodity that is a proven risk elsewhere poses risk to the country into which it is being imported. This approach has been criticised by invasion ecologists as being insufficiently stringent (Simberloff, 2005; Lodge et al., 2006; Brasier, 2008; Roy et al., 2014). New Zealand's pre-border, relatively risk-intolerant regime and management system attempts to take a 'guilty until proven innocent' approach and has been cited as particularly progressive (Simberloff, 2003, 2013). New Zealand's intended appropriate level of protection is strict compared to that of most other developed countries. New Zealand's Biosecurity Act 1993 was the first national law that took a 'risky until proven otherwise' approach towards regulating the risk of non-native species associated with imports (Simberloff, 2003).

Intentional introductions of new species into New Zealand are governed by the Biosecurity Act and the Hazardous Substances and New Organisms Act 1996. The purpose of the Biosecurity Act is to prevent unintentional introductions of invasive species and their spread within New Zealand (sections 16, 42, 54, 143). The purpose of the Hazardous Substances and New Organisms Act is to protect the environment, and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms. Any new organism proposed for import must be approved by both the Ministry for Primary Industries under the Biosecurity Act and the Environmental Protection Authority under the Hazardous Substances and New Organisms Act. The Hazardous Substances Act is governed by Ministry for the Environment, administered by the Environmental Protection Authority and policed by the Ministry for Primary Industries. Both the ministry and the authority undertake risk assessments. The authority considers the risks and benefits of an organism's introduction before granting approval, and must have 'particular regard' to the Department of Conservation (DOC)'s view (Hazardous Substances and New Organisms Act 1996, section 58(1)(c)). The ministry governs accidental organism imports. This involves assessing the potential biosecurity risks from pests and diseases that approved imported organisms may carry. For instance, the Environmental Protection Authority may approve a new plant introduction. The Ministry for Primary Industries would identify any pathogens associated with that introduction and apply appropriate sanitary measures. Proposed introductions may be rejected by the ministry or the authority based on risk posed to New Zealand. Costs of the risk assessments may be borne partly, or wholly, by the importer.

In terms of ability to manage non-native species introduction, nations have far more control over the intentional import of non-native species than over unintentional introductions associated with commodities or transport. It is here, therefore, that risk-intolerant policies are at their most efficacious in reducing non-native species risk and impacts (although risk assessment is applied effectively to unintentional introductions too). Species can be evaluated before introduction and, if found to be high-risk, denied import, thereby directly preventing any impact and costs associated with post-border control.

A risk assessment approach to intentional introductions

No biosecurity regime provides a fail-safe 'zero risk' system. Instead, non-native species risk management of intentional introductions exists on a continuum. At one end of the continuum, no species are accepted for import, although no nation employs this approach. Towards the other end of the continuum, most or all species are accepted for import. New Zealand sits towards the risk-aversion end of this continuum, as the Environmental Protection Authority and the Ministry for Primary Industries undertake risk assessments for all potential importations and only species assessed to be of low risk are accepted for import.

The benefits of risk assessment

Species-specific risk assessment tools and methodologies have been developed that allow for robust and transparent predictions of risk posed by new species (e.g. Pheloung, Williams and Halloy, 1999). Risk-screening systems have been demonstrated to be accurate across many parts of the world (Gordon et al., 2008). Risk assessment protocols have also been shown to produce an economic benefit, even accounting for losses through the incorrect rejection of species with net benefits (Keller, Lodge and Finnoff, 2007). These benefits are consistent across both the animal and plant trades (Springborn, Romagosa and Keller, 2011; Schmidt, Springborn and Drake, 2012).

As noted above, the SPS Agreement makes it clear that countries may choose their own appropriate level of protection, which may be highly precautionary. This holds true so long as there is scientific justification, risk assessment is undertaken and similar risks are treated in a non-discriminatory way so they are not a disguised restriction on trade (articles 2.3, 3.3; WTO, 1997, p.173). International disputes have arisen over inconsistent treatment of risk (WTO, 1998). Formal, transparent and consistent risk assessment policies therefore have the added benefit of reducing the risk of trade-related disputes regarding non-native species risk as well as reducing the economic, environmental and social impacts of invasive species.

From a New Zealand conservation perspective, risk assessment is beneficial, but not a panacea for the invasive species problem.

Potential conservation issues

From a New Zealand conservation perspective, risk assessment is beneficial, but not a panacea for the invasive species problem. Evidence suggests that islands are more easily invaded than mainland environments (Courchamp, Chapuis and Pascal, 2003), and New Zealand has a particularly unique natural history: for instance, the evolution of flora and fauna in the absence of mammals. The WTO's Appellate Body has made clear that risk assessments must explicitly consider the 'probability' as opposed to the 'possibility' of potential consequences of the importation of new species or commodities (WTO, 1998, pp.123-4). This is problematic in a country such as New Zealand with high levels of endemism, as it is difficult to probabilistically predict how endemic species will react to novel invaders. Species for which the Ministry for Primary Industries possesses little information often rate by default as 'low risk' during risk assessment and few if any protection measures are put in place.

This is understandable, as protective measures imposed without evidence could be seen as potential barriers to free trade. However, it means that new organisms entering New Zealand are often not picked up as environmental pests until their impacts are felt. This is most likely an intractable issue from a New Zealand conservation perspective. Risks of international trade disputes will not increase political appetite to reform the risk assessment process for species on which little information exists. It is, therefore, important that the post-border management regime is well-developed and effective at dealing with species that do pass pre-border controls.

Notwithstanding the conservation issues, prevention of unwanted non-native species arrivals is the most cost-effective method of managing risks of invasive species and does have conservation benefits (Keller, Lodge and Finnoff, 2007; Springborn, Romagosa and Keller, 2011; Schmidt, Springborn and Drake, 2012). Empirically validated risk assessment protocols are currently available and are steadily improving (Pheloung, Williams and Halloy, 1999; Lester, 2005; Gordon et al., 2008). New Zealand's pre-border approach to intentional new organism introductions provides a good blueprint for policies and legislation that effectively utilise these tools to prevent the introduction of potentially invasive non-native species. As we have observed, biological invasions are a major driver of extinction and biodiversity loss (Vitousek and D'Antonio, 1997), as well as has having major economic impacts (Pimentel, Zuniga and Morrison, 2005). A consistent, risk-based approach is critical to mitigating the effects of invasive species. Formal risk assessments represent a readily available tool that should form part of governments' policies for managing risks arising from this global challenge. However, if a species does elude pre-border management, or is allowed to be imported because of lack of evidence of harm, then it is crucial that the domestic regime can respond quickly and effectively.

Post-border pest management in New Zealand

New Zealand's post-border management framework

Management of pests at the border has two main goals, species exclusion or eradication. However, New Zealand has a large number of established and establishing pest species. Management of these pests is undertaken by a range of agencies, operating under different strategies, at different geographic levels and under a range of legislation.

> The Ministry [for Primary Industries] is the lead manager of pest management if … the pest is already in New Zealand and an objective has been set to eradicate it or contain it nationally.

Initiatives may be pest-led or site-led. Pest-led initiatives are intended to manage pests across large areas. Such programmes may be undertaken at national, regional or sub-regional scales, and are usually for pests with limited distributions. Site-led initiatives focus on spatially limited areas with high amenity values. Limited area size means pest control is feasible. These programmes usually address widespread animal pests and weeds for which broader-scale management is impractical. Site-led management includes most of DOC's management in reserves and national parks for biodiversity outcomes, community restoration projects and farmers' pest control activities. A wide range of legislation is involved, including the Wild Animal Control Act 1977, the Conservation Act 1987, the Resource Management Act 1991 and the Biosecurity Act. Many groups undertake work, including the Ministry for Primary Industries, DOC, regional councils, TBfree New Zealand, agricultural industry groups, public bodies and private landowners.

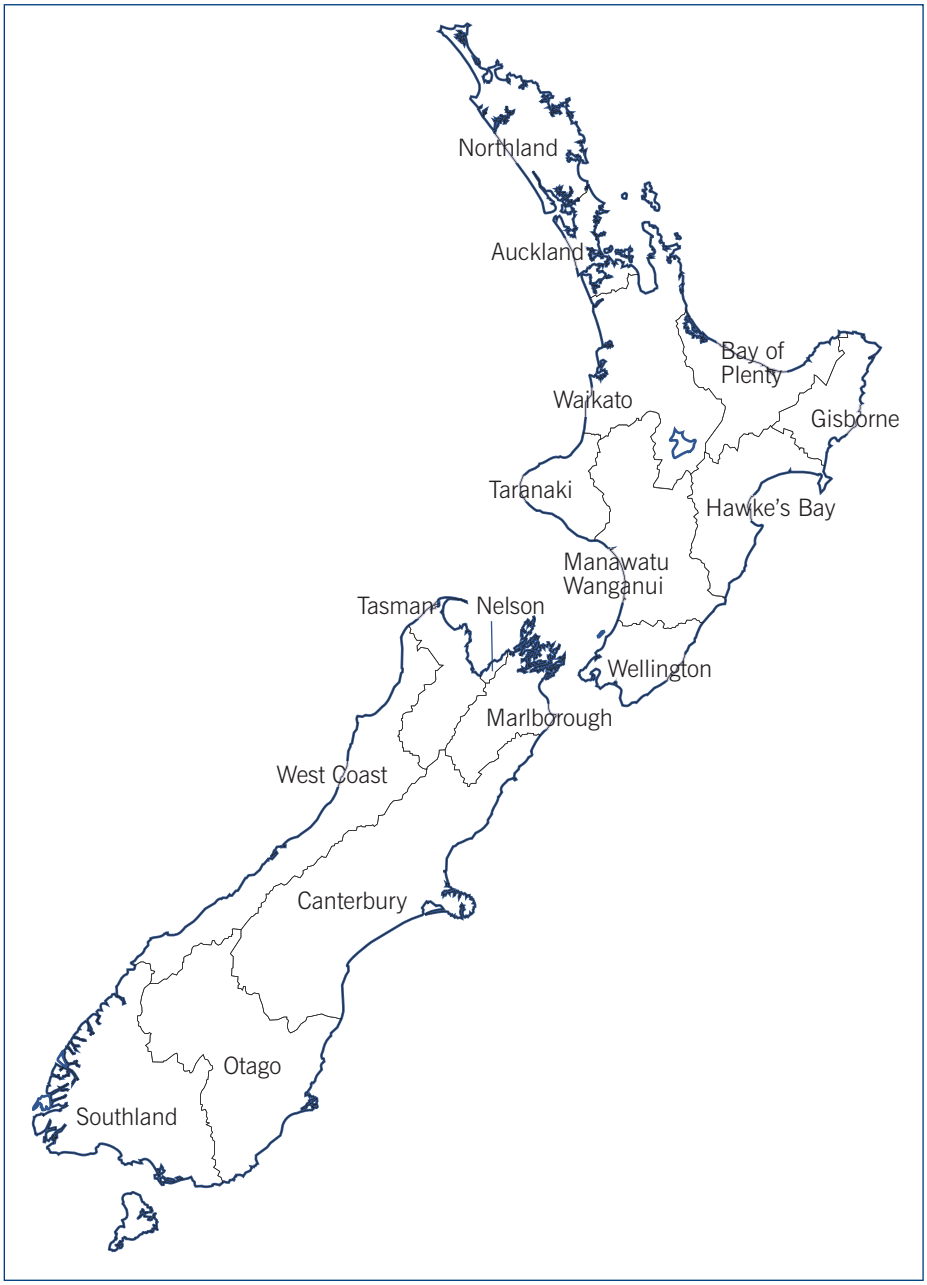
Besides regulation of pre-border risk, the Biosecurity Act also regulates management of invasive species incursions and establishment in New Zealand. Pest management activities take place under part 5 of the act, the purpose of which is to provide for the eradication or effective management of harmful organisms that are present in New Zealand (section 54). It does this by enabling the development of national or regional pest and pathway management plans and small-scale management programmes.

Under the Biosecurity Act, the Ministry for Primary Industries provides overall leadership for pest management in New Zealand (section 12A). Leadership includes overseeing and developing management systems, as well as measuring performance. It also includes promoting public support of an aligned, collaborative approach involving a range of stakeholders. The ministry has a memorandum of understanding on biosecurity with DOC, the Ministry of Fisheries and the Ministry of Health (Ministry of Agriculture and Forestry, 2006). This provides a framework for how these agencies work together on biosecurity matters. Responsibility for management of pests post-border is largely led by the Ministry for Primary Industries, DOC and regional government bodies. The ministry is the lead manager of pest management if (a) an organism has not been previously detected in New Zealand, or (b) the pest is already in New Zealand and an objective has been set to eradicate it or contain it nationally. A recent example is the Queensland fruit fly incursion in Northland. Some pest species that have established are managed by the ministry-led National Interest Pest Response. Species are included in this programme due to their potential to have a significant impact on economic, social and cultural values: examples are the water hyacinth and the rainbow lorikeet. DOC has an interest in any pests or diseases that are potentially harmful to native flora, fauna and natural ecosystems (Ministry of Agriculture

and Forestry, 2006) and will undertake eradication for conservation pests the ministry has decided not to respond to, such as the great white butterfly.

At the regional level, New Zealand is divided into 16 regions for devolved local government (see Figure 1). The regional councils or unitary authorities governing these regions have responsibility for pest management within their regions. Regional councils[2] lead control efforts for pests that are already in New Zealand where no decision has been made to eradicate or contain the pest nationally: i.e. most pest species. The Biosecurity Act (section 12) requires that regional councils provide leadership regionally, and prescribes a nuanced and collaborative approach to pest management, involving aligning interested groups, facilitating management activities and promoting public support (section 12B(2)). Regional council management is done through regional pest management plans, which are drafted under part 5 of the act for the purpose of the eradication or effective management of particular pests in a region (section 2).

Figure 1: Map of New Zealand showing regional councils and their boundaries



National policy direction

The Biosecurity Act requires that the responsible minister enact a national policy direction (section 56(1)). The purpose of a national policy direction is to ensure that activities under part 5 of the act provide the best use of available resources for New Zealand's interests and align with one another. In August 2015 the Ministry for Primary Industries released the 'National policy direction for pest management 2015' (Ministry for Primary Industries, 2015). This aims to achieve its purpose by:

a. clarifying requirements for Part 5 regulatory instruments; and
b. ensuring consistent application of these requirements nationally and between regions as appropriate (p.3).

It provides directions on:

- the setting of plan objectives: the adverse effects being addressed, planned outcomes and the geographic area to which the outcomes apply;
- programme descriptions: limiting programmes to one of five broad categories of pest management – exclusion, eradication, progressive containment, sustained control and site-led;
- analysing benefits and costs: providing criteria to be considered in a benefit-cost analysis;
- allocation of costs: directions on considerations when allocating costs of the plan. For instance, who benefits? Who exacerbates the problem?; and
- good neighbour rules: directions on criteria to be met when setting rules that impose requirements on landowners to manage spread of pests between properties so that the impacts on neighbours are not unreasonable.

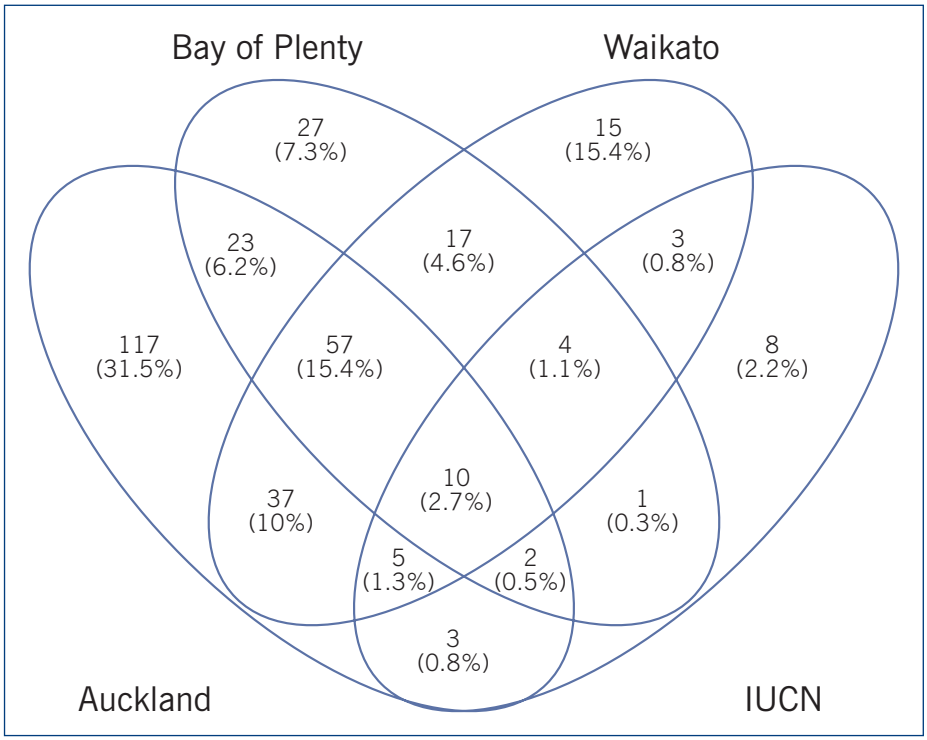
The changes required by the national policy direction to regional pest management plans will very likely improve New Zealand's domestic pest management system. It sensibly aims to provide more consistent management by providing guidance on: the language used to describe programmes; outcomes required of programmes; what is required for robust benefit-cost analyses; and what constitutes the new 'good neighbour' rules. While the national policy direction very usefully adds consistency to the pest management system, there are some notable regulatory inconsistencies and

Table 1: Regional pest management

Authority	Pest plants regulated	Pest animals regulated	Publicly available marine pest management strategy?	Annual regional council spend $/km2
Northland	118	63	Yes	$91*
Auckland	208	46	No	Incomplete data#
Waikato	146	44	Developing	$259*
Bay of Plenty	113	28	Yes	$210*
Gisborne	45	25	No	$131*
Hawke's Bay	24	14	No	$239*
Manawatu-Wanganui	62	35	No	$260*
Taranaki	28	23	No	$271*
Wellington	71	25	No	$658*
Marlborough	34	4	Top of the South Marine Biosecurity Partnership	$110*
Nelson/Tasman	45	17	Top of the South Marine Biosecurity Partnership	$51*
Tasman/Nelson	45	17	Top of the South Marine Biosecurity Partnership	$51*
Canterbury	84	19	No	$74*
West Coast	35	No publicly available animal pest management plan	No	No data#
Otago	20	4	No	$67*
Southland	63	42	Included in RPMP	$72*
				Average: $182

* These figures were sourced from RPMP reports. There may be extra pest management spending not included in report figures.
# Incomplete or no data available from RPMP.
Source: data obtained from regional pest management plans

Figure 2: Venn diagram showing inconsistency of management of pest species within regional pest management plans



The diagram includes pest species regulated by pest management plans of three regionally proximate, environmentally similar councils. Additionally, animal species from the IUCN list of 100 of the world's worst invasive species (Lowe et al., 2000) that are, or have been, present in New Zealand are included.

gaps that should be addressed. Below we provide evidence for this view.

Inconsistency in pest species regulated

The number of pest species directly regulated is inconsistent, ranging from 254 in Auckland to 24 in Otago (see Table 1). It might be argued that the lower South Island regions, such as Otago, are environmentally less hospitable to invasive species and therefore it is reasonable that fewer pest species are regulated. However, the inconsistency is a national phenomenon. For example, Auckland, Waikato and Bay of Plenty are similar climatically and share borders with one another, yet the number of pests species regulated varies significantly between these regional councils: Auckland, 254; Waikato, 190; and Bay of Plenty, 141. Further, the species regulated are different (Figure 2). Auckland has 117 unique species in its regional pest management plan not covered in the Bay of Plenty or Waikato plans. Of all species regulated, only 57 are regulated by all three councils. Moreover, some significant invasive species are being regulated inconsistently across these councils. The IUCN (International Union for Conservation of Nature) list of 100 of the world's worst invasive alien species (Lowe et al., 2000) includes 36 species that are, or have been, present in New Zealand. Eight of these species are unregulated by the three councils. Of the other 28, only ten are regulated by all three councils.

This inconsistency is potentially problematic. First, these regions are broadly geographically contiguous, with well-developed transport connections and frequent inter-region movement. There is a risk that species not regulated in one region could provide a source population to invade or reinvade a contiguous region, or attenuate efforts at population control or containment. Additionally, trade is a major driver of invasive species risk. The top three ports by dollar value for commodities imported to New Zealand are Auckland seaport, Auckland Airport and Tauranga seaport (Bay of Plenty). This year these three ports have imported, by dollar value, 43.7%, 19.9% and 10.6% of New Zealand's total commodity imports respectively.[3] Given the likely import-associated pest pressure, these regions should have consistent approaches to pest management, while consistency

would also help to ameliorate the potential issue of source populations.

We are not suggesting a standardised 'blacklist' approach for all regional pest management plans nationally. Such approaches assume that all potentially invasive species have similar impacts wherever they are found. In reality, invasive species' impacts can vary depending on species' distributions and densities and the climatic suitability of a particular region. Instead, we suggest that in areas where species may pose similar risks – such as Waikato, Auckland and Bay of Plenty – there should be significant coordination, and possible standardisation, of control programmes.

Inconsistency in funding

Domestic pest management spending involves financial contributions from a variety of stakeholders, including private landowners, Māori, regional councils, the Ministry for Primary Industries, DOC and other public bodies. Direct regional council spending is only a part of the total management spend. However, as the Biosecurity Act tasks regional councils with leadership in pest management at a regional level, it is interesting to assess their relative pest management effort.

Pest management under regional pest management plans is partially funded from rates (Biosecurity Act, section 100T). Rates levied on land occupiers can vary depending on the interests of the occupiers; that is, the extent to which they benefit from pest management and the extent to which they exacerbate the pest (Biosecurity Act, section 100T(2)(a)-(d)). However, this funding system is problematic as regions' populations differ substantially in terms of size, demographics and income; therefore, rate-dependent funding for pest management will also differ. These differences may be reflected in the 2013-14 pest management spend per square kilometre across regional councils (Table 1). By far the most spent by any one council was by Wellington Regional Council at $658 per km2, whereas Tasman/Nelson spent $51; the national average was $182 per km2. Per square kilometre spend on pest management may be reflective of variable council pest management effort across regions. This inconsistency may be counterproductive, in that while one region may be controlling pests effectively, neighbouring regions may expend less effort, undermining broader-scale management effectiveness. But it should be noted that other potential explanations exist for inconsistency in management spend. Population variation may lead to variable rate intake across regions. Alternatively, level of expenditure may be influenced by how many pests there are in a region and the vulnerability of habitat to invasion. For example, two councils with relatively low spends per square kilometre, Otago and Southland, are cold environments ill-suited to pest establishment. Finally, councils generally do not undertake management on protected Crown land, so regions with higher proportions of Crown land may have lower council activity.

Marine biosecurity

Maritime transport is a major source of non-native species introductions (Molnar et al., 2008). For example, ballast water harbours many non-native species (Roman and Darling, 2007), and although ballast water exchange protocols have been implemented, their efficacy has been questioned (Tsolaki and Diamadopoulos, 2010). Ships themselves also act as vectors. Hull fouling – the hitchhiking of non-native species on ship hulls – is a major issue (Molnar et al., 2008). Marine invasive species are an increasing threat to marine biodiversity worldwide (ibid.). In New Zealand recent invaders include the Mediterranean fanworm, which has been found in Northland and the Bay of Plenty, and the highly invasive seaweed *Undaria pinnatifida*, which is present in almost all of New Zealand's international ports.[4]

Despite the high risk posed by ballast and hull-fouling, only six of New Zealand's 16 regional councils have specific marine pest management plans in place. Auckland region, whose seaport handles over 40% of all of New Zealand's imported goods by dollar value, does not have a publicly available marine pest management plan. Councils recognise their lack of management plans to be an issue: the Waikato Regional Council has specifically requested direction on this issue in its pest management plan (Waikato Regional Council, 2014, p.254). Encouragingly, the country's second biggest port by dollar value, Port of Tauranga, does have a marine pest management plan. This management plan could be developed or enhanced for use by other ports.

Despite the high risk posed by ballast and hull-fouling, only six of New Zealand's 16 regional councils have specific marine pest management plans in place.

Another encouraging development is the Top of the South Marine Biosecurity Partnership. This regionally focused group was formed with the intention to improve marine biosecurity management in the top of the South Island. It involves representatives from Tasman, Nelson and Marlborough regional councils, the Ministry for Primary Industries, DOC, the aquaculture industry, Māori, port companies and other groups. It undertakes a range of roles, including project management, media and public awareness, development of manuals and plans, scientific support/technical solutions, and incident readiness and response. We suggest that such a regionally focused management approach should be applied to other marine areas with similar risk profiles around New Zealand.

Conclusion

New Zealand's pre-border approach to invasive species management has

been heralded as particularly effective (Simberloff, 2013). Risk assessment for new commodities and species proposed for import has allowed New Zealand to largely avoid many of the damaging species introductions that have occurred elsewhere. Evidence suggests that pre-border risk assessments can result in long-term economic net benefits (Keller, Lodge and Finnoff, 2007; Springborn, Romagosa and Keller, 2011; Schmidt, Springborn and Drake, 2012). However, from a conservation perspective the current paradigm of risk assessment in international trade is imperfect, given the need for probabilistic scientific evidence of harm. New organisms that are environmental pests are often not picked up until their impacts are felt. It seems unlikely that this problem will be addressed, given the differing political priorities attached to trade and conservation.

It is particulary important, therefore, that New Zealand's post-border management of invasive species is well-developed and effective. Funding and species regulated in regional pest management plans is inconsistent across regions, even in environmentally similar areas. Further, key regions lack marine pest management strategies. This is not to say that New Zealand's post-border approach is poor relative to the rest of the world; worse examples exist elsewhere (Quinn, Barney and Endres, 2013). However, New Zealand is world-leading in its pre-border pest risk management. So, too, in certain areas of domestic pest management, such as predator removal on offshore and mainland islands (Bellingham et al., 2010). Trade-related invasive species pressure is highly likely to increase. Therefore, regulatory change should come sooner rather than later. A truly integrated, consistent and effective pest management framework would go some way towards ameliorating the challenge of invasive species to New Zealand.

1 http://thekiwifruitclaim.org/; see also *Strathboss Kiwifruit Ltd v Attorney-General* [2015] NZHC 1596.
2 The distinction between regional councils and unitary authorities is not relevant to pest management, and the term 'regional council' is used in this article to refer to both.
3 http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7302, accessed 19 October 2015.
4 http://www.biosecurity.govt.nz/pests/undaria.

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