



A successful model from Hawaii for rapid response to invasive species

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SUMMARY

We outline a functional management model for the eradication of incipient populations of invasive species that avoids reliance on official governmental response. This model involves formation of informal multi-partner committees that utilise outside funding to achieve pest-management goals. We describe why such a system was needed in Hawaii, how it is structured, how it operates, its achievements, and its advantages and limitations. Fragmented and incomplete governmental authorities are currently the rule for invasive-species management in many parts of the world and typically lead to non-response or an ineffective response. The model we describe serves the useful function of allowing eradication of incipient pests to proceed while comprehensive biosecurity programs are devised through more traditional governmental channels.

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Introduction to general problem

Invasive species are major vehicles of ecological alteration, and in many parts of the world – in particular, on oceanic islands – they easily comprise the greatest current threat to native species persistence (Baret et al. 2006; Pimentel 2002; Ziegler 2002). Indeed, in some of these regions, the influx of invasive plants and their ungulate and avian enablers is so great as to blur the distinction between the disturbance categories of “habitat alteration” and “invasive species”.

In responding to this threat, it has long been recognised that management can best focus on different aspects of the sequential invasion process: preventing introductions from occurring; detecting incursions at an early stage; and rapidly eradicating them, and/or mitigating the worst effects of well-established invasives (Hobbs & Humphries 1995; Hulme 2006). The first of these can involve screening systems to exclude deliberate importation of species most likely to become invasive, pre-export screening for pests of products intended for import, and/or port-of-entry screening of products thought or known to be at high risk for harbouring pests (Andow 2003; Bomford & Hart 1998; Daehler et al. 2004; Gratz et al. 2000; Pheloung et al. 1999). Rapid-response programs should ideally involve systematic attempts to detect new pest incursions, followed by programs to eradicate (or at least contain) the worst pests so detected (Anderson 2005; Timmis & Braithwaite 2002; Westbrooks et al. 2000). Long-term mitigation is usually focused only on areas having especially high values needing protection

(e.g., national parks, wildlife sanctuaries, productive agricultural lands), but will sometimes involve attempts to control a species over much of its invaded range via use of biocontrol organisms (P.A. Rejmánek & Pitcairn 2002; Williams 1997).

A comprehensive program incorporating all of these management facets is often referred to as a “biosecurity” program, but, to date, such comprehensive response to invasive species has only been attempted in a few jurisdictions, such as Australia, New Zealand and Galapagos (Biosecurity New Zealand: <http://www.biosecurity.govt.nz/>; Australian Biosecurity System for Primary Production and the Environment: <http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/biosecurity/ausbiosec>; Galapagos Inspection and Quarantine System: <http://www.galapagos.org/2008/index.php?id=110>). In the few instances where such an approach has proven effective, two preconditions for success have been met. First, there was broad public and governmental support for such action, sufficient to countermand the desires of those industries and individuals seeking unregulated import; in New Zealand public support originated in the agricultural industry (Warren 2006). Second, governmental responsibility for biosecurity was sufficiently centralised that effective management response could be achieved.

In most jurisdictions (e.g., the United States, China), public and governmental support for responding to invasive species is divided, because strong economic forces and private desires, which are satisfied by a non-responsive status quo (e.g., Ding et al. 2008; Li et al. 2007; Margolis et al. 2005), work to limit governmental action. As well, for some of these jurisdictions, even if public and governmental support were to become more favourable toward stemming biotic invasions, governmental authorities are woefully diffuse. For example, in the United States

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federal government alone, approximately 35–40 agencies have some form of responsibility for invasives management (National Invasive Species Council 2005; C. Dionigi, National Invasive Species Council, pers. comm.). Individual states, counties, and municipalities may contribute additional layers of bureaucracy to this total. This bewilderment of authorities scattered among agencies makes it easy for modest public or governmental opposition to invasive-species control to succeed in maintaining the inertia of inaction. As a result, the United States (and, no doubt, many other jurisdictions) has had a difficult time making progress against the rising tide of invasive species threatening its economy and ecosystems.

In Hawaii, there has been considerable progress in circumventing some of the jurisdictional limitations endemic to the US governmental structure through the development of early detection/rapid-response programs in a series of “Invasive Species Committees” (ISCs). We discuss this ISC model here in the hopes that it may prove useful for other jurisdictions caught in labyrinths of divided authorities, similar to those that characterise American governmental structures.

Management limitations in Hawaii

Hawaii has the largest problem with invasive alien species of any state in the United States, with at least 5311 alien species already established (Eldredge 2006), of which approximately 300–500 are estimated to be invasive, that is, spreading widely and causing significant environmental or economic damage (Loope & Kraus in press). The current introduction rate is approximately 50,000 times the natural background rate, and an average 89 additional alien species were documented to be established in Hawaii each year from 1995–2003 (Loope & Kraus in press). As in many other jurisdictions, the available evidence suggests that the rate of introduction has been rising approximately exponentially over the past several decades (e.g., Kraus 2002 for reptiles and amphibians). These invasions have resulted in extinction of hundreds of native species, endangerment of hundreds more, and large-scale replacement of native vegetation with alien plant communities (cf. Cox 1999; Hobdy 1993; Loope 1998; Stone & Scott 1985; Stone et al. 1992). Economic impacts have also been large and varied (Burnett et al. 2007; CGAPS 1996; Kaiser & Burnett 2006), but rarely measured. Similar damages occur throughout the United States (e.g., Cox 1999; Pimentel 2002), although few areas of the mainland are so heavily impacted by invasives as is Hawaii.

Historically, eradication of new invasive-species incursions has rarely occurred in Hawaii. State responsibilities toward alien invasions have largely been divided between two agencies, although neither has been tasked with a clear mandate to effect eradications generally, and neither has received a sufficient budget to do so in most circumstances. The Hawaii Department of Agriculture (HDOA), which has authority to prevent pest introductions, has in the past not viewed environmental pests as falling under its purview, and it generally lacked authority to operate outside port areas except with the cooperation of a landowner. This effectively limited the department to taking action primarily against agricultural pests, at least two of which (turmeric scale, *Aspidiella hartii*, and an unidentified *Heliconia* wilt) were successfully eradicated (Heu 2004).

The Hawaii Department of Land and Natural Resources is responsible for managing native wildlife and many public, largely upland, forests. It is often pressured to control environmental pests on its lands but has historically not had authority to conduct operations outside those lands. By the time pests reach those areas from the initial loci of invasion, they are so widespread that

eradication is usually not an option. Thus, most environmental pests arriving in Hawaii have had an unchallenged opportunity for establishment in the wide jurisdictional gap existing between the ports of entry and the upland forests that serve as the respective foci of activity for these two agencies.

Particularly absent was any authority to compel invasive-species control on private lands, which comprise a majority of the state (Juvik et al. 1999) and the vast majority of new invasion sites. Absent a mandate, clear authorisation from the State Legislature, and adequate resources, agencies have been reluctant to undertake such efforts. Furthermore, as occurs over much of mainland United States (Goldstein 1992; Olson 1980), many landowners in Hawaii distrust government and are not inclined to invite agency staff onto their properties to engage in actions that they do not perceive to benefit them directly.

A further limitation is also common across the United States. As noted above, there are numerous governmental agencies with some involvement in alien-species management, but historically these have communicated and collaborated poorly. In Hawaii, relevant State agencies operated independently and were frequently distrustful of each other, and some relevant agencies denied any responsibility for or involvement with the invasive-species problem (Warren 2006). Federal agencies acted on their own lands but couldn't legally operate outside them. County governments were initially not engaged with the problem at all.

Because of difficulties in achieving agreement on goals and methods between agencies, lack of information sharing, and inefficiencies of scale, only the largest landowners could afford to tackle invasive-species problems by themselves. Effectively, this meant that the National Park Service and Hawaii's Department of Land and Natural Resources controlled some of the more obvious environmental pests on some of their lands, but these usually involved well-entrenched species of widespread distribution. Programs to detect and eradicate incipient populations of new alien species before they became irremediably established and widespread were lacking, even though such efforts were recognised in some circles (e.g., Hobbs & Humphries 1995) as being potentially very cost effective.

Invasive species committees (ISCs)

Structure

The model Hawaii developed to circumvent these assorted limitations involved forming informal, inter-agency partnerships to cooperate in identifying and eradicating several of the most-threatening incipient pests. The impetus for the formation of these partnerships was an initial joint effort begun on Maui in 1991 directed toward controlling *Miconia calvescens* DC, a highly invasive melastome tree from Central and South America that had devastated Tahiti's forests (Meyer 1996) and threatened to do the same if left unchallenged in Hawaii (Conant et al. 1997). This effort has helped contain that species ever since. The personnel involved on Maui were acutely aware that many other species required similar attention, so in December 1997 they expanded their efforts toward eradication of a wider diversity of pests thought to be incipient. Similar efforts were soon adopted on other islands. Each island-based partnership was referred to as an “invasive species committee”; hence, Maui Invasive Species Committee (or MISC), Oahu Invasive Species Committee (OISC), etc. Since 2001, ISCs have operated on all six of the main, non-privately held Hawaiian islands. MISC covers the sparsely populated island of Lanai as well as Maui and is the only ISC to cover more than one island.

The cooperative ISC model is based on the fundamental recognition that invasive species are a problem across landscapes

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