

A RESOURCE MANAGER'S PERSPECTIVE ON THE ROLE OF BIOCONTROL IN CONSERVATION AREAS IN HAWAII

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Abstract. Resource managers in Hawaiian conservation areas view biological control as an important component of forest weed management. Biological control is not regarded as a panacea for all widespread weeds. However, it is perceived as an additional tool for selected appropriate species for which conflicts with economic interests or non-target species are not present. Biological control is employed as a control method, along with exclusion, rapid response, control of disturbance sources, chemical and manual control, and cultural practices such as seeding or outplanting. The role of biological control in the management of forest weeds in conservation areas is described.

Key words: biological control, Hawaiian forest weeds, control strategies

INTRODUCTION

Many widespread alien plants have invaded protected natural areas in Hawaii. Nearly 100 species have been identified as threats to natural areas because of their ability to form monospecific stands or to markedly alter ecological processes (Smith 1985). Many of these disruptive weeds are already distributed widely in some natural areas, particularly in the lowlands. Others are incipient pests inside natural areas or nearby.

Resource managers with the National Park Service, US Fish and Wildlife Service, The Nature Conservancy of Hawaii, the Hawaii State Division of Forestry and Wildlife Natural Area Reserves, and private reserves have developed strategies to manage weeds in their natural areas. These approaches emphasize chemical, manual, or cultural control techniques. Manual and chemical techniques of weed control practiced in conservation areas are not applicable on a landscape level, at least at current and foreseeable funding levels. In addition, follow-up treatments are needed at regular intervals for the indefinite future for widespread weed species. Resource managers perceive biological control of widespread weeds as an attractive tool for long-term control of widespread weeds on a landscape level. Even though an interagency Memorandum of Agreement was developed in the early 1980s, to date, biological control has not contributed effectively to the control of weeds in natural areas of Hawaii.

WEED CONTROL STRATEGIES

Statewide and island wide strategies.

The potential importance of biological control in the management of Hawaii's forest weeds can be characterized by describing its role in the overall strategy for alien plant control in natural areas (Figure 1). Biological control may have a role in the control of a number of widespread weed species, but is not appropriate for certain species just becoming established in Hawaii.

Control strategies begin, ideally, with exclusion on national, statewide, or islandwide bases. Exclusion is the most cost-effective strategy in alien plant management, keeping potential weed species out of Hawaii or preventing their

movement among islands. However, the system of exclusion and quarantine practiced by federal and state agricultural agencies lacks the regulatory teeth or funding resources effectively to keep potentially invasive species out of Hawai'i. Current lists of prohibited species, screening, and quarantine are highly selective and exclude few species from entering Hawai'i. Effective exclusion would require major legislative and policy shifts at both the federal and state levels to modify methods by which proposed introductions are assessed for their potential risk and impacts. Natural areas managers and researchers with the US Geological Survey—Biological Resources Division (BRD) are preparing data bases on current or potentially invasive species to reduce potentially invasive species' introductions to the state.

A rapid response capability is needed to eradicate or contain incipient invasive species. A rapid response approach has begun on an island-wide basis. Haleakala National Park and BRD initiated an effort on Maui to contain or eradicate *Miconia calvescens* DC (Myrtales, Melastomataceae), a stand-forming tree from tropical America, to prevent its establishment in the park. The rapid response effort on *Miconia* control evolved into the Maui Invasive Species Committee (MISC), funded by local, state, and federal agencies and set up to contain or eradicate other incipient invasive plant species island-wide on Maui. Invasive species committees have developed more recently on Hawai'i Island and Kauai to address the rapid response needs on these islands. However, a committee approach is not viable in the long term. One state agency should be given the mandate for rapid response to incipient invaders and to which and interagency committee could contribute.

Biological control is probably not the appropriate tool for management of some newly established species, but is generally more appropriate for widespread species. However, biological control should be considered for serious weed pests that appear to be uncontrollable. The current response to *Miconia* provides an example. There is little doubt that *Miconia* is a serious threat to both managed and natural ecosystems in Hawai'i and that a situation similar to that in Tahiti should be avoided if at all possible. Considerable effort has been put into containing the infestation while biological control research was undertaken. One agent, a fungal pathogen (Killgore, this volume), has been released, but further funding for exploratory research has been limited. Now that it is generally accepted that eradication of *Miconia* is not feasible and containment efforts over broad areas will continue indefinitely (Duane Nelson and Lloyd Loope, personal communication), a renewed effort at developing effective biological control agents has begun. *Miconia* is a highly suitable target for biological control in that potential non-target hosts and conflicting economic interests are minimal. Closely related species in the family Melastomataceae are all introduced; it is a family that contains many undesirable invasive species.

Even if exclusion of new introductions is tightened and rapid response capabilities are strengthened, new invasive species will arrive in Hawai'i and become widespread and the populations of other species will expand and become invasive. Moreover, many ecologically disruptive species already have become widespread in Hawai'i (Smith 1985). Biological control is an appropriate strategy for only a subset of these species. The most suitable candidates for biocontrol are those for which minimal non-target impacts are expected and no conflict with economic interests exist (Davis and Gardner 1982). There are also greater chances of developing successful biological control agents if the native range, taxonomy and biology of the target species are well known. Most study of the biology, handling techniques and efficacy assessment ideally should be studied in the native range of the target host y wherever possible.

Conservation area strategies

Other alien plant control strategies are implemented in parks, refuges, preserves, reserves, and other conservation areas (Figure 1), once invasive weed species become established. A cultural technique of weed control practiced by all conservation agencies is to remove sources of disturbance; in Hawai'i this entails exclusion of alien ungulates such as feral goats and pigs, axis deer, or mouflon sheep. Hawai'i's flora evolved without selective pressure from large mammalian herbivores and lacks defenses against browsing. Hawai'i's introduced ungulates severely browse native species, disturb soil, and disperse weed seeds, thereby facilitating the spread of introduced plant species. The importance of alien ungulates in the spread of alien plant species is shown in natural ungulate exclosures on cliff faces, in pit craters, or on isolated mountain tops, all areas without a history of ungulate browsing where native vegetation flourishes. Such areas are largely free of weed species (Loope and Scowcroft 1985, Belfield 1998). In fenced exclosures from which alien ungulates have been removed, native vegetation often recovers and the spread of weeds is inhibited (Loope and Scowcroft 1985).

Most managers of conservation areas practice a form of rapid response for newly introduced species known to be invasive in other areas. Often they arrive in conservation areas in predictable corridors of invasion such as along roadsides, trails, or developed areas. Monitoring and attacking new populations while they are still localized is a highly cost-effective approach, because species are controlled while they still can be eradicated readily, rather than attempting control after they have become widespread.

Containment rather than eradication is implemented for some localized or even widespread species. The goal of containment is to prevent further spread and typically is executed by eradicating satellite populations first and then attacking the more typically dense core populations (Tunison *et al.* 1994).

Control of species widespread in conservation areas is often intractable because of limited financial resources. One approach pioneered by national parks in Hawai'i is to control widespread weeds in high priority sites within conservation areas even though these species are not controllable throughout the protected area. In national parks, the targeted areas are called Special Ecological Areas (SEA) (Tunison & Stone 1992). These areas typically are selected for their intact native plant communities, high degree of manageability, high biological diversity, concentrations of rare species, particularly representative or unique characteristics, potential for research and interpretation, and other criteria. All ecologically disruptive, widespread alien plants are controlled in SEAs by manual and chemical control methods.

The SEA approach has a number of shortcomings, indicating the need for a concurrent biological control strategy. An SEA approach cannot be applied on a landscape level; it is most effective where weed densities are low. Recurring control efforts are needed on an annual or multiyear basis, for the indefinite future. Unmanaged lands in which the target widespread weeds are present often surrounded SEA's. Even when the local seed bank in the SEA is exhausted, seed dispersal into the target area will continue.

Another alien plant cultural control technique being developed in some of Hawai'i's conservation area is restoration of native communities by outplanting and seeding native plant species. Manual and chemical control is effective in bringing about native plant recovery in conservation areas, when carried out in areas where alien plants occur at low densities in otherwise largely intact communities. In those cases, native plants colonize the small gaps created by removal of scattered alien plants. However, outplanting and seeding are now being used, along with alien plant control, in sites highly altered by alien species. The newly established native vegetation reintroduces seed sources and provides competition for alien species.

For conservation areas, biological control is an important tool to be implemented in conjunction with manual, herbicidal, and cultural control techniques, rather than instead of these techniques. Only a subset of the widespread weeds affecting natural areas are suitable candidates for biological control; most widespread weed species will need conventional approaches. For those species which are suitable candidates for biological control, finding, testing, and releasing effective biological control agents may take a number of years. More time may be required for populations of biocontrol agents to build up to have an impact on the target weed species. In the meantime, valuable biological resources in conservation areas need require protection from the impacts of ecologically disruptive alien plants. This requires chemical and manual control. Also, biological control may be only partially effective and vary in effectiveness by habitat. Chemical and manual control should be used to reduce densities of the target alien plant species to acceptable levels. Funding for the necessary research for development of biological control agents will be difficult to obtain until the efficacy of the approach can be clearly and concisely demonstrated.

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FIGURE 1. ALIEN PLANT CONTROL STRATEGIES FOR CONSERVATION AREAS

