

CONTROL OF ALIEN PLANTS ON NATURE CONSERVANCY PRESERVES

R. Alan Holt

ABSTRACT

The Nature Conservancy of Hawaii is currently (1989) engaged in active alien plant control on two large montane forest and shrubland preserves on the islands of Moloka'i and Maui. The national Conservancy organization is in the process of developing comprehensive guidelines for the use of pesticides in alien species control and is producing an Element Stewardship Abstract database to assemble pertinent information on management of key alien species. Strategy for alien plant control in Hawai'i follows that of Hawaii Volcanoes National Park in prioritizing control tasks but is highly reliant on volunteer labor and interagency collaborative research effort. Conservancy managers view effective ungulate control as a necessary prerequisite to long-term alien plant control. Current alien plant control priorities are localized infestations of highly invasive weeds (e.g., *Rubus argutus* and *Clidemia hirta* on Moloka'i) and development of control methods for more widespread invasive plants that threaten preserve integrity. Interagency cooperation to eliminate new alien plant populations before they spread to key natural areas and research on revegetation and weed control through use of native plants are recommended.

INTRODUCTION

The Nature Conservancy is a private, nonprofit conservation organization dedicated to establishing managed, protected habitat for the full array of the earth's remaining natural communities and species. To that end, the Conservancy has set aside more than 31 million acres (12 million ha) of land in the United States, Canada, Latin America, and the Caribbean since the early 1950s. Today The Conservancy manages more than 1.3 million acres (526,000 ha) itself in about 1,630 Conservancy nature preserves nationwide. Programs of the Conservancy for the control of alien plant species on nature preserves nationally and in Hawai'i are described in this paper.

ORGANIZATIONAL POLICIES AND PROGRAMS

The control of alien plants is a serious concern of land stewards on many Nature Conservancy preserves. The Conservancy has been active in management applications of alien plant control methods in native ecosystems, with the greatest attention to date given to the maintenance and restoration of native grasslands and savannah in the western, midwestern, and southeastern U.S., through mowing, grazing, and prescribed burning. Organizational policy states that the use of chemical herbicides for alien plant control is to be viewed as a "last resort" after manual and other methods have been exhausted, and that herbicides used must be the most biologically safe available (The Nature Conservancy 1984). Conservancy managers are currently developing a more detailed and comprehensive set of policies and guidelines for pesticide use and are considering those of the National Park Service as a model from which to start.

The Conservancy is also developing a nationwide database of biological and other management-related information on priority alien plant species. Information on each species is compiled in an "Element Stewardship Abstract," which can then be shared by the resource management community. Such abstracts have been completed for several dozen species, including a handful that are important to Hawai'i. Probably the greatest benefit of the Element Stewardship Abstract database to Hawai'i is the abstract format itself, which local managers may use to organize and share important information.

THE CONSERVANCY'S APPROACH TO ALIEN PLANT CONTROL IN HAWAI'I

The Nature Conservancy of Hawaii is currently engaged in active alien plant control work at the 2,744-a (1,110-ha) Kamakou Preserve on Moloka'i and the 5,230-a (2,117-ha) Waikamoi Preserve on Maui. With extremely limited staffing (one staff person per preserve between 1983 and 1986, three or four per preserve since 1987), limited funding, and other urgent resource management demands, alien plant control efforts to date have concentrated on 1) establishing an organizational framework for effective alien plant control, and 2) addressing the most pressing weed problems with the help of volunteers.

The Conservancy's strategy assumes that most alien plant species have difficulty becoming established or spreading rapidly in an intact native plant community (Juvik and Juvik, this volume; Stone *et al.*, this volume; Tunison, this volume). The majority of aliens appear to rely on disturbance of the native vegetation by feral ungulates or humans to create or maintain the opportunity for invasion. Exclosure studies have also demonstrated that in some cases, native vegetation can recover area lost to alien plant species once ungulate and direct human disturbance of the plant cover is halted (Loope and Scowcroft 1985).

For these reasons, the alien plant control program on Conservancy preserves in Hawai'i is closely linked with ungulate control efforts. Ungulate control is seen as a necessary prerequisite to effective alien plant control. Preserves must also be protected from trampling or other direct damage by humans.

These assumptions about the relationship between disturbance and alien plant problems have prompted us to organize alien plant control along three lines. First, like the National Park Service, we have prioritized the list of alien plant species occurring in our preserves according to their invasiveness. This divides alien plants into two broad categories: 1) those that appear to be dependent on some disturbance of the native cover to become established or to maintain a place in the plant community, and 2) those that exhibit an ability to invade native vegetation even in the absence of such disturbance. Our top priority must be to control or eradicate the latter, more disruptive, species in preserve areas. A list of these and other target weeds being worked on at Waikamoi and Kamakou Preserves is given in Table 1.

Second, we have divided the alien plant control program on each preserve according to feasibility, or the chance to make real progress in control. We elect not to work on species that are very widespread. Likewise, we will seize any opportunity to eradicate the only population of a moderately invasive weed before it can become a problem. For disruptive species for which no adequate control method exists, we seek outside help to develop appropriate methods.

Third, we divide the alien plant control problem geographically. As in the National Park Service (Tunison and Stone, this volume), we give priority to controlling weeds in pristine areas and areas especially rich in rare species, although portions of a preserve already dominated by alien plants and containing no rare native species may eventually be marked for restoration.

Using the guidelines of species invasiveness, feasibility of control, and location of weed populations within the preserve, Conservancy preserve managers have developed an Alien Plant Control Job List, which sets the direction for volunteer and staff work schedules and for collaborative research. Volunteers have accounted for the majority of manpower devoted to alien plant control at the Kamakou Preserve in the past, and after six years they can be credited with effective control of several populations of serious invasive species (Tunison and Misaki, this volume). Where access to problem weed populations is difficult or when control methods that are potentially hazardous to the environment or workers are used (e.g., application of restricted chemicals), reliance on volunteers may not be feasible. This has been the case at Waikamoi Preserve in most aspects of gorse (*Ulex europaeus*) and blackberry (*Rubus argutus*) control.

The current staff and volunteer work activity of Conservancy preserves is not adequate to meet the full challenges of alien plant control. Present programs are especially inadequate in dealing with widespread or high-biomass weed problems (e.g., alien tree plantations or widespread

Table 1. Current target alien plants at Kamakou and Waikamoi Preserves.

Species	Common name	Kamakou	Waikamoi	Management Status	Prevalence
<i>Acacia mearnsii</i>	Black wattle	X		Controlled with some resprout	Localized
<i>Acacia melanoxylon</i>	Australian blackwood		X	Not managed	Localized
<i>Casuarina equisetifolia</i>	Ironwood	X		Not managed	Localized
<i>Cirsium vulgare</i>	Bull thistle	X	X	Not managed/ not managed	Localized/ localized
<i>Clidemia hirta</i>	Clidemia	X		Mostly controlled	Localized
<i>Corynocarpus laevigatus</i>	Karakanut	X		Controlled; reduced to seedling stage	Localized
<i>Ehrharta stipoides</i>	Meadow ricegrass		X	Not managed	Localized
<i>Eucalyptus robusta</i>	Swamp mahogany	X		Not managed	Localized
<i>Eucalyptus saligna</i>	Sydney blue gum		X	Not managed	Localized
<i>Fraxinus uhdei</i>	Mexican ash	X	X	Not managed/ controlled w/ some resprout	Localized/ localized
<i>Grevillea banksii</i>	Kāhili flower	X		Not managed	Localized
<i>Grevillea robusta</i>	Silk oak	X		Not managed	Localized

Species	Common name	Kamakou	Waikamoi	Management Status	Prevalence
<i>Hedychium coronarium</i>	White ginger	X		Ongoing control	Widespread
<i>Hedychium flavescens</i>	Yellow ginger	X		Ongoing control	Widespread
<i>Hedychium gardnerianum</i>	Kāhili ginger		X	Ongoing control	Localized
<i>Lophostemon confertus</i>	Vinegar tree	X		Ongoing control	Localized
<i>Melaleuca quinquenervia</i>	Paperbark	X		Controlled in one population	Localized
<i>Opuntia ficus-indica</i>	Prickly pear	X		Not managed	Localized
<i>Passiflora edulis</i>	Liliko'i	X		Mostly controlled	Localized
<i>Pennisetum clandestinum</i>	Kikuyu grass		X	Mostly controlled	Localized
<i>Phormium tenax</i>	New Zealand flax	X		Not managed	Localized
<i>Pinus</i> spp.	Pines	X	X	Not managed/ mostly controlled	Localized/ localized
<i>Psidium cattleianum</i>	Strawberry guava	X		Not managed	Localized
<i>Psidium guajava</i>	Common guava	X		Not managed	Widespread
<i>Rubus argutus</i>	Blackberry	X	X	Controlled/ not managed	Localized/ widespread

Table 1, continued.

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Species	Common name	Kamakou	Waikamoi	Management Status	Prevalence
<i>Schinus terebinthifolius</i>	Christmas berry	X		Not managed	Localized
<i>Syncarpia glomulifera</i>		X		Not managed	Localized
<i>Syzygium jambos</i>	Rose apple	X		Controlled	Localized
<i>Ulex europaeus</i>	Gorse		X	Ongoing control	Localized

grasses). The Conservancy has not yet undertaken major alien plant removal from sizable areas of rich native habitat, focusing limited resources instead on localized populations of the most worrisome alien plant species.

The Nature Conservancy of Hawaii has enjoyed the cooperation of State and Federal research agencies in field programs to develop or refine treatment methods for weeds in native plant communities. The Conservancy does not have the capability to conduct these and other research activities on its own and will continue to rely on this sort of interagency support. Field trials have been conducted or are under way for treatment of blackberry, gorse, strawberry guava (*Psidium cattleianum*), tropical ash (*Fraxinus uhdei*), and several other species under the auspices of the University of Hawaii Cooperative Extension Service. The U.S. Soil Conservation Service has provided valuable input on gradual removal of alien tree plantations, and the Hawaii Volcanoes National Park Division of Resources Management has shared information on control methods and organization of workloads (Taylor, this volume; Tunison and Zimmer, this volume). Volunteers from Colorado College and from Chicago's McHenry County Conservation District have conducted extensive field surveys of priority weeds and have studied the population biology of tropical ash. The Conservancy hopes to establish long-term collaborative relationships with these and other institutions to bring funds and research personnel to bear on critical alien plant management problems in Hawai'i by offering appropriate Conservancy preserves as field research stations for interested workers.

CURRENT PRIORITIES FOR ALIEN PLANT CONTROL ON TWO PRESERVES IN HAWAI'I

The Kamakou and Waikamoi preserves differ in the character and extent of their alien plant control problems. At Kamakou, 169 of the 442 known vascular plant species (38%) are aliens. Of these, 16 are regarded as dangerously invasive and requiring eradication or intensive control, while several others (mostly plantation trees) require some control but do not immediately threaten the integrity of the preserve. Most of these 16 weeds are accessible to volunteer or staff crews, and many are still localized enough that complete eradication is a feasible goal.

At Waikamoi Preserve on Maui, 71 (21%) of the 343 known vascular plant taxa are aliens. Eight of these are considered to be habitat-modifying weed species that should be controlled and monitored to prevent their further spread. Unlike Kamakou, much of Waikamoi is too rugged or inaccessible for volunteer work parties, although volunteers do provide the majority of labor for control projects in the accessible management units.

Alien plants on Conservancy preserves that are of special interest are documented below. The listing is not comprehensive, but it is intended to familiarize other workers in alien plant control with the range of preserve control programs. A complete list of priority weeds on these two preserves is given in Table 1.

Blackberry (*Rubus argutus*)

Blackberry is the alien plant of greatest concern at Waikamoi Preserve on Maui, where the species is found scattered throughout subalpine shrublands and portions of koa (*Acacia koa*) and 'ohi'a (*Metrosideros polymorpha*) forests. Managers are uncertain of the effects that goat (*Capra hircus*) and pig (*Sus scrofa*) removal will have on this pest. Manual control followed by treatment of new growth with glyphosate (ROUNDUP) is used to keep trails clear and to control small populations in otherwise native vegetation. On Moloka'i, this weed is abundant in a fairly restricted area (about 500 a or 200 ha) of forest reserve near the Kamakou Preserve. Small, localized patches have been found and destroyed in the Preserve, indicating that blackberry is being disseminated into the island's native forests.

Tropical Ash (*Fraxinus uhdei*)

Occurring on both Preserves, tropical ash is a serious threat to mesic koa-'ohi'a forests at Waikamoi and especially the diverse mesic forest remnants in the gulches of Kamakou Preserve. Ash escaped from tree plantations in Kamakou Preserve, is spreading rapidly along water courses, and is forming dense, nearly monotypic stands. Control efforts will be focused on preventing ash establishment in new drainages and on development of herbicide injection treatments for mature trees. A serious concern is disposal of the large numbers of dead trees. Logging followed by revegetation with natives and treatment of ash seedlings may be the only feasible approach to large-scale ash control in established stands.

Koster's Curse or Clidemia (*Clidemia hirta*)

A few individuals of this species have been found on Kamakou Preserve since 1979. All were located in a heavily-used public area of the Preserve, indicating that the original introduction may have been by humans. Otherwise, clidemia is presently widespread in Wailau and Pelekunu valleys on Moloka'i. Without development of an effective control method for large, established populations and a coordinated, island-wide control strategy, this species will probably overrun the understory in much of Moloka'i's native upland forest.

Karakanut (*Corynocarpus laevigatus*)

Kamakou Preserve contains what is believed to be the only population of karakanut on Moloka'i. This invasive, alien, subcanopy tree has become a serious localized weed on Kaua'i. At Kamakou, chemical control (with ROUNDUP applied on cut stumps or frilled trunks) of mature trees and pulling of seedlings and saplings by volunteers over the past three years have nearly eliminated this species.

New Zealand Flax (*Phormium tenax*)

This native of New Zealand has spread over about 10 a (4 ha) of very wet forest terrain at Kamakou. Volunteer crews have cut back and injected with ROUNDUP at least 60% of the original infestation and have eliminated several outlying smaller populations.

Molasses Grass (*Melinis minutiflora*)

While no control efforts are currently under way, this alien grass is perhaps the principal concern in preservation and restoration of dry and mesic shrublands and forests in Kamakou Preserve below about 3,700 ft (1,125 m) elevation. As the Conservancy and other managers of natural areas look toward protection of remaining dry lowland areas, control of molasses grass and the wildfire that is part of its ecology will be a critical stewardship issue.

***Pinus* spp.**

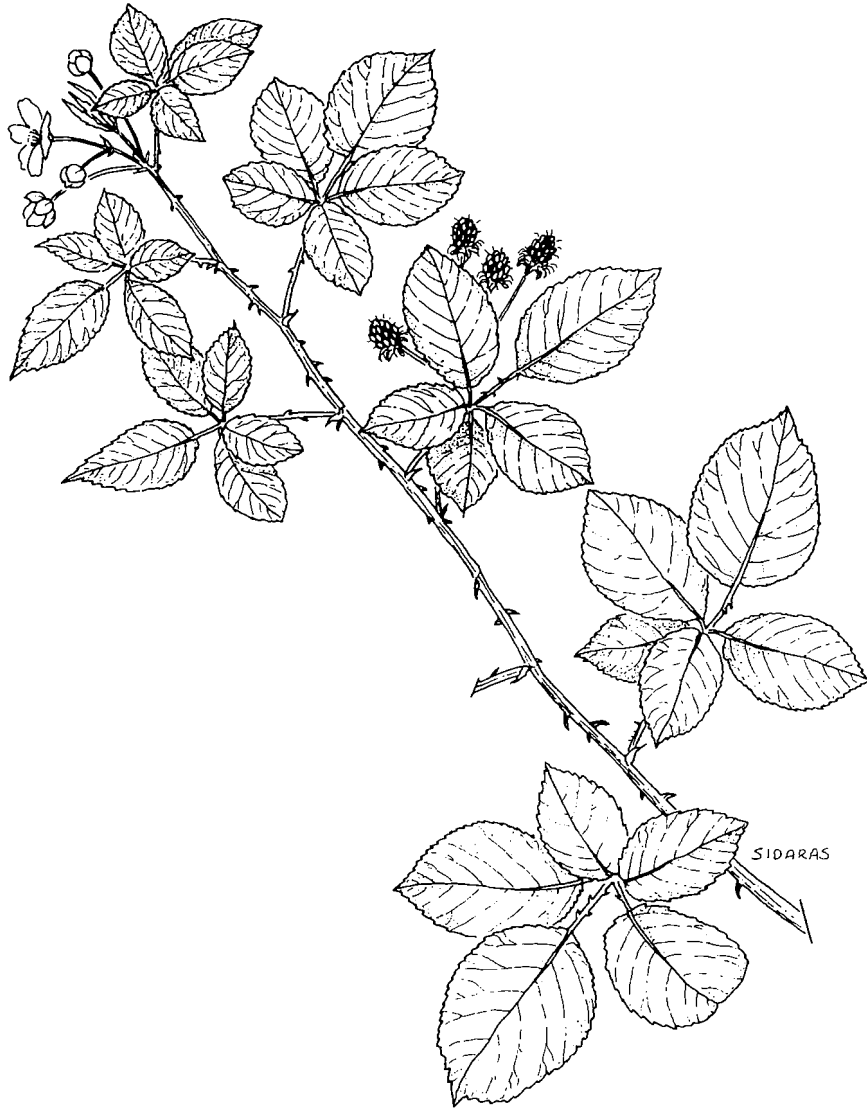
Control of pines and other conifers escaping from established stands in both Kamakou and Waikamoi Preserves is important to maintenance of both low-elevation and subalpine shrublands. While removal of individual trees is technically quite simple, the control effort is made difficult by the steep terrain the trees are invading. In the long run, complete removal of source tree stands from preserves may be the only effective solution. The Conservancy's concern is that these stands be removed in a way that allows native vegetation to become reestablished and avoids accumulation of large pine slash and detritus fuel loads. At Kamakou, The Conservancy is contemplating gradual thinning of stands, with thinned trees sold or donated for biomass energy products or rough lumber. Most trees in these stands are not of millable size.

RECOMMENDATIONS

Clearly, the chief concern of Conservancy managers, like managers of any natural area, is to prevent the introduction of any new, uncontrollable weeds. Unfortunately, the control of species not yet established in preserves is something natural resource managers have very little ability to effect. Managers are generally limited in their jurisdiction by the legal boundaries of the property they manage, while weeds are not held to the same limits. For this reason, it is recommended that resource managers from private and government entities cooperatively control priority alien plant species or populations. These include weeds that threaten forests and other native ecosystems and that are not currently the focus of agricultural weed control efforts. Such an interagency task force would cooperate to eliminate localized infestations before they become well established on an island or in a nature preserve, natural area reserve, or park. The task force, to be effective, must be allowed to address serious weed problems wherever they occur. The idea is to not restrict alien plant control along political boundaries that the target species does not observe. Such an approach could result in a more effective statewide control effort and allow for efficient pooling of limited management resources and knowledge. Such an interagency group is the Interagency Commission on Biocontrol of Forest Pests, now developing strategy and funding for biological control of a few weeds.

As managers face the many years of alien plant control ahead in Hawai'i, it is important that control methods be developed that minimize nontarget negative impacts on the native biota and the overall ecological health of the Islands. Research is needed to develop methods of revegetation with

native species in formerly weed-dominated areas, and it should consider the use of invasive native species to outcompete alien populations. The latter idea requires further understanding of the roles of native species in plant succession.



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