THE U.S. DEPARTMENT OF AGRICULTURE'S RURAL DEVELOPMENT APPROACH TO ALIEN PLANT CONTROL IN HAWAI'I: A CASE STUDY

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Alien plant control programs provide no guarantees of success. In Hawai'i today we are faced with many plants that are extremely threatening to our native ecosystems, and gorse (*Ulex europaeus*) is one of them. Gorse also presents a fire hazard to private property (primarily on Maui now); it invades critical watersheds (*e.g.*, 20% of the water we drink in Hilo comes from the Hilo watershed, where gorse grows as low as 1,500 ft (460 m) elevation); and it threatens agricultural and grazing lands.

In this paper, the gorse problem on the island of Hawai'i is described and an approach to its solution detailed. The strategy involves interagency cooperation and a task force and management team. A similar approach is currently being used in dealing with the problem of firetree (*Myrica faya*) invasions on several islands.

THE PROBLEM

Gorse was inadvertently introduced sometime before 1910 with the establishment of the wool industry in Hawai'i. By 1966, upcountry Maui above Makawao was infested; a few thousand acres of gorse were present by 1986. Gorse now threatens to expand into suburban areas in upper Kula on Maui. On Hawai'i Island, the sheep industry produced mutton and wool for U.S. West Coast markets by the early 1900s. The major sheep (*Ovis aries*) raising area was at Humu'ula. With the fall of wool prices during the Depression and competition from foreign markets, ranchers converted the Humu'ula land division to cattle (*Bos taurus*) ranching. Gorse, until that time effectively controlled by sheep grazing, began to increase, and each succeeding drought seemed to contribute to the infestation as foraging animals were temporarily removed. Gorse now is found on some 20,415 a (8,262 ha) at Humu'ula. The infestation on Maui has followed a similar course, with total infested area estimated at 14,800 a (5,985 ha).

The current gorse infestation at Humu'ula (Fig. 1) affects three major ranch operations: Parker Ranch, Pu'u 'Ō'ō Ranch, and Pua 'Ākala Ranch. It also impacts the Wailuku watershed area. Gorse has effectively removed

7,500 a (3,035 ha) of land from forage production in the area. The bulk of the land infested is leased from the Hawaii Department of Hawaiian Home Lands. As of spring 1987, the total known area of distribution, excluding isolated plants located in the Mauna Kea and Hilo forest reserves, was estimated at 20,415 a (8,262 ha), with a heavy concentration of plants on 6,200 a (2,509 ha) located along Keanakolu Road at Humu'ula. The lower boundary of gorse infestation was generally the upper edge of the Hilo and Mauna Kea forest reserves at 2,400 m (7,870 ft) elevation.

On Maui, the northernmost part of the 14,800-a (5,985-ha) infestation was at an elevation of 2,070 ft (630 m) near Pu'u Pi'iholo, southeast of the community of Makawao. The northernmost and highest point of the infestation at 7,280 ft (2,220 m) is located at the boundary of Haleakala National Park (Fig. 2). The heaviest concentration of plants is located within a half-mile radius of the Olinda Endangered Species Captive Propagation Facility at 3,530 ft (1,025 m). An isolated patch of plants was located at 2,070 ft (630 m) elevation along Māliko Gulch.

Temporary control of gorse was accomplished in the 1970s, with manpower provided through the funding of the Comprehensive Employment Training Act and the use of 2,4-5 T, or Agent Orange. Termination of the Training program and a subsequent ban of 2,4-5 T by the U.S. Environmental Protection Agency allowed a major increase.

THE GORSE TASK FORCE

Program and Objectives

The gorse control program in Hawai'i now consists of a coordinated management approach featuring a containment program, a long-term biological control program, and implementation of an integrated native species reforestation and grazing management program. In order to manage and coordinate the program, a management team and a Gorse Task Force, consisting of affected land owners, ranchers, and government agency representatives, were established. The Task Force is sponsored and supported by the Mauna Kea Soil and Water Conservation District. This District draws its legal authority from Chapter 180, Hawaii Revised Statutes, and all land owners in the District are represented on the Task Force. At the onset, landowners and operators realized that they could not control gorse without the assistance of the Hawaii Department of Agriculture and the U.S. Department of Agriculture.

The Task Force was developed to plan a strategy for an immediate containment program and also to combat gorse over the long term. There were four program considerations: 1) A strategy for securing adequate funding had to be developed. (Markin *et al.*, this volume, alluded to the need for at least a million dollars for insect biological control agents alone.) 2) Research and development had to be conducted throughout the project term. (The Gorse Task Force decided on a seven-year project.) 3) Approaches to resolving the gorse problem had to be integrated with long-term land use objectives of the land owners. 4) Cooperation among

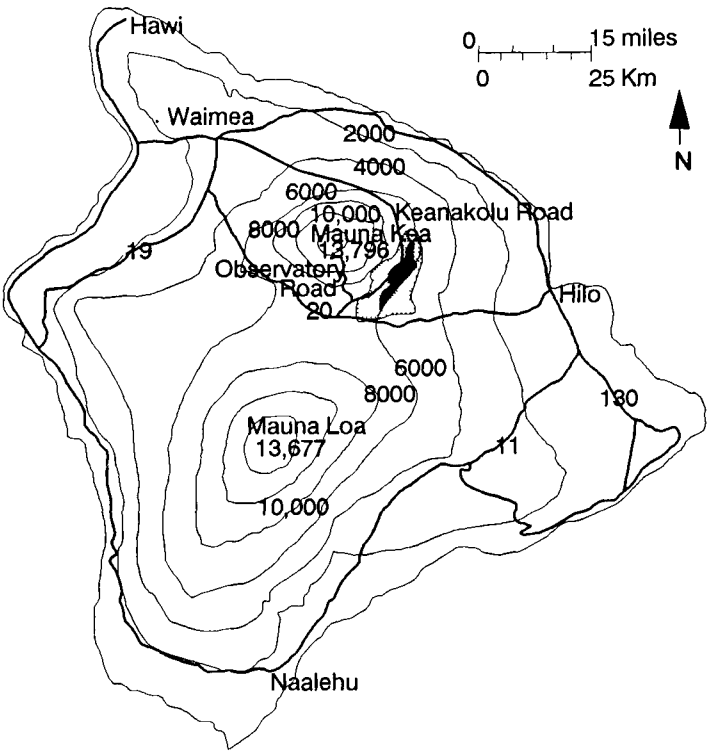

Figure 1. Gorse infestation areas on the island of Hawai'i are indicated by shading (sparse) and solid-fill (abundant). Contour lines are at 2,000 ft (610 m) intervals.

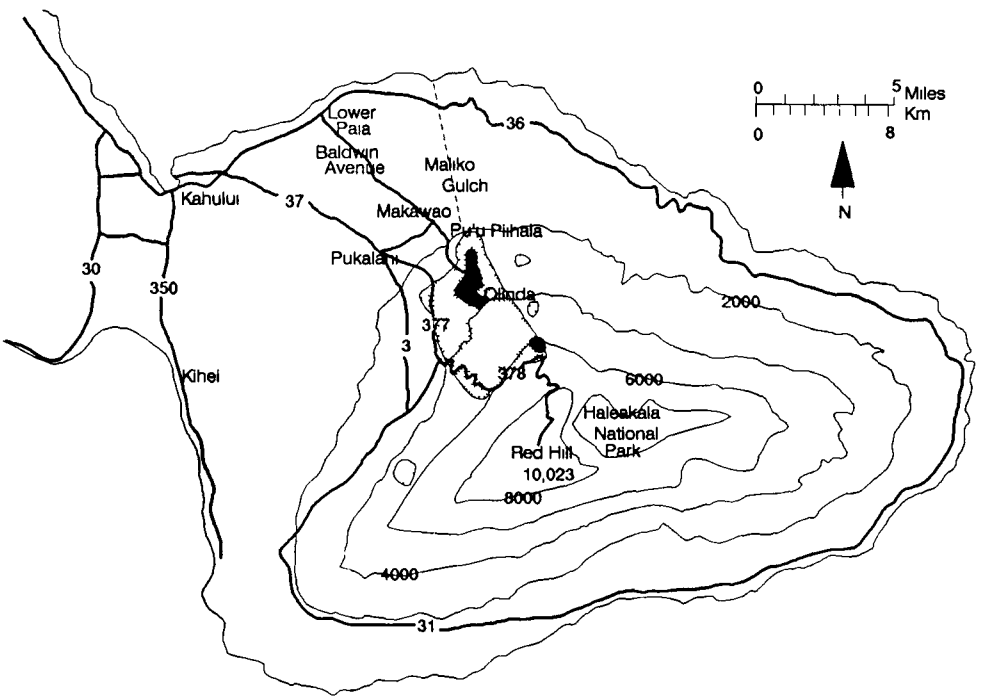

Figure 2. Gorse infestation areas in East Maui are indicated by shading (sparse) and solid-fill (abundant). Contour lines are at 2,000 ft (610 m) intervals.

governmental agencies, special interest groups, and private industry had to be initiated and maintained during program operation.

Present planning objectives of the Task Force are to: 1) contain the gorse infestation on Hawai'i Island to its present extent at Humu'ula and prevent its spread to other areas; 2) reduce gorse within the project area to a level that ranchers can economically justify controlling; 3) restore the productive capacity of affected rangelands; 4) protect the Hilo watershed and the surrounding forest areas by introducing native trees such as koa (*Acacia koa*) and māmane (*Sophora chrysophylla*) in suitable sites within the project areas.

Planning for the first five years of the program is completed, and all phases of the program (below) were implemented in the field by October 1986. The search for and testing of potential biological control insects began simultaneously with the herbicide spraying of gorse patches located along the borders of the project area and 100 ft (33 m) on each side of Keanakolu Road. The Tordon 22K spraying plan was designed to eliminate any possibility of seed transport to other areas of Hawai'i.

Task Force Plan Components

The biological control component of the plan features research on pathogens in the first year. Late in 1986, a researcher sponsored by private industry was sent to Western Europe (England, Spain, France, and Portugal), the native habitat of gorse, to develop a list of gorse pathogens. A list of 20 pathogens was reviewed, and at least one should be released within the next several years. Pathogens must be carefully screened to assure that they will not attack nontarget plants. A $1.5 million pathogen lab has been constructed in Honolulu, and a research pathologist has been hired.

Under a cooperatively funded contract managed by the Hawaii Department of Agriculture and the Ministry of Agriculture and Forestry, Government of New Zealand, host testing of biological control insects of gorse were undertaken in England. Candidates considered were the gorse mite (*Teranycus lintearious*), the gorse thrips (*Sericothrips staphylinum*), and the spine-feeding moth (*Scythris grandipennis*). In addition, a new colony of moths (*Agonopterix ulicitella*) was secured as new genetic material for mass rearing. During 1984, the gorse seed weevil *Apienulicis* was released and continued to expand its range and increase its population through the gorse population on Mauna Kea. To date, the weevil is well established and spreading rapidly to all parts of the gorse infestation in the Humu'ula area on the island of Hawai'i.

The reforestation component of the program is jointly pursued by the Hawaii Division of Forestry and Wildlife and the U.S. Forest Service. Experiments using various alien and native forest tree species to suppress gorse growth by shading and the release of plant toxins are in progress on the islands of Maui and Hawai'i. Seven experiments are ongoing: one at Olinda, Maui, and six in the Humu'ula area of Hawai'i Island. Interim reports indicate that slash pine (*Pinus elliottii*) and koa may be the most promising candidates. The slash pine, after 10 years' growth, has

completely eliminated any gorse growth within the reforested ara. The koa, after five years, appears to be outgrowing and suppressing gorse by "shading out" the gorse plants in the experimental plots.

The chemical component of the program is really a containment operation that is designed to keep the gorse infestation in check and reduce populations until gorse can be controlled by a biological control program. Herbicides, which are expensive management tools, provide quick suppression but not permanent control. The Hawaii Department of Agriculture has undertaken an aggressive program to control gorse growth in a corridor along the Keanakolu road on the island of Hawai'i. The Department has also executed cooperative herbicide spraying agreements with all the ranches in the gorse-affected areas in Hawai'i.

The animal impact component of the gorse control program is managed by the University of Hawaii Cooperative Extension Service through a grant received from the county of Maui. The grant of $10,000 has established an ongoing experiment on Maui using goats (*Capra hircus*) as a potential grazing management for gorse control without the use of herbicides. A grazing management trial was also undertaken by the Agricultural Research Division, Ministry of Agriculture and Fisheries, of New Zealand in January 1981. This trial compared the effects of goats or sheep grazed alone, or in mixtures with two goats equivalent to one sheep (all dry stock), with either rotational grazing or set stocking (Rolston *et al.* 1981; Radcliffe 1985). An extra-fast rotation with sheep was included. Three years of grazing after a gorse burn and oversowing resulted in both goat-only management treatments and the sheep and goat mixtures rotationally grazed reducing gorse to negligible levels. If the experiment on Maui proves to be equally successful, the Gorse Interagency Task Force plans to expand the goat trials to 600 a (240 ha) in the Laumai'a area located within the gorse infestation at Humu'ula, Hawai'i.

Why don't we control gorse by burning it? Gorse, believe it or not, is a very combustible plant. In Europe, it has been burned for hundreds of years to control it and encourage reproduction, but seed banks are, unfortunately, encouraged by fire. One gorse fire that we deliberately set in June 1985 was visible 25 mi (35 km) away in Hilo and burned very rapidly. The response of gorse to this fire is being monitored.

DISCUSSION AND CONCLUSIONS

The alien plant problem is largely one of rural communities and natural areas. To be successful, programs dealing with such problems must have adequate financing. Researchers, administrators, and resource managers concerned with alien plants must develop sound strategies and collective approaches. Equally important, rural areas must do a good job of program management in order to compete with urban programs for much-needed funding.

Resource managers, researchers, and administrators have to recognize the realities of gorse control. Alien plant problems are long term and require

long-term and expensive solutions. They require considerable research, commitment of personnel, and real continuity of support. Control is very expensive, especially when requirements of international travel, communication, and coordination of a biological control program are considered. Alien plant control is highly political, and coordination, planning, and an organized approach to obtain support are necessary. Political actions must be well timed, and friendships and knowledge must be cultivated before a well-documented plan goes into effect.

A cooperative approach using a variety of control methods is the most feasible way to address problems of such complexity and expense. A well-designed program demands the cooperation and support of all participants. A program to control aggressive and oppressive plants like gorse is best coordinated by a task force, which can identify and marshall all the resources that relate to the alien plant. Politicians must be lobbied to obtain legislative action. We must enjoin the support of government at all levels -- county, State, and Federal -- and establish positive working relationships. We must develop a well conceived strategy that is supported by effective public information programs. And lastly, we must not forget that we are part of a large community and must try to work within that framework. Our task is too important to accommodate adversary relationships.

ACKNOWLEDGMENTS

Sincere appreciation is expressed to members of the Hawaii Interagency Committee on Gorse Control for their technical assistance and valued cooperation: G.P. Markin, U.S. Forest Service; H. Ooka, M. Isherwood, and E. Yoshioka, Hawaii Department of Agriculture.

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