PROPOSED MANAGEMENT STRATEGY FOR COQUI FROGS
MĀLIKO GULCH, MAUI

Maui Invasive Species Committee

Pacific Cooperative Studies Unit, University of Hawaii

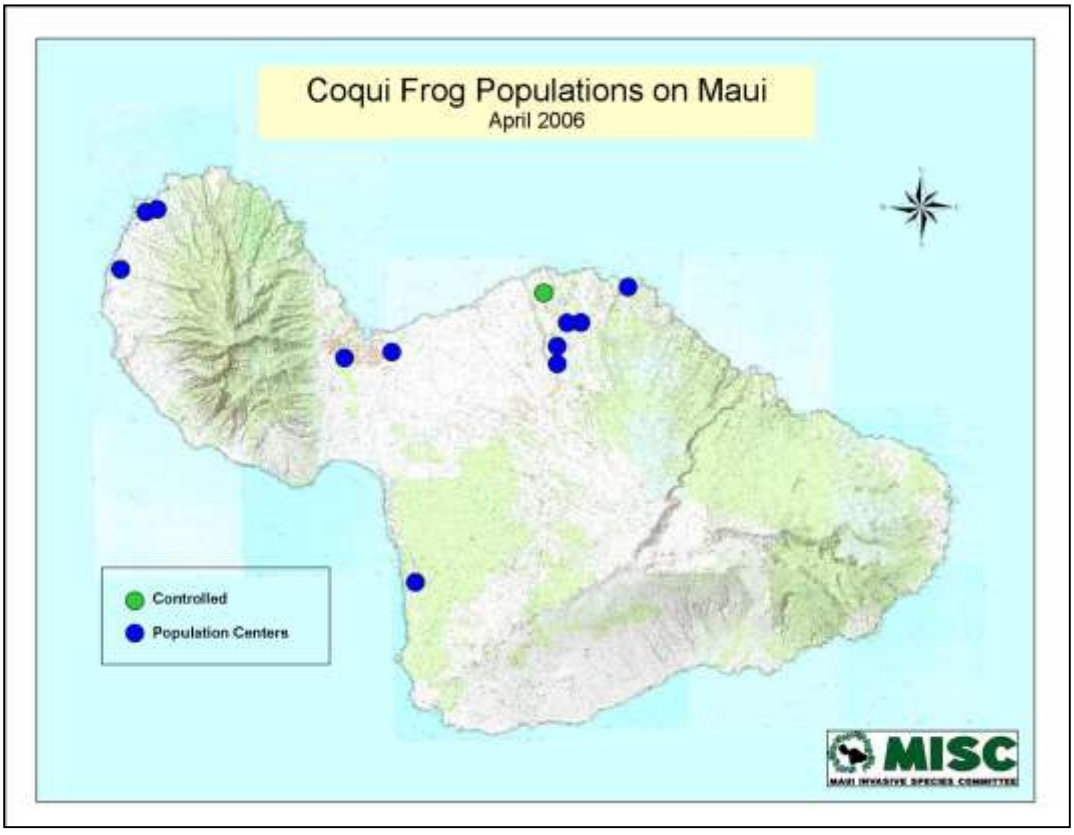
I. BACKGROUND

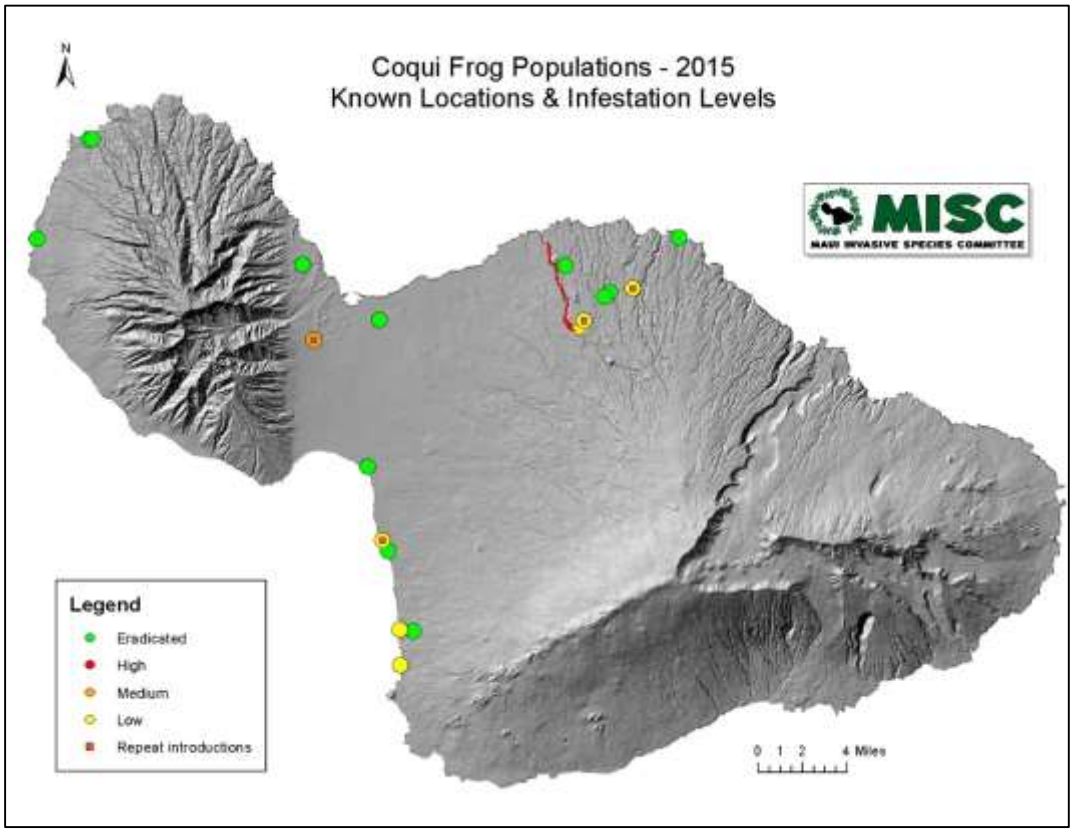
The invasive coqui frog (*Eleutherodactylus coqui*) threatens Maui's economy, quality of life, and environment. First discovered at one location on Maui in 1997, the frog has since been detected at nearly all inhabited areas of Maui. The purpose of this document is to outline previous control efforts, describe the current status of coqui on Maui, and propose a plan of action for control Māliko gulch – on the island's north shore.

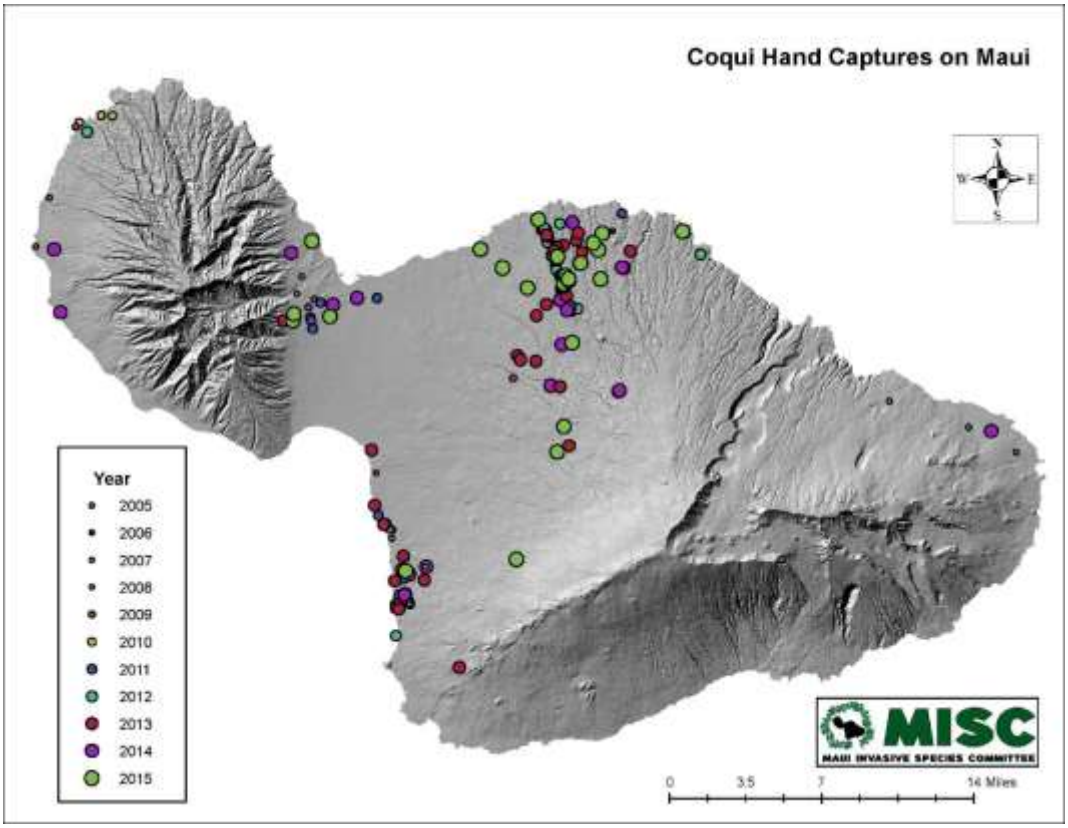
A. EFFORTS TO CONTROL COQUI ON MAUI

From 2000-2002, MISC responded to reports from the public and hand captured frogs whenever possible. During 2002, MISC conducted caffeine trials under an experimental permit to using caffeine to control coqui. The EPA declined to renew the permit due to concerns about non-target impacts and high toxicity for humans. Citric acid was approved for use with coqui frogs and MISC began control work using citric acid.

By 2006, MISC had identified 12 population centers on the island. Only one population had been eradicated (no calling frogs for at least one year). By 2015, 12 populations had been eradicated, including a 13-acre infestation in Honopou, one located at the Ritz Carlton, and another at an East Maui junkyard; however, another 7 had become established. During this same time, new introductions from the Big Island continued to increase. The number of hand captures per year reflects this steady increase.




Coqui Frog Populations - 2015
Known Locations & Infestation Levels
N
MISC
MAUI INVASIVE SPECIES COMMITTEE
Legend
Eradicated
High
Medium
Low
Repeat introductions
0 1 2 4 Miles

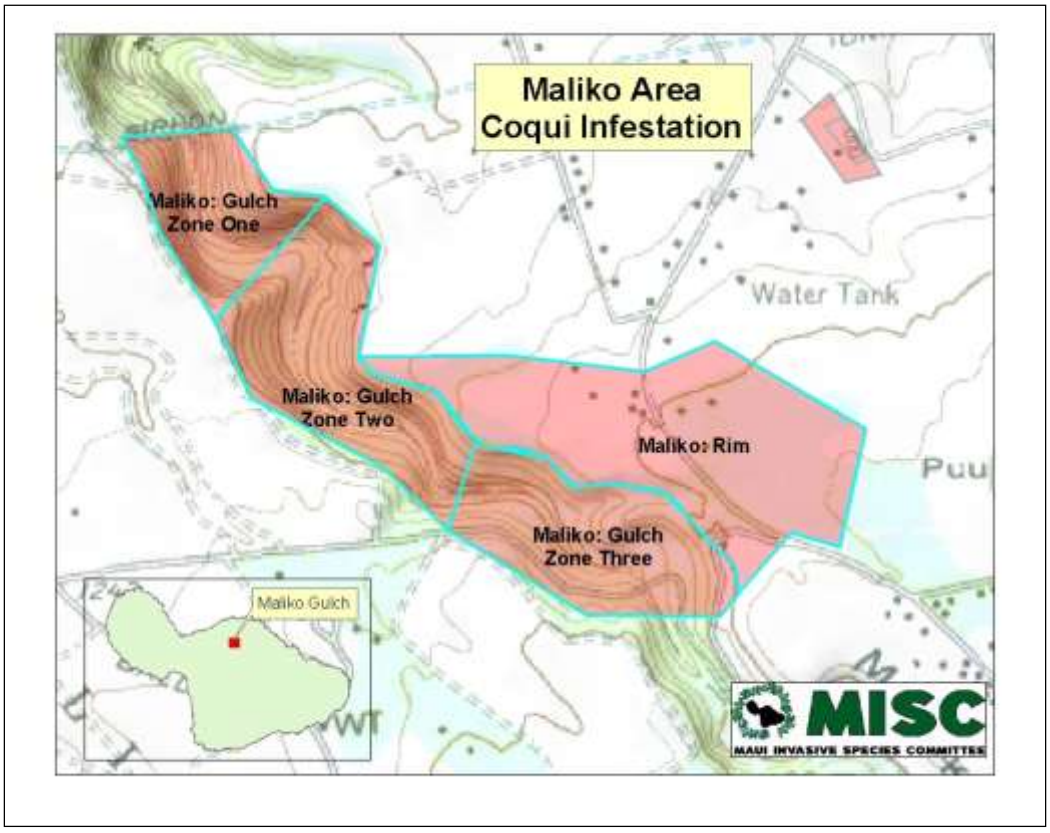

Coqui Hand Captures on Maui
N
W
E
S
Year
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
MISC
MAUI INVASIVE SPECIES COMMITTEE
0 3.5 7 14 Miles

Sites on Maui are either “closed” or “open” populations; the latter are locations with repeat introductions. There are at least four businesses that repeatedly import plant materials infested with coqui frogs from the Big Island. This issue has been raised to elected officials for many years; in the absence of legislation to address it, MISC developed its own coqui-free certification program to encourage businesses to “do the right thing.” Thirty businesses participate in the program; repeat offenders either do not wish to participate or would not qualify.

II. CURRENT STATUS OF COQUI IN MĀLIKO

A. POPULATION DISTRIBUTION

In 2005, MISC estimated that the Māliko infestation covered 127 acres. MISC had divided the area into three zones, with the infested portion of what was called “Māliko Rim” limited to the uppermost section of the gulch.



Despite ongoing efforts by MISC to contain the spread of coqui to Māliko gulch, including substantial efforts within the gulch, coqui have spread down the gulch, up the gulch walls, into adjacent residential areas and agricultural lands, and via the irrigation ditch system. The infested area is now estimated to cover up to 1,300 acres and affects more than 500 TMKs in and near Māliko gulch. The infestations appear to be spreading along the EMI ditches and in agricultural lands to the west of the gulch, but the full extent of the infestation is not known.

This expansion has occurred for four reasons: the Māliko infestation is extremely challenging from logistical, safety and operational perspectives; weather over the last several years has been extremely conducive to coqui reproduction, including torrential rains which move the frogs downstream; coqui have hit a critical population threshold, where the population has seemed to increase exponentially "overnight"; and resources to address the Māliko infestation have never been adequate.

B. TERRAIN AND ACCESS CHARACTERISTICS

The Māliko infestation comprises four main habitat types, each with unique challenges:

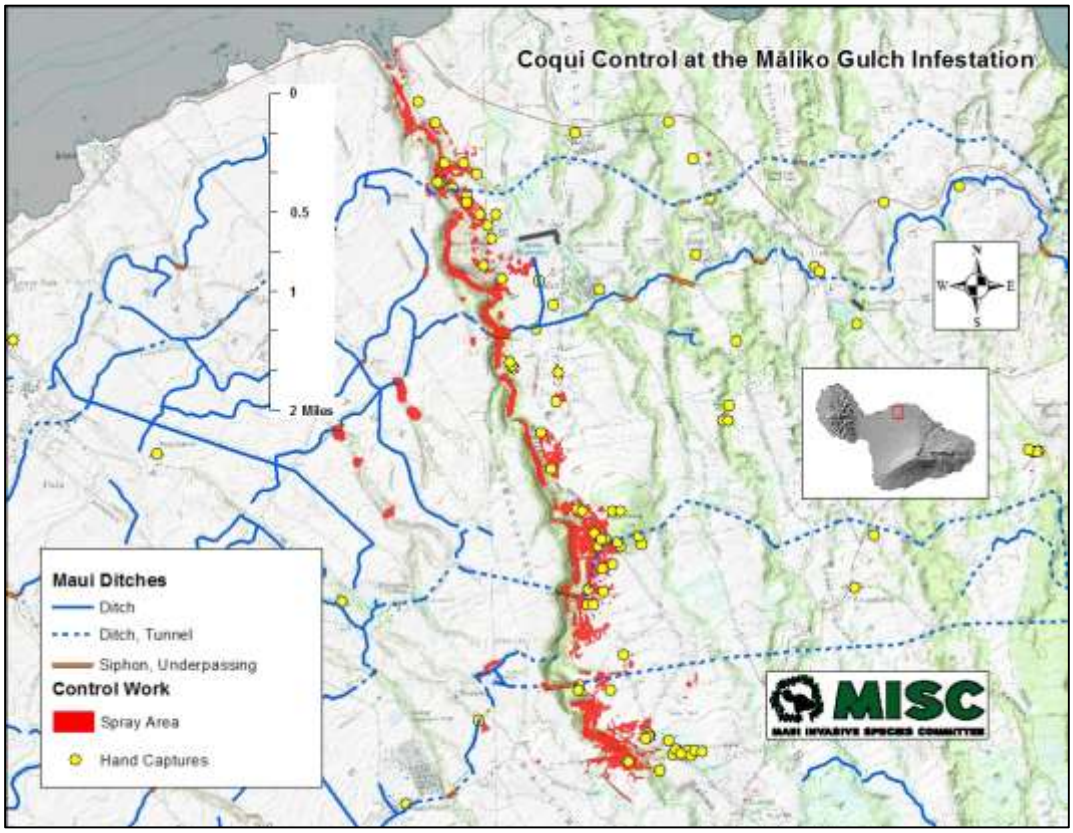
a. **Wildland gulch**: characterized by steep heavily-vegetated slopes, including finger gulches, as well as the gulch floor.
   - Subject to periodic flooding including flash floods
   - Falling boulders
   - Irregular terrain
   - Mosquitos

b. **Residential rim**: typical sites are two-acre parcels with significant landscaping.
   - Dogs
   - Many properties abut the gulch
   - Not all landowners allow access or control -

c. **Agricultural lands**: either actively managed or fallow, which may also include small infested gulches.

d. **Agricultural ditches**: flow from Māliko which may be transporting coqui and creating unknown populations to the west of the gulch.
   - Difficult to navigate at night, when frogs would be calling

III.

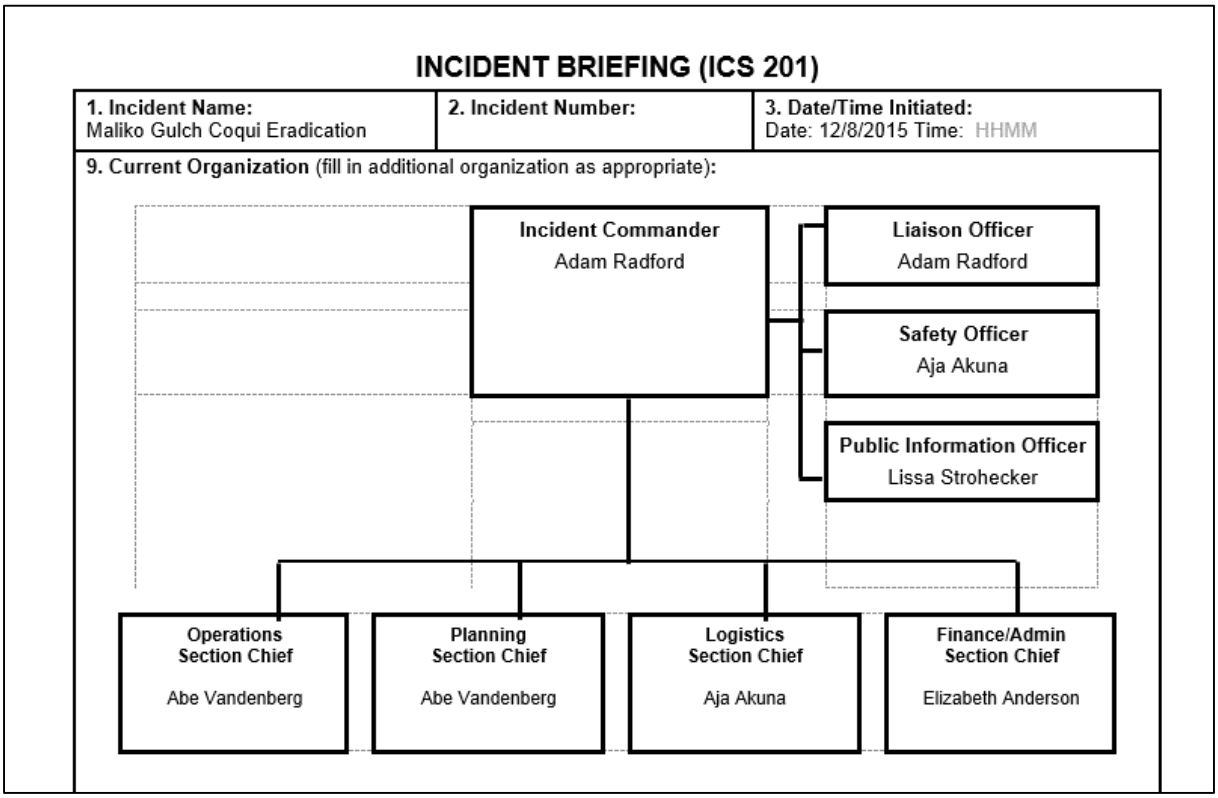


III. OPERATIONAL STRATEGY: MĀLIKO GULCH

The overall approach uses the Incident Command System structure to identify responsibilities and resource needs and allocation. Resources may include MISC staff, other agency staff, county, state or federal equipment, community volunteers, equipment and supplies. The following section outlines the management structure, control operations, planning assumptions, process and evaluation, communications, and community engagement.

A. MANAGEMENT STRUCTURE

Using positions developed under the Incident Command System, MISC will use the following "positions," which will be filled by existing or additional MISC staff. Key positions for the Māliko Incident Plan include: Incident Commander, Liaison Officer, Public Information Officer, Safety Officer, Operations Chief, Planning Chief, Logistics Chief and Finance Chief. Operational "strike teams" fall under the Operations Chief. The specific duties are outlined in Appendix A.



B. CONTROL OPERATIONS

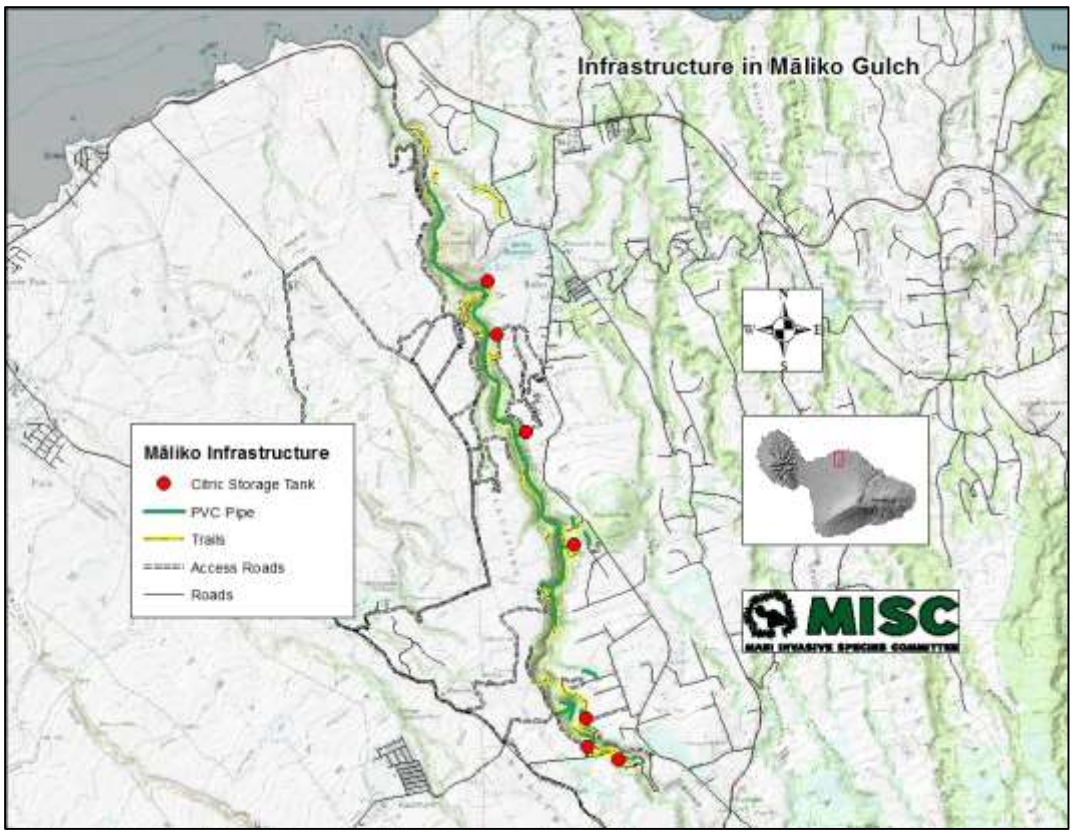
1. SPRAYING

The primary control strategy is to spray coqui with a 12 percent citric acid solution. Three systems for spraying citric acid have been developed over the years which have proven to be effective:

a. Ground operations use trailered tanks, sprayers, and hoses in residential areas
b. Large-capacity tanks for mixing and holding citric acid connect to sprayers and/or a gravity-fed system of PVC pipes, valves and hoses located in the bed of the gulch
c. High-volume sprinklers attached to fixed stands have been installed at strategic locations along the edge of the gulch

Aerial spraying has been used to control areas of the gulch that are not accessible by any other means; this method is less precise and more expensive.

Much of the infrastructure for work in the gulch was purchased with state (Hawaii Invasive Species Council) and federal (U.S. Fish & Wildlife Service) funding. Over several years, MISC developed trails, established water storage and mixing stations, obtained access to water from private and county sources, installed a series of high-volume sprinkler stands, laid pipe, and developed cooperative working relationships with local landowners. Some work is needed to refurbish the existing system.

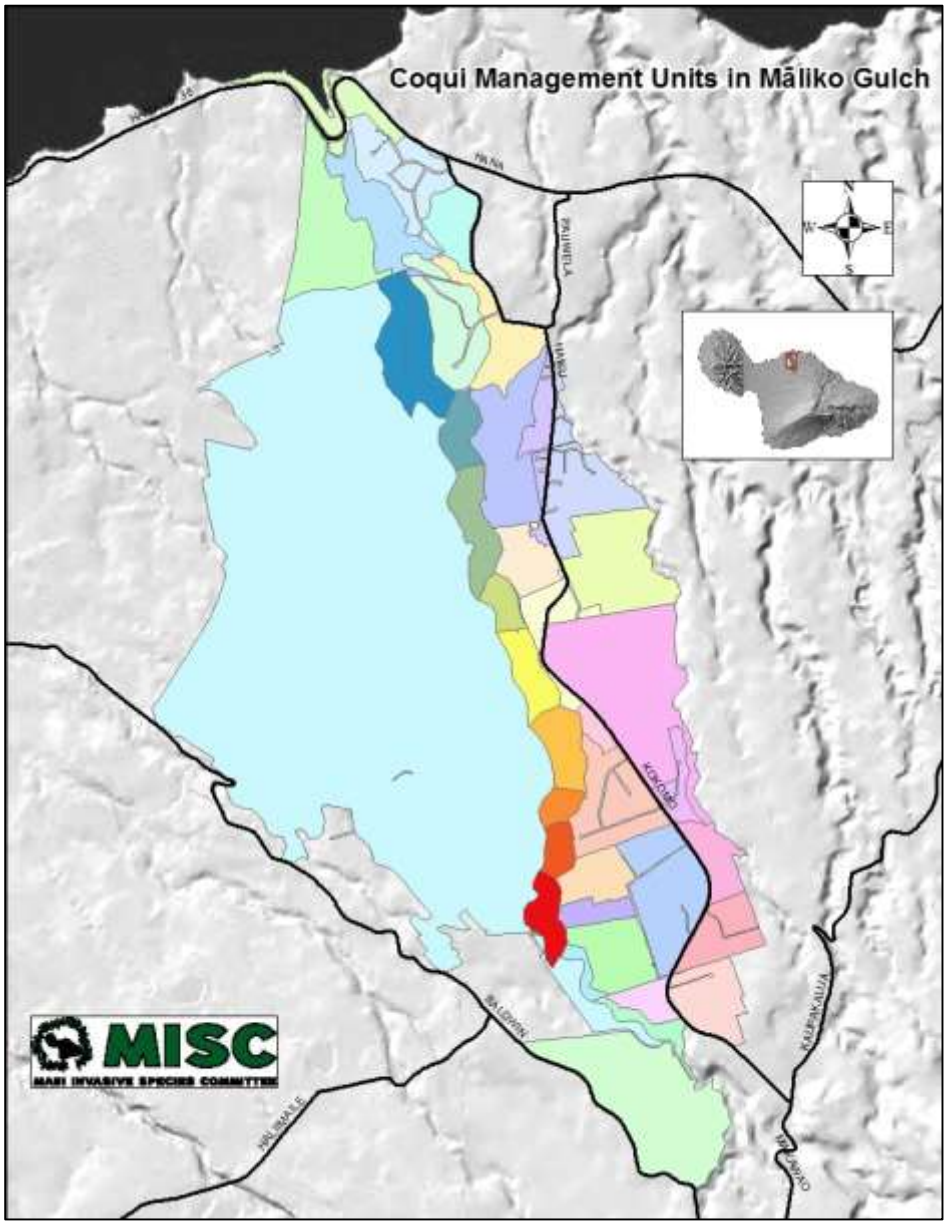


2. HABITAT MODIFICATION

Eliminating coqui-friendly habitat can significantly reduce the amount of required control efforts. MISC conducts extensive habitat removal throughout the residential rim area before treatment to increase efficacy. Techniques include: mowing, chainsaw work, chipping, and herbicide treatment of vegetation.

C. MANAGEMENT UNITS

A management unit system helps organize work efforts, track progress and engage the community. Units are based on land use, subdivisions, and terrain considerations. Site-specific plans may also be developed to work with individual landowners.



D. PLANNING AND EVALUATION

Effective operations require timely and accurate feedback systems to capture information about effort expended and to evaluate progress toward established goals and objectives. MISC will track data using an integrated GPS and geodatabase system. Information to be tracked includes:

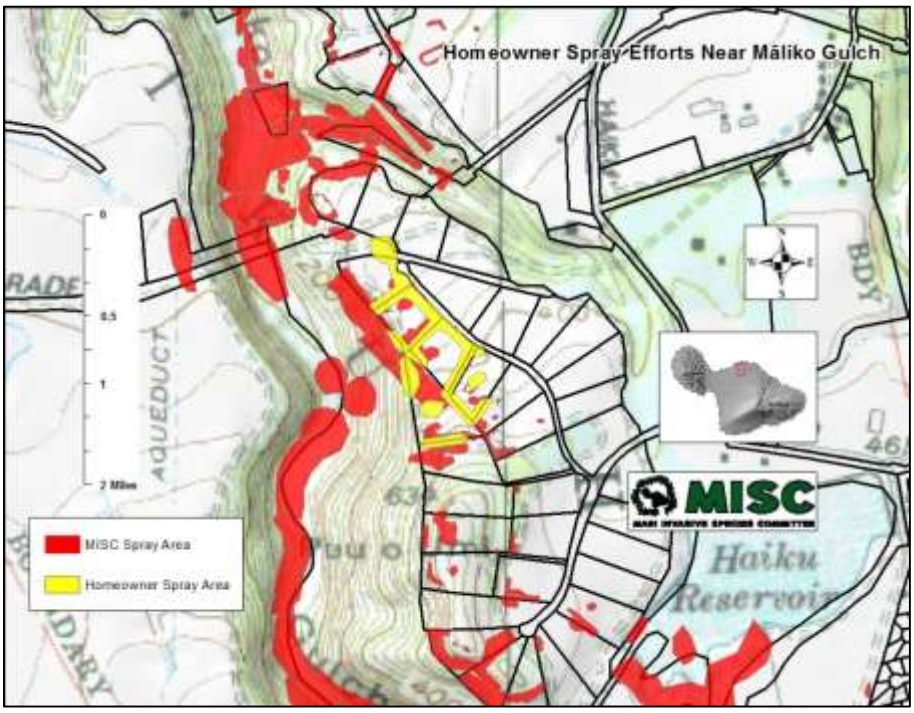
- Coqui-infested acres in Māliko gulch and along the rim
- Acres treated
- Staff hours worked on project
- Gallons of citric acid applied
- Number of landowners assisting with control
- Number of community events
- Pounds of citric acid distributed to residents
- Volunteer efforts on habitat removal or control

Weekly meetings with key positions covering overall command, logistics, operations, planning, and public information, and finance will ensure that the team is on track with established objectives and schedules. A summary of those meetings will help track progress. Quarterly reports will be provided to all relevant agencies and funders.

E. COMMUNITY OUTREACH & ENGAGEMENT

Community involvement is critical to the eventual success of the coqui eradication project. Effective communication is necessary to keep residents informed and provide opportunities to assist with overall efforts. Regular meetings with resident groups will help ensure ongoing communication and engagement. Residents will be asked to assist with the following activities:

1. **Surveys**: Identify and report locations of coqui frogs, especially in areas where the current distribution is not known or certain.
2. **Habitat modification**: Reduce coqui-friendly habitat on their properties and clear debris and landscape material in advance of scheduled spray operations.
3. **Spray operations**: Conduct spray operations using sprayers and citric acid supplied by MISC or assist with MISC operations.
4. **Storage of supplies**: Store equipment or citric acid on site to reduce transportation time and cost.
5. **Tracking of effort:** Track and report locations sprayed or habitat work conducted.
6. **Community liaison:** Each Management Unit will have a "Captain" who is responsible for communicating with MISC about schedules, equipment loans, citric acid delivery, etc.



IV. RESOURCE NEEDS

A. PLANNING ASSUMPTIONS

Primary cost factors are labor and citric acid. Additional equipment needs include sprayers and vehicles to move teams, equipment, and citric acid. The next phase should include improved storage at the UH-CTAHR facility. Averages are used for overall estimates; caveats about such averages include uncertainty about the extent of the infestation, variability in terrain, and weather complications.

The proposed work assumes that costs associated with the existing coqui crew of five will be covered by other funding. The initial proposal adds nine FTE staff, which may be a combination of full-time positions and pulses of temporary workers. Teams of two-to-three will be the normal operational unit and after an initial effort to push back the frogs along major roads, teams will work through the different management units on a weekly basis.

B. COST ESTIMATES

1. **Cost per acre:** $1,550-2,000 per treatment (citric acid & labor)
2. **Pounds/gallons of citric acid per acre per treatment**: 765 (up to 975)
3. **Person-hours per acre**: 30 (up to 50)
4. **Infested acres**: 1,000 (up to 1,300)
5. **Treatments needed to eradicate coqui**: 10 (up to 20)

Based on these assumptions and variables, the total cost for eradication of coqui frogs from Māliko Gulch ranges from $4.6 to over $20 million. As outlined in the FY16 proposal to Maui County, MISC proposes to focus on the following priority areas for initial control.

C. GOALS & OBJECTIVES

GOAL 1:	**Expand control operations in Māliko gulch.**
OBJECTIVE 1:	Reduce infestation levels and stop the current spread, with the eventual goal of eradication.
ACTION STEP 1:	Refine management units to define and prioritize geographically-based operations.
ACTION STEP 2:	Increase staffing capacity and obtain necessary equipment and operational supplies.
ACTION STEP 3:	Implement expanded operational schedule to detect and control coqui frogs using appropriate methods depending on land ownership and terrain considerations.
PERFORMANCE MEASURES:	Coqui-infested acres in Māliko gulch and along the rim; number of acres treated; staff hours focused on Māliko project; gallons of citric acid applied.

GOAL 2:	**Increase community involvement in detection and control of coqui frogs.**
OBJECTIVE 1:	Landowners assist with habitat removal and coqui control.
ACTION STEP 1:	Using geographically-based community groups, expand outreach efforts to educate local residents and encourage participation.
ACTION STEP 2:	Provide residents with citric acid, equipment, training and follow-up.
PERFORMANCE MEASURES:	Number of landowners assisting with control; number hours contributed to habitat removal or control operations; pounds of citric acid distributed to residents; number of outreach activities.

D. SCHEDULE FOR 2016

January through March

Teams focus on locations where coqui have crossed the road:

- Kaluanui Road
- Kokomo Road
- Hana Highway

April through December

- Kaluanui Mauka
- Kaluanui Coffee
- Aikane to Kaluanui
- Pololei to Puuomalei
- Haupoa Place / Kokomo Residential East
- Lilikoi Residential West
- Strawberry Lilikoi Gulch
- Hunawai Gulch & Residential
- Lilikoi Residential East
- HC&S Fields
- Māliko Proper
- Haiku Mauka
- Kapii
- Giggle Hill
- Giggle Hill Makai Residential West
- Giggle Hill Makai Fields
- Lokelau Gulch
- Haiku Subdivision 2 Makai & Haiku Reservoir
- Haiku Cannery Residential West / East
- Haiku Hill
- Piialii Gulch
- Haiku Makai
- Haiku Road Makai
- Haiku Subdivision 2 Mauka & Mini Gulch
- Māliko Bay Nursery to Siphon
- Māliko Bay
- HC&S Fields Makai

APPENDIX A: ROLES & RESPONSIBILITIES (INCIDENT COMMAND SYSTEM STRUCTURE)

Incident Commander

- Supervises Command and General Staff
- Briefs staff
- Determines information needs
- Establishes parameters for resource requests and releases
- Establishes planning levels needed
- Approves and authorizes implementation of Incident Action Plan
- Ensures overall coordination of Command and General Staff

Liaison Officer

- Obtains information from cooperating agencies, including contacts, available resources and capabilities
- Participates in coordination of media releases
- Participates in planning meetings
- Monitors operations to identify potential inter-organizational problems.

Safety Officer

- Identifies hazardous situations and potentially unsafe acts. Ensures adequate protective equipment is available and used.
- Identifies corrective actions, makes recommendations, and ensures implementation.
- Prepares Incident Action Plan Safety & Risk Analysis.
- Participates in planning meetings.

Public Information Officer

- Establishes contacts with local media representatives as appropriate
- Releases news to media; coordinates information releases
- Coordinates communications with affected communities
- Attends planning meetings

Operations Chief

- Establishes operational period
- Establishes staging areas
- Develops and manages tactical operations to meet incident objectives
- Assesses safety issues
- Determines needs and requests additional resources
- Attends tactics and planning meetings; provides updates

Planning Section Chief

- Meets with Operations Chief and Command staff to discuss proposed strategy
- Maintains resource tracking system
- Maintains / develops incident maps
- Prepares contingency plans & alternative strategies and identifies resources for implementation
- Identifies need for specialized resources
- Conducts planning meetings

Logistics Chief

- Participate in planning meetings and preparation of Incident Action Plan
- Review plan to estimate needs for next operational period
- Research availability of additional resources
- Develop and implement resource orders
- Provide input on resource availability, gaps and timelines
- Identify future operational needs to anticipate logistical requirements

Finance / Administration Chief

- Attend Planning meetings
- Gather relevant financial information
- Determine any cost-share agreements
- Maintain documentation of labor, equipment, services, materials expenditures
- Ensure that personnel records reflect incident activity
- Assist with procurement

Strike Team / Task Force Leader

- Attends Operations briefings
- Reviews assignments with subordinates and assigns tasks
- Coordinates activities with adjacent teams
- Monitors safety