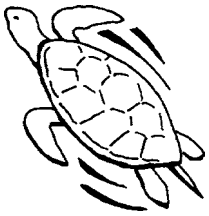


Activity #2

Red Imported Fire Ant Prevention & Quick Response Plan

● ● ● **In Advance** *Research Preparation and Student Reading*

- Student research may go more quickly if you look through the "Research Resources" listing in the Student Page "RIFA Prevention and Quick Response Plan" (p. 31-33). Place an interlibrary loan order for some of the books and journal articles listed there, and put them on reserve in your school library or make them available in your classroom.
- Assign the Student Page "Endangered Water Birds Threatened by . . . Ants?!?" (pp. 27-30)

● ● ● **Class Period One** *Team Research Projects*

Materials & Setup

Available in the classroom or on reserve in the library

- One or more copies of the "Resource Packet on Red Imported Fire Ants" (included as an appendix to this unit)

For each student

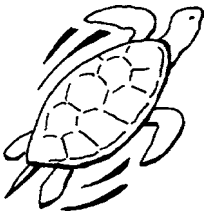
- Student Page "Endangered Water Birds Threatened by . . . Ants?!?" (pp. 27-30)
- Student Page "RIFA Prevention and Quick Response Plan" (pp. 31-33)

Instructions

1) Divide the class into teams of four to eight students. Hand out the Student Page "RIFA Prevention and Quick Response Plan." Each team will be responsible for developing a plan for the island of Maui. The plan's purpose is to prevent the red imported fire ant *(Solenopsis invicta)* from becoming established on Maui as well as to respond rapidly to control the ants' spread if it is discovered on the island. Students will be researching and developing their plans during this class period, on their own time, and during the second class period.

2) To jump-start students' thinking, start the class off by reviewing the main points from the reading. Before the teams start their work, brainstorm a list of ideas with the whole class.

   One question to brainstorm about is: "Where is the red imported fire ant most likely to be introduced to Maui?" Brainstorming places where entry is likely will help students thing about how to target prevention and monitoring efforts.



Research may be done on the Internet, in local college libraries, and through interlibrary loan. See also the "Resource Packet" included as an appendix to this unit, which consists of pages downloaded from various Internet sites listed in the Student Page "RIFA Prevention and Quick Response Plan." Students may want to check the webpages themselves for updated information.

Each team will produce an outline and rationale for its plan. Use the Student Page "RIFA Prevention and Quick Response Plan" as a guide. As the group works together, each student should take responsibility for doing a particular aspect of the research so that the work—and the learning—gets spread around. Use the four elements of the plan listed on the student page (p. 31) to divide responsibility. For groups of more than four students, have pairs of students work together.

Note

Allow several days between class periods one and two to allow teams time to work on their research and plans.

● ● ● Class Period Two *Research Team Meetings*

1) Allow student research teams to meet to finalize their plans and to prepare for their in-class presentations.

● ● ● Class Period Three *Team Presentations*

1) Student teams make five- to ten-minute presentations of their plans to the class.

Journal Ideas

- How can you help spread the word about the threat of fire ants? What do other people need to know?
- How big of a threat do you think red imported fire ants are to Maui native ecosystems, including wetlands? Explain your reasoning.

Assessment Tools

- Prevention and Quick Response Plans (see the Student Page "RIFA Prevention and Quick Response Plan" for a list of elements that will help you evaluate the plans)
- Team presentations

Endangered Water Birds Threatened by . . . Ants?!?

In 1992, Keālia Pond National Wildlife Refuge was created from land donated to the government by the Alexander & Baldwin company. A primary purpose of the refuge is to protect habitat for three endangered Hawaiian water bird species: the *ae'o* (Hawaiian black-necked stilt), *'alae ke'oke'o* (Hawaiian coot), *koloa* (Hawaiian duck).

These endangered species—and other native water birds—breed, nest, raise their young, and reside year round in wetland areas like Keālia Pond, scattered around the islands. All together, eight native species of water birds rely on wetlands, including the ones listed above and the Hawaiian gallinule or moorhen, Laysan duck, pied-billed grebe, fulvous whistling duck, and black-crowned night heron.

In the fall and winter, Keālia Pond and other Hawaiian wetlands come to life with an influx of migratory birds that head south from colder climes. Pintail ducks, Canada geese, sanderlings, and plovers (including the *kōlea*) join some 90 other species of water birds and an occasional gull or osprey blown in by winter storms.

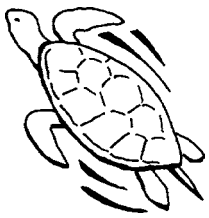
But scientists predict the refuge won't be such a lively place if the red imported fire ant (*Solenopsis invicta*) gets to the Hawaiian Islands. And it's the native species that nest here that are likely to be hardest hit.

Invicta Means Invincible

Solenopsis invicta was so named by Dr. William Buren in 1972. The meaning of the Latin "invicta" is "invincible," which is an accurate description of the red imported fire ant. The red imported fire ant (or RIFA, as you'll see in much of the nonscientific literature about these ants) is a particularly aggressive invader, even overrunning areas that were once inhabited by another aggressive fire ant species, *Solenopsis geminata*.

Ae'o *in a pond*
(Photo: Eric Nishibayashi)

RIFA colonies are extremely dense and grow rapidly, compared to other ant species. Individual colonies consist of hundreds of thousands of ants, and there can be 1500-3000 worker ants *per square meter* in infested areas. Imagine an eighth of a cup of rice grains running around in your bathtub and you get the picture. The red imported fire ant is aggressive, territorial, and predatory—with a powerful sting that makes it a danger to most animals.



Some ant species run away when their nest is disturbed or the object they are on moves. Not so for *Solenopsis invicta*. Thousands of these ants will swarm on and relentlessly sting anything that is unfortunate enough to disturb their colony. One researcher was stung over 250 times on one leg within ten seconds of inadvertently disturbing a nest. These ants are quick, each one can sting repeatedly, and the sting is exceptionally painful, usually turning into a white pustule by the following day.

Solenopsis invicta = red imported fire ant = RIFA

The red imported fire ant is an opportunistic feeder, taking advantage of whatever food source is at hand. They actively prey on invertebrates, vertebrates, and plants. Any animal that is relatively immobile and unable to run away from attacking ants is susceptible to RIFA predatory attacks. These ants are documented to have preyed upon a whole range of animals including birds, lizards, turtles, small mammals, and invertebrates. Human deaths have also been reported among individuals who are hypersensitive to *S. invicta* venom or who were bedridden and immobile.

Nestlings and "pipped" eggs (which have just started to hatch and have a hole broken in them), especially of ground-nesting birds, turtles, and lizards, are particularly vulnerable to predation. If *Solenopsis invicta* makes it to the islands, that fact could spell trouble for Hawaiian wetland birds.

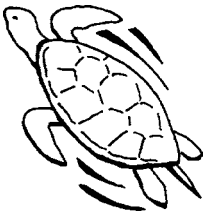
Solenopsis Invicta in Wetlands

The red imported fire ant is well adapted to wetland conditions. It is believed to be native to southern Brazil, in a region where seasonal flooding is the norm. RIFA is able to thrive in seasonally flooded habitats where other ant species are absent.

Solenopsis invicta was unintentionally brought to Mobile, Alabama in the 1930s, probably in soil used as ship ballast. Since that time, it has invaded over 300 million acres in the United States, primarily in southeastern states. Since the red imported fire ant has been around the continental U.S. for decades, scientists have had plenty of time to study the ants' effect on wildlife. Studies in wetlands have reported:

- Water bird breeding success declines in areas inhabited by *S. invicta*. RIFA attack and prey upon pipped eggs and nestlings of several species of ground- and shrub-nesting birds including egrets, herons, spoonbills, cormorants, and gulls. There was a 92 percent overall reduction in water bird reproduction during the part of the breeding season studied. During one month, hatchling mortality was 100 percent in RIFA-infested areas, compared to 0 percent in non-infested areas (Drees).
- *S. invicta* attacks the nestlings of wood ducks and is thought to exclude wood ducks from natural cavity nest sites. In one study, RIFA destroyed 15 percent of clutches in wood duck nest boxes (Ridlehuber).
- In RIFA-infested areas, chick mortality among endangered least terns is 27 percent higher than in noninfested areas (Lockly). Least terns nest on the ground.

In Hawai'i, wetland habitat is extremely rare, comprising only about three percent of the islands' total land area. Degradation and loss of habitat have been primary contributors to the decline of native water birds. Invasion by red imported fire ants would undoubtedly cause further habitat degradation—a loss that species whose populations number as few as 1500 birds (in the case of the *ae'o*) may not be able to withstand.



Other Fire Ant Concerns

Protecting endangered water birds is not the only reason people want to keep the red imported fire ant away from Hawai'i. They are also concerned about what could happen to our quality of life and the future of the tourism industry if *S. invicta* establishes itself here. In some places it has invaded, it is impossible to sit in the grass or stand on a shoreline to fish without being stung. Hunting, ranching, and outdoor recreational activities can be affected by the presence of this ant. And, once it is established, the red imported fire ant has proven impossible to eradicate. In many places, control programs have reduced ant populations to bearable levels with repeated use of chemical pesticides. However, this approach works only for limited areas, and there are concerns about the threats widespread use of these toxicants would pose to water quality and the overall health of ecosystems such as wetlands.

In the 13 states and Puerto Rico where RIFA is found, it has been reported in virtually every crop. Because of its opportunistic feeding habits, including a predilection for seeds of all kinds, *S. invicta* has the potential to cause great damage to crops. It has also been known to cause damage to irrigation systems and cut down on the efficiency of agricultural operations as pickers and equipment operators adjust their work to avoid disturbing or running over nests.

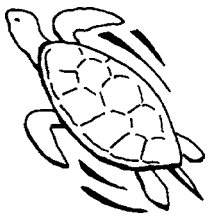
Red imported fire ants also infest electrical equipment, chewing on insulation and causing short circuits or interfering with switching mechanisms. They sometimes nest in buildings and commonly nest in home gardens, landscaped areas, and nursery stock.

Some people point out that RIFA can have benefits, too. Researchers have found that RIFA can be beneficial in sugar cane and cotton fields where they prey upon pest species. And *Solenopsis invicta* predation may help control flea and tick populations. However, in a place such as Hawai'i, where native plants and animals evolved with no ant predators whatsoever and where working and playing outdoors is so important, it is difficult to conclude that the benefits of the red imported fire ants would outweigh the long list of negative consequences of its arrival here.

RIFA can be a threat to agricultural operations (Photo: Carol Gentz)

In 1998, the red imported fire ant was found in California. Since then, infestations have been discovered in several counties. Around the state, people are scrambling to determine the best way to minimize the impact of this species. Now that RIFA has gained a foothold in California, some people believe it is just a matter of time before these ants make it to Hawai'i. With the large volume of goods shipped back and forth between Hawai'i and California, as well as the numbers of people who use California as a departure point for their air travels to the islands, the ants may have plenty of opportunities to hitch a ride over.

The state Department of Agriculture does have a quarantine and inspection policy for products such as nursery stock shipped to Hawai'i from infested areas. But *S. invicta* has successfully worked its way across the continental United States, despite the existence of a federal quarantine policy begun in 1958. Many researchers, agricultural operators, and resource managers



believe it will take much more than agricultural quarantine to protect Maui and the other Hawaiian Islands from this invader.

Joining forces as the "Ant Working Group," they have begun putting together a prevention plan as well as a contingency plan for detecting and limiting the spread of red imported fire ants if they should arrive on the islands. Here are a few of their ideas for preventing RIFA from arriving on Maui:

1) Chemically treat goods before they are shipped from RIFA-infested areas.
2) Give Hawaii Department of Agriculture inspectors the authority to inspect non-agricultural items such as building materials.
3) Establish regular state reviews of first class mail from the mainland, looking for suspicious packages and then applying for federal warrants to inspect these packages.

Can you think of other ideas for preventing this dangerous invader from arriving on Maui—or for quickly responding to stop its spread once it gets here? *Your* idea could be one that ultimately protects Maui—especially its wetland areas—from the "invincible" *Solenopsis invicta*.

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Ridlehuber, K, "Fire Ant Predation on Wood Duck Ducklings and Pipped Eggs," *Southwest. Natur.,* No. 27, 1982, p. 222.

Tanji, Edwin, "Maui Wants Refuge Enlarged; Kealia Pond Important to Wildlife, Near-Shore Reefs," *The Honolulu Advertiser,* January 20, 1997.

VanGelder, Ellen, "HNIS Report on *Solenopsis invicta*" at <www.hear.org/hnis/index.html#HNISreportsavailable>.

_____, Personal communication and unpublished work plan for Proactive Protection of Hawaii's Wetlands and Other Ecosystems from the Red Imported Fire Ant project, June 2000.

Vinson, S. "Impact of the Invasion of *Solenopsis invicta* on Native Food Webs,"in D. Williams (ed.), *Exotic Ants: Biology, Impact, and Control of Introduced Species,* Westview Press, Boulder, Colorado, 1994, pp. 241-258.

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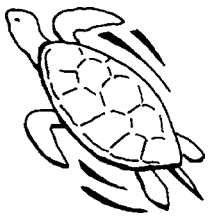


RIFA Prevention and Quick Response Plan

Your team's assignment is to work together to develop a "Prevention and Quick Response Plan" for the red imported fire ant on Maui. You will present an outline and rationale for the plan to the class when you are finished. You may even want to pass some of your ideas along to the Maui Ant Working Group, a collaboration involving scientists and resource managers from around the island.

Goals

Like your team, the Maui Ant Working Group aims to:

1) Prevent the arrival of the red imported fire ant on Maui,
2) Monitor for its presence to detect it before it is well established, and
3) Respond rapidly and effectively to contain the spread of the red imported fire ant if it is found on Maui.

Research

Your plan needs to be backed up with factual information and a clear explanation of what each component is designed to accomplish. You will need to do some research in order to develop your plan. Your teacher has a collection of resources available for classroom use, and there are many other sources available through public and university libraries as well as on the Internet. See the "Research Resources" section of this student page for a beginning list of research leads.

Keywords for Internet searches include:

- red imported fire ant
- *Solenopsis invicta*

If you use the following search terms, double-check to make sure the information you retrieve is about *S. invicta* and not another ant species:

- fire ant
- pest ants
- pest ant control

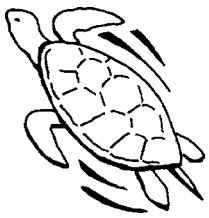
Outlining a Plan

Divide up responsibility for developing your plan among team members. Make sure everyone is responsible for part of the plan. Your plan should include the following elements:

1) A description of the problem, including potential threats to ecosystems and humans based on the problems encountered in other states;
2) A plan to prevent the ant's arrival;
3) A plan to monitor for its presence and detect it before it is well established; and
4) A plan to respond rapidly and contain the ant if it invades.

Support *each element* of the plan with:

1) A description of your reasoning for this part of the plan and factual information that supports your plan;
2) Ideas about whom should be involved in implementing this part of the plan; and
3) Suggestions for containing costs (e.g., by forming creative partnerships, raising money locally, getting time and resources donated to the project, or involving students and other people who are not normally involved in work like this).



Starting Points

Here are some of the questions being asked by Maui Ant Working Group members as they consider what their plan will be. Use these questions as a starting point for your own thinking.

- What kind of information should Maui residents and visitors have about RIFA? What are the best ways to get that information to them? How can we get residents and visitors to pay attention to this threat?

- What is the basic ecology of RIFA—including its colony structure, how it reproduces, what makes it such a successful invader, suitable habitats, etc.? These characteristics affect how and how easily they may become established, how quickly they can spread, where they are likely to invade, and what kinds of controls are likely to work.

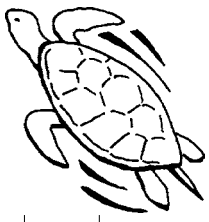
- Where is RIFA most likely to be introduced to Maui? In theory, it takes only one mated queen to establish a new colony, although there may be a much greater chance of survival if a whole or partial nest is moved. That is one reason nursery stock receives so much scrutiny, since ants and even nests can be moved in the soil they are shipped with. If RIFA came to Maui in nursery stock, where could it become established? What about other vehicles such as containers in which fruits or vegetables, soil, and other agricultural products are shipped? Airports? Cars being shipped from infested areas? Shipments of lumber and furniture? Where else might RIFA stow away?

- How does the current Hawai‘i and Federal RIFA quarantine system work? Has anything different been tried in other states or countries?

- What are the likely impacts/effects of the RIFA, should it ever become established on Maui or the Hawaiian Islands? Are there certain parts of the island or certain ecosystems that seem particularly threatened and of high priority for protection?

- What control mechanisms are currently being used and recommended in infested areas? What experiments are being tried with new methods such as “biocontrol” (using other insects or diseases to control populations of pest species such as the RIFA)?

- What kinds of permits would be needed to use some of the pesticides being used in other states, here on Maui in the places that are most likely to need protection? Should we be stockpiling pesticides so we can quickly respond if RIFA is found here?



Research Resources

	General Information	RIFA ecology	Control methods	Quarantine	Impacts of RIFA
Texas A&M University, Department of Entomology, "Imported Fire Ant" at <fireant.tamu.edu>.	•	•	•	•	•
VanGelder, Ellen, "Hawai'i Non-Indigenous Invasive Species (HNIS) Report on *Solenopsis invicta*" at <www.hear.org/hnis/index.html#HNISreportsavailable>.	•	•	•	•	•
California Department of Food and Agriculture, "Red Imported Fire Ant Information" at <pi.cdfa.ca.gov/rifa/newfact.htm>.	•				•
University of Arkansas, Arkansas Cooperative Extension Service, "Red Imported Fire Ant" at <www.arnatural.org/fireants/default.asp>.	•	•	•	•	•
Lockley, T. C., University of Minnesota Integrated Pest Management Program, "Imported Fire Ants" at <ipmworld.umn.edu/chapters/lockley.htm>.	•	•	•		•
County of Los Angeles, Agricultural Commissioner/Weights & Measures, "Red Imported Fire Ant" at <acwm.co.la.ca.us/scripts/RIFA.htm>.	•				•
National Park Service, "National Park Service Integrated Pest Management Manual—Fire Ants" at <www.colostate.edu/Depts/IPM/natparks/fireants.html>. *Includes a brief section on monitoring*	•		•		
Vinson, S., "Impact of the Invasion of *Solenopsis Invicta* on Native Food Webs,"in D. Williams, (ed.), *Exotic Ants: Biology, Impact, and Control of Introduced Species,* Westview Press, Boulder, Colorado, 1994, pp. 241-258.		•			•
Drees, B., "Red Imported Fire Ant Predation on Nestlings of Colonial Waterbirds," *Southwest Entomology,* No. 19, 1994, pp. 355-359.					•
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