

Little Fire Ants



Hawai'i's Invasive Little Fire Ants

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Governor Ige with one of Hawai'i's worst invaders, the Little Fire Ant, Photo DLNR, OISC.

Title: Little Fire Ants (*Wasmannia auropunctata*)

Grades: 4-12

Time: 2-4 hours in class, 3-5 days with school and community activities.

Na Hopena A'o

- Strengthened Sense of Belonging: understand how actions affect others; actively participate in school and community
- Responsibility: Question ideas and listen generously; reflect on the quality and relevancy of the learning
- Strengthened Sense of Aloha: Respond mindfully to what is needed.
- Total Well-being: Feel safe physically and emotionally

NGSS Disciplinary Core Ideas LS1.A: Structure and Function:

- 4-LS1-1; MS-LS1-4: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- MS-LS2-1: Ecosystems: Interactions, Energy, and Dynamics: Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem;
- MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems;
- MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.)

NGSS 4-ESS3 Earth and Human Activity: Cross-cutting Concepts:

- Influence of Science, Engineering and Technology on Society and the Natural World
- 4-ESS3-1: Over time, people's needs and wants change, as do their demands for new and improved technologies.

Hawai'i Content and Performance Standards III

Little Fire Ants

- **Std 3: Life and Environmental Sciences: ORGANISMS AND THE ENVIRONMENT:** Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment.
- **Std 4: Life and Environmental Sciences: STRUCTURE AND FUNCTION IN ORGANISMS:** Understand the structures and functions of living organisms and how organisms can be compared scientifically

TO THE TEACHER: CONNECTIONS TO PLACE & CULTURE(S)

There are no native ants in Hawai‘i. Humans have introduced around 60 species from the time of James Cook's arrival in 1778. Some ants are especially good at “hitching a ride,” traveling in goods and cargo being shipped around the world. Most of the species of ants in Hawai‘i arrived in the past 100 years- many are considered "tramp ants" and are closely associated with the plant trade that also introduced the Coqui frog.

One new arrival to O‘ahu of great concern is the tramp species known as the little fire ant (*Wasmannia auropunctata* or LFA). It gets its name from its powerful sting that can feel like fire. It is a destructive, pervasive, tramp ant that occurs in very high densities, eats a wide variety of prey, and is an extremely voracious predator. In some infested areas of New Caledonia LFA makes up 90% of the insect population. LFA can completely take over, eliminating other ants and attacking and preying on native invertebrates and vertebrates such as reptiles, mammals, and birds. It may also sting the eyes of mammals, causing them to go blind.

LFA can nest almost anywhere, on the ground as well as up in trees. That is bad news for humans and their domestic animals as it’s almost impossible to enjoy being outdoors where they have invaded. For an arboreal species (lives in trees) LFA are not very good at hanging on: wind can cause the ants to rain down on those below. People get stung while gardening, picking fruits or flowers, or enjoying other outdoor activities. In some areas of Tahiti stings from the ant are so overwhelming that people have given up, abandoning their ancestral land and leaving their crops to go unharvested.

LFA is now widely established on the island of Hawai‘i and has been repeatedly detected in nursery plant shipments. Hawai‘i Island is a large supplier of agricultural and landscaping products to other islands, increasing the risk of transporting colonies of LFA around the state. In fact, the little fire ant has already arrived. Two large populations were detected in late 2013 and early 2014 on O‘ahu. The good news is, if we find the ants early, before they form large supercolonies, their populations are easy to control and even eradicate. It is in our best interests to find out as soon as possible where LFA may be. **Lessons below show ways to help with this important mission.**

Ants in Hawaiian language newspapers

Students began learning about ants soon after missionaries arrived in 1820 and started schools at the request of the royal family. Below is a translation of an excerpt of an article that appeared in *Ke Kumu Hawaii*, Vol. 3, No. 15, on December 20, 1837. Kam is short for *kamali‘i*, or child (student in this case). Ku is short for *kumu*, or teacher. The term *classes* refer to the western classification of animal types.

Kam: These [animals] belong to the fourth class.

Ku: Tell me the names of some animals belonging to this class.

Kam: The bonito fish, the flying fish, the lobster, the shark, the humpback whale, the dolphin, many animals are in this class!

Ku: That is right. And what are the animals of the fifth class?

Kam: What indeed? We don’t know, you tell us.

Little Fire Ants

Ku: The dragonfly, the butterfly, the monarch butterfly, the fly, the bee, the honeybee and the wasp, and all the little things that fly or jump like the louse, the mosquito, these belong to the fifth class. Same for the things that crawl, like the yard spider, the house spider, the ant, and the mite. All these are grouped in the fifth class. Some of these have wings, like the fly. Others are lacking wings. For those without wings, some run, like the spider, and some jump, like the flea. Still some just crawl slowly, like the ant. What class do these animals belong to?

Kam: The fifth class.

Ku: And which class holds the moth and the cockroach?

Kam: Still the fifth class.

Kam. No ka papa eha.

Ku. E hai mai i ka inoa o kekahi mau holoholona o keia papa.

Kam. He aku, he malolo, he ula, he mano, he kohola, he naia, a he nui wale na mea no keia papa.

Ku. Ua pono ia. A heaha na holoholona no ka papa elima?

Kam. Heaha hoi? aole makou ike. Nau e hoike mai.

Ku. O ka pinao, ka pulelehua, ka lepelepeohina, ka nalo maoli, ka nalo meli, ka nalohuelohewa, a me na mea liilii a pau e lele ana e like me ka uku, a me ka makika, no ka papa alima no lakou. Pela no hoi kekahi mau mea kolo, o na nananana, na peapeamakawalu, na naonao, a me na nonanona. No ka papa alima ia mau mea a pau. He mau eheu ko kekahi e lele ai, e like me ka nalo. A ua nele kekahi i ka eheu ole. A o ua poe eheu ole la, holo no kekahi, e like me ka nananana, a lele wale kekahi, e like me ka uku lele, a kolo malie wale no kekahi, e like me ka naonao. No ka papa ehia lakou nei a pau?

Kam. No ka papa elima.

Ku. No ka papa ehia ka okai a me ka elelu?

Kam. No ka papa alima no.

5 E INSTRUCTIONAL ACTIVITIES:

1. **Engage:** Connect to prior knowledge, engage learners in concept, process or skills to be learned.
 - What are ways native plants and animals arrived in Hawai‘i before humans?
 - How do they arrive now?
 - Share something you know about ants in Hawai‘i or anywhere else.
 - What problems can be caused by ants?
 - Share a personal experience with ants. When and where did it occur?
 - Watch the MISC video on the impact of LFA on Hawai‘i:
https://www.youtube.com/watch?v=_u3lyvhhR-s&feature=youtu.be
2. **Explore:** Which skills will be used? What will students do? Describe science lesson or laboratory activity.
 - Interview an adult about ants, problems, and how to address them.
 - Learn about ants (see Lesson IV)
 - Learn from an expert Lesson II: Help Detect, Report, and STOP the Little Fire Ant
 - Schoolyard Survey. Use the instructions from the Hawaii Ant Lab Website (<http://www.littlefireants.com/survey.html>) to observe, identify, record, photograph ants found on campus. Use the Visual Identification Key:

Little Fire Ants

http://pick4.pick.uga.edu/mp/20q?guide=Ants_Hawaii to become familiar with identifying ants under the microscope.

- Group Field Guide: Classify ants from kingdom through species then make a photo field guide of ants. Where did they from, what is their life cycle, what is their role in the ecosystem, what are their economic impacts? Share your findings and field guide.
3. **Explain:** What are main ideas and concepts? How will they be constructed and explained? Connect Engage and Explore to bigger culture-science picture.
- What are the structures and behaviors of ants? Create an “Ant City” similar to the common “cell city” lesson to further their understanding of ants. See Lesson IV and V below.
 - What are some human activities that directly and indirectly affect ant populations?
 - Mock Neighborhood Board Meeting: Student groups take the role of various stakeholders and prepare presentations for the board. (See Lesson III below)
4. **Elaborate/Extend:** Interdisciplinary, local to global: address *Na Hopena A’o*.
- What can you do personally to reduce LFA or other invasive species in your home or community?
 - What can you and classmates do to inform your peers and community about LFA and other important invasive species? <https://www.youtube.com/watch?v=R2ZvRJZjGPA>
5. **Evaluate:** How will students show/know what they have learned? How do activities enable students to develop the following *Na Hopena A’o* outcomes?
- Strengthened Sense of Belonging: understand how actions affect others; actively participate in school and community;
 - Responsibility: Question ideas and listen generously; reflect on the quality and relevancy of the learning;
 - Strengthened Sense of Aloha: Respond mindfully to what is needed;
 - Total Well-being: Feel safe physically and emotionally

Teacher reflection: How could the lesson be more effective? What went well, what would you do differently?

INSTRUCTIONAL ACTIVITIES

LESSON I. HAWAIIAN NEWSPAPER CURRENT EVENTS: OCTOBER 27, 1866

This article shows how close observations of ant behavior led to *biocontrol*, the use of one organism to control another.

Directions: Read the Hawaiian newspaper article below then answer the following questions.

1. Who is Solomon and why do you think he is referred to for asking “sleepy people” to observe ant behavior? What does this imply about the writer and his audience?
2. How can ants be a problem for people?
3. How can the so-called problem behavior also be used to solve a problem in Hawai‘i?
4. Where were caterpillars a problem? According to legend, why were caterpillars a problem?
5. Describe the scientific steps Hawaiians took to solve the caterpillar problem including sharing their findings with others.

Little Fire Ants

6. Compare and contrast: In what way are caterpillars and beef the same? How are they different? Name a food you eat that is in the same category as caterpillars and beef.
7. The writer, W. N. Pualewa makes a clever comment about Lana‘i’s ranchers. What is this comment? What makes it humorous? Are these four animals native or introduced?
8. Beyond the story: Why do people intentionally introduce new animals or plants to Hawaii? What are possible negative impacts of new organisms on people and native plants and animals?
9. Beyond the story: What are some ecological, economic, cultural, and technological reasons that Hawai‘i is a hotspot for invasive species and site of so many extinct and endangered species?

Concerning the Ant

To *Ke Au Okoa*: — Regards,

The ant is a tiny little animal to look upon and it is scorned by some. In the lands of central Africa there are many white ants and black ants; the residents there likely know the story of the ant. When we observe its form and its nature it does not generate appreciation, but in Solomon's presentation of his story about the ant, sleepy folk were commanded to go and observe the ant.

Amazing: why would men, a being with spirit, be commanded to go and observe the ant? It was so it could be seen that the ant is always working, while man is lazy, sleeping in the day.

There are two kinds of ants. One – destructive to some. Two – something that does away with other destructive forces burdening man. About the destructive ones. In the foods and drinks of man, the ant can fill up all the space it wants. If a food container should be left with pork or beef inside and securely covered, when you go to open it the next morning after sleeping, you look and it is completely filled with ants. The same is true with water containers; the ant can completely fill its space as much as it wants. If you don't notice the evil little things inside, the ant will end up inside of you.

About doing away with some things that damage the efforts of man. In lands where ants are plentiful, that little creature assists man. In lands where crops are often troubled or consumed by caterpillars, if there are many ants in that land, the Caterpillar will not be victorious in the sweet potato patch, for the ant is completely able to finish off the caterpillar. In sweet potato patches without sufficient ants, clearly the caterpillar will be the victor. In some places in the world, they are cultivating the ants, knowing that they are a good thing.

In recent days, K. Maakuia spoke to me, saying that the farmers of *Lāna‘i* are bringing ants from Maui to *Lāna‘i*. Pieces of beef are being put into containers as rewards and left open until filled with ants, and taken over to the island of *Lāna‘i*. They are taken directly to the sweet potato gardens, where they are scattered and left to live in the sweet potato garden. When the short caterpillar comes to get the sweet potato leaves, the ants unleash their great force.

Thus *Lāna‘i*'s problem was solved by ants, sparing the plants from the caterpillars.

I am a native son of *Lāna‘i*, and I have always known the abundance of caterpillars, to a point where those who fear the caterpillar should not go on the roads. When *Lāna‘i*'s residents go to farm, they dig a deep trench at the edge of the garden, and they must dig pits, so when the caterpillars crawled in they fall into the trench and the farmer can kill them. That was how the caterpillar was killed then.

But that is a great effort, yet once the ant was obtained, *Lāna‘i*'s problem was finally solved. It is a new thing for *Lāna‘i*'s people to raise ants, and *Lāna‘i* should be called a "ranching company." For years now I have seen that *Lāna‘i*'s folk raise sheep, goats and turkeys. Now they will be an Association of Ant Ranchers.

In the time of *Kaululā‘au*, an ancient character and the first mischief-maker of *Lāna‘i*, he sealed shut the eyes of the deity of *Lāna‘i* Hale, but left the eyes of the caterpillar, yet now in times

of the grandchildren of that Kaululā'au, a way to end the caterpillars has been found, namely the thing noted in the title above "The Ant."

Go forward, Lāna'i, in cultivating the ants.

W. N. Pualewa.

Honolulu, Oct. 27, 1866.

No ka Nonanona.

E KE AU OKO A E — Aloha o
Oka Ne... he wahi holoholona i lili
loa ia ke hana aku.

A he mea hoowabawaha ia hoi e kekahi poe. Ma na aina o Aferika wsena kahi i nui ai na Nonanona keokeo a me na Nonanona eleele; ua ike ia no paha e na kamaaina oia wa ka moololo o ka Nonanona.

Ma ko kakou nana pono ana i kona kino a me kona ano, aole ku i ka mabalo iaia. Aka, ma ko Solomona boike ana i kona moololo no ka Nonanona. Ua kauoha ia mai ke kanaka e hiamoe ana, e hele e nana i ka Nonanona.

Kupanaha maoli; no keaba i kauoha ia i ke kanaka, ka mea uhane, e hele e nana i ka Nonanona?

No ka ikeia he mea hana mau ka Nonanona, a he mea molowa wale ke kanaka, hiamoe wale i ka ia.

Ehua no ano o ka Nonanona. 1—He mea e ino ai kekahi mea. 2—He mea hoopau ae i kekahi mau mea hana i ka luhio o ke kanaka.

No na mea e ino ai. Aia ma na mea ai a me na mea inu a ke kanaka, ua hiki loa i ka Nonanona ke hoopaha pono i kona mau rumi ana i makemake ai.

Ina paha he mau ipu kai e waiho ana, ua uhao ia nae i ka io puana me ka bipi, a ua poi ia no hoi a paa, alaila, i ka moe ana a kakahiaka nui se, kii aku oe e wehe ae, nana iho oe, ua paha pono loa i ka Nonanona.

Pela no i ka huewai, ua hiki no i ka Nonanona ke hoopaha pono i kona mau waihana e like me kona makemake.

Ina aole oe e nana mau ina mea ino meloko, alaila, e komo pu ana ka Nonanona iloko ou.

No ka hoopau ana i kekahi mau mea e po-

ino ai ka luhio o ke kanaka.

Ma na Aupuni i laha nui ai ka Nonanona. Ke kokua mai nei no ia holoholona lili i ke kanaka.

Ma na aina i pilikia pinepine na mea kanu no ka pau i ka enuhe (oia hoi ka peelua.) A i na he nui ka Nonanona ma ia aina, alaila, aole e lanakila mai ka enuhe maluna o na mala uala, no ka mea, he biki loa i ka Nonanona ke hoopau ae i ka enuhe.

Ma na mala uala i paha pono ole i ka Nonanona, ua maopopo no, e lanakila ana ka enuhe maluna ona.

Ma kekahi mau aina o ke ao nei, ke mala ma nei lakou i ka Nonanona, no ka ikeia he mea maikai.

Ma keia mau la koke iho nei no, ua kemalilio mai o K. Maskua ia'u, ke lawe nei ko Lanai poe mahai i ka Nonanona mai Maui a i Lanai: Ua bahao ia kekahi mau io bipi iloko o na puniu a me na pobue, ua waiho hamama ia a paha i ka Nonanona, alaila, popoi ia ke poi, a o ka lawe aku no ia i ka mukupuni o Lanai. O ka lawe loa aku no ia a ka mala uala, malaila e lu aku ai, a noho aku la iloko o ka mala uala. I ka wa e kii mai ai na enuhe poko i na lau uala, alaila, o ka hohu se la no ia o na Nonanona i ko lakou mana nui.

Pela iho la i pau ai ko Lanai piliki i ka Nonanona, a koe na mea kanu i ka enuhe.

He keiki kamaaina au no Lanai, a ua ike nui au, i ka nui o ka peelua, a o ka poe makau i ka peelua, aole e pono ke hele ma na alanui. I ka wa e mahai ai ko Lanai mau kamaaina, e eli auwaha mau lakou ma hai o ka mala a hohonu, e eli i mau lau, a i ka wa e kolo mai ai na enuhe a hualu i ka auwaha, alaila, kii aku ka mahai a pepehi iho i ka enuhe, a pela iho la e make ai ka enuhe ia manawa.

He hana nui nae ia, aka, i ka wa i loa aku nei ka Nonanona, akahi no a pau ko Lanai pilikia. He mea hou i ko Lanai poe ka hana ana i ka Nonanona, a he pono ke kapa ia o Lanai. "Hui hana holoholona." He

Little Fire Ants

mau makahiki ae nei ko'u ike ana, he hanai
Hipa, Kao, Pelehu ko Lanai.

A i keia wa hoi auanei, he Ahahui hanai
Nonanona.

I ka wa o Kaululau kekahi kanaka kabiko,
ke kupu eu mua o Lanai, o ke akua o Lanai
Hale kana i kapilipili i ka maka, koe no ka
maka o ka enuhe, eia ka i ka wa mai nei o
na moopuna a ua o Kaululau nei, loa mai
nei ka mea e pau ni ka enuhe, oia hoi ka
mea nona ke poo e kau ae nei maluna "No-
nanona."

E hele imua o Lanai ma ka malama ana i
na Nonanona. W. N. PUALEWA.

Honolulu, Oct. 27, 1866.

LESSON II. CITIZEN SCIENCE: Help Detect, Report, and STOP the Little Fire Ant

First, contact the Invasive Species office on your island to arrange two visits from an outreach educator (<http://dlnr.hawaii.gov/hisc/info/policy/>). In the activity below for grades 4+, students first learn how to collect ants near school, home, or elsewhere on the island. In the second visit, students identify whether they are (or might be) *Wasmannia auropunctata*, the little fire ant.

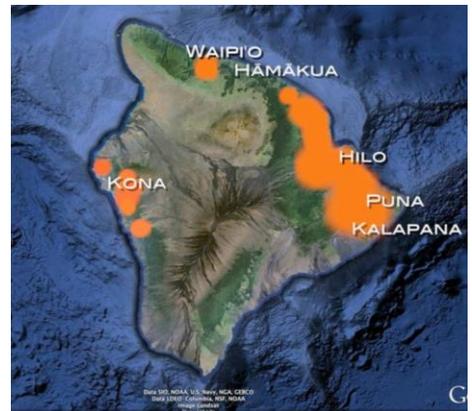
Day 1: Survey for Ants

First, learn the impacts of LFA by watching MISC's movie:

<https://www.youtube.com/watch?v=u3lyvhhR-s&feature=youtu.be>. Next, learn what you can do. View this 3-minute video on how to survey for LFA:

<http://vimeo.com/97558997>. Surveying your property and turning in ant samples are the best ways to help. It is very important to follow instructions, and be accurate about where the ants were collected. If students share ant samples with others who forgot to bring in samples from their own yards, this is OK, but they may NOT claim that they were collected in different places. Inaccurate or false data can harm our ability to find and eradicate LFA.

You won't get stung while surveying for LFA. They move very slowly; do not run around when disturbed, and do not sting unless accidentally squeezed between clothes or watchbands and skin.



Materials & Setup

- 10 (or more) clean, disposable chopsticks (or popsicle sticks).
- Peanut butter (the cheaper kind works best; the "natural" kind doesn't work as well; if you have peanut allergies, use small squares of luncheon meat, with tongs to pick them up)
- Small, zip-top plastic bags (sandwich or snack size)
- 1 larger bag (large ziplock) to keep ant samples and data sheet together
- Pencil for filling in the Survey Log sheet
- Permanent marker/sharpie to write on the bags

Little Fire Ants

- Survey Log sheet

Survey Instructions

Survey in the mornings or early evenings, in dry weather. **Do not survey when it is raining.**

1. Fill in the Survey Log (attached) with your name and contact information, and draw an easy map of your location in the space provided (see example on Survey Log).
2. Smear a tiny amount of peanut butter on the non-painted end of each of the chopsticks. Scrape most of the peanut butter OFF and back into the jar—ants can smell even a small amount of peanut butter.
3. Place the chopsticks around your yard or survey area in moist, shady areas, in and around plants, at the edges of your property, and near trashcans and mulch or green waste piles. Try to place the sticks about 15 feet apart.
4. On your Survey Log, number each site where you place your chopsticks, (1-15, or however many chopsticks you use).
5. Wait 1 hour.
6. Open a ziplock bag and carefully pick up and place any chopstick with ants into its own zip-top bag. Seal it then use the permanent marker to number the bag so it corresponds to the number on the map. **Note:** don't open the bag again after you've sealed it. Use a new bag for each stick, so there is no chance of ants escaping from a previously sealed bag.
7. Repeat for other chopsticks with ants.
8. Place all the bags in the freezer overnight to kill the ants.
9. Bring the frozen samples for ant identification to class or next meeting; or, if unable to attend ID lab, samples and data sheets may be mailed or delivered to Hawai'i Department of Agriculture, 1428 S. King St. Honolulu, Hawai'i 96814.

Day 2: Little Fire Ant Identification Lab

On the day of the ID lab, try to keep the bags with samples frozen or refrigerated until the lab. Avoid carrying the bags with samples around too much, as the ants may get crushed or too coated with peanut butter to be able to identify them.

Materials & Setup

1. Ziplock bags of frozen ant specimens collected by students
2. Completed Survey Log sheet
3. Hand lens of at least 10x or dissecting microscopes (one for each lab group or student)
 - Student page “*Quick Sort*” available online: <http://stoptheant.org/wp-content/uploads/LFA-quick-sort-Final.jpg>
 - Rulers with millimeter markings
 - Computer with student data spreadsheet available here: [Spot the Ant Stop the Ant Data sheet for Oahu Citizen Scientists survey locations 091815](#)

ID Lab Instructions

1. Divide students into lab groups of two to four students each. Or allow students to work on their own if you have enough magnifying lenses or dissecting microscopes.
2. Keep each specimen with the appropriate bag and Survey Log.
3. Work through the sample bags one at a time using the Quick Sort sheet. Bags of ant samples that may be LFA (or that are unclear) should be brought to the teacher's attention.
4. Enter all highlighted fields into the Excel spreadsheet found online .

Little Fire Ants

5. Repack all suspect samples with Survey Logs for transport to HDOA. A biologist will identify the ants and notify you if they are LFA. If you suspect LFA, do NOT disturb or try to control the ants on your own, as this may spread the ants further. If they are confirmed to be LFA, we will help you.
6. Optional and effective: Follow up with an ecosystem role play where students act out different organisms, how they relate to each other, and the impact of an invasive species like LFA that can destroy the linkages among organisms.

Didn't find LFA? Don't be disappointed! The information you have gathered is very important. You have contributed information that will help guide eradication efforts. We encourage you to re-survey at least once a year, and always survey newly bought plants or materials.

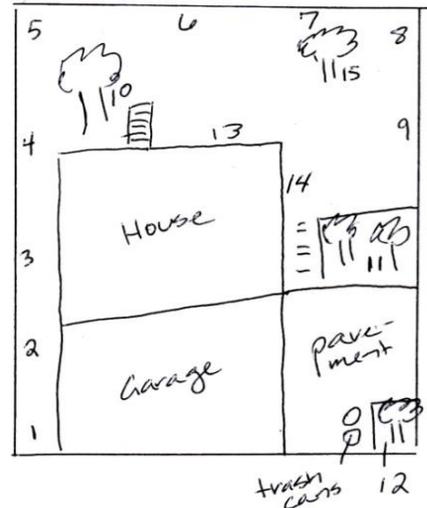
To report LFA or other species of concern, call the Pest Hotline at 643-PEST, or the Oahu Invasive Species Committee at 266-7994.

ANT SURVEY LOG SHEET

Please complete this form and bring with your ant samples for ID.

Your Name	Date of Survey
Address or Location of Survey	Start Time of Survey
Guardian or Parent Contact Name	Contact Phone (if LFA found)

In the space below, draw a diagram of your yard or survey area. Number the approximate locations of each chopstick. Example:



LESSON III. MOCK LFA HEARING OF YOUR NEIGHBORHOOD BOARD

1. Research information about the organization you will be representing in the mock hearing to determine the likely stance it would take on the issue.
 - a. **A Hearing** is an opportunity for various organizations to be heard, for them to present testimony and arguments about an issue. Typically, testimony will be given to a judge or officials before a decision is made.
 - b. **You will be presenting testimony regarding the monitoring and removal of Little Fire Ants (LFA) in your community.**
 - c. You will be representing a particular group, arguing for their viewpoint
2. Use the “tree map” below to list the pros and cons of the issue and your organization’s involvement in the removal of LFA in relation to the three components of sustainability.
 - a. The organization you will be representing may have a clear stance one way or the other. However, a great way to argue your point is to understand both sides and be able to anticipate the arguments of others, potentially using those arguments to further your statement/stance
 - b. Provide information/evidence to support the pros and cons you listed
 - c. Use the table provided to help sort out your ideas.
3. Prepare testimony for the hearing
 - a. Your group will be allowed 5-7 minutes to present information
 - b. You may not speak or argue during another group’s presentation
 - c. Visual aids (overheads, PowerPoint slides, charts, etc) may be used to help you make your case...do some research
 - d. Each group member must speak and make a statement
 - e. Introduce yourselves, your organization and your stance before beginning your arguments
 - f. Research your organization (aside from basic information given so you clearly understand their stance)
 - g. Dress the part (optional, extra credit). For example, if you are city council member...dress how you think he or she would dress

Pose the following question: Which stakeholder should be responsible for the removal and monitoring of Little Fire Ant infestations found in (name of your community)

Assign groups* to represent stakeholders the discussion:

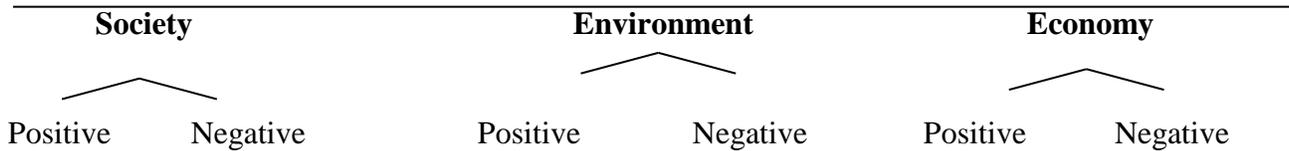
Group	Potential Organizations/Stakeholders
1	Your Town Association
2	O’ahu Invasive Species Committee
3	Residents of LFA-infested areas
4	Residents of non-LFA-infested areas
5	Management of local nursery
6	Pesticide Company Representatives
7	City Council and State Representatives from the neighborhood
8	Neighborhood Board

Little Fire Ants

*All groups should consider things like: human health, ecological impacts, sustainability, resources needed (financial, environmental, social). Students may use the tree map to help them begin to sort out their thoughts and ideas.

Sustainability Tree Map

Sustainability and Invasive species/LFA in Your Community



Elements of a strong socio-scientific justification (Source: NSTA The Science Teacher)

Makings of a strong justification	Which means...
Decision	A position (claim) is clearly stated. The decision relates directly to the ethical question.
Facts	The facts and science content can be confirmed or refuted regardless of personal or cultural views. These can be used as evidence to support the claim.
Ethical considerations	Ethical considerations may include respect for persons, maximizing benefits and minimizing harm, and justice. These can serve as evidence to support the claim.
Stakeholder views	There are a variety of views and interests in the decision, and more than one individual or group will be affected by the outcome.
Alternative options and rebuttals	No one decision will satisfy all parties. A through justification considers strengths and weaknesses of various positions.
Reasoning and logic	A logical explanation that connects the evidence to the claim provided

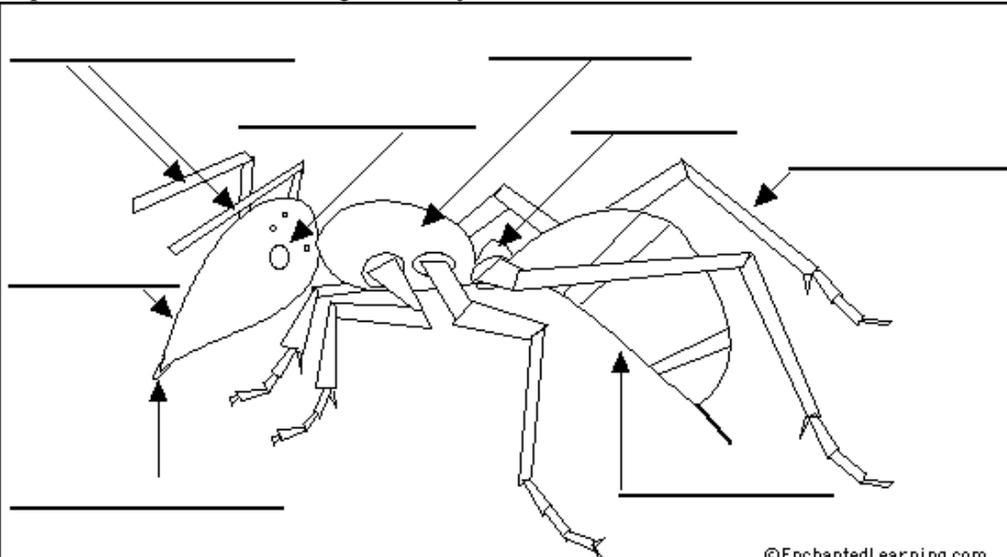
Use the table below to help you prepare for your participation in the debate
Name of the organization/stakeholder your group is representing:

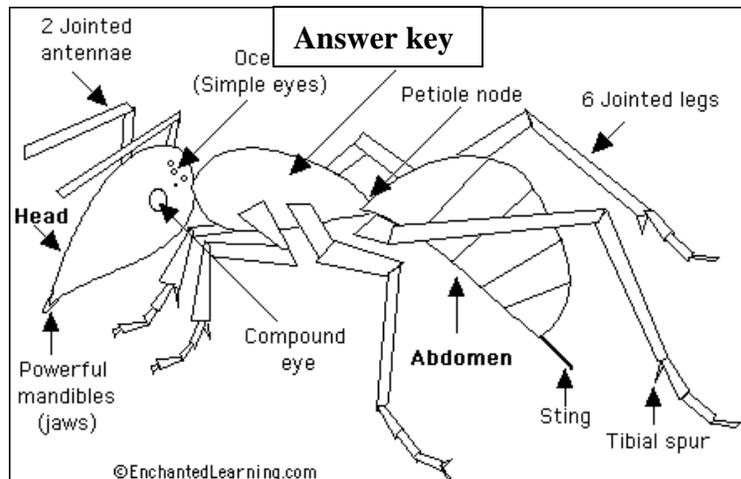
Justifying your position	Statements your stakeholder/organization might use during the debate
Decision/Position	
Facts	
Ethical considerations	
Alternative options and rebuttals	

Little Fire Ants

Reasoning and logic behind your views and position	
Final Statement...a way to drive home your point/position about the debate	

LESSON IV. ANT ANATOMY GAME

Ant Anatomy Word Bank	Ant picture
	<p>Source: http://www.enchantedlearning.com/subjects/insects/label/ant/label.GIF</p>
Head Thorax Abdomen Petiole Legs Feet/Foot Mandible Antenna Segment Spines Hair Face Eye Sting	 <p style="text-align: right; font-size: small;">©EnchantedLearning.com</p>



Little Fire Ants

LESSON V. ANT CITY, A STEAM (Science, Technology, Engineering, Art, Math) LESSON

NGSS 4-ESS3 Earth and Human Activity: Cross-cutting Concepts: Influence of Science, Engineering and Technology on Society and the Natural World

Students sketch a city or other location/object that has components that can be analogous to ant physiology and anatomy. For example, the stomach of the ant could be compared to the garbage trucks in a city or the engine in a car. Students may need to research the anatomical parts to help them make analogies to the parts of their “city.”

Modify for grade level of your students.

Fill in the chart to help you develop your Ant City

Internal or External Anatomy	Function in Ant	Analogous to...	Reason it makes sense
Brain			
Heart			
Nerve Cord			
Crop			
Stomach			
Rectum			
Poison Glands			
Dufour’s Gland			
Head			
Thorax			
Abdomen			
Petiole			
Legs			
Feet/Foot			
Mandible			
Antenna			
Antenna Segment			
Spines			
Hair			
Face			
Eye			
Sting			

RESOURCES FOR LITTLE FIRE ANT LESSONS

Chris Frohlich's Picks: Resources for Little Fire Ant

1. Top on the list would be the Stop the Ant website:
 - <http://stoptheant.org/> has condensed a lot of the updates and educational videos into one website.
 - Fire! Youtube video: <https://www.youtube.com/watch?v=u3lyvhhR-s&feature=youtu.be>
 - Identification keys for ant species in Hawaii.
 - Discover Life Ant ID: http://www.discoverlife.org/mp/20q?guide=Ants_Hawaii
 - Antweb for Hawaii:
<https://www.antweb.org/taxonomicPage.do?rank=genus&project=hawaiiant&images=true>

Additional Resources

1. "Welcome to the Hawaii Ant Lab." *Welcome to the Hawaii Ant Lab*. N.p., n.d. Web. 14 Mar. 2016. <http://littlefireants.com/research.html>
2. [How to test for LFA***](#)
3. <https://vimeo.com/97558997>
4. <http://dlnr.hawaii.gov/hisc/info/little-fire-ants-on-oahu-response-updates/>
5. Ho'ike o Haleakala Curriculum - <http://www.hoikecurriculum.org/activity/finding-the-little-fire-ant/>
6. UH GK-12 Project Ant Project - Dan Gruner - <http://www.hawaii.edu/gk-12/evo/dang.mp.htm>
7. Identification Keys for Ants in Hawaii - <http://www.hear.org/ants/speciesinfo/keys/>

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