

FIRE ANTS

The following information on fire ants is compiled from the NPS IPM Manual, university publications, pesticide labels, and Internet resources. Use it as a source of basic information to implement your IPM program for fire ant management. Formulate your pest management plan or activity within the framework of the management zones where it will be implemented and give full consideration to threatened and endangered species, natural and cultural resources, human health and safety, and legal responsibilities.

Fire ants are aggressive and swarm over anyone and anything when their nests or mounds are disturbed. Stepping on a mound is almost unavoidable when walking in heavily infested areas. Many mounds are not easily seen and have lateral tunnels extending several feet away from the mound just beneath the soil surface. Ants defend these tunnels as part of their mound. A person who stands on a mound or one of its tunnels, or who leans against a fence post included in the defended area, can be attacked. Typically, the ants can be swarming on a person for 10 or more seconds before they grab the skin with their mandibles and inject their stingers.

In infested areas, fire ant stings occur more frequently than bee, wasp, hornet, and yellow jacket stings. Although a single fire ant sting hurts less than a bee or wasp sting, the effect of multiple stings is impressive. Some people experience a generalized allergic reaction to a fire ant sting and each sting usually results in the formation of a pustule within 6 to 24 hours. The majority of stings are uncomplicated, but secondary infections may occur if the pustule is broken, and scars may last for several months. However, if a sting leads to hives, chest pains, nausea, severe sweating, loss of breath, serious swelling or slurred speech, the person should receive emergency care immediately. Persons hypersensitive to fire ant venom face a life-threatening situation. Individuals who are allergic to fire ant toxins may require desensitization therapy.

Fire ants typically are ground nesting but will nest in boat hulls, wall voids, around plumbing, and under carpeting in structures. Mounds are often built adjacent to walls, tombstones, curbs, boulders, or slabs that hold and radiate warmth. They have also been found in outdoor electrical equipment, switch boxes, telephone booths, and light poles, apparently attracted to the electrical fields. Other infested sites include household electric meters, traffic signal control boxes, and even airport runway lights. Playgrounds, parks, and picnic areas in fire ant-infested areas go unused and it can be difficult to put up or take down a tent at an infested campsite without being stung.

Fire ants cause damage by feeding directly on plants or by protecting other insects that damage crops. Mounds in fields and lawns often interfere with mowing operations. Dried and hardened fire ant mounds damage equipment and operators may be reluctant to enter areas infested by ants. The number of mounds per acre that can be tolerated in regards to equipment damage must be determined on a case-by-case basis. Fire ants have caused sections of roads to collapse by removing soil from under the asphalt.

Fire ants may be considered beneficial because they aerate and move large volumes of soil and are voracious predators, especially on pests such as boll weevils, sugarcane borers, ticks, house fly larvae and cockroaches. However, they are not selective predators and thus reduce biodiversity wherever they are located.

Fire ant management consists of a series of questions and decisions: What species are in the area? How extensive is the infestation? How high is the risk that visitors or park personnel will be stung? How much damage are the ants doing? Is control action justified? What are the best strategies of control? Answering these questions requires inspection and monitoring to determine the nature and extent of the problem.

BIOLOGY AND IDENTIFICATION OF FIRE ANTS

There are many species of fire ants in the United States, but the most serious pests for NPS personnel are four in the genus *Solenopsis*: the red imported fire ant, the black imported fire ant,

the southern fire ant, and the fire ant. Distinguishing between imported and native species of fire ant is difficult. The four species of major concern are:

Red imported fire ant, *Solenopsis invicta*, was introduced from South America and ranges over 230 million acres in the Southeast from Texas to North Carolina. This ant is associated with disturbed habitats that are mostly created by humans. Fire ants are abundant in old fields, pastures lawns, roadsides and many other open sunny areas. This species is rarely found in mature forests and other areas with heavy shade unless fire or storms have disturbed part of the area. The red imported fire ant becomes the number one fire ant pest wherever it occurs.

The red imported fire ant builds mounds (up to 1,000 per acre) that are symmetrical piles of excavated soil, rich in organic materials and are laced with interconnected galleries and chambers. Mounds can be 10 to 24+ inches in diameter and 10 to 18 inches high. In areas where grass is periodically cut, mounds are flush with the ground and are hard to see. There are usually 30 to 100 single-queen mounds per acre. There may be 80,000 to 250,000 ants per colony. Multi-queen mounds, containing 10 to 100 queens per mound, are smaller but there may be 200 to 700 mounds per acre. Mounds provide for microclimate regulation--controlling the temperature and humidity. The ants can maintain a temperature inside the mound much higher than that found outside. This allows the colony to continually grow during cool weather. The mounds' galleries and chambers' tunnels may extend 6 feet underground. During foraging periods, only a small percentage of ants stay inside the mound; most ants are out gathering food and exploring.

A newly established nest rapidly produces young and winged reproductives for most of the year (8-10 months). Red imported fire ants quickly spread through suitable habitat, and the species is now found throughout most of the southeastern United States and west into Texas.

Black Imported Fire Ant, *Solenopsis richteri*, is found in a small area of northern Mississippi. It is very similar to the red imported fire ant but may be displaced from established habitats by the red fire ant. Although some scientists believe that the black and red fire ants are two distinct species, it has been discovered that hybrids of these ants produce viable offspring. Some scientists now wonder whether they are simply two races of the same species that vary only in color and perhaps behavior.

Southern Fire Ant, *Solenopsis xyloni*, is a native species that occurs from North Carolina south to northern Florida, along the Gulf Coast and west to California. Typical mounds are flattened and irregular, covering 2 to 4 square feet. Mounds are frequently constructed under stones, boards, and other objects or at the base of plants. These ants also nest in wood or the masonry of houses (especially around heat sources such as fireplaces). Nests often consist of loose soil with many craters scattered over 2 to 4 square feet. In dry areas, nests may be along streams, arroyos, and other shaded locations where soil moisture is high. Southern fire ants usually swarm in late spring or summer.

Fire Ant or tropical fire ant, *Solenopsis geminata*, is a native that ranges from South Carolina to Florida and west to Texas. Very similar to the southern fire ant, it usually nests in mounds constructed around clumps of vegetation but may nest under objects or in rotting wood.

The Ant Colony and Life Cycle

The life cycles of the four fire ant species discussed above are very similar. Fire ants begin life as an egg, which hatches into a legless, grub-like larva that depends totally on worker ants for food and care. After molting and reaching its final size, the larva becomes a pupa in which various adult structures, such as legs, and in some cases, wings become apparent for the first time. The pupa is the transitional stage between the larva and the adult. In insects in general, the adult stage is specialized for reproduction and dispersal; with ants, some adult individuals are capable of reproduction (queens and kings) and the remainder are sterile workers.

The social unit of fire ants is the colony. Colonies pass through a characteristic life cycle. In addition to workers and a queen(s), mature colonies contain males and females capable of flight and reproduction. These individuals are generally called "reproductives." On a warm day, usually

one or two days following a rain, the workers open holes in the nest through which the reproductives exit for a mating flight. Mating takes place 300' to 800' in the air. Mated females descend to the ground, shed their wings, and search for a place to dig the founding nest (a vertical tunnel 2" to 5" deep). They seal themselves off in this founding nest to lay eggs and to rear their first brood of workers. During this period they do not feed and instead utilize reserves stored in their bodies. The first worker brood develop in about a month; these are the smallest individuals in the entire colony cycle. They open the nest, forage for food, rear more workers, and care for the queens. Hereafter, the queen(s) essentially become egg-laying machines -- each may lay up to 1,500 eggs per day.

Colonies of red and black imported fire ants become territorial as they grow; they defend an area against all other fire ants. Therefore, fire ant colony populations often reach an upper limit depending on the territory size of mature colonies. A typical figure for pastureland seems to be about 20-50 mounds per acre in single queen nests. Mature colonies of imported red fire ants consist of approximately 80,000 workers, but colonies of up to 240,000 and more have been reported.

Multiple queen colonies are fairly common. A colony may have 10 to 100 or more reproducing queens. Multiple queen colonies can mean up to 10 times more mounds per acre. Queens generally mate several times and may live for several years.

The colony grows rapidly by the production of workers that gradually enlarge the original vertical tunnel into multiple passages and chambers. The colony matures when reproductives are once again produced. The reproductives leave to mate and form new colonies. A mature colony of red imported fire ants may have 6-10 mating flights between spring and fall and produce 4,500 reproductives during the year. Colonies can produce nearly 100,000 queens per acre in heavily infested land, but mortality rates, mostly from predators, can reach 99%. Workers are short-lived and usually will not survive an entire season.

Feeding Habits

The oldest and most expendable 20% or so of the colony's workers leave the nest to search for food. They explore 50-100 feet from the nest with an efficient looping pattern. Although the worker ants can chew and cut with their mandibles, they can only swallow liquids. When they encounter liquid food in the field, they swallow it and carry it back to the nest. Solid food is cut to reasonable size and carried back to the nest.

Like other ants, they share their food with their nest mates by regurgitating. In this way, most ants in the nest get fed equally. This food sharing is also why baits can be an effective control tactic against fire ants.

MONITORING AND THRESHOLDS FOR FIRE ANTS

Monitoring

The first step is to identify the species of fire ants found in the park. Next, determine the number of active mounds in a particular unit area. Any mound, where at least three ants are observed after mound disturbance, should be considered active. Twenty or more mounds per acre in a heavily used area is considered a heavy infestation. Heavily infested fields can contain over 1000 active mounds per acre.

To estimate populations for comparison studies, collect ants attracted to baits in a test area. A small piece of hamburger and a small piece of sweet food are each placed on a piece of aluminum foil or in a small plastic cup. The two baits are placed on the ground, 1 to 3 inches apart, at each bait station. Bait stations are placed about 10 yards apart. The number of ants attracted to the baits per unit time is determined.

Threshold/Action Population Levels

The threshold population levels for fire ants will vary according to the species and the sites. In certain camping and recreational areas, for example, very few active mounds per acre would be

tolerated. In contrast, a few active mounds per acre probably would be acceptable in other types of sites; little-used hiking areas, for example. Correlate fire ant populations observed through the use of monitoring techniques with complaints received from park visitors and personnel. In this way, a complaint threshold level can be established for each park site.

In areas where fire ants are not causing any problems, the best solution may be to do nothing. Some sites will only support a limited number of fire ants. These may be in the form of a few large colonies or many small ones. Established mounds defend territories and prevent the establishment of new colonies. Maintaining several large and perhaps well-marked colonies may stabilize fire ant populations in an area as long as they are in infrequently visited sites.

Some researchers believe it may be best to selectively control fire ant colonies. This allows native species to flourish as a way to prevent the introduction of the imported species, or leaving single queen imports alone to prevent the area from invasion by a multiple-queen "supercolony."

NON-CHEMICAL CONTROL OF FIRE ANTS

Water

Pouring boiling water on individual mounds will give varying degrees of success. Research shows that, when 3 gallons of very hot water were poured into mounds, approximately 60% of the treated mounds were eliminated. Thus, surviving mounds will need to be treated again. Steam treatments, using a steam generator, have been utilized with some success. However, both techniques are cumbersome in the field and, in heavily infested areas, require carrying large volumes of water.

Area-wide flooding or prescribed burning of fire ant infested areas is ineffective and may promote the establishment of new colonies.

Mechanical Disturbance

Destroying mounds during the warm season will not reduce the number of active mounds as ants quickly rebuild their nests. However, dragging or knocking down mounds just before the first hard freeze may provide a limited level of control. Pulling a steel I-beam bar, weighing about a ton, behind a tractor across the ant-infested area will knock down mounds.

A number of mechanical mound pulverizers, ant electrocuters, even nest exploders, have been developed for fire ant control. However their practicality and their effectiveness have been less than desirable.

Biological Control

Nematodes, bacteria, fungi, viruses, parasitic phorid flies, and microsporidia have been evaluated as biological controls. So far, the most effective of these is a nematode, *Neoaplectana carpocapsae*. In trials, one application inactivated about 80% of treated mounds in 90 days. The straw itch mite, *Pyemotes tritici*, has also been shown to inactivate fire ant mounds. Three to ten applications at about two week intervals gave 70% control. Practical use of this mite for fire ant control must await the development of more efficient methods of mass production and increased effectiveness. Another problem is that this mite is a pest of people and animals as its bites cause dermatitis.

Several species of South American Pseudacteon phorid fly parasitoids are being studied for their ability to reduce the aggressiveness and ecological impact of introduced fire ants. Some species are specific to the imported fire ant and are now permitted for release in Texas. These parasitoids disrupt ant foraging efficiency and nest defense actions. Their most significant impact appears to be their ability to compete for food not to reduce populations through direct mortality, but rather to reduce the capacity of target species to compete with other ants for food or (presumably) nest sites.

Exclusion

Fire ants nesting near buildings will enter through tiny cracks and openings and forage through a structure. Caulking and sealing cracks and crevices can suppress their entering. Many effective, easy-to-use silicon sealers and expandable caulk products are available and easy to use. Fire ants and other pests can be excluded with proper maintenance of structures, by installing door sweeps and screening, and eliminating desirable nesting habitat adjacent to the structure.

Public Education

Education is the most effective measure for preventing injury to park visitors and personnel. Direct visitor activities away from highly infested areas. Inform visitors about the habits of fire ants, how to recognize them, and how to avoid them. Also, encourage visitors to use proper sanitation so that fire ants are not attracted to use areas and post information on what to do if a person is stung by fire ants.

CHEMICAL CONTROL OF FIRE ANTS

Many different chemical products are available for fire ant control. There are three major ways to manage fire ants with chemicals: broadcast treatment of large areas, treating individual mounds, and spot treating infestations and mounds in and around structures. Remember to consult with your IPM coordinator for specific pesticide recommendations for your area.

Do not use gasoline or other petroleum products for fire ant control. While many of these materials will kill fire ants, they are extremely flammable, will kill grass and other plants around treated mounds and can seriously pollute the environment.

Broadcast Treatments

Baits for broadcasting consist of pesticides on soybean oil-coated corn grits. Although baits can be applied as an individual mound treatment, they are most effective when used as a broadcast treatment. Broadcast treatments are less expensive (in terms of product cost as well as time) and control colonies even when mounds are not visible. See The Two Step Method of Fire Ant Control for more on baiting.

Bait products (see attached labels) contain different active ingredients that work in unique ways. AMDRO® (hydramethylnon) is a slow-acting poison that causes approximately 80 to 90 percent of the mounds in a treated area to become inactive within 1 to 5 weeks. AWARD® (fenoxycarb) and PT 370 ASCEND® (avermectin) act as insect growth regulators. Their main function is to keep queen ants from producing more workers. It may take 5 to 10 weeks or more for the results to be seen, but as many as 90 percent of the fire ant mounds in the treated area may be eliminated. Control usually peaks 3 to 4 months after application. Baits applied in the spring (March through May) provide the most rapid population suppression. Although control may last up to a year, especially in areas larger than an acre, reinvansion occurs about six months after treating. Smaller yards may show less dramatic results because they are more easily reinfested from adjacent, untreated sites. Baits can be applied with hand-held seed spreaders such as the Cyclone Seed Sower® or Ortho Whirlybird®. Set the spreader on the smallest opening and make one or two passes over the area at a normal walking speed to apply the recommended rate (generally 1 to 1 ½ pound per acre or approximately 1 ounce per 2000 square feet).

Broadcast insecticide spray applications are an undesirable treatment option because of the broad spectrum of such treatments and their effects on non-target species.

Individual Mound Treatments

There are both chemical and non-chemical methods for treating fire ant mounds one at a time. Treating individual ant mounds is time consuming, but it is generally the most effective method of control in small areas. It takes from a few hours to a few weeks to "kill" the mound, depending on the method or product selected. Individual mound treatment is usually most effective in the spring. The key is to locate (good luck!) and treat all the mounds in the infested area. If many small mounds are missed, re-infestation of the area can take place in less than a year.

Baits should be applied around the periphery of individual mounds. When doing so, DO NOT disturb the mound.

Mound drenches are labor intensive because large volumes of water are used. They are most effective after rains when the ground is wet and the ants have moved up into the drier soil in the mound. To enhance effectiveness during excessively dry weather, soak the soil around the mound with water before you treat. Products containing carbaryl, diazinon, and chlorpyrifos are labeled for fire ant control. Solutions in 1 to 2 gallons of water are poured on the mound to penetrate the entire nest. Mound drenches generally eliminate mounds within a few hours. Avoid getting the product on your skin by always wearing unlined rubber gloves. Mix the proper amount in a 1 or 2-gallon container such as a sprinkler can and write "Poison" on the container and do not use it for any other purpose. Follow directions for dilution of the insecticide and gently wet the mound and surrounding area with insecticide. Then break open the top of the mound and pour the insecticide dilution directly into the galleries.

Dusts must be dry and evenly distributed over the top of the mound to be effective. Dusts, such as ORTHENE® Fire Ant Killer (75 percent acephate), are picked up by ants walking through the treated soil and transported back to the mound. Within a few days the entire colony should be killed. To use a dust, distribute the recommended amount evenly over the mound. The disadvantage of using dusts is that a noticeable residue is left on the surface for several days following treatment.

Granular products offer another method of getting insecticide into fire ant mounds but are labor intensive and must be watered in. The active ingredient is released when water is poured over the granules. To treat a single mound, the recommended amount is sprinkled on top of and around the mound and then watered in with 1 to 2 gallons of water sprinkled on so as not disturb the mound or wash the granules off the mound.

Expect poor results if you apply less than the recommended amount of water with either liquid concentrates or granular insecticides. Unless the product completely penetrates the mound, ants will move to a different site via underground foraging tunnels to avoid the poison.

Mound injection insecticides are injected directly into fire ant mounds. They may be injected using a "termite rig" with a soil injector tip, a standard 1-3 gallon compressed air sprayer with a fire ant injector tip, or a special aerosol soil injector system. The mound is injected in a circular pattern, usually at 3 to 10 points.

Low Toxicity and Non-chemical Treatments

A few active ingredients used in fire ant control products are commonly referred to as "organic" or "least-toxic" (e.g., boric acid, pyrethrins, rotenone and diatomaceous earth). Diatomaceous earth, a natural silica-based dust, will kill some ants, but is not very effective when the soil is moist and it rarely eliminates ant colonies when used alone.

The effectiveness of products containing pyrethrins and boric acid, as compared to standard insecticides, has not been adequately determined.

Spot treat with insecticides if fire ants are nesting in a structure (in a wall void, for example). The nest should be treated directly - usually by drilling and injecting with a residual insecticide). Treating ant trails or applying barrier treatments to keep fire ants from foraging in occupied areas are generally not acceptable choices for Park Service facilities.

Summary of Management Recommendations

Park visitors and personnel should be directed away from infested areas and encouraged to observe proper sanitation procedures so that fire ants are not attracted to recreational sites.

Mechanical and other non-chemical control measures should be considered first if control is deemed necessary. Remember that control may not be necessary in many cases. When it is

necessary, chemical control, particularly the use of baits, may be used if other control measures have failed given unsatisfactory results.

The Two-Step Method is a simple approach that can effectively control fire ants in heavily infested areas where non-chemical means have not provided satisfactory control.