Invasive Species Management Plan

Eradication of the Little fire ant *Wasmannia auropunctata* from Anguilla

This document presents an eradication plan for Little fire ant *Wasmannia auropunctata* (LFA) from Anguilla. LFA is a small ant, highly invasive worldwide, that could be relatively easily eradicated from the limited populations in which it is currently found on Anguilla.

The plan includes biosecurity actions to reduce the risk of reinvasion.

There are four main sections:

Section I Situation analysis: provides the background, justification and general information on the problem: why this species needs to be managed, who is concerned and who will be involved in implementing the action plan.

Section II Technical considerations: identifies and assesses the different management options available, with their respective pros and cons.

Section III Action plan: outlines the proposed procedure, based on the information and constraints outlined in Sections I and II.

Section IV Further information: references and links for further information on the target species and management methods considered.

Annexes include information on the target species, and any best practice guidelines appropriate for managing it.

Section I. Situation analysis

This section provides background, justification and general information on the problem.

Title	Response
Target species	(Give common and scientific names) Little fire ant *Wasmannia auropunctata* (LFA)
Distribution in territory	(As detailed as possible) In 2006, J.K. Wetterer reported only one region in Anguilla where a dense population of this species was found, in the closed canopy forest of Katouche Valley. However, the exact distribution of the species in Anguilla is not known and there is low confidence in the situation assessment for this species. It is known to be established in neighbouring St. Martin.
Why is the species a problem?	(Justify why this species needs to be managed, summarising it's impacts on biodiversity, the economy and/or public health) This ant is highly invasive worldwide. It forms 'supercolonies' and has been responsible for reducing species diversity in many places where it is invasive, including impacts on vertebrates (e.g. turtles and breeding birds) and invertebrates (e.g. tree dwelling insects and arachnids). It also causes a painful and long-lasting sting and could become a substantial nuisance for people and tourism. In infested citrus groves in the US the ants are prominent on the leaves, around fruit, and on the trunk, making contact between the ants and workers unavoidable, adversely affecting fruit production. In houses, the little fire ant may infest clothing, beds, furniture, or food. In houses the ants prefer foods such as peanut butter and other oily materials, while in nature the ants tend honeydew-secreting insects. The workers also feed on dead arthropods and small animals, and are probably predacious on many live insects. It is considered to be perhaps the greatest ant species threat in the Pacific region. This species has been nominated among 100 of the 'World's Worst' invaders.
Does the species provide any beneficial effects?	(Identify any benefits this species provides) It is used as a biological control agent on cocoa plantations in Gabon and Cameroon.
Previous or current management in the territory	(Summarise previous successes and failures at managing this species, if any) This species has not been managed before in Anguilla.
Pathways of entry	(How does this species arrive in the territory?)

<table>
<tr><td></td><td colspan="2">Risk of introduction is high as it is likely to be transported in soil and on plant parts as a contaminant, and it is also associated with fresh produce, equipment, lumber.</td></tr>
<tr><td>Pathways of spread</td><td colspan="2">(How does the species spread within the territory? This may be different for different life stages)
Through movement of infested material within Anguilla. This includes plants, planting material, soil, composts, equipment and lumber.

It can spread via floating vegetation or debris, particularly on logs.</td></tr>
<tr><td>Gaps in knowledge?</td><td colspan="2">(Identify any key areas where knowledge is lacking, if any)
Mapping required to confirm the current distribution and abundance.</td></tr>
<tr><td>Legal framework</td><td colspan="2">(Identify the legislation covering management actions for this species in terms of what can be done, gaps)
• Plant Protection Act:
o Can restrict the importation of plants that may pose a pest or disease risk</td></tr>
<tr><td rowspan="7">Key stakeholders affected by this species</td><td colspan="2">(List the key stakeholders and note briefly their interest in this species – impacts or benefits. Add lines as necessary)</td></tr>
<tr><td>Stakeholder</td><td>Interests</td></tr>
<tr><td>Hoteliers</td><td>Interest in eradication due to the threat of impact on tourism</td></tr>
<tr><td>Householders</td><td>Interest in eradication due to the threat of impact to recreational activities, gardening etc.</td></tr>
<tr><td>Environment</td><td>Concerned about invasion further in the wider environment</td></tr>
<tr><td>National Trust</td><td>Concerned about invasion to off-shore islands</td></tr>
<tr><td>Agriculture</td><td>Concerned about impacts on farming if they spread, as stings would affect farmers activities</td></tr>
<tr><td rowspan="5">Agencies involved in management</td><td colspan="2">(List the agencies or bodies who would be involved in managing this species. Add lines as necessary)</td></tr>
<tr><td>Agency</td><td>Role</td></tr>
<tr><td>Environment</td><td>TBC</td></tr>
<tr><td>National Trust</td><td>TBC</td></tr>
<tr><td>Agriculture</td><td>TBC</td></tr>
</table>

	Hoteliers	TBC
Any other relevant information	(Include any other information relevant to management of this species) Identified in the prioritisation exercise in March 2020 as a species with a high feasibility of eradication[1]. This species currently appears to be isolated to a relatively small part of Anguilla and immediate eradication could prevent substantial problems in the future for both biodiversity and tourism. Ants can be difficult to detect and identify and so surveillance would be necessary to ensure they are not already more widely established than currently suspected. Eradication should be highly feasible; however, given the suspected location of this species in the Katouche Valley, access to the land may be difficult (hence only medium score for practicality). As this species is known to be established in neighbouring St. Martin there would be a likely risk of reinvasion post eradication, for which biosecurity would need to be implemented.	

[1] See the workshop report at http://www.nonnativespecies.org//downloadDocument.cfm?id=2285

Section II. Technical considerations

This section assesses the different management options available.

Goal	(Identify where you want to be in the future. For example: eradication of species X from Y Cay) The Little fire ant *Wasmannia auropunctata* will have been completely eradicated from the territory of Anguilla, with a low, managed, risk of reintroduction.
Objectives	(What you want to happen in order to reach the goal. Add extra lines if required)
	1. Development of a detailed eradication plan
	2. Eradication of the Little fire ant using ant-specific pesticides
	3. Reduction of the risk of re-establishment

Assessment of possible management methods

List the possible methods for management if there are more than one. Examples are: manual removal; using pesticides; biocontrol, etc.). Add extra lines if required.

Method	**Summary outline of the method**	**Pros** Consider: effectiveness, practicality, existing expertise, cost, negative impacts, and acceptability	**Cons**	**Conclusion on feasibility**
Chemical control	Ants, including this species, have been eradicated in similar situations using ant-specific pesticides (formicides) in the form of granular baits which worker ants feed to the queen. See the CABI datasheet for details, and two examples are: 1. LFA was successfully eradicated from Marchena Island in the Galapagos using Hydramethylnon with soybean oil, 0.88%	Very effective, practical, very acceptable to stakeholders. Cost estimated to be less than US$50,000	Potential non-target impacts need to be assessed.	Very feasible

	active ingredient, applied three times in the treatment area in Marchena Island at three month intervals during the eradication programme. 2. The Hawaiian Department of Agriculture primarily used Hydramethylnon granular ant bait to target *W. auropunctata*. It is effective when it can be evenly broadcast throughout a population and when excessive humidity or rainfall does not disrupt application operations.			
Manual control	No effective methods available.			Not feasible
Biocontrol	No biocontrol agent known.			Not feasible

Section III Action Plan

This is the proposed procedure, based on the information and constraints outlined in Sections I and II.

Title	**Response**		
Strategy to be used	(Note that this may use a combination of the methods outlined in Section II) Eradication of Little fire ant using ant-specific pesticides in the form of granular baits.		
Budget (add extra lines as required)	**Item/action**	**Sources of funding**	**Cost $**
	Labour	TBC	$ TBC
	Transport	TBC	$ TBC
	Materials (pesticides, monitoring baits, application equipment, PPE)	TBC	$ TBC
	Communications materials	TBC	$ TBC

Actions

The objectives come from the table in Section II. Actions should include stakeholder engagement, and post-management surveillance. Add further objectives if required.

Objective 1. Development of a detailed eradication plan		
Proposed procedure (add more lines as necessary)		
Timeline	**Action**	**Responsible**
TBC	Initiate a monitoring programme using a grid of fixed monitoring stations	TBC
TBC	Map the current distribution of LFA	TBC
TBC	Communications and awareness programme with the community to raise awareness	TBC
TBC	Trial the baiting techniques and assess the risk of non-target species	TBC

TBC	Develop a detailed eradication plan	TBC

Objective 2. Eradication of the Little fire ant using ant-specific pesticides		
Proposed procedure (add more lines as necessary)		
Timeline	**Action**	**Responsible**
TBC	Train teams in safe pesticide application	TBC
TBC	Implement the eradication plan using a programme of ant-specific bait applications	TBC
TBC	Monitor to check efficacy and non-targets	TBC

Objective 3. Reduction of the risk of re-establishment		
Proposed procedure (add more lines as necessary)		
Timeline	**Action**	**Responsible**
TBC	Establish a long-term monitoring programme	TBC
TBC	Deliver a periodic communications programme to pick up any new outbreaks / infestations through citizen science	TBC

Biosecurity measures required to prevent reinvasion		
Proposed procedure (add more lines as necessary)		
Timeline	**Action**	**Responsible**
TBC	Biosecurity checks of high risk imported goods	TBC

TBC	Biosecurity inspectors and agriculture officers trained in identifying this species.	TBC
TBC	Factsheets developed for biosecurity inspectors and customs officers. Information shared with all ports of entry	TBC
TBC	Inter-island biosecurity measures implemented	TBC

Section IV Further information

For further information see the references and links below.

References

Anon. (2009) Operational plan for management of *Wasmannia auropunctata* (Little Fire Ant) on the island of Maui, Hawaii. 2009. http://www.littlefireants.com/maui%20plan%20public.pdf

Anon. (2009) A plan for the prevention of establishment of new ant species in Hawaii, with special attention to the red imported fire ant (*Solenopsis invicta*). Hawaii Ant Group1, October 2001. https://www.invasive.org/gist/moredocs/solinv03.pdf

Booy, O. *et al*. (2020). Prioritising the management of established invasive non-native species in Anguilla: eradication and spread prevention. March 2020. http://www.nonnativespecies.org//downloadDocument.cfm?id=2285

General Emergency Response Plan for Invasive Ant Incursions. Secretariat of the Pacific Community. 2008. http://piat.org.nz/uploads/PIAT_content/pdfs/spc_ant_erp_2008.pdf

IUCN (2018). Guidelines for invasive species planning and management on islands. Cambridge, UK and Gland, Switzerland: IUCN. Viii + 40pp.

PII. 2013. Delimiting Surveys for Invasive Ants. Pacific Invasives Initiative, Auckland, New Zealand.

Links

- CABI Datasheet https://www.cabi.org/isc/datasheet/56704
- University of Florida http://entnemdept.ufl.edu/creatures/urban/ants/little_fire_ant.htm
- Ant wiki https://www.antwiki.org/wiki/Welcome_to_AntWiki
- Pacific invasive ant toolkit http://piat.org.nz/problem-ants/worst-5-identification/little-fire-ant
- Pacific invasives ant key http://idtools.org/id/ants/pia/

Annex 1. Information on the target species

Species name	(Common and scientific names) Little fire ant *Wasmannia auropunctata*
Description	(Give details of all stages in the life cycle) *W. auropunctata* is approximately 1.5 mm in length and reddish to golden brown in colour. The workers are monomorphic (they look identical). The antennae consist of 11 segments with the last two forming a distinct club. The head and thorax are heavily sculptured with grooves and pits. The erect body hairs are long, coarse and rather sparse.
Similar species	(Give details of any other species which could be confused with the target species) There are many species of ant and expertise is required to confidently identify them. The common species of fire ants can be identified in the Pacific invasives ant key http://idtools.org/id/ants/pia/
Life cycle	(Include seed bank longevity for plants) Both multiple queened (polygyne) and single queened (monogyne) colonies occur. Colonies show low intraspecific aggression (unicolonial) and high interspecific aggression. Queens typically live about a year. Sexuals are produced throughout most of the year. It was recently discovered that populations of this species have two types of reproductive system: 1) clonal populations in which males and females reproduce independently by clonation, and workers reproduce sexually; and 2) classical sexual population (workers and females reproduce sexually and males by arrhenotokous parthenogenesis). Clonal populations are associated with human or man-made habitats, whereas sexual populations occur in natural habitats.
Ecology and behaviour	A single nest of little fire ants may contain several wingless reproducing queens, numerous workers, pupae, larvae, and eggs. *W. auropunctata* has two types of ecologically distinct populations: 1) dominant populations with a high density of nests and workers, associated with highly disturbed environments (prone to anthropic or natural disturbance) and low ant species richness; 2) non-dominant populations (low density of nests and workers) associated with undisturbed environments. The success of this species as an invasive is associated with its unicolonial social organization in which individuals from different nests mix freely, forming a large, highly competitive supercolony, which can reach hundreds of kilometres in invaded areas. This type of organization has also been observed in some areas of its native range, although they form much smaller colonies. *W. auropunctata* is a generalist feeder, preferring invertebrates, seeds and other plant parts. When honeydew-producing Homoptera are present, a

	large part of its diet is likely to consist of the carbohydrate-rich residues produced by these insects
Habitats	*W. auropunctata* has been described as a true generalist in its choice of nest sites and habitats. It occurs in a range of habitats from urban settlements and fields through to undisturbed forest. Generally, *W. auropunctata* nests in unstable microhabitats. It can occur in habitats that are wet or dry and it will nest on the ground or in trees. Unlike *Solenopsis geminata*, it does not colonize disturbed habitats rapidly In natural environments *W. auropunctata* efficiently exploits twigs and leaf litter, and for its nesting substrate, while in houses, it may infest beds, furniture and food. The little fire ant nests under leaf debris, rotten limbs, stones, and in the crotches of trees or clumps of grass. Nests are frequently found behind the sheaths of palms or palmettos. The little fire ant is highly adaptable, nesting in both open and shaded areas. During heavy rains nests may be moved into buildings or trees. Favourable ant habitats include the following: Low vegetation (including grass), soil, disturbed sites, rubbish piles, road margins, building edges and foundations, concrete slab edges, cracked concrete, drains and culverts, electrical equipment, exposed rocks, fence palings, grass areas, verges, isolated weeds, logs and log stoppers, loose gravel, plant pot bases, base of flowering tree, shrubs, poles, watertraps, tree crotches, weed and plant re-growth, wooden structures and pallets.
Any other relevant information	The little fire ant is a common tramp ant species, native to Central and South America. *W. auropunctata* is atypical of many ant species in that it does not rely on the winged queen to form a new colony. The colony radiates outwards from its center of origin and comes to occupy extensive areas.

Little fire ant worker. Image ©Michael Branstetter / © AntWeb.org / CC-BY-SA-3.0

Annex 2. Best practice guidelines

These following two protocols are generic, and include all common species of fire ant.

A. Monitoring protocol for fire ants

Monitoring is done by using protein and sugar baits placed in a grid or in a line. Each bait station consists of a small (eg 60ml) clear plastic vial or jar with a lid, placed on its side on the ground.

Mark out the grid or line of the bait stations:

Where the ant habitat is continuous, bait stations should be placed in rows 10 m apart, alternating between protein and sugar baits. Where the ant habitat is patchy, at least one of each bait type should be placed (minimum of one protein and one sugar bait stations within 15 square metres), ensuring they are at least 1 m apart. Bait can also be placed in trees, taped into position. See Table 1 for a list of favoured ant habitats.

Bait stations should be placed in the shade, if possible, as at temperatures above 28°C baits rapidly dry out, reducing their attractiveness to ants.

Mark the location of each bait stations with tape or spray paint spot.

Ant surveys should be done when temperature does not limit ant activity, early morning (6am - 10am) and late afternoon (3pm – 6pm).

Surveillance should not occur during or after rain, and the bait traps need to be deployed during a time when no rain is anticipated as no rain should occur between placement of bait traps and their retrieval.

Disturbance of the litter layer, soil or infrastructure at assessment points is considered beneficial to stimulate ant activity. If baits need to be placed within a forest environment, or within leaf litter, clear a patch of leaf litter to expose the soil before setting out the bait on the cleared ground. This will increase the chances of ants locating baits in these habitats as they also travel under and within the leaf litter and could miss baits.

Remove the lid, bait the vial and place it on its side on the ground at the bait station. Baits are as follows:

a. Protein based bait: smear a line of peanut butter blended with vegetable oil (the size of half a pea) to the inner side of each bait container. In addition, place a slice of sausage, smear of tinned cat food, or piece of canned tuna inside each pot.
b. Sugar based bait: smear a line of light coloured sugary jam (eg apricot or pineapple, with no lumps or seeds) to the inner side of each bait container.

See Table 2 for which species are attracted to which baits. Only fresh baits should be used as ants are not attracted to old baits.

Bait stations should be collected 1 – 2 hours after being laid.

As each vial is picked up, the lid is put on to prevent any ants escaping. Add some 70% alcohol to any vial containing ants to preserve them, and label the vial with:

- Date set and collected (if different)
- Bait used
- Location
- Name of the person in charge of the survey

All bait stations with ants should be sent to a competent authority to identify the specimens; more than one species could be found in a bait station.

Table 1. Favoured habitats for fire ants.

Vegetation:

- Tree trunks, tree crotches and hollows.
- Flowers, weeds and plant re-growth.
- Shrubs
- Low vegetation (including grass).
- Plant pot bases.

Built environment:

- Building edges and foundations.
- Hard seal (concrete/asphalt) slab edges.
- Cracked concrete/asphalt and junctions between pavers
- Drains and culverts.
- Electrical generators and fittings.
- Hot water pipes and heaters, air conditioning units.
- Wooden structures.

General:

- Fence palings.
- Loose gravel.
- Logs.
- Exposed rocks.
- Underneath stones, concrete rubble, timber and debris.
- Rubbish piles.
- Disturbed sites.

Table 2. Bait preferences for different ant species

Scientific name	Common name	Protein bait	Sugar bait
Monomorium destructor	Singapore ant	Prefer peanut butter baits	Will come to sugar baits
Tapinoma melanocephalum	Ghost ant		Prefer sugar baits
Anoplolepis gracilipes	Yellow crazy ant	Prefer protein baits	
Paratrechina longicornis	Longhorn crazy ant	Will come to both protein and sugar baits	
Wasmannia auropunctata	Little fire ant (LFA)	Prefer oily protein baits	Will come to sugar baits
Solenopsis invicta	Red imported fire ant (RIFA)	Prefer protein baits	

Adapted from: PII. 2013. Delimiting Surveys for Invasive Ants. Pacific Invasives Initiative, Auckland, New Zealand.

B. Rapid response protocol for the eradication of fire ants

Introduction

A rapid response takes place when an ant sample has been confirmed by a competent authority as a new invasive non-native species of fire ant to Anguilla.

Goal

Eradication of a new non-native fire ant species from Anguilla.

Objectives

- Contain and eradicate a newly detected population of fire ants
- Prevent further spread, by human mediated or other means
- Surveillance of high risk sites to identify other possible incursions
- Raise public awareness to encourage reporting of other infestations
- Prevent new introductions arriving

Summary of rapid response protocol

1. Suspected fire ant collected and identification confirmed.
2. Conduct pre-treatment survey to determine the extent and nature of the infested area.
3. Treat the infested area.
4. Conduct surveys for 2 years post-treatment.
5. Repeat treatment as required.
6. Infested area should be free of ants for 2 years.
7. Determine the pathway of introduction and put in place measures to reduce the likelihood of new incursions.

Roles and responsibilities

The rapid response will be activated and coordinated by [insert relevant authority or authorities here]. Their function is to alert and call together the rapid response team, and the team will collectively assign roles and responsibilities. The rapid response team membership consists of the following core members, who may choose to recruit additional members to provide specialist input depending on the ant species and the nature and location of the incursion:

- [complete list as appropriate]

The following specific roles need to be assigned.

Field controller

- Organises surveillance and treatment schedules;
- Responsible for day to day implementation of the operation;
- Ensures that:
    - Appropriate procedures are followed and records are kept;
    - Infested products are disposed of or treated in the most appropriate way;
    - Treatments are applied correctly;
    - Health and safety procedures are followed.

Coordinator

- In charge of administration and finance;
- Coordinate actions and calls rapid response team meetings as required;
- Manages the flow of information;
- Prepares briefing notes to stakeholders;
- Designs and implements public outreach strategy.

Technical adviser

- Compiles a factsheet on the detected species including:
    - Potential impacts
    - Known control measures: outline options available
    - Potential pathways of introduction to Anguilla
- Potential means of transfer within Anguilla
- Provides technical advice on the design, format and progress of the response

Pre-treatment survey

Aim: establish the extent of the infested area.

The pre-treatment survey consists of both visual and baiting techniques.

Procedure:

When arriving at the infested site, park your vehicle at least 100m away from the suspect nest in order to minimise the chances of live ants climbing on board the vehicle and being transported elsewhere when you leave.

Before leaving the site, check your vehicle, clothing and equipment very carefully to ensure no live ants are being transported from the site.

Look for obvious mounds or nests. If appropriate, ask local people or the person who reported the ants where they were seen.

DO NOT disturb, poke or interfere with the nest. Many invasive ant species will disperse quickly when disturbed and this will make future treatment more difficult. Also be aware that several invasive ant species have unpleasant stings, so handle live ants carefully and make sure not to get any lodged in clothing. If you are worried about ant stings, dust your hands with talcum powder and/or wear latex gloves when collecting samples.

Baiting surveys:

- Use the fire ant monitoring protocol (Annex 1A), using the appropriate bait for the species which has been identified. For example, if the incursion is of ghost ants (*Tapinoma melanocephalum*) use sugar baits, if it of the little fire ant (*Wasmannia auropunctata*) use oily protein baits, while for the longhorn crazy ant (*Paratrechina longicornis*) use both types of bait.
- Each team needs to be made up of two people: one person to record complete sample sheet and/or mark waypoints, one person to deploy baits. One team should be able to place and collect around 200 vials in a day. When preparing baits, make up around 70 per person working in the survey.

Visual surveys:

- On a dry sunny day, ant foraging activity can be observed, and the foraging trail can be traced back to the colony.
- Check all favourable habitats (see the fire ant monitoring protocol for a list) for signs of ants.
- Pick a small number of colonies for detailed counts; the number will depend on staff resources, ideally pick at least 10. Within a predetermined time frame (for example, 800am), and within similar daytime temperatures, visually determine worker ant numbers moving along a selected ant pathway for three to five minutes to establish a baseline of activity.

All nests should be flagged, mapped, and GPS coordinates recorded if possible.

In addition to surveying the site where you know there is an infestation, check out any other high risk areas with at least visual surveys where it is possible other incursions have occurred, such as:

- Areas with recent landscaping or construction;
- Areas which received the same goods as the known incursion site;
- Port area (lay down site for shipping containers, unpacking area, etc.)

Bait spacing and programme details are given in Table 1.

Treating the infested area

Aim: to eradicate the ants.

Eradicating an ant infestation is a difficult task. The accepted approach is to repeatedly treat the infested site using a granular poison bait, along with a buffer zone, until ants are no longer observed. Granular baits are used as the worker ants feed it to the queen and this kills the colony, insecticide sprays are no good as these just kill the workers and the queen compensates with an increase in egg laying.

It is not possible to get 100% control from a single ant bait treatment, and most pesticides typically provide 70-85% control, leaving a small residual population. A total of 8 - 12 treatments over 2 - 5 years might be necessary for complete removal of the ants. The site is monitored for at least two years after the last sighting to ensure no incipient colonies remain.

Procedure:

The technical adviser will advise on the most appropriate active ingredient and bait for the species identified, and also the size of the buffer zone.

As the climate is similar all year round, regular treatments can be scheduled, treating the infested site and a buffer zone on a monthly basis, for one year.

The baits need to be applied to dry soil followed by 12-24 hours without rain. Baits can be hand broadcast or using small inexpensive spreaders which are available from a number of sources, and most pesticide suppliers will be able to supply them. The aim is to deliver an even distribution of the bait over the soil surface at the dose rate given on the product label.

Items capable of vectoring movement of the ant beyond the site are to be prevented from movement or be treated in a manner approved by [appropriate authority]. The technical adviser will advise on the items, depending on the ant species and location of the incursion.

Monitor the infested area periodically (see below, post-treatment surveys). Re-treat the infested area according to the product label if ants are still present after 6-8 weeks, and monitor for another 6-8 weeks.

Collect data on the following:

- Dates of treatments
- Location and areas of incursions
- Quantities of each product used, on each occasion
- Temperatures and rainfall on the day and following day of treatment
- Names of the pest control operatives applying the baits
- Survey results

During-treatment and post-treatment surveys

Aim: to determine if the treatment is working.

Monitoring should be conducted during the treatment period to check efficacy. A visual survey of the wider surrounding area should also be conducted to ensure no infested areas have been excluded from treatment.

After the last sighting of live ants, the site and surrounds should be surveyed for two years to confirm that the eradication has been successful.

Procedure:

Monitor known nests visually for 6-8 weeks after first treatment. Within a predetermined time frame (for example 800am), and within similar daytime temperatures, visually determine ant worker numbers moving along a selected ant pathway for three to five minutes and compare to previous such counts to determine if worker numbers are declining.

Re-treat infested area according to label if ants are present after 6-8 weeks and monitor for another 6-8 weeks.

Monitor infested area at 6 month intervals for 2 years after the last treatment.

When workers are no longer found, follow-up surveys methods should be conducted as in the pre-treatment survey using protein and/or sugar baits. Place the baits where colonies were found in the past such as bases of trees, in raised flower beds, etc.

Surveillance needs to cover all previously infested areas.

Bait spacing and programme details are given in Table 1.

Table 1. Bait spacing and programme details.

	Delimiting surveys	Post treatment	General
Methods	Vials	Vials	Vials
Baits	Sugar and/or protein, alternated	Sugar and/or protein, alternated	Sugar and/or protein, alternated
Vial spacing	100 to 200/ha, 1 vial every 7 to 10m.	400/ha, 1 vial every 5m	100-400/ha, 1 vial every 5-10m depending on available resources
Frequency/ length of programme	Immediately, if results negative follow up every six months for 2 years If results positive, treat and monitor out to delimiting boundary	Six months for 2 years beyond last detection	Six monthly annually (2 rounds per year)
Buffer zone	Depends on species.	Depends on species.	50m
Visual Surveillance	Very efficient in high density areas especially if surveyors are familiar with the ant. Habitat is 3-dimensional, with soil, intermediate and canopy vegetation. Target leafy vegetation and coconut trees first. A good visual method is to use a smear of peanut butter on a plastic card as a bait, and watch it for around 1 hour.		

Preventing re-infestation

Aim: to reduce the risk of future incursions.

It is important to identify, as far as possible, how the ants were introduced to Anguilla / the outer islands in order to put measures in place to reduce the risk of future introductions of the same and other species of fire ant.

To do this, consider the following:

- Is the incursion clearly associated with a particular pathway, such as fresh produce, construction materials or passengers luggage? Note that the introduction may have occurred several weeks or even months previously.
- If it is not clearly associated with a particular pathway:
    - What are the commonest pathways known for this species?
    - What is its geographic distribution – where could it have entered a pathway?
    - Where is the incursion located in Anguilla?
    - How widespread is the incursion? Smaller infestations are more likely to be of more recent introduction so you are not looking so far into the past to identify how they might have arrived.

    - Can a link be made with any recent (within the past few months) imports or arrivals to Anguilla along these common pathways?
- Are there any clues from the ecology and biology of the ant species and the location of the incursion?

There are a number of options to reduce the risk of new introductions, and which is most appropriate will depend on the species of ant, most likely pathway of introduction of the present incursion, and practical considerations; see Table 2.

Table 2. Mitigation options for reducing the risk of arrival of fire ants.

Pre-border	Border	Post-border
For pathways such as fresh produce, luggage, personal effects (intentional introduction plus contaminants)		
Ban importation	Fumigation	Surveillance: visual surveys
Fumigation	Inspection	Surveillance: traps
Inspection	Quarantine	Rapid response
	Destruction	
For pathways such as stone etc, sand, aggregate, general commodities (contaminants)		
Ban importation	Fumigation	Surveillance: visual surveys
Fumigation	Freezing	Surveillance: traps
Freezing	Bleach	Rapid response
Bleach	Inspection	
	Quarantine	
	Pesticide treatment	
	Destruction	
For pathways such as shipping containers (stowaways)		
Fumigation	Fumigation	Surveillance: visual surveys
Pressure washing	Inspection	Surveillance: traps
Cleaning (other)		Rapid response
Inspection		

Raising public awareness

Aim: to reduce the risks of accidental introduction of fire ants with returning personnel, and also to engage the community to report any new fire ant outbreaks.

The activities listed here are intended to take place once an incursion has been detected.

Messages to convey:

- Fire ants sting and will impact outdoor activities such as fishing, bar-b-ques and sports
- Fire ants can infest electrical items and will be very expensive to control
- Fire ants can be accidentally introduced in luggage and personal effects, including electrical items such as computers.
- Check all your luggage and goods for ants before you leave home to come to Anguilla: "Don't Pack a Pest"
- "Have you seen this ant?" Report any new or unusual looking ant or other creatures you see in Anguilla

Proposed methods:

- Put up simple posters with a few large images of the introduced ant species and key messages in English and other appropriate languages.
- Include the messages above in all induction and briefing talks
- Add the message above to training materials and briefs sent out to personnel before they arrive.

Equipment needed

- Vials for surveys
- Baits for surveys:
    - Peanut butter (smooth)
    - Vegetable oil to mix with the peanut butter and make it easier to spread
    - Cat food / tuna / sausage
    - Jam (clear, smooth)
- Poison baits: as specified by the technical adviser.
- 70% alcohol for preserving specimens
- Fine forceps and small paint brush for handling specimens during the surveys
- Nitrile gloves for handling poison baits
- Chemical suits for handling poison baits
- Hand spreader for poison baits
- Dust masks, when applying poison baits
- Hi-vis vests
- Flagging tape, spray paint to mark bait stations
- Notebooks, clipboards, pens
- Posters
- Digital camera
- GPS

Sources

This protocol has been adapted from:

Operational plan for management of *Wasmannia auropunctata* (Little Fire Ant) on the island of Maui, Hawaii. 2009. http://www.littlefireants.com/maui%20plan%20public.pdf

General Emergency Response Plan for Invasive Ant Incursions. Secretariat of the Pacific Community. 2008. http://piat.org.nz/uploads/PIAT_content/pdfs/spc_ant_erp_2008.pdf

A plan for the prevention of establishment of new ant species in Hawaii, with special attention to the red imported fire ant (*Solenopsis invicta*). Hawaii Ant Group1, October 2001. https://www.invasive.org/gist/moredocs/solinv03.pdf