Pacific Ant Project

Training manual: Surveillance for invasive forest ants

Version 2.0 – February 2011

For training with Garmin Foretrex® 301 GPS unit

Aloha and welcome to the Pacific Ant Project (PAP)!

The PAP project has been funded by the United States Forest Service (USFS) and is being carried out by the Division of Forestry and Wildlife, Hawaii (DOFAW) and the Pacific Cooperative Studies unit of the university of Hawaii (PCSU).

This training manual is the first in a series designed to provide useful information relating to prevention, surveillance, identification and management of invasive forest ants in the Republic of Palau, Federated States of Micronesia, Commonwealth of the Northern Mariana Islands and Hawaii. Forestry and other agencies from each country are collaborators in this project.

The manual has been designed to provide you with some basic information about conducting surveys for invasive forest ants. It has four parts:

Section 1 – information about the Little Fire Ant (Wasmannia auropunctata) which is one of the most damaging invasive forest ant species to threaten the Pacific

Section 2 – a step-by-step guide to conducting a survey to detect new species of invasive ants

Section 3 – a series of how-to guides for operating a Garmin® GPS unit

Section 4 – some guidelines for the management and storage of data

The manual is meant as a companion to the survey exercises that are part of the training package. I hope you find this information useful.

Cas Vanderwoude
Pacific Cooperative Studies Unit, University of Hawaii
Hawaii Department of Agriculture
16 East Lanikaula St Hilo
Hawaii USA 96720
Ph +1 808 989 9289 ; Fax +1 808 974 4148
Email casperv@hawaii.edu

Sheri S. Mann
Cooperative Resource Management Forester
Division of Forestry & Wildlife
Department of Land & Natural Resources
Hawaii USA
Ph: +1 808-587-4172, Fax: +1 808-587-0160, Cell: +1 808-721-6092
email: sheri.s.mann@hawaii.gov

Project website: www.littlefireants.com

Table of Contents

Introduction **1**

Section 1. Little Fire Ant Biology and Ecology **1**

Spread in the Pacific region 2

Economic impacts 2

Environmental impacts 3

Social impacts 3

Typical LFA habitats 3

Potted plants 3

Favorite trees 3

Near homes and other structures 4

In the garden 5

Other locations 5

Survey methods 5

Collecting specimens 6

What to collect 6

Section 2. Standardized surveillance and monitoring procedure for invasive ant surveys **7**

Purpose 7

Scope 7

Work instructions 7

Overview 7

Equipment and supplies needed 7

Planning the survey 8

Bait preparation 8

Conducting the survey 9

How to number the bait vials 10

Sample storage after the survey 10

Section 3. Using a GPS for invasive ant surveys **16**

The Garmin GPS 16

Buttons and menu pages 17

Page 1 (Map Page).....18
Page 2 (Compass Page).....18
Page 3 (Trip Computer).....19
Page 4 (Main Menu).....19
Common warning messages.....19
Common warning messages.....20
Instructions for recording a waypoint.....20
Instructions for setting a new starting number for waypoints.....22
Instructions for returning to a previously stored waypoint (GO-TO).....24
Section 4. Data capture and management procedure for Invasive Ant Surveillance.....26
File Naming Conventions.....26
Opening and viewing the GPS data on a computer.....26
Saving the GPS data onto your computer.....30
Combining data from 2 units and saving as a single data file for sample screening.....32
Deleting data from the Foretrex GPS.....32
Uploading waypoint data back onto a GPS.....34
Displaying your data in Google Earth.....36
Importing directly from a GPS.....36
Opening a GPX file inside Google Earth.....38
Saving a Google Earth image.....39

Figures and Tables

Photo above – a sugar bait (left) and a protein bait (right) ready to use. 9
Table 1. Survey specifications for Red Imported Fire Ants and other exotic ants 11
Table 2. Survey specifications for Little Fire Ants.....12
Table 3. A list of common ant habitats 13

Introduction

This training manual is designed to provide you with some basic information about conducting surveys for invasive forest ants. It has four parts:

Section 1 – information about the Little Fire Ant (*Wasmannia auropunctata*) which is one of the most damaging invasive forest ant species to threaten the Pacific

Section 2 – a step-by-step guide to conducting a survey to detect new species of invasive ants

Section 3 – a series of how-to guides for operating a Garmin® GPS unit

Section 4 – some guidelines for the management and storage of data

It is meant as a companion to the survey exercises that are part of the training package. I hope you find this information useful.

Section 1. Little Fire Ant Biology and Ecology

Ants are social insects closely related to bees and wasps. As a rule they live in a colony with one or more queens. Workers are sterile females who perform specialized roles including caring for brood (larva), feeding and attending to the needs of the queen(s), foraging for food and defense of the colony. Worker ants are dispensable as the queen produces a regular supply of replacement workers.

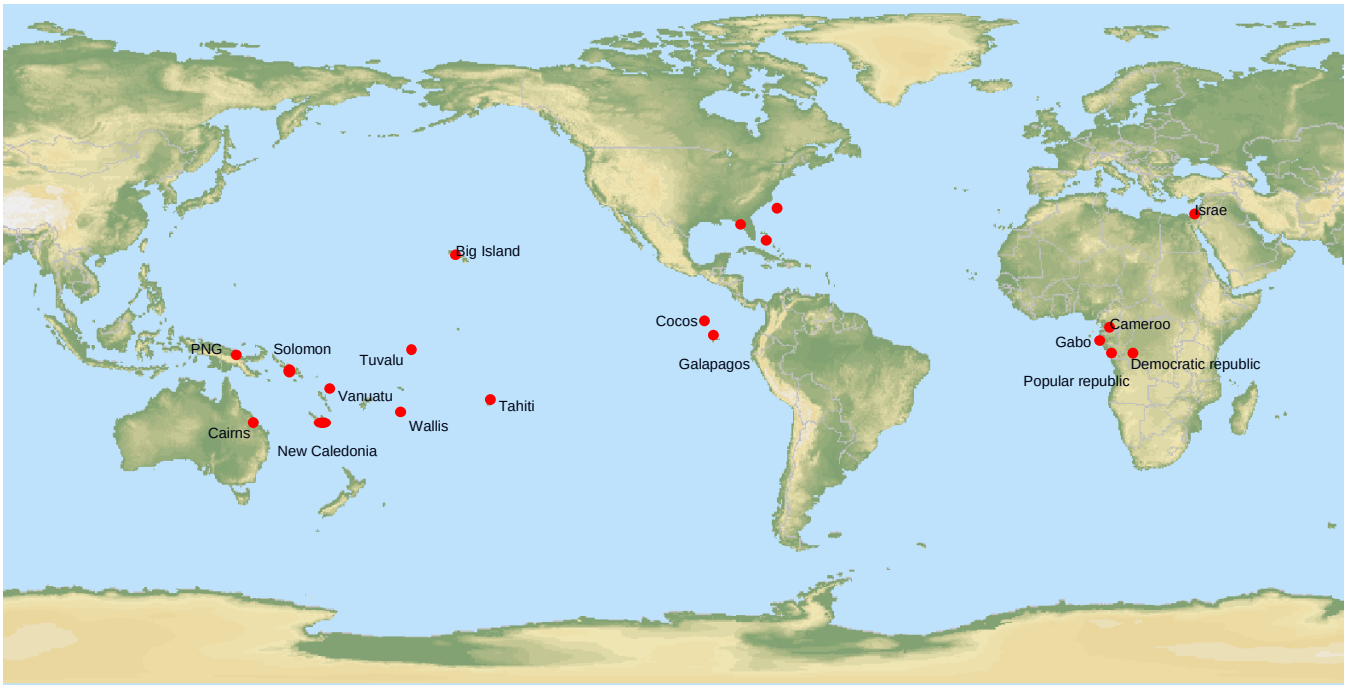
Males are notably absent from day to day life and are produced seasonally for breeding purposes. After mating, their purpose is served and they die. Most ant species spread by means of production of winged reproductive casts (male and female) which leave the parent nest in synchronized nuptial flights. Mating takes place in the air and fertilized female queens then return to the soil surface and establish new colonies independent from the parent colony.

Many invasive ant species including Little Fire Ants do not use this dispersal method. Rather, mating occurs within the parent colony (or close nearby) and newly fertilized queens either remain there or disperse on foot taking with them a small number of workers (to care for them and the new brood which the queen will produce). Often, these nests remain connected with the parent colony and the tasks of territory defense and food gathering are shared. This results in a polydomous, unicolonial “supercolony” with no intraspecific aggression between workers and queens. The loss of workers and even queens does not threaten the viability of the colony as production of new workers and queens occurs constantly.

The dispersal strategy and social nature of invasive ant species makes them a formidable enemy to competitors and prey in habitats they have invaded. Indeed the impacts of these invasions are all the greater due to this feature. They are able to monopolize resources and

overpower competitors through sheer force of numbers. In the case of Little Fire Ants, assessments of abundance are measured in billions per hectare.

Dispersal over distances greater than a few meters are almost always human-mediated. Small colony fragments "hitch-hike" with personal possessions, freight or produce and establish a colony in a new location. The most common way this happens in Hawaii is through the movement of infested potted plants.



Sites with introduced Little Fire Ant populations

Economic impacts

Wasmannia auropunctata is a shade-loving species that nest in vegetation and on the ground. Little Fire Ants interfere with production in agricultural systems such as coffee and citrus where they promote scale insects and interfere with biological control organisms. Workers have refused to harvest or tend orchards infested with this species in Hawaii[1] .

Another serious impact of LFA is their affects on subsistence gardens - often a mixture of tree (coconut, banana, papaya, mango, breadfruit etc) and ground crops (maize, taro, yams, aibika, kangkong, pitpit etc). These food gardens are a haven for Little Fire Ants who will inhabit both the ground layer and tree trunks and canopies. Here they promote crop pests especially homoptera and sting people tending their crops and harvesting food. As workers move through their gardens, they disturb the foliage dislodging ants which then become entangled in the

[1] See http://hawaiihealthguide.com/healthtalk/display.htm?id=613&hhsid=0c022d71674bd3e3df465f733b25ddb1

workers' clothes, stinging them. Little Fire Ants have been found in the crowns of mature coconut trees, making harvesting of even this commodity difficult and painful.

Environmental impacts

One immediately noticeable impact on natural ecosystems invaded by this ant is the virtual absence of other ant species. Indeed, the boundary between invaded areas and un-invaded areas are most easily delineated by the presence of other ant species in un-invaded areas. There is also considerable anecdotal evidence that Little Fire Ants sting domestic and wild animals especially on the eyes, causing blindness.

Social impacts

Little Fire Ants forage and nest in houses and outbuildings and this puts them into direct contact with people. Once they have infested houses, it is common for children and adults to be stung regularly and for the ants to spoil prepared food items in kitchens and pantries. While stings are only moderately painful to adults, children appear to be much more sensitive and often are stung multiple times in their sleep. The high cost and non-availability of medical facilities can make this a difficult issue for families to manage.

Typical LFA habitats

Most invasive ants are sun-loving animals. They prefer to nest and forage in open, dry places. Most often their nests are built in the soil. Little Fire Ants are very different. They are native to the rainforests of south America where it is warm, wet and shady. While they will nest in the ground, they will also nest in trees and other vegetation. This means when surveying for LFA, search efforts should be concentrated on those areas where LFA are most likely to be found.

Potted plants

We know that the movement of potted plants is one way that LFA are moved from place to place. It stands to reason then, that this is a good place to search for them. Potting media is usually soft and easily penetrated, shaded by the plant, and kept at an ideal moisture level for both the plant and LFA. Often removing the plant from the pot will reveal LFA present between the wall of the pot and the root ball. Just lift the plant out and wait for a few seconds. Another good location is under the pot or the drip tray. Again these are dark cool spots that LFA seek out.

Favorite trees

Here in Hawaii, almost every home has banana plants or palms somewhere in the garden. These are without question the favorite plants for LFA. The reason for this is that these plants

give them the two things they need most: food and shelter. The base of older leaves make a ready-made nest site. Peeling back a few of these leaves in a banana clump often reveals the tell-tale signs of an LFA nest – a bunch of small slow-moving ants and the white eggs and larva. Sometimes you will see ants with wings – these are the new unmated queens.

Typical LFA nest in a banana leaf

ideal location for LFA nest in a palm crown

Near homes and other structures

When visually surveying or baiting for LFA around houses and other structures, focus on the shady side of the building (usually on the north side). LFA rarely nest inside houses, preferring to build their nests outside and forage inside the house. Many people mistakenly spray or otherwise treat ants inside their homes when the ants are actually nesting outside.

Nests and foraging trails are most commonly found at the base of exterior walls, where the walls meet the ground. If the homeowner has been trying to control them, “drifts” of dead ants are often obvious around entrances such as doors and windows,

The bottom track of a sliding door showing dead LFA that have been killed by sprays or other treatments applied by the homeowner.

In the garden

Gardens provide ideal nesting and foraging places for LFA. The places to concentrate on for survey are:

- At the base of trees and other plants (on the shady side of the stem)
- Near sources of moisture
- Shaded areas
- Under rocks, stones and other objects on the ground
- In rock walls (especially north-facing ones)
- In and behind moss growing on trees and rocks
- In deep litter/mulch

Other locations

People with pets often have the food and water bowls in a specific location. This invariably attracts ants including LFA. Always place a bait or two near these locations. Lift the bowls and check carefully underneath – often a nest will establish at these locations.

Trash bins, compost piles and piles of garden waste also provide ideal nesting locations for LFA so these are also worth checking out.

Survey methods

There are three main survey types: detection surveys, delimiting surveys and monitoring surveys. Each survey type has a different aim and the type of information that needs to be gathered is also different. In a detection survey, the objective is to determine if a site does, or does not, have LFA. This is the easiest type of survey to conduct because all that is needed to confirm presence of the ant is a single specimen. In delimiting surveys, we are trying to map out exactly the infested area. This type of survey needs to be much more exacting. Monitoring surveys are used to determine the success or failure of treatment. For this type of survey we need to know not only where LFA are but also how dense the population is. For our purposes, detection surveys are most suitable, and they are also the easiest to conduct.

Collecting specimens

What to collect

There are about 50 ant species present in Hawaii. Many of these do not look anything like LFA but several other species are indistinguishable from LFA to the naked eye. A careful surveyor can visually eliminate many ant specimens by following some simple methods. LFA are:

1. very small – as long as a penny is thick
2. a uniform dark yellow-orange color. Ants that have a different head or abdomen color are definitely not LFA
3. slow moving

Three other ant species (see below) can easily be mistaken for LFA: *Plagiolepis allaudi* (A), *Solenopsis sp.* (B), *Tertamorium similimum,* (C). Image D below is the Little Fire Ant.

Section 2. Standardized surveillance and monitoring procedure for invasive ant surveys

Purpose

The purpose of this document is to outline the procedures for conducting surveillance and monitoring for invasive forest ants for the Pacific Ant Project.

Scope

This standard operating procedure provides a standardised surveillance method for use in forest habitats and other high risk locations that targets the detection of, Little Fire Ants (*Wasmannia auropunctata*) and other invasive forest ant species not present on the island to be surveyed.

Work instructions

Overview

Surveillance for ants is accomplished by placing vials baited with attractive food items in a grid pattern over the entire area to be surveyed, and collecting the vials after 30-60 minutes exposure. While the baits are in the field, any ants foraging nearby will be attracted to the baits and these can be sealed inside the vials and identified in the laboratory. Procedures that specifically target Little Fire Ants or Red Imported Fire ants are different, and the procedures for delimiting, monitoring and general surveillance are also slightly different. This procedure only covers general surveillance.

Equipment and supplies needed

Bait materials

- A sufficient number of “Biolab” 60cc bait vials or similar. It can be helpful to have two different coloured lids so different bait types can be distinguished in the field. Light coloured lids are preferred as it makes lab sorting more efficient.
- 1 jar of “creamy” peanut butter per 500 baits
- 1 tin Spam® or similar firm luncheon meat per 500 baits
- 1 jar of jam or jelly (clear, without lumps or seeds)

Bait preparation

- Paper or plastic plates
- 2 dessert spoons for mixing
- A sharp knife

Survey equipment and supplies

- Map of survey area
- Sample summary sheets
- GPS
- Spare batteries
- Hi-Viz vests
- Supermarket bags or other bags
- First aid kit
- pens
- Permanent marker vivid pens or china pens to mark the vials

Planning the survey

When planning the survey, work out the area you want to cover and obtain a map or aerial image of the site. Google Earth is a good source of maps but most ports have port plans which can also be used. Contact site management at least a day before the survey to make sure you have permission to enter and arrange any port passes etc that might be needed. In the case of an airport or sea port, try to pick a time when no planes are expected or ships are being loaded/unloaded. Also, plan to do the survey during clear weather when rain is not expected.

The survey can be done by a single person but its easier if each team is made up of two people. One person can take the waypoints and hold the bags while the other person places them on the ground and writes the sample numbers on the vials. One team should be able to place and collect around 200-300 vials in a day. When preparing baits, make up around 125 per person working in the survey. If you know the size of the area you have to cover and the survey type, you can also use these rates to work out how many days you will need to complete the survey. Keep a record of the number of baits placed and the total person-hours for each site for planning future surveys.

Bait preparation

Different ants are attracted to different food types so a mixture of bait types is used. Its best to make only enough baits for a days work. This way the baits will be fresh and attractive to ants (ants are not as interested in old baits). If possible, make them up the day before and store them in a refrigerator overnight. This way you can make an early start before temperatures get too hot.

You will make two types of bait: a protein bait and a sugar bait. When you lay them out in the field, these will be placed alternately – a protein bait, then a sugar bait, then a protein bait etc. Use vials with different colors for each bait type if you have them. That way you will know which is which. Keep these in separate bags.

Protein baits contain a smear of peanut butter and a small cube of luncheon meat. They should be prepared by smearing a line of peanut butter (half the size of a pea) on the inner side of each

bait container on the side corresponding with the back of the label[2] if the vials are labeled. In addition, a small cube of luncheon meat is to be placed inside each vial.

If available, use a vial with a different color lid for sugar baits. The sugar baits contain a smear of light colored jelly or jam on the inner side of each bait container on the side corresponding with the back of the label. The jam should be light colored and not contain seeds, lumps or rinds. A little water should be mixed with the jam to make it easier to spread.

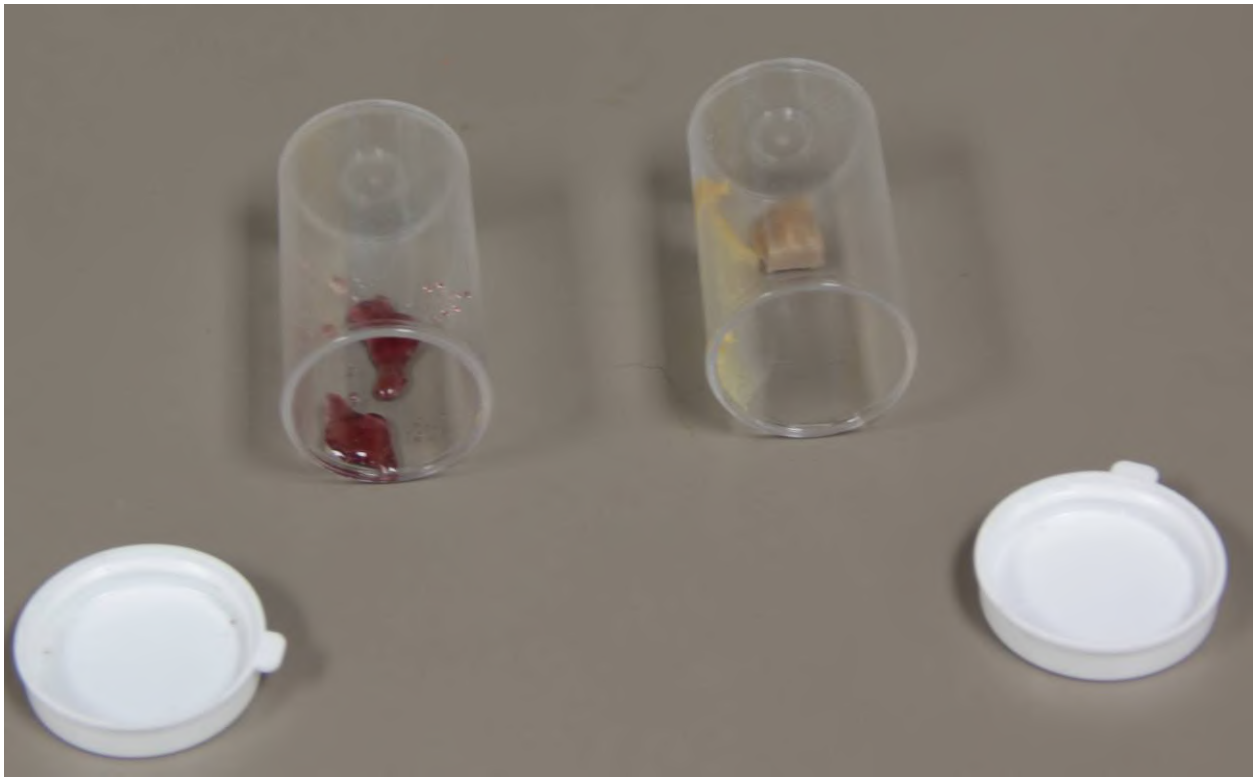


Photo above – a sugar bait (left) and a protein bait (right) ready to use.

Conducting the survey

The aim of the survey is to thoroughly sample the ants at the site. This is done by placing baits in a grid pattern over the entire area, placing protein baits and sugar baits alternately. The spacing between baits should be around 10 paces. It is not important to have the grids at **exactly** this spacing as long as they are approximately correct. See Table 1 and 2 for survey specifications for different types of survey. Sections of the survey site that are all concrete or asphalt do not need to be sampled because few ants nest in these locations. Common ant habitats are listed in Table 3 and it is important that these are all sampled.

[2] This makes it easier for the entomologist to identify specimens.

Bait vials should be collected 30-60 minutes after placement. It takes much less time to retrieve vials than it does to deploy them. As a guide, teams should place vials for one hour, then stop and retrieve the vials they have deployed in the order they were deployed. This way, the vials placed at the beginning will have been out for 60 minutes and the ones deployed last will have been exposed for about 30-45 minutes depending on ant species. Try to plan out a route that will take you back to the point where you started – it saves extra walking.

Surveillance should not occur during or after rain when the ground surface is still wet, or on windy days. Also no rain should fall between placement of bait traps and their retrieval. If rain is imminent, it is a good idea to stop deploying baits and retrieve the ones already out. If this is not possible, collect the baits one hour after the rain has stopped. If not many ants are at the baits, it might be necessary to re-survey the rain-affected section.

Bait vials should be placed in the shade where possible. Remember the sun might have moved by the time you collect the vials so place them carefully to avoid this. As a hint place your vials away from prevailing wind and angle the entrance slightly to the ground. This helps prevent vials filling with water and debris if you encounter a sudden down pour.

Any unusual ants (that look different from common established species) sighted while conducting surveillance should also be collected.

How to number the bait vials

This type of survey is normally conducted to find invasive ants before they become established. Once the entomologist identifies the samples you have collected, the results need to be recorded and if a new species is found, we need to be able to get back to where the sample was taken. Before the availability of global positioning devices (GPS), this was done by numbering each sample vial and marking the location on a map. This took a long time and generated a lot of paperwork.

GPS units use satellites orbiting the earth to triangulate the user's location. They are very accurate, usually to within 30 feet, and sometimes even better. Most GPS units can store "way-points" which is the exact location of where you are at that time. You can then download the waypoints you have taken into a computer and either store them in a file or plot them on a map. We use a GPS to record the location of every bait we place and use the waypoint number as the sample number. This saves a lot of paperwork both in the field and in the laboratory.

During the survey, mark waypoints in the GPS for each bait placed and record the waypoint number on the vial with a marker pen or china pencil.

Sample storage after the survey

At the end of the day you will have a whole bunch of vials – some with ants inside and some without. These need to be frozen to kill the ants and also to prevent the vials from going moldy inside. Once the samples get moldy they are very difficult to identify. Put all your vials in a

plastic bag and also insert a data collection form with the samples. Leave the bag in a deep freeze. The data collection form you will include lets the entomologist know who collected the samples, on which date and which GPS holds the survey data. This paper is very important! Without the collection form it can be very difficult to work out where the samples came from. A template form is included at the end of this section.

Table 1. Survey specifications for Red Imported Fire Ants and other exotic ants

Red Imported Fire Ants and other invasive ants	**Detection Survey**	**Delimiting Surveys**	**Post Treatment Monitoring**
Methods	Bait vials	Bait vials	bait vials
Baits/ Food lures	sugar and protein alternated	sugar and protein alternated	sugar and protein alternated
Vial spacing	100/ha, 1 vial every 10m	200/ha, 1 vial every 7m	400/ha, 1 vial every 5m
Time in field	30 -60 minutes	30 -60 minutes	30 -60 minutes
Frequency/ length of program	Six monthly (2 rounds per year)	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
Buffer zone	50m beyond site boundary	2 km from known nest(s)	200m beyond treated area

Table 2. Survey specifications for Little Fire Ants

	Detection survey	Delimiting Surveys	Post Treatment Monitoring
Methods	vials	vials	pitfall traps and vials
Baits/ Food lures	Peanut butter only	Peanut butter only	Peanut butter only
Vial spacing	200-400/ha, 1 vial every 5-7m depending on available resources	100/ha, 1 vial every 10m. Once no ants detected, switch to 1 vial every 5 m at least 20m beyond the limits of detection	400/ha, 1 vial every 5m
Time in field	45 min, maximum up to 1.5 hours	45 min, maximum up to 1.5 hours	45 min, maximum up to 1.5 hrs
Frequency/ length of program	Six monthly annually (2 rounds per year)	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
Buffer zone	50m	20m	20m
Visual Surveillance	Very efficient in high density areas especially if surveyors are familiar with the ant. Habitat is 3 dimensional- in soil, intermediate canopy, vegetation, target bananas and coconut trees first. A good visual method is to use a smear of peanut butter on a plastic card as a bait.		

Table 3. A list of common ant habitats

1.	Tree trunks (visual inspection and bait at base if appropriate).
2.	Flowers and trunks of trees.
3.	Shrubs and poles.
4.	Building edges and foundations.
5.	Concrete slab edges.
6.	Cracked concrete.
7.	Disturbed sites.
8.	Drains and culverts.
9.	Electrical generators and fittings.
10.	Exposed rocks.
11.	Fence palings.
12.	Grass areas.
13.	Verges.
14.	Hot water pipes and heaters.
15.	Isolated weeds.
16.	Logs.
17.	Loose gravel.
18.	Low vegetation (including grass).
19.	Plant pot bases.
20.	Road margins.
21.	Rubbish piles.
22.	Shiny surfaces.
23.	Soil.
24.	Tree crotches and hollows.
25.	Vertical surfaces.
26.	Weed and plant re-growth.
27.	Wooden structures.
28.	Underneath stones or concrete rubble.

PAP survey sample submission sheet

GPS number	date	
	start time	
	end time	
address		site code
TEAM MEMBERS		
	first vial	last vial
vial numbers		

SIGNED team member 1……. team member 2……...

SIGNED BY supervisor……...

Survey notes

Section 3. Using a GPS for invasive ant surveys

GPS units used to be large and expensive devices used by navigators to work out exactly where they were. Nowadays, GPS units are inexpensive, about the size of a cell phone or even smaller. A basic GPS unit can be used for 2 important functions – storing the latitude and longitude of your current location and getting directions back to that location. You can download information about a trip and store it on your computer, and upload a previously saved trip.

Imagine you regularly go fishing. You can record the location where you started, like your home port, and also all your favorite fishing spots, reefs etc. You can keep all these locations in a file and the next time you go fishing, upload them onto the GPS. The GPS can then be used to find each of your favorite spots again. If you are caught in a storm or after dark, you can also use it to find your way home again.

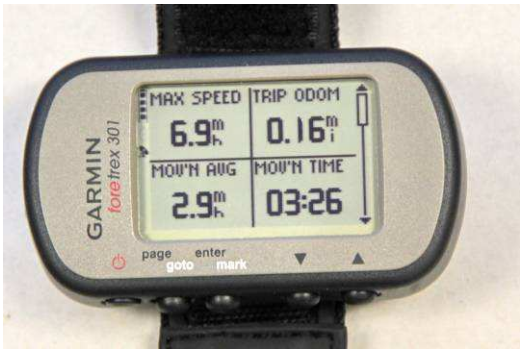
For this course, we will be using GARMIN Foretrex® 301 GPS units. These are compact, basic GPS that can be worn like a wrist-watch. The reason that the Foretrex® 301 is the standard device for this project is that:

1. its not expensive
2. it has a high-sensitivity GPS which means it works much better under a forest canopy
3. it can be worn on your wrist and operated with one hand
4. transferring data to a computer is very simple
5. 2 x AAA rechargeable batteries will last all day.
6. resistant to water and dust.

The instructions that follow refer to the Garmin operating system. Each GPS model and brand is a bit different but once you learn how to use one, using another brand will be fairly easy.

The Garmin GPS

Below is a Garmin “Foretrex® 301 which can be worn like a wrist watch. This is the unit we will be using.



Buttons and menu pages

The Garmin Foretrex® has only 5 buttons and once you become familiar with their functions, you will find it very easy to operate the unit.

Power

This button turns the power on and off. To turn off, hold the button down for several seconds until the screen goes blank.

Page

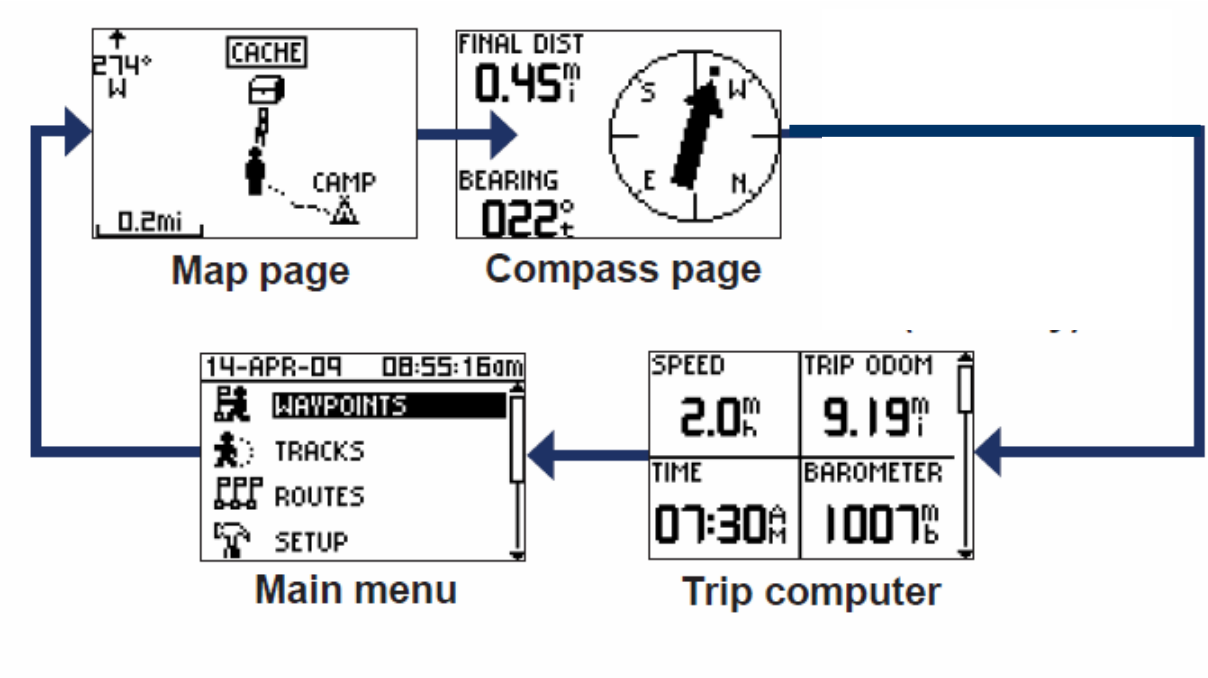
The "**page**" button takes you from screen to screen on the GPS. It also works like an "escape" button. If you are in a menu item and want to return to the previous page, press the page button to get back to where you were.

Up-Down

The scroll buttons let you highlight a particular menu item on a page.

Enter

The **"enter"** button will select the highlighted menu item.



There are 4 menu pages on the GPS and these are listed below along with what each page is used for.

Page 1 (Map Page)

This is the first screen you will see when turning on the power. It shows you the path you have traveled – like leaving a trail of breadcrumbs. It also shows the waypoints that are logged in the unit. While on this page, the **scroll up/down buttons** will change the scale (make the map smaller or larger). The little guy on the screen represents you and where you are in relation to the trail. The map page can be very helpful if you are trying to get back the same way you came; for example a forest path or navigating through a reef.

On the left hand edge, there will be 2 indicators. One shows how much charge is left in the battery – much like a cell phone. The other indicator shows whether the unit has found all the satellites. When the indicator flashes on and off it is searching for satellites. Once the indicator stops flashing, you are ready to navigate. Leave the unit to "warm-up" for at least 5 minutes at the start of each day even if the indicator stops flashing earlier.

Press the **"page"** button to go to the next screen.

Page 2 (Compass Page).

This screen can be used for 2 things. When you are traveling, it will show your compass bearing as well as your speed. It is also the screen you use when you are trying to find a

previously stored waypoint (see the **GO-TO** section for more information). Press the **"page"** button to go to the next screen.

Page 3 (Trip Computer)

This page shows a summary of the trip being taken, including total distance traveled, maximum speed, average speed and a trip timer. Press the **"page"** button to go to the next screen.

Page 4 (Main Menu)

This screen is used to change the GPS settings, to enter waypoints, and to choose a waypoint to find. Use the **scroll up/down** buttons to highlight the menu item you want, then press **"enter"** to enter that menu item.

There are 6 menus on this screen,

Waypoints – a list of all the waypoints currently stored on the GPS

Tracks – a list of track maps saved on the GPS (see **page 2 (map screen)**

Routes – not used for surveys

Setup – this is where all the GPS settings are stored. do not enter or change anything on this screen. This is best left to the supervisor because if some settings are accidentally changed, the waypoint data could become corrupted.

A note on batteries

If you plan to use a GPS regularly, it makes sense to buy rechargeable batteries and a charger. When shopping for batteries, choose the NIMH type because they hold a better charge and last longer than the older NICAD type. However, a freshly charged battery will lose about 1% of its charge every day. This means after a month or so, your charged battery might be only half charged. The very best battery type to look out for is the "always ready" type. Like Sanyo Eneloop®. These will hold a charge for several years without draining and are therefore a much better option.

Common warning messages

There are some common warning messages that will occasionally pop up.

Weak GPS signal.

This warning is to let you know when the GPS is having trouble getting a fix on its location. It usually happens when you are standing close to a building or under a dense canopy. Press **"OK"** to acknowledge that you have read the warning.

Trouble acquiring satellites

This warning message will appear when the GPS is turned on indoors, in a poor reception area, or hundreds of miles from where it was last used.

Select **"no"** if you are indoors. The GPS will assume you are using the unit on a computer and will stop searching for satellites. Select **"yes"** to keep searching for satellites.

If you select **"yes"**, a second warning screen might appear asking if you have moved a long distance since last using the unit. It asks this question because it "remembers" the satellites it used the last time it was turned on and expects them to be there.

Instructions for recording a waypoint

Ok folks, its as easy as 1 – 2 – 3

1 – After turning on the GPS, wait until its ready to navigate and press the "**page**" button until you reach the " **main menu**" screen. Make sure the "**waypoints**" menu line is highlighted.

2 – Press "**enter**" and you will see a new screen with a flag. The number on the flag is the waypoint number the GPS will give your new waypoint.

3 – Press "**enter**" again. The waypoint will be recorded and the GPS will return to the "**waypoint**" screen and you are ready to do it all over again!

GARMIN
fore trex 301
TROUBLE FINDING
SATELLITES.
CONTINUE SEARCHING?
NO
YES
page
goto
enter
mark

1 2 3

28-JAN-11 07:41:00am
WAYPOINTS
TRACKS
ROUTES
SETUP
WAYPOINTS
CREATE NEW
LIST ALL
NEAREST
OK?
100
ELEV: 119ft
N 15°13.499'
E 145°44.771'

Instructions for setting a new starting number for waypoints

The GPS automatically assigns a number to each new waypoint, starting at 001 and ending at 500 when the memory will be full. When 2 or more teams are surveying on the same site with different GPS units, there will be 2 sets of vials each starting at 1 and ending at the last sample taken. This will be very confusing when the entomologist identifies the samples and records the information because it will not be possible to work out where each sample came from. To prevent this confusion, it is best for each team to have their own set of numbers.

The Garmin GPS will let you select a starting number for waypoints, and once this is set, subsequent waypoints will be automatically numbered in ascending order. So, if GPS number 2 is set to start at 500, the next waypoint will be 501, 502 and so on. Manually setting a waypoint number is a bit fiddly, like setting a name into your cell phone but after doing it a few times it will come naturally and it only needs to be done once at the start of the survey. Here is how:

Lets set a "dummy" waypoint at 500. There will be no sample associated with this number, its only going to be used to start the numbering.

The screen shots on the next page show what the screen should look like for each step.

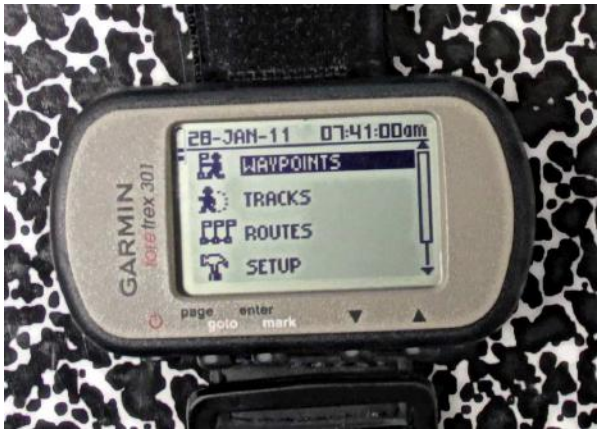
1. Start the GPS, go to the "**waypoint**" screen,
2. Instead of pressing "**enter**" and accepting the number "001", use the scroll buttons to highlight the number. Then press "**enter**"
3. the "**edit waypoint**" screen will now appear, with the first space for a number highlighted.
4. Press "**enter**" and a drop-down panel will appear. Use the scroll buttons to highlight the number "5" and press "**enter**"
5. the "**edit waypoint**" screen will now appear, with the number "5" in the first space and the highlight over the second space. Press the "**enter**" button again and use the scroll buttons to highlight the number "0" and press "**enter**"

   repeat step 5 to enter the second "0".
6. Scroll down the "**edit waypoint**" screen to highlight the box that says "**OK**" and press "**enter**"… ok?

   the original "**waypoint**" screen will now appear with the waypoint on the flag set to "500". Scroll down to the "**OK**" box and press "**enter**" … ok?

Wow! ALL DONE. The first few times you do this you will probably hit the wrong button a few time. Whenever you want to go back a step, press the "**page**" button to return to the previous screen. Practice this a few times and it will become second nature. However, once you have set the first waypoint at 500, the next time you mark a waypoint, the GPS will automatically choose "501", then "502" etc.

1


28-JAN-11 07:41:00am
WAYPOINTS
TRACKS
ROUTES
SETUP
GARMIN
foretrex 301
page enter
goto mark

2

WAYPOINTS
CREATE NEW
LIST ALL
NEAREST
GARMIN
foretrex 301
page enter
goto mark

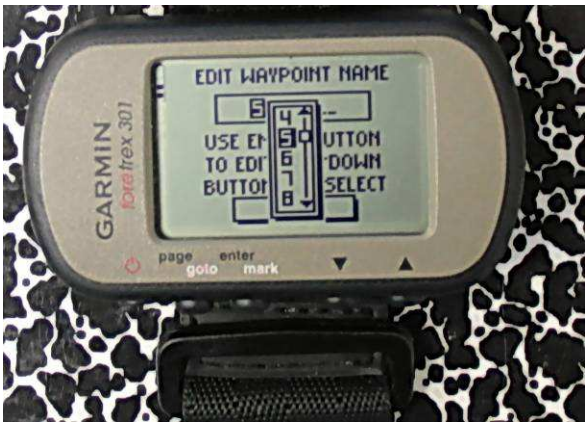
3

OK?
701
ELEV: 119ft
N 15°13.499'
E 145°44.771'
GARMIN
foretrex 301
page enter
goto mark

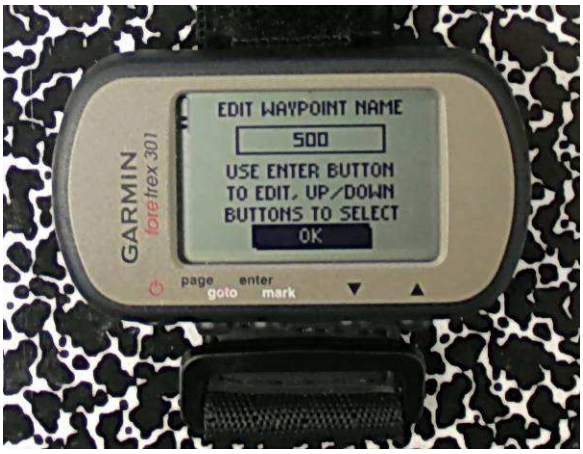
4

EDIT WAYPOINT NAME
USE ENTER BUTTON
TO EDIT, UP/DOWN
BUTTONS TO SELECT
OK
GARMIN
foretrex 301
page enter
goto mark

5


EDIT WAYPOINT NAME
GARMIN
foretrex 301
page enter
goto mark

6


EDIT WAYPOINT NAME
500
USE ENTER BUTTON
TO EDIT, UP/DOWN
BUTTONS TO SELECT
OK
GARMIN
foretrex 301
page enter
goto mark

Instructions for returning to a previously stored waypoint (GO-TO)

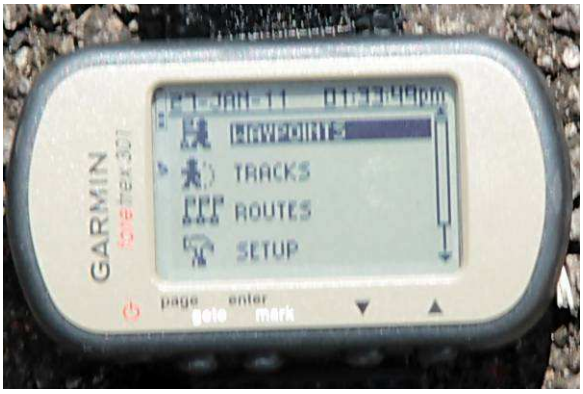
So, now you have some waypoints set on your GPS and one of them is your favorite fishing spot. How do you use the GPS to guide you to that spot? Easy – use the "**GO TO**" function. As an example, I want to return to waypoint "501" on my GPS….

The screen shots on the next page show what the screen should look like for each step.

1. Go to the "**main menu**" page and enter the "**waypoints**" menu.
2. Here you can choose, "**create new**", "**list all**", or "**nearest**", Select the "**list all**" option and press "**enter"**
3. All the waypoints on the GPS will appear, except they will be sorted into groups tabbed "0-9", "A-H", "I-P" etc. I think this is a bit fiddly so I rarely use names for waypoints because they become too difficult to find.
4. The "0-9" tab on the left hand side of the screen is highlighted by default, so press "**enter**" again to move the highlight bar into the list of numbers.

   Now you can use the scroll bar to highlight the waypoint (501) you want to go to. Press "**enter**" again
5. A new screen appears with the waypoint number on a flag. There are 4 options that can be highlighted" "**delete**", "**map**", "**go**", "and o**ptions**". The "**go**" is selected by the GPS as the default, so press "**enter**" one last time.
6. The "**Compass Page**" screen now appears with showing a compass with an arrow showing which way to walk, a distance and travel speed. The compass is not "dynamic" and does not work while you are standing still. However, as soon as you start walking, the compass and the arrow update every ½ second or so and the distance measure changes as you move closer to or further away from your target.

1


GARMIN
fore trex 301
WAYPOINTS
TRACKS
ROUTES
SETUP
page
enter
goto
mark

2

GARMIN
fore trex 301
WAYPOINTS
CREATE NEW
LIST ALL
NEAREST
page
enter
goto
mark

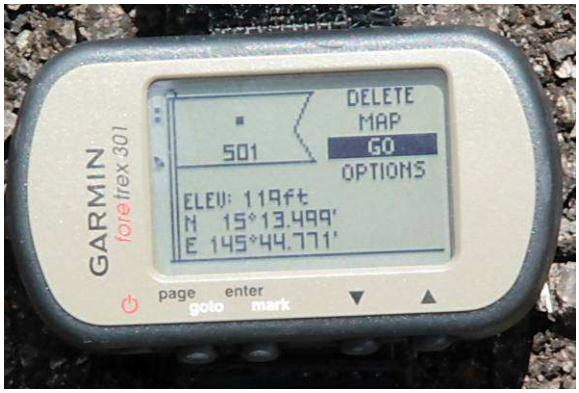
3

GARMIN
fore trex 301
WAYPOINTS
0-9
A-H
I-P
Q-Z
500
501
502
503
504
page
enter
goto
mark

4

GARMIN
fore trex 301
WAYPOINTS
0-9
A-H
I-P
Q-Z
500
501
502
503
504
page
enter
goto
mark

5


GARMIN
fore trex 301
501
DELETE
MAP
GO
OPTIONS
ELEV: 119ft
N 15°13.499'
E 145°44.771'
page
enter
goto
mark

6

GARMIN
fore trex 301
FINAL DIST
3899m
SPEED
0.0m/h
S
E
N
page
enter
goto
mark

Section 4. Data capture and management procedure for Invasive Ant Surveillance

This procedure describes how data from surveillance activities are to be downloaded, manipulated and stored for future use. Where more than one GPS units are used on the same survey, each GPS should be set to start recording from waypoint a different waypoint number. This way, every vial will have a unique number and this will make it much easier to combine the information later. So, if there are 2 GPS units being used, one should be set to start at 001 and the other at 501. If there are 3 GPS units used, start them at 001, 301, and 601, and so on.

File Naming Conventions

In order to ensure consistent data storage, files are to be named as follows:

Filename = [project name] + [site code] + [GPS number] + [date]

The project name and the site code will be determined by the survey coordinator and the GPS number helps us match the bag of samples to the downloaded GPS computer file. A good date convention to be used is YYYYMM. For example, the files produced after a CAPS survey at Hilo airport conducted on 12 March 2009 would be:

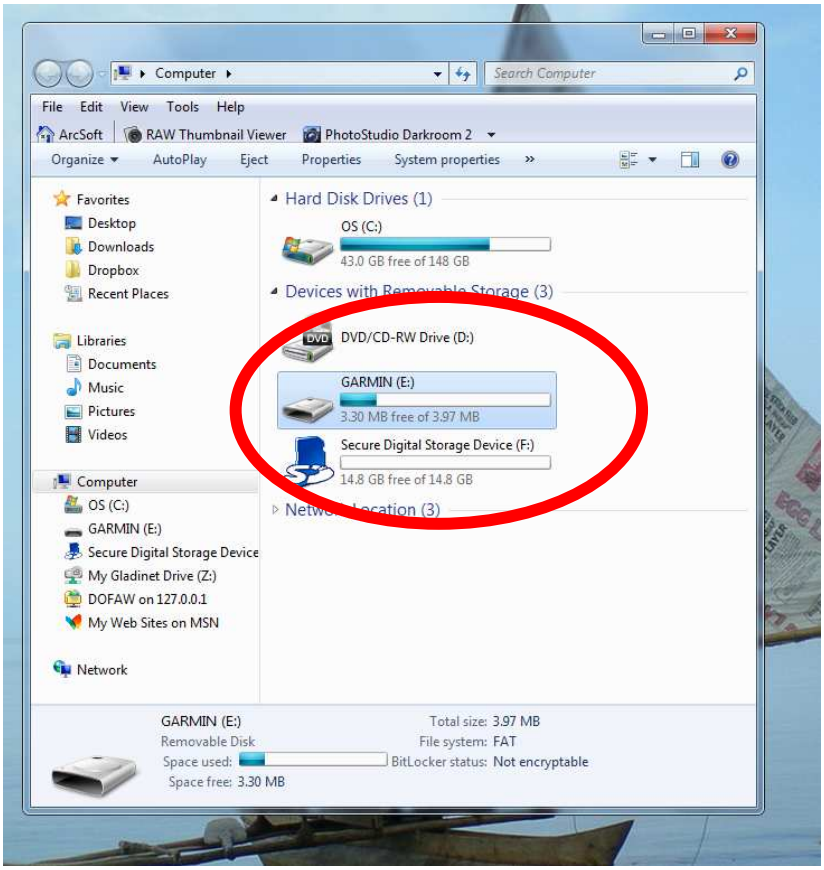
capsITO-A200903.txt (a text file containing waypoint details for each sample) This file will be used by the entomologist to enter species information.

capsITO-A200903.gpx (a GPS readable file containing waypoint, route and date-time details for the survey). This file can be loaded back onto a GPS should any sample require further investigation.

Opening and viewing the GPS data on a computer

Downloading the data from the Foretrex® is very easy. Simply connect the GPS to your computer with the USB cable, turn on the power, and the GPS will appear on your computer as another drive. Every computer is going to be slightly different. On some computers, the new drive will be automatically detected and you will get a series of autoplay options like the screenshot below. Choose "**open folder to view files**" Otherwise, go to "**my computer**" and double-click the Garmin drive letter.

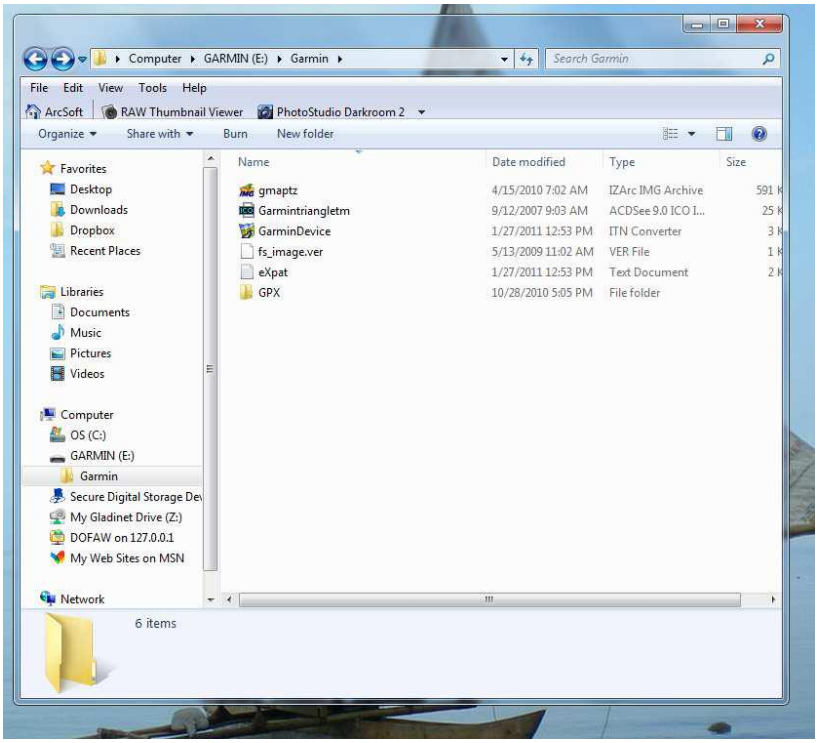
Autoplay menu options if your computer automatically detects the new device. Choose “open folder to view files”



The “my computer” window showing the Garmin Foretrex® as Drive E: Double click on the drive letter to view the files. Your computer might show the GPS as another driver letter like “F” or “G” depending on how many other drives you have,

Once the “**Garmin**” folder is opened, you will see a number of files and a directory called “**GPX**”. The files you see run the GPS and the actual data is stored in the “**GPX**” directory. When the “**GPX**” directory is opened, there will be two files visible” “**current.gpx**” and “**position.gpx**”. The file called **current.gpx** contains all the waypoints and trip data saved on the GPS.

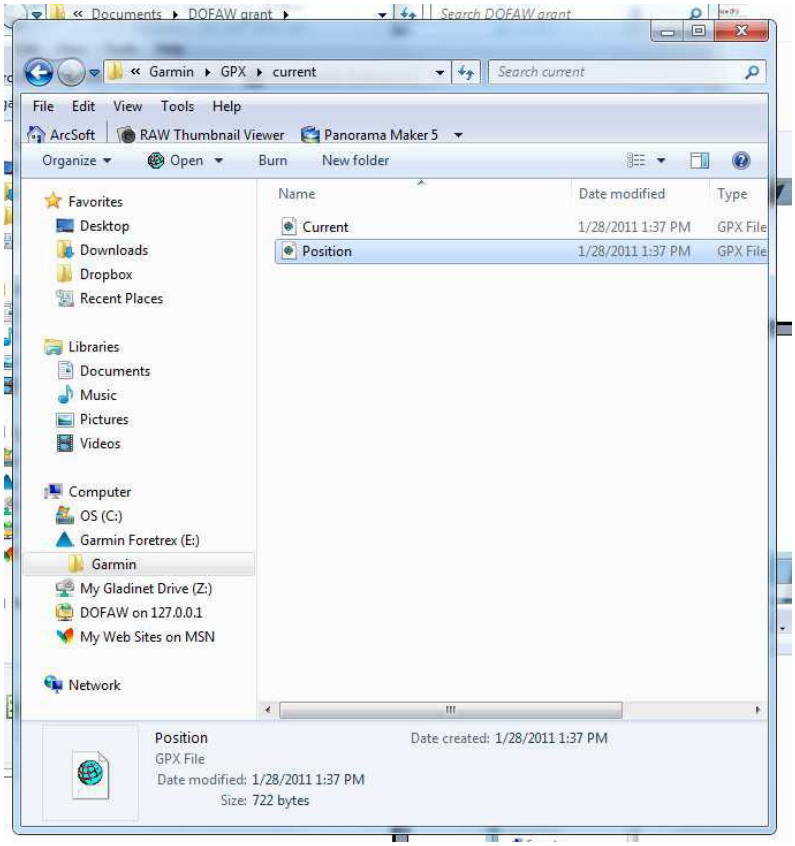
Double-click the file called **current.gpx** and it will open in Mapsource®.



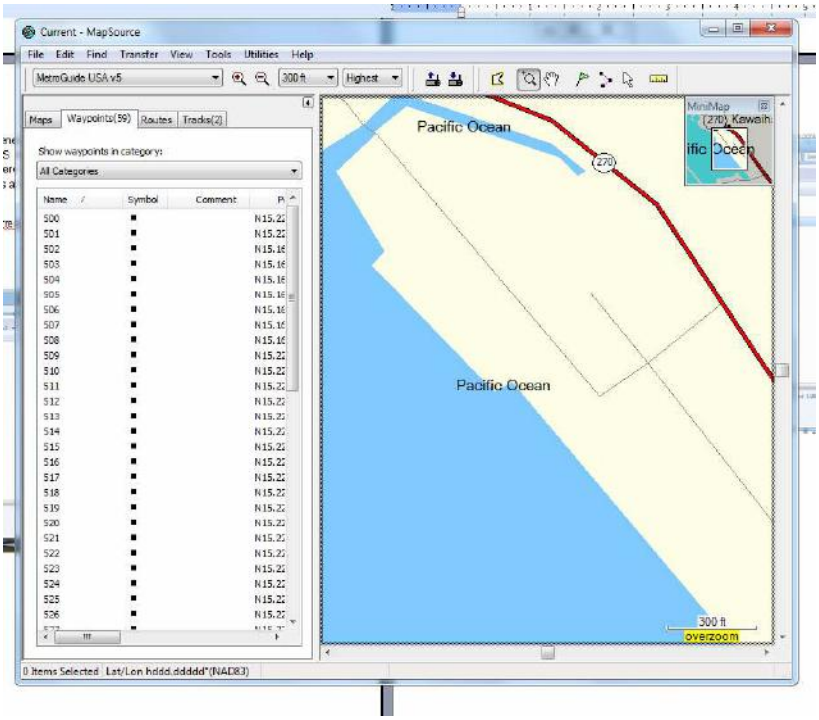
Opening the Garmin drive with “my computer” or widows explorer”

Double-click the GPX folder to view the data files

Choose the "**current.gpx**" file and double-click to open this with the Garmin Mapsource® software

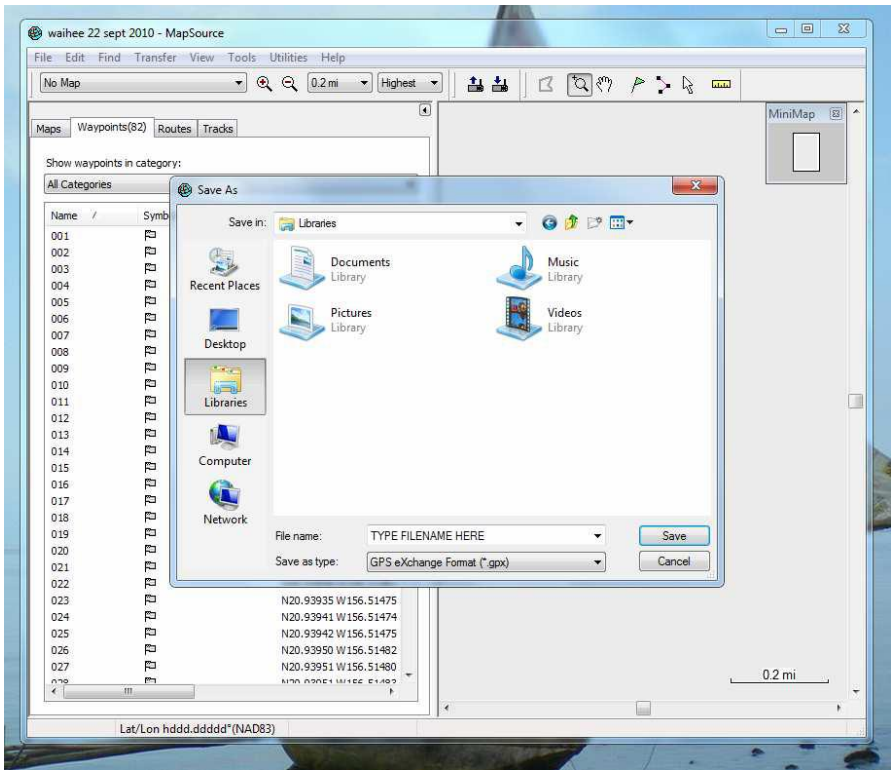


The Mapsource® program will start and show all the waypoints and trip data saved on the GPS.



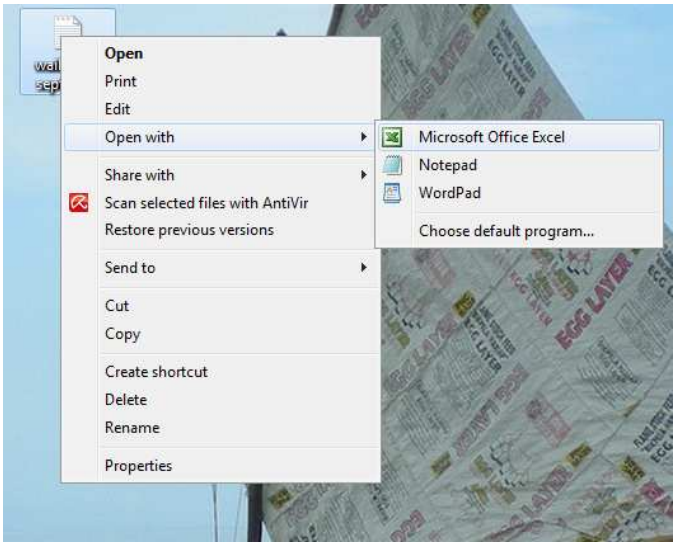
Saving the GPS data onto your computer

1. save the GPS file by choosing "*save as*", and selecting " **GPS eXchange Format (*.GPX)**" and giving the file an appropriate name. The file name should comply with the format outlined in the previous section.
2. Save the file again (with the same name) but this time as a **tab-delimited text file**,
3. Open the txt file by right clicking the file, choosing "**open-with**", and selecting "**Microsoft Excel**" as the program. On some computers, you might have to click on "**choose default program**" and then find the **Excel** program. The waypoint data will now open in **Excel** and allow you to modify columns to suit your needs. You can insert 2-3 columns between the waypoint number and the GPS coordinate where the entomologist can enter the specimen ID.
4. Importantly, when you first save this file, choose "***save-as***", and change the file format to "***Microsoft Excel 97- Excel 2003 & 5.0/95 workbook (*.xls)"***.
5. Data in the additional GPS unit can be downloaded in the same way.
6. **ALWAY**S back-up these files to a secure drive in case of hard drive or computer failure. Also, print out a copy of the combined excel file for archive purposes.

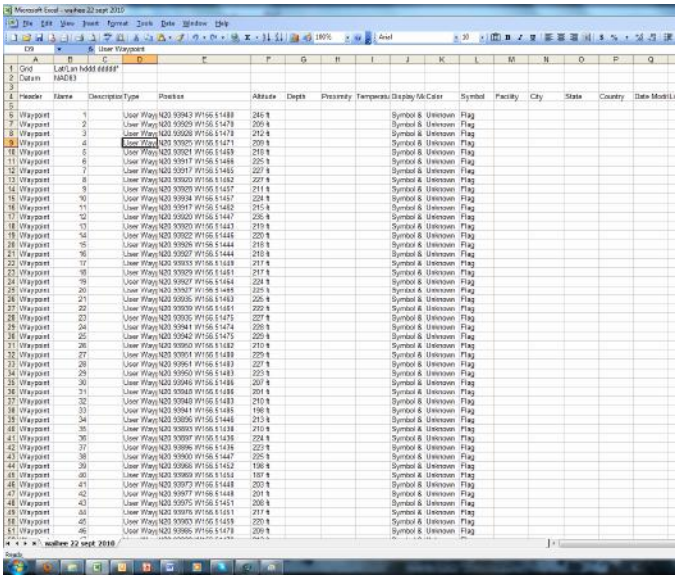


"**Save-as**" screen for saving to a "GPX" file. The drop-down box below the filename will also let you change the format to a "**text (tab delimited"** file type.

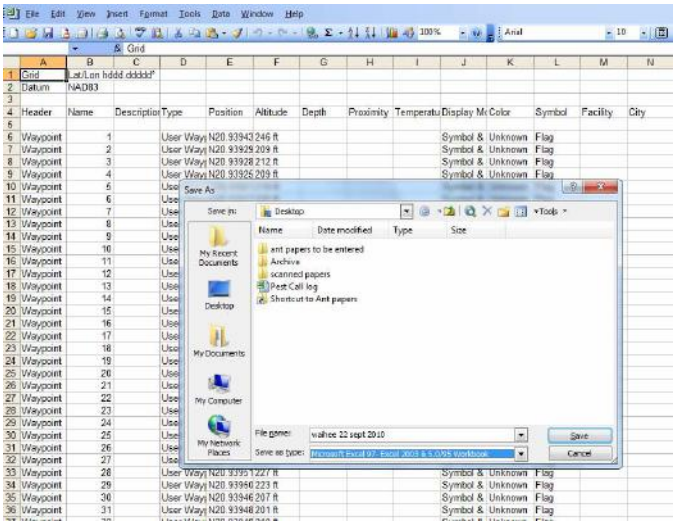
Right-click the text file highlight “open with”, then choose **Microsoft Office Excel**”



Once opened in **Excel**, each waypoint is shown along with the GPS coordinates. At the bottom of the spreadsheet will be time and date stamps



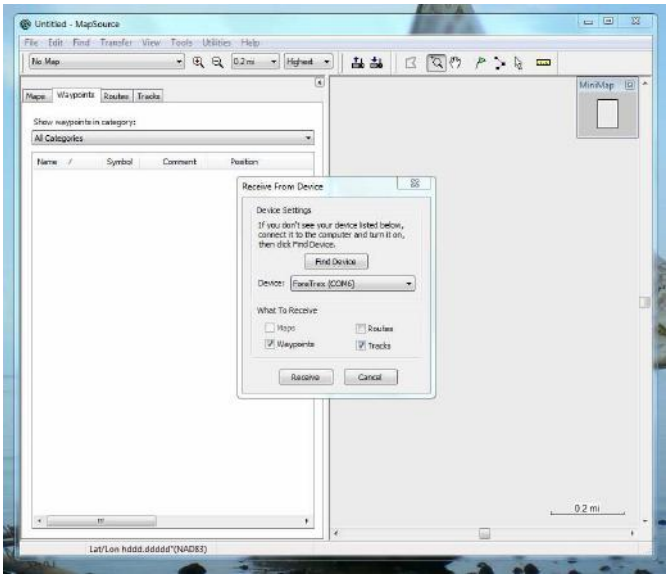
When saving the **Excel** file for the first time, chose “**save as**” and select **“Microsoft Excel 97-Excel 2003 & 5.0/95 workbook**”



Combining data from 2 units and saving as a single data file for sample screening

Data from both units can be imported into Garmin Mapsource®. It is important that the waypoints on each GPS are unique because if some waypoint numbers are the same, they will be over-written when the second instance of that waypoint number is downloaded.

1. connect the GPS to the computer and turn on power
2. start the Mapsource program
3. click "***transfer***", then choose "***receive from device***" a popup window (like the one to the left) will appear showing the GPS unit and allowing a choice of waypoints, tracks and routes to be downloaded.
4. If your GPS does not appear in the "device" box, click "***find device***". If the device can not be found, check the cables and make sure the GPS is turned on.
5. choose to download waypoints only



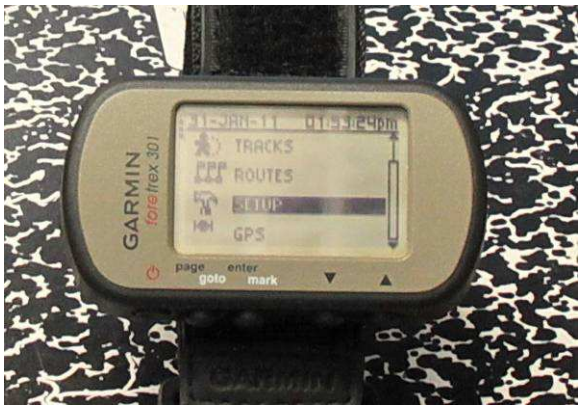
6. the program will download these and show the waypoints in the left hand section of the screen.
7. Connect the second unit and retrieve only the **WAYPOINT** data as in above.
8. this file can be saved both as a GPX and a TXT file in the same way as above.

Deleting data from the Foretrex GPS

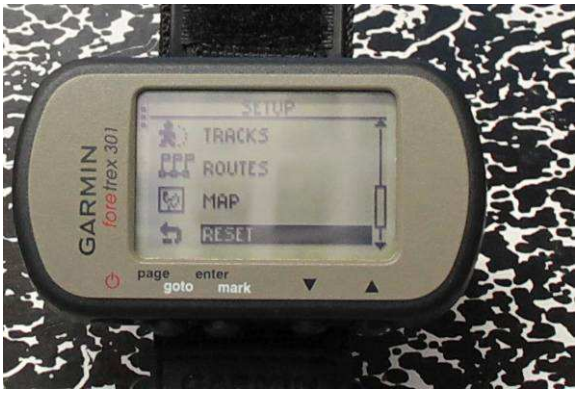
Now you have saved each GPS file individually and saved them as GPX and tab-delimited files; and combined the waypoint data from both units into a single file. The GPS units can now be cleared of all data ready for the next survey. Deleting the waypoints from the Garmin Foretrex 301 is a bit fiddly.

1. Go to the "**Main Menu**" page and scroll down to "**setup**"
2. Within the "**setup**" menu. Scroll down to "**reset**"
3. highlight "Dist, avg, elev, times" and press enter. Highlight the "Yes" box and press "enter" again
4. highlight "Delete all waypoints" and press enter. Highlight the "Yes" box and press "enter" again

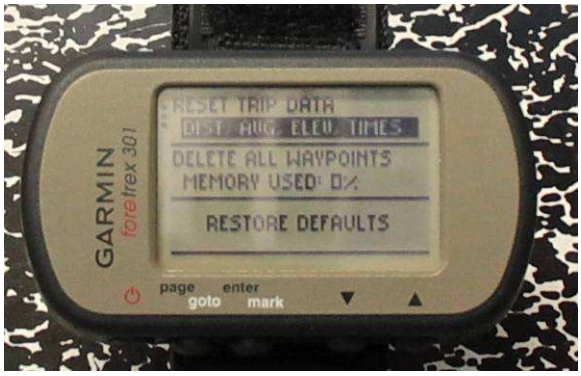
1

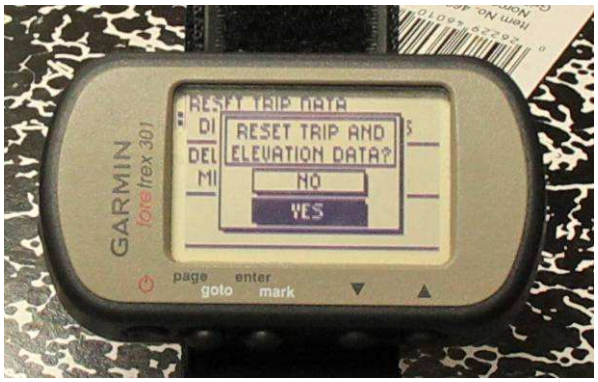

GARMIN
fore trex 301
TRACKS
ROUTES
SETUP
GPS
page
goto
enter
mark

2

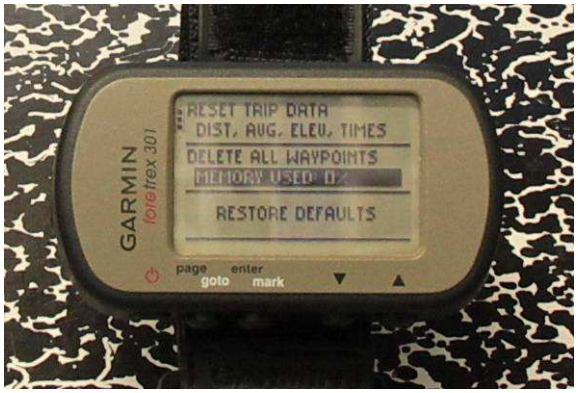

GARMIN
fore trex 301
SETUP
TRACKS
ROUTES
MAP
RESET
page
goto
enter
mark

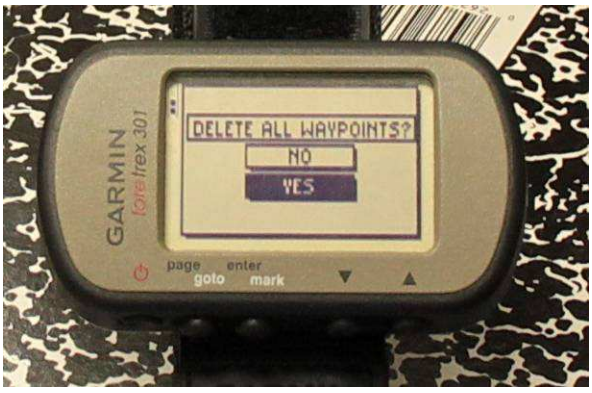
3


GARMIN
fore trex 301
RESET TRIP DATA
DIST, AVG, ELEV, TIMES
DELETE ALL WAYPOINTS
MEMORY USED: 0%
RESTORE DEFAULTS
page
goto
enter
mark


GARMIN
fore trex 301
RESET TRIP AND
ELEVATION DATA?
NO
YES
page
goto
enter
mark

4

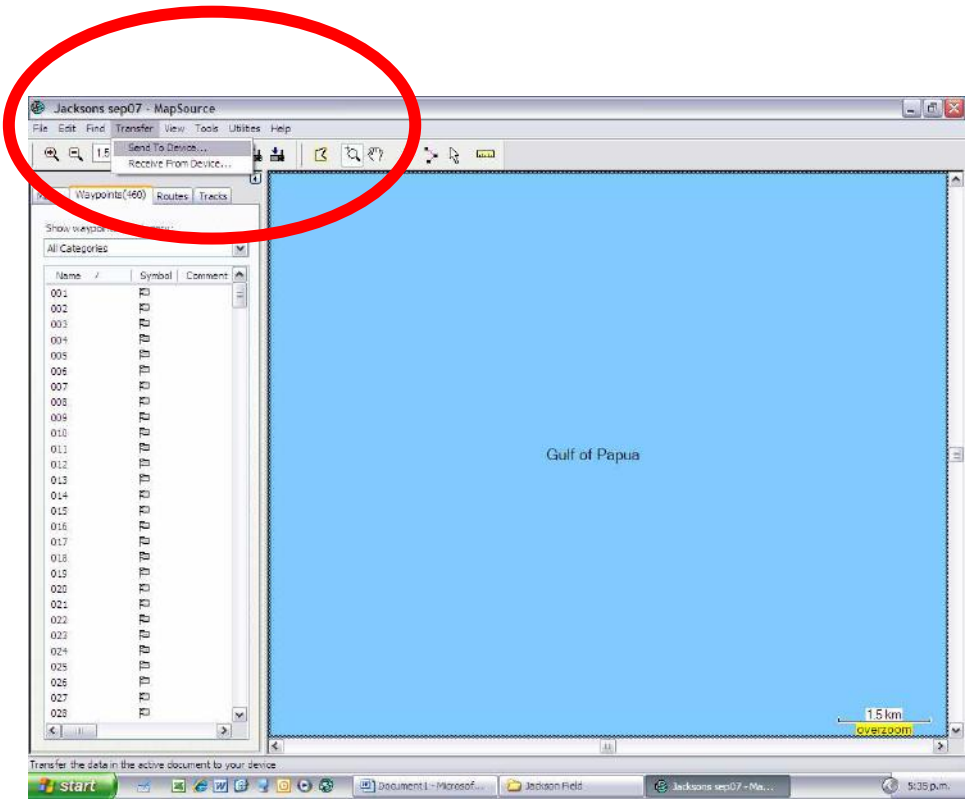

GARMIN
fore trex 301
RESET TRIP DATA
DIST, AVG, ELEV, TIMES
DELETE ALL WAYPOINTS
MEMORY USED: 0%
RESTORE DEFAULTS
page
goto
enter
mark

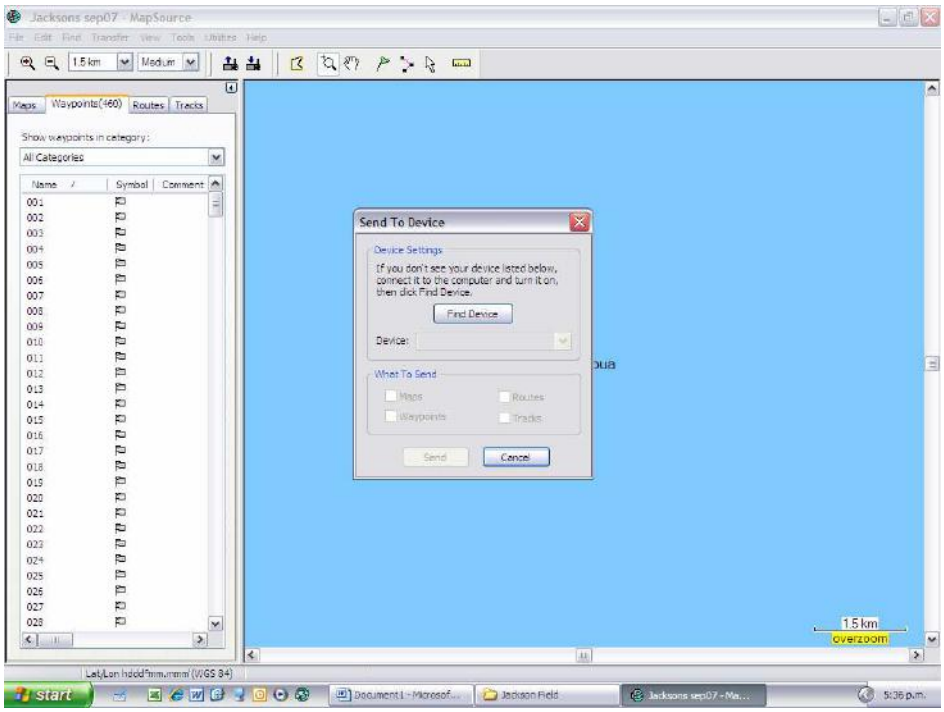

GARMIN
fore trex 301
DELETE ALL WAYPOINTS?
NO
YES
page
goto
enter
mark

Uploading waypoint data back onto a GPS

There are at least 2 reasons for uploading data back onto a GPS. First, Mapping the waypoints on Google Earth can only be done with waypoints in a GPS. Second, if you need to return to a particular waypoint because a suspect sample has been identified, using the GPS go-to function makes it much easier to do so.

1. To upload all waypoints onto a GPS, first make sure all waypoints on the GPS are deleted.
2. connect the GPS to the computer and turn it on – double click on the GPX file containing the waypoints you want to upload.
3. click on "transfer" and choose "*send to device*". A popup window will appear showing the GPS unit and allowing a choice of waypoints, tracks and/or routes to be chosen. Select waypoints only, then click "*send*".
4. Garmin Mapsource will now upload all the waypoints onto the GPS.
5. If only one or some of the waypoints need to be uploaded, delete the unwanted waypoints on the Garmin Mapsource screen before uploading.
6. Make sure when you close the Mapsource program that you do not save changes, **otherwise you will lose data!!!**.


Jacksons sep07 - MapSource
File Edit Find Transfer View Tools Utilities Help
Send To Device...
Receive From Device...
Waypoints(460) Routes Tracks
All Categories
Name / Symbol Comment
Gulf of Papua
1.5 km
overzoom
Transfer the data in the active document to your device
start
Document1 - Microsof...
Jackson Field
Jacksons sep07 - Ma...
5:35 p.m.


Jacksons sep07 - MapSource
1.5 km
Medium
Maps Waypoints(460) Routes Tracks
Show waypoints in category:
All Categories
Name / Symbol Comment
Send To Device
Device Settings
If you don't see your device listed below, connect it to the computer and turn it on, then click Find Device.
Find Device
Device:
What To Send
Maps
Routes
Waypoints
Tracks
Send
Cancel
1.5 km
overzoom
start
Document1 - Microsof...
Jackson Field
Jacksons sep07 - Ma...
5:36 p.m.

Displaying your data in Google Earth

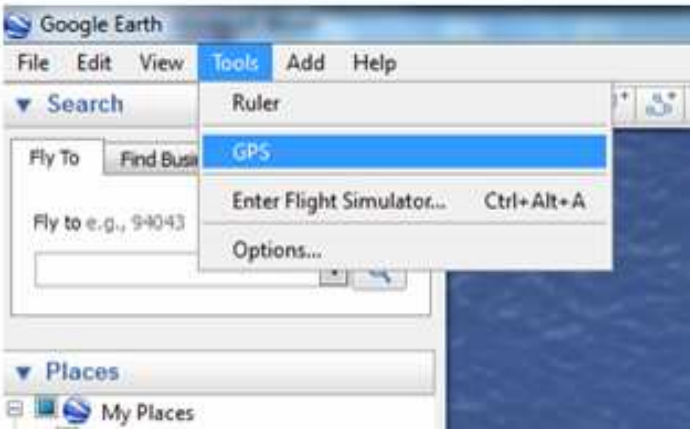
You have probably seen or used Google Earth already. Google Earth is a mapping program that lets you view satellite images and other maps on you PC for free. An internet connection is needed. This program can be downloaded at Google's website http://www.google.com/earth/index.html

One great feature of Google Earth is that you can over-lay GPS data on the satellite imagery. This is a really simple thing to do. And can be done in one of 2 ways – either by importing the data directly from the GPS or by opening a .GPX file. Remember, every computer will be a little bit different so the screen you see might be a bit different from what is shown here.

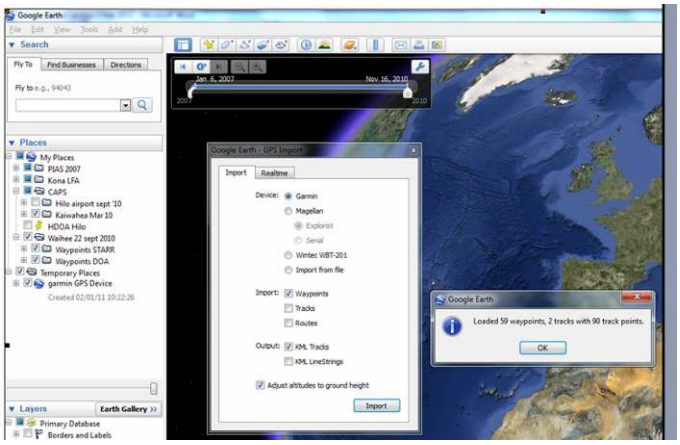
Importing directly from a GPS

1. Start Google Earth, connect the GPS to your computer, then click on "tools" and select "GPS"
2. This will open a pop-up window where you select "Garmin" and whether you wish to import waypoints only or track data as well. Click on "import" and the data points will be uploaded to Google Earth
3. Your data are now available in the left hand panel, under "Temporary Places"
4. Right-click the "waypoints" item in "temporary Places". Now you can save these points in "my places" so you can view them anytime in the future, or save just the waypoints as a ".KMZ" file. Saving it as a KMZ file allows you to keep that file with the data or even email it to someone else for them to view. You can do both. COOL!

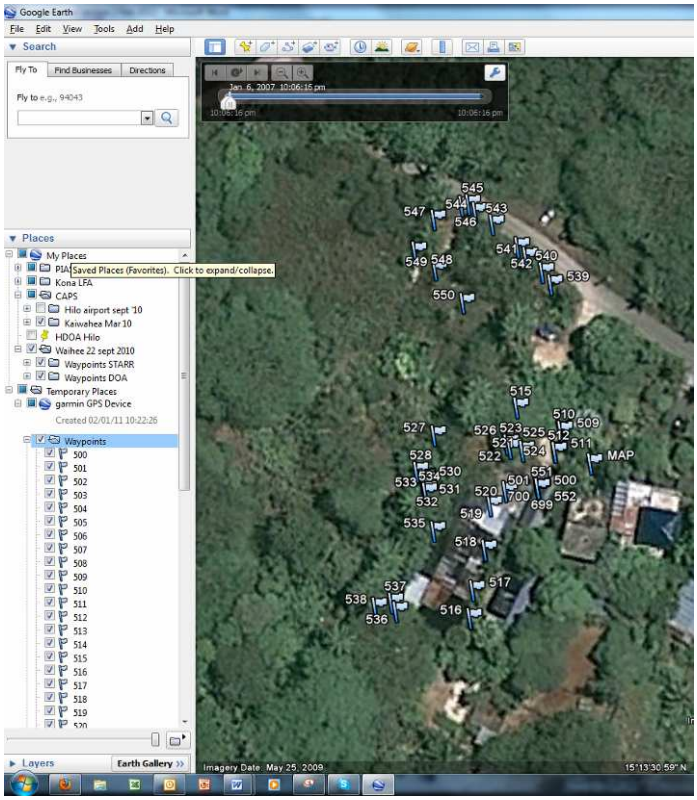
Sometimes (I don't know why) the waypoints will not show on the map. If I uncheck the box called "**waypoints**" then recheck it, the waypoints magically appear… So if this happens to you, maybe try this too.


Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Busi
Fly to e.g., 94043
Ruler
GPS
Enter Flight Simulator... Ctrl+Alt+A
Options...
Places
My Places

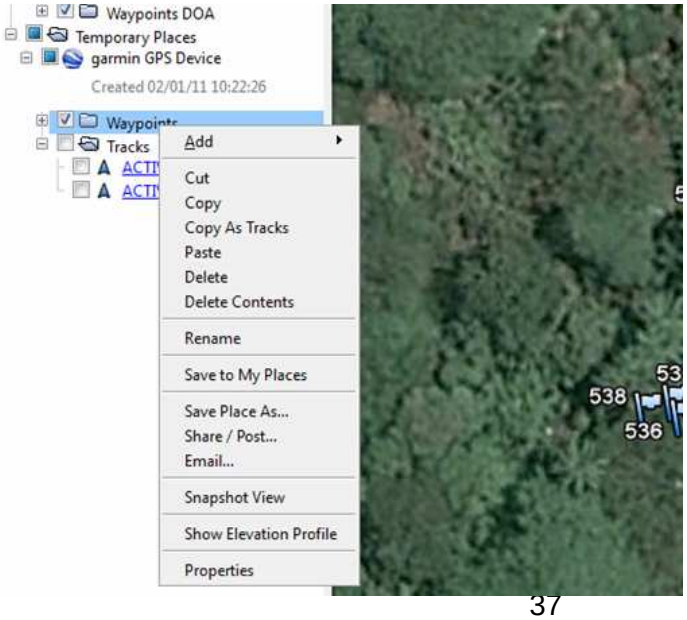
1


Google Earth
Search
Places
Google Earth - GPS Import
Import
Realtime
Device: Garmin
Magellan
Import from file
Import: Waypoints
Tracks
Routes
Output: KML Tracks
KML LineStrings
Adjust altitudes to ground height
Import
Google Earth
Loaded 59 waypoints, 2 tracks with 90 track points.
OK
Layers
Earth Gallery

2


Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Places
My Places
Saved Places (Favorites). Click to expand/collapse.
Kona LFA
CAPS
Hilo airport sept '10
Kaiwahea Mar 10
HDOA Hilo
Waihee 22 sept 2010
Waypoints STARR
Waypoints DOA
Temporary Places
garmin GPS Device
Created 02/01/11 10:22:26
Waypoints
Layers
Earth Gallery
Imagery Date: May 25, 2009

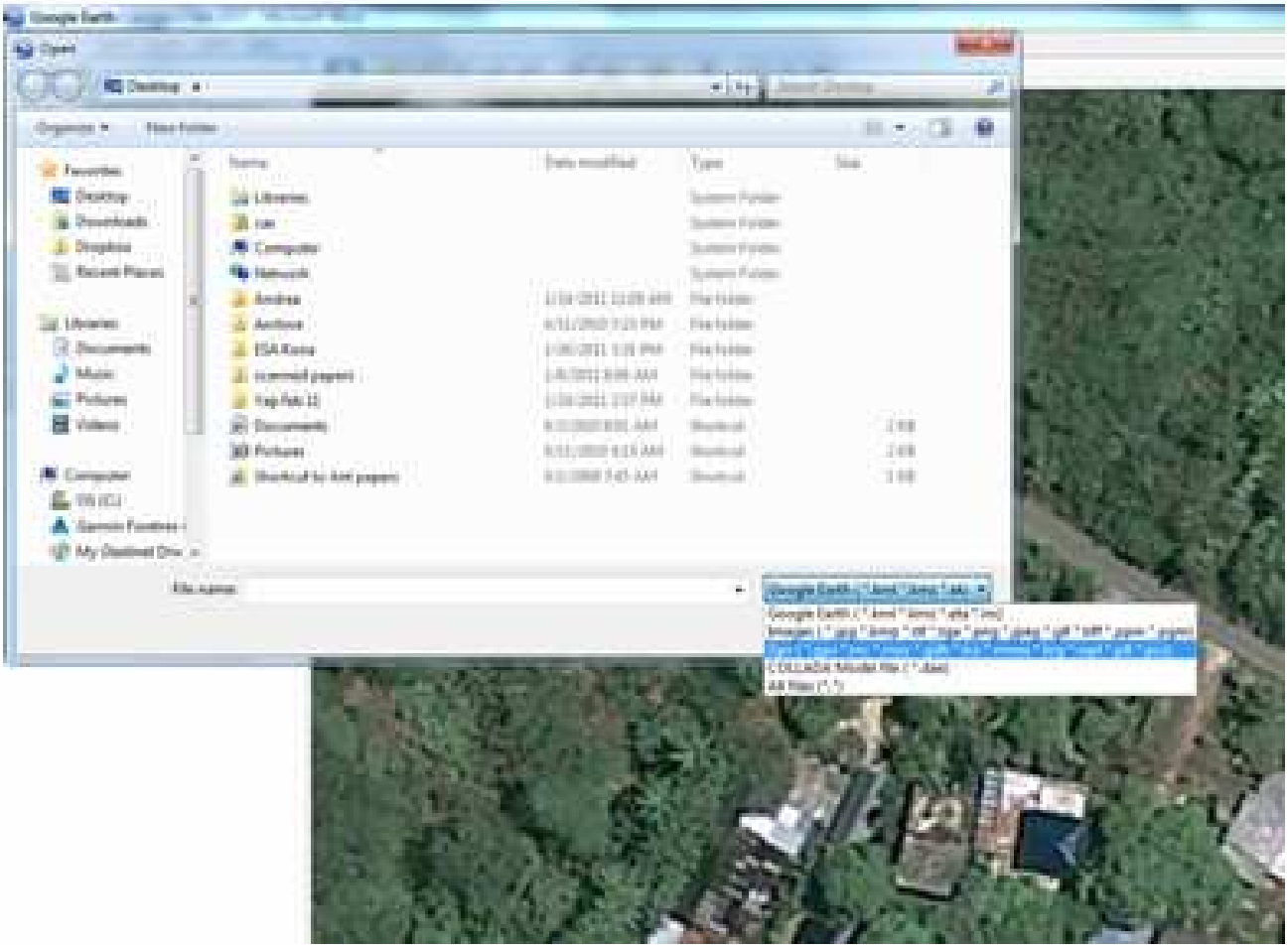
3


Waypoints DOA
Temporary Places
garmin GPS Device
Created 02/01/11 10:22:26
Waypoints
Tracks
Add
Cut
Copy
Copy As Tracks
Paste
Delete
Delete Contents
Rename
Save to My Places
Save Place As...
Share / Post...
Email...
Snapshot View
Show Elevation Profile
Properties

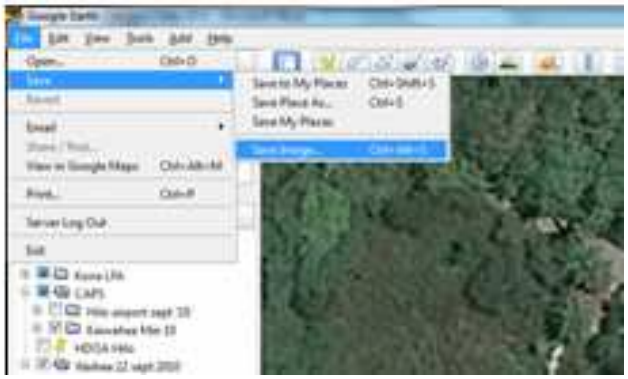
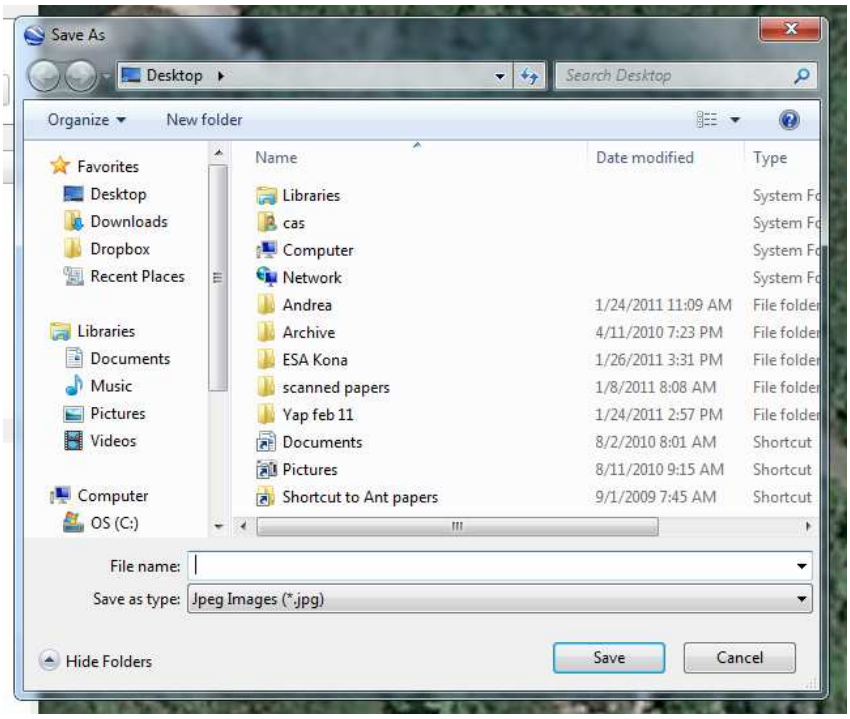
4

Opening a GPX file inside Google Earth

1. Start Google Earth, click on “File” in the top left hand corner of the screen, then select “Open”
2. A search screen will open, but before browsing to the file you want to open, choose the “GPS File” option in the drop-down box next to the file name.
3. Once you have opened the GPX file, everything for saving and viewing the datapoints is much the same as uploading directly from a GPS unit.



Saving a Google Earth image

Having a satellite image with the survey points showing can be very useful for presentations and reports. In Google Earth, its very easy to save an image.

1. Once you have zoomed and framed the image just the way you want, click “foile” then “save” and choose “save image”.
2. A window will pop up allowing you to name your new file and select where it will be saved.