INTRODUCTION

This document contains templates for all of the Kitzes Lab protocols for preparing, deploying, and managing AudioMoths.

Edit the copied document based on what needs to be done on this deployment. Read through this document and follow the instructions in red to make the appropriate changes described before each protocol, including deleting unneeded protocols. Delete the red text when you are done with each task.

Make sure to add relevant dates to the lab calendar as needed (e.g. pickup date; deployment target date for future field seasons).

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Close out deployment

PRE-DEPLOYMENT

If you need to label new microSD cards (fresh from the box), print as many copies of this page as needed and fill them out. If you do not need to label new microSD cards, delete this page.

Set up new microSD Cards (bulk)

Name: Date:

- ☐ Find next card ID by looking at the equipment tracking spreadsheet
- ☐ Log card at the bottom of the "cards" sheet. MicroSD cards should start with the prefix "MSD-"
- ☐ Use a fine-point Sharpie to label card ID **without** MSD prefix. Underline label
- ☐ Connect card to Mac, open it in *Disk Utility*, and Erase card with following settings:
  - "Name" field: card code (MSD-XXXX)
  - "Format" field: MS-DOS (FAT) → card will turn into "FAT32" after formatting
    - Do not use ExFAT unless the AudioMoths have firmware version 1.2.2 or above
    - On Windows computer, download this program to reformat 64GB+ cards to FAT
- ☐ Unmount card by clicking the "eject" symbol in the left menu
- ☐ Double-check that all of the above are consistent

Card name	Card labeled in Sharpie? ✓	Card logged on CARDS sheet? ✓	Card named on computer? ✓	Card formatted MS-DOS (FAT)? ✓	Double-check and initial
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					
MSD-_____					

MSD-_____					

If you need to prepare brand-new AudioMoths, follow the following instructions for each AudioMoth. If not, delete this page. This page is for learning how to set up AudioMoths. To set up many in bulk, after you have learned, use the table on the next page.

Set up new AudioMoth (single)

Below is a detailed setup protocol that can be used to learn how to set up AudioMoths. For bulk setups, print the bulk setup page.

Name: Date: Recorder ID: M____-_____

Label and glue AudioMoth

- ☐ Find the next recorder ID at the bottom of the equipment tracking sheet
- ☐ Log recorder at end “recorders” sheet. Version 1.1 recorders should start with prefix “M11-”
- ☐ Use a fine-tip sharpie to label recorder on white panel **without** M11 prefix & underline label
    - If number is messy, spray rubbing alcohol on a tissue to wipe away number. Wait to dry before rewriting & be careful not to get rubbing alcohol anywhere but the white panel
- ☐ Write recorder prefix and ID number at the top of this protocol
- ☐ Hot glue sharp pins on top of board
    - Avoid touching the circuitboard with the tip of the hot glue gun
    - Make sure the glue touches the circuitboard and not just the metal pins
    - Re-glue board to battery pack if needed

To flash new firmware onto AudioMoth:

- ☐ Download the AudioMoth-Flash app via https://www.openacousticdevices.info/flashing
- ☐ Open the AudioMoth-Flash app and connect the AudioMoth to your computer
- ☐ Hold a paperclip to the “PROG” pins on the AudioMoth until the app finds the AudioMoth
- ☐ Navigate to the desired firmware version (which version?) and download it if necessary
- ☐ Press the green “Flash AudioMoth” button and wait for the config program to apply the firmware
- ☐ Write the firmware version in the “firmware” column on the “recorders” sheet

CHECK:

- All information at the top of this sheet is filled out
- All steps on this sheet are completed and checked off, or have an explanation if they weren’t
- The first three columns of the “recorders” sheet are filled out

Initials:

If you need to prepare brand-new AudioMoths, follow the following instructions for each AudioMoth. If not, delete this page. This page is for setting up AudioMoths in bulk. To learn how to set up an AudioMoth, first use the checklist on the previous page.

Set up new AudioMoths (bulk)

Name: Date:

Recorder version & ID (e.g. M11-1000)	Recorder version logged on recorders sheet? ✓	Recorder ID logged on recorders sheet? ✓	Recorder labeled neatly with Sharpie? ✓	Pins glued? ✓	Firmware flashed? ✓	Hardware version written on "recorders" sheet? ✓	Double-check & initial
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							
M___-_____							

If you need to deploy AudioMoths, follow the instructions on the following three pages. (MicroSD cards and AudioMoths should already be formatted/labeled). If not, delete these three pages.

If you are going to deploy AudioMoths, follow the instructions on this sheet and the next two pages. If you aren't going to deploy AudioMoths, delete these pages. If you are new to preparing up AudioMoths, print several copies of this page to start. Once you are familiar with how to set up AudioMoths, use the bulk setup protocol (next page).

If a "deployments" sheet doesn't already exist for this location, create one by copying this document and then adding it to this master list.

Prepare AudioMoth for programming

Below is a detailed preparation protocol that can be used to learn how to prepare AudioMoths for deployment. For large deployments setups, print the bulk preparation page.

Name: **Recorder ID:** M____-_____

Date: **MicroSD card ID:** MSD-_____

Anticipated deployment date (YYYY/MM):

- ☐ Write recorder ID (prefix and number) at the top of this protocol
- ☐ Write card code (number) at the top of this protocol

Prepare the AudioMoth hardware

- ☐ Use a fine-point Sharpie to very carefully rewrite recorder ID if it is faded
- ☐ Gently move switch to "CUSTOM" mode
- ☐ Insert three AA batteries
- ☐ Check that LEDs are blinking
    - If blinking, move switch to "OFF" mode
    - If not blinking, check that batteries are inserted correctly
- ☐ Use a fine-point Sharpie to very carefully rewrite microSD card ID if it is faded
- ☐ Insert microSD card

Check AudioMoth hardware

- ☐ Switch the AudioMoth to "default" mode, let it record for 1 minute, then turn it "OFF"
- ☐ Inspect microSD card on computer to ensure that recording was saved on card
- ☐ Reformat microSD card

Log recorder on DEPLOYMENTS sheet

- ☐ Make a new deployment on this site's "deployment locations" sheet
    - Give recorder a sequential deployment number (SITE_YEAR_XXXX, e.g. SCBI_2020_0001)
    - Log recorder ID & card ID
- ☐ Write deployment number at the top of this protocol

CHECK:

- The first three columns of the "deployment locations" sheet are filled out
- Both columns at the top of this sheet are filled out
- All checkboxes on this sheet are checked, or have an explanation if they aren't checked

Initials:

Prepare AudioMoths for programming (Bulk)

Name: **Date:**	**Site:** **Deployment date (YYYY/MM):**

For bulk setups, print as many times as needed. When finished, file printouts in file cabinet.

Batteries, SD card, and tape can be put into recorders in an “assembly line” format before filling out this sheet, e.g. putting in all cards first, putting in all batteries second, taping all batteries, etc. In any case, this sheet should be used to log the recorder/card associations and put information into the “deployment locations” sheet

- ☐ Log recorder ID and SD card ID on “deployment locations” sheet
- ☐ Give recorder a sequential deployment number (SITE_YEAR_XXXX, e.g. SCBI_2020_0001)
- ☐ Check battery orientation by switching to CUSTOM mode and ensuring LEDs flash, then turning OFF
- ☐ Check that batteries are taped securely into AudioMoth

Recorder ID:	SD card ID:	Deployment number (SITE_YEAR_XXXX)	Switch off? ✓	Batteries taped in? ✓	Check & initial:
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			
M___-________	MSD-________	_______-_______-_______			

If you need to create or change a recording schedule for the AudioMoth, follow the steps below

Create recording schedule for AudioMoth

Decide on timing

- Identify the local timezone that the AudioMoth will be deployed in
    - Keep in mind whether the AudioMoth will be deployed during daylight savings time
    - **Local time zone: _____**
- Identify how many hours ahead or behind UTC the timezone is
    - UTC does not observe daylight savings time
    - E.g. Eastern Standard Time (EST-5) is 5 hours behind UTC
    - Eastern Daylight Time (EDT-4) is 4 hours behind UTC
    - **Offset from UTC: _____**
- Decide on the time of day, in the timezone, that the AudioMoth should record
    - Keep in mind that sunrise/sunset times will change over the course of the deployment
    - If selecting sunrise time: can use average sunset time over the course of the deployment, or use the earliest sunrise time to be sure you capture sunrise
    - **Recording period (local time zone): _____**
- Convert the time in the timezone to UTC
    - Keep in mind that UTC is a 24-hour timezone (1PM UTC = 13:00 UTC)
    - **Recording period (UTC): _____**

Create schedule

- Write in recording start and end period in UTC
- Click “add recording period”
- Select sample rate (audible sounds = 32kHz; ultrasonic = 192 kHz or more)
    - **Sample rate: _____**
- Select a sleep and recording duration in **seconds**
    - Make sure each file size is substantially less than 1000 MB (659 MB is good)
- Enable or disable LEDs

Save and store schedule

- Open save dialogue (AudioMoth-Config menu > Save configuration)
- Name config file with a descriptive name in the following format:
    - SITENAME_YEAR-MO_LOCALSTARTTIME-LOCALENDTIME_DESCRIPTION.CONFIG
    - E.g. PNRE_2019-04_0541-0841_starting30minbeforesunrise.config
- Upload config file to google drive in the field season folder for this deployment

Program AudioMoths

Name: Date:

- ☐ Open config file in AudioMoth-Config software (AudioMoth-Config > Open Configuration)
- ☐ Plug AudioMoth into computer
- ☐ Check that batteries are inserted correctly by using time on config app
    - If counting from 00:00:00 01/01/1970, unplug Audiomoth & recheck battery orientation
- ☐ Find AudioMoth row on this site's "deployment locations" sheet
- ☐ In AudioMoth's row, write firmware version shown at top of AudioMoth-config app
- ☐ In AudioMoth's row, write filename of config file in the "deployment locations" sheet
- ☐ Press the green "Configure AudioMoth" button
- ☐ Wait until green button lights up again then disconnect AudioMoth
- ☐ Recheck all actions and initial

AudioMoth ID	Check time on config app? ✓	Firmware version on dep. loc. sheet? ✓	Name of config file on dep. loc. sheet? ✓	Configure AudioMoth? ✓	Recheck and initial
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					
M____-_____					

If you are going to place AudioMoths in vacuum-sealed bags, follow the steps below

Seal AudioMoths in bags

Create bag

- Use vacuum sealer such that bag is sealed on 3 sides: 2 long, one short
- Push short sealed side of bag as far back into vacuum sealer as possible to create second seal at the top of the bag
    - Bags should be big enough that they have at least 4 inches of space between the second seal and the bottom of the bag
- Snip corners in and insert strap between seals

Static spray

- Open bag such that it stays open
- Spray static spray to lightly cover inside of bag (avoid condensation/drips)
    - Alternatively, rub inside of bag thoroughly with dryer sheet
- Allow static spray to dry with bag opened

Put AudioMoth into bag

- Make sure there is no condensation remaining e.g. in the corners/edges
- Snugly place information card at top corner of bag (if using cards)
- Place desiccant next to note at top of bag
- Turn AudioMoth on CUSTOM mode and ensure SD card is inserted correctly
- Put AudioMoth in bag under note
- Seal bag closed

Example information card text:

This equipment is being used to record bird songs from 5:00AM-8:00AM. University of Pittsburgh researchers use these recordings to identify breeding bird species and study their distribution. Please contact <NAME> at <EMAIL ADDRESS> with questions about this study.

Delete all unnecessary items from this checklist, fill in all blanks, then print.

Packing checklist

Deployment date: _____

Anticipated activities: (choose one)

- First deployment (first placement of AudioMoths of the season)
- Hotswap (remove deployed AudioMoths and place new AudioMoths)
- Removal (remove deployed AudioMoths)
- Localization test

Anticipated return date(s): _____

Site-specific instructions (update on master copy as needed)

- ☐ AMPR: Extra time to account for shipping
  - ☐ 80 total moths, not more than 20 to be in bison pastures (tupperwares)
- ☐ Sproul State Forest: Research agreement

AudioMoth hotswap equipment

- ☐ Moths: num. recorders & microSD cards = _____
- ☐ Extra moths & microSD cards = _____
- ☐ Extra AA batteries
- ☐ First deployment: pre-packed bags = _____
  - ☐ Plastic bags or cases
  - ☐ Notes for plastic bags
  - ☐ Desiccant packets
  - ☐ Straps
- ☐ Hotswap: how to change this equipment/streamline the process?
- ☐ Removal: how to change this equipment/streamline the process?

First deployment: setup equipment

- ☐ Sign setup equipment
  - ☐ “Consent to be recorded” signs on Rite in the Rain paper (make them larger next time?)
  - ☐ Hammer
  - ☐ Nails
  - ☐ Straps or poles
- ☐ Localization setup equipment
  - ☐ Poles/stakes
  - ☐ Hammers
  - ☐ Transect tape
- ☐ Tree-based setup equipment
  - ☐ Straps
  - ☐ Flagging tape
  - ☐ Screwdrivers

GPS-related

- ☐ Garmin GPS handheld unit (for accessing GPS points)

- [ ] GPS points loaded into GPS unit
- [ ] Charging cord & wall charger for Garmin
- [ ] Garmin manual
- [ ] Extra AA batteries for Garmin

Protocol-related

- [ ] A list of the tasks in field (written on the Deployment Checklist)
- [ ] Appropriate number of field protocols (created from template), printed on Rite in the Rain paper + extras: _____ + _____
    - [ ] Record microSD number if possible (put on field protocol if cards being removed but recorders being left behind; put on equipment check-in protocol if entire housing is being removed)
    - [ ] Next localization trip: localization testing protocols
- [ ] Click-to-write waterproof pens (Rite-in-the-Rain type) or pencils
- [ ] Binders/clipboards for protocols
- [ ] Post-deployment notes for previous deployment at this location (on a sheet of paper for reference in the field)

First aid kits

- [ ] Personal first aid kits
- [ ] Hygiene & antiseptics
    - [ ] Antiseptic/alcohol wipes
    - [ ] Iodine
    - [ ] Nitrile gloves
    - [ ] Hand sanitizer
- [ ] Bandages & wound coverings
    - [ ] Adhesive tape
    - [ ] Adhesive bandages (bandaids) - multiple sizes
    - [ ] Sterile gauze bandages
    - [ ] Roller bandages
    - [ ] Absorbent compress
    - [ ] QuikClot bandage
    - [ ] Moleskin tape
    - [ ] Sterile wound closure strips
- [ ] Medication and ointment
    - [ ] Antibiotic ointment (Neosporin)
    - [ ] Oral antihistamines (Benadryl, Zirtec, Claritin)
    - [ ] Topical anti-itch lotions (hydrocortisones, Calamine)
    - [ ] Poison ivy cleansing soap (Tecnu)
    - [ ] Oral pain relievers (NSAIDs: Ibuprofen, acetaminophen, Naproxen sodium, or aspirin products)
    - [ ] Anti-diarrheal medicine - Diamode, Imodium, or any other Loperamide product
    - [ ] Antacids like pepto-bismol or Maalox
    - [ ] Eye wash
    - [ ] Ammonia inhalant ampoules
- [ ] Other
    - [ ] Oral rehydration salts
    - [ ] Instant cold packs

- [ ] Instant heat packs
- [ ] CPR mask
- [ ] Duct tape
- [ ] Superglue

- [ ] Reusable supplies
  - [ ] Waterproof carrying case for first aid kit, ideally unzips and lays flat
  - [ ] Field safety manual and emergency plan
  - [ ] First aid scissors and EMS shears
  - [ ] Miscellaneous forceps and fine point tweezers
  - [ ] Pencil + Paper for vitals and symptoms notes, Rite in the Rain or similar notebook preferred
  - [ ] Irrigation syringe
  - [ ] SAM splint
  - [ ] ACE bandages
  - [ ] Tick-twister or tick key
  - [ ] Thermometer
  - [ ] Hand mirror

Other

- [ ] Long deployments: box to hold a small ready supply of moths & housings
- [ ] Box to hold used SD cards
- [ ] Box to hold used batteries
- [ ] Boxes to hold old moths
  - [ ] Long transect: boxes should be numbered & assigned to a certain series of points
- [ ] Misc. toiletries
  - [ ] Tissues
  - [ ] Sunscreen
  - [ ] Permethrin/tick repellent
  - [ ] Baby wipes
- [ ] Programming tools
  - [ ] Laptop & case
  - [ ] Apps on laptop
  - [ ] Laptop charger
  - [ ] SD cards for programming SM4s/SM3s
  - [ ] Lightning-to-USB port
  - [ ] MicroUSB cord
  - [ ] SD card reader
  - [ ] Extension cord
- [ ] Misc. tools
  - [ ] Umbrella
  - [ ] Bright orange vests
  - [ ] Sticky notes
  - [ ] Write-on tape
  - [ ] Scissors
  - [ ] Box-cutter
  - [ ] Duct tape
  - [ ] Machete

- [ ] Gloves
- [ ] Extra paper/notebook
- [ ] External battery pack & charging cords (e.g. phone cord, speaker cord, etc.)
- [ ] Several microUSB cords: _____
- [ ] Cigarette lighter charger
- [ ] Trash bag
- [ ] Emergency contact method if cell phones are not available

Field safety training and preparation

All lab members should refamiliarize themselves with two field safety manuals:

- Pitt field safety manual
- Transportation and wildlife safety

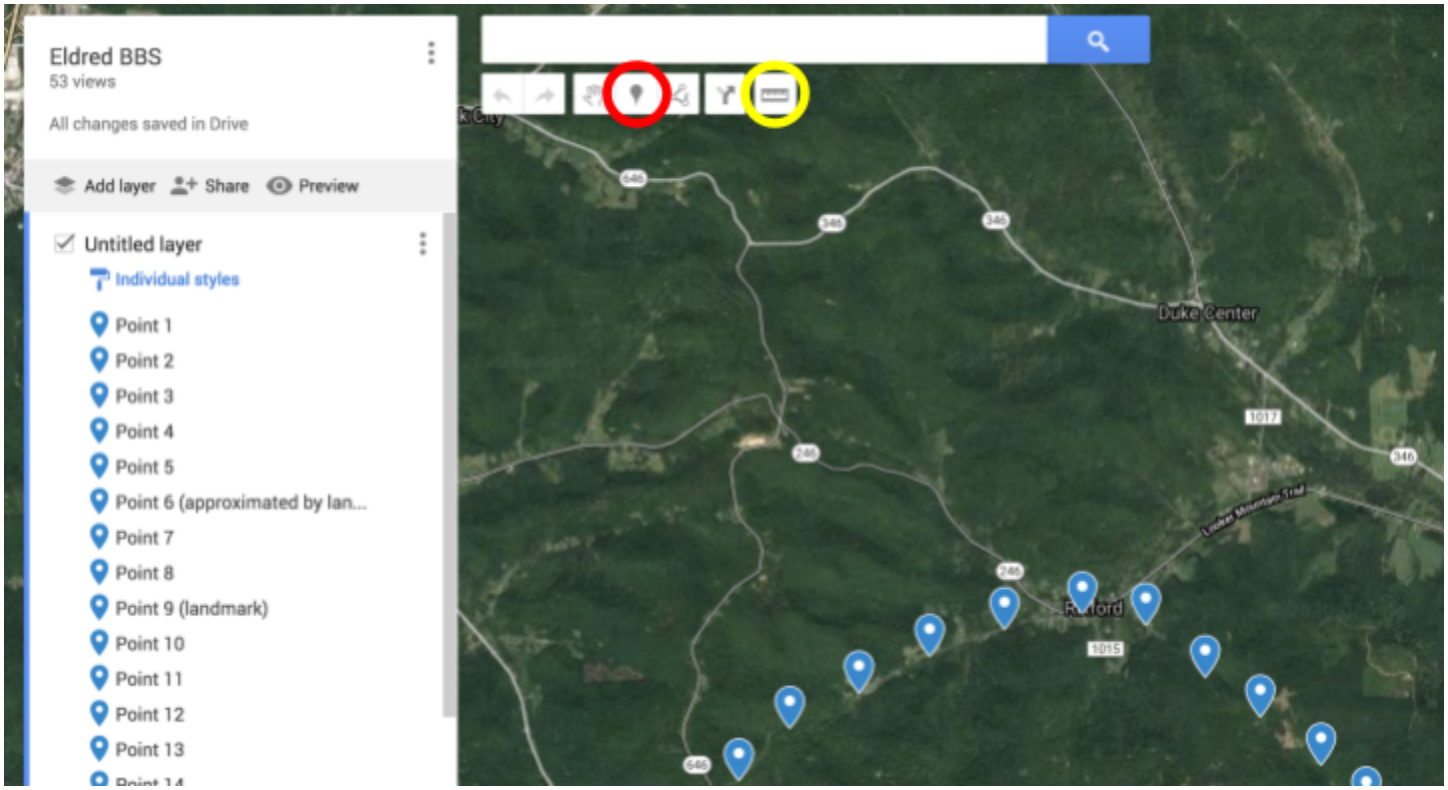
Lab members should take action on these manuals where necessary including, but not limited to:

- If using field vehicles, stock vehicles with recommended safety equipment (Appendix 3)
- Fill out the field safety plan (Appendix 4)
- Replenish first aid kit where needed (See packing list; taken from Appendix 5)
- Prepare and distribute individual first aid kits
- Add any other needed actions here

Use the following protocol if you want to hand-select deployment locations using Google Maps online

Select locations using Google Maps

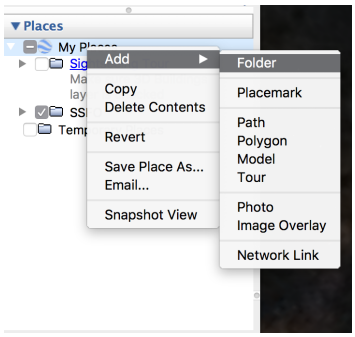
- First, create a Google Map: google.com/maps > Menu > Your Places > Maps > Create Map
- Name the map as desired
- To set a point, use the “Add Marker” button circled in red (see image below). Your pointer will turn into cross-hairs, and you can then click the map where you would like the point to go.
- To measure distance between points, use the ruler button circled in yellow (see image below)
- Rename and add notes to points as desired
- When you are happy with your points, click the three dots to the right of the map name (here, “Eldred BBS”) and export as KML/KMZ.



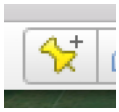
Use the following protocol if you want to select deployment locations using the Google Earth desktop program

Select locations using Google Earth

1. Using Google Earth Pro, locate your study area
2. Right click on “My Places” in the left-hand pane and click “Add > New Folder”

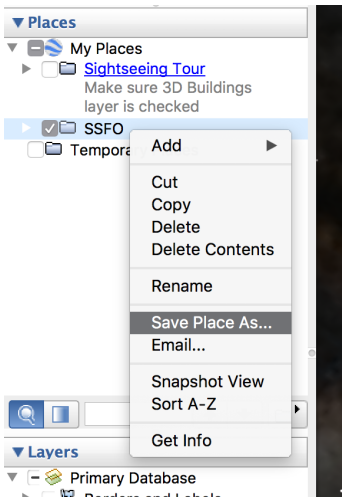


3. Use the four-letter bird code convention to name your folder (e.g. Sproul State Forest = SSFO)
4. Use the placemark tool to create a waypoint



5. Use the four-letter bird code convention to name your waypoints, followed by a dash and a four-digit number, (e.g. first point in Sproul State Forest = SSFO-0001)
6. Make sure your waypoint is saved in the right folder under “My Places”
7. Use the show ruler tool to measure 100m from the first waypoint. This is where your next waypoint will be placed

8. Repeat steps 2-4 as needed
9. Right click on your transect folder and click “Save Place As…”



10. Save as a .KML file to a directory that you will remember.
11.

Use the following protocol to transfer a KML file onto a Garmin GPS unit

Transfer Waypoints from Google Maps/Earth to Garmin GPS Unit

1. Get KML file from Google Maps or Google Earth
2. Convert map file to .GPX format using https://mygeodata.cloud/conversion
3. Download and unzip the converted file.
4. Connect Garmin to the computer via USB.
5. Open Garmin drive and navigate to the “GARMIN” folder.
6. Drag and drop the GPX XML file to the “GARMIN” folder.
7. Eject the Garmin.
8. Your waypoints have successfully been added to the GPS unit!
9. In the field, if you need to move a point for any reason, you can do that on your GPS unit either by resetting the point or by making a new point. Document this in your notes so it’s clear which points were moved where.

FIELD

If you are picking up old recorders and placing new ones (hotswap), print this sheet as many times as necessary. Modify the parts in red as needed. Make sure numbered steps correspond to descriptions in table.

AudioMoth Hotswap Datasheet

Deployment team: _____ Today's date: _____

1. Write down point number
2. Carefully remove old recorder, write down recorder number, and turn switch to OFF.
3. **If not using heat-sealed bags**: Write down the name of the old SD card
4. Write down the number of the new recorder
5. **If not using heat-sealed bags (NHS)**: Write down the name of the new SD card
   If using heat-sealed bags (HS): Check that microSD card is fully inserted. Reinsert if necessary
6. **NHS**: Switch AudioMoth to CUSTOM mode. **HS**: Check AudioMoth is switched to CUSTOM mode
7. Check that the AudioMoth LED lights aren't blinking.
8. Strap AudioMoth to tree. Check that mic faces outward, isn't obscured by desiccant, and bag is intact
9. Write any needed notes, e.g. blinking, bag broken, tampered with, point repositioned on GPS, etc.
10. Review that ID numbers are correct & double-check that every action was done. Initial to confirm

1. Point number	2. Old recorder number **(OFF)**	3. Old SD card number (✓)	4. New recorder number	5. New SD card number inserted? (✓)	6. CUSTOM mode? ✓	7. LEDs not blinking ✓	8. Mic clear & bag intact? ✓	9. Notes (bag broken?, point moved?)	10. Review (initial)

If you are only placing new recorders (first deployment), print this sheet as many times as needed. Modify the parts in red as needed. Make sure the numbered steps correspond to their short descriptions in the table.

AudioMoth First Deployment Datasheet

Deployment team: _____ Today's date: _____

1. Write down the number of the point. Flag if needed
2. Write down the number of the new recorder
3. **If not using heat-sealed bags (NHS)**: Write down the name of the new SD card
   If using heat-sealed bags (HS): Check that microSD card is fully inserted. Reinsert if necessary
4. Check that the AudioMoth is switched to "CUSTOM" mode
5. Check that the AudioMoth LED lights aren't blinking.
6. Strap AudioMoth to tree. Check that mic faces outward, isn't obscured by desiccant, and bag is intact
7. Write any needed notes, e.g. positioning, possible obstructions, etc.
8. Review that ID numbers are correct & double-check that every action was done. Initial to confirm

Before deployment: **After deployment:**

1. Point number (flagged)	2. Recorder number	3. MicroSD card number/ inserted? (✓)	4. CUSTOM mode? ✓	5. LEDs not blinking? ✓	6. AudioMoth mic clear & bag intact? ✓	7. Any notes needed	8. Actions reviewed (initial)

If you are only picking up old recorders (Removal), print this sheet as many times as required. Modify the parts in red as needed. Make sure the numbered steps correspond to their short descriptions in the table.

AudioMoth Removal Datasheet

Deployment team: _____ Today's date: _____

1. Write down point number
2. Carefully remove old recorder, write down recorder number, and turn switch to OFF.
3. **If not using heat-sealed bags**: Write down the name of the old SD card
4. Take note of anything unusual that happened to the moth, e.g. blinking, bag broken, tampered with, etc.
5. Review that ID numbers are correct & double-check that every action was done. Initial to confirm

1. Point number (flagged)	2. Old recorder number **(turn off)**	3. Old SD card number	Notes (bag broken?, location moved?)	Review (initial)

POST-DEPLOYMENT

Upload point latitudes/longitudes to deployment locations spreadsheet

- Get a map file (format: .KML or .GPX)
    - From a map on Google Maps: Download KML
        - Open map in Google My Maps (maps.google.com > Menu > Your Places > Maps)
        - Click the three dots to the right of the map name and export as KML
    - From a map on Garmin: Download GPX file
        - Main Menu > Setup > System > Interface > Garmin Serial
        - Connect to computer
        - On computer, navigate to the map on your Garmin, e.g., Volumes/GARMIN/Garmin/GPX/Waypoints_[fielddate].gpx/
- Convert map file to .CSV format using https://mygeodata.cloud/conversion
- Download and unzip converted file
- Open converted .CSV file in Excel
- Copy and paste information onto “location” sheet of deployment locations spreadsheet
    - site (e.g. PNRE-POND or PNRE-MACA)
    - location ID number
        - Formatted ID numbers the same way as on the deployment locations sheet: numbers/suffixes only, e.g. 64-N. These location names are used as ground truth to check that the location IDs on the deployment locations spreadsheet exist.
    - latitude (X)
    - longitude (Y)
    - Any notes

This should be done before microSD cards are removed from recorders. Remove any unneeded sections based on whether this is a first deployment, hotswap, or removal.

Digitize field datasheets

For each row of the field protocol, do the following. Place a check mark (✓) in each cell of the field datasheet when it has been checked.

For old recorders that were picked up: Look up the **recorder_ID** on the deployment locations sheet. Make sure to use the most recent deployment of that recorder. Review or fill in these columns in the recorder's row:

- ✓ **card_ID:** if card IDs were noted in the field, check that the pairing is right
    - Make note on brain dump of the recorder_ID and potential card_IDs if pairing is not right
- ✓ **location_number:** check that the location on the field note sheet is the same
    - Make note on brain dump of the recorder_ID and location_number
- **pickup_date**: write the date the recorder was picked up based on the date at the top of the protocol
- ✓ **pickup_notes:** write any relevant notes from the field notes

Any remaining old recorders on the "deployment locations" sheet that were not picked up on the field protocol are considered "lost." Do the following for these recorders:

- **pickup_date** and **recorder_checkin_date**: write NA
- **pickup_notes** and **recorder_checkin_notes**: write "lost" or any other details
- **card_upload_date:** write NA for lost cards
- **card_upload_notes:** write NA for lost cards
- If necessary: Mark recorder "lost" on master recorder tracking sheet with today as retirement date
- If necessary: mark SD card "lost" on master card tracking sheet with today as retirement date

For new recorders that were deployed: Look up the **recorder_ID** on the deployment sheet. Make sure to use the most recent deployment. Review or fill in these columns in the recorder's row:

- ✓ **card_ID:** if card IDs were noted in the field, check that the pairing is right
    - Make note on brain dump if pairing is not right
- ✓ **location_number:** write the location the recorder was deployed
- **dropoff_date:** write the date each new recorder was deployed based on the date at the top of protocol
- ✓ **dropoff_notes:** write any relevant notes from the field notes

Any recorders or microSD cards that were thought to be lost but were found:
Update status of recorders/cards on master equipment tracking sheets

Always:

- Transfer any relevant notes about the location to the "locations" sheet
- Place check mark on field protocol
- Double check all actions & initial in the table below

Review:

- Double check that each cell of the field protocol has been checked
- Double check that each row of the relevant recorders is filled out
    - All cells up to dropoff_notes if recorder was just deployed
    - All cells up to pickup_notes if recorder was just picked up, or is lost

Use the following protocol to sort out any used or unused recorders brought back from the field.

Check in recorders

For each *used* recorder brought back: Look up the **recorder_ID** on the deployment sheet.

- Ensure recorder is turned off
- Write today's date as the **recorder_checkin_date**
- If necessary, note recorder's status (e.g. corrosion) in **recorder_checkin_notes**
- Check previous deployment's brain dump to see if this recorder was mentioned.
    - If microSD cards on the deployment locations sheet didn't match, check the microSD card currently in the recorder and correct the sheet accordingly.
- Remove the SD card, batteries, & external attachments
    - Place SD card in a "TO UPLOAD" box
    - Place batteries in recycling bin
- Put recorder in "TO TEST" box

For each *unused* recorder brought back

- Ensure recorder is turned off
- Write today's date as **recorder_checkin_date**
- Write a description of why recorder was not used in **recorder_checkin_notes**
- Write "NOT DEPLOYED" in the **dropoff_notes** column
- Write "NA" in the site column and date columns: **location_site, dropoff_date, pickup_date, recorder_checkin_date, card_upload_date**
- Remove SD card, batteries, & external attachments (e.g. GPS)
    - Place SD card in labeled holding bin ("UNUSED CARDS TO BE REFORMATTED")
    - Place batteries in recycling bin
    - Mark card as "retired" on master card tracking sheet if necessary (broken)

For any *deployed* recorders not brought back:

- Write "LOST" in the **pickup_notes** column
- Write "NA" in the following columns: **pickup_date, recorder_checkin_date, card_upload_date**
- Retire the recorder on the master recorder tracking sheet if necessary

If used SD cards were brought back from the field, use the following protocol to upload them to permanent storage.

Upload microSD card recordings

- Ensure all power cables for SD card hubs are connected to power before plugging hub into computer
- Remove SD cards from recorders. Write today's date on their deployment sheet in the "**card_upload_date**" column.
- Insert all SD cards into hub. Wait for each card to appear on desktop before mounting another.
    - This both ensures the mounting process goes smoothly, and lets you identify any cards that are broken and won't mount.
    - Broken cards should be retired on the master cards spreadsheet and put in the RETIRED box
- Check that the number of SD cards mounted on the desktop matches the number plugged in
- Create a folder on an external hard drive of Robin. It should be the date of the last pickup date in YYYYMMDD format, e.g. if recorders were picked up from October 20, 2018 to October 22, 2018, the folder should be called 20181020
    - So, ultimately, the cards will be uploaded to this path: /Volumes/EXTERNAL_HD_NAME/field-data/INSERT_DATE_HERE
- Ensure there is enough space on the external hard drive before running the upload script
    - Use Finder to identify a card that was capturing recordings from the entire deployment (e.g. the recorder didn't die halfway through the deployment)
    - Open Disk Utility
    - Click on the card you identified and note its used space
    - Multiply the used space by the number of cards you are uploading
    - Compare the calculated amount with the amount of free space on Seagate2
    - If there is not enough space on the external hard drive, transfer files to Rook (see below)
- Run the following script in Terminal to transfer cards to computer:
    - Use the -n flag with this script to check that it runs correctly first
    - rsync -rhv --min-size=1k /Volumes/MSD* --exclude .Spotlight* --exclude .fsevents* --exclude System* /Volumes/EXTERNAL_HD_NAME/field-data/INSERT_DATE_HERE
- Eject the hard drive and attach to Rook
- Copy recordings to Rook to create a second copy
- Once recordings are uploaded to Rook, use Disk Utility to reformat all SD cards
- Eject all microSD cards and put them in holding chamber for reformatted cards
    - Rewrite labels on any cards where the labels have rubbed off
- Repeat the above process until the uploads for the deployment are complete, or until Seagate2 can't handle any more uploads

If recorders have returned from the field, use this protocol to test their microphone quality.

Test returned AudioMoths

Equipment required

- ❏ New audiomoth as “control”
- ❏ Used audiomoths that have been checked in
- ❏ Two empty boxes for “good” and “bad” moths
- ❏ Bluetooth speaker with SD card
- ❏ Micro-USB Cable and dongle for programming Audiomoths
- ❏ Laptop
- ❏ SD card readers and USB hub (if using multiple card readers)

Testing Procedure

- ❏ Add 10-second pink noise clip (from this document’s folder) to the speaker’s sd card (card must be formatted FAT32) - this may be done already
- ❏ If necessary, set up new SD cards (following deployment protocol procedure, including logging on master equipment spreadsheet)
- ❏ Set up 1-12 AudioMoths to test at a time, plus one “control” device that is known to record properly
    - ❏ Use empty and formatted SD cards and at least almost-new batteries. Record the AudioMoth-SD card pairs and any notes in a spreadsheet for later reference.
    - ❏ Configure with settings:
        - ❏ Gain: **LOW**
        - ❏ Sample Rate: 32kHz
        - ❏ Sleep Duration: 0s
        - ❏ Recording Duration: 3600s (1 hour)
    - ❏ Set to Default mode (red light should start blinking to indicate moth is recording)
- ❏ Line up all of the prepared AudioMoths with about 1cm distance between each. Also record with one AudioMoth that is known to be in good condition (as a control). Arrange the moths so they are of approximately equal distances (1 m) and orientation to (directly facing) the speaker
- ❏ Play the clip by turning on the speaker with a long press
- ❏ Switch AudioMoths to USB/OFF mode, remove SD cards, and connect all microSD cards to computer
- ❏ Open recordings from each device in Audacity, using Spectrogram view (you can compare 1 v 1 or all at once, depending on your preference)
- ❏ Visually compare the spectrograms’ pink noise recordings to the control recording. If there are noticeable differences (such as a quieter recording, pops/clicks, or no audio recorded), retire the moth and place a note on it describing the issue.
- ❏ Update the device’s row in the master equipment tracking sheet: add “last tested” date and mark the moth as “retired” if necessary. Put retired moths in the retired box in 103 Clapp
- ❏ Use Disk Utility to reformat all SD cards

Brain Dump

Name: Field location:
Date(s): Field date(s):

Examples of things to write on this sheet:
Things to update on packing list & field protocols
If we don't have card-watching code:
Units that were lost: which ones, what location, specific signs of damage:
Units that were not deployed and why they were not deployed (e.g. lights flashing; had extra):
Units on deployment locations sheet with inconsistencies in location_ID and card_ID (describe inconsistency):
Any difficulties accessing site (e.g. the names of any skipped points; any difficult or hazardous conditions):
Concerns about deployments left behind (e.g. deployments too public; unit might not have been turned on):
Errors found checking over deployment spreadsheet

Close out deployment

To close out a deployment, do the following:

- Fill out any missing columns/rows in deployment sheet
- Add the next relevant dates to the lab calendar (e.g. pickup date; next year's target deployment date)
- Ensure that you have completed all of the tasks above
- Store any paperwork in the correct place
    - By field site for site-specific procedures (e.g. pickup)
    - In other folders for procedures that aren't site specific (e.g. recorder testing)