Appendix V. Microclimate - Multi-species Baseline Initiative

Lucid, M.K., L. Robinson, and S.E. Ehlers. 2016. Multi-species Baseline Initiative project report. 2010-2014. Idaho Department of Fish and Game, Coeur d'Alene, Idaho, USA.

Appendix Va: Air Temperature/Relative Humidity Protocols and Data Sheets
Appendix Vb: Water Temperature Protocols and Data Sheets
Appendix Vc: Air Temperature Algorithm

Appendix Va: Air Temperature/Relative Humidity Protocols and Data Sheets

Protocol adapted from:
Holden, Z.A., A. Klene, R. Keefe and G. Moisen 2013. Design and evaluation of an inexpensive solar radiation shield for monitoring surface air temperatures. Agricultural and Forest Meteorology 180: 281-286

Logger Installation

TEMPERATURE LOGGER LOCATION

1) Travel to the assigned waypoint for the grid. Find a suitable tree within 40 meters of assigned point for climate logger (>12" diameter, a conifer, not whitebark pine, and in shady location). Place logger on **north** side of this tree. *If no trees, do not deploy logger.*
2) Write cell number in dry erase marker on 'begin' card. Take a picture of the paper. While standing at climate logger tree take three pictures facing 45°, 180°, and 315°, including note card with bearing (write cell # on card) in photo. Label pictures C, cell #, P, bearing.

CLIMATE DATA LOGGER

1) **Record 10 digit serial number of data logger. DO NOT PRESS START button**.
2) Use aluminum nails to attach radiation shield cover to north side of tree about 5 feet off the ground.
3) Use 4" zip tie to attach data logger to top of 2 plate shield fairly tight.
4) Use three 8" zip ties to suspend the 2 plate shield from cover.
5) Photograph the radiation shield. Photo should show the surroundings of the shield. Label photo: C, cell #, P, T.
6) Measure distance in centimeters from the ground to the bottom of the radiation shield.
7) Determine the amount of shade using the following metric:
    - 1: Completely open (clear cut or field).
    - 2: Not completely open but looks like it would probably get some direct sun.
    - 3: Looks pretty shady but might be some sunlight getting thorough.
    - 4: Completely shaded, not hit by direct sunlight all year.
8) Waypoint station and tie flag around tree above it. Label flag with cell #.

Logger Takedown/Replace

TEMPERATURE LOGGER LOCATION

1) **Travel to Waypoint with GPS**
2) **Find Logger:** Once you reach the waypoint, spend 30 minutes searching for logger.
    a. If you find a tree with pink flagging tied around the trunk you have found the logger tree (but the rad shield and logger are gone). Search the ground for the logger and rad shield.
3) **Note on Data Sheet if Not Found**

CLIMATE DATA LOGGER

1) **Photograph*:*** Take four photographs. One photograph of the logger tree, then three photos at 45°, 180° and 315° of the surrounding vegetation. Include a card that has the photo ID in each photo (example: CXXXP45)
2) **Shade Metric*:***
    a. 1: Completely open (clear cut or field).
    b. 2: Not completely open but looks like it would probably get some direct sun.

c. 3: Looks pretty shady but might be some sunlight getting thorough.
d. 4: Completely shaded, not hit by direct sunlight all year.

3) **Height:** Measure distance (centimeters) from the ground to the bottom of the rad shield.
4) **Habitat Changes:** Note any major habitat changes (i.e. clear cut, fire) that appear to have occurred since logger was deployed.
5) **Logger on Ground?** Note on data sheet if logger was found on the ground.
6) **Rad Shield Damage:** Note any damage or anything unusual about radiation shield.
7) **Take Logger Out:** Use knife to cut zip-ties and remove data logger. **Do not push START button!!!**
8) **Write Data on Back of Logger with Sharpie*:*** Date (e.g. 9 Sept 2014) - Military Time - Waypoint ID - Your 3 initials

REPLACING CLIMATE LOGGER

1) Repair any damage to the radiation shield. Add more aluminum tape to the top shield.
2) **Record 10 digit serial number of the new data logger. DO NOT PRESS START button.**
3) Use 4" zip tie to attach data logger to top of 2 plate shield fairly tight.
4) Use three 8" zip ties to suspend the 2 plate shield from cover.

TAKE DOWN CLIMATE LOGGER

1) **Take RAD SHIELD Down With Hammer**
2) **Leave No Trace!** Make sure to take all flagging, nails, and other hardware out of the woods.

Logger Installation Data Sheet

Cell: _____ Date (e.g. 15 June 2013):_____Start Time: _____Observer(s):_____

Plot Photo IDs (CxxxP bearing): 45°_____ 180°_____ 315°_____

Directions to Plot:

_____
_____
_____
_____

Weather Station

Type of weather station (circle one): TRIX8 HAXO8 none

Waypoint Name (CxxxT): _____ Weather Station Photo ID (CxxxPT):_____

Lat. _____ Long. _____ (WGS 84, decimal degrees)

Serial Number: _____ **DO NOT PRESS START BUTTON!**

Logger Height (cm):_____ Shade metric (1-4):_____

Logger Takedown/Replace Datasheet

Front of datasheet

Waypoint ID	Cell #	Takedown Date (M/D/YY)	Takedown Time (Military time)	OBS	Pictures				Logger height (cm)
					Logger (CXXXPT_2014)	45 CXXXP45_2014	180 CXXXP180_2014	315 CXXXP315_2014	
					Tidbit WXXXTidbitP_2014	Wetland WXXXP_2014			Tidbit Depth (cm)

Back of datasheet

Waypoint ID	Shade Metric	Logger on ground?	Logger Serial #	Habitat changes(i.e. fire, clear cut)	Damage (i.e. tape rip, logger above water?)	New Logger Serial #	Comments

Radiation Shield Construction Supplies

Item	Number/ site	Supplier	Item #	Web Page
4mm corrugated white plastic (48x96)	1-12x12” 2-8x8”	Laird Plastic	110143	https://www.lairdplastics.com
2 ½” x 60 yds. 324A-Premium Cold Weather HVAC Foil Tape		Home Depot		http://www.homedepot.com/
Heavy Duty Plier Stapler	1	Salco	P694STD	https://www.stapleheadquarters.com
3/8” staples	8	Salco	PSTCR5019/10	https://www.stapleheadquarters.com
Utility knife	1			
8” Zip Ties	6			
4” Zip Ties	1			
Aluminum nails	3			
LogTag Temperature Recorders (TRIX8, TRIX16, or HAXO8)	1	ThermoWorks		http://www.thermoworks.com/
LogTag USB Interface Cradle	1	ThermoWorks		http://www.thermoworks.com/

Radiation Shield Construction Video:

https://www.youtube.com/watch?v=LkVmJRsw5vs

Appendix Vb: Water Temperature Protocols and Data Sheets

Protocol Adapted from:
Isaak, D. J., D.L. Horan, and S.P. Wollrab 2013. A Simple Protocol Using Underwater Epoxy to Install Annual Temperature Monitoring Sites in Rivers and Streams**.** Gen. Tech. Rep. RMRS-GTR-###. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Available online:
http://www.fs.fed.us/rm/boise/AWAE/projects/stream_temp/downloads/2013_StreamSensorEpoxyProtocol_RMRS_GTR.pdf

The ideal time to install data-loggers in small ponds is late summer or early fall when water levels are lowest. This allows the logger to be placed in a location where it is most likely to remain underwater for the entire year.

Water Data Logger Installation

1) Select a rock in secluded and shady location. A large boulder on the north side of the wetland would be ideal. If no rocks are present you may transport a rock to the site and attach the logger to it.
2) Use wire brush to clean rock of any debris or algae. If no rock available use re-bar.
3) Rub a half golf ball size of each epoxy together for one minute (wear gloves!). Place around rim of male portion of rad shield. Attach to rock.
4) Zip-tie Tidbit to female portion of rad shield (write down serial number!). Make sure the side that says, 'Tidbit' faces out. Use teflon tape and screw female part on male part.
5) Measure the distance between the surface of the water and the top of the logger shield in centimeters
6) Measure the distance between the water's edge and the logger in centimeters
7) Take excellent waypoint and draw diagram of tidbit location. Take photo showing tidbit and surroundings.
8) Flag the nearest location to the tidbit and label flag with cell #.

Water Data Logger Download

1) Locate data logger (Tidbit). Spend at least 1 hour searching for the tidbit. Make sure to bring a trowel and chisel. The housing may have been buried in silt or the cap may have been epoxied.
2) Once the logger is located, take a photograph of the logger. Also take a photograph of the wetland.
3) Measure the logger depth (centimeters)
4) Measure the distance the logger is located from the water's edge (centimeters).
5) Unscrew the PVC cap and snip the zip tie holding the tidbit in place
6) Ensure the LED bulbs are still attached on the front of the tidbit and that the sensor is still blinking.

a. If the bulbs are broken or missing, collect the tidbit to bring back to the office. Remove all other materials from the field (leave no trace). **Do not throw the tidbit away!**

7) Press the tidbit firmly into the shuttle coupler with the LED lights facing down and squeeze the black lever. Press hard enough that the lever bends.

a. An amber light will blink if the data is downloading. **Do not remove the tidbit from the coupler during the download.**

b. A red light will blink on the shuttle if it is not properly engaged. Remove the logger and gently clean the tidbit with the kimwipes and try again.
c. A green light will blink when the data is done downloading. It will blink for 15 minutes. It is safe to remove the tidbit from the shuttle at this time. Press the black lever again to stop the green light from blinking.

8) Record the serial number of the tidibit on your datasheet.
9) Redeploy the tidbit by securing it in the PVC cap with a zip tie. Make sure the LED lights are facing outwards.
10) Screw the cap back into the base.
11) Mark the nearest spot on land with pink flagging. Make sure to label the flagging with a waypoint ID.

Water Temperature Data Logger Data Sheets (See Appendix IIIa for complete amphibian datasheet)

Water Data Logger Installation (most often in conjunction with an amphibian survey)

Wetland ID: _____ Cell: _____ Date (e.g. 15 June 2014):_____ Start Time: _____ Observer(s):_____

Weather (circle one): Sunny, Mostly Sunny, Partly Sunny, Overcast, Light Rain, Heavy Rain, Snow

Wetland Type (circle one): Natural Pond, Ephemeral Natural Pond, Constructed Pond, Modified Natural Pond, Lake, Stream , Channels Near Stream, Puddles, Emergent Wetland, Meadow, Forest-No Wetland, Not-Forested-No Wetland, Beaver Pond, Other: _____

Site is (circle one): Wet or Dry Search Type (circle one): Full Perimeter, 500 Meter Shoreline, 30 Minute T.S.

Wetland Waypoint: _____Lat:_____ Long: _____ Wetland Photo ID: (W, cell#, P) _____

TidBit: Yes or No TidBit Waypoint: _____ Lat: _____Long:_____ TidBit SN: _____

Wetland Diagram

Last Section (m): _____

Total Perimeter (m): _____

Tidbit Diagram

Tidbit Photo ID: _____

Directions to Plot:

Directions to Tidbit:

Landowner Name: _____

Landowner phone: _____

Tidbit Depth (cm):____

Distance to shore (cm):_____

Water Data Logger Download (in conjunction with Air Temperature Logger takedown/replace)

Front of datasheet

Waypoint ID	**Cell #**	**Takedown Date (M/D/YY)**	**Takedown Time (Military time)**	**OBS**	**Pictures**				Logger height (cm)		
					Logger (CXXXPT_2014)	45 CXXXP45_2014	180 CXXXP180_2014	315 CXXXP315_2014			
					Tidbit WXXXTidbitP_2014	Wetland WXXXP_2014			Tidbit Depth (cm)	Distance to water edge (cm)	

Back of datasheet

Waypoint ID	Shade Metric	Logger on ground?	Logger Serial #	Habitat changes(i.e. fire, clear cut)	Damage (i.e. tape rip, logger above water?)	Comments

SUPPLIES

Item	Number/ site	Supplier	Item #	Web Page
1 ½" x ¾" Schedule 40 Reducer Bushing	1	PVC Fittings Online	439210	http://www.pvcfittingsonline.com/
1 ½" Schedule 40 Threaded cap	1	PVC Fittings Online	448015	http://www.pvcfittingsonline.com/
FX-764 Hydro-Ester Splash Zone & Underwater Paste (Fox Industries)		Simpson Strong-Tie		http://www.strongtie.com/
Plumber's tape				
4" Zip Tie	1			
Vinyl gloves	2			
Containers for epoxy	2/person			
Wire Brush	1/person			
TidbiT V2 Water Temperature Logger	1	Onset Computer Co.	UTBI-001	http://www.onsetcomp.com/
Hobo Underwater Data Shuttle	1	Onset Computer Co	U-DTW-1	http://www.onsetcomp.com/
Chisel	1/person			

Radiation Shield Construction Instructions:

http://www.fs.fed.us/rm/boise/AWAE/projects/stream_temperature.shtml

Appendix Vc: Air Temperature Algorithm

Andrew Shirk (University of Washington) developed and wrote the algorithm code with input from Michael Lucid (Idaho Department of Fish and Game) and Dr. Sam Cushman (US Forest Service Rocky Mountain Research Station)

We developed an algorithm which enforced the following 6 rules to determine if air temperature data was accurate or erroneous.

1) Maximum allowed daily temperature: 38.8°C

This was the maximum temperature recorded at SNOWTEL stations located within the study area from 2010-2014.

2) Minimum allowed daily Temperature: -30.0°C

3) Minimum min-max daily temperature range: 2.0°C

We assumed if the min-max daily temperature range was <2.0°C the data logger was affected by snow pack.

4) Maximum temperature anomaly threshold: 2.5°C

We assumed if the temperature spiked ≥2.5°C and the logger was affected by direct sunlight.

5) Maximum allowed missing observations per day: 2

Data for the entire 24 hour period was removed if >2 data points were not recorded by the data logger.

6) Maximum allowed interpolated observations per day: 2

If one data point was missing or determined erroneous by the algorithm, but was bounded by 2 acceptable data points, a mean of the 2 bounding points was calculated to replace the erroneous point. Only 2 interpolated points were allowed be 24 hours period or the entire period was deleted.