Choosing Sites

*Making a Geodatabase*

* When receiving data (shapefiles, rasters, etc.) from collaborators or online resources put them in a folder called “Incoming Data” that is a subfolder of your project folder on File Explorer
  + Project (i.e., “Seasonally Disconnected Habitats”) > “GIS” > “Incoming Data”
* Open ArcGIS Pro and add data to your map for the project (.mxd project file)
  + You may need to create a folder connection to the “Incoming Data” folder
* They will show up in your contents panel on the left side of ArcGIS Pro
* Open the Catalog by going to the View tab and clicking “Catalog Pane”
* Go to your “GIS” subfolder within your project folder and right click then select New > New File Geodatabase
* Name the geodatabase something like “Seasonal\_Habitats\_Sites.gdb” or “REM\_Sites.gdb”
  + Think of the geodatabase as a filing cabinet and feature datasets as drawers
* If you want to organize the data in your dataset even more you can right click on your geodatabase > New > Feature Dataset
* Name your feature dataset something appropriate for the type of data that you will put in it (e.g., Seasonal\_Habitat\_Water for hydroline data or watershed boundaries)
  + You don’t need to make feature datasets but it may be helpful if you can organize data by categories
* Right click on each item in your catalog (other than basemaps) and select Data > Export Features
* Name the feature class something appropriate and select the geodatabase or feature dataset within that geodatabase as the Output Feature Class location and click “Run”
* It will me added to your map so you can delete the old duplicate which is sourced to the “Incoming Data” folder
  + This way everything in your map is sourced from the same geodatabase
  + Data is converted from a shapefile to a feature class within a geodatabase
    - Better for storage space and organization
* If someone wants a specific feature class from your map you can export it as a shapefile, zip the folder, and send it to them

*Classifying REM*

* Use the raster file “Middle\_Skagit\_REM\_2016.tif” created by Kate Ramsden who is the GIS Analyst at SRSC
  + Any GIS files that are being used for a specific project should go in a database made just for the project (i.e., “REM\_Sites.gdb”)
    - See “*Making a Geodatabase*”
  + The ArcGIS Pro file (i.e., “REM\_Site\_Personal.mxd”) cannot go in the geodatabase but should go in a subfolder with the geodatabase so if you want to send it to someone else you can zip the whole subfolder containing the geodatabase and .mxd
    - The .mxd contains symbology so if you want the symbology to stay the way that it is in your map you have to include the .mxd in the zipped folder
* Import into ArcGIS Pro

Text

Description automatically generated with medium confidence

* It will look like a gradient of gray when you import it
* Right click on the file and click on “Symbology” > “Classify” (drop down menu)
* Click on the drop down menu “Method” and click “Manual Interval” then go into the table and manually change the values for the color breaks
  + You can also change the “Color Scheme” to whatever you want
    - If you wanted to change the actual values of the raster (i.e., 1, 2, 3 instead of -5.215011 – 0, 0.000001 – 0.5, 0.500001 – 1 then you would use the “Reclassify” tool in the Spatial Analyst Toolbox
* The resulting change in symbology will allow you to see potential pinch points at site outlets
  + Use this raster file in conjunction with aerial imagery and hydroline shapefile

A picture containing bar chart

Description automatically generated

*Selecting Outlets*

* Using the REM, aerial imagery, and hydroline shapefile find potential outlets of seasonally disconnected sites
* Create a new point feature class in your .mxd by opening the Catalog > Right click on the geodatabase that you made for the project (i.e., “REM\_Site.gdb”) > Create Feature Class
* Name the new feature class (i.e., “Placemarks\_Final\_WGS”) and then go through the six pages making sure that you select the feature type (point) and appropriate projection (WGS 1984)
  + If you want to calculate the latitude and longitude in decimal degrees the projection must be in WGS 1984
* Click on Edit > the feature class that you created (i.e., “Placemarks\_Final\_WGS”)
* Place points at site outlets and select the box with the green check mark when you’re done so that it is saved

A picture containing diagram

Description automatically generated

*Calculating Latitude and Longitude of a New Point Feature*

* Once points have been placed in the new feature class you can name and calculate the latitude and longitude in decimal degrees of each point
* After making any edits make sure to press the “Save” button in the Edits tab
  + You will not be able to add a field (i.e., “Name”) unless all edits have been saved

A picture containing graphical user interface

Description automatically generated 

* Add two new fields called Latitude and Longitude with a Data Type of “Text” and a Length of 50
  + Make sure to save once the new field has been created
* Right click on the field Latitude and click “Calculate Field” then enter Python code into the “Latitude =” box
  + !shape.extent.YMax!
* Right click on the field Longitude and click “Calculate Field” then enter Python code into the “Latitude =” box
  + !shape.extent.XMax!
    - There is an easier way to do this in ArcMap but this is the most straightforward way to do it in ArcGIS Pro

Graphical user interface, application

Description automatically generated

Fieldwork – Reconnaissance

*Uploading Coordinates Onto GPS*

* Choose the feature class that you want to upload to the GPS in ArcGIS Pro and right click > Data > Export Features
* Choose the folder location for your shapefile to be created
  + Make sure that it is in a normal folder (i.e., “Seasonally Disconnected Habitats” > “GIS” > “Exported Shapefiles”)
    - It won’t be saved as a shapefile if it’s in a geodatabase
* Click Run and the new copy which is now sourced to the “Exported Shapefiles” folder will show up on the map
  + Go ahead and delete it because you want to keep the feature class that is sourced to the geodatabase
* Open DNRGPS and click File > Load From > File
  + Make sure ESRI Shapefile (2D) is the file type and select the shapefile that you just exported form ArcGIS Pro
* Choose the column that you want to be IDENT
  + This will be what shows up on the GPS in the field so choose that “Site Name” column
  + You can also edit columns in DNRGPS
* Upload to the GPS using GPS > Upload All

*Equipment*

* Dry suits with neoprene footies and boots
* Charged dive light, snorkel, hood
* Pontoon
* Pontoon oars and cross-bar
* Pontoon pump
* GPS with sites pre-loaded
  + Make sure it is the right GPS and there is enough battery life – if not replace batteries from battery/SD card box
* Survey temperature logger (white)
* Field laptop
* Shuttle for HOBO loggers
* Rangefinder
* Stadia rod
* YSI
* Distilled water (to calibrate YSI)
  + Put a small amount of distilled water in the YSI boot (but not so much that the probe is wet) and press “Calibrate” for DO%
  + The calibration should be somewhere near 100.00%
  + Accept calibration
* Swoffer (rod with propeller and box reader)
* Red clipboard with datasheets and Rite-in-Rain with logger metadata
  + Use a datasheet with site name “Boat Recon” with the date and just use WPT column to put the outlet identifier (e.g. J1, J2, C1, etc.)
  + Start a new data sheet if you end up doing an actual snorkel survey
* HOBO temperature pendants with PVC housing, wire, wire cutters
* Solinst water level logger with PVC gages with screw-on lids, string, metal clamp with screwdriver to tighten
* DO logger with PVC shield, boot, and cord
* Time-lapse camera with 6 lithium batteries (there’s an EJECT button on the inside that you push to open the battery compartment) and an SD card (under the screen) installed
* Time-lapse camera t-post mount
* Post pounder
* T-posts
* Phone/camera (have the coordinates settings on if your phone has that feature – makes it easier for me to find out where the pictures were taken)

*Protocols*

* Time-lapse camera installation
  + Set-up the camera
    - Switch to ON
    - Press the M button (this opens the setup window)
    - Enter date and time
    - Mode: Timelapse+
    - CaptureDelay: 60Min
    - PicSize: Low[4MP]
    - MultiShot: Off
    - CapStart: 12:00 AM
    - CapEnd: 12:00 AM
    - SmartIR: On
    - NightExp: PwrSave
    - TLFrequency: 60Min
    - TLPeriod: 1Hr
    - TempUnit: F
    - InfoStrip: On
    - SDManagement: Off
    - MotionDetect: Long
    - MotionTest: OK
    - Language: English
    - Name: SITE[e.g.AA]
      * Say you check out outlet C2 and place a time-lapse camera somewhere in that site you would name it SITEC
    - The rest of the settings just leave as is
    - If the screen falls asleep just push the M button to wake it up
  + Position time-lapse camera
    - Attach to the t-post mount
    - Find a spot so that facing the pinch point but tucked away if possible so tweakers won’t be enticed to steal it and pound in t-post
    - Get it positioned right using the screen to make sure the pinch point is in the frame (someone can stand in the pinch point to make sure it is framed well)
  + Document
    - Take a GPS point and note in the Rite-in-Rain (write down site and date) along with brief description
    - Take a picture or two
* Water level logger installation
  + Launch the Solinst logger with the logger shuttle in HOBOware on the field laptop
    - Make sure that it is recording in 15 minute intervals
    - Make sure that the delayed start time is for midnight on the day of installation
  + Pound in a t-post that is in a deep spot at the downstream end of the pond/pool holding water (ideally where we have seen fish nearby)
    - The idea is to put it in a spot that will still hold water when the site is disconnected in the summer
  + Write down the Solinst logger ID, the length of the string, the height of the water on the gauge once you have it clamped to the t-post, the date, time, waypoint, and description of location in Rite-in-Rain
    - Make sure to record the Solinst logger number, date, and time in the Rite-in-the-Rain when removing the level logger
  + Take a picture or two
* Temperature logger installation
  + Launch the temperature pendant with the logger shuttle in HOBOware on the field laptop
    - Make sure that it is recording in 15 minute intervals
    - Make sure that the delayed start time is for midnight on the day of installation
  + Put the temp logger in the PVC housing and feed wire through it, cut with wire cutters
  + Attach either to branch, stump, etc. or to the outside of the level logger
  + Write down pendant ID, the date, time, waypoint, and description of location in Rite-in-Rain
    - Make sure to record the pendant number, date, and time in the Rite-in-the-Rain when removing the temperature logger
  + Take a picture or two
* DO logger installation
  + Launch the DO logger with the logger shuttle in HOBOware on the field laptop
    - Make sure that it is recording in 15 minute intervals
    - Make sure that the delayed start time is for shortly before it will be put in the water
  + Take off the DO boot!
  + Make sure that the cord is fed through the PVC shield and the loop in the top of the logger and tie to a branch, stump, etc.
  + Write down logger ID (if there is more than one DO logger in rotation), the date, time, waypoint, and description of location in Rite-in-Rain
    - Make sure to record the date and time in the Rite-in-the-Rain when removing the DO logger to move to another site
  + Take a picture or two
* Snorkel survey
  + Launch the white survey temperature logger with the logger shuttle in HOBOware on the field laptop
    - Make sure that it is recording in 5 second intervals
    - Make sure that the delayed start time is before you will be starting the survey (preferably not too soon before because wastes storage on the GPS)
  + When ready to start the survey turn on tracking on the GPS
    - Main Menu > Setup > Tracks
      * Track Log: Record, Show On Map
      * Record Method: Time
      * Recording Interval: 00:00:05
        + Make sure that it is the same interval that the survey temperature logger is recording in (in this case 5 seconds)
  + When the tracklog is running and the temperature logger is in the water record survey start time on datasheet
  + At each location where you see fish record:
    - Waypoint
    - Fish quantity, species, and size class
    - Depth (m) using a stadia rod
    - Substrate (mm) by randomly grabbing whatever is at the tip of your boot
    - Distance to cover (yd) using a rangefinder
    - Temperature (°C) and DO (mg/L) with the YSI
    - Velocity (mps) using the swoffer
      * Will likely be 0 mps in seasonally disconnected habitats
  + Randomly take supplemental habitat condition points
    - Same measurements as above but just put a line through fish quantity, species, and size class columns
  + Take pictures when you can
  + Take any extra notes about site conditions, visibility, etc.
  + Record survey end time when the temperature pendant is out of the water and turn off GPS
  + Readout the white survey temperature logger with the logger shuttle in HOBOware on the field laptop and save the HOBO file as “Logger#\_Date\_SiteCode\_SiteName” (e.g., “21099530\_09212021\_AA\_James\_Brown\_Slough”)
* At the end of each day take a picture of any datasheets or notes taken in Rite-in-the-Rain

Organizing Fieldwork Data

* After each week of fieldwork you will have some combination of the following:
  + Datasheets
  + HOBO files from survey temperature loggers
  + A GPS with tracklog and waypoint data
  + A Rite-in-the-Rain with timelapse camera and logger metadata
  + Pictures
  + Notes of site features and conditions
  + Logger and timelapse data (at the end of the field season)
* Make a folder for each site as “SiteCode SiteName” (e.g., “AB McCleod Slough”)
  + Make a subfolder called “Notes”

*Datasheets*

Scanning and Entering Data into an Excel File

* Make a subfolder within “SiteCode SiteName” (e.g., “AB McCleod Slough”) for each snorkel survey as “MM-DD-YYYY (SurveyType)” (e.g., “4-14-2021 (Snorkel Survey)”) for sites that were surveyed
* Make a subfolder within “MM-DD-YYYY (SurveyType)” called “Datasheets”
* Scan datasheet(s) for the appropriate site and put in the “Datasheets” folder named as “SiteCode\_SiteName\_Date” (e.g., “AB\_McCleod\_Slough\_04142021”)
  + If a datasheet was used to take boat reconnaissance notes then scan datasheet(s) and put in a “Boat Recon” folder in the main “Data” folder
    - Boat recon has information for multiple sites so should not be in a specific site folder
    - This information can be put in the “Notes” word document for respective sites
* Make a folder called “Survey Data” in the main “Data” folder
* Make an Excel spreadsheet called “Seasonal\_Habitat\_Survey\_Data”
* Enter all survey data from the datasheets

Assigning Coordinates to Survey Waypoints

* Copy all of the waypoints from the project with their latitude and longitude from DNRGPS and paste them into an Excel spreadsheet called “Seasonal\_Habitat\_Survey\_Data\_Waypoints”
* If using more than one GPS unit (e.g., “Estuary” and “Floodplain”) that have overlapping WPT numbers, create a new column with the GPS Unit and WPT combined in Excel so that each is a unique identifier (“GPSUnitWPT”) for both the snorkel dataset (“Seasonal\_Habitat\_Survey\_Data”) and the waypoint with coordinates dataset (“Seasonal\_Habitat\_Survey\_Data\_Waypoints”)
  + =[GPS Unit cell]&[WPT cell]
  + =A2&B2
    - “Estuary” and “184” 🡪 “Estuary184”
* Open both the snorkel dataset (“Seasonal\_Habitat\_Survey\_Data”) and the waypoint with coordinates dataset (“Seasonal\_Habitat\_Survey\_Data\_Waypoints”)
* In the empty “Latitude” cell that you want to fill with a coordinate in the snorkel dataset use VLOOKUP()
  + =VLOOKUP([GPSUnitWPT cell in snorkel dataset],[range of cells including GPSUnitWPT, Latitude, and Longitude in the waypoint with coordinates dataset], column number within that range that corresponds to Latitude (i.e., 2)], FALSE)
  + Repeat this step with Longitude changing the second to last variable to 3
* Once you have finished, copy and paste the Latitude and Longitude columns as plain text and delete the GPSUnitWPT column to clean up the data

*HOBO Files*

* HOBO files from survey temperature loggers will be saved as “Logger#\_Date\_SiteCode\_SiteName” (e.g., “21099530\_09212021\_AA\_James\_Brown\_Slough”) either on a thumb drive or on my OSU laptop in the field
* Copy and paste the HOBO file for each site into a subfolder of “MM-DD-YYYY (SurveyType)” (e.g., “4-14-2021 (Snorkel Survey)”) called “Survey Temp Logger”
* Open the HOBO file in HOBOware
* Click File > Export Table Data
* Name the exported .csv file the same as the HOBO file
  + “Logger#\_Date\_SiteCode\_SiteName” (e.g., “21099530\_09212021\_AA\_James\_Brown\_Slough”)
* Open the .csv file and Save As an Excel (.xlsx) file with the same name
* Look at the notes from the datasheet to see when the survey temp probe was in and out of the water and highlight the times that it was in the water a pale green
  + There may be multiple instances where the probe was out of the water for a couple of minutes to get up over logs or other obstacles

*GPS Data*

* Plug in the GPS and open DNRGPS
* Click GPS > Download All

Table Data

* Make a new subfolder of “MM-DD-YYYY (SurveyType)” (e.g., “4-14-2021 (Snorkel Survey)”) called “Tracklogs and Waypoints”
  + Each survey folder within a site folder should have three subfolders
    - “Datasheets”
    - “Survey Temp Logger”
    - “Tracklogs and Waypoints”
* Highlight the waypoints for a specific site visit and click File > Save To > File
* Save as a text file (either comma-delimited or tab-delimited) named as “SiteCode\_Site\_Name\_Waypoints\_Date” (e.g., “AA\_James\_Brown\_Slough\_Waypoints\_06092021”)
  + You can save this as a .csv or .xlsx file later if needed
* Repeat this process for tracklogs
  + If the tracklog intervals and the survey temp logger intervals line up (which they didn’t in most cases because used “Most Often” as interval on GPS instead of “00:00:05”) then can make a new .xlsx document using time to sync the tracklog and survey temp logger to get spatiotemporal temperature data
* NOTE: Table data should only be saved in cases where a survey took place
  + Waypoints taken at sites not part of a survey (e.g., during a boat reconnaissance or opportunistically) can be saved as GIS data only

GIS Data

* You should have a “GIS” folder which should be within your project folder but separate from your “Data” folder
  + GIS files are too large to be held in places like GitHub so save GIS files just one folder hierarchy outside of the local repository but within your project folder
* In your “GIS” folder make a “Tracklogs and Waypoints” subfolder and organize like this:
  + “GIS” > “Tracklogs and Waypoints” > “Tracklogs” > “MM-DD-YYYY” (e.g., “4-12-2021”)
  + “GIS” > “Tracklogs and Waypoints” > “Waypoints” > “MM-DD-YYYY” (e.g., “4-12-2021”)
* Highlight the waypoints for a specific site visit and click File > Save To > File
* Save as an ESRI Shapefile (2D) in the “GIS” folder under the appropriate data type (tracklogs or waypoints) and date named as “Date\_SiteName” (e.g., “04122021\_Powerline\_Pond”
* Repeat for tracklogs

*Logger and Timelapse Metadata*

* Make a subfolder in “Data” called “Equipment Locations” and create an Excel spreadsheet called “Equipment\_Locations”
  + Once all equipment location data (i.e., timelapse camera, level logger, barometer temperature pendant) has been entered into the “Equipment\_Locations” Excel file it can be imported into ArcGIS Pro and then exported as a shapefile
    - This shapefile can then be loaded into DNRGPS to upload the waypoints onto a GPS unit

Timelapse Camera Metadata

* Notes (including pictures) about timelapse camera installation in the Rite-in-Rain can be typed into a Word document in the “Notes” folder named “SiteCode\_SiteName\_Notes” (e.g., “AA\_James\_Brown\_Notes”)
* Coordinates of timelapse camera locations can be added to the “Equipment\_Locations” Excel file and also to the “Site\_Breakdown\_Selection” Excel file which keeps track of activity at all sites

Level Logger Metadata

* Notes (including pictures) about level logger installation in the Rite-in-Rain can be typed into a Word document in the “Notes” folder named “SiteCode\_SiteName\_Notes” (e.g., “AA\_James\_Brown\_Notes”)
* Coordinates and other installation information (i.e., serial number, installation date/time, string length) should be saved in an Excel file called “Level\_Logger\_Metadata” saved in a subfolder of the “Data” folder called “Water\_Quality\_Metadata”
* Information from the “Level\_Logger\_Metadata” Excel file can be copy and pasted into the “Equipment\_Locations” Excel file and also to the “Site\_Breakdown\_Selection” Excel file

Temperature Logger Metadata

* Notes (including pictures) about temperature logger installation in the Rite-in-Rain can be typed into a Word document in the “Notes” folder named “SiteCode\_SiteName\_Notes” (e.g., “AA\_James\_Brown\_Notes”)
* Coordinates and other installation information (i.e., serial number, installation date/time, etc.) should be saved in an Excel file called “Temperature\_Logger\_Metadata” saved in a subfolder of the “Data” folder called “Water\_Quality\_Metadata”
* Information from the “Temperature\_Logger\_Metadata” Excel file can be copy and pasted into the “Equipment\_Locations” Excel file and also to the “Site\_Breakdown\_Selection” Excel file

DO Logger Metadata

* Notes (including pictures) about DO logger installation and movement in the Rite-in-Rain can be typed into a Word document in the “Notes” folder named “SiteCode\_SiteName\_Notes” (e.g., “AA\_James\_Brown\_Notes”)
* Coordinates and other installation information (i.e., serial number, installation date/time, removal date/time, etc.) should be saved in an Excel file called “DO\_Logger\_Metadata” saved in a subfolder of the “Data” folder called “Water\_Quality\_Metadata”
* Since the DO logger gets rotated regularly, the metadata should not be included in the “Equipment\_Locations” Excel file but should be included in the “Site\_Breakdown\_Selection” Excel file to keep track of which sites had a DO logger rotation

*Pictures and Notes*

* Notes in the notes box of the datasheet, descriptions of waypoints marking features on the datasheet, descriptions of waypoints marking features from boat reconnaissance, and any additional notes should be put in a Word document in the “Notes” folder named “SiteCode\_SiteName\_Notes” (e.g., “AA\_James\_Brown\_Notes”)
* Pictures should be opened in Google Photos and (for pictures taken with phones with GPS turned on) pictures can be sorted into the “Notes” folder for each site
  + No need to rename the image file just keep whatever name Google Photos assigns it

*Logger and Timelapse Data*

Timelapse Camera Data

Level Logger Data

* Create a new folder called “Level Logger Data” in Data > Water\_Quality\_Metadata
* Use the Solinst software (<https://www.solinst.com/downloads/>) to download the data off of the loggers and export as a .csv file in the “Level Logger Data” folder with the name of the site
* Use the “Level\_Logger\_Metadata” file to select the rows when the level logger was installed at the site
* Copy and paste these rows into a .csv file called “Level\_Logger\_Data\_SiteCode\_SiteName” (e.g., “Level\_Logger\_Data\_R\_Hurn\_Field” that should be saved in a new folder called “Logger Data” in Data > SiteCode SiteName (e.g., “AB McCleod Slough”)

Temperature Logger Data

DO Logger Data

* DO logger data will be collected continuously throughout the season because it is being rotated between sites and data is periodically downloaded
* At the end of the season when loggers and timelapse cameras are retrieved…
* Will eventually have HOBO files for the long-term loggers (temperature loggers and level loggers)
* “Connectivity” folder
* Make sure “DO\_Data” file and HOBO output files are saved as Excel Workbooks so able to highlight active time periods as green
  + Save all logger data that goes in site folders as .csv to import into R
  + Only data that needs to be color coordinated, bolded, etc. for organization should be in an Excel file and raw data should be as .csv
* Once retrieve level logger and temperature logger from sites, add a new folder to each site for temporal data
  + Also use take each site from “DO\_Data” file and put in respective site folders with other temporal data
* Folder organization (what subfolders should be in each folder)
* Save a “READ\_ONLY” version of your data after doing any manual cleanup and before starting any analysis