TOS STANDARD OPERATING PROCEDURE: NEON Aquatic and Terrestrial Site Navigation

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1 DESCRIPTION

1.1 Purpose

The purpose of this SOP is to provide guidance for effective navigation around a NEON Aquatic or Terrestrial site. This document provides sampling navigation guidance to field staff intended to minimize accidental plot disturbance and to reduce the environmental impact from repeated sampling.

1.2 Scope

This document provides a change-controlled version of an Observatory procedure. Documentation of content changes (i.e. changes in particular tasks or safety practices) occur via this change-controlled document, not through field manuals or training materials.

1.3 Applies To

The procedure described in this document is used in the following protocols:

Table 1. This is a list of protocols that use this procedure to navigate a site.

Doc #	Title
NEON.DOC.001024	Canopy Foliage Sampling
NEON.DOC.000987	Measurement of Vegetation Structure
NEON.DOC.014049	Mosquito Sampling
NEON.DOC.001710	Litterfall and Fine Woody Debris
NEON.DOC.003162	Wadeable Stream Morphology
NEON.DOC.014042	Plant Diversity Sampling
NEON.DOC.000481	Small Mammal Sampling
NEON.DOC.004130	Wetland Soil Sampling
NEON.DOC.003045	Periphyton, Seston, and Phytoplankton Sampling
NEON.DOC.014048	Soil Biogeochemical and Microbial Sampling
NEON.DOC.002905	Water Chemistry Sampling in Surface Waters and Groundwater
NEON.DOC.001194	Zooplankton Sampling in Lakes
NEON.DOC.003046	Aquatic Macroinvertebrate Sampling
NEON.DOC.001199	Surface Water Dissolved Gas Sampling
NEON.DOC.001711	Coarse Downed Wood
NEON.DOC.014037	Measurement of Herbaceous Biomass
NEON.DOC.014050	Ground Beetle Sampling
NEON.DOC.014045	Tick and Tick-Borne Pathogen Sampling
NEON.DOC.000693	Reaeration in Streams
NEON.DOC.001193	Sediment Chemistry Sampling in Wadeable Streams
NEON.DOC.001191	Sediment Chemistry Sampling in Lakes and Non-Wadeable Streams
NEON.DOC.001295	Fish Sampling in Wadeable Streams
NEON.DOC.001296	Fish Sampling in Lakes
NEON.DOC.001197	Bathymetry and Morphology of Lakes and Non-Wadeable Streams

Doc #	Title
NEON.DOC.001714	Agricultural Biomass SOP, Ag Productivity
NEON.DOC.003564	Herbarium Specimen Prep SOP
NEON.DOC.014038	Below Ground Biomass
NEON.DOC.002792	Secchi Disk and Depth Profile Sampling
NEON.DOC.003039	Aquatic Plant, Bryophyte, Lichen, and Macroalgae Sampling
NEON.DOC.003044	Aquatic Microbial Sampling
NEON.DOC.014040	Plant Phenology
NEON.DOC.001886	Stable Isotope Sampling in Surface and Ground Waters
NEON.DOC.014039	Digital Hemispheric Photos for Leaf Area Index
NEON.DOC.001709	Bryophyte Productivity
NEON.DOC.001715	Cactus Biomass and Handling
NEON.DOC.014041	Breeding Landbird Abundance and Diversity
NEON.DOC.001085	Stream Discharge
NEON.DOC.001718	DSLR Configuration
NEON.DOC.001716	Toxicodendron Biomass and Handling

1.4 Acknowledgments

This document is based on field and data processing procedures developed by Melissa Slater and Rachel Swanson.

2   RELATED DOCUMENTS AND ACRONYMS

2.1   Applicable Documents

Applicable documents contain higher-level information that is implemented in the current document. Examples include designs, plans, or standards.

AD[01]	NEON.DOC.004300	EHS Safety Policy and Program Manual
AD[02]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD[03]	NEON.DOC.001155	NEON Training Plan
AD[04]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD[05]	NEON.DOC.000724	Domain Chemical Hygiene Plan and Biosafety Manual

2.2   Reference Documents

Reference documents contain information that supports or complements the current document. Examples include related protocols, datasheets, or general-information references.

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.002652	NEON Data Products Catalog

2.3   Acronyms

Table 2. This is a list of acronyms for commonly abbreviated terms used in this document.

Acronym	Definition
AGOL	ArcGIS Online

2.4   Definitions

Layer: Geographic representation of dataset in ArcGIS Online

Style: Combination of the attribute displayed and the symbology

Symbology: Graphic symbol visually representing data on map

3   SAFETY

This document identifies procedure-specific safety hazards and associated safety requirements. It does not describe general safety practices or site-specific safety practices.

Personnel working at a NEON site must be compliant with safe field work practices as outlined in the Operations Field Safety and Security Plan (AD[02]) and EHS Safety Policy and Program Manual (AD[01]). Additional safety issues associated with this field procedure are outlined below. The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions.

4   PERSONNEL

4.1   Training Requirements

All technicians must complete required safety training as defined in the NEON Training Plan (AD[04]). Technicians must also complete procedure-specific training for safety and implementation of this procedure as required in Field Operations Job Instruction Training Plan (AD[05]). Additional training materials can be found in the Training Center.

4.2   Specialized Skills

It is advised to have a baseline familiarity with AGOL functions and capabilities especially as it pertains to the use of Explorer, Collector, and Tracker applications for the purposes of backcountry navigation. Due to the possibility of malfunctioning electronics, technicians are required to know how to navigate the backcountry using map and compass and/or the Garmin GPS units.

Required skills for operating the ESRI apps include:

- Downloading, syncing, and updating mobile applications

- Verifying map updates are successfully transferred to mobile device

- Using ArcGIS Explorer for backcountry navigation

Preferred skills for operating Explorer/Collector apps include:

- Creating a custom map from an existing NEON map

- Adding features to a map

- Making a map available for offline use

5   CONTINGENCIES AND NOTES

See Figure 1 to determine whether to use ArcGIS Explorer, Collector, or Tracker. The offline maps should be downloaded and / or updated at the domain office or field house prior to entering the site. The data in AGOL may have been modified since the last download and any updates need to be captured. Additionally, most field sites do not have reliable cellular or data service, so it is important to make these updates beforehand. It is also good practice to leave the map open after updating so that the accelerometer in the device can place its location without service.
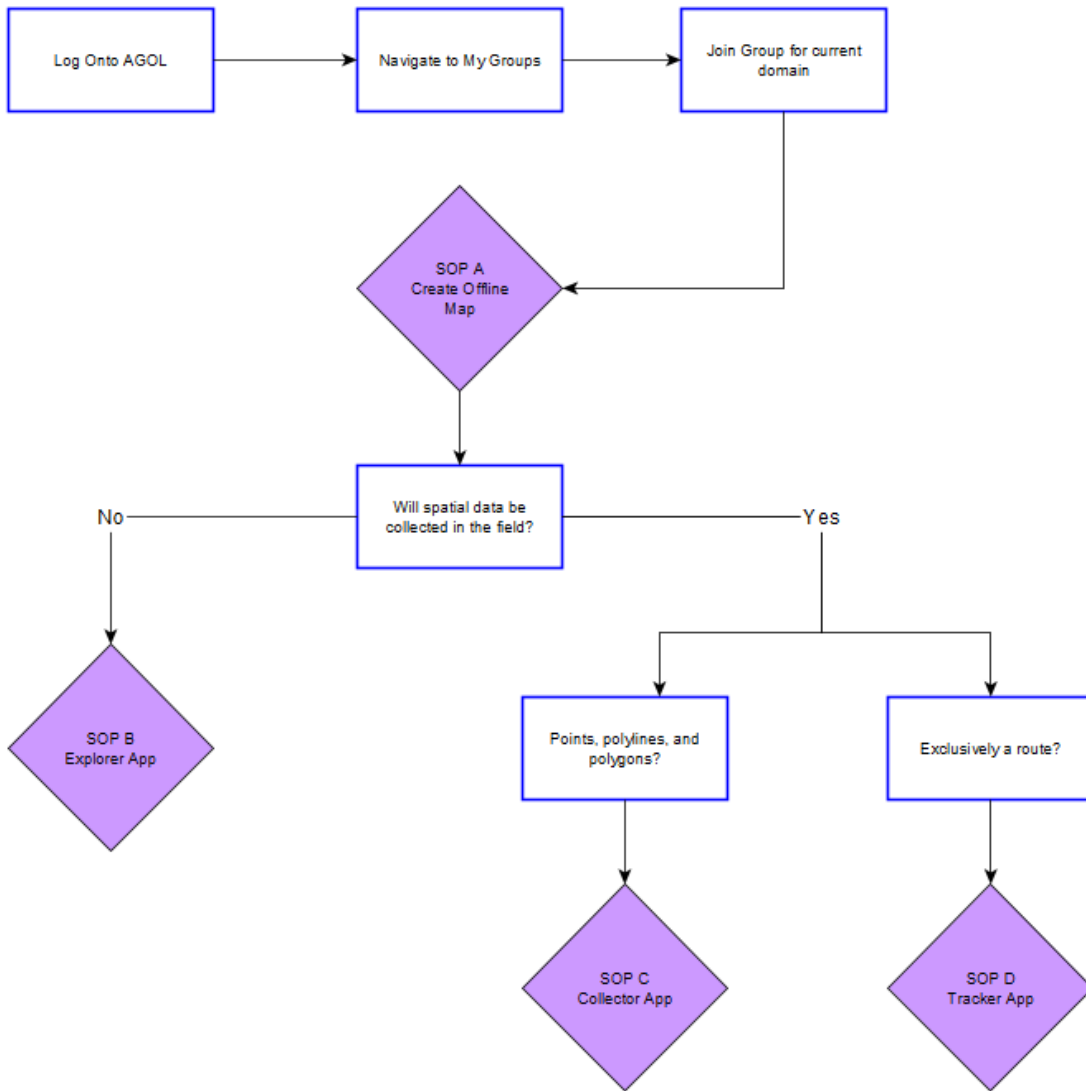
6   STANDARD OPERATING PROCEDURES

Figure 1. The workflow diagram outlines whether to use ArcGIS Explorer, Collector, and Tracker.

SOP A Create an offline map in AGOL

Maps generated in AGOL can be fully customized with relevant layers and information. By adjusting the settings, the maps can be available for offline use to navigate a field site without cellular service.

Creating a customized map

1. Log onto AGOL (Appendix A), then select 'Groups' and 'My Organization's Groups' (Figure 2).
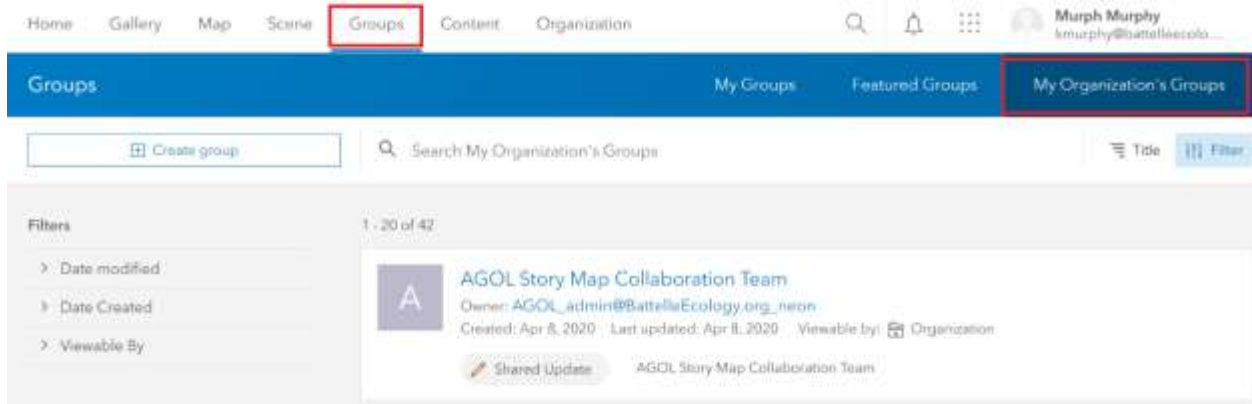

Figure 2. The location of all of the Organization's Groups.

2. Navigate to the desired domain's page, then click 'Join Group.'
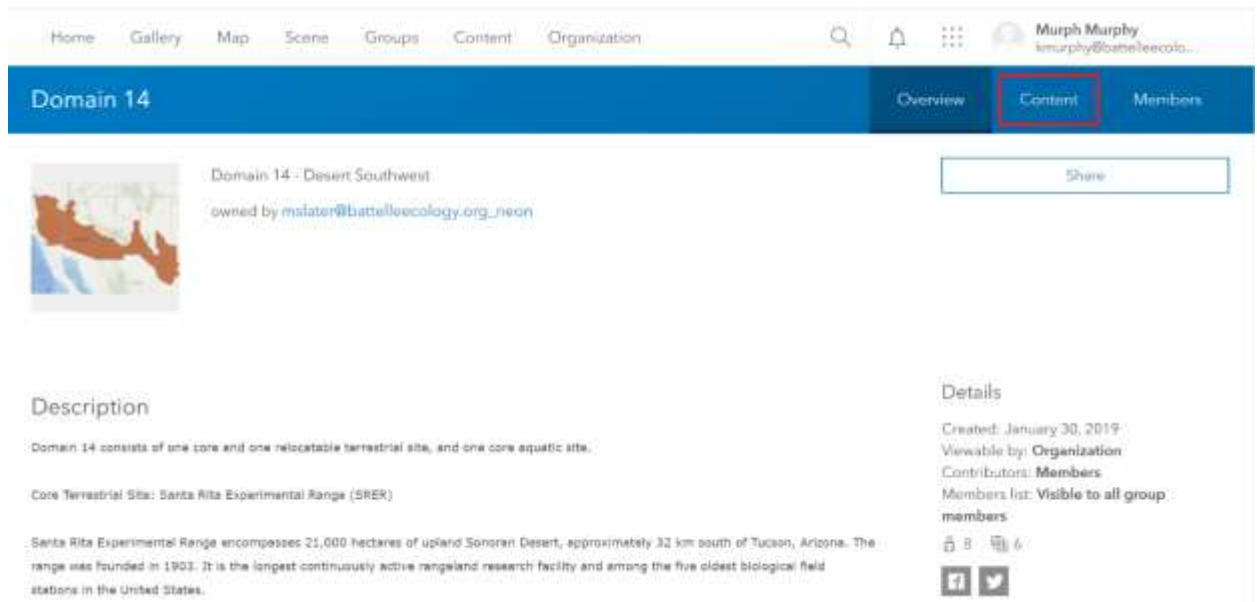

Figure 3. The 'Content' tab houses all the maps and layers shared with the Group.

3. From the domain's homepage, select 'Content' (Figure 3).

4. Select the authorized domain map – the one created by "AGOL_admin."

5. From the metadata page, select 'Open in Map Viewer.'

6. Zoom to the area of interest:

    a. Different layers will become visible based on the zoom level.

    b. If a layer is 'grayed-out,' change the zoom level to make it visible.

7. Check all the layers that should be viewable and uncheck or delete the layers that should be hidden or removed (See Figure 3). To accomplish this, use the middle tab, 'Show Contents of Map,' from the map options.

    a. The recommended viewable content for site navigation will depend on the information that is pertinent to the field work. For example, an uncluttered map with relevant information for TCK sampling may include: Plot centroids and Plot polygons; the map may exclude the Tower footprint, the Tower itself, NEON Field Sampling boundaries, Aquatic reaches, etc.
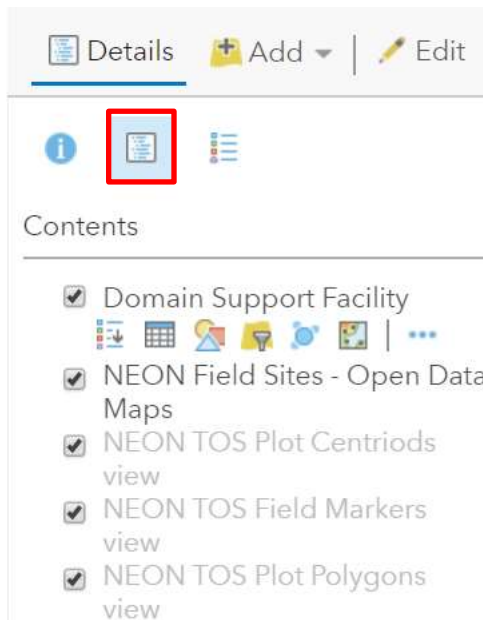

Figure 4. The "Show Contents of the Map" icon shows the available layers in the map.

8. (*Optional*) Add additional layers that are not present in the authorized domain map.
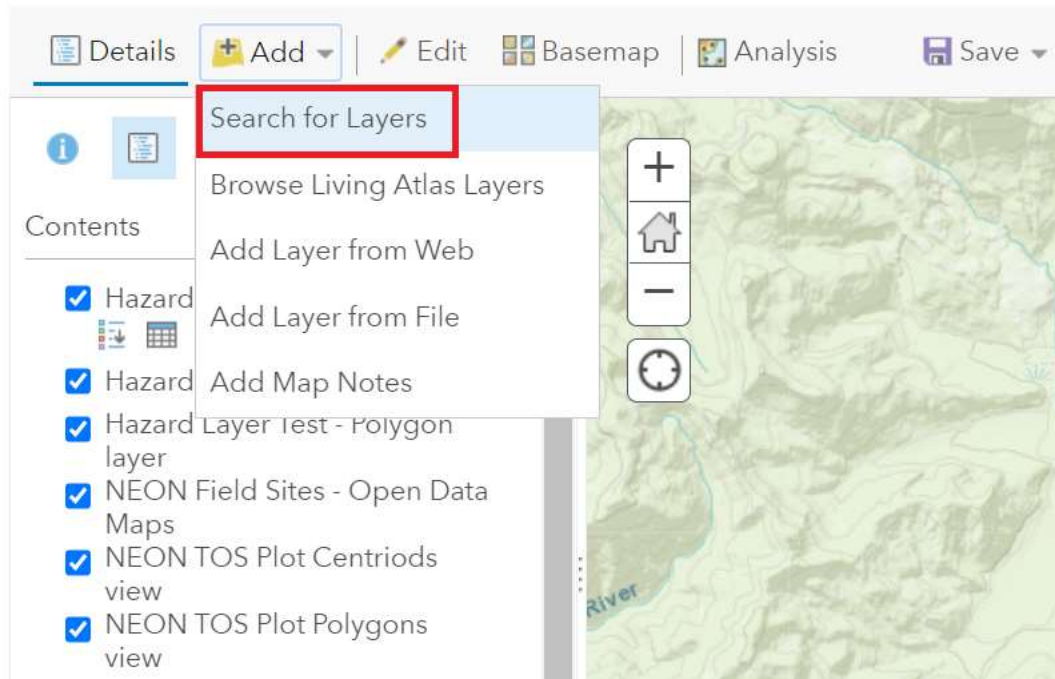
SOP A

Figure 5. "Search for Layers" to add layers to the map that are already in AGOL.

9. To add a layer from an existing shapefile that *has* previously been added to AGOL:

    a. Click 'Add Content to Map' in the tool bar, then select 'Search for Layers' (See Figure 5).

    b. In the 'Content' dropdown menu select a search filter. *Recommended: 'My Content,' 'My Groups,' 'My Organization'*

    c. Use the 'Search for Layers' search bar to find a specific layer

    d. Click the plus sign on the layer item to add it to the map

10. To add a layer from an existing shapefile that has *not* previously been added to AGOL:

    a. Open 'Windows Explorer' window and navigate to the local location of the shapefile.

    b. Zip all associated file extensions together, e.g. .shp, .prj, .dbf, etc.

    c. On the AGOL Map Viewer screen, click 'Add' in the tool bar, then select 'Add Layer from File'.

    d. Click 'Choose File', and select the zipped folder and click 'Open'.

    e. Select 'Keep original features', then click 'Import Layer'.

    f.   Follow guidelines to adjust the style by selecting the attribute to show and its symbology.

        i.   It is acceptable to choose 'Show location only' from the attribute list.

11. To create a non-existing layer in AGOL:

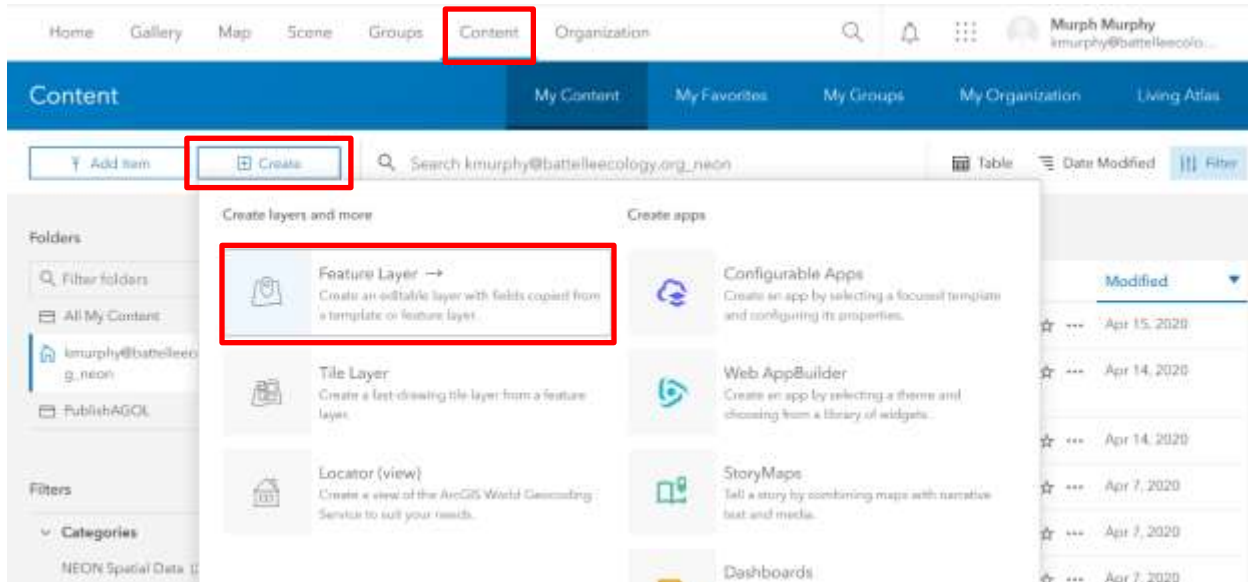   a.   From the main tool bar, select 'Content,' then choose 'Create' and 'Feature Layer' (Figure 6).

Figure 6. The Create tool is used to establish a blank feature layer to be populated with information in the field.

    b.   Type 'polygon' in the search bar.

    c.   Select 'Points, lines, and polygons', then click 'Create' on the side pop-up.

    d.   Leave all three options (point layer, line layer, polygon layer) selected and click 'Next'.

    e.   Zoom to the region of the site on the pop-up map. The zoomed region can be coarse, but is helpful to provide a starting point. Click 'Next'.

    f.   Enter a title for the file, e.g. 'D12 YELL Mosquito Track'.

    g.   Add additional informative tags for domain, site, and other descriptors that would be helpful to organize the output file.

    h.   Click 'Done'.

12. Change symbology to the desired color-scheme. *This step is not necessary for authorized layers, but could be useful for personally added layers.*

a. In the Contents list, click on the 'Change Style' symbol,   , under the layer to be changed

b. Under 'Select a drawing style,' click 'Options' to change the symbol, color, and/or size

c. Click 'OK' and then 'Done' to save the new symbology

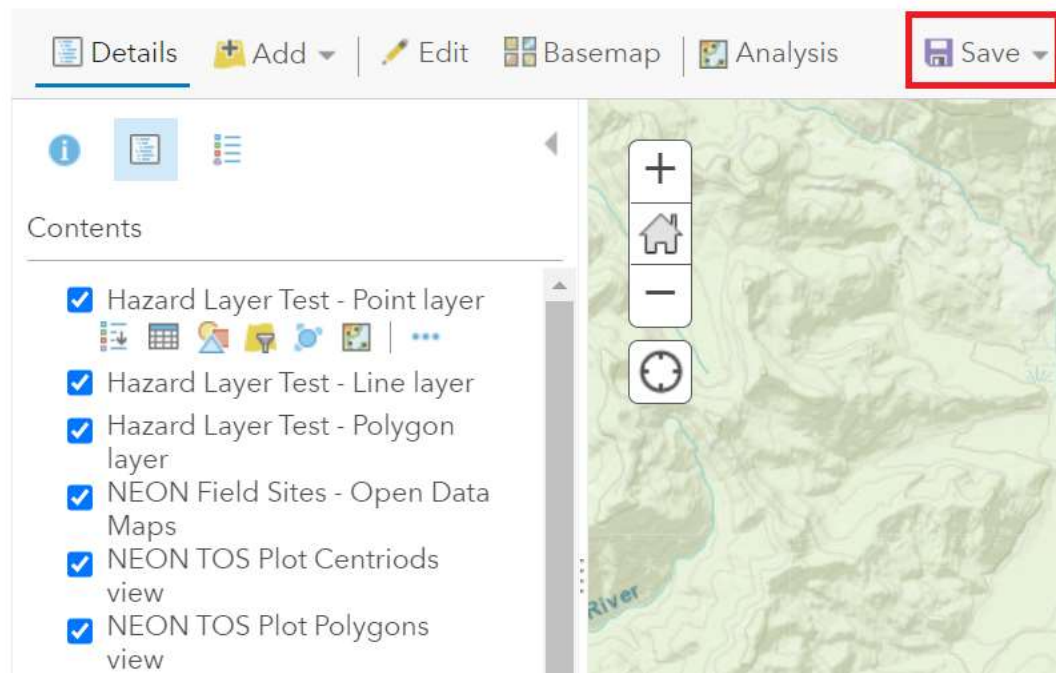**Figure 7**. The main tool bar shown in the Map Viewer. Use the 'Save' tool to make a personal copy of a map.

13. Save the customized map with a new name (Figure 7):

a. Click 'Save' from the ribbon above the map and select 'Save As'.

b. Name the map and add appropriate categories and tags. Tagging the map with identifiable information (e.g. Domain#, Site, map theme) helps users find the map when searching.
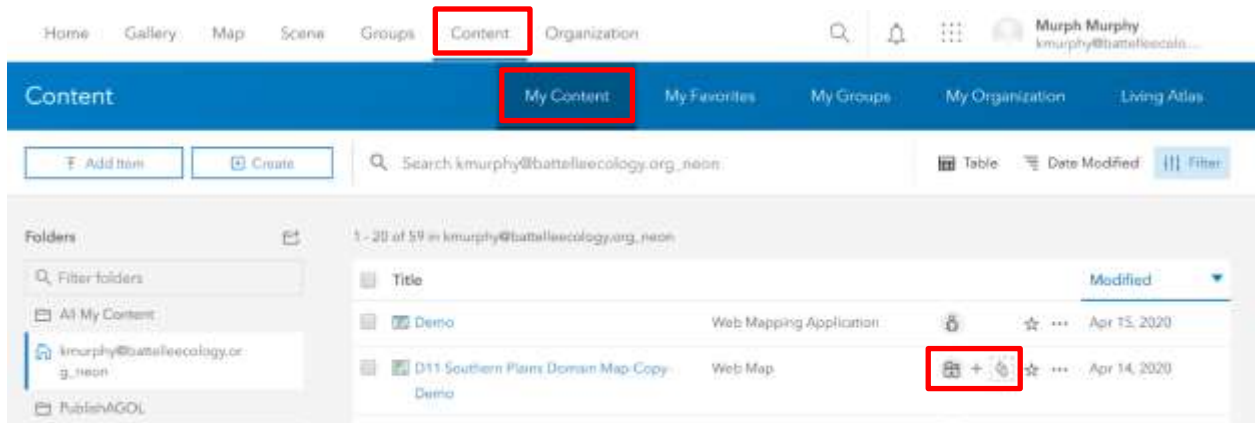
Figure 8. The icons illustrated on the 'Content' screen show each map's or layer's distribution scope. If the icon is a person, it is only shared with the individual that created it. If the icon is a building, it is shared with the organization. If the icon is a globe, it is shared with the public.

14. To share the map with other members of the organization:

    a. Click 'Home' and select 'Content' from the drop-down menu.

    b. Click 'My Content' in the blue ribbon.

    c. Find the new map and/or layers and change their sharing level from 'owner' to 'organization'. Share map with the domain group as well (Figure 8).

15. If any new layers were created or uploaded, select them from the list on the 'My Content' page (Figure 8).

16. On the feature layer's metadata page, click 'Settings.'

General   Feature Layer (hosted)
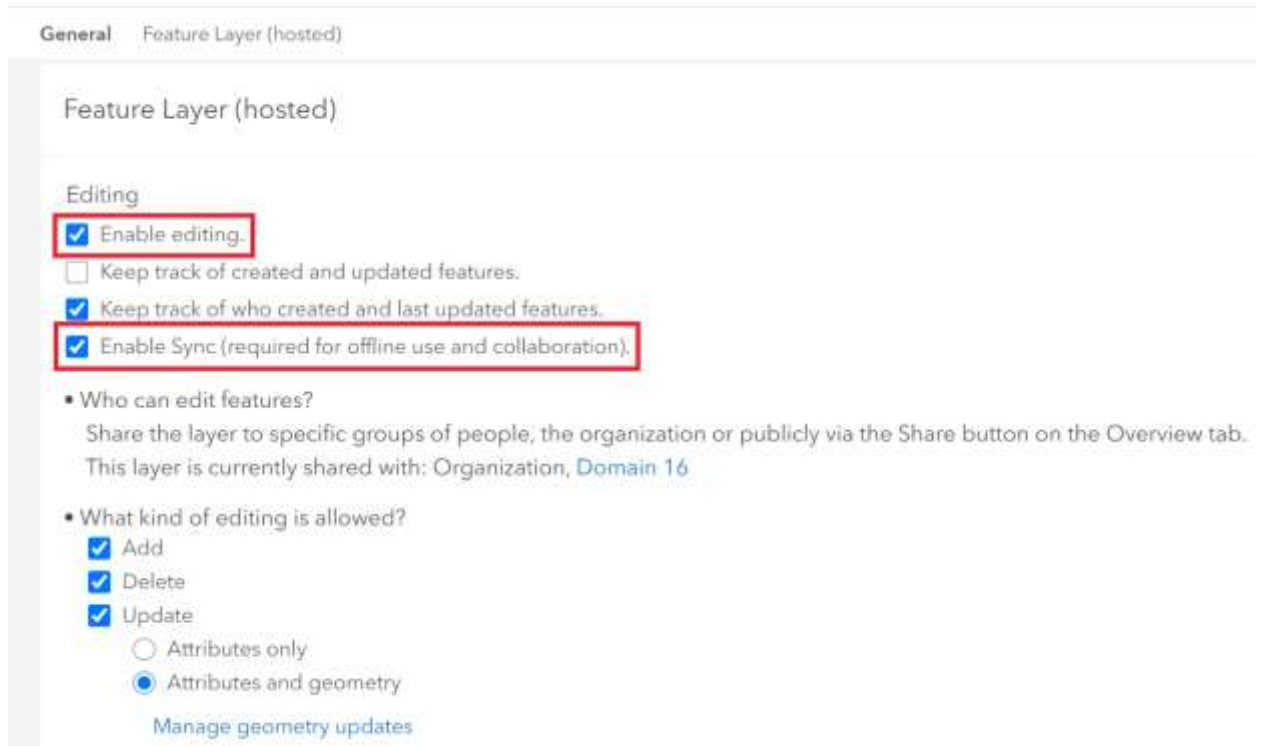
Feature Layer (hosted)

Editing
- ☑ Enable editing.
- ☐ Keep track of created and updated features.
- ☑ Keep track of who created and last updated features.
- ☑ Enable Sync (required for offline use and collaboration).

• Who can edit features?
  Share the layer to specific groups of people, the organization or publicly via the Share button on the Overview tab. This layer is currently shared with: Organization, Domain 16

• What kind of editing is allowed?
  - ☑ Add
  - ☑ Delete
  - ☑ Update
    - ○ Attributes only
    - ● Attributes and geometry
    - Manage geometry updates

Figure 9. The AGOL feature layer settings. Check the "Enable Sync" box to allow the map to be viewed Offline. Check the "Enable editing" box to allow data for this layer to be collected in the field.

17. Scroll to the 'Feature Layer (hosted)' section and check 'Enable Sync.' If this is a layer that will be populated with data in the field, also check 'Enable editing.' (Figure 9)

18. Click 'Save.'

19. Click on the Map name. From its metadata page, select 'Settings.'

20. If all of the feature layers included in the map have been shared with the organization and enabled to sync, the 'Offline' section will be available.

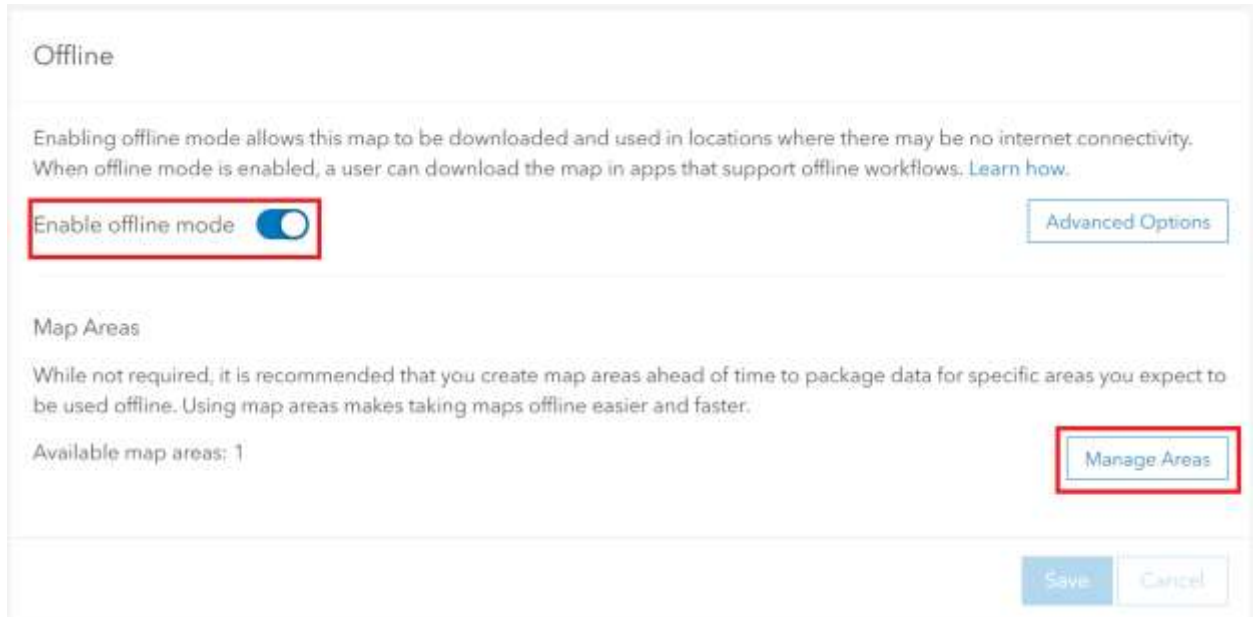21. Toggle 'Enable offline mode' on and select 'Manage Areas' (Figure 10).

Figure 10. The required settings to access an AGOL map offline, which is necessary for use at most field sites.

22. Click 'Create Area' and then use the sketch rectangle tool, , to select the area of interest.

23. Once the area is selected, adjust the 'Level of Detail' to appropriate levels for field navigation. 'Town' and 'Small building' are good starting points. If there is an error indicating that the area is too large, adjust the 'Level of Detail'. Click Save.

24. The Map Area will take several minutes to 'Package.'

25. Once 'Packaging' disappears from the name, the map area is ready to use offline.

26. If any updates are made to the map or its layers it is necessary to update the Map Area before opening in any of the field applications.

SOP B ArcGIS Explorer

ArcGIS Explorer is a mobile application that can access pre-made maps offline but cannot collect data in the field. Follow the steps outlined in SOP A to prepare feature layers and maps for offline use. If any changes have been made to the map or its layers since the offline area was created, it is necessary to update it. This is done by selecting the Manage Areas button (Figure 10), selecting the map area, and clicking "Update."

B.1. ArcGIS Explorer Application

1. Download the 'ArcGIS Explorer' app from the app store.

2. Sign in with ArcGIS Enterprise using the url: "https://neon.maps.arcgis.com" (Figure 11).

Figure 11. Sign in page on the ArcGIS Explorer app specifying the correct URL.

3. Click 'Battelle Ecology' and sign in with Battelle credentials.

4. From the main page, scroll to the 'Groups' section and select the one for the desired domain.

5. In the domain group, the maps available for offline use will have an 'Offline areas' label (Figure 12).
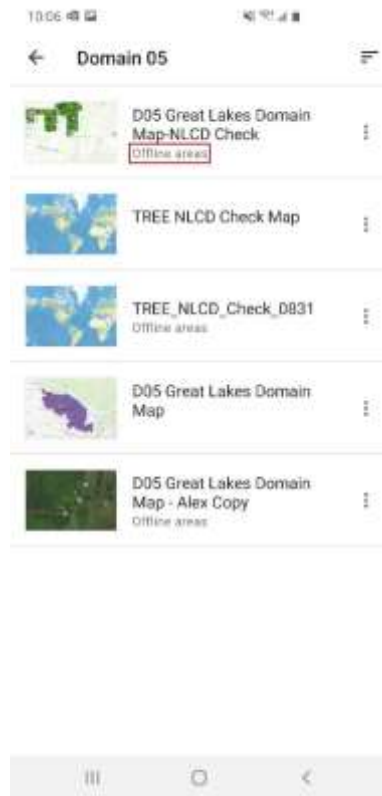
Figure 12. Maps that are capable of being used in the field are tagged with 'Offline areas' as seen in the Group view on ArcGIS Explorer.

6. Click the map and select which map area to view. This may take a minute if it is the first time opening the map on a device.

7. Once open, layers can be turned visible or invisible by clicking on the layers' icon, ♦ , and checking / unchecking layers.

8. Leave the map open on the device and when in the field the user's location will appear as a blue dot.

9. Touch any feature on the map to open its attribute table.

SOP C ArcGIS Collector

ArcGIS Collector is an application that allows the user to navigate through the site and record geographic information to add to an AGOL map. Common examples of information collected are sampling tracks, field hazards, or pictures. These points of interest and tracks can be uploaded to AGOL when connected to WiFi. If any changes have been made to the map or its layers since the offline area was created, it is necessary to update it. This is done by selecting the Manage Areas button (Figure 10), selecting the map area and clicking "Update."

C.1. Log in to ArcGIS Collector

1. Download the 'ArcGIS Collector' app from the app store.

2. Sign in with ArcGIS Enterprise using the url: "https://neon.maps.arcgis.com."

3. Click 'Battelle Ecology' and sign in with Battelle credentials.

C.2. Open map in ArcGIS Collector

1. These steps must be completed while on WiFi. Leave the map open when navigating to the field site.

2. Click on the icon, ≡ , and select the current domain group.

3. All maps that can be used offline will have a 'Download' button.

4. Click 'Download' and select the desired basemap.

5. When choosing the work area, zoom to include the full extent of the map area selected in SOP A.

C.3. Create track in ArcGIS Collector

1. Follow log-in steps in C.1.

2. Open the map as described in C.2.

3. To begin collecting a feature or creating a track, click on the plus sign (Figure 13).

Figure 13. Map view in the Arc Collector app highlighting the location of the icon to add a new layer.

4. Select 'New Feature Line layer'.

5. On the top icon bar click the icon that looks like a map (Figure 14).

6. Click 'Stream' on the bottom icon bar (Figure 14).

Figure 14. The Stream icon is used to collect a polyline in Arc Collector app.

7. Walk the desired path.

8. Click 'Pause' when the path is complete.

9. Click the check mark in the upper tool bar when finished.

10. When data collection is finished for the day and the device is connected to WiFi, click 'Sync' to upload the data to AGOL.

11. The layer has now been added to the AGOL network and can be used in ArcGIS Collector or ArcGIS Explorer in the future.

SOP D ArcGIS Tracker

D.1. Log in to ArcGIS Tracker

1. Download ArcGIS Tracker from the app store.

2. Sign in with ArcGIS Enterprise using the url: "https://neon.maps.arcgis.com."

3. Click 'Battelle Ecology' and sign in with Battelle credentials.

D.2. Functions within the ArcGIS Tracker application

1. The application should be opened at the domain office while on WiFi before entering the field.

2. The application opens to a map view of the world. Zoom to the user's location.

3. Toggle on the 'Track my location' button, , to begin creating a track.

4. When track is finished and the user is connected to WiFi, click on the Profile icon, , and select 'Upload now.' This will sync all tracks collected in the field to AGOL.

D.3. View Tracks within AGOL

1. Log into AGOL using the steps in Appendix A.

2. Navigate to the proper domain group and view the content.

3. The tracks created by all domain members will appear in a feature layer named "DXX Location Tracking," populated with the specific domain.

4. This layer can be used in AGOL maps or either of the other ArcGIS mobile applications.

7   REFERENCES

ESRI. 2020. ArcGIS Online – Get started. <https://doc.arcgis.com/en/arcgis-online/get-started/get-started.htm>. 21 April 2020.

APPENDIX A - AGOL OVERVIEW

ArcGIS Online (AGOL) is a cloud-based mapping and analysis solution. Similar to other ESRI products, AGOL makes maps, analyzes data, and has numerous sharing and collaborating features. At NEON, everyone is able to access AGOL through their Battelle Ecology email account.

Sign in:

1. https://www.arcgis.com/home/signin.html

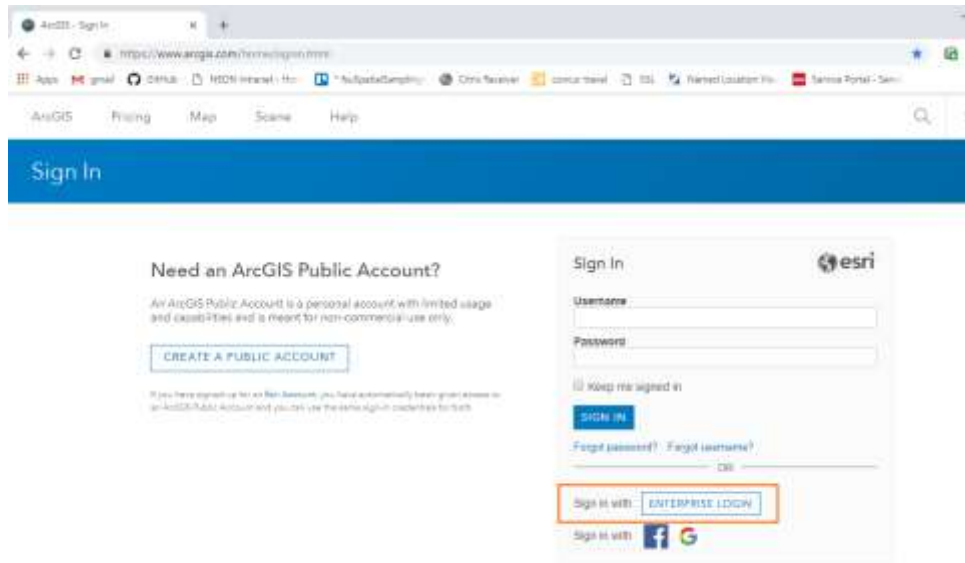2. Sign in with "Enterprise Login"

Figure 15. The Enterprise Sign In screen for ArcGIS Online.

3. Enter our ArcGIS organization's URL "NEON.maps.arcgis.com". Hit "Continue"

Figure 16. The Enterprise URL used to sign in.

4. Sign in using your Battelle Ecology credentials

Basic organization:

- Home: Opening page, brief introduction to NEON

- Gallery: Highlights NEON's publicly available maps that have the most views

- Map: Similar to ArcMap- Platform to add layers, make maps, share final product.

- Scene: Mapping in an interactive 3D environment.

- Groups: Groups organize data around themes and teams. Groups can be private or public to the organization. Anybody can create a group.   Content within a group can be shared to group members only or to the entire organization.

- Content: Data layers within AGOL. Content is uploaded by the user or pulled in the through the Living Atlas database. Curated by Esri with contributions from its partner and user communities, the Living Atlas contains valuable maps, data layers, tools, services, and apps for geographic analysis.   Base layers are available as well.

APPENDIX B - REMINDERS

- Make all layers available to the organization and share them with the proper group.

- Ensure all layers have the sync setting enabled. If a layer will be used in the Collector app, it must also have the editable setting enabled.

- Enable maps for offline use and choose an area of interest in AGOL.

- Download or update the map every time before going into the field. Spatial data across all domains is updated together, so even though there may not be any changes to the current domain, there may be changes in another that will affect the layer.

APPENDIX C - EQUIPMENT

The following equipment is needed to implement the procedures in this document. Equipment lists are organized by task. They do not include standard field and laboratory supplies such as charging stations, first aid kits, drying ovens, ultra-low refrigerators, etc.

Table 3. Equipment list – Navigating a field site

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
Field phone	N	Provided android or apple mobile device	Host for the Arc navigation apps	1
ArcGIS Explorer	Y	Mobile application	Application for viewing data and navigating a site	1
ArcGIS Collector	Y	Mobile application	Application for viewing data, navigating a site, and collecting data. There must be the editable file included to access the map.	1
ArcGIS Tracker	Y	Mobile application	Application for collecting a route traveled at the site. Since other NEON users that are currently using the application are visible, it can be used as a field safety tool.	