



Using ArcGIS Collector for Non-Lethal Bumble Bee Data Collection On the Upper Mississippi River National Wildlife and Fish Refuge



Prepared By:
Michelle Turton

ON THE COVER

Rusty-patched bumble bee (*Bombus affinis*) on prairie clover at Wabasha Prairie near Pool 4.
Taken in 2017.

Photograph by: Michelle Turton

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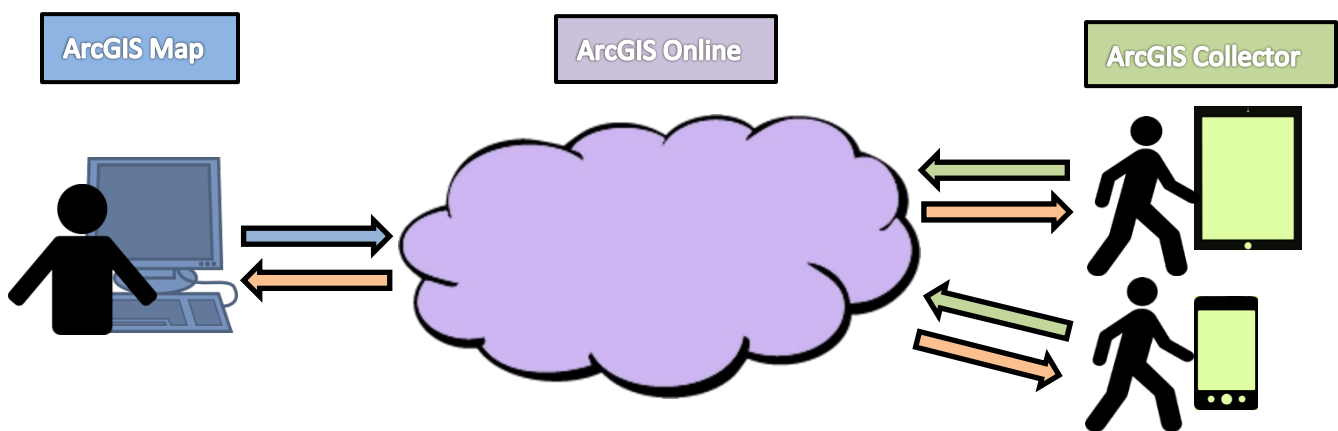
Introduction

The US Fish and Wildlife Service listed the rusty-patched bumble bee (*Bombus affinis*) as endangered under the Endangered Species Act on March 21, 2017. Since the late 1990s, *B. affinis* distribution and abundance has declined. Upper Mississippi River National Wildlife and Fish Refuge (Refuge) is committed to maintaining and enhancing pollinator habitat. The Refuge lacks an adequate bumble bee inventory. The purpose of this survey is to acquire present/absence data of bumble bee species on the Refuge in order to properly manage the Refuge's current and potential pollinator habitat.

Geographic Information Systems (GIS) is a powerful tool for visualizing and analyzing map data. In the USFWS, much of our work depends on accurate local and national maps. We use maps to make sound management and policy decisions to support wildlife and the public.

ESRI's desktop ArcGIS Map software allows us to display and analyze the locations of habitat, species, and changes over time on the landscape. This important data can be shared across the Service and with partner agencies, non-government organizations, researchers or displayed for the public.

ESRI has developed the mobile app, ArcGIS Collector, to collect and update data in the field in conjunction with cloud-based content GIS management system, ArcGIS Online (AGOL). Multiple users in an organization can access maps from AGOL to either work in real-time or offline to add data and photos from their mobile device.



In this manual, you'll find the instructions for using Collector to gather non-lethal bumble bee data following the Corps' survey protocol. The combined inventory results and spatial data will be used to inform restoration activities.

1. Setting up ArcGIS Online U.S. Fish and Wildlife Service (FWS) Organizational (FWS or Collaborator) Account

In order to use ArcGIS Collector, an individual must have an AGOL FWS Organizational Account in order to access the bumble bee content. The Department of Interior and FWS is working on an Authority to Operate for data and maps on the AGOL. **NEVER POST PERSONALLY IDENTIFIABLE INFORMATION** (PII) on any system without authorization. The AGOL account administrator and FWS Information Resources and Technology Management (IRTM) will not be held responsible for data and maps put onto AGOL and will not monitor the maps, applications, data, and users. The use of this system is included in the DOI Enterprise License Agreement with unlimited credits/use, except for geocoding.

Follow the instructions in the link to create your ArcGIS Online account using your Active Directory. You need an active US Fish and Wildlife Service email.

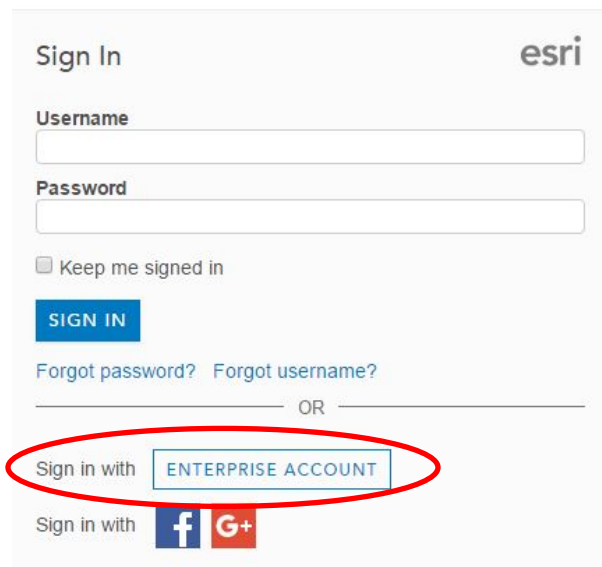
https://fishnet.fws.doi.net/projects/gisnew/SitePages/AGOL_Get_Started.aspx

2. Accessing Your AGOL Account and Collector

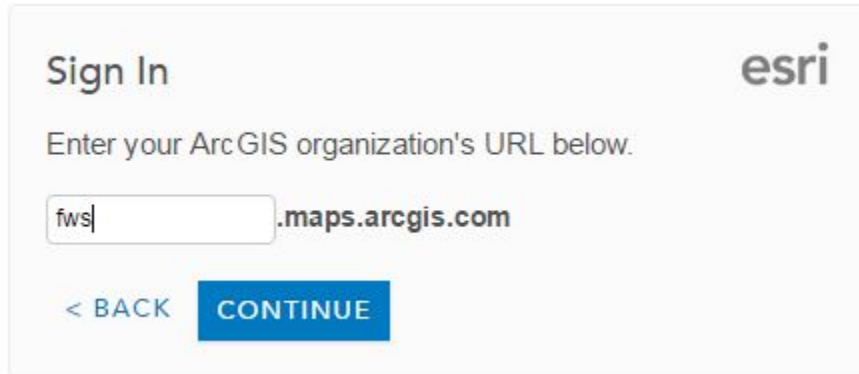
- The login process is the same for AGOL and Collector.
 - A. Open AGOL in your web browser (<https://www.arcgis.com/home/index.html>).
 - B. Click on Collector App icon on your mobile device.
- Click “Sign In.”



- Click on “Sign in with Enterprise Account.”

A screenshot of the ArcGIS Sign In page. The page has a white background with the 'esri' logo in the top right corner. The main heading is 'Sign In'. Below the heading are two input fields: 'Username' and 'Password'. There is a checkbox labeled 'Keep me signed in'. A blue button labeled 'SIGN IN' is positioned below the checkbox. Below the 'SIGN IN' button are two links: 'Forgot password?' and 'Forgot username?'. A horizontal line with 'OR' in the center separates the standard login options from the social login options. Below the line, there is a 'Sign in with' label followed by a button labeled 'ENTERPRISE ACCOUNT', which is circled in red. At the bottom, there are two more social login options: 'Sign in with' followed by Facebook and Google+ icons.

- Enter **fws.maps.arcgis.com** for ArcGIS organization's URL.



Sign In esri

Enter your ArcGIS organization's URL below.

.maps.arcgis.com

< BACK CONTINUE

- Click on "Using Your U.S. Fish and Wildlife Service Account."



Sign in to U.S. Fish & Wildlife Service esri

USING YOUR U.S. FISH AND WILDLIFE SERVICE ACCOUNT

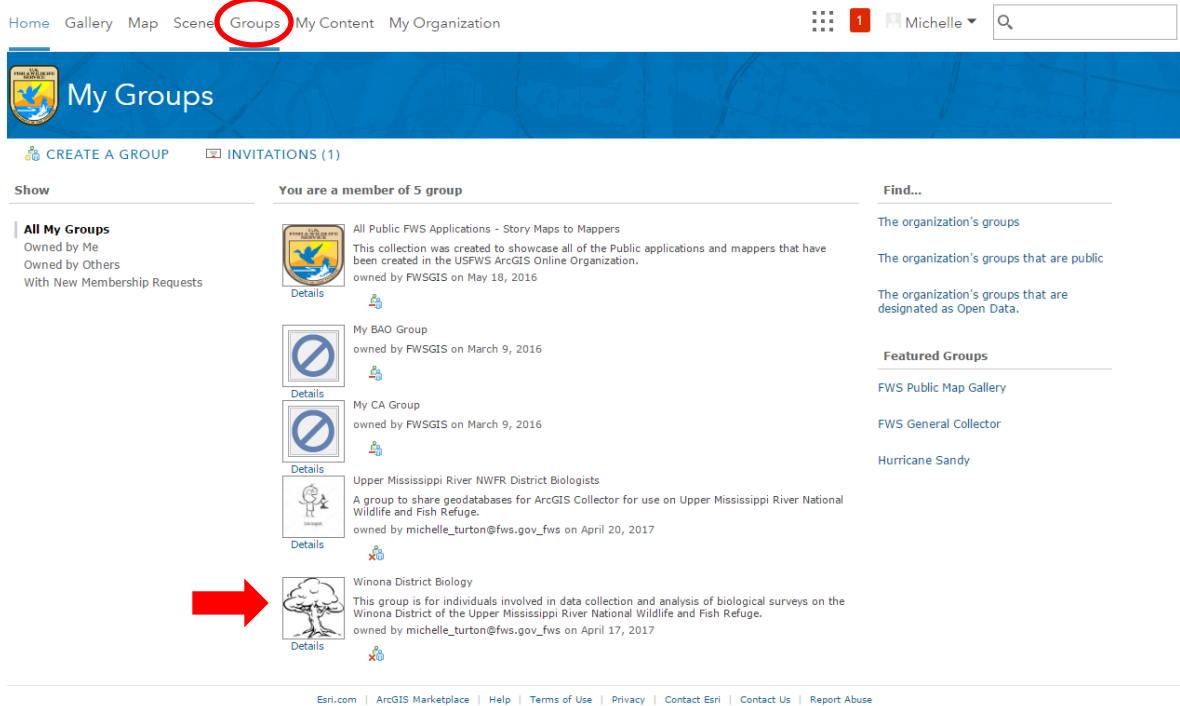
OR

USING YOUR ARCGIS ACCOUNT

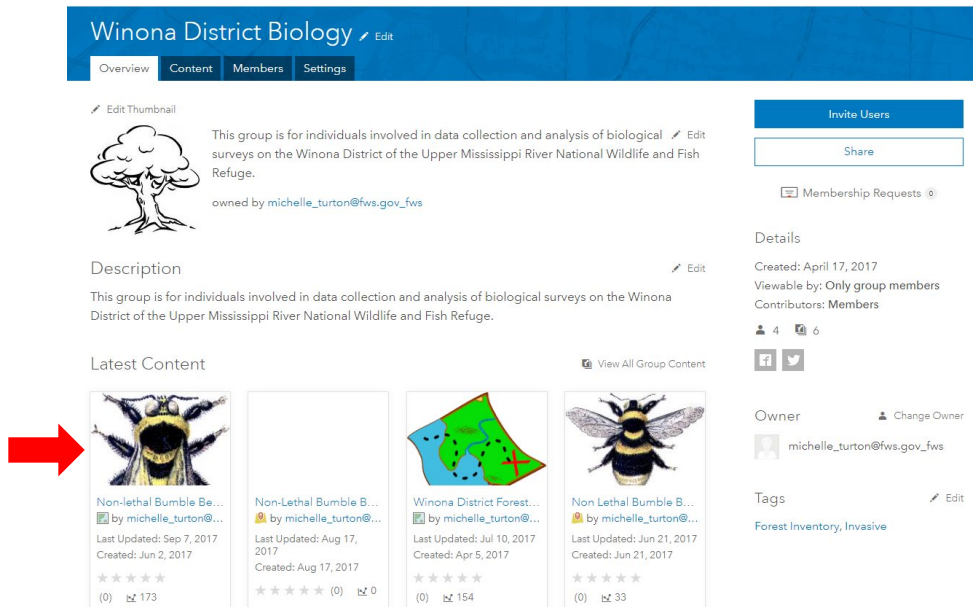
- Sign in using your **active directory** email and password.

3. Checking Access to Shared Bumble Bee Map on AGOL

- Once you login to AGOL (see section 2), click on the “Groups” tab and see if you have your District’s biology group under “My Groups.”



- If you do not see your District’s biology group, please contact your District biologist so he or she can add your username to the group.
- Click on the District biology group and on the bumble bee web map.



- Click on the web map and you should see these three layers: Individual Bee Data, Survey Date Information, and Habitat Data.

Non-lethal Bumble Bee Map [Edit](#)

Overview Usage Settings

[Edit Thumbnail](#)

Map for non-lethal bumble bee protocol data collection. [Edit](#)

by michelle_turton@fws.gov_fws
Last Modified: September 7, 2017

[Web Map](#)

★ Add to Favorites

Description [Edit](#)

Add an in-depth description of the item.

Layers

- Non-Lethal Bumble Bee Protocol v2.0 - Individual Bee Data
- Non-Lethal Bumble Bee Protocol v2.0 - Survey Date Information
- Non-Lethal Bumble Bee Protocol v2.0 - Habitat Data

Open in Map Viewer

Open in ArcGIS Desktop

Create Presentation

Create Web App [v](#)

Share

Metadata

Details

★ ★ ★ ★ ★ (0) [v](#) views: 200

Created: June 2, 2017

Size: 14 KB

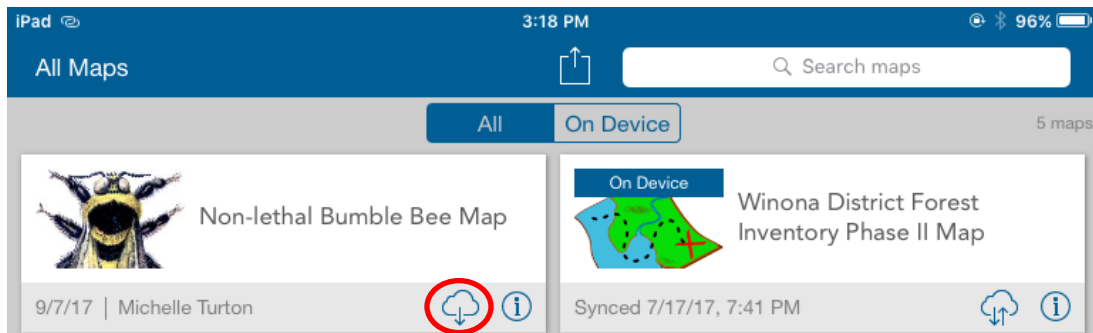
Shared with: The item is not shared.

[f](#) [t](#)

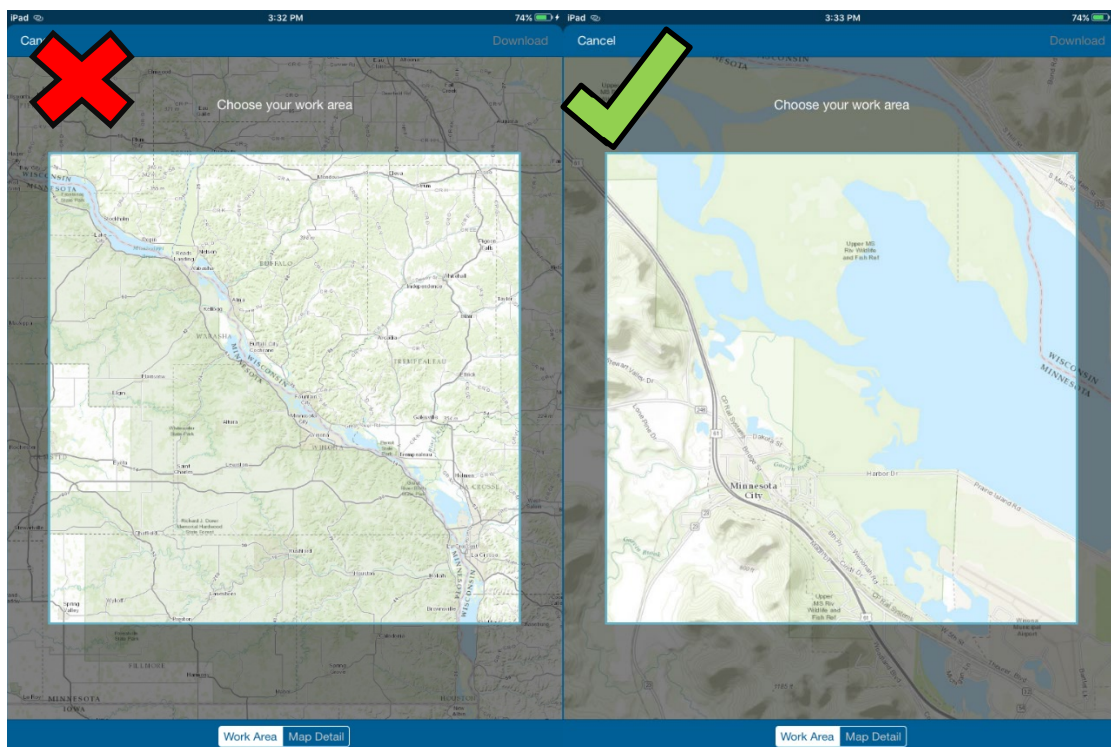
- If your map has these three layers, then you are ready for to login in to Collector. **Do NOT make any edits to the map or layers without permission from your District biologist including symbols.**

4. Downloading Data for Offline Data Collection

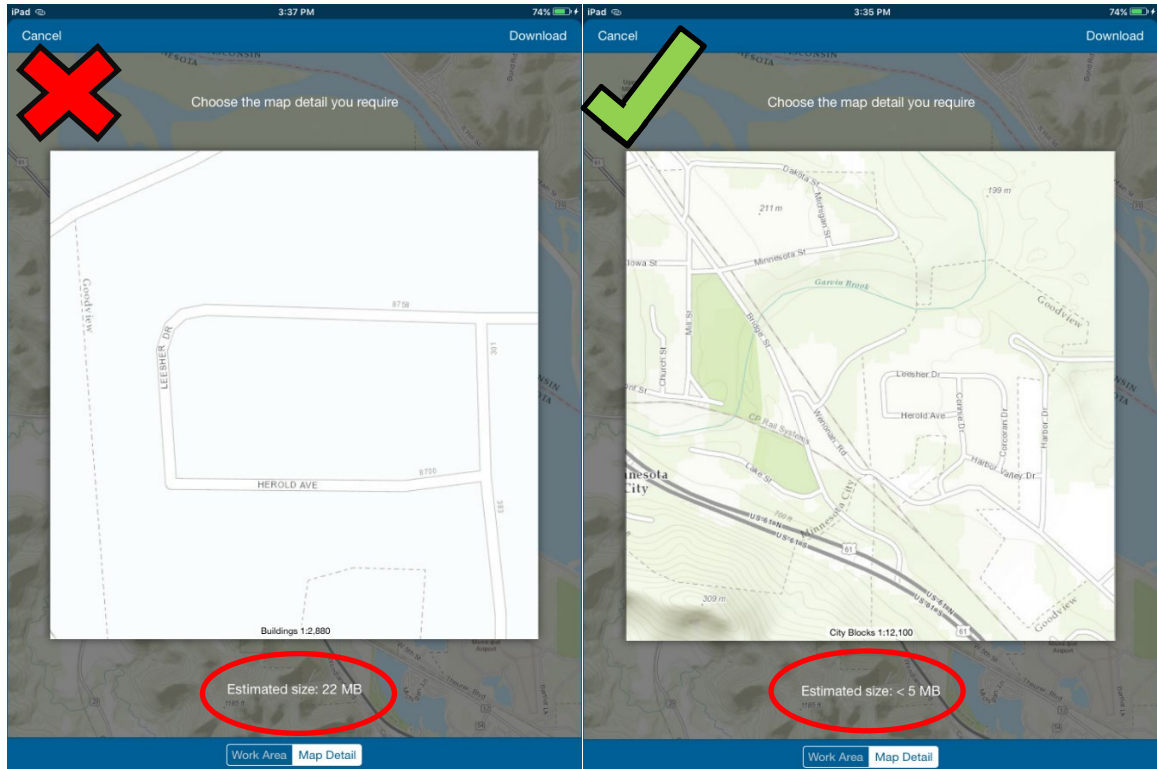
- Collecting offline can extend a mobile device's battery life.
- Login into Collector on your mobile device following instructions from section 2.
- Click on the "Cloud" button to download the forest inventory map from AGOL



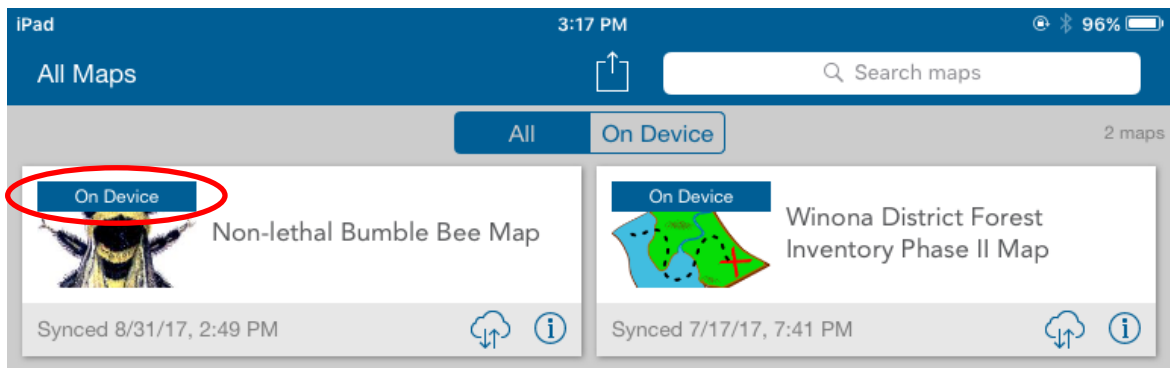
- Choose your work area; this is the area you will be collecting data. It is best to choose a smaller site limited to where you are collecting points than choosing a work area that is pool size or larger.



- Choose your detail level by paying close attention to the estimated size. The greater the detail, the more space that is required on your device. More detail also increases download time. Try to keep size under 15 MB.

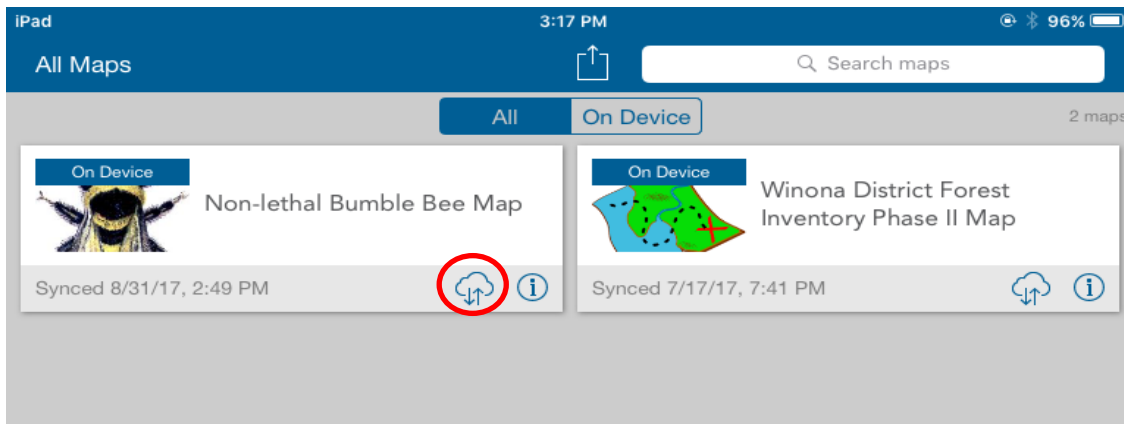


- After work area and map detail is chosen, click download in the upper right corner.
- When finished downloading, you'll now see the map listed as "On Device." You will only have the area you selected on the device.



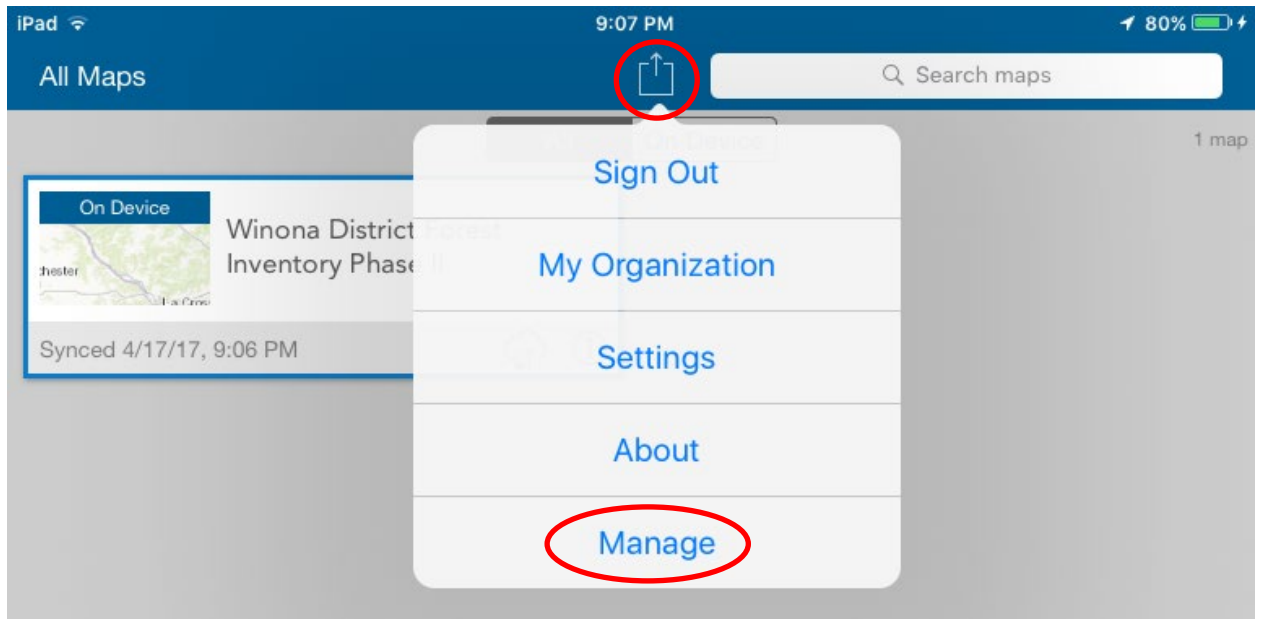
5. Uploading Data from Collector to AGOL

- In order to sync data, you need to have access to the internet (data plans, WiFi, or direct connection). Sync your data by using the cloud icon on the map at the main Collector menu. The number in red indicates the number of pending feature updates. **Data should be sync to AGOL after every work day.**

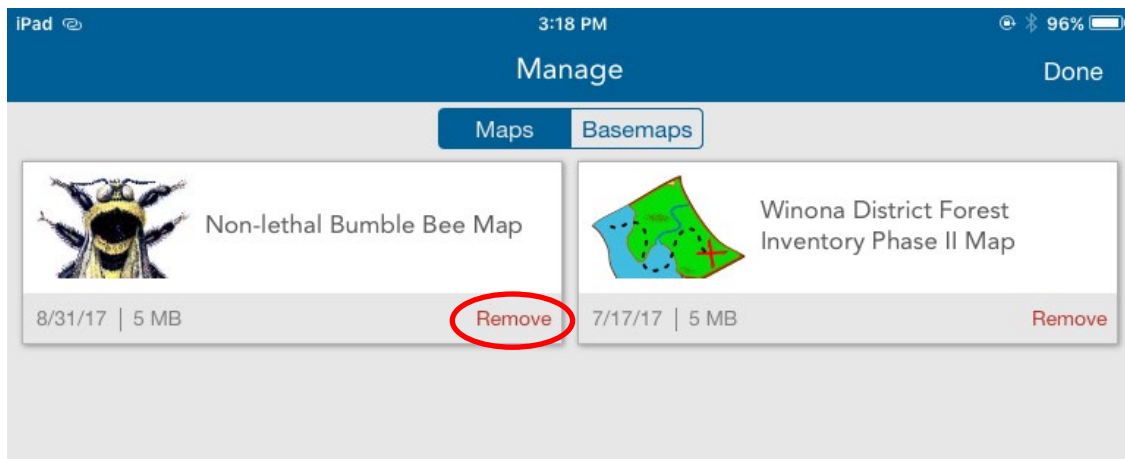


6. Removing “On Device” Features or Entire Map

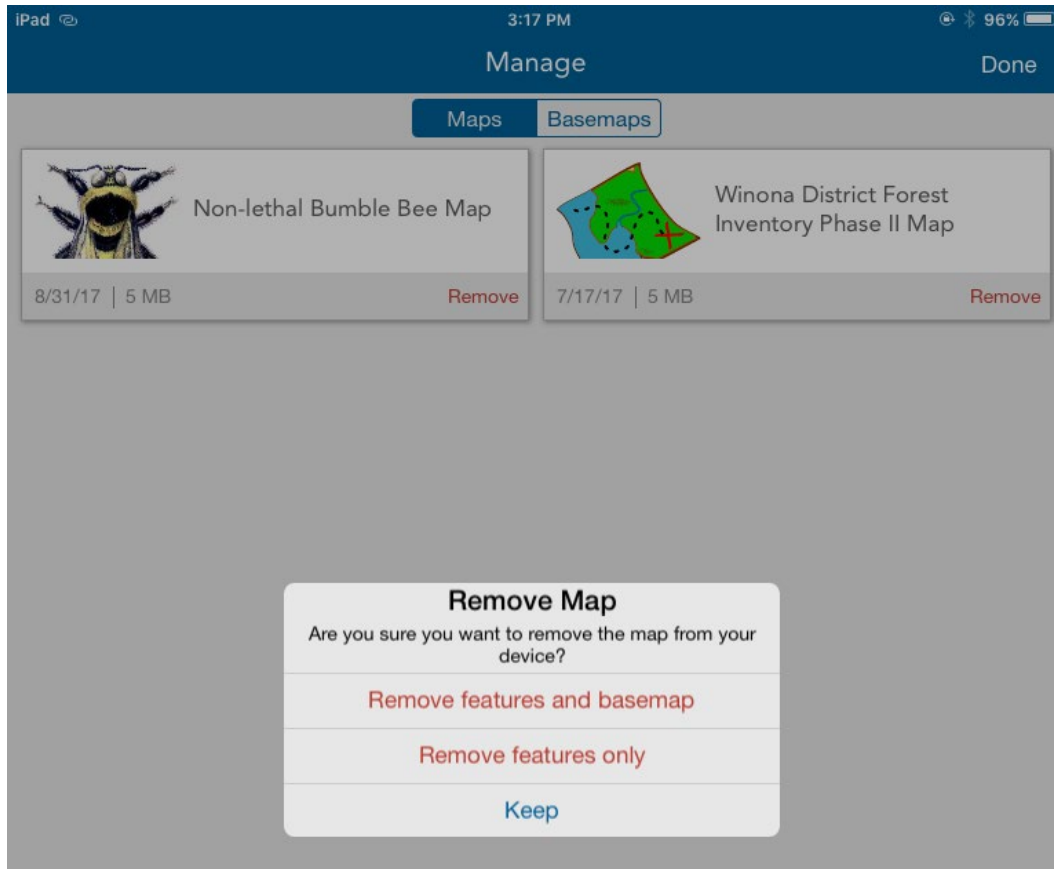
- Removal of only features while keeping the basemap, will be useful to not have to download the basemap repeatedly. **Make sure to SYNC before removing any data of the device.**
- Removal of the entire map will allow you to collect data in real time or change work area.
- Click on “Options” button, and choose “Manage.”



- Choose “Remove” from your map.



- Choose if you want to remove features and basemap or just features.



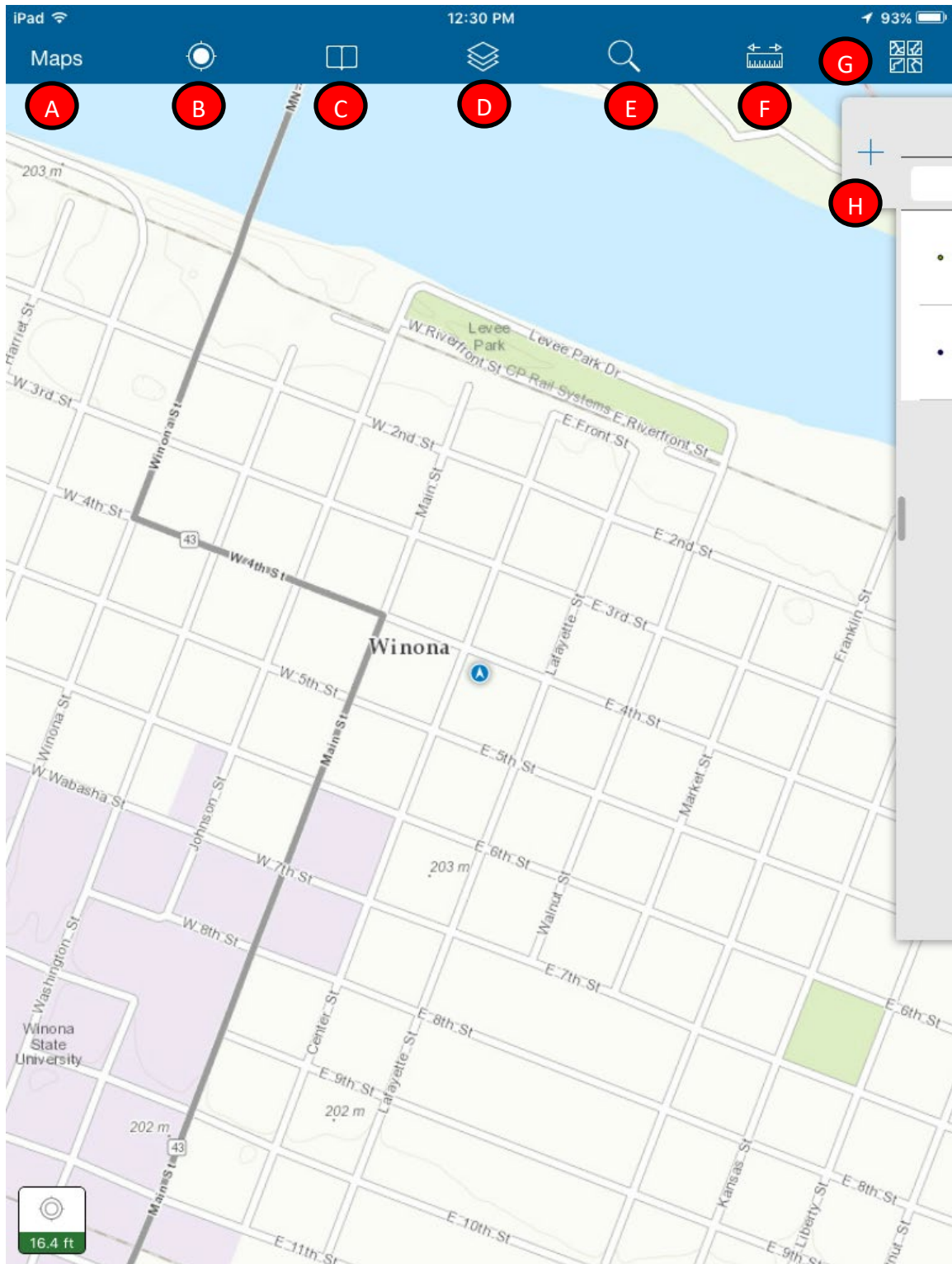
- Click "Done." Return to main menu, you will see that your map has lost the "On Device" designation.

7. Collector Map Screen

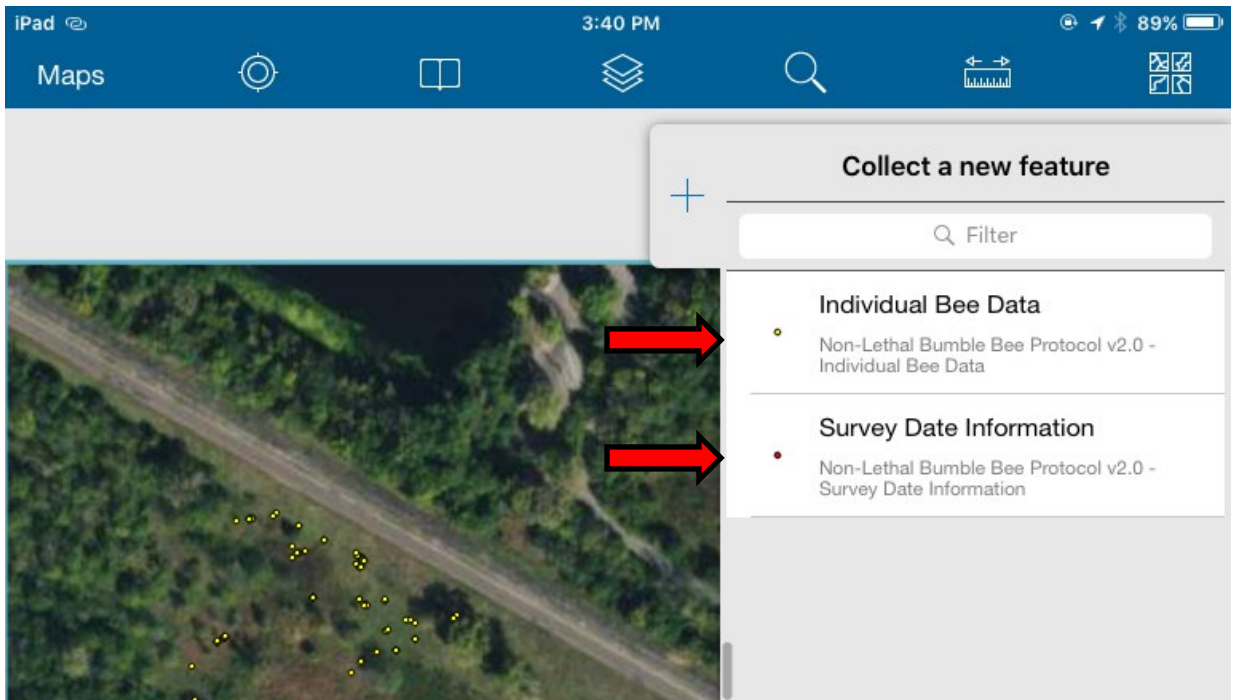
- Collecting data is the same for “On Device” and real time. Click on the map icon.



- When you are in your map, take a second to familiarize yourself with what the icons means.
 - “Maps” button will return you to the main menu.
 - “Find my location” button will use the GPS to find your location.
 - The “Bookmark” button allows for saving specific locations/map extents. This eliminates the guesswork if you need to jump between two areas.
 - “Layers” tool is useful for turning on and off datasets when one type may not be in use.
 - “Search” tool allows you to search the map and zoom in or out.
 - “Measurement” tool allows you to measure distance and areas by drawing temporary lines and polygons on the map.
 - “Basemap” tool allows you to select and change the basemap
 - Clicking on or dragging the plus sign will allow creation of new features.

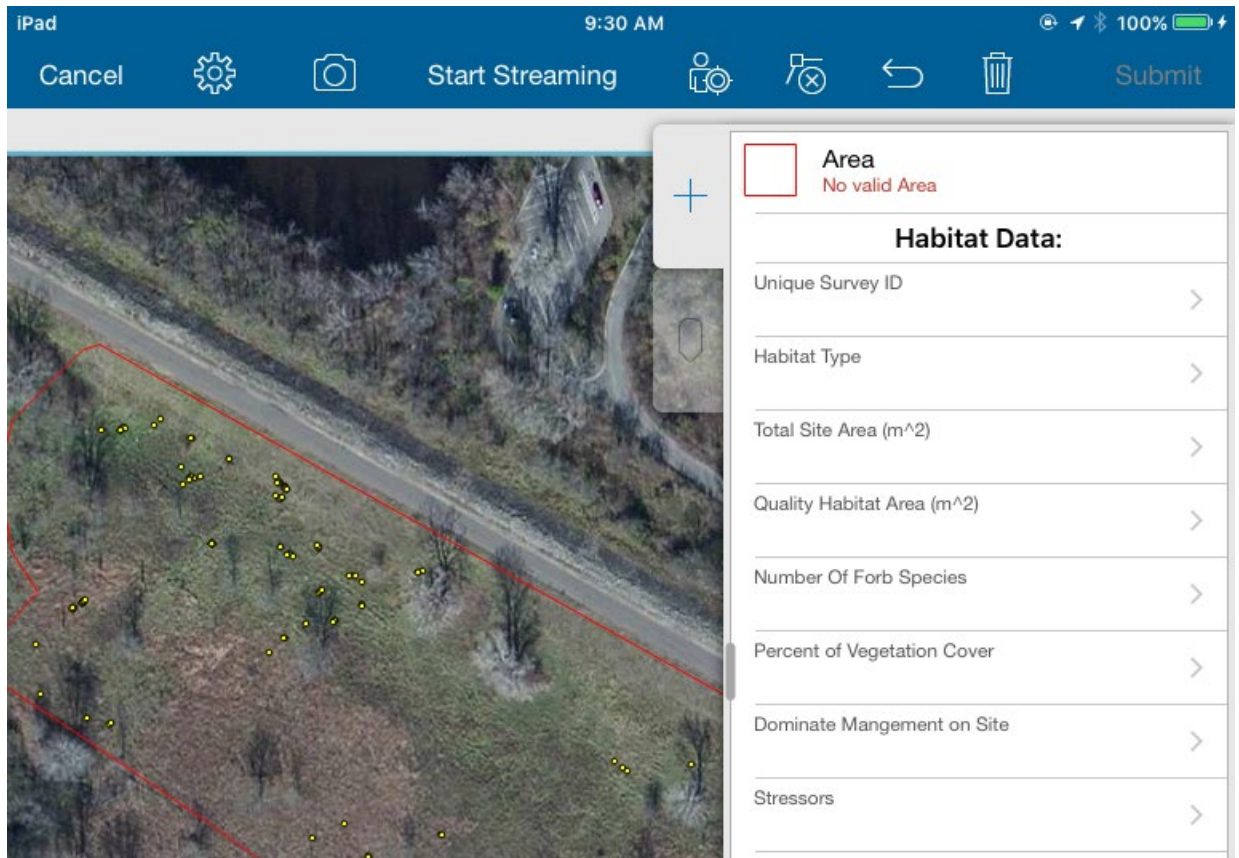


- Click/drag on the plus sign or H from above to collect a new feature. You should see the two layers in the image below. **Once you reach the data point**, indicated by the separate GPS unit or mobile device, you are ready to collect data.

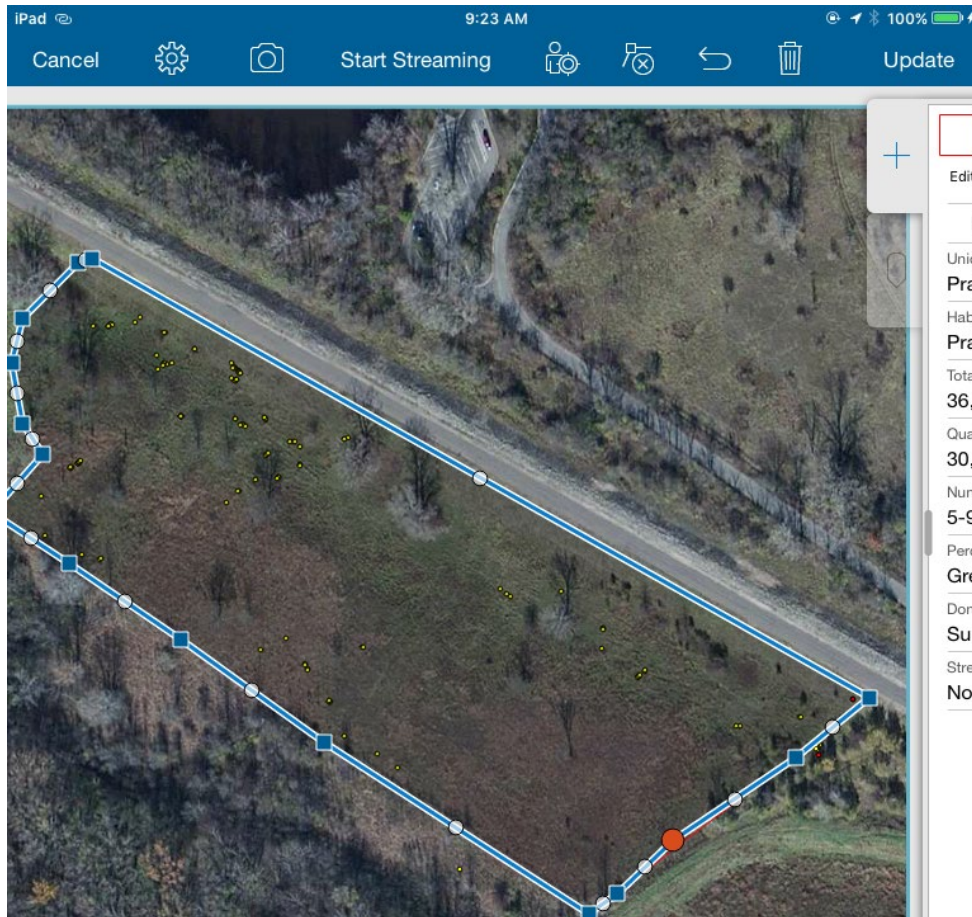


8. Collecting Habitat Data

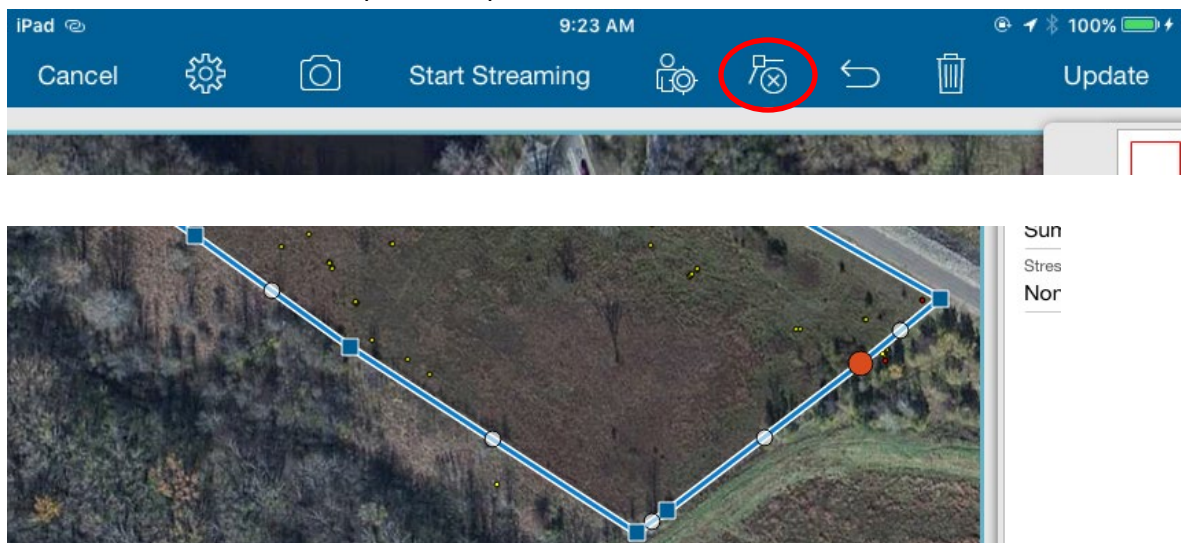
- Only **ONE** habitat data polygon for a site. Drawing the polygon can happen at the office before going to the site or in the field.



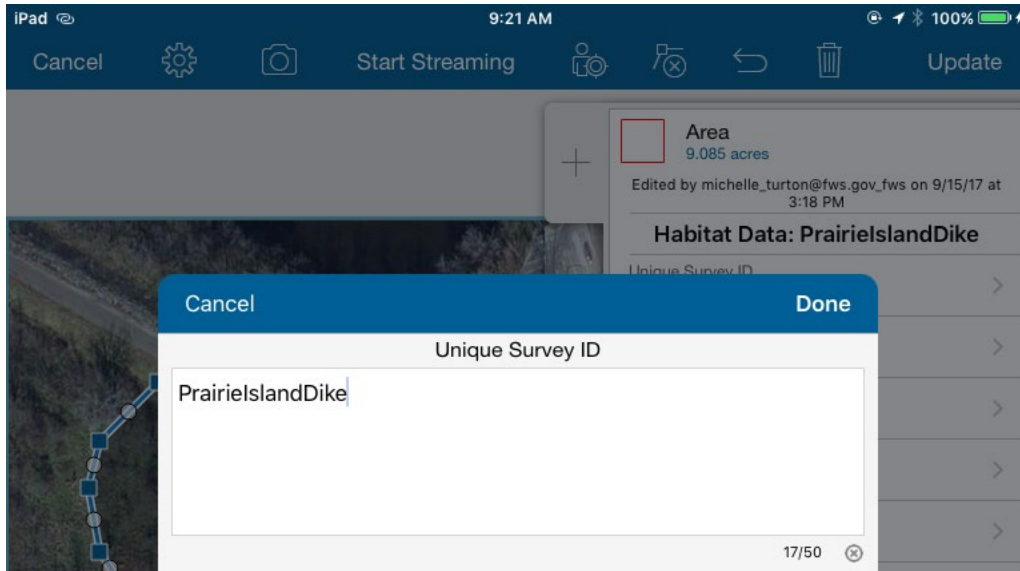
- You can draw a polygon over the survey area using the touch screen to add points to form a polygon. When you are creating or editing the polygon it is blue.



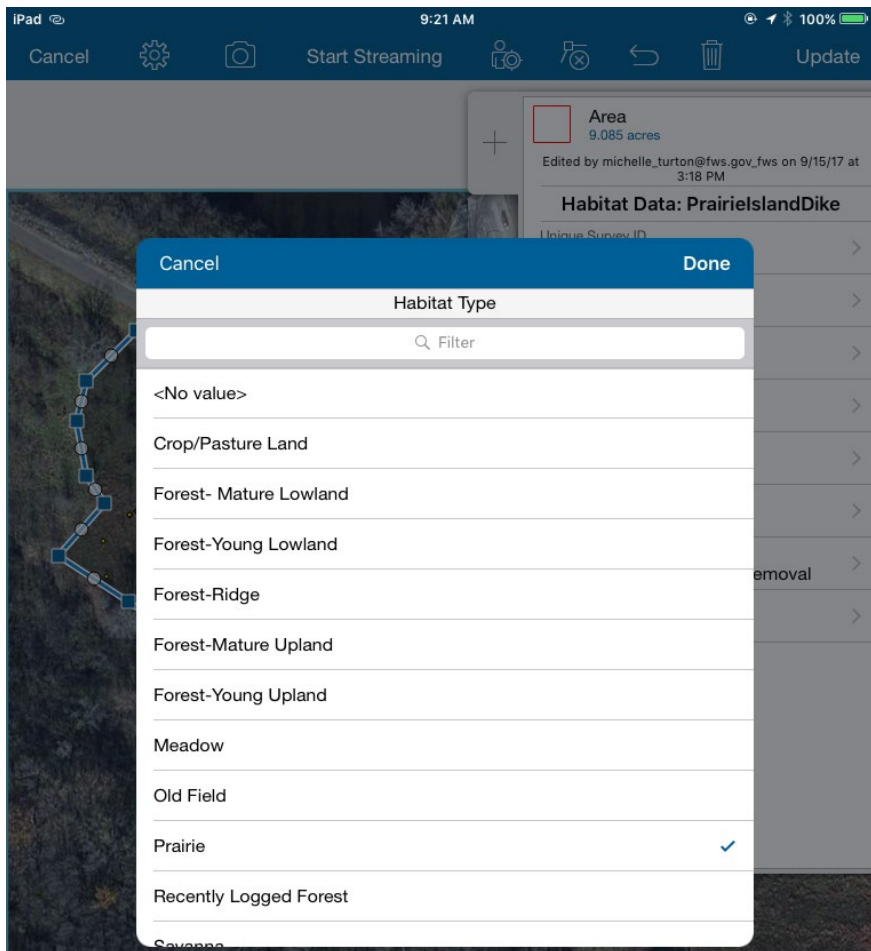
- To delete a point you can touch the point on the polygon you wish to delete. Then use the delete button on the top menu options.



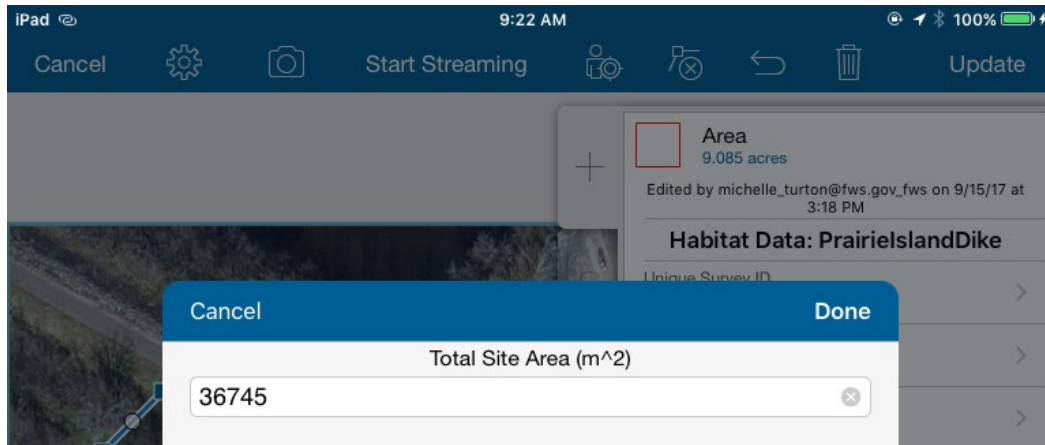
- Click on Unique Survey ID, this is the name of the survey site.



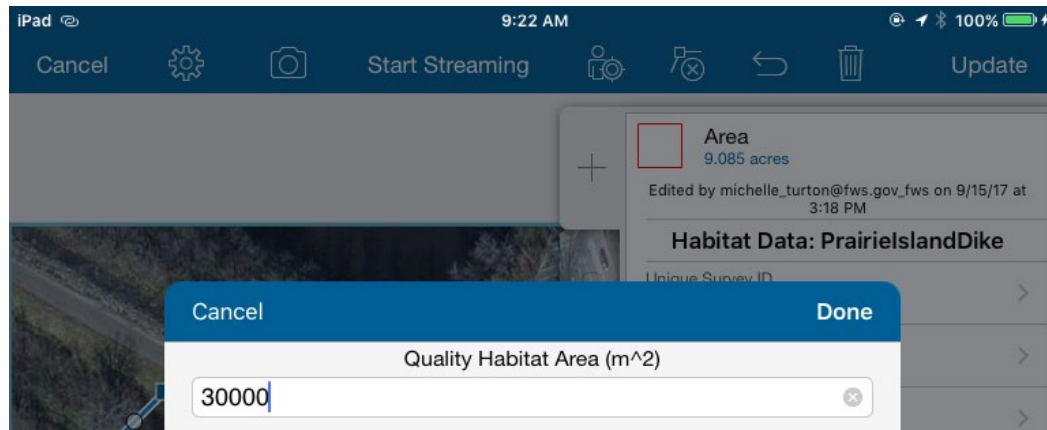
- Choose the type of habitat that best characterizes the survey site.



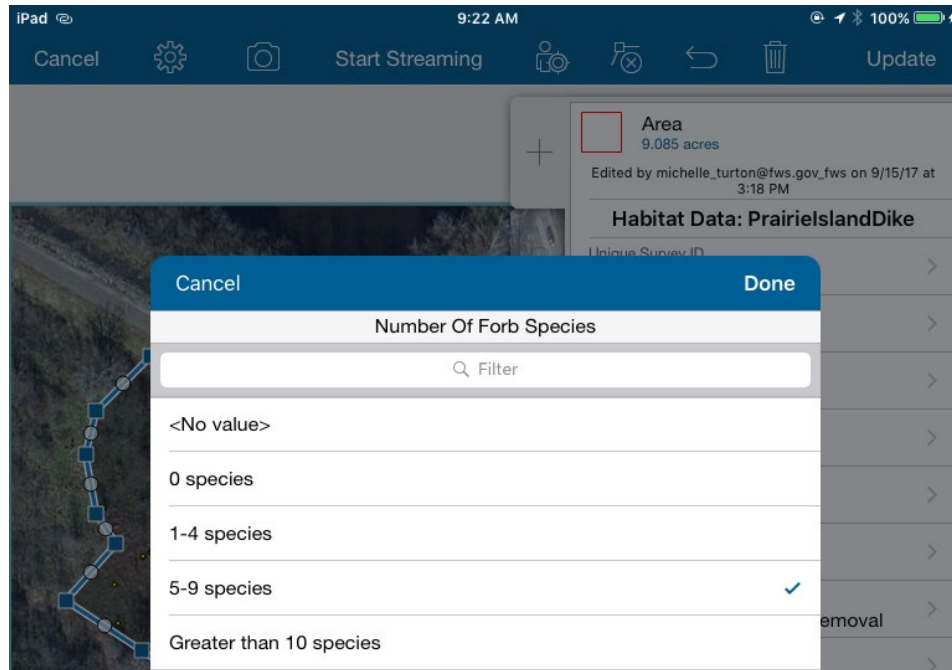
- Calculate the total area of the survey site including areas not surveyed in m^2 . The area can be calculated later at the office and updated.



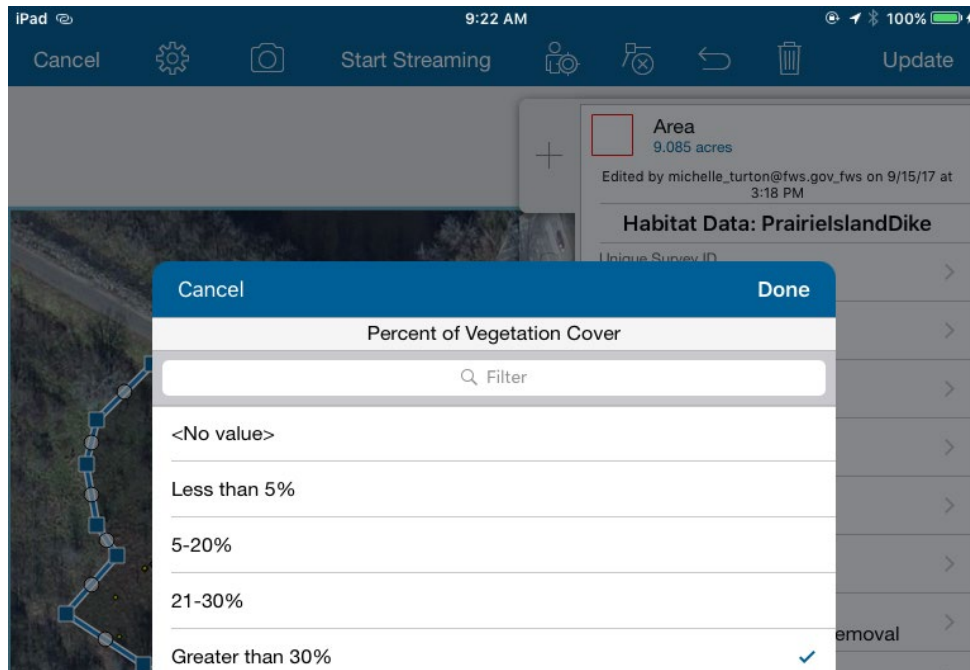
- Estimate the area of the quality bumble bee habitat in the survey site in m^2 . Quality habitat is areas with abundance diverse floral resources. See the Survey Protocols for the Rusty Patched Bumble Bee (*Bombus affinis*) Version 1.2 for more information on what is considered quality habitat. .



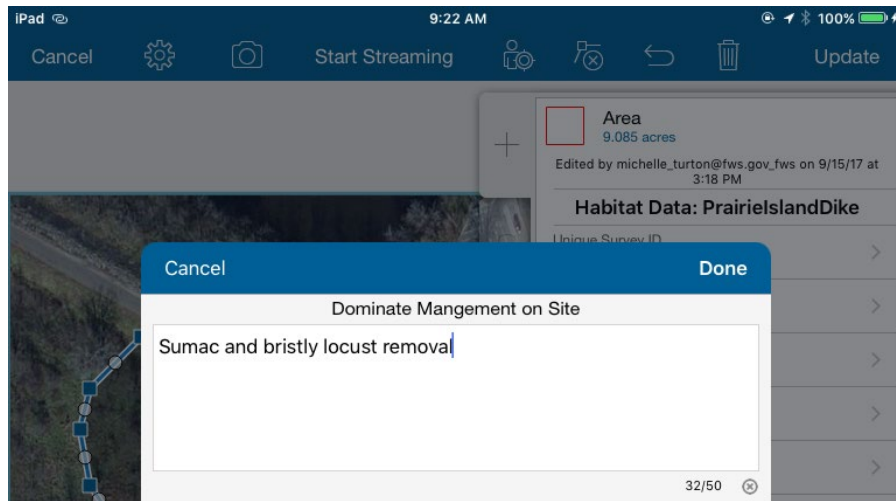
- Choose the number of species of forbs at the site with includes flowering shrubs and pollinator-friendly trees in bloom during the survey.



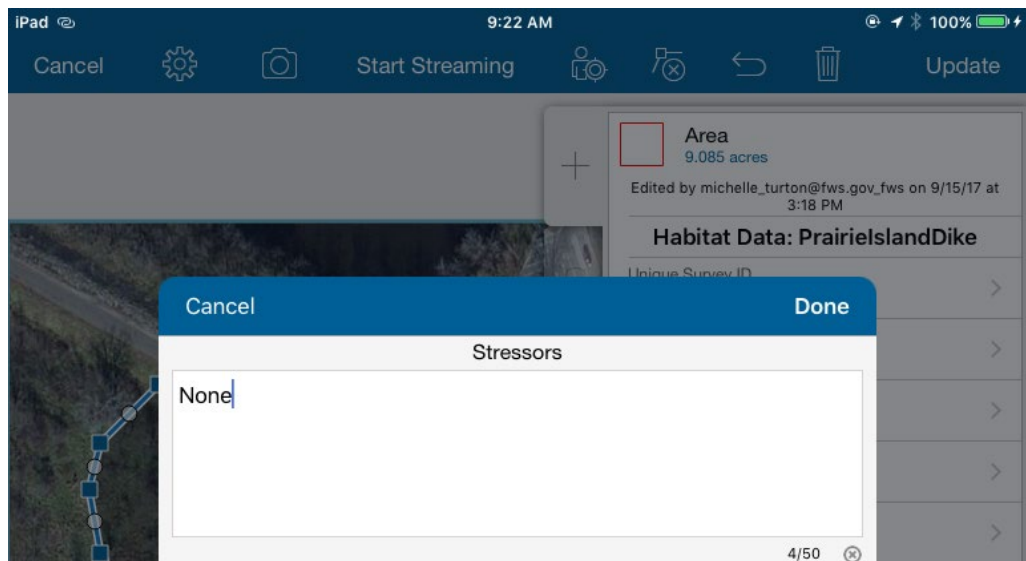
- Percent of vegetative cover that is forbs, flowering shrub, or pollinator-friendly trees.



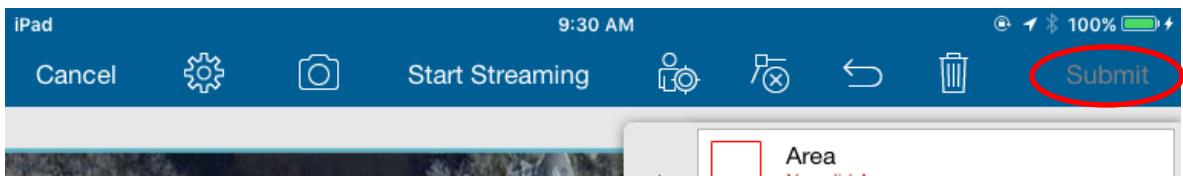
- Describe the dominant management practices on the survey area.



- Describe the observed or likely stressors in survey area (such as use of pesticides, tilling, etc).

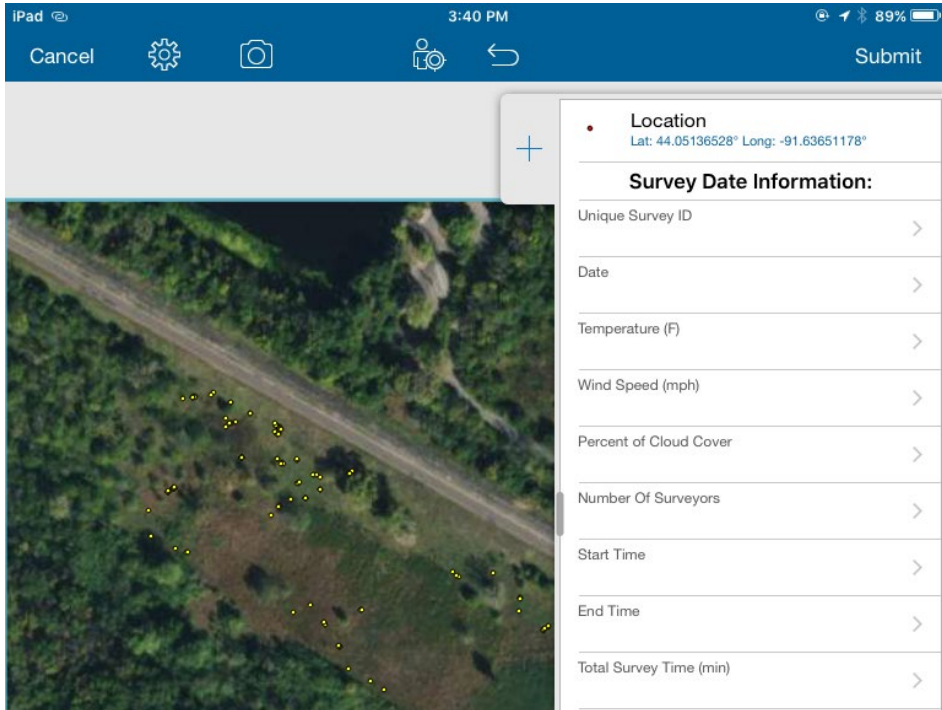


- Click "Submit" button in the upper right corner after all data is recorded.

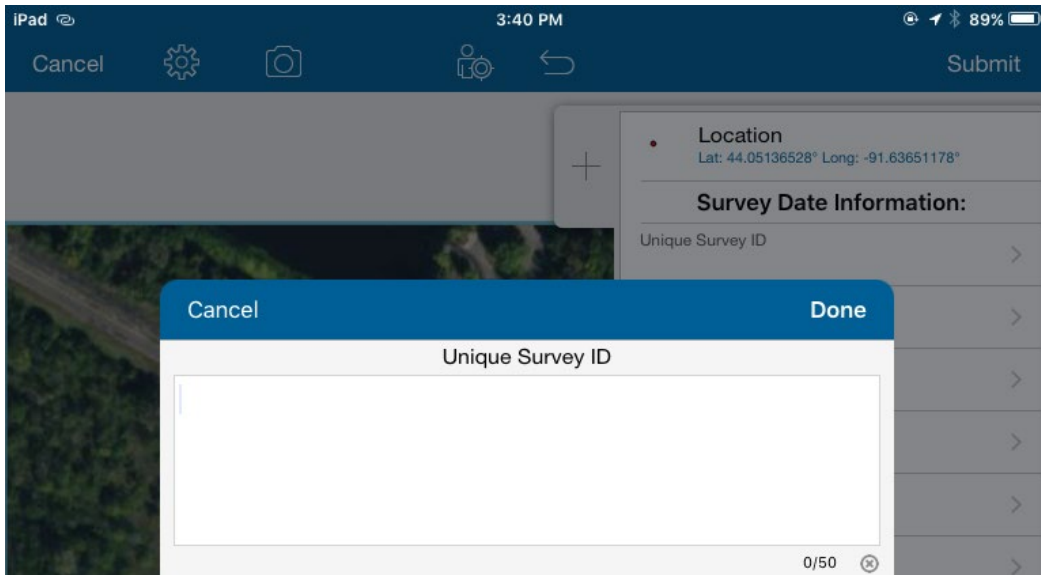


9. Collecting Survey Date Information

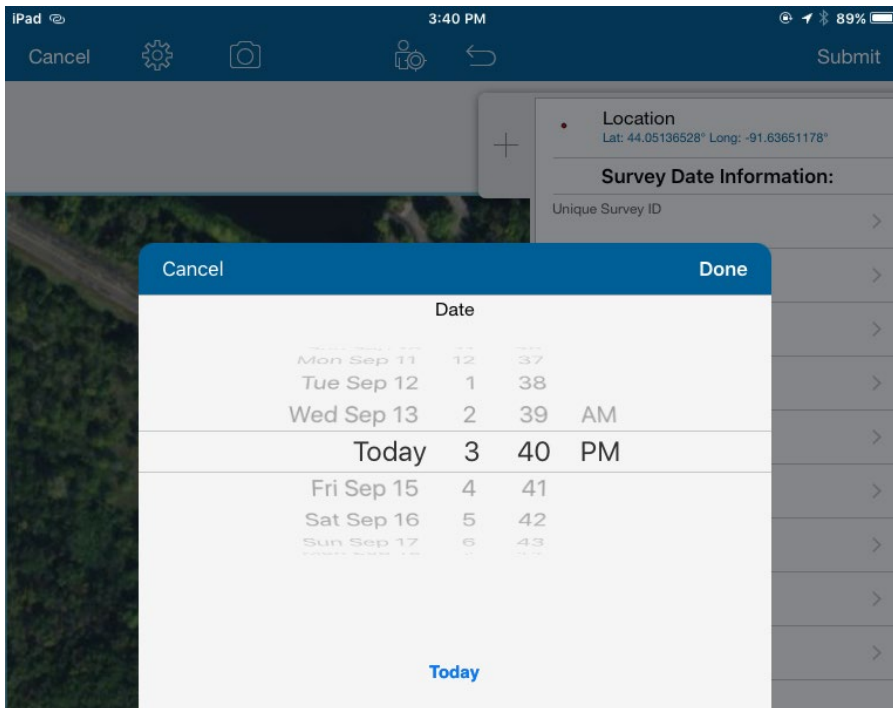
- Only ONE survey date information point should be recorded for the day of the survey.



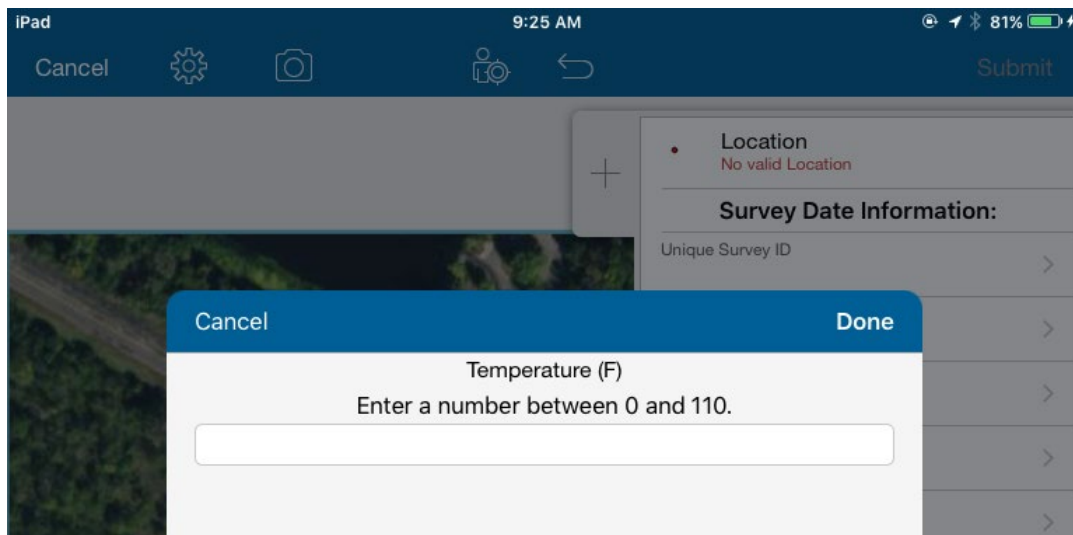
- Click on Unique Survey ID, this is the name of the survey site.



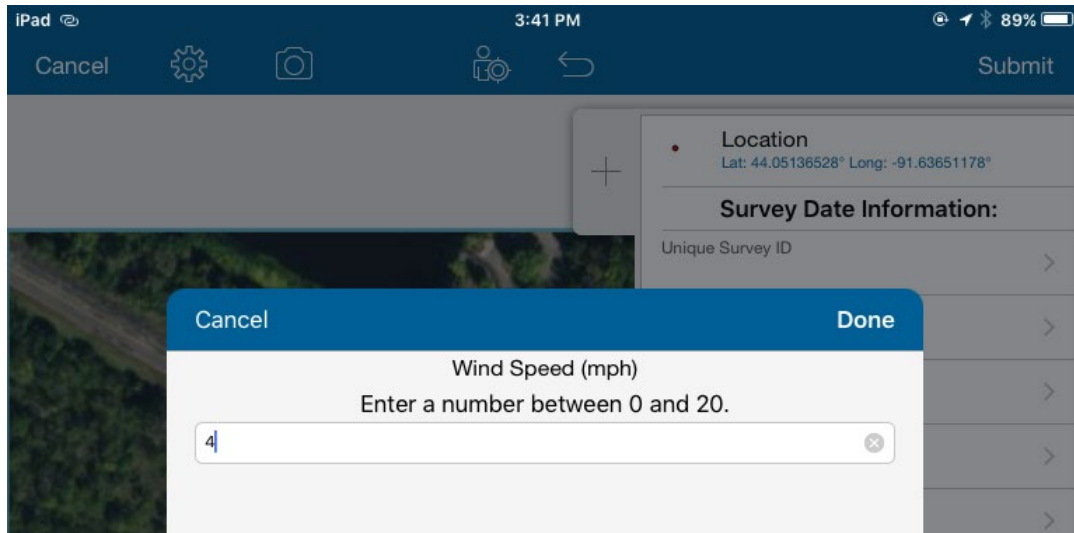
- Enter survey date.



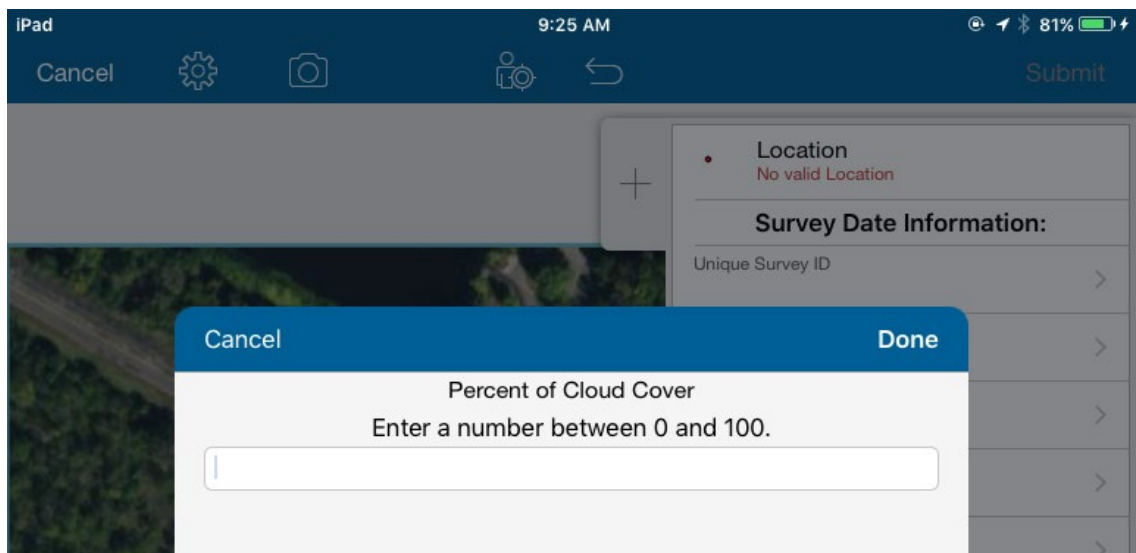
- Record the current temperature in Fahrenheit for the site. Surveys should only take place when temperatures are **above 60°F**.



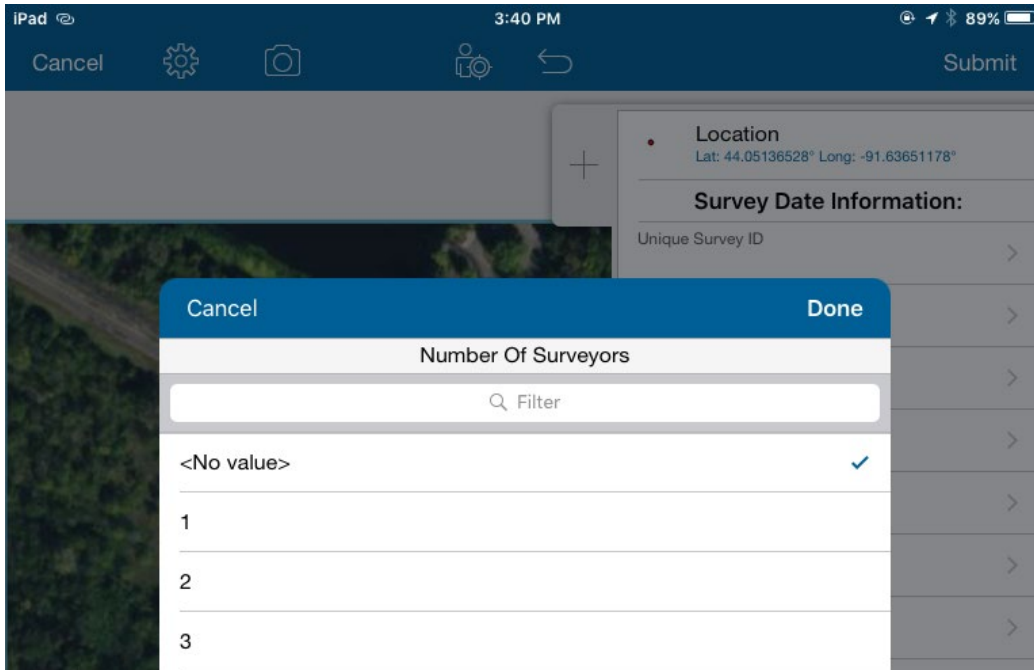
- Record wind speed at the site using a wind gauge. Wind speeds should be less than 8mph.



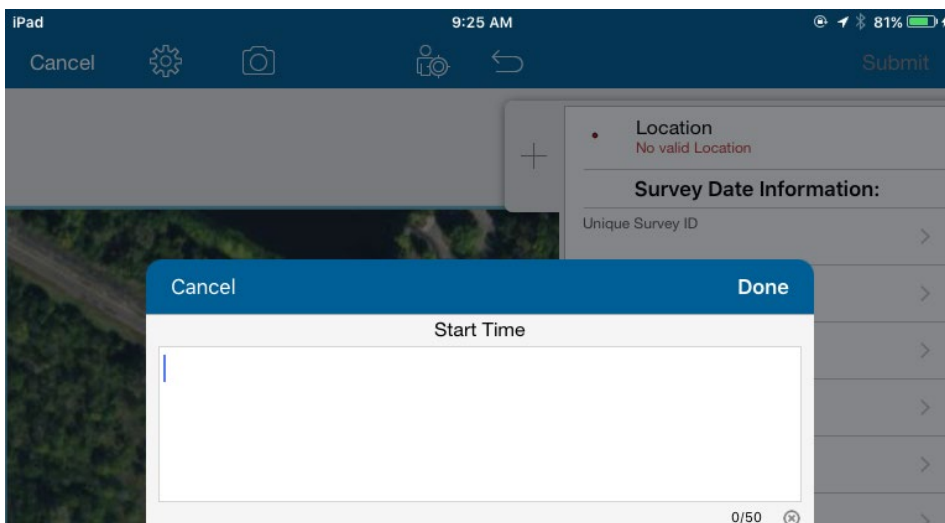
- Record the cloud cover percentage. Surveys should not occur during wet conditions (e.g. foggy, raining, or drizzling). Wait at least 1 hour after rain subsides before conducting a survey. Cloudy days or overcast are okay as long as you can still see your shadow.



- Use drop down to list the number of people participating in the survey.

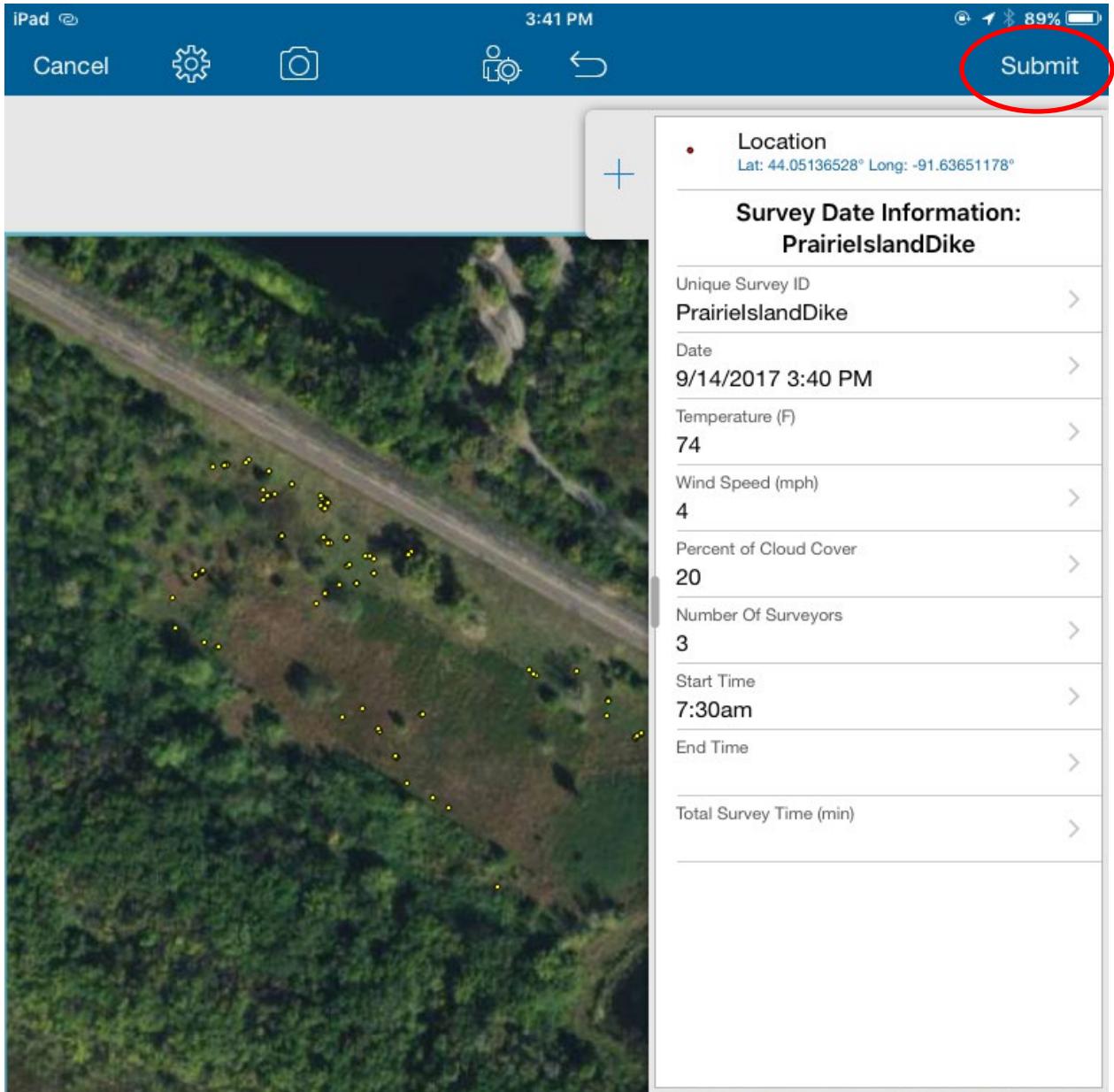


- Record the start time of the survey. Survey should be conducted at least 2 hours after sunrise and 3 hours before sunset.



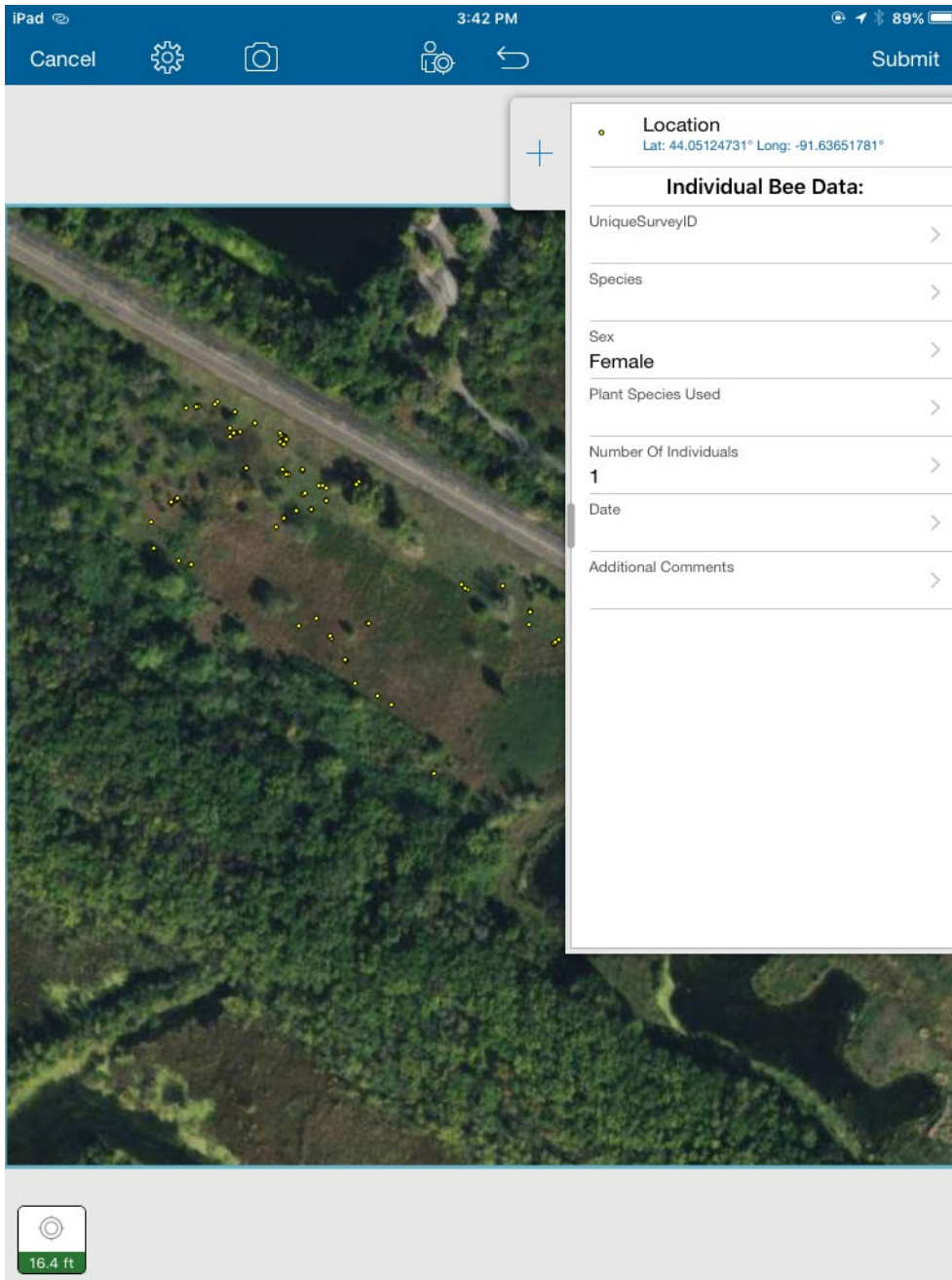
- Wait until the end of the survey to record “End Tim” and “Total Survey Time (min).”

- Click “Submit” button in the upper right corner after all data is recorded.

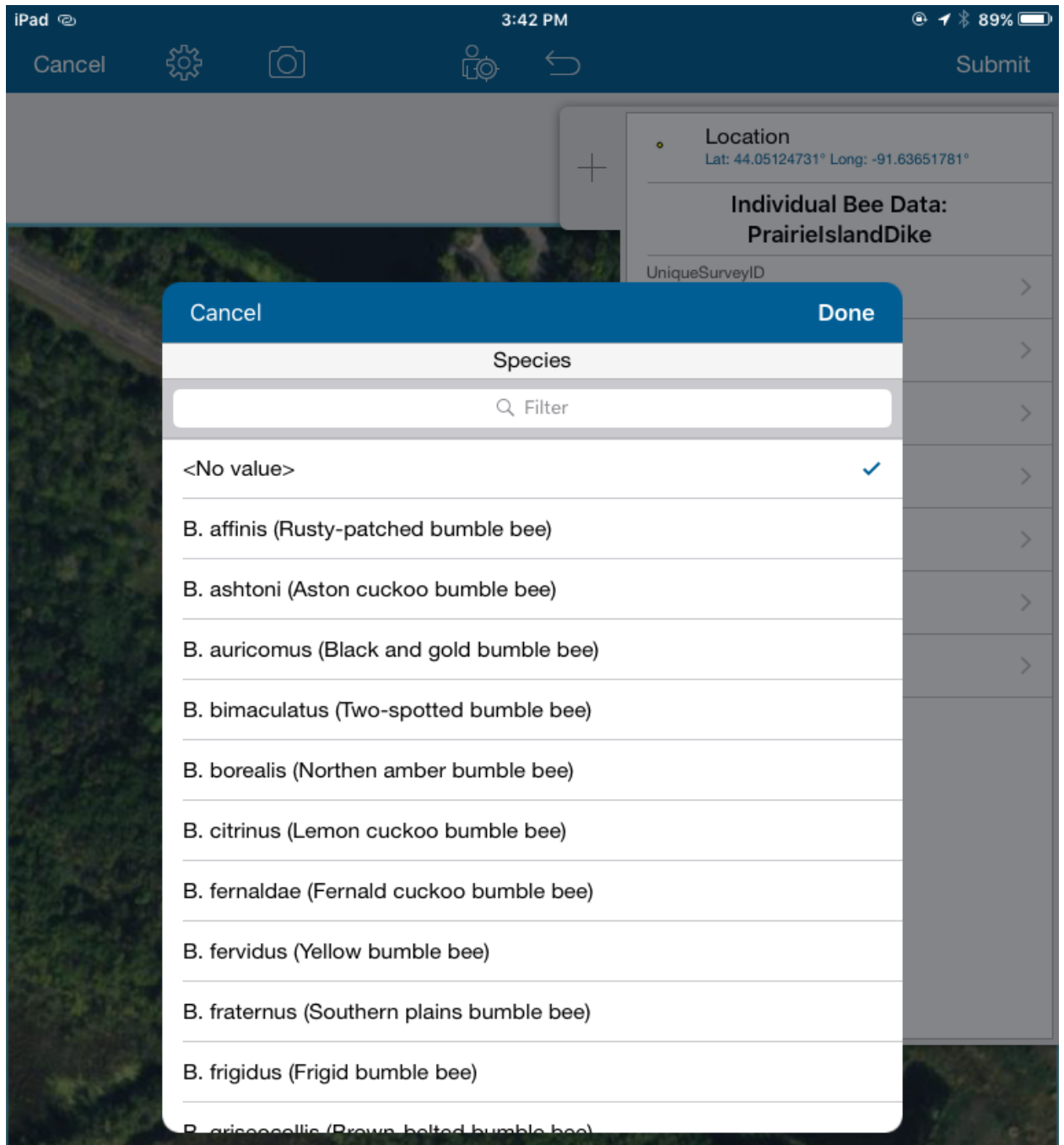


10. Collecting Individual Bee Data

- One individual bee data point should be collected for EACH capture bumble bee.
- Some fields are pre-populated with the most common selections to save time recording. These fields can be changed.

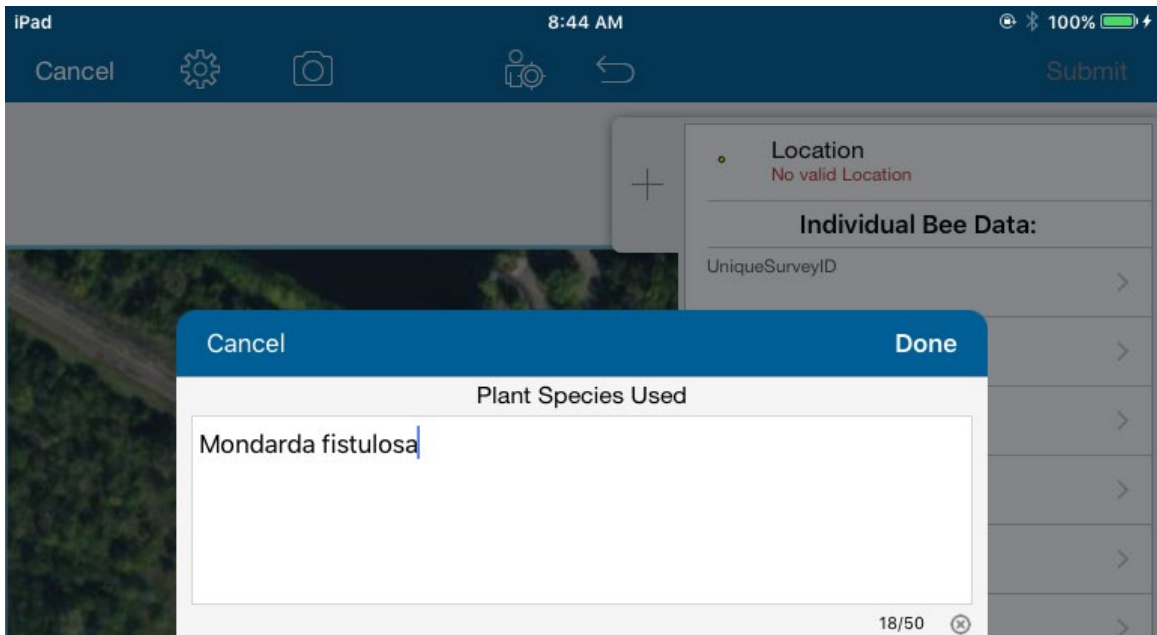


- For UniqueSurveyID, record the **SAME** site name as the Survey Date Information.
- Species is a drop down list of eastern bumble bee species. Species can be added now if species known or added later after picture identification.

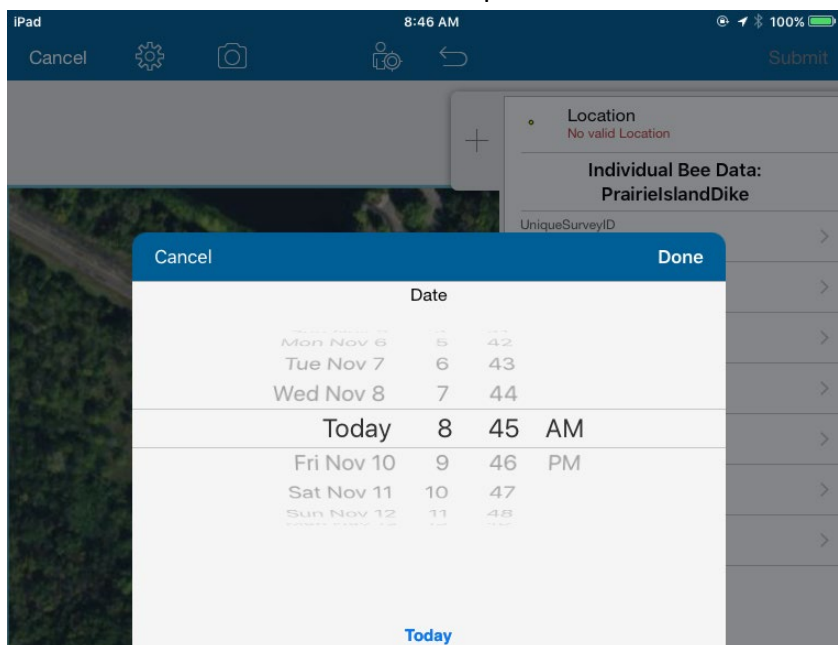


- Sex is auto populated to female and can be changed to “Queen” and “Male.”

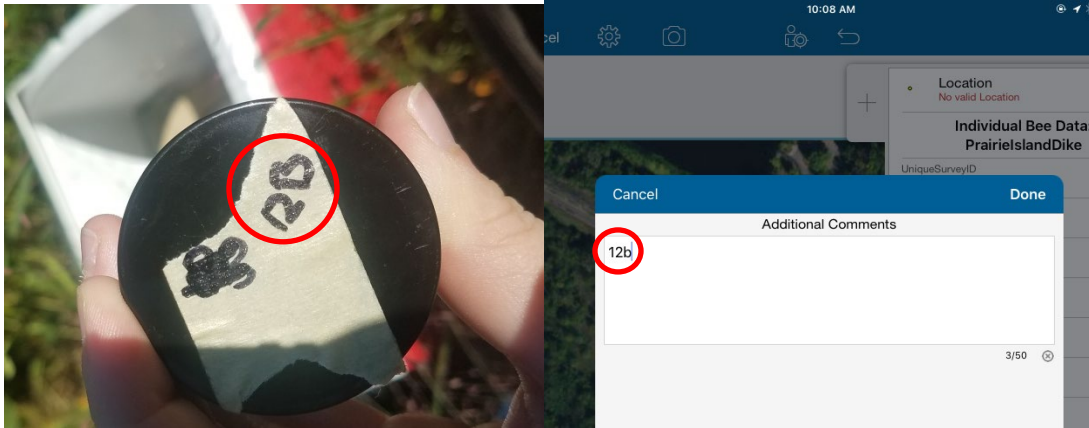
- Plant Species Used is the plant that the bumble bee was using before capture. **Plant scientific name should be used.** If scientific name is not known, common name can be used, and then changed later to scientific in the office.



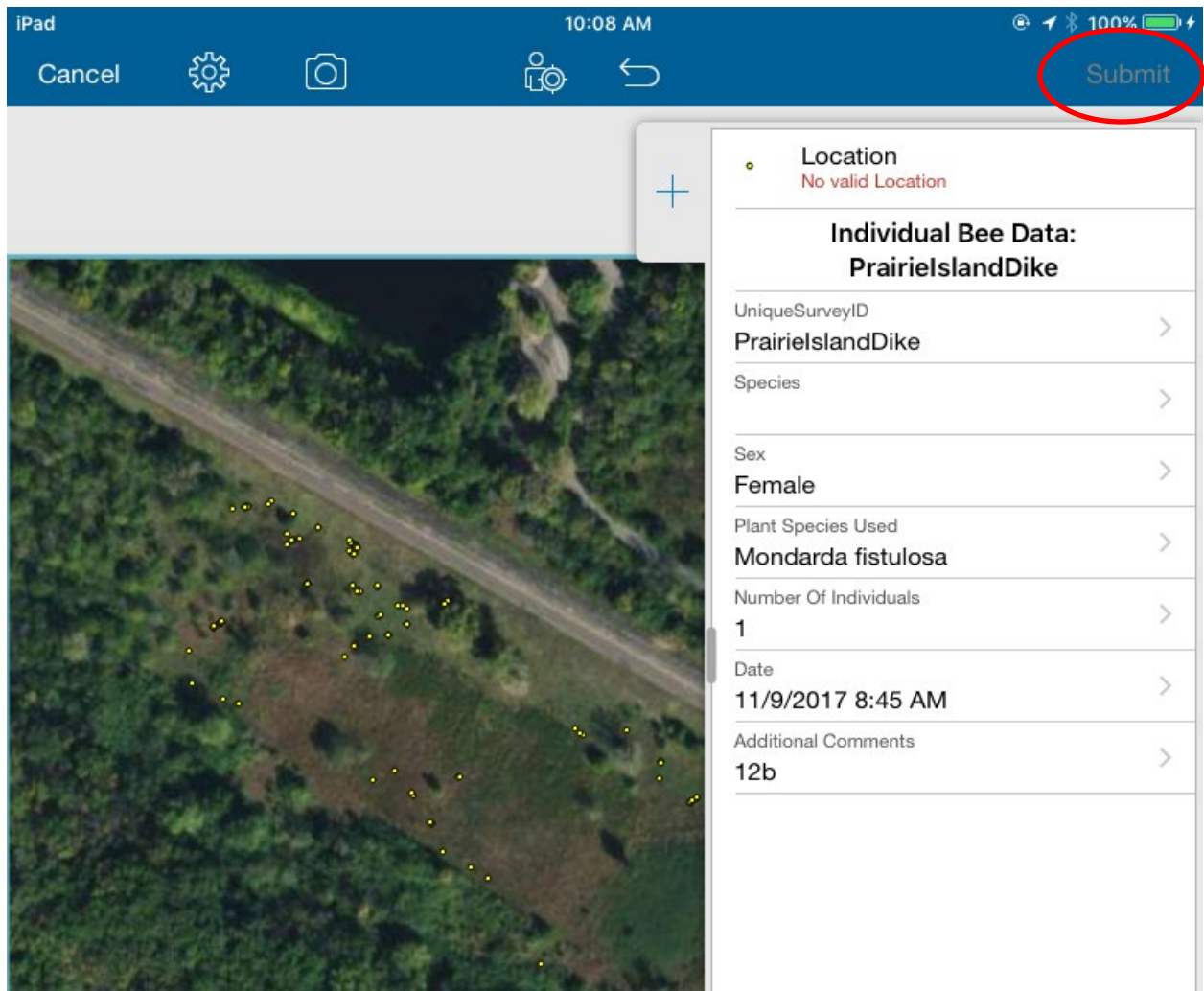
- Number of Individuals refers to the number of individual bees for this record. This is pre-populated to be "1."
- Add the date the bumble bee was captured.



- Additional Comments is where you can add any notes about the captured bumble bees. You can add the number of the container so pictures taken can be later linked to the correct record.

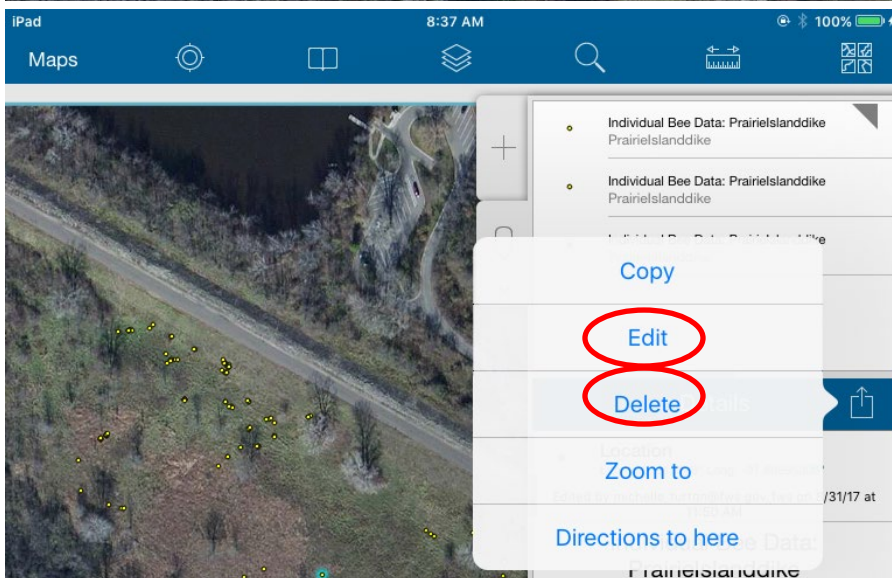
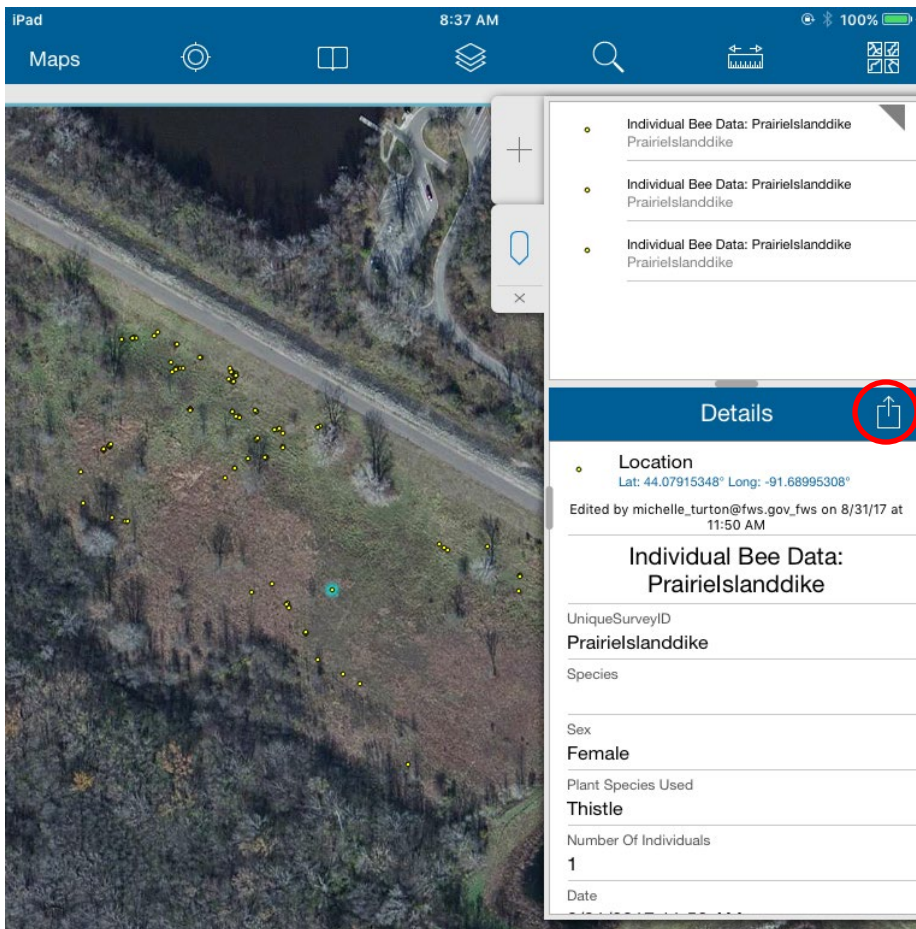


- Click “Submit” button in the upper right corner after all possible data is recorded.



11. Editing or Deleting a Point in Collector

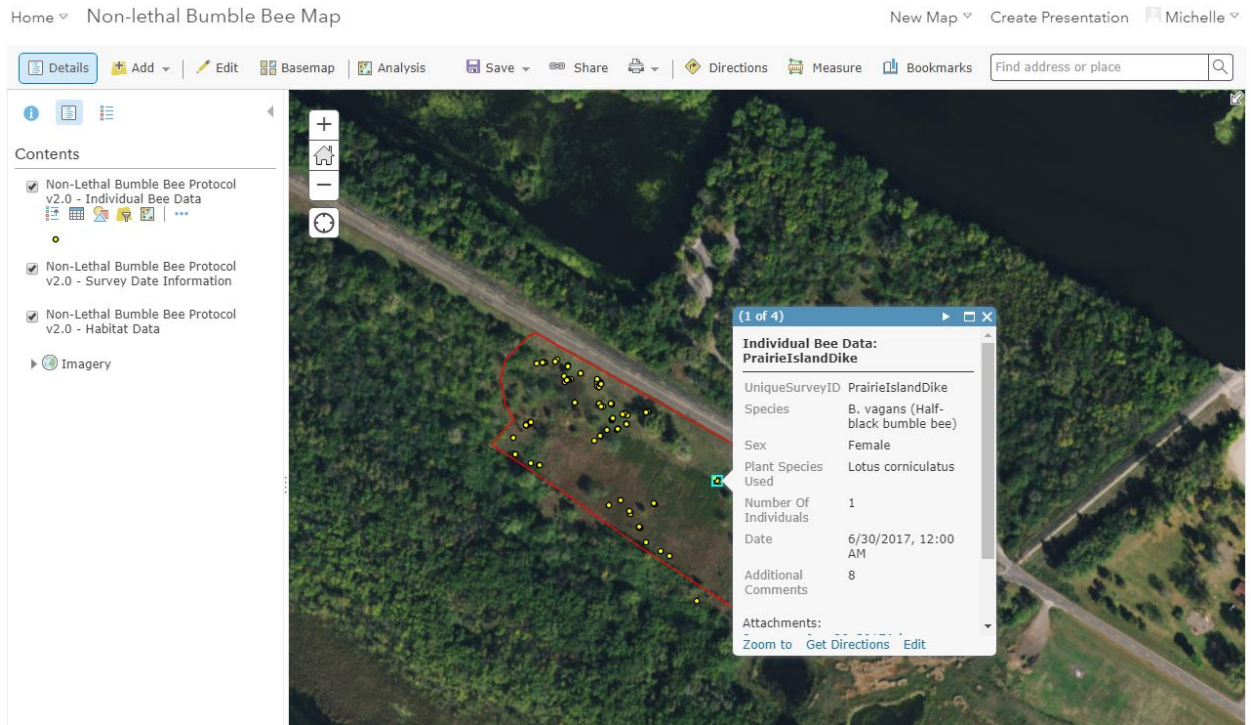
- You have to click on the point you wish to edit or delete on screen.
- To edit or delete the selected point, click on the “Options” button.



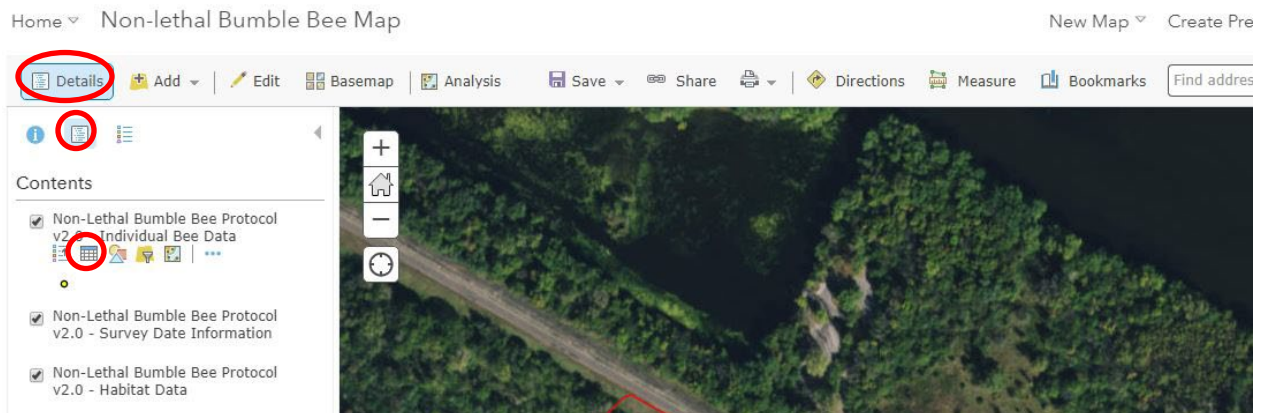
- To edit, click on the fields you want to change then hit “Submit.”

12. Editing or Deleting a Point in AGOL

- Once the data has been **sync to AGOL** (see section 5), login into AGOL (see section 2).
- Open your District's non-lethal bumble bee map in AGOL, and you should see the points you collected.
- Click on the point you wish to edit or delete.



- You can also search for the point you wish to edit or delete by opening the attribute table of which layer the point is in. Click on "Details", and make sure you are on "Show Contents of Map." Hover over the layer and click on the icon that looks like a table.



- Click on the point in the attribute table you wish to edit or delete. The selected point will have a light blue box around it.

Home ▾ Non-lethal Bumble Bee Map New Map ▾ Create Presentation Michelle ▾

Details Add ▾ Edit Basemap Analysis Save ▾ Share Directions Measure Bookmarks Find address or place

Contents

- Non-Lethal Bumble Bee Protocol v2.0 - Individual Bee Data
- Non-Lethal Bumble Bee Protocol v2.0 - Survey Date Information
- Non-Lethal Bumble Bee Protocol v2.0 - Habitat Data
- Imagery

Non-Lethal Bumble Bee Protocol v2.0 - Individual Bee Data (Features: 574, Selected: 1)

UniqueSurveyID	Species	Sex	Plant Species Used	Number Of Individuals	Date	Additional Comments
	eastern bumble bee)					
PrairieIslanddike	B. impatiens (Common eastern bumble bee)	Female	Cirsium spp.	1	8/31/2017, 11:49 AM	42b
WabashaPrairieNorth		Female	Monarda punctata	1	8/18/2017, 12:00 AM	69
WabashaPrairieNorth	B. impatiens (Common eastern bumble bee)	Female	Monarda fistulosa	1	8/18/2017, 12:00 AM	12

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- Click on the selected point on the map and click the “Edit” button at the bottom.

Home ▾ Non-lethal Bumble Bee Map New Map ▾ Create Presentation Michelle ▾

Details Add ▾ Edit Basemap Analysis Save ▾ Share Directions Measure Bookmarks Find address or place

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Non-Lethal Bumble Bee Protocol v2.0 - Individual Bee Data (Features: 574, Selected: 2)

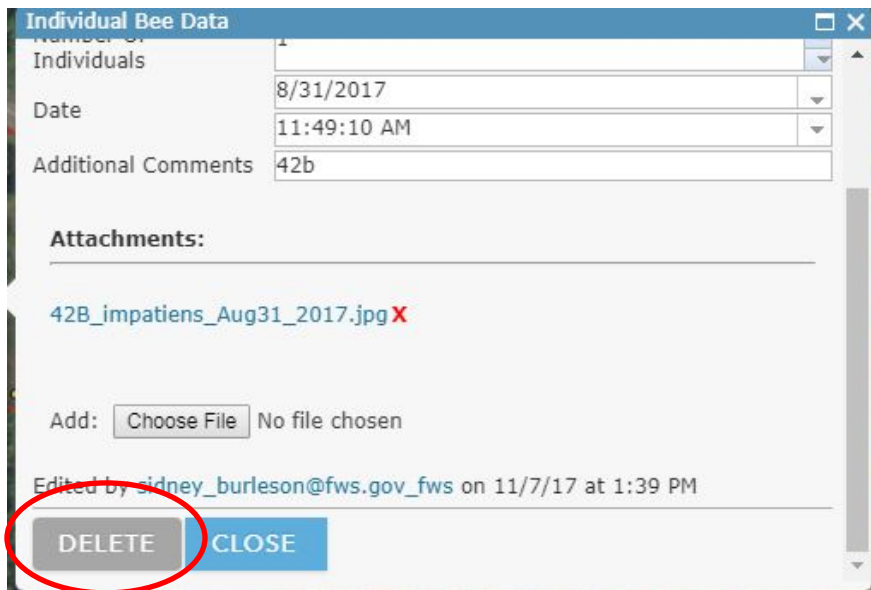
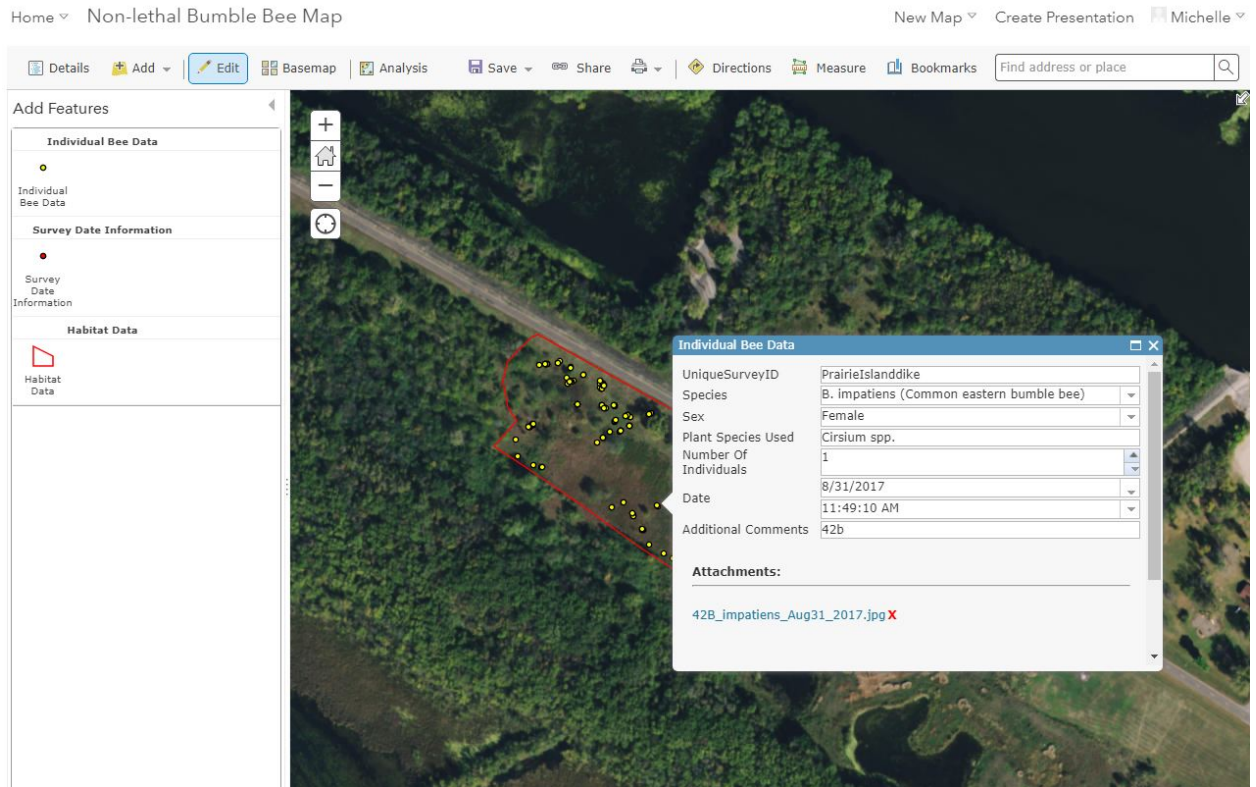
UniqueSurveyID	Species	Sex	Plant Species Used	Number Of Individuals	Date	Additional Comments
	B. impatiens (Common eastern bumble bee)	Female	Cirsium spp.	1	8/31/2017, 11:45 AM	41b
PrairieIslanddike	B. impatiens (Common eastern bumble bee)	Female	Cirsium spp.	1	8/31/2017, 11:49 AM	42b

Individual Bee Data: PrairieIslanddike

UniqueSurveyID: PrairieIslanddike
 Species: B. impatiens (Common eastern bumble bee)
 Sex: Female
 Plant Species Used: Cirsium spp.
 Number Of Individuals: 1
 Date: 8/31/2017, 11:49 AM
 Additional Comments: 42b

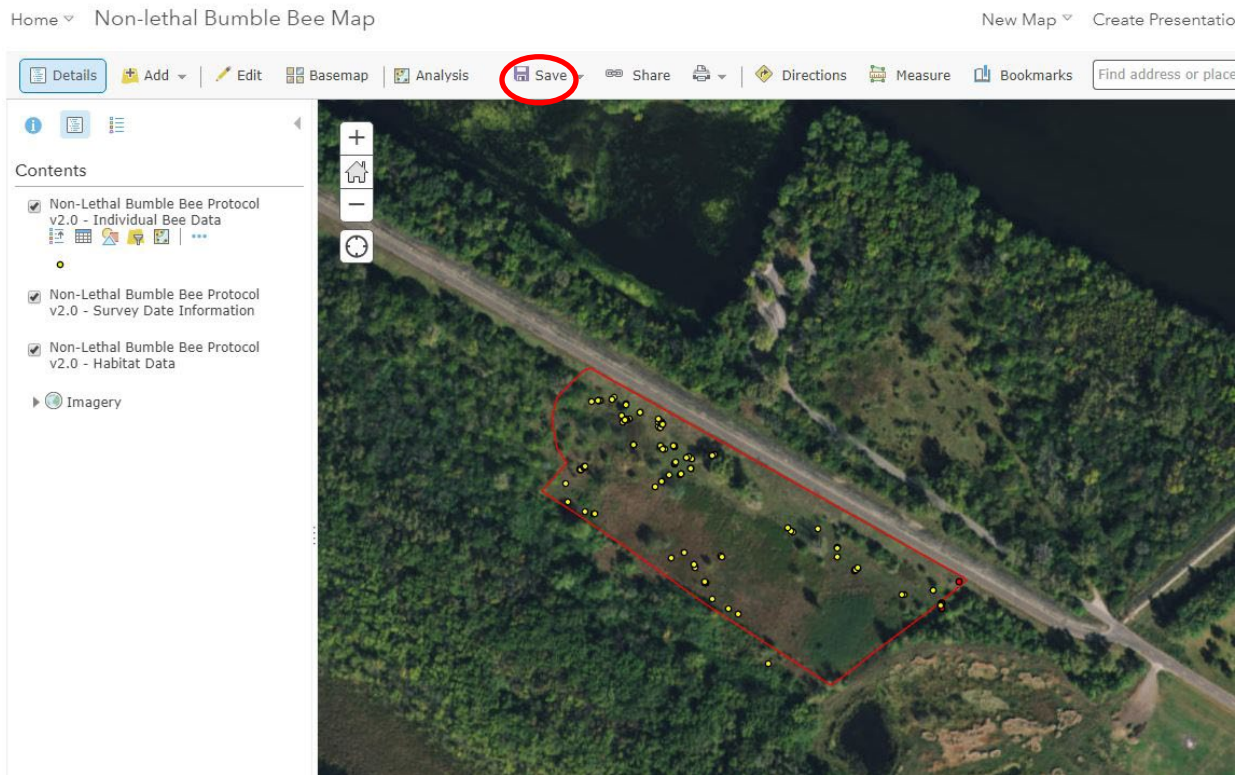
Zoom to Get Directions **Edit**

- You can edit the different fields or if you scroll to the bottom you can delete a point.



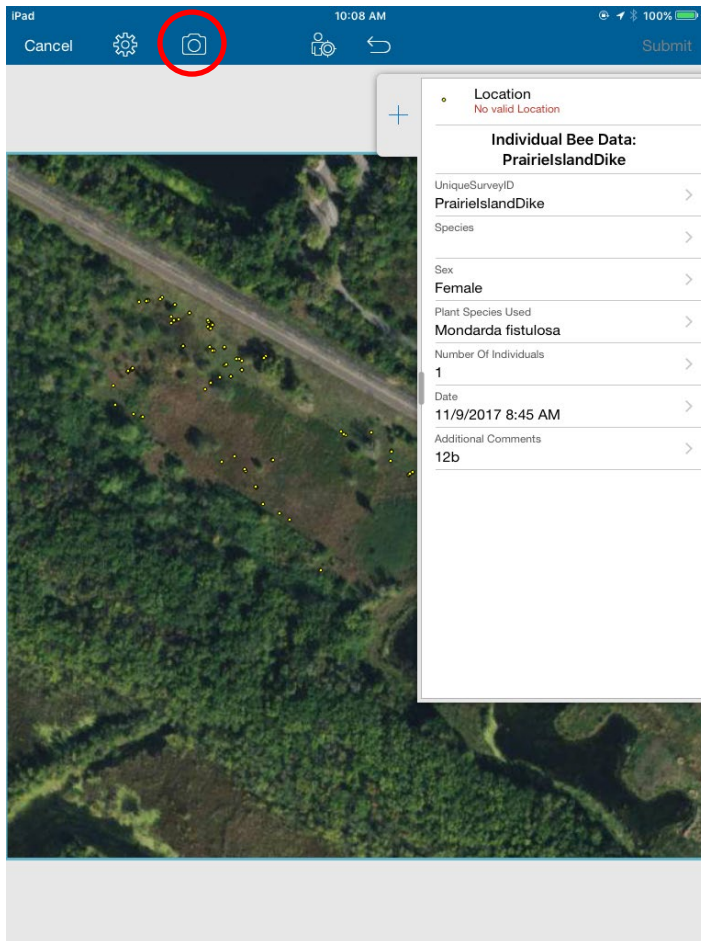
- If making editing changes, the bottom of the page will record your username and when it was edited. Click on “Close” button after you make your edits to the points.

- It is important after making any edits, to click on the “Save” button. Select “Save” not “Save as.”

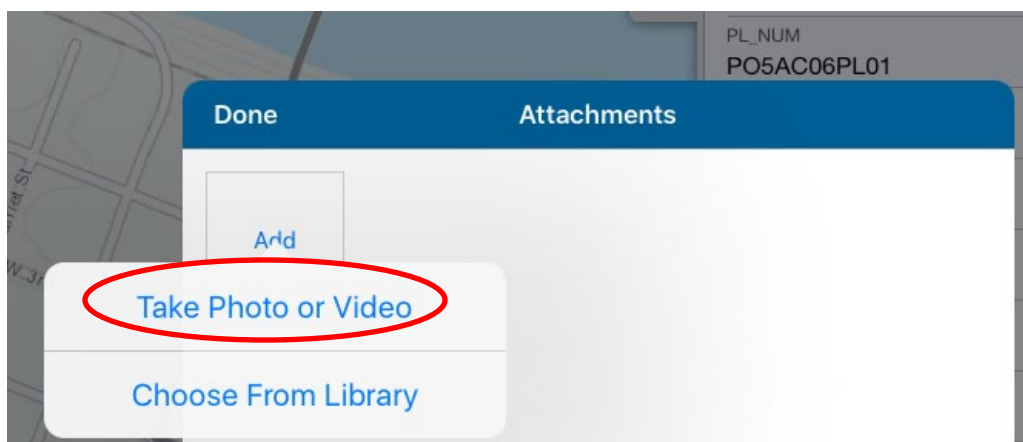


13. Taking a Photograph in Collector

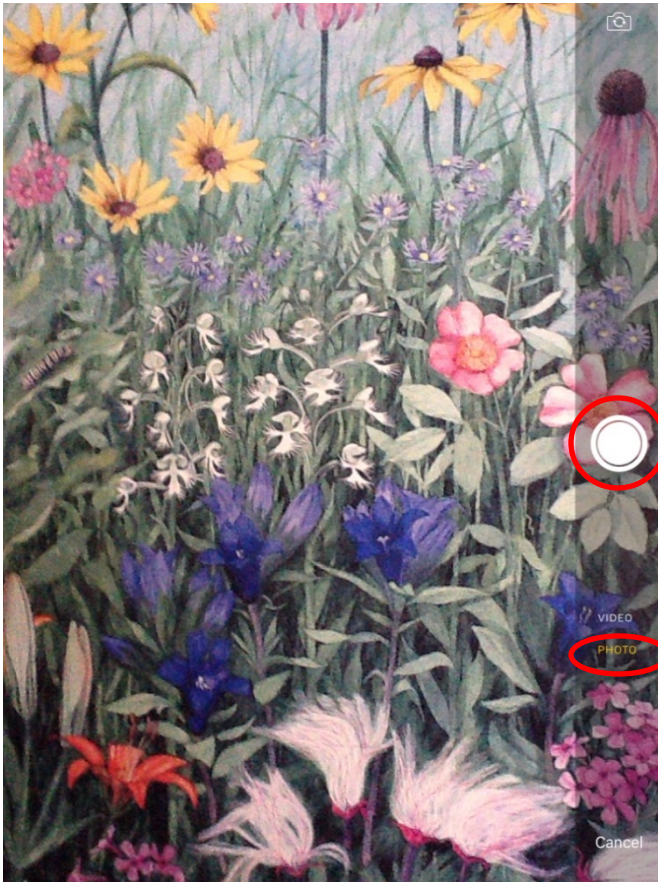
- Pictures can be taken when there is an unknown species of plant. A sample of the plant should also be collected. Site pictures can also be taken but only as advised by your District biologist. To take picture in Collector, you have to be currently recording a point or editing a point in collector. Click on the “Camera” button.



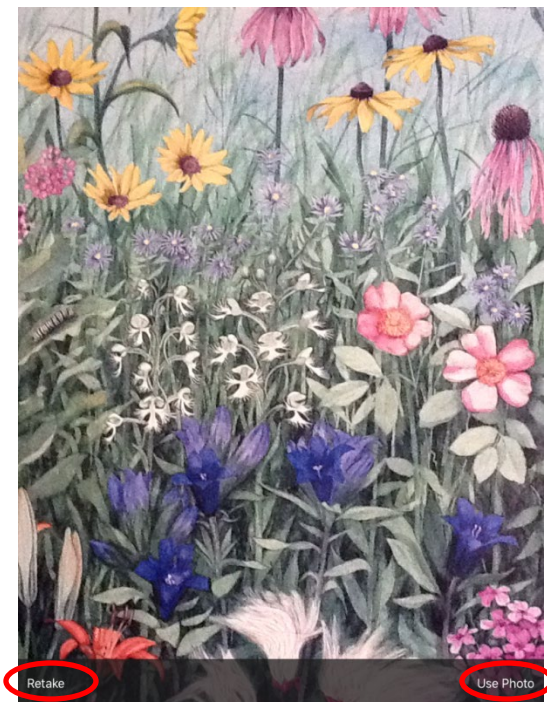
- Click on “Add” and then “Take Photo or Video.”



- To take a photograph, make sure you are on “Photo” and click the “Capture” button when ready.



- If you like the picture, click “Use Photo.” If you are not satisfied, you hit “Retake.”



Appendix A: Attribute Field Definitions

Non-Lethal Bumble Bee Protocol v2.0-Habitat Data		
Field Name	Field Description	Data Type
Unique Survey ID	Survey site identification name.	Text
Habitat Type	The type of habitat that best characterizes the survey site.	Drop down list
Total Site Area (m ²)	The total area of the survey site including areas not surveyed in m ² .	Long integer
Quality Habitat Area (m ²)	Area of the quality bumble bee habitat in the survey site in m ² . Quality habitat is areas with abundance diverse floral resources.	Long integer
Number Of Forb Species	Number of species of forbs with includes flowering shrubs and pollinator-friendly trees in bloom during the survey.	Drop down list
Percent of Vegetation Cover	Percent of vegetative cover that is forbs, flowering shrub, or pollinator-friendly trees.	Drop down list
Dominate Management on Site	Description of dominant management practices on the survey area.	Text
Stressors	Description of observed or likely stressors in survey area (such as use of pesticides, tilling, etc).	Text

Non-Lethal Bumble Bee Protocol v2.0- Survey Date Information		
Field Name	Field Description	Data Type
Unique Survey ID	Survey site identification name.	Text
Date	Date that the survey was conducted on.	Date
Temperature (F)	Current temperature in Fahrenheit for the site. Surveys should only take place when temperatures are above 60°F	Short integer
Wind speed (mph)	Wind speed at the site using a wind gauge measured in miles per hour. Wind speeds should be less than 8mph.	Short integer
Percent of Cloud Cover	Cloud cover percentage. Surveys should not occur during wet conditions (e.g. foggy, raining, or drizzling). Wait at least 1 hour after rain subsides before conducting a survey. Cloudy days or overcast are okay as long as you can still see your shadow.	Short integer
Number Of Surveyors	Number of people participating in the survey.	Drop down list
Start Time	The start time of the survey. Survey should be conducted at least 2 hours after sunrise and 3 hours before sunset.	Text
End Time	The end time of the survey	Text
Total Survey Time (min)	The total time the survey was conducted in minutes. This is the combination of minutes from all the surveyors.	Long integer

Non-Lethal Bumble Bee Protocol v2.0- Individual Bee Data		
Field Name	Field Description	Data Type
Unique Survey ID	Survey site identification name.	Text
Species	Species is a drop down list of eastern bumble bee species.	Drop down list
Sex	Sex of captured bumble bee.	Drop down list
Plant Species Used	Plant Species Used is the plant that the bumble bee was using before capture. Plant scientific name should be used. If scientific name is not known, common name can be used, and then changed later to scientific in the office.	Drop down list
Number Of Individuals	Number of Individuals refers to the number of individual bees for this record.	Range
Date	Date that the survey was conducted on.	Date
Additional Comments	Additional comments about the captured bumble bees. Number of the container can be recorded here so pictures taken can be later linked to the correct record.	Text

Appendix B: Additional Resources

Non-Lethal Bumble Bee Protocol

- Survey Protocols for the Rusty Patched Bumble Bee (*Bombus affinis*) Version 2.1
<https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/SurveyProtocolsRPBB28Feb2018.pdf>
- U.S. Fish and Wildlife Service's Rusty Patched Bumble Bee Guidance on ESA Implementation
<https://www.fws.gov/midwest/endangered/insects/rpbb/>

Bumble Bee Identification

- USDA's Guide to Bumble Bees of the Eastern United States
<https://www.fs.fed.us/wildflowers/pollinators/documents/BumbleBeeGuideEast2011.pdf>
- Xerces Society's Pocket Guide to Identifying the Rusty Patched Bumble Bee (*Bombus affinis*)
http://www.xerces.org/wp-content/uploads/2009/02/affinis_pocketid.pdf

Plant Identification

- United States Department of Agriculture's Plants Database website (find USDA plant codes)- <https://plants.usda.gov/java/>
- Minnesota Wildflowers: a field guild to the flora of Minnesota-
<https://www.minnesotawildflowers.info/>
- Wetland Plants and Plant Communities of Minnesota and Wisconsin, 3rd Edition-
http://www.bwsr.state.mn.us/wetlands/delineation/WPPC_MN_WI/
- Lady Bird Johnson Wildflower Center at the University of Texas at Austin-
<http://www.wildflower.org/plants/>

ArcGIS Collector Help

- Esri's Collector for ArcGIS homepage-
<http://doc.arcgis.com/en/collector/>
- Esri's Quick reference guide for Collector-
<http://doc.arcgis.com/en/collector/ios/collect-data/quick-reference.htm>
- Esri's Training: Offline Data Collection Using Collector for ArcGIS Seminar-
<https://www.esri.com/training/catalog/5763042b851d31e02a43ed68/offline-data-collection-using-collector-for-arcgis/>