

Herbarium Georeferencing S.O.P.

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Open Web Pages with Supplemental Maps

- You can view a variety of helpful base maps and overlays within the GEOLocate interface. We recommend opening the following supplemental maps in another browser tab or window.
- **Google Maps:** It can be helpful to use Google Maps (<https://maps.google.com/>) in a separate tab or window to search for locations, roads, or other landmarks that are mentioned in the locality record but are not clearly labeled in the GEOLocate map interface.
- **Arcgis.com Map:** Some specimens may have township, range, and section for locality information. It can be helpful to have a good map with township, range, and section grids. In a separate browser tab or window, open the following URL:
http://www.arcgis.com/home/webmap/viewer.html?url=https%3A%2F%2Fgis.blm.gov%2Farcgis%2Frest%2Fservices%2FCadastral%2FBLM_Natl_PLSS_CadNSDI%2FMapServer&source=sd
 - FOR ARKANSAS: If that link stops working for some reason, you can try to look for a new link here <http://gis.arkansas.gov/product/plss-townships-blm/> click on the “Web Map Service” button, and then choose “ARCGIS Online map viewer.”
 - To use the TRS lines in ArcGIS.com, follow these instructions:
 - In the arcgis.com map, you can select a map base layer, this time using the “Basemap” button in the upper left of the screen (Figure 1). The “USGS National Map” matches the “ESRI USGS Topo USA” map in the geolocate tool, which makes it very useful for switching between the two tabs or windows to find a location.

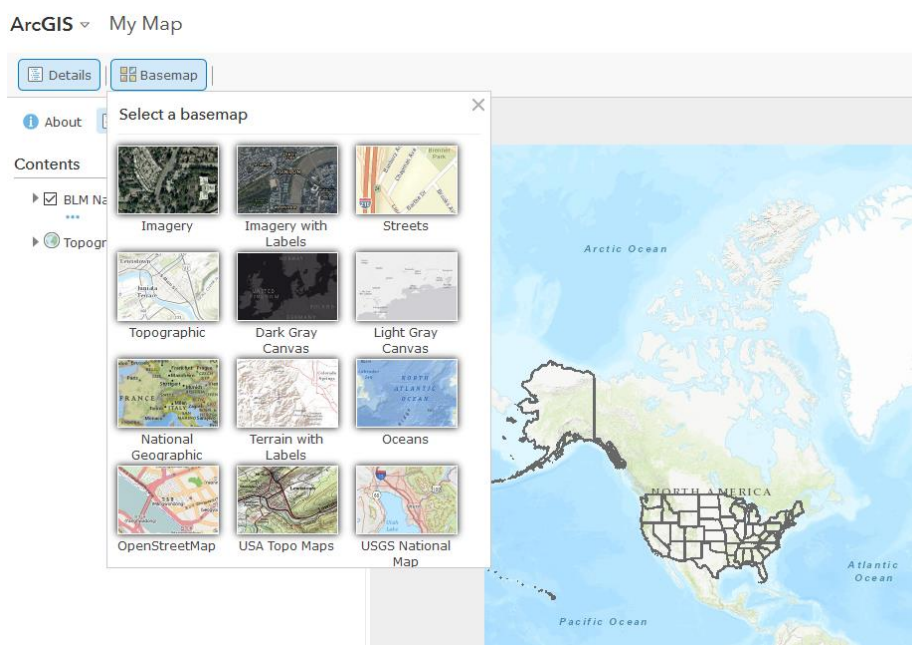


Figure 1. View on opening the map at http://www.arcgis.com/home/webmap/viewer.html?url=https%3A%2F%2Fgis.blm.gov%2Farcgis%2Frest%2Fservices%2FCadastral%2FBLM_Natl_PLSS_CadNSDI%2FMapServer&source=sd

- Use the scroll wheel to zoom in until you see both the red squares and the values of the township and range grid (Figure 2).

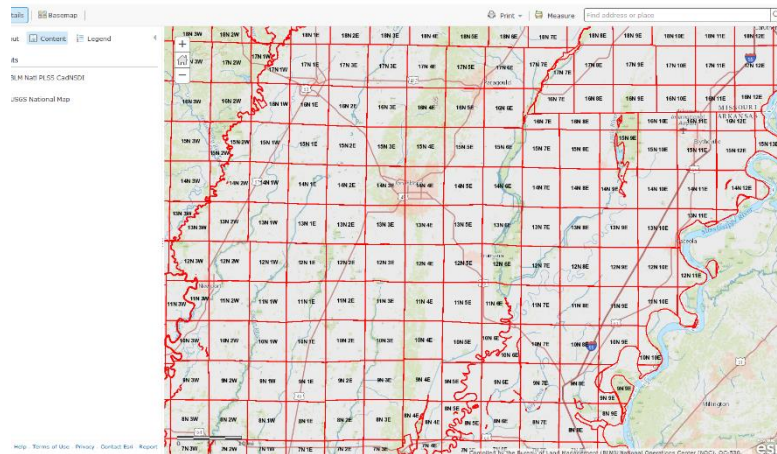


Figure 2. Zooming in until you can see the township and range numbers in Arkansas.

- Now, click and drag until you find the grid square you're interested in. Then, zoom in further so you can match up reference points (roads, rivers, towns, etc.) between maps.
 - This tool also has a fantastic search feature in the top right under "Modify Map" and "Sign In."

Login to GEOLocate and Set up Your Workbench

- Open the GEOLocate Collaborative Georeferencing Web Client at <http://www.geolocate.org/web/WebComGeoref.aspx> and log in with your GEOLocate credentials (Figure 3).
 - Remember that your username and password are both case-sensitive.
- Once you are logged in, set up your Workbench.
 - Click on the "Arkansas Vascular Flora" circle under Available Communities (Figure 3).
 - A list should appear to the right under "Data sources in selected community" (this list just shows the data linked to the project – no action required).
 - Click on the "Continue" button in the bottom right under "Data sources in selected community."

| Workbench | | Results | |
|--------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Arkansas Vascular Flora created on 4/17/2011 | | Available communities (check name to set): | |
| Username: <input type="text" value="soteropoulosd2"/> Password: <input type="password"/> <input type="button" value="Logout"/> | | <input checked="" type="radio"/> Arkansas Vascular Flora <input type="radio"/> Sandbox (test) <input type="radio"/> Eastern Arkansas Counties | |
| | | Data sources in selected community: | |
| | | Monroe County, added 5/4/2020 with 66 records. ^ STAR_BentonCo, added 5/6/2020 with 6 records. ANHC_BentonCo, added 5/6/2020 with 139 records. APCR_BentonCo, added 5/6/2020 with 97 records. v <input type="button" value="Continue"/> | |

Figure 3. View of GEOLocate login (to left) and community selection (to right) with the Arkansas Vascular Flora community selected.

The GEOlocate Collaborative Georeferencing Web Client Overview

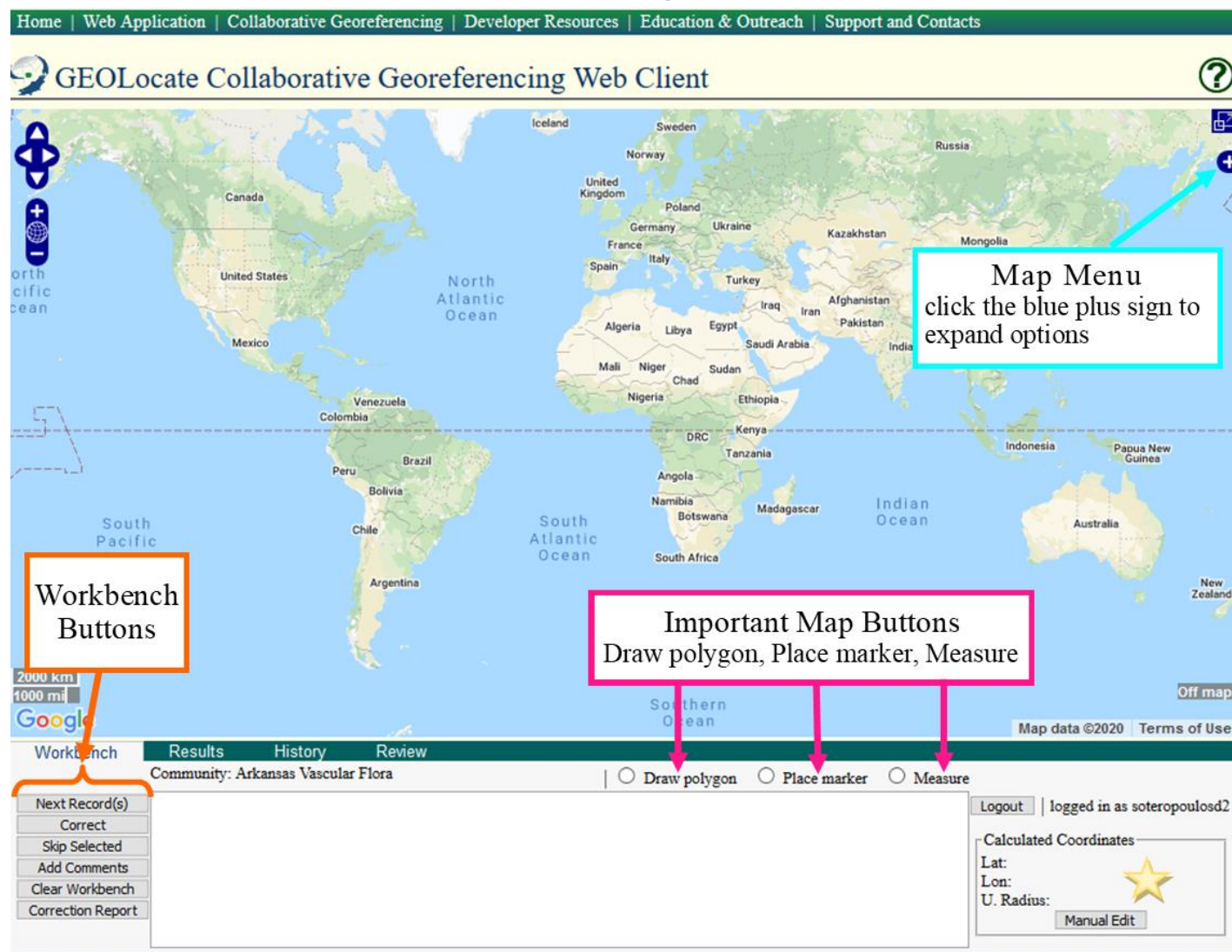


Figure 4. View of the Workbench and map interface in GEOlocate. See the “The Workbench Buttons” for descriptions of the Workbench Buttons, see the “The Map Options” for a description of the map menu, and see the “Important Map Tools” section under “Georeferencing Records” for descriptions of the Important Map Buttons.

The Workbench Buttons.

- On the left side of the interface, below the map, there is a row of buttons for interacting with the records in the georeferencing project (Figure 4).
 - Next Record(s):** click to add the next locality in the project queue into the workbench.
 - Correct:** click to submit the record after you have selected the Geolocation, uncertainty radius, and (as needed) drawn a polygon.
 - Skip Selected:** click to skip the locality (see Important Points on p 14).
 - Add Comments:** click to open a box to type a comment about the record(s) you are georeferencing (see Add Comments on p 11).
 - Clear Workbench:** click to clear all records from the workbench.
 - Correction Report:** click for a summary of the group’s progress on the georeferencing project.

The Map Options.

- The top left of the map has arrows that can be used to move the map (Figure 4).
 - Under the arrows are a “+” to zoom in and a “-” to zoom out.
- The icon in the top right corner of the map (Figure 4) allows you to pop the map out into its own window (not advised – you can’t use all the tools as easily with the map popped out).
- The “+” in the top right opens a Map Menu to select which map interface you want to see (Figure 5). Here are brief descriptions of select map options with pros/cons (suggested maps are **bolded**):
 - **Google Hybrid**: shows the Google Satellite and Google Streets simultaneously. Can load slowly and be a lot of information.
 - Google Satellite: shows satellite information only. Not particularly helpful to find named locations.
 - **Google Streets**: shows street information only. Great to find names locations after searching in Google Maps.
 - Google Terrain: shows topography and street information. Can load slowly but useful if identifying localities with a designated slope aspect (rare).
 - Bing Hybrid, Bing Roads, Bing Aerial (similar to Google Hybrid, Google Streets, and Google Satellite, respectively). I have not used Bing in searches and cannot advise on its search abilities.
 - **ESRI USGS Topo USA (faster)**: shows township, range, and section data with limited street and town information. Use for localities with TRS information in combination with the ArcGIS.com map. You can always see the section number when zoomed in enough, but it’s almost impossible to see the values of township and range grids on this map.
 - **Historical USGS Topo (beta)**: has historic TRS maps. For the area displayed on the map, available TRS maps over time are available. Select the map closest to the date identified on the specimen. The historic TRS will be overlaid on top of a base layer. Select a clean base layer (e.g., Google Streets) for easier viewing. Can be helpful for historic specimens where road names or town locations have changed.

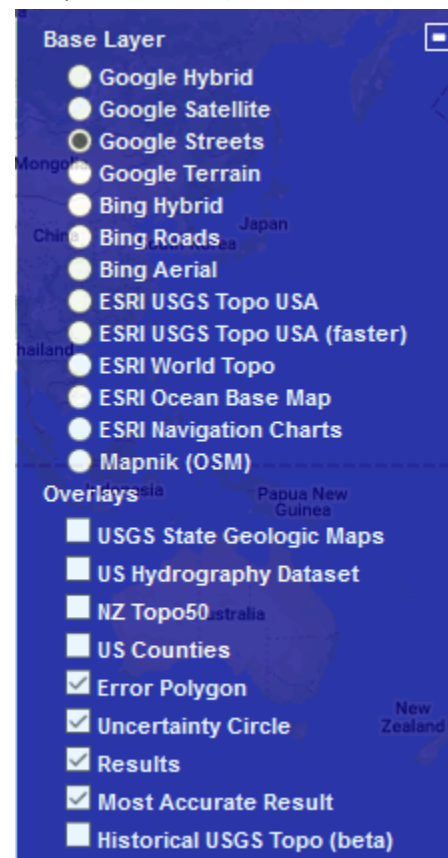


Figure 5. Map Menu.

Loading a Locality and Reviewing Locality Record Details

- Click on the “Next Record(s)” button in the Workbench.
- Read the highlighted locality string (Figure 6). The data in the locality string are presented in the following order: specific locality; country; state; county; date.

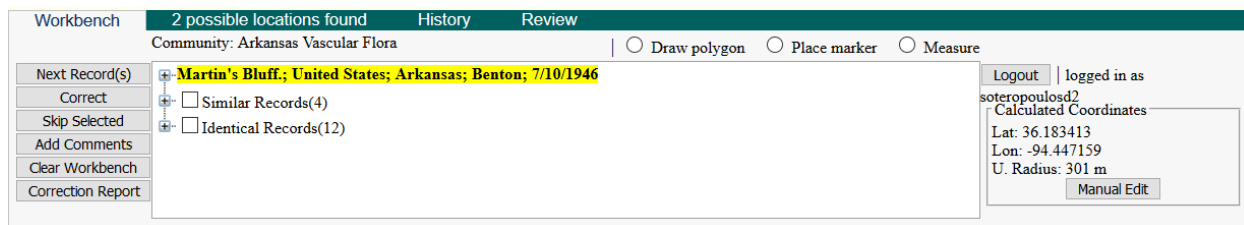


Figure 6. Workbench with a locality record loaded.

- If the highlighted locality includes coordinates (lat/long or UTM), then you should enter the coordinates into the appropriate fields.
 - Click on “Manual Edit” in the bottom right of the screen under Calculated Coordinates to see the window in Figure 7.
 - The “Latitude” and “Longitude” fields only accept decimal degrees, e.g.
 - Latitude: 36.183413
 - Longitude: -94.447159
 - The field expects positive and negative values, not N/S or E/W. The above example is how you would enter 36.183413 N 94.447159 W
 - If the available coordinates are in UTM (e.g., 706446.28 Easting, 3966426.51 Northing, Zone 15S) or in degrees, minutes, and seconds, (e.g., 34° 13’ 25” N 91° 2’ 44” W), click “Skip Selected” in the Workbench, leave a comment about the coordinate format from the locality description, and email me (diana.soteropoulos@arkansas.gov). I’ll update the record in SERNEC (should be rare).
- Clicking on the “+” to the left of the highlighted locality shows the specimen record(s) with a link to the SERNEC record if you want to see the specimen image.
- Localities can be georeferenced individually, but you should check if any other records contain the same locality information (see Select Locality Records to Georeference as a Batch).

Figure 7. Manually entered coordinates, typed into the box that opens after clicking “Manual Edit.”

Select Locality Records to Georeference as a Batch

Similar Records

- Similar Records are from the same state and county, and they share location words/phrases (e.g. the city name “Maysville” or township, range, and section) with the highlighted locality.
 - Compare the locality description in each Similar Record to the highlighted locality (Figure 8).
 - Check the box beside each Similar Record that provides the same information as the highlighted locality. Note, the locality description may be in a different order but provides the same details. Rows with the box checked will be georeferenced as a batch (Figure 8).
 - Do not check the box beside any Similar Record that provides more, less, or different information from the highlighted locality (Figure 8).
 - Tip: when there are many similar records, begin by comparing records with the same collection date as the active record. You may need to use the horizontal scroll bar to see the date at the end of the record.
 - Example: The first three Similar Record differ from the highlighted locality in the collection date; these three records should be selected to be georeferenced as a group. The fourth record includes additional information, “E. Martin’s Bluff” and should be georeferenced separately.

Figure 8. Similar Records viewed in list form. The list was expanded by clicking the plus sign (now a minus sign to toggle the list closed again) beside the heading “Similar Records (4).”

Identical Records

- Identical Records share the locality description of the highlighted locality verbatim. Check the box for all Identical Records (without expanding the list so all records are checked together) so they will be georeferenced with the active record (Figure 6).
- Tip: Click the plus sign beside a record to expand a list with the barcode number and scientific name of the source specimen(s) for the record (see the active record in Figure 6).
 - Clicking a barcode number will open the relevant specimen in SERNEC.
 - Viewing specimens in SERNEC is completely optional but can be helpful in verifying information from the specimen label. Sometimes the actual label data is not correctly transcribed, and sometimes habitat information can be helpful to find the location.

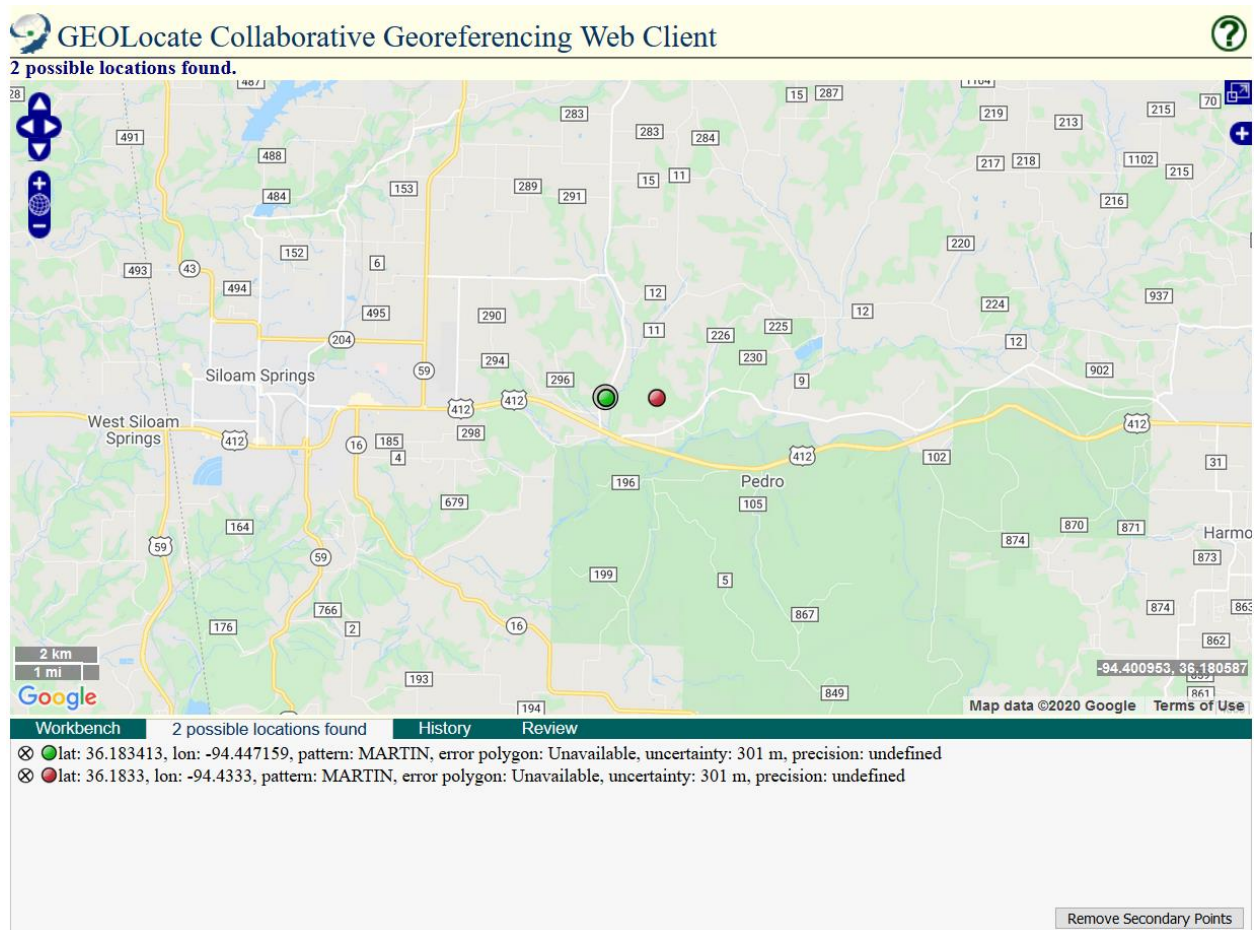


Figure 9. Checking the suggested locations under “# possible locations found.”

Georeferencing Records

Possible Locations

- Click “# possible location(s) found” below the map and right of “Workbench” (Figure 9).
 - 1 to several suggested points should be displayed as green and red dots, which are also visible on the map.
 - The algorithm’s best guess is automatically selected and is green.

- The algorithm's other guesses are red.
- Clicking on a red point will select it and change it to green. If you drag the green point to improve the location, a red dot will remain as a marker of the suggested point.
- Beside each dot listed under "possible location found," you can see the "parse pattern," which is the text in the locality field that was used to select each point.
- If you have already georeferenced records in that area, GEOLocate may also show an orange dot with a white star in the middle for the locations of other records.
- The GEOLocate map may display an orange polygon outlining the border of a town or county.

Finding Your Point

- When a highlighted locality contains both a description (i.e., driving directions) and PLSS data (township, range, and section) are given, make sure that these agree with each other.
- If the PLSS data helps you get to the location and the other details match up, that is a good indication that both are probably correct.
- If not, you may have to use your judgement. It is more likely for there to be a single typo causing problems in the township, range, and section, but highway numbers can also commonly be mis-entered and can change over time.
 - Try to find the location via the description, and then see if the township is North instead of South, for instance. If you can identify a simple error that would make the two match, use the error-free portion of the locality information to place the point.
 - To view historic maps in GEOLocate, click the blue plus sign to open the map options. Under "Overlays," select "Historical USGS Topo (beta)." A white box with text saying, "Click anywhere on the map to get started," will pop up.
 - Click anywhere on the map, and the white box will fill with map options from various years.
 - Click on the map you would like to view.
 - Because the historic maps are overlays, you will be able to see the Base Layer you have selected through your historic map.
 - Reduce visual clutter by selecting a more compatible base map (Google Streets may be a good option) or by increasing the historic map's opacity using the scroll bar on the historic maps menu box by clicking and dragging the green circle to the right.
 - When you "Add Comments," list the name and year of any historic map(s) that played a key role in your decision-making while georeferencing.
- You can click-and-drag the markers to move them. Clicking on (with or without dragging) a red marker will select it, turning it green.

Editing Uncertainty

- Once you have found the described location, you will need to edit the uncertainty.
 - Click on the point you want to edit. The option to "edit uncertainty" should be a clickable link. This will provide you with a stylized arrow along the upper right edge of your uncertainty circle. You can click on and drag this arrow to make the circle larger or smaller.
 - If you chose a point selected by the algorithm, it may already have an uncertainty circle that could be too large to see at your current zoom level. After clicking the "edit uncertainty" link, zoom out until you can see the full circle and the arrow to resize it.
 - **It is better to err on the side of having a larger uncertainty to ensure the true location is encompassed.**

Important Map Tools

Place Marker

- You can also place your own marker by clicking on the “Place marker” circle button (below the map) and then clicking on the map.

Measure

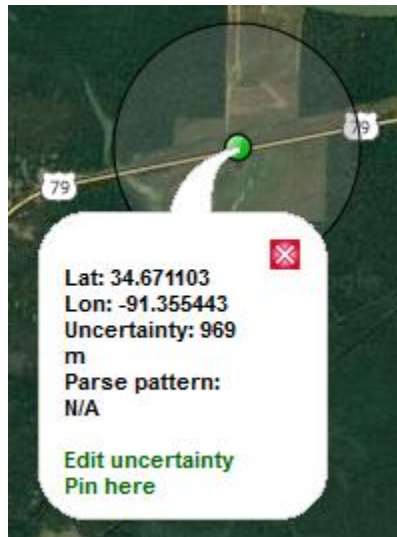
- You can use the “measure” tool to measure distances on the map. If, for example, the locality is “2 miles north of Reyno, AR”, find Reyno, AR on the map, then click the “measure” circle button below the map. Now, clicking on the map (not click-and-drag – that pans the map) will start measuring line segments. While the measure tool is active, you can still zoom in and out with the scroll wheel or the + / - buttons in the map.

Draw Polygon

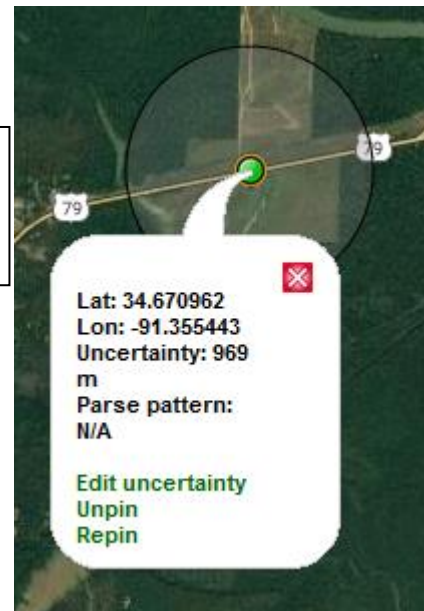
- In addition to the uncertainty circle, you may need to draw a polygon. There will always be an uncertainty circle, you may not always need a polygon.
 - If the parsing algorithm places a polygon on the map and you determine that the actual location is outside the polygon, you should click the “clear polygon” button to remove it.
 - Text indicating the need for a polygon include “along highway xx” or “bank of Y Creek” or when the only location information is at the level of county or city limits.
 - Click the “Draw polygon” circle button under the map to start drawing. A single click on the map will place a vertex of the polygon, and a double-click will place the last vertex and complete the shape. If, for instance, you want to draw a rectangle, you will create 4 vertices. Note that while drawing the polygon you can still click-and-drag to pan the map, and you can still zoom either with the scroll wheel or by clicking on the + and – buttons in the upper left of the map.
 - When drawing a polygon, make sure to include every area on the map that the locality information is describing. If, for example, it says “along road” with no indication of which side, make sure your polygon includes both sides of the road.
 - Finish the polygon by double-clicking in the location at which you want to place the final vertex. If you make a mistake and create a vertex in the wrong place, you’ll have to start over by first finishing the polygon by double-clicking, then click the “Clear polygon” button, and then click the “Draw polygon” radio button to start again.
 - After you have drawn the polygon, you still want to include an uncertainty radius, but the tool can help you size it to the maximum distance from the dot that is still inside your polygon. Click on the dot showing your estimate of the collection location and choose “Resize uncertainty to polygon”. If your polygon is long and skinny, this will give you a relatively large circle, but the radius is still the accurate representation about how far the point could be from where the collection was actually made.
 - Every georeferenced point should have an uncertainty radius. Once you have placed your point (and have not added a polygon), click on it and choose “edit uncertainty.” An arrow will appear in the upper right of the shaded circle that shows the uncertainty radius. You may have to zoom out to see it. Click and drag that arrow to resize the uncertainty. You might size this to include a section or two or to include a second, less-likely, putative location.

Marker "Pinning"

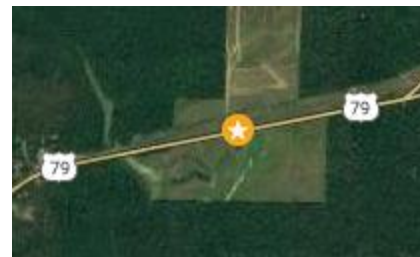
- When placing or dragging a marker (from an existing GEOLocate generated marker), an option to "pin" the marker is available. This function allows you to set multiple markers while researching locations. Depending upon computer memory available, approximately 12 markers may be pinned during a browser session. These markers will be available across multiple browser "sessions" on the same computer. Once placed, and you drag the green dot away from them, the pinned location appears as a starred marker.



Once pinned, you can see a yellow outline around the green (selected) marker.



Then, if you drag the green marker to another location, or select/set another marker, the pinned one remains as a yellow circle with star.

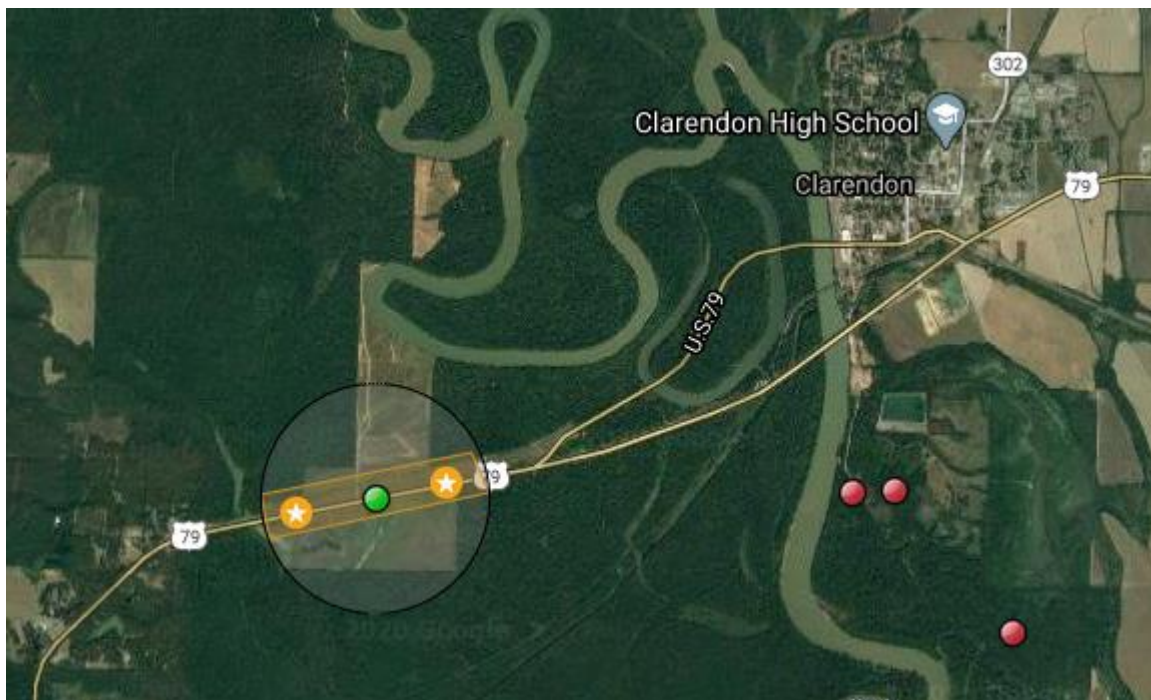


You can also "unpin" a previously pinned marker. Once you do so and then drag the green marker to another location, or select/set another marker, the pinned one remains as a red circle. But it only remains while working the current record.



- An example of how you might use pinned markers:

A locality states “3.0 miles southwest of Clarendon on Hwy 79.” In this case, the starting point is undetermined. It can be from the center of town, or maybe from the municipal boundary on the southwest edge of town. In order to provide a reasonable Uncertainty Radius (U. Radius), you could measure from the center of town and pin a marker at that distance. Then measure from the southwest municipal boundary and pin another marker. Now draw a polygon to encompass both markers and Hwy 79. Lastly, place a marker at the midpoint between the “pinned” markers and resize the U. Radius to the polygon.



- Remember: Regardless of how a marker was placed, the only one to be recorded when you submit a correction is the **green marker**. In this case, only the green marker between the “pinned” markers and the polygon will be recorded. When you move to another record during your browser session, the pinned markers will remain unless you “unpin” them.

Add Comments

- Click the “Add Comments” button on the left and leave a note about your thought process.
 - Your comment may be as simple as “Agreed with TRS,” or you may need to briefly explain how you decided to resolve conflicting information in the locality description.
 - Details about the map you used, especially if an Historical USGS Topo was referenced, should be added.
 - When you are finished typing your comment, click “Continue.” This will save your comment with the record(s) you are working on.

Submitting! (Select “Correct”)

- Click the “Correct” button on the left to save your work and submit the record as correctly georeferenced.
 - Be careful not to click this button on accident, especially if you are working on multiple records. If you need to go back and correct an error for a group, see page 13 “Editing a group of similar records.”
- The record(s) that had coordinates updated will be removed from the list of specimens to georeference.

Next Record(s)

- You are now ready to georeference the next record(s)!
- If you had unchecked boxes in “Similar Records,” the next record from the list will become the highlighted locality.
 - This feature is great to work with a lot of records around the same area.
- If you entered all the records from the page, click “Next Record(s)” to bring the next record in the locality queue into the Workbench.

Revisiting Your Work

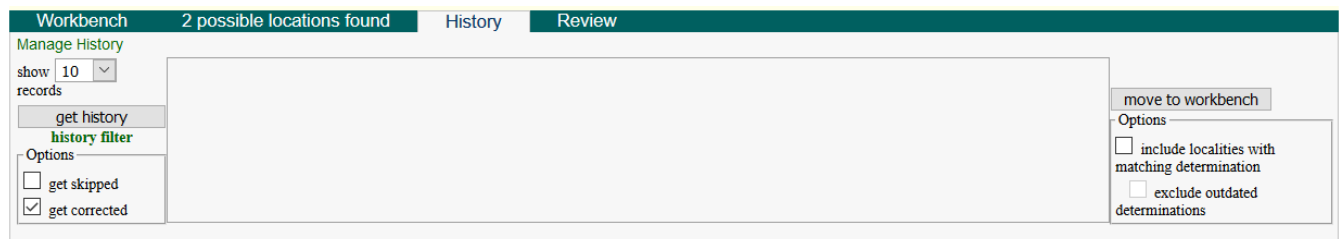


Figure 10. Revisiting previous work under “History.”

Editing a single record

- If you ever need to edit a record you georeferenced previously, click “History” below the map (Figure 10).
 - Select the number of previously submitted records you would like to search from the dropdown in “Show ## Records.” You can also refine your search parameters using the checkboxes under “Options” on the bottom left and bottom right sides of the interface.
 - “Get skipped” will allow you to revisit localities you skipped.
 - “Get corrected” will allow you to revisit localities you georeferenced. This function is great if you come across a similar location name and want to see your previous work.
 - “Include localities with matching determination” shows corrections that share the same GPS point and uncertainty, i.e., single georeferenced points will not appear in this search.
 - “Exclude outdated determinations” will show only the most recently assigned georeferencing data.
 - Click the “get history” button.

- Each record found will appear in a list. The date and time when the record was submitted as correct will appear at the beginning of each record.
- Select a record by clicking on it. The selected record will be highlighted yellow.
 - You can view the comment you added to the record by clicking the “view comment” button to the right.
- Add the record back to your workbench by clicking the “move to workbench” button to the right. A notification should pop up telling you that the record has been moved. Close the notification and navigate to your workbench by clicking “workbench.” You should see the record you want to edit.
- Make the edits you would like to make.
- Click “Add Comments” and leave a note explaining the edits you made.
- Click “Correct” to save your changes
 - OR, if you decide not to edit the record, click “Clear Workbench.” This will remove the record from your workbench without changing the record from how you submitted it previously.
- The edited record will be saved again in your history with a new timestamp. The row showing when the record was previously submitted as correct will still show up, but the text will be blue to indicate that the record has been edited since then.

Editing a group of similar records

- If you ever need to edit a group of similar records you georeferenced previously as a group, click “History” below the map (Figure 10).
 - Select the number of previously submitted records you would like to search from the dropdown in “Show ## Records.” You can also refine your search parameters using the checkboxes under “Options” on the bottom left and bottom right sides of the interface.
 - Click the “get history” button.
 - Each record found will appear in a list. The date and time when the record was submitted as correct will appear at the beginning of each record.
 - Select a record from the group of similar records you wish to edit by clicking on it. The selected record will be highlighted yellow.
 - You can view the comment you added to the record by clicking the “view comment” button to the right.
 - In the “Options” area, select the check box next to the text reading “Include localities with matching determination.” This selects corrections that share the same GPS point and uncertainty. This will include your group.
 - Add the records back to your workbench by clicking the “move to workbench.” A notification should pop up telling you that the records have been moved. Close the notification and navigate to your workbench by clicking “workbench.” You should see the records you want to edit.
 - Select the desired records and make the edits.
 - Click “Add Comments” and update or leave an existing note explaining the corrections and edits you made.
 - Click “Correct” to save your changes
 - OR, if you decide not to edit the record, click “Clear Workbench.” This will remove the record from your workbench without changing the record from how you submitted it previously.

- The edited records will be saved again in your history with a new timestamp. The row showing when the record was previously submitted as correct will still show up, but the text will be blue to indicate that the record has been edited since then.

Important Points

- **It is ok to skip a record.** If you aren't confident in the locality description, hit "Skip Selected" and leave a note about what made the locality difficult. Details about the maps used are helpful to retrace your steps.
- **The GEOLocate Collaborative Georeferencing Web Client browser will time out!** The time-out has been increased to two hours. If you have not submitted a correction within the time limit, you will need to refresh the screen and log back in. When you log back in and select "Next Record," you should be taken back to the record on which you were previously working.

Some Helpful Techniques

- **Save your comments to a word document.** If you save your comments to a word document it is easy to go back to them when you are presented with a "Next Record" that is similar. This is also useful if you "time out" or the comment data does not save correctly.
- **Use the history function to reduce workload.** If you select "Next Record" and are presented with a locality that is like one that you previously corrected, you can use your earlier work to save some time. Here are the steps:
 - Copy key locality data from the current record and search for it in History.
 - Select the historical record with like or similar locality.
 - View and copy your previous comments if they appear useful.
 - Switch back to the Workbench (but don't move the historical record to the workbench).

Note: When you switch back the Workbench, the marker of the historical record is presented in your current map.

- Find the marker from the historical file on your current map.
- If the marker position is correct, click on it to turn it green.

Note: If you drew a polygon in the historical record map, clicking on the marker will cause it to appear on the current record map.

- Paste your previous comments (with any necessary modifications) into the current record "Add Comments" window.

Quick Reference Guide

Links to Web Pages [Google Maps](#) | [Arcgis.com Map](#) | [GEOLocate CoGe Web Client](#)

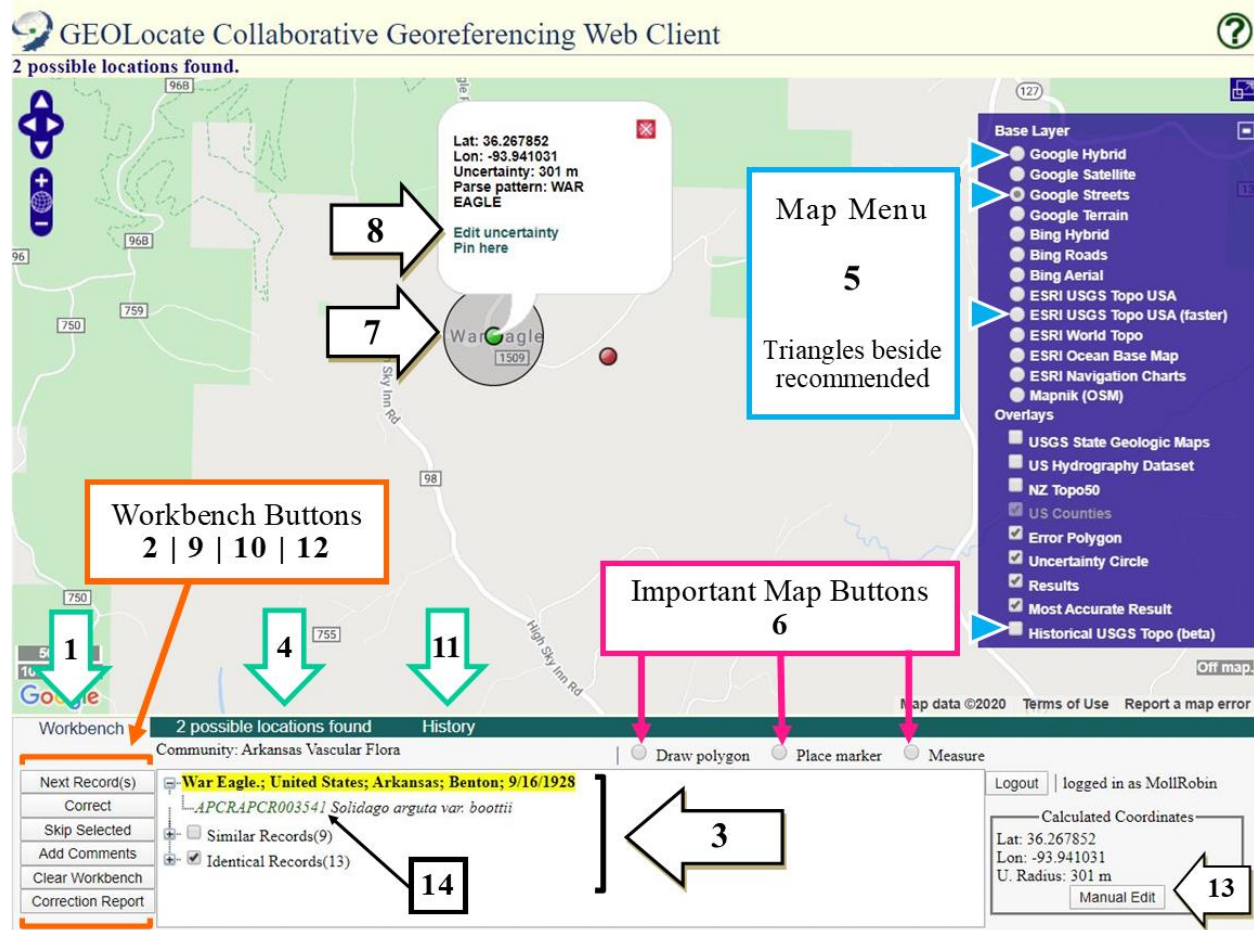


Figure 11. Companion image for Quick Reference Guide for Georeferencing with CoGe.

Georeferencing Steps (see Figure 11)

1. Log in & select the "Arkansas Vascular Flora" community to open your **Workbench**.
2. Click "**Next Record(s)**."
3. Read the **Highlighted Locality** & check the boxes to select records to georeference as a batch.
 - **Similar Records(#)**: select records that provide the same information as the highlighted locality.
 - **Identical Records(#)**: select all.
4. Click "**# possible location(s) found**" and consider the suggested points.
5. **Map Menu**: view map layers/overlays to find the described locality.
6. **Important Map Buttons**
 - **Draw polygon**: click the map to begin drawing; double-click to finish the shape; always select a point marker inside the polygon and "Resize uncertainty to polygon."
 - **Place marker**: click the map to place a point marker; click-and-drag to move it.
 - **Measure**: click the map 2 or more times to measure the line segments created.
7. Click to **select a point marker** for the locality. The selected point is green.
8. Click "**edit uncertainty**" and use the arrow to adjust the uncertainty radius around the point.
9. Click "**Add Comments**" and note your thought process, historical maps used, errors found, etc.
10. Click "**Correct**" to submit the record.

As Needed

11. Click “**History**” to revisit your work (details in main text of S.O.P.).
12. Other Workbench Buttons
 - **Skip Selected**: click to skip the record; add a note about what made the locality difficult.
 - **Clear Workbench**: click to remove all records from the workbench.
 - **Correction Report**: click to see a summary of the community’s progress on the project.
13. If a locality contains lat/long coordinates in decimal degrees, click “**Manual Edit**” to enter them.
14. **View Specimen Images** in SERNEC by clicking the specimen barcode number.