Webinar Series

Data Use Skills
Featuring Data from Natural History Collections

September 21 - November 30, 2022

https://www.idigbio.org/content/biotaphy-2022-webinar-series
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iDigBio.org
Thank You

Maria Cortez
Aimee Stewart

Jill Goodwin
Gil Nelson
Webinar 4

Georeferencing with GEOLocate
How to use locality information in specimen records to obtain georeferences (i.e., latitude and longitude)
Learning Objectives

Biological Objectives:
✓ Introduction to basic geospatial concepts and their relevance in biodiversity analyses
✓ Introduction to georeferencing and its importance for biodiversity analyses
Technical Objectives:

✓ Introduce GEOLocate as a tool to recover geographic coordinates based on locality information.
✓ Demonstrate and practice how to use GEOLocate
✓ Practice how to manually add modified georeferences to the spreadsheet containing geographic coordinates.
1. Exploring Concepts: understanding spatial concepts and GEOLocate
2. Demonstration: how to use GEOLocate
3. Exercises: using GEOLocate to recover geographic coordinates and merging the information recovered to your dataset!
4. Session Summary, Q&A and Discussion
Biological Objectives:
✓ Introduction to basic geospatial concepts and their relevance in biodiversity analyses
Learning Objectives

Biological Objectives:

✓ Introduction to basic geospatial concepts and their relevance in biodiversity analyses

✓ Introduction to georeferencing and its importance for biodiversity analyses
What is a georeference?
What is a georeference?

Species: *Polypodium californicum*
State: CA
County: Marin
Locality: Marin Municipal Water District Lands: Mount Tamalpais. Middle Peak Rd. culvert RT-3
What is a georeference?

A numerical description of a place that can be mapped.
What is a georeference?

A numerical description of a place that can be mapped

37.93, -122.59
What is a georeference? process of turning a textual description into a numerical description

Species: *Polypodium californicum*
State: CA
County: Marin
Locality: Marin Municipal Water District Lands: Mount Tamalpais. Middle Peak Rd. culvert RT-3

37.93, -122.59
Why georeference?

• Add more occurrences to a data set

• Correct geographic and specimen identification data = dependable occurrence record

• Provide uncertainty data, which allow points to be evaluated with regard to fitness for research applications and the resulting quality of output
Sources of uncertainty

- Coordinate uncertainty
- Map scale
- GPS accuracy
- Unknown datum
- Imprecision in direction measurements
- Imprecision in distance measurements
- Extent of locality

<table>
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<th>Uncertainty (m)</th>
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20° 30’ N 112° 36’ W
Sources of uncertainty

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- Map scale
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<td>0.01 seconds</td>
<td>1 m</td>
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Exploring Concepts

Sources of uncertainty

- Coordinate uncertainty
- Map scale
- GPS accuracy
- Unknown/incorrect datum
- Imprecision in direction measurements
- Imprecision in distance measurements
- Extent of locality

USGS Standard Map Accuracy
Sources of uncertainty

- Coordinate uncertainty
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- Extent of locality
Sources of uncertainty

- Coordinate uncertainty
- Map scale
- GPS accuracy
- **Unknown/incorrect datum**
- Imprecision in direction measurements
- Imprecision in distance measurements
- Extent of locality
Datum

What is a datum?
A geodetic datum is an abstract coordinate system with a reference surface (such as sea level) that serves to provide known locations to begin surveys and create maps. In this way, datums act similar to starting points when you give someone directions.

Geodetic datum
A model of the Earth used for geodetic calculations (related to Earth’s figure, orientation, and gravity). A geodetic datum describes the size, shape, origin, and orientation of a coordinate system for mapping the surface of the Earth.

https://oceanservice.noaa.gov/facts/datum.html#:~:text=A%20geodetic%20datum%20is%20an,when%20you%20give%20someone%20directions.
Sources of uncertainty

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Error assuming NAD27 vs NAD83 or WGS84
Exploring Concepts

Sources of uncertainty

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N > NE > ENE
Exploring Concepts

Sources of uncertainty

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Exploring Concepts

Sources of uncertainty

• Coordinate uncertainty
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• Imprecision in distance measurements
• Extent of locality
Sources of uncertainty: Extent of locality

“Davis, Yolo County, CA”

Point Method
38.5463, -121.7425
Sources of uncertainty: **Extent of locality**

“Davis, Yolo County, CA”

**Bounding-Box Method**

38.5486, -121.7542
38.545, -121.7394
Sources of uncertainty: **Extent of locality**

“Davis, Yolo County, CA”

Point-Radius Method

38.5468, -121.7469

Uncertainty radius: 8325 m
What is the ideal georeference?
What is the ideal georeference?

A numerical description of a place that can be mapped
What is the ideal georeference?

A numerical description of a place that can be mapped and that describes the spatial extent of a locality and its associated uncertainties.
How to do it?

Paper Maps

• Time-consuming
• Good quality paper maps may be hard to find
Exploring Concepts

How to do it?

Google Maps

• Search and directions
  • Free text search
  • Directions for traveling by car, bike, public transportation, or foot
  • Data compiled from different sources
• Maps
  • Views: map, satellite, terrain, Google Street View
  • Sources of maps indicated at bottom
Exploring Concepts

How to do it? GEOLocate

- Software services for georeferencing of natural history collection data
- Automated georeferencing
- Verification and correction
- Multi-lingual
- Interoperability
- Training
- Uncertainty determination
- Batch processing
- Collaborative georeferencing
- Geographic visualization
- Kml export

GEOLocate
https://www.geo-locate.org/
Exploring Concepts

How to do it?

Falling Rain

- Worldwide gazetteer for cities and towns
- Great for hard-to-find localities, especially outside US
- No search
- Provides hierarchy, alternative names, topo maps, altitude, weather information, and location of nearby towns
- Example: Qaryeh-ye Gol’alam, Velayat-e Lowgar, AF

www.fallingrain.com
How to do it?

**Getty Thesaurus of Geographic Names**

- Worldwide gazetteer by The Getty
- Useful for alternative and old names
  - Feature types
  - Geographical hierarchy
  - Degrees-minutes, not coordinates
- Use recent name and search in Google Maps
- Example: New Amsterdam, US

How to do it? GEOLocate

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GEOLocate
https://www.geo-locate.org/
Access GEOLocate web interface and learn how to navigate it
Demonstration: How to use GEOLocate

GEOLocate Workflow

1. Data Entry & Preparation
   - pushepatapa creek, trib. to pearl river, 7.8 miles north of bogalusa at hwy 21; Washington; LA; USA

2. Automated Processing
   - Georeferencing Algorithm
     - Visualize, verify & adjust output coordinates & uncertainties

3. Manual Verification
   - latitude: 30.88797
   - longitude: -89.83601
   - uncertainty radius: 48m
   - uncertainty polygon: 30.88823,-89.83641, 30.88815,-89.83634, 30.88808,-89.83622…
Demonstration: How to use GEOLocate

GEOLocate Workflow

A Platform for Georeferencing Natural History Collections Data

For Users:
- Overview
- GEOLocate Web Clients
- Collaborative Georeferencing
- Education & Outreach

For Developers:
- Web Services
- Embeddable Web Client

Web Applications
Georeference collections data using your web browser. Quick and easy georeferencing.

Web Services
Integrate georeferencing into your own databases and applications using GEOLocate web services.

Collaborative Georeferencing
Build communities, share data, relate records across collections and improve verification efficiency.
Demonstration: How to use GEO Locate

GEO Locate Workflow

The following web clients are available to allow you to georeference data directly from your web browser:

- **Standard Client**: Simply type in your locality description and get back georeferenced results. Start here if you are new to GEO Locate.
- **Batch (File Based) Client**: Allows you to upload a .csv file and batch process it. (file formatting instructions)
- **Collaborative Georeferencing Client**: Utilizes the collaborative georeferencing framework. Ideal for largescale multi-institution projects. (https link)

Note: if you use the secure SSL (HTTPS) link, please make sure your browser is configured to allow mixed content, or you may see a blank map.

Here are SSL configuration instructions for various browsers: in English and in Spanish (special thanks to David Draper for the Spanish translation).

**Embeddable client**
- A streamlined web client for the purpose of embedding in other web applications.
- **Sample link** demonstrating use this client.
- **Documentation link** on how to craft URLs for this client.

**Other Clients**:
- Arctos
- Specify
- Symbiota
- Tropicos

Know of any other web based clients using GEO Locate? Let us know and we will be happy to list them.
Demonstration: How to use GEOLocate

GEOLocate Workflow
Demonstration: How to use GEOLocate

GEOLocate Workflow
Demonstration: How to use GEOLocate

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GEOLocate Workflow

Web Based Clients

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Demonstration: How to use GEOLocate

**GEOLocate Workflow**

**Batch Georeferencing**
Time to Exercise!

✓ Instruction sheet

✓ Data file

✓ Go to geo-locate.org
Instruction sheet

Georeferencing Exercises

Resources:
- Google Maps: https://www.google.com/maps
- Falling Rain: http://www.fallingrain.com

1. Use the standard GEOLocate client to identify the first three localities in the GeorefExamples_Florida.xls file.
   a. Enter the locality string, country, state, and county information from the Excel sheet.
   b. Click “Georeference.”
   c. Inspect the “Possible Locations” by clicking on the “XX possible locations found” where XX is the number of locations GEOLocate identified.
   d. Use an alternative resource to double check the locality. Try Google Maps.
   e. Adjust the point location as you see fit. The green point is the active one.
   f. Click the green point on the map, then click “Edit uncertainty”. Adjust the uncertainty radius by moving the grey arrow.
   g. Return to the “Workbench” and record the latitude, longitude, and uncertainty.
   h. If the uncertainty is >1000, it then discards the points.
Time to Exercise!

✓ Data file

| N6 | United States, Florida, Columbia, United States: Florida: Columbia County. Flora of O'Leno State Park, Florida. Open ruderal area along trail leading north from entrance road, starting NW of park center. | Internet Manual Author: Date Last Updated: 2023-01-01 |}

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<th>D</th>
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<td>Florida</td>
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Georeferencing Exercises
1. Use the standard GEOLocate client to identify the first three localities in the GeorefExamples_Florida.xls file.
   a. Enter the locality string, country, state, and county information from the Excel sheet.
   b. Click “Georeference.”
   c. Inspect the “Possible Locations” by clicking on the “XX possible locations found” where XX is the number of locations GEOLocate identified.
   d. Use an alternative resource to double check the locality. Try Google Maps.
   e. Adjust the point location as you see fit. The green point is the active one.
   f. Click the green point on the map, then click “Edit uncertainty”. Adjust the uncertainty radius by moving the grey arrow.
   g. Return to the “Workbench” and record the latitude, longitude, and uncertainty.
   h. If the uncertainty is >1000, it then discards the points.
✓ Check results...
2. Use the batch GEOLocate client to upload the localities in the GeorefExamples.xls file.
   a. Copy and paste the appropriate information from the GeorefExamples.xls file into your own GEOLocateBatchFormat.csv.
      ii. Do not label the columns (your first row = first sample)
      iii. **Make sure to save as a .csv**
      iv. The majority of the columns will be empty
   b. Go to the batch GEOLocate client and upload the formatted csv file
   c. “Page Georeference” will georeference all eight localities available at once. “Georeference” will do one at a time.
   d. Select a locality and go through Steps 1c to 1g. Once you are pleased with the locality and uncertainty, click “Correct” to note that you have gone through this georeference.
   e. Work through the remaining localities.
   f. If you do not finish a batch georeferencing, you can click on “File Management” at the bottom of the screen to receive a retrieval code. This will allow you to re-access this file whenever you wish without the need to download and upload.
   g. If you do finish a batch georeferencing, you can click on “File Management” and then “Export” to download the finished georeferenced file.
2. Use the batch GEOLocate client to upload the localities in the GeorefExamples.xls file.

   How to import data from Microsoft Excel into GEOLocate
   Create a blank spreadsheet within Excel. Add the following to the first row of columns in your spreadsheet:

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
<th>Column 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>locality string</td>
<td>country</td>
<td>state</td>
<td>county</td>
<td>latitude</td>
<td>longitude</td>
<td>correction status</td>
<td>precision</td>
<td>error polygon</td>
<td>multiple results</td>
</tr>
</tbody>
</table>

After the 10th column, you may add the names of other fields in your dataset that you would like to include (field number, localityID, remarks etc.) but you must be certain that each entry in the first row is unique.

Copy and paste your data from its original source to the appropriate columns starting at row 2 (alternatively, you could modify an existing spreadsheet to conform to the above format).

Select Save As... from the file menu in Excel. Enter a filename for your file, select CSV (comma delimited) (*.csv) from the drop down box labeled Save as type, and click the save button. Exit Microsoft Excel.

You now have a file that can be used with GEOLocate.

From the GEOLocate file menu, select Import -> CSV, and select the file you just created to import.

*NOTE: Our web based file client now supports the generation of uncertainty radii.

If you wish to generate and record uncertainty radii for your records using this client, your spreadsheet must also include an additional column to store that data. In this case you would need at least 11 columns for your data instead of 10. Using uncertainty radii is optional, so you can ignore this, if you choose not to utilize that option.
2. Use the batch GEOLocate client to upload the localities in the GeorefExamples.xls file.
2. Use the batch GEOLocate client to upload the localities in the GeorefExamples.xls file.
   a. Copy and paste the appropriate information from the GeorefExamples.xls file into your own
      GEOLocateBatchFormat.csv.
         ii. Do not label the columns (your first row = first sample)
         iii. **Make sure to save as a .csv**
         iv. The majority of the columns will be empty
   b. Go to the batch GEOLocate client and upload the formatted csv file
   c. “Page Georeference” will georeference all eight localities available at once. “Georeference” will do one at a time.
   d. Select a locality and go through Steps 1c to 1g. Once you are pleased with the locality and uncertainty, click
      “Correct” to note that you have gone through this georeference.
   e. Work through the remaining localities.
   f. If you do not finish a batch georeferencing, you can click on “File Management” at the bottom of the screen to
      receive a retrieval code. This will allow you to re-access this file whenever you wish without the need to download
      and upload.
   g. If you do finish a batch georeferencing, you can click on “File Management” and then “Export” to download the
      finished georeferenced file.
Time to Exercise!

✓ Check results...
✓ Understand the importance of georeferencing for biodiversity analyses
✓ Understand the sources of uncertainty in a georeference
✓ Be familiar with GEOLocate
✓ Use GEOLocate to georeference localities
Links with links...

- HerpNet: http://herpnet.org/Gazetteer/GeorefResources.htm
Any questions??

Please use the chat for questions!