Where does georeferencing fit into the digitization workflow?

- Traditional approach: As complete records are entered, all data, including georeferences are determined and entered.

- Proactive approach: Due to the prevalence of GPS devices, many modern collectors include georeferencing data which can be entered/uploaded at the time a specimen is initially cataloged. Each collecting locality gets named, georeferenced, and entered. Collections at that locality are all linked to the same event and are “automatically” georeferenced as they are entered/uploaded.
Where does georeferencing fit into the digitization workflow?

- Newer approach for legacy data (especially for entomology): Georeferencing becomes an activity focused on collecting events and their localities and precedes specimen/tray-based data entry. This allows records with identical or similar localities to be parsed and pooled by technicians or software that assign georeferences in bulk. Subsequent tray or specimen records are linked to these georeferenced localities.

- In bulk or individually based on known boundaries of counties, parks, preserves, sections, towns, or other areas with a defined boundary and known extent. In these cases, georeferencing is reported accurate to the known extent. Such georeferencing can be accomplished in bulk through database queries that insert centroid data into reference tables.
Georeferencing Data Elements

- Latitude (dd.dddd)
- Longitude (dd.dddd)
- Datum (coordinate system)
- Projection
- Precision
- Georeferencing method
- Georeferencing remarks
Georeferencing Methods and Tools

ArcGIS

Google Earth/Maps

Geolocate
ArcMAP
Drawbacks

- Slow
- Requires assembling and fiddling with map layers
- Potentially expensive
- Requires expert knowledge and familiarity with GIS and region
Open Source GIS

Quantum GIS

DIVA-GIS
Free, simple & effective
Google Maps
Collaborative Georeferencing

www.museum.tulane.edu/geolocate/

GEO Locate
A Platform for Georeferencing Natural History Collections Data

For Users:
- Overview
- GEO Locate Web
- GEO Locate 3.x.x (standalone)
  - Global Expansion
- GEO Locate 4.x.x (java client)
- Collaborative Georeferencing

For Developers:
- Soap Services
- Rest Services (coming soon)
- WMS/WFS Services (coming soon)

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

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

Desktop Application
The original standalone desktop application.

Java Client Application
Cross platform Java application. Users web services for georeferencing.

Collaborative Georeferencing
Build communities, share data, relate records across collections and improve verification efficiency.

Currently integrated with Specify and Symbiota
www.museum.tulane.edu/geolocate/community/default.html

Collaborative Georeferencing

The goal of this project is to provide a mechanism whereby groups of users can form communities to collaboratively georeference and verify a shared dataset. This collaborative georeferencing framework consists of two end-user components:

1. A client application for reviewing and editing community records. Currently, there are 2 applications available for this task:
   - The GEOLocate desktop application
   - The GEOLocate web-based collaborative client (click link to try it out)
2. Web-based data management portal for creating and managing communities, their respective users and data sources

Shared community datasets created via the portal may consist of multiple underlying data sources from either live DIGIR providers and/or uploaded text files. Support for TAPIR providers is currently under development. Data are stored using the full Darwin Core 1.2 specification, but subsets and/or alternatives schemas may be imported using the schema mapping interface. During import, data items are automatically normalized, georeferenced and related to one another via a similarity index. This index is used to identify all records that appear to describe the same collection locality regardless of syntax. During coordinate verification, users have the option to re-classify records that were incorrectly related to one another.

Verification and correction of the computer generated geographic coordinates is accomplished using the GEOLocate desktop application. GEOLocate allows users to login to their communities, retrieve and visualize results, make any necessary corrections, provide additional comments, define errors as polygons, and save the results back to the shared dataset. The verified results of georeferencing can then be downloaded via the portal's data management interface for re-import to the parent database.

To examine the gains in efficiency over traditional georeferencing, 2100 randomly selected collecting events from the TUMNH fish collection were imported and georeferenced using the collaborative georeferencing framework. The TUMNH fish collection was georeferenced by hand in the mid to late 90's and therefore provides a useful test bed for assessing the efficiency and accuracy of automated methodologies. Of the 2100 records, 30% were identified as being similar to other records and an additional 33% were duplicates leaving a total of 782 unique locations requiring correction, a 63% reduction in effort overall.

Video Tutorials
http://www.museum.tulane.edu/coge/

Sign in

Requires a free account
Data sources
Community: Duval

Data source management operations

- Add new community data source via OGR
- Add new community data source via CSV files

Click on an item’s header to expand/collapse its content.

- Community-wide
- Duval
- Clay1

Secondary names:
- Clay1
- drive
Type: .csv
Owner: you
Number of records: 50
Status: cached
Records statistics:
- Total correct specimen records: 783
- Total correct locality records: 518
- In this data source:
Mark placed roughly at the point of locality string.....or not!
Shaded circle=radius of uncertainty.
Uncertainty

Edit uncertainty
View corrections
<table>
<thead>
<tr>
<th>InstitutionCode</th>
<th>CollectionCode</th>
<th>Country</th>
<th>Province</th>
<th>County</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>25003</td>
<td>14453</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>On east side of St. Johns River, Pine Island State Preserve, 2.5 miles west of Orange City Hill; 3 miles west of US 17 and SR 15; Orange City Quad. Deciduous hardwood swamp.</td>
</tr>
<tr>
<td>25024</td>
<td>14454</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Along Kepler rd, just off Minnesota ave., Osteen.</td>
</tr>
<tr>
<td>25028</td>
<td>14457</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Cat-Tail, Cat-tail</td>
</tr>
<tr>
<td>25243</td>
<td>14533</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Chadwick preserve, 4 miles west of Volusia.</td>
</tr>
<tr>
<td>26802</td>
<td>14630</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>New Smyrna Beach Ca, nine miles south of New Smyrna Beach just north of Turtle Hound. Sarcopt scrob on stabilized sand behind dune ridge of ocean beach. Glacis covered with Surfgrass.</td>
</tr>
<tr>
<td>26804</td>
<td>14631</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>New Smyrna Beach Ca, nine miles south of New Smyrna Beach just north of Turtle Hound. Sarcopt scrob on stabilized sand behind dune ridge of ocean beach. Glacis covered with Surfgrass.</td>
</tr>
<tr>
<td>26833</td>
<td>14632</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>New Smyrna Beach Ca, nine miles south of New Smyrna Beach just north of Turtle Hound. Sarcopt scrob on stabilized sand behind dune ridge of ocean beach. Glacis covered with Surfgrass.</td>
</tr>
<tr>
<td>26876</td>
<td>14633</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>New Smyrna Beach Ca, nine miles south of New Smyrna Beach just north of Turtle Hound. Sarcopt scrob on stabilized sand behind dune ridge of ocean beach. Glacis covered with Surfgrass.</td>
</tr>
<tr>
<td>26877</td>
<td>14634</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>New Smyrna Beach Ca, nine miles south of New Smyrna Beach just north of Turtle Hound. Sarcopt scrob on stabilized sand behind dune ridge of ocean beach. Glacis covered with Surfgrass.</td>
</tr>
<tr>
<td>27229</td>
<td>14651</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Barbenie Os Flia, 31 mi S of Daytona Beach, W of Exit 140, S of SR 40, E of SR 40, generally E of Barbenie Os Flia. Sandy soil.</td>
</tr>
<tr>
<td>27235</td>
<td>14652</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Galatea Os Flia, 31 mi S of Daytona Beach, W of Exit 140, S of SR 40, E of SR 40, generally E of Barbenie Os Flia. Sandy soil.</td>
</tr>
<tr>
<td>26951</td>
<td>14653</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Galatea Os Flia, 31 mi S of Daytona Beach, W of Exit 140, S of SR 40, E of SR 40, generally E of Barbenie Os Flia. Sandy soil.</td>
</tr>
<tr>
<td>27222</td>
<td>14654</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>Indigofera minuta var. leptosepala</td>
</tr>
<tr>
<td>27235</td>
<td>14655</td>
<td>United States</td>
<td>Florida</td>
<td>Volusia</td>
<td>New Smyrna Beach Turtle Mount Volusia county, ca, nine miles south of New Smyrna Beach just north of Turtle Hound. Sarcopt scrob on stabilized sand behind dune ridge of ocean beach. Glacis covered with Surfgrass.</td>
</tr>
</tbody>
</table>

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Last updated February, 2012
<table>
<thead>
<tr>
<th>Collection Code</th>
<th>Catalog Number</th>
<th>Scientific Name</th>
<th>Country</th>
<th>State</th>
<th>County</th>
<th>Locality</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>17</td>
<td>Sarracenia flavia</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Wilma Apalachicola National Forest, tiki bog, near Wilma, in a sphagnum area, presently dry, tiki bog.</td>
<td>30.088636</td>
<td>-85.08262</td>
<td>Georef Me!</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>Sarracenia flavia</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Sumatra 11.5 miles northwest of Sumatra; slash pine savanna, open slash pine savanna, with S. pittaccica.</td>
<td>30.179643</td>
<td>-85.087362</td>
<td>Georef Me!</td>
</tr>
<tr>
<td>4</td>
<td>195</td>
<td>Drosera capillaris</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Hosford Apalachicola National Forest, ditch at roadside bordering longleaf pine, wiregrass savanna, 14 miles S of Hosford, Apalachicola National Forest. Boggy ditch at roadside bordering longleaf pine, wiregrass savanna.</td>
<td>30.313648</td>
<td>-84.957362</td>
<td>Georef Me!</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>Drosera capillaris</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Wilma Apalachicola National Forest tiki bog, near Wilma. In tiki bog.</td>
<td>30.169997</td>
<td>-84.899559</td>
<td>Georef Me!</td>
</tr>
<tr>
<td>6</td>
<td>274</td>
<td>Drosera tracyi</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Sumatra ditch bordering pine flatwoods; 11.5 miles N of Sumatra; sandy peaty soil, broad roadside ditch bordering pine flatwoods.</td>
<td>30.277722</td>
<td>-84.910509</td>
<td>Georef Me!</td>
</tr>
<tr>
<td>7</td>
<td>459</td>
<td>Pinguiulus punica</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Sumatra Apalachicola National Forest, by forest road 123, 0.5 mile from FLa rd 370, NW of Sumatra. Turned over longleaf pine flatwoods.</td>
<td>30.023252</td>
<td>-84.980563</td>
<td>Georef Me!</td>
</tr>
<tr>
<td>8</td>
<td>520</td>
<td>Utricularia comuta</td>
<td>USA</td>
<td>FL</td>
<td>Liberty</td>
<td>Sumatra pond along Hwy 65 near Placca savannahs; 4 mi NNE of Sumatra; in shallow water of Hypnumic pond; near Placca savannahs.</td>
<td>30.073648</td>
<td>-84.953504</td>
<td>Georef Me!</td>
</tr>
</tbody>
</table>

=HYPERLINK((LEFT(CONCATENATE("http://www.museum.tulane.edu/geolocate/web/webgeoref.aspx?&Country="&D2,"&State="&E2,"&County="&F2,"&Locality="&G2),255)),"Georef Me!")