Georeferencing Natural History Collections Data: The GEOLocate Project

Nelson E. Rios
What is Georeferencing

pushepatapa creek, trib. to pearl river, 7.8 miles north of bogalusa at hwy 21; Washington; LA; USA

latitude: **30.88797**
longitude: **-89.83601**
uncertainty radius: **48m**
uncertainty polygon: **30.88823,-89.83641, 30.88815,-89.83634, 30.88808,-89.83622...**
3 billion specimens with \( \frac{1}{2} \) billion collecting events
Traditional Methods
Software & services for georeferencing of natural history collections data

- Automated georeferencing
- Verification & correction
- Multi-lingual
- Interoperability
- SOAP & REST API
- Training
- Uncertainty determination

KML export
Batch processing
Geographic visualization
Google, Bing, OpenStreet, WMS
Collaborative georeferencing
Typical 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
   latitude: 30.88797
   longitude: -89.83601
   uncertainty radius: 48m
   uncertainty polygon: 30.88823,-89.83641,
   30.88815,-89.83634,
   30.88808,-89.83622...

3. Manual Verification
Options: Web vs. Desktop?

Web Based Clients

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

- User input georeferencing client
  - Simply type in your locality description and get back georeferenced results. Start here if you are new to GEOLocate.
- File based input (batch) georeferencing client
  - Allows you to upload a .csv file and batch process it.
- Collaborative georeferencing client
  - Utilizes the collaborative georeferencing framework. Ideal for large-scale multi-institution projects.
- Embeddable client
  - A streamlined web client for the purpose of embedding in other web applications.

Sample link of how an external application on another domain might use this client.
Documentation link on how to craft URLs for this client.

GEOLocate Standalone Desktop Application (version 3.xx)

Features | Frequently Asked Questions | Updates | Downloads
Georeferencing Example: Desktop App

TULANE UNIVERSITY COLLECTIONS

Family No. 385
Cat. No. 34409
Species: COTTUS TALLAPOOSAE
Dr. ALABAMA RIVER No. of Specimens 10
State: GEORGIA County: HARALSON
Locality: TALLAPOOSA RIVER 5.0mi. N of
Buchanan, Hwy 27
Date: 31 August 1944 Col. No. RDS 3572
Col. by: Suttles & Ramsey

Locality String: Tallapoosa River 5.0 mi N of Buchanan, Hwy 27

Calculated Coordinates:
Lat: 33.863430
Lon: -85.213334

Georeference:
County: USA
State: GEORGIA
County: HARALSON

Precision: High
1 possible location found.

**Family:** COTYS TALLAPOOSA

**State:** Georgia

**County:** Haralson

**Locality:** Tallapoosa River 5.0 mi. N of Buchanan, Hwy 27

**Date:** 31 August 1964

**Col. by:** Suttles & Ramsey
## Algorithm Performance

### Versus Known U. S. Localities

<table>
<thead>
<tr>
<th></th>
<th>% Found</th>
<th>Mean Dist. Off</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOLocate</td>
<td>95%</td>
<td>6.1 km</td>
<td>2.1 km</td>
</tr>
</tbody>
</table>

![Map showing location accuracy](image)
## Algorithm Performance

### Versus Known Australian Localities

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>% Found</th>
<th>Mean Dist. Off</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO Locate</td>
<td>86 97%</td>
<td>796 218 km</td>
<td>154 48 km</td>
</tr>
</tbody>
</table>

![Map showing distances](image-url)
Verification & Adjustment of Automated Outputs

Computed coordinates are displayed on digital maps

Manual verification of each record

Drag and drop correction of records
Multiple Result Handling

Caused by duplicate names, multiple names & multiple displacements

Results are scored and most “accurate” result assigned to active marker (green)

All results are recorded and displayed as static markers (red)

Beaver Creek; Louisiana; USA
Measuring Uncertainty

- Point
- Point & Radius
- Point, Radius & Polygon
Mythical Place
7 miles North of Mythical Place
7 miles North of My Creek at Hwy 1
Match Water Body | Detect Hwy/River Crossing | Do Uncertainty
Do Error Polygon | Displace Polygon | Restrict to Lowest Adm. Unit
Language: English
### Generating Polygons:

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawrence, KS</td>
<td>15 mi N of Lawrence, KS no displacement</td>
</tr>
<tr>
<td></td>
<td>15 mi N of Lawrence, KS displaced polygon</td>
</tr>
</tbody>
</table>
Visualization: Base Layers

- Google Hybrid
- Google Satellite
- Google Streets
- Google Terrain
- Bing Hybrid
- Bing Roads
- Bing Aerial
- ESRI USGS Topo USA
- ESRI USGS Topo USA (faster)
- ESRI World Topo
- Mapnik (OSM)

Overlays
- US Counties
- Error Polygon
- Uncertainty Circle
- Results
- Most Accurate Result
Evaluating Results

Beaver Creek, LA, USA

16 possible locations found.
### Batch Georeferencing

#### Workbench

2 possible locations found

<table>
<thead>
<tr>
<th>Locality</th>
<th>Country</th>
<th>StateProvince</th>
<th>County</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Corrected</th>
<th>precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chambers Spring Road 2.5 km S of Hwy 412, 8.0 km E of Siloam Springs, T17N, R33W,</td>
<td>USA</td>
<td>Arkansas</td>
<td>Benton</td>
<td>36.188027</td>
<td>-94.451005</td>
<td>no</td>
<td>High(89)</td>
</tr>
<tr>
<td>Osage Creek, 1.0 mile N on gravel road to bridge crossing, gravel road jcts with</td>
<td>USA</td>
<td>Arkansas</td>
<td>Benton</td>
<td>36.189077</td>
<td>-94.395375</td>
<td>no</td>
<td>High(87)</td>
</tr>
<tr>
<td>Yocum Creek, near Oak Grove (Pass 11a), Sec. 30</td>
<td>USA</td>
<td>Arkansas</td>
<td>Carroll</td>
<td>38.454986</td>
<td>-93.322008</td>
<td>no</td>
<td>Low(35)</td>
</tr>
<tr>
<td>Village Creek State Park, S of driving range, Sec. 6</td>
<td>USA</td>
<td>Arkansas</td>
<td>Cross</td>
<td>35.16111</td>
<td>-90.70633</td>
<td>no</td>
<td>Low(39)</td>
</tr>
<tr>
<td>Sugar Creek, Hwy 163 at Bay Village, Sec. 4</td>
<td>USA</td>
<td>Arkansas</td>
<td>Cross</td>
<td>35.44900</td>
<td>-90.67533</td>
<td>no</td>
<td>High(100)</td>
</tr>
<tr>
<td>Buck Creek, 8.0 miles SE Corydon</td>
<td>USA</td>
<td>Indiana</td>
<td>Harrison</td>
<td>38.155118</td>
<td>-86.014724</td>
<td>no</td>
<td>High(88)</td>
</tr>
<tr>
<td>E Branch Mill Creek, Hessdale Road, 4.0 km S of Allendorph, Sec. 36</td>
<td>USA</td>
<td>Kansas</td>
<td>Wabaunsee</td>
<td>39.003564</td>
<td>-96.277745</td>
<td>no</td>
<td>High(88)</td>
</tr>
<tr>
<td>Blissdale Creek, Hillside National Wildlife Refuge, 500 m SW of Blissdale on Blis</td>
<td>USA</td>
<td>Mississippi</td>
<td>Holmes</td>
<td>33.083754</td>
<td>-90.224833</td>
<td>no</td>
<td>High(84)</td>
</tr>
</tbody>
</table>
Collaborative georeferencing

- Increased output by taking advantages of similarities across collections
- Distribution of workloads to appropriate expertise

1 + 1 = 3
Collaborative Georeferencing: Sharing Data

<table>
<thead>
<tr>
<th>Location</th>
<th>Country</th>
<th>State</th>
<th>County</th>
<th>Year</th>
<th>Specimen Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homochitto River, 4.9 mi. E Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1960</td>
<td>11</td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, MS Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1968</td>
<td>11</td>
</tr>
<tr>
<td>Homochitto River at Route 550 bridge, 5.0 mi. E of Union Church.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1970</td>
<td>10</td>
</tr>
<tr>
<td>Homochitto River at MS Hwy. 550 bridge 5.0 mi. E of Union Church.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td>2</td>
</tr>
<tr>
<td>Homochitto River at Hwy. 550 bridge 5.0 mi. E of Union Church.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 4.7 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 4.7 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td></td>
</tr>
<tr>
<td>Homochitto River 5 mi. SE of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td>8</td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1971</td>
<td>8</td>
</tr>
<tr>
<td>Homochitto River 4.7 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1972</td>
<td>7</td>
</tr>
<tr>
<td>Homochitto River 5 mi. E of Union Church, Hwy. 550.</td>
<td>USA</td>
<td>Mississippi</td>
<td>Lincoln</td>
<td>1972</td>
<td>6</td>
</tr>
</tbody>
</table>

Corrected 22 collecting events, approx. 200 specimen records
Collaborative Georeferencing Performance

- 2100 randomly selected collecting events from the Tulane University fish collection were imported and georeferenced using the collaborative georeferencing framework
- 33% were duplicates
- 30% more related by similarity index

2100 → 782

★ 63% reduction in effort overall
Distributing Workloads
Collaborative Georeferencing within GEOLocate

Remote Data Source

CSV Upload

Cache Update Web Service

Data Retrieval Web Service

Data Store

Insert Correction Web Service

Georeferencing Web Service

Record Processor

CoGe Web Portal Application

Community & Data Management

CoGe Client Application (Desktop or Web)

Correction & Verification
Welcome to the Tulane University Museum of Natural History's Community Edition of GEOLocate. This site along with GEOLocate (version 3 and higher) and DiGIR provider software form the foundation of community-based georeferencing, whereby participants form communities and pool data to maximize efficiency of georeferencing.

Beta testing is now open, so if you are interested in using our software and services for collaborative georeferencing please follow the registration link below. After personal review of your registration information, you will be granted access to the system. Questions or comments may be directed to Nelson Rios.

Registration is free and gives you access to restricted areas of this portal, where you can join or create a community. Read more about us.
Georeferencing Communities

Create Communities

Data Sources

Add New Users & Link Out
Assign all records from Kenya to experts on East African regions.
Monitoring & Managing Progress
## Data Repatriation

### CoGe: Corrections details for the "TU Fish" data source - Mozilla Firefox

Showing 1 to 50 of 1559.

<table>
<thead>
<tr>
<th>Data source</th>
<th>Continent</th>
<th>Ocean</th>
<th>Country</th>
<th>StateProvince</th>
<th>County</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Utah</td>
<td>Washington</td>
<td>Santa Clara River, 2.75 mi. above Gunlock.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data source</th>
<th>Continent</th>
<th>Ocean</th>
<th>Country</th>
<th>StateProvince</th>
<th>County</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Copiah</td>
<td>Trib. to Homochito River, 4.6 mi. NE Caseyville.</td>
<td></td>
</tr>
<tr>
<td>Corrected by</td>
<td>abentley</td>
<td></td>
<td>Corrected latitude</td>
<td>28.81056</td>
<td>10/27/2008 9:49:00 PM</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data source</th>
<th>Continent</th>
<th>Ocean</th>
<th>Country</th>
<th>StateProvince</th>
<th>County</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Louisiana</td>
<td>Orleans</td>
<td>South shore of Lake Pontchartrain near I-10 bridge.</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Simpson</td>
<td>Strong River at rapids upstream from Hwy. 28 bridge, 2 mi. W of Pinola.</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>North Carolina</td>
<td>Macon</td>
<td>Little Tennessee River, 5 mi. NW Franklin, Hwy. 28.</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Louisiana</td>
<td>Orleans</td>
<td>Lake Pontchartrain at south end of causeway on Rt. 11</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Louisiana</td>
<td>La Fourche</td>
<td>Ditch near canal, 5.7 mi. south of Golden Meadows on Rt. 78</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Marion</td>
<td>Upper Little River tributary of Pearl River, 4.8 mi. SE of Columbia, MS on I-20.</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Marion</td>
<td>Trib. of Pearl R. 4.8 Mi. N of Sandy Hook on Rt. 35</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Alabama</td>
<td>Mobile</td>
<td>Trib. of Escatawpa River 6.8 mi. E of Hurley, MS</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Marion</td>
<td>Trib. of Pearl River 6/10 mi. N of LA state line on Rt. 35</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Florida</td>
<td>Bay</td>
<td>Trib. of Escatawpa River at Youngstown on Rt. 231</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Marion</td>
<td>Trib. of Pearl River 1.2 mi. N of MS state line on Rt. 35</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Louisiana</td>
<td>St. Tammany</td>
<td>Trib. of Pearl River 12.7 mi. NW of town of Pearl River on Rt. 58.</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Marion</td>
<td>Trib. of Pearl River 2.7 mi. N of Sandy Hook on Rt. 35.</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Mississippi</td>
<td>Hancock</td>
<td>Long Bay, trib. to Turtleskin Cr. 11.2 mi. E of Picayune or 2 mi. W of turn</td>
<td></td>
</tr>
<tr>
<td>TU Fish</td>
<td>North America</td>
<td>USA</td>
<td>Florida</td>
<td>Jackson</td>
<td>Chipola River 1.5 mi. N of Marianna</td>
<td></td>
</tr>
</tbody>
</table>

[View Corrections](http://www.museum.tulane.edu/coge/protected/ShowDetails.aspx?w=3909f73d&total=1559&show=135&obj=ds)
Lake Winnipesaukee, Fish Cove near mouth of T 108, 3.5 mi ESE of Meredith, Merrimack Watershed, elev. 50 ft.
ON WORKBENCH:
Lake Winnipesaukee in Blackey Cove & outlet Lake Kanasatka, Merrimack Watershed, 0.75 mi E of Center Harbor, elev 504; United States; New Hampshire; Carroll;
Interoperability

- **Webservices**
  - SOAP
  - JSON
  - GeoJSON

- **Web Client**
library(RJSONIO)
library(RCurl)

setwd("E:/FishNetGeoRef")

INPUTFILENAME="t_localities4GLC.csv"
OUTPUTFILENAME="t_localities4GLC_out.csv"
OUTPUTFILENAMEFIRSTRESULT="t_localities4GLC_out_first_result.csv"

OPTIONS="&doduncan=true&dopoly=false&displacepoly=false"
glcIn= read.csv(INPUTFILENAME)
umGLCRuns = 0
recordCounter = 0
for (k in 1:nrow(glcIn)) {
  print(k)
  Sys.sleep(3) # be nice and pause a few seconds between requests
  Country=glcIn[k,]$Country
  Locality=glcIn[k,]$Locality
  StateProvince=glcIn[k,]$StateProvince
  County=glcIn[k,]$County
  q=gsub(',','%20',q)

  tryCatch({
    JSONresponse = basicTextGatherer()
    curlPerform(url = q, writefunction = JSONresponse$update)
    glcRecNum = k
    glc = fromJSON(JSONresponse$value())
    numresults = glc$numResults
    if (numresults > 0) {
      for (i in 1:numresults) {
        glcRank = i
        glcLongitude = glc$resultSet$features[[i]]$geometry$coordinates[1]
        glcLatitude = glc$resultSet$features[[i]]$geometry$coordinates[2]
        glcPrecision = glc$resultSet$features[[i]]$properties$precision
        glcScore = glc$resultSet$features[[i]]$properties$score
        glcParsepattern = glc$resultSet$features[[i]]$properties$sparsePattern
        glcUncert = glc$resultSet$features[[i]]$properties$uncertaintyRadiusMeters
        glcPoly = glc$resultSet$features[[i]]$properties$uncertaintyPolygon
        #if a polygon is present reformat coordinates to geolocate format-a comma delimited array
        if ("coordinates"%in%names(glcPoly)) {
          sPoly = "
        
        } else {
          sPoly = "
        
        }
      }
    }
  }, try={
    print("Failed")
  })
}

Application Services: Web Client APIs

- URL API for user input & lightweight web clients
- Lightweight client, specifically designed for embedding into other web applications.
  - Two way communication between web sites uses JavaScript postMessage()
  - Compatible with all modern browsers:
    - IE 8.0+
    - Firefox 3.0+
    - Safari 4.0+
    - Chrome 1.0+
    - Opera 9.5+
1 possible location(s) found.

- 30.79083, -89.84861 (BOGALUSA)

Georeference a locality description

1 possible location(s) found.

- 30.801736012, -89.8943429191...

Save To Your Application
Arizona State University Vascular Plant Herbarium

Return Count: 39

Pima County, Growing on sanitary landfill, Tumamoc Hill, Tucson [1]
Pima County, N slope above laboratory ground, Tumamoc Hill [1]
Pima County, North slope above laboratory grounds, Tumamoc Hill, Tucson [1]
Pima County, North slope above laboratory grounds, Tumamoc Hill, Tucson [1]
Pima County, S side of Tumamoc Hill on Desert Laboratory property, TRS: T14S R13E S15 [1]
Pima County, South side of Tumamoc Hill along 22nd Street, TRS: T14S R13E S15 SW1/4 [1]
Pima County, South side of Tumamoc Hills along 22nd Street, TRS: T14S R13E S15 [1]
Pima County, SW base of Tumamoc Hill on Desert Laboratory property, TRS: T14S R13E S15 SW1/4 SW1/4 [1]
Pima County, Tucson Mountains, Tumamoc Hill just below (west of) the University of Arizona Geochronology Lab, TRS: T14S R13E S15 NW1/4 [1]
Pima County, Tucson Mountains, Tumamoc Hill, Tucson [1]
Pima County, Tucson Mountains, Tumamoc Hill [1]
Pima County, Tucson Mountains, Tumamoc Hill just below (west of) the University of Arizona Geochronology Lab, TRS: T14S R13E S15 [1]
Pima County, Tucson Mountains, Tumamoc Hill, AZ [1]

Deg. Min. Sec. Decimal
Latitude: N =
Longitude: W =

Error (in meters):
Datum:

Sources:
egbot 2012-04-01

Remarks:

Verification Status: reviewed - high confidence

Elevation:
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locality</td>
<td>Country</td>
<td>State</td>
<td>County</td>
<td>Link to GEOLocate Web App</td>
</tr>
<tr>
<td>Bogalusa</td>
<td>USA</td>
<td>LA</td>
<td>Washington</td>
<td>Georeference Me!</td>
</tr>
</tbody>
</table>

Georeferencing Wet Collections:

The FishNet 2 Project
Global network of fish collections

53 data providers

3.3 million lots

30+ million specimens

57% georeferenced

4+ million lots

100% georeferenced
Distributed Georeferencing
“Preliminary” Assignments

2 out of 4 million records in need of georeferencing
~290,000 locality records
Workflow: Integrating API’s

1. Clean data, match against pre-existing etc.
2. Pre-georeference, assess verification difficulty, identify problematic records.
3. Produce datasets for CoGe based on region and anticipated difficulty of verification.
4. Assign workloads by institution, difficulty & region.
5. Final review of results.
6. Repatriate clean data, match against pre-existing etc.
7. Verify, correct & annotate.
8. Collaborative Georeferencing.
10. Data providers.

FishNet 2

R
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