Georeferencing Overview

University of Florida

Created by Blaine Marchant, Grant Godden, and Charlotte Germain-Aubrey

FLORIDA MUSEUM

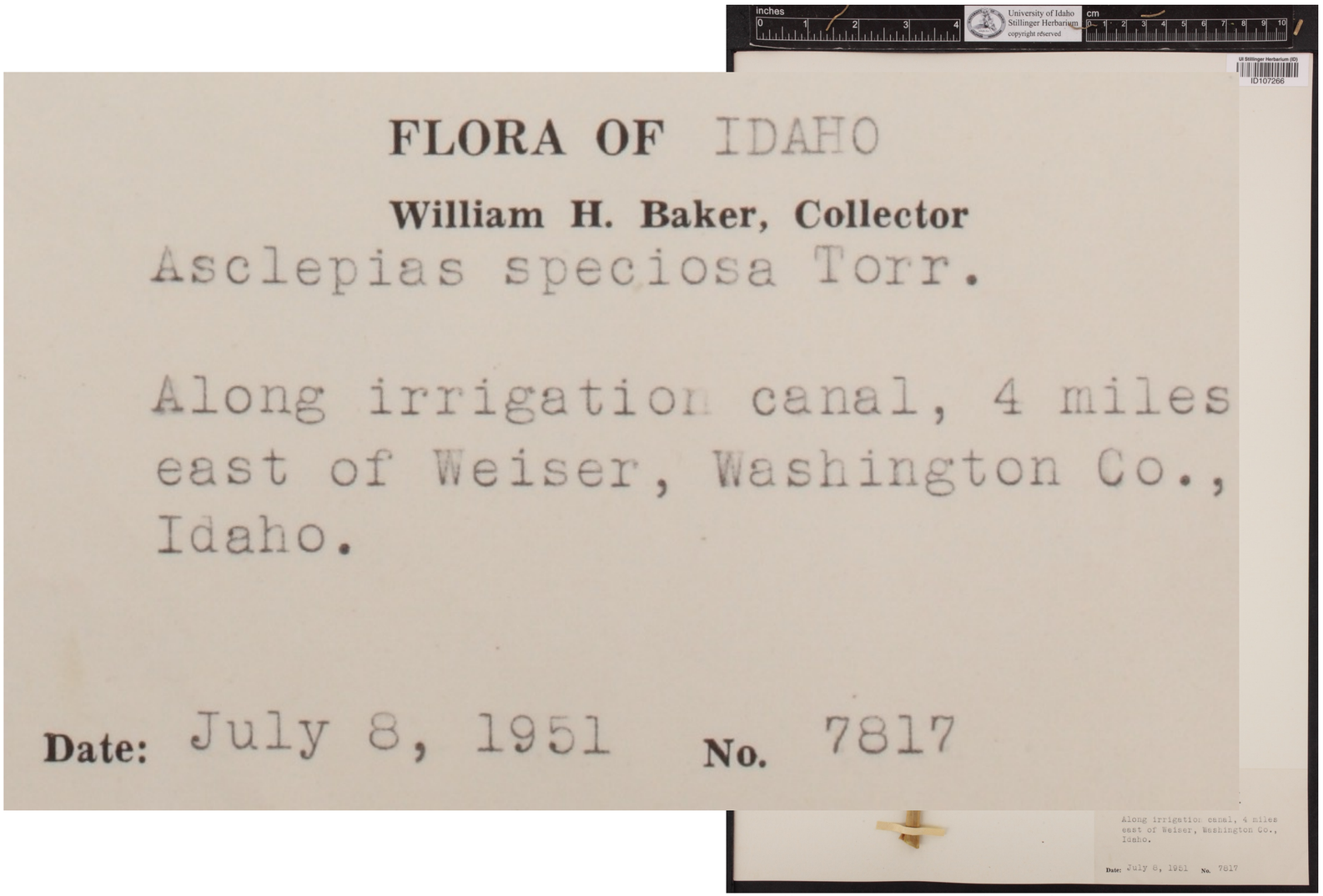
UF | UNIVERSITY of FLORIDA

iDigBio
Integrated Digitized Biocollections

NSF

BiotaPhy

What is a georeference?

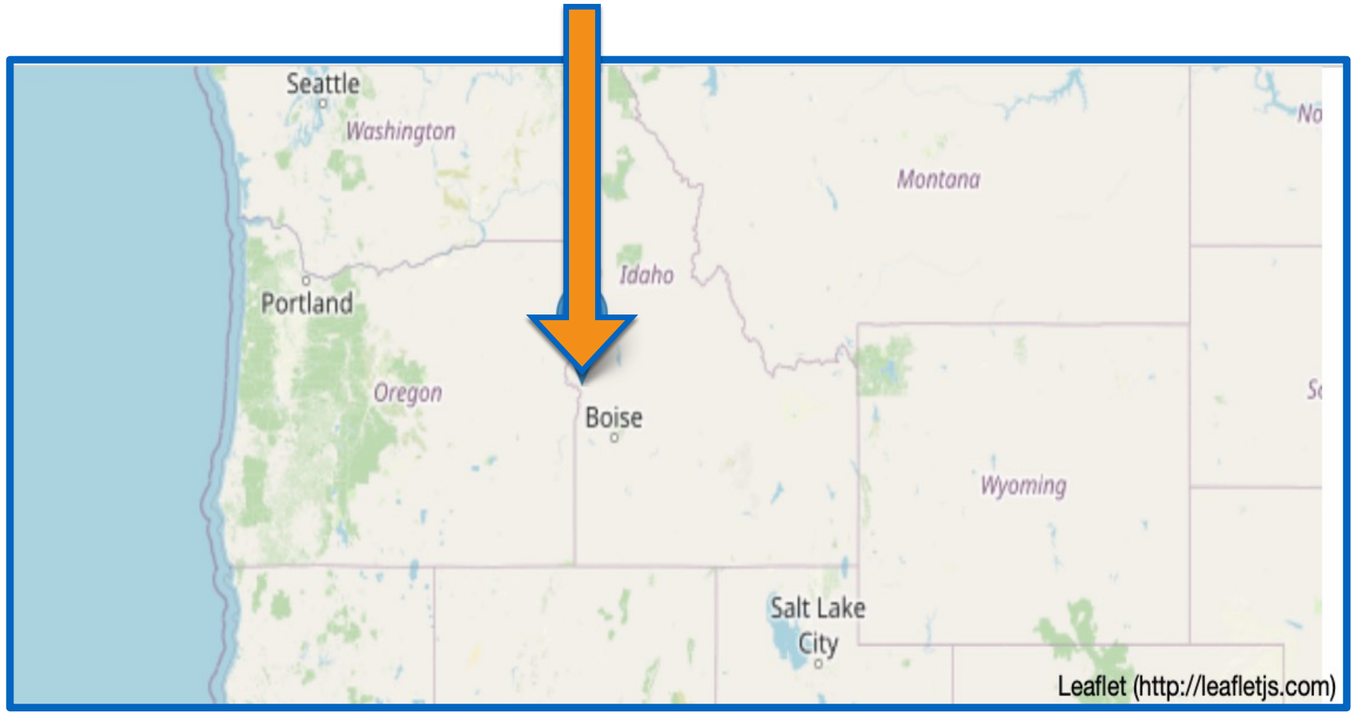


https://www.pnwherbaria.org/images/jpeg.php?Image=ID107266.jpg

***Asclepias speciosa* Torr.**

Along irrigation canal, 4 miles east of Weiser, Washington Co., Idaho.

What is a georeference?



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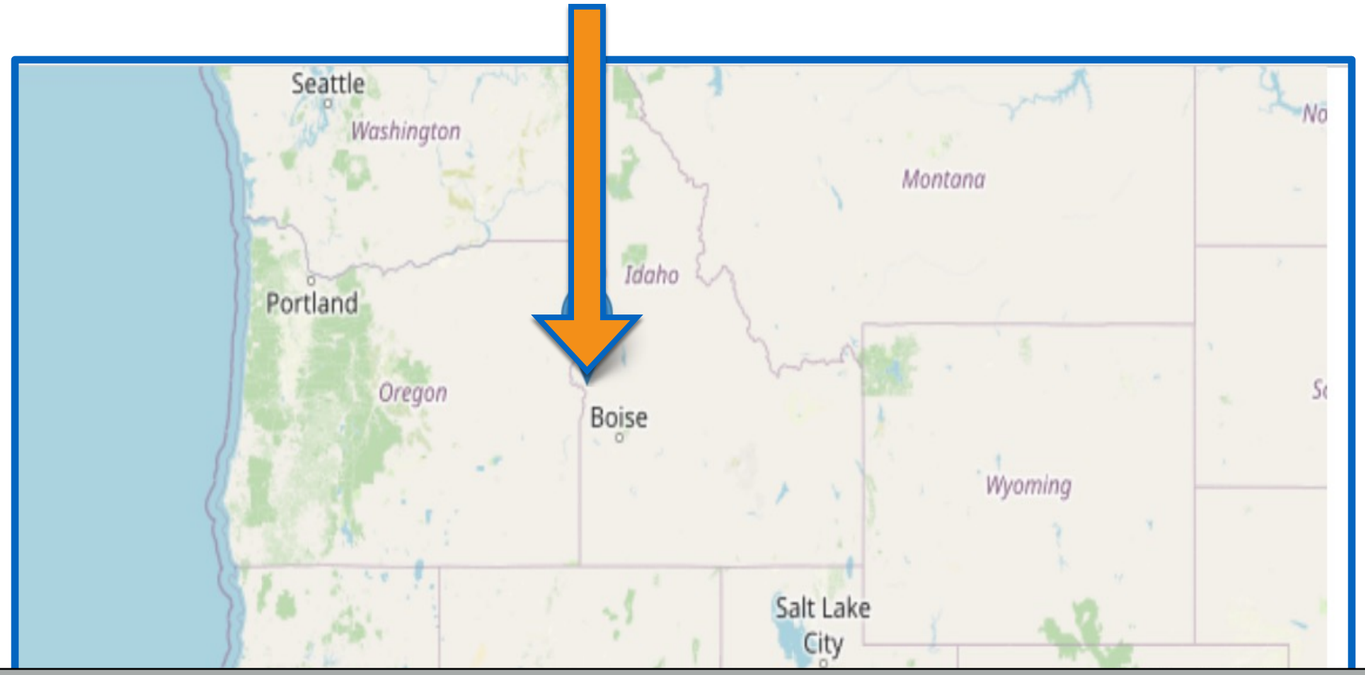
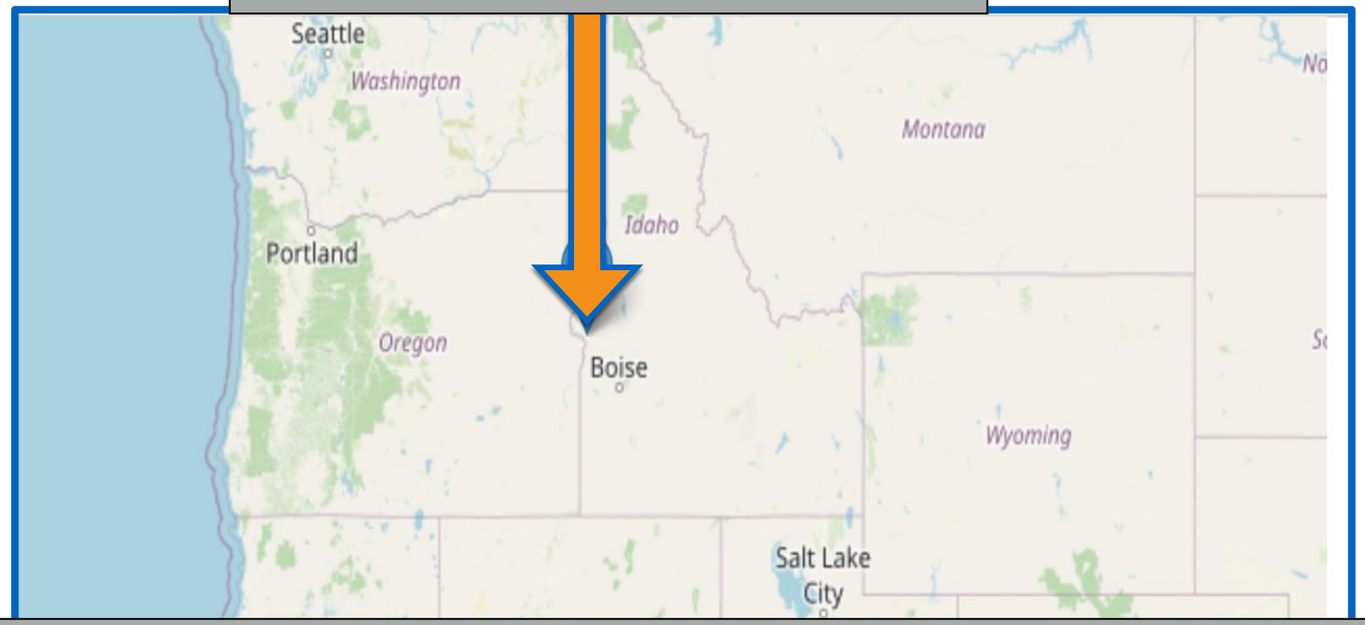


A numerical description of a place that can be mapped

What is a georeference?

44.23, -116.88



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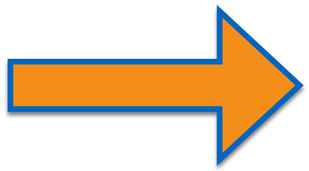

44.23, -116.88

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 regarding 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

20° 30’ N 112° 36’ W

Scale	Uncertainty (ft)	Uncertainty (m)
1:1,200	3.3 ft	1.0 m
1:2,400	6.7 ft	2.0 m
1:4,800	13.3 ft	4.1 m
1:10,000	27.8 ft	8.5 m
1:12,000	33.3 ft	10.2 m
1:24,000	40.0 ft	12.2 m
1:25,000	41.8 ft	12.8 m
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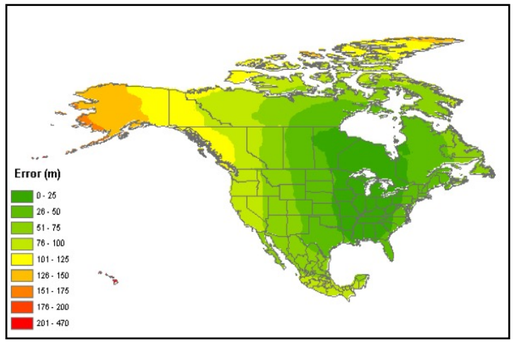
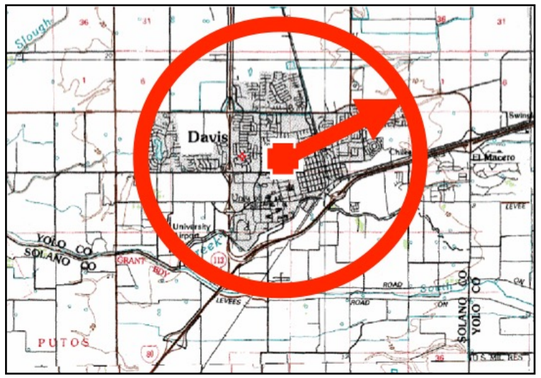
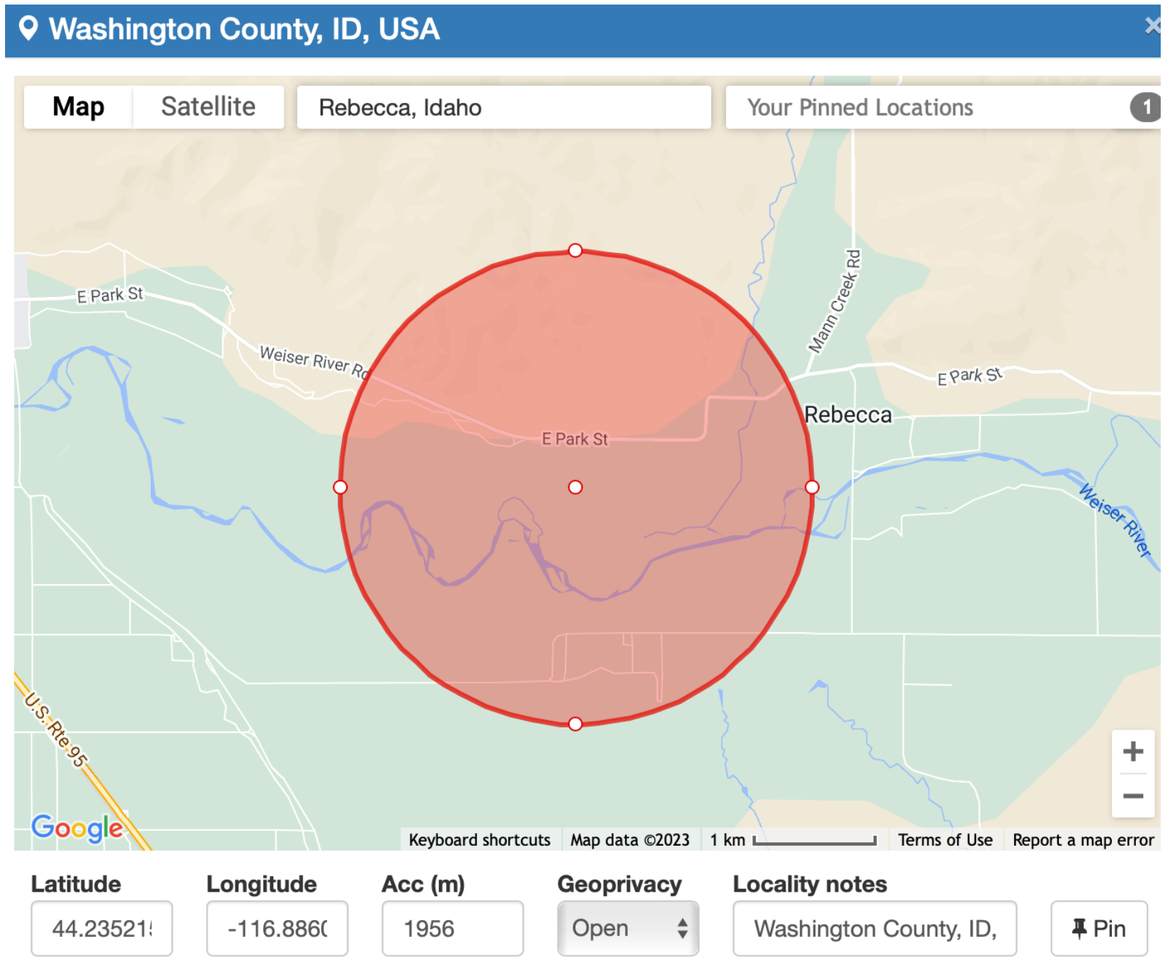




Coordinate uncertainty



Locality

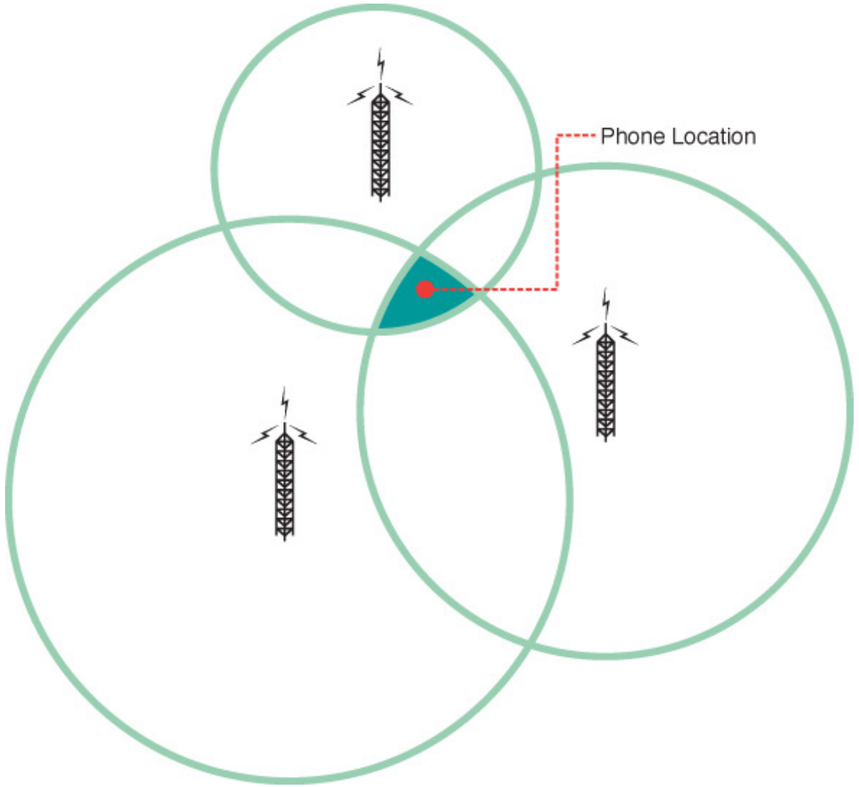
Country	U.S.A.
Country Code	US
State / Province	Idaho
County	Washington
Higher Geography	U.S.A., Idaho, Washington County
Continent	north america
Locality	4 miles east of Weiser.
Habitat	Along irrigation canal.
Decimal Latitude	44.235228
Decimal Longitude	-116.886394
Coordinate Uncertainty In Meters	1956
Geodetic Datum	WGS 84
Georeferenced By	Lindsey Clemens

Coordinate Uncertainty in Meters: **1956 m**

iDigBio
Integrated Digitized Biocollections

Map scale

GPS accuracy



Images left to right urls: https://www.outdoorsgeek.com/product/garmin-etrex-vista-cx-handheld-gps-rental/, https://www.apple.com/iphone-14-pro/specs/, https://www.oreilly.com/api/v2/epubs/9780133383959/files/graphics/17fig02.jpg

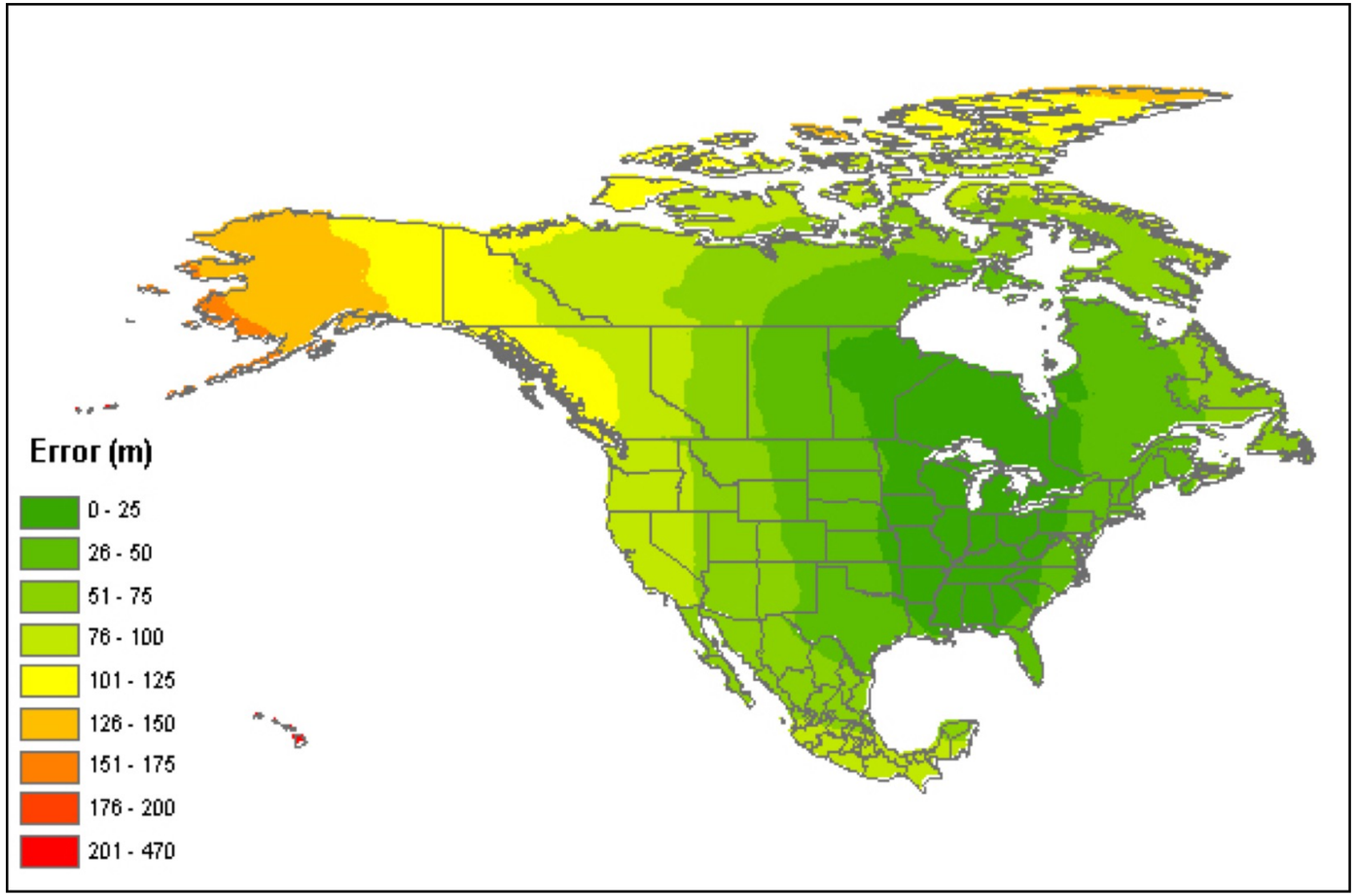
Datum

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.

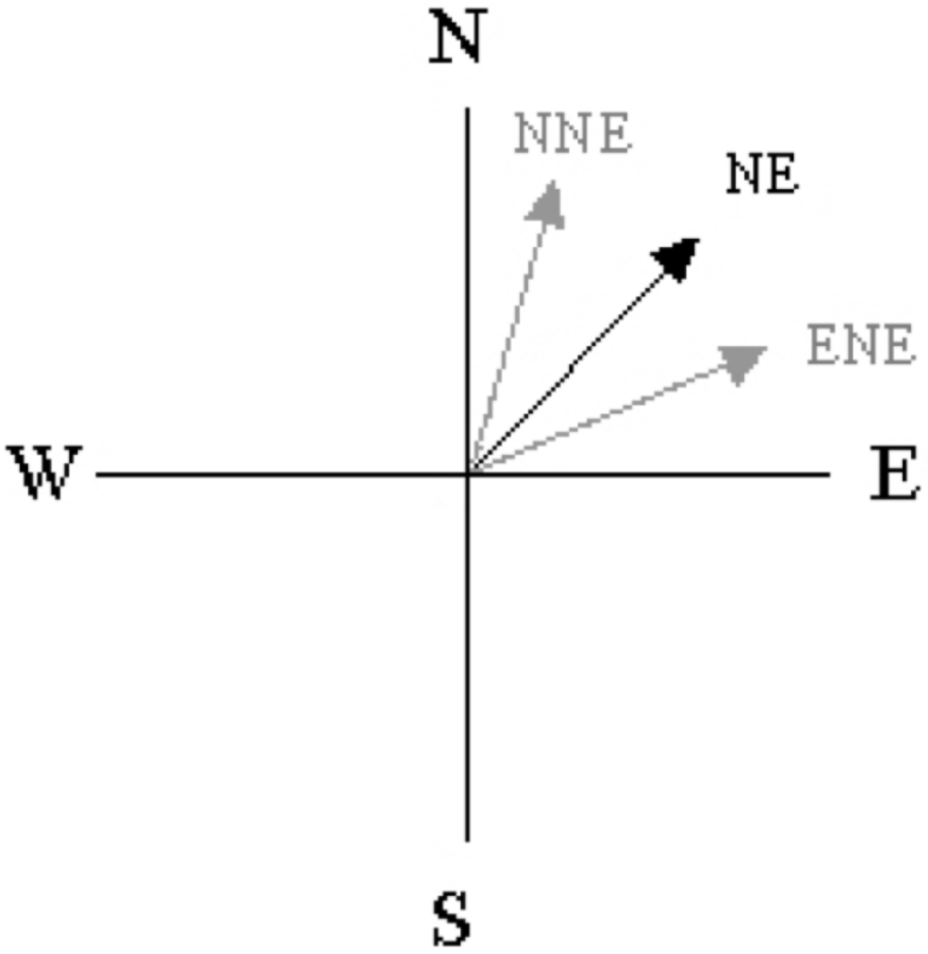
https://oceanservice.noaa.gov/facts/datum.html#:~:text=A%20geodetic%20datum%20is%20an,when%20you%20give%20someone%20directions.

Datum uncertainty

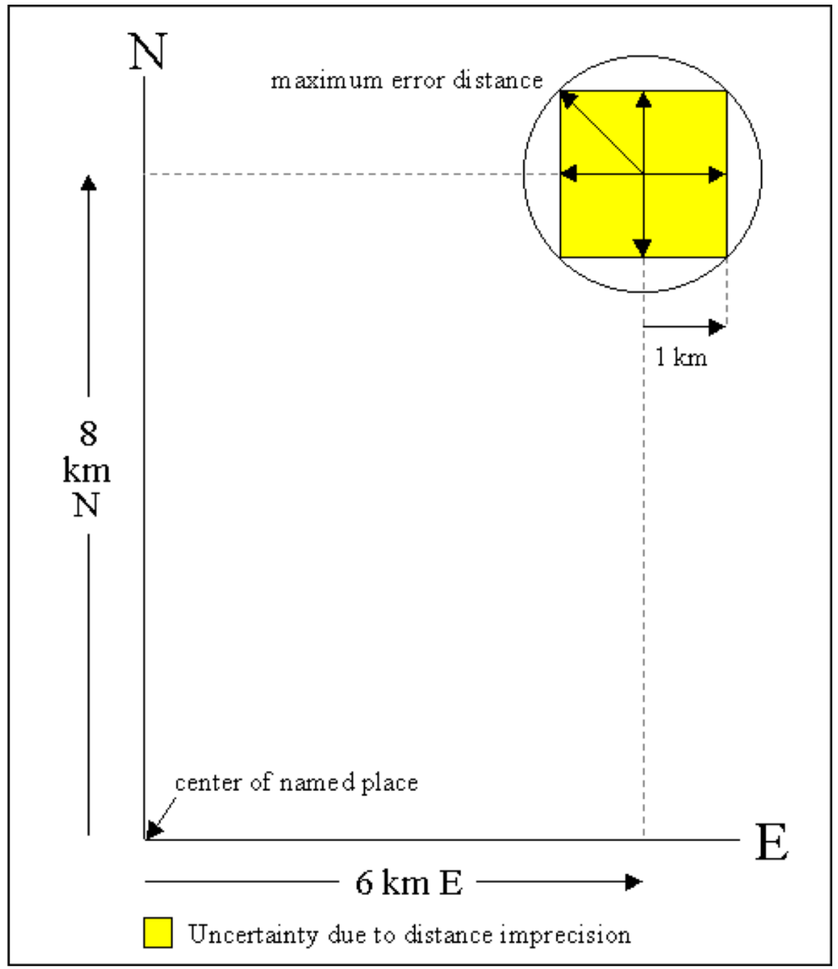


Error assuming NAD27 vs NAD83 or WGS84

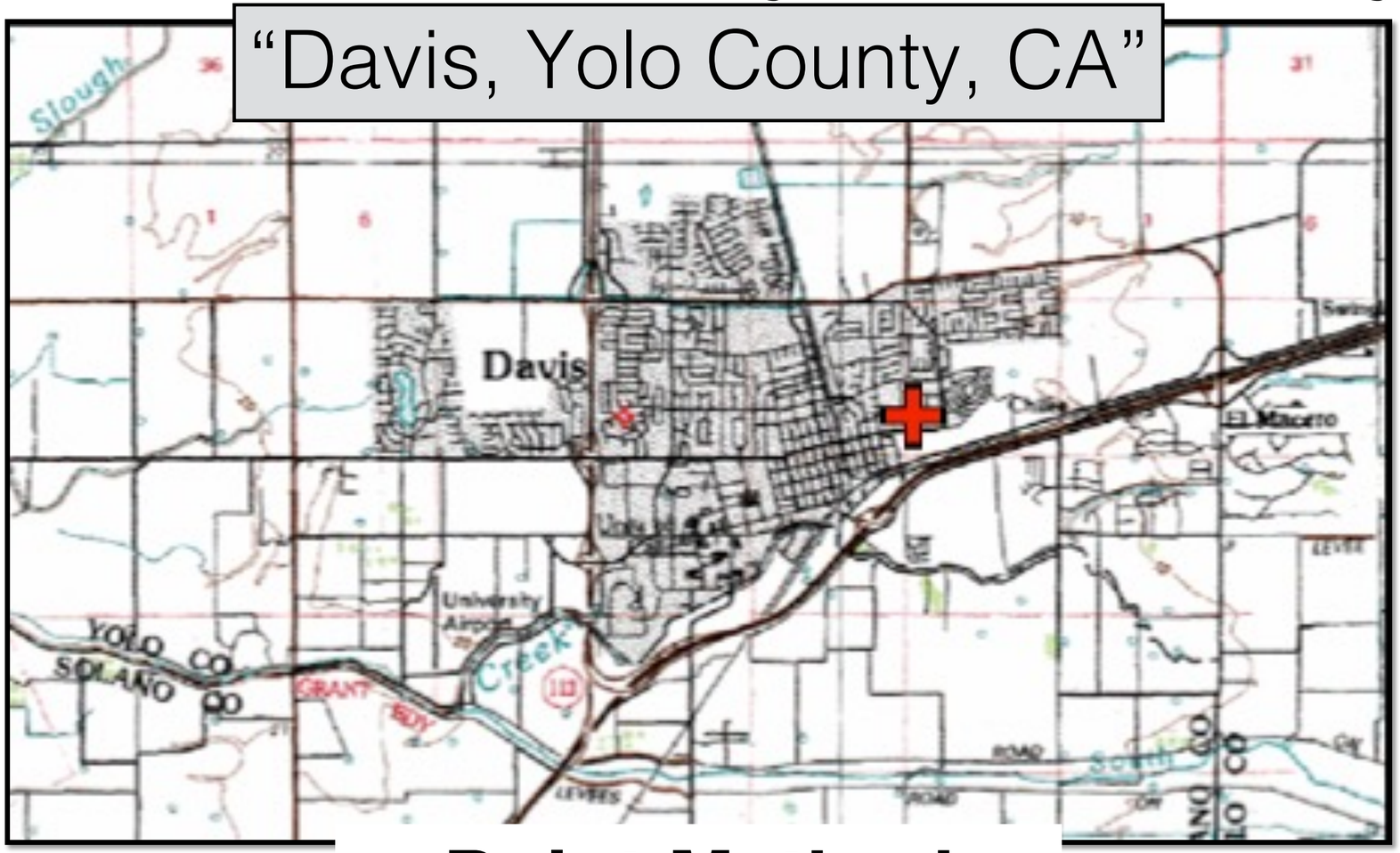
Direction and Distance measurement uncertainty



N > NE > ENE



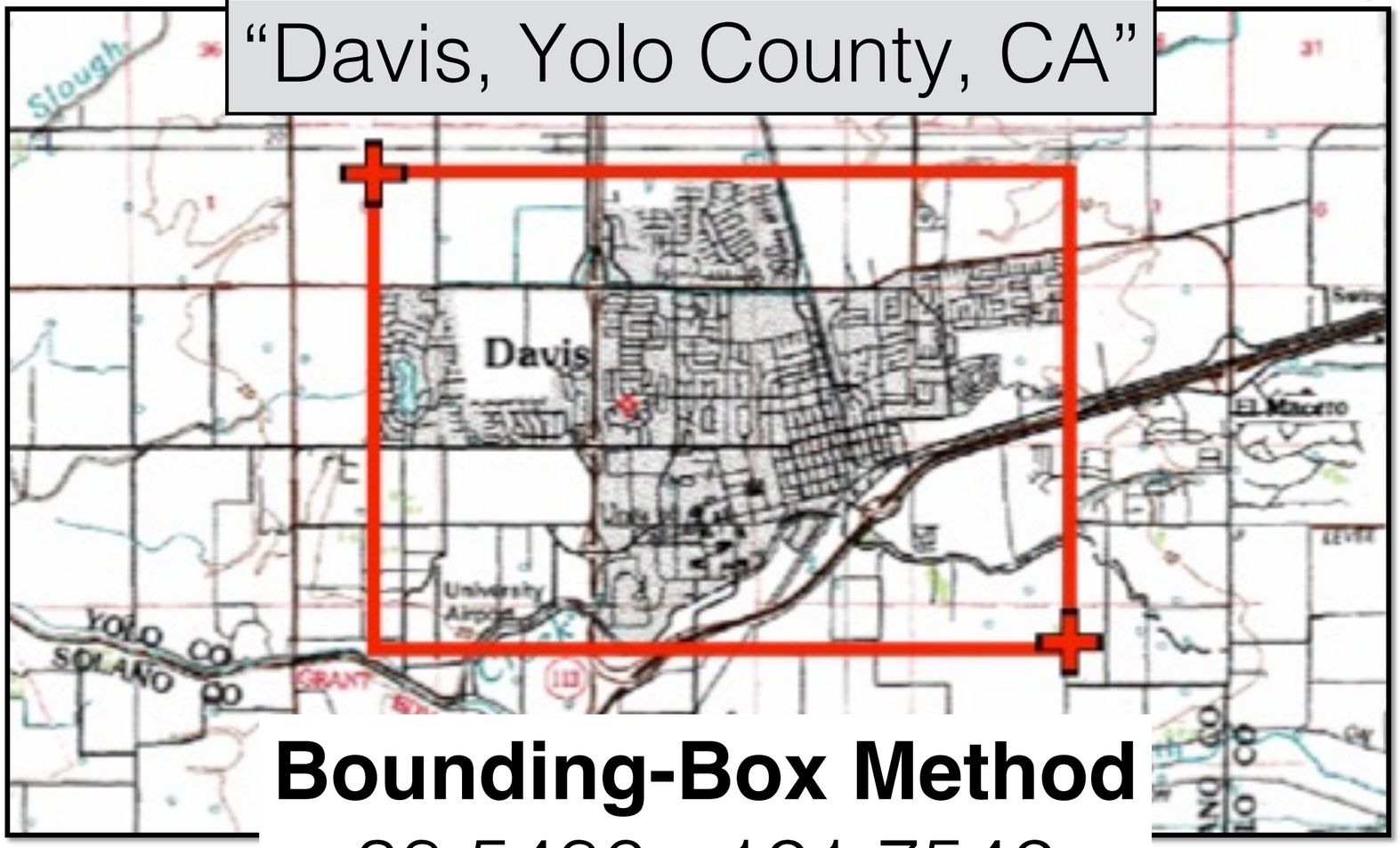
Extent of locality uncertainty



Point Method

38.5463, -121.7425

Extent of locality uncertainty

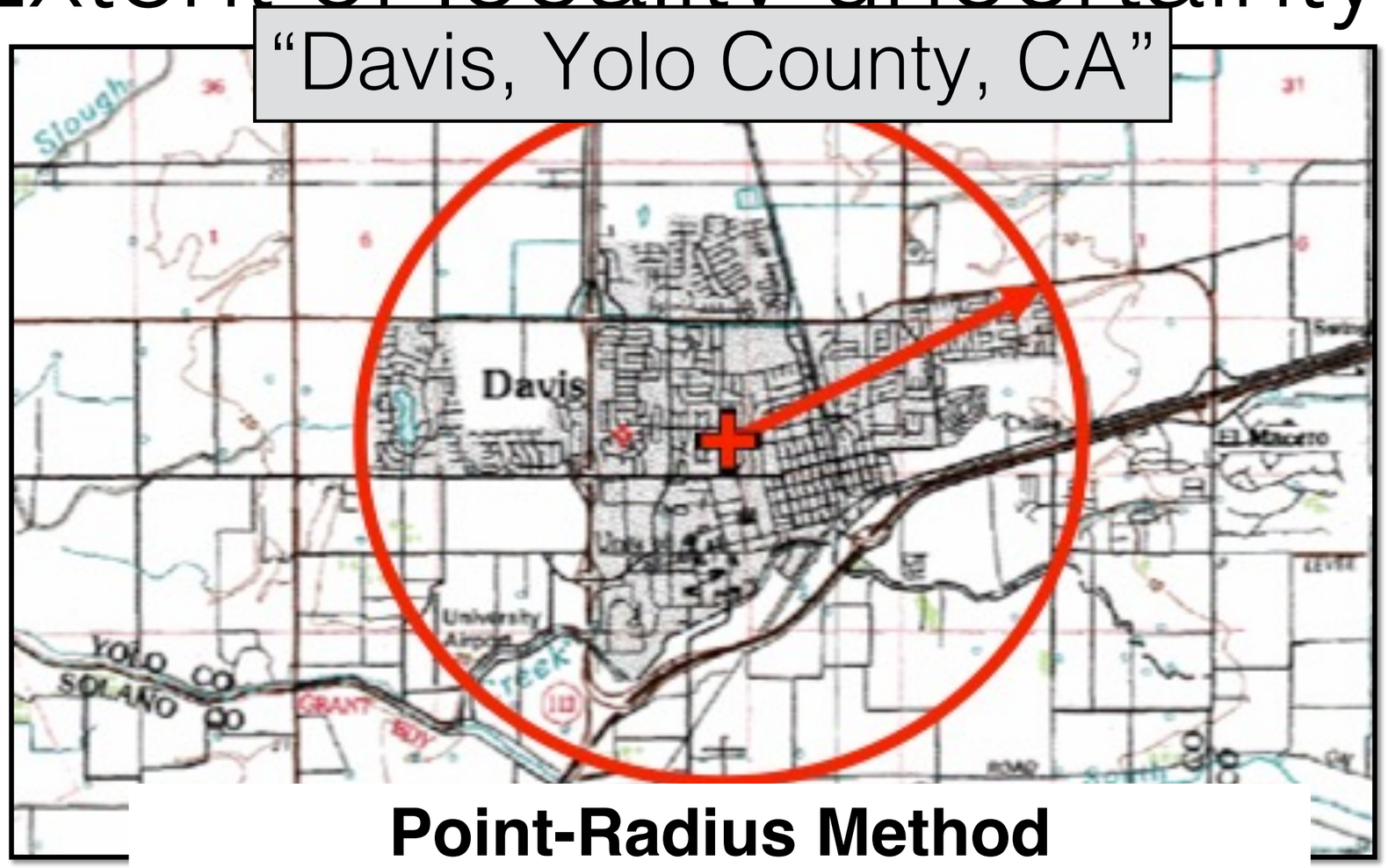


Bounding-Box Method

38.5486, -121.7542

38.545, -121.7394

Extent of locality uncertainty



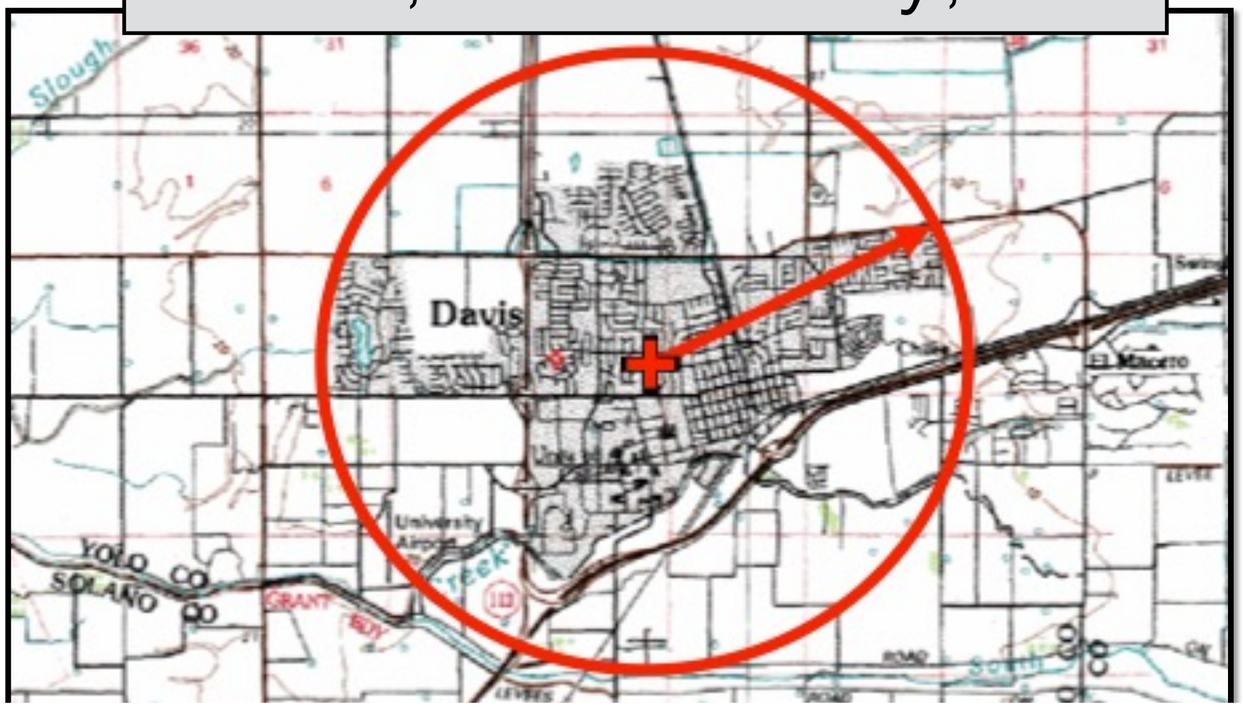
Point-Radius Method

38.5468, -121.7469

Uncertainty radius: 8325 meters

Extent of locality uncertainty

"Davis, Yolo County, CA"



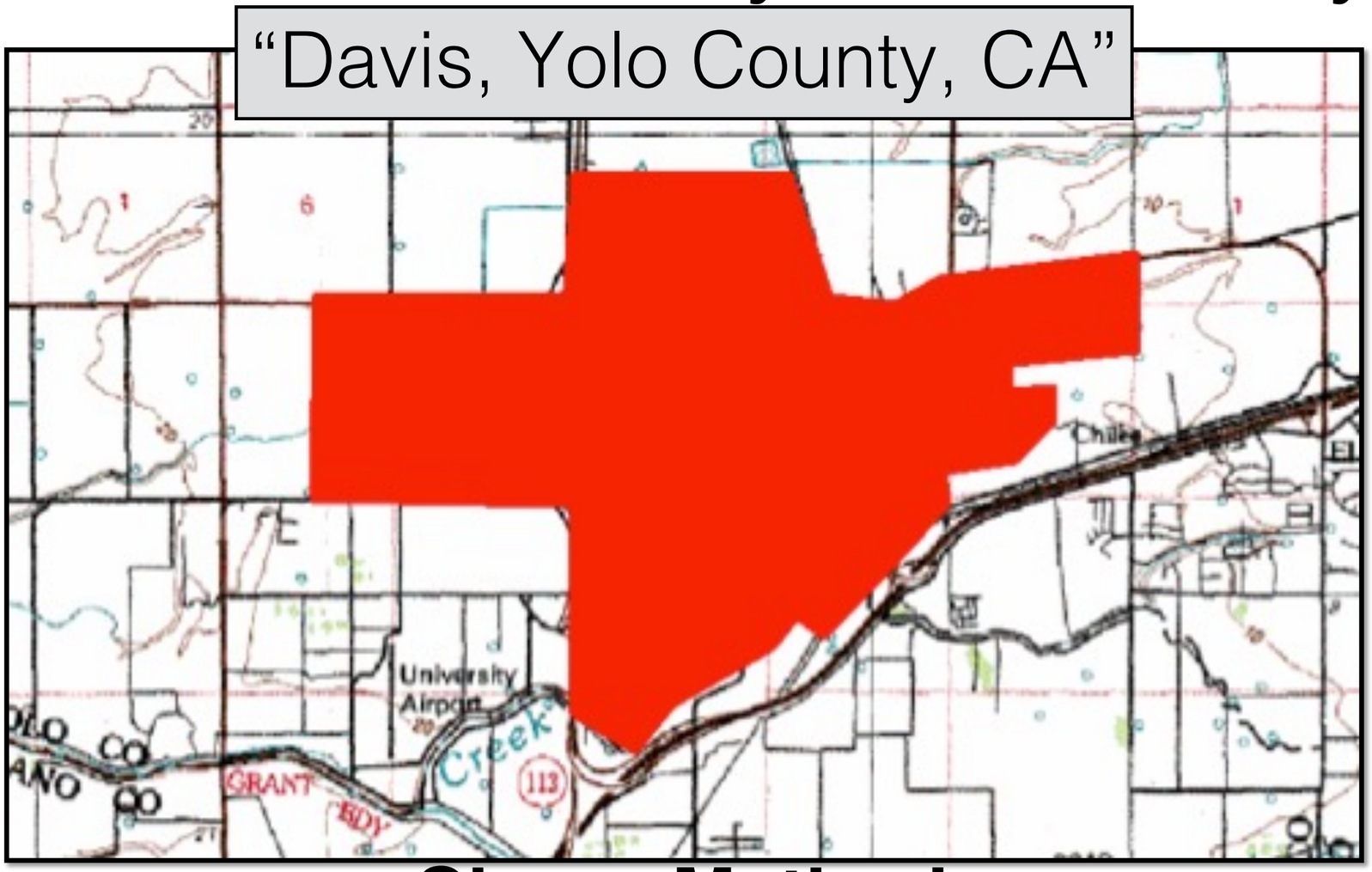
Point-Radius Method

38.5468, -121.7469

Uncertainty radius: 8325 meters

Note the uncertainty! If greater than the size of your variable layers, throw the locality away!

Extent of locality uncertainty



Shape Method

Sources of Uncertainty

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20° 30’ N 112° 36’ W

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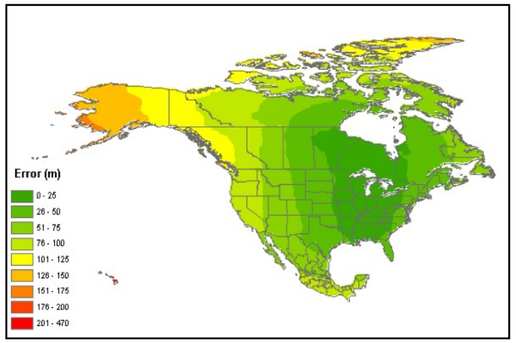
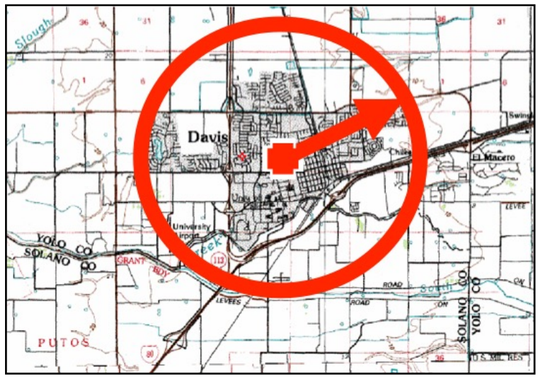




What is an ***ideal*** georeference?

What is an ***ideal*** georeference?

A numerical description of a place that can be mapped

What is an ***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

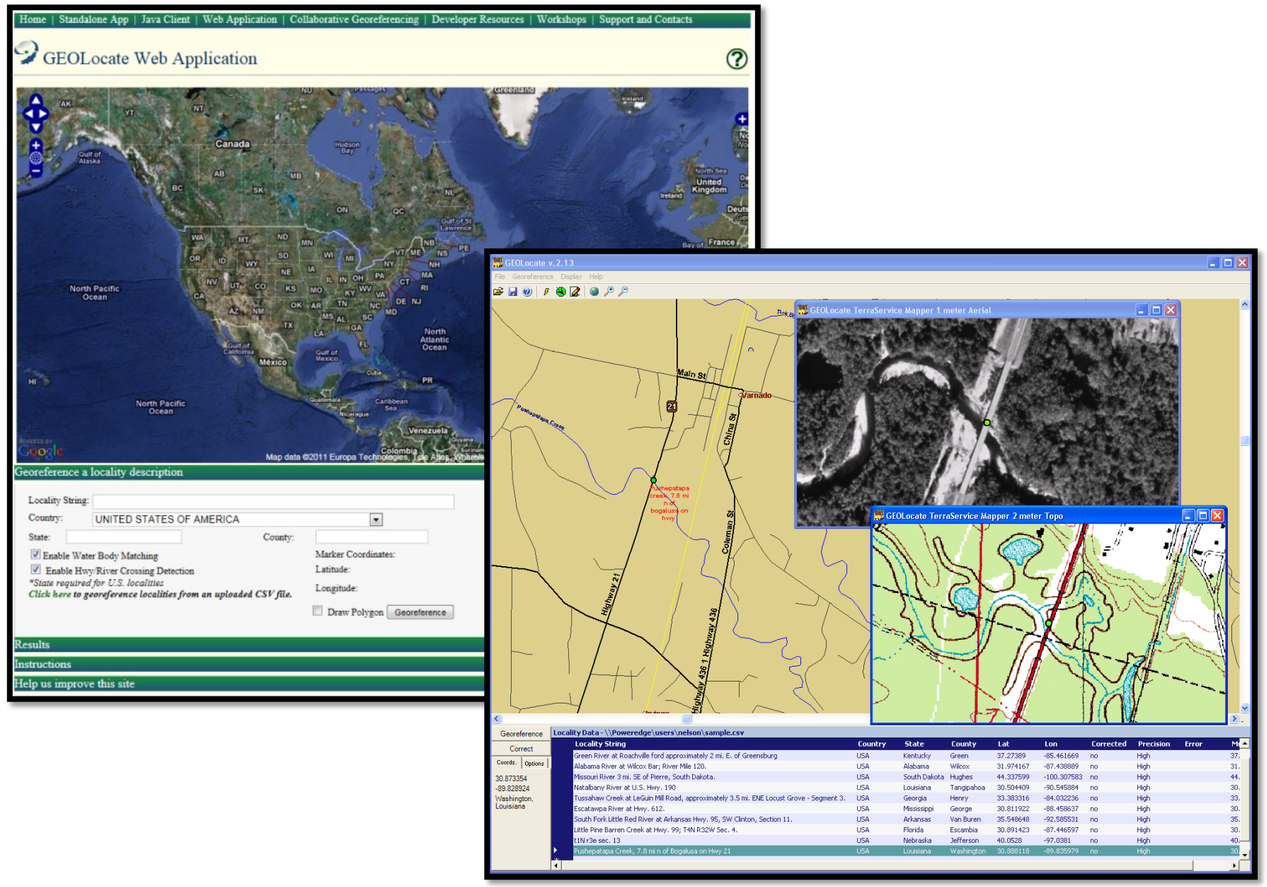
- Time-consuming
- Good quality paper maps may be hard to find

Internet Resources

GEOLocate

https://www.geo-locate.org/

- 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 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

3 **Manual Verification**

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…***

GeoLocate Workflow

Hom | Web Application | Collaborative Georeferencing | Developer Resources | Education & Outreach | Support and Contacts

GEOLocate

A Platform for Georeferencing Natural History Collections Data

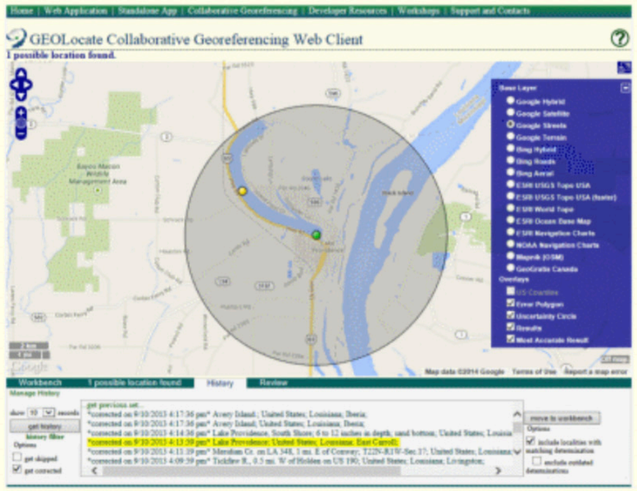
For Users:

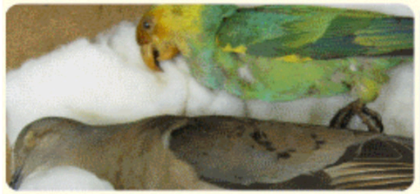
- Overview
- GEOLocate Web Clients
- Collaborative Georeferencing
- Education & Outreach

Brief overview (video) of the GEOLocate Project.

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 webservices.

Collaborative Georeferencing

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

GeoLocate Workflow

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Web Based Clients

The following based 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 GEOLocate.

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 you browser is configured to allow mixed 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

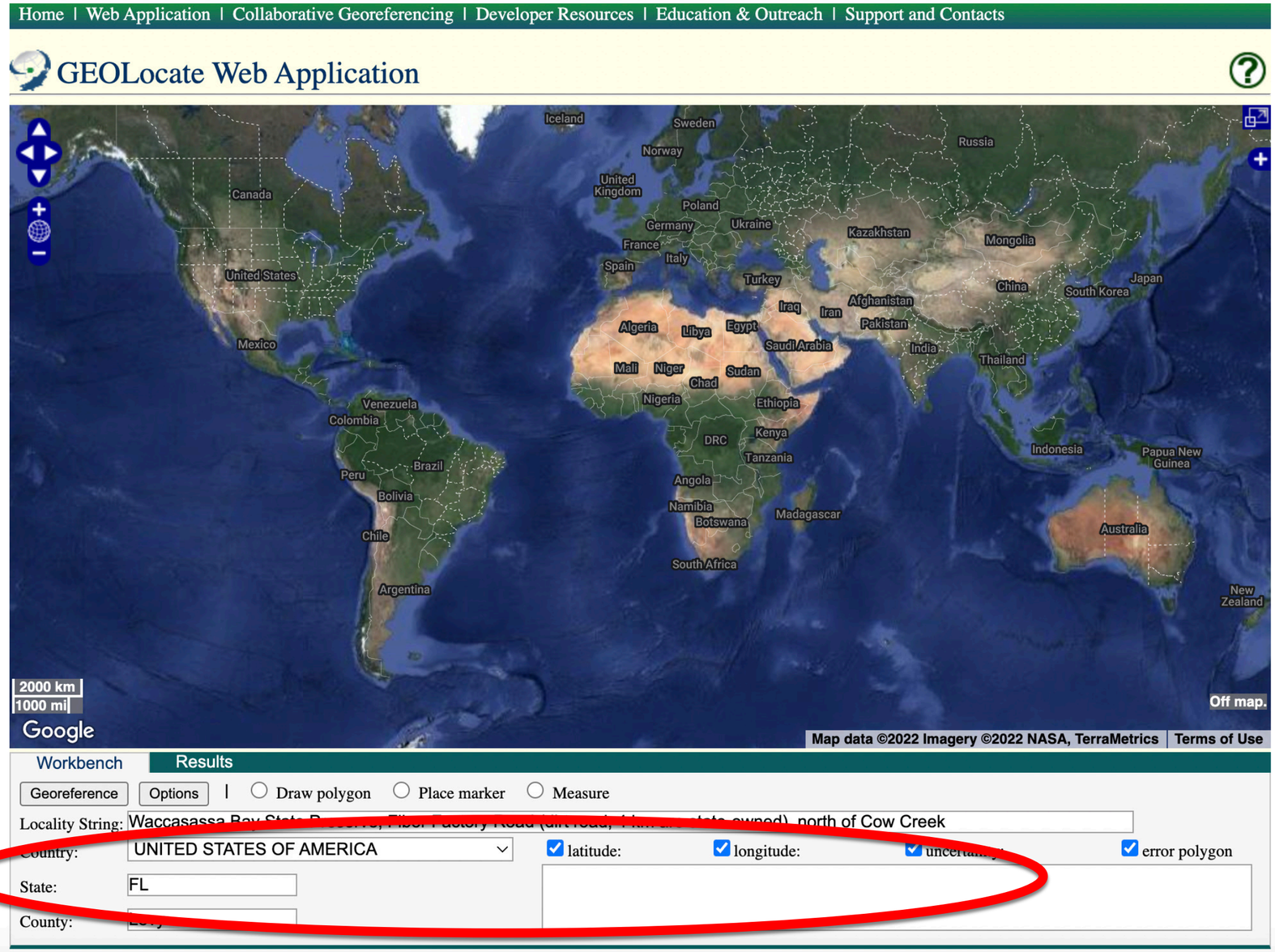
- A streamlined web client for the purpose of embedding in other web applications.
  Sample link demonstrating use this client.
  Documentation link on how to craft URLs for this client.

Other Clients:

- Arctos
- Specify
- Symbiota
- Tropicos

Know of any other web based clients using GEOLocate? Let us know and we will be happy to list them.

GeoLocate Workflow



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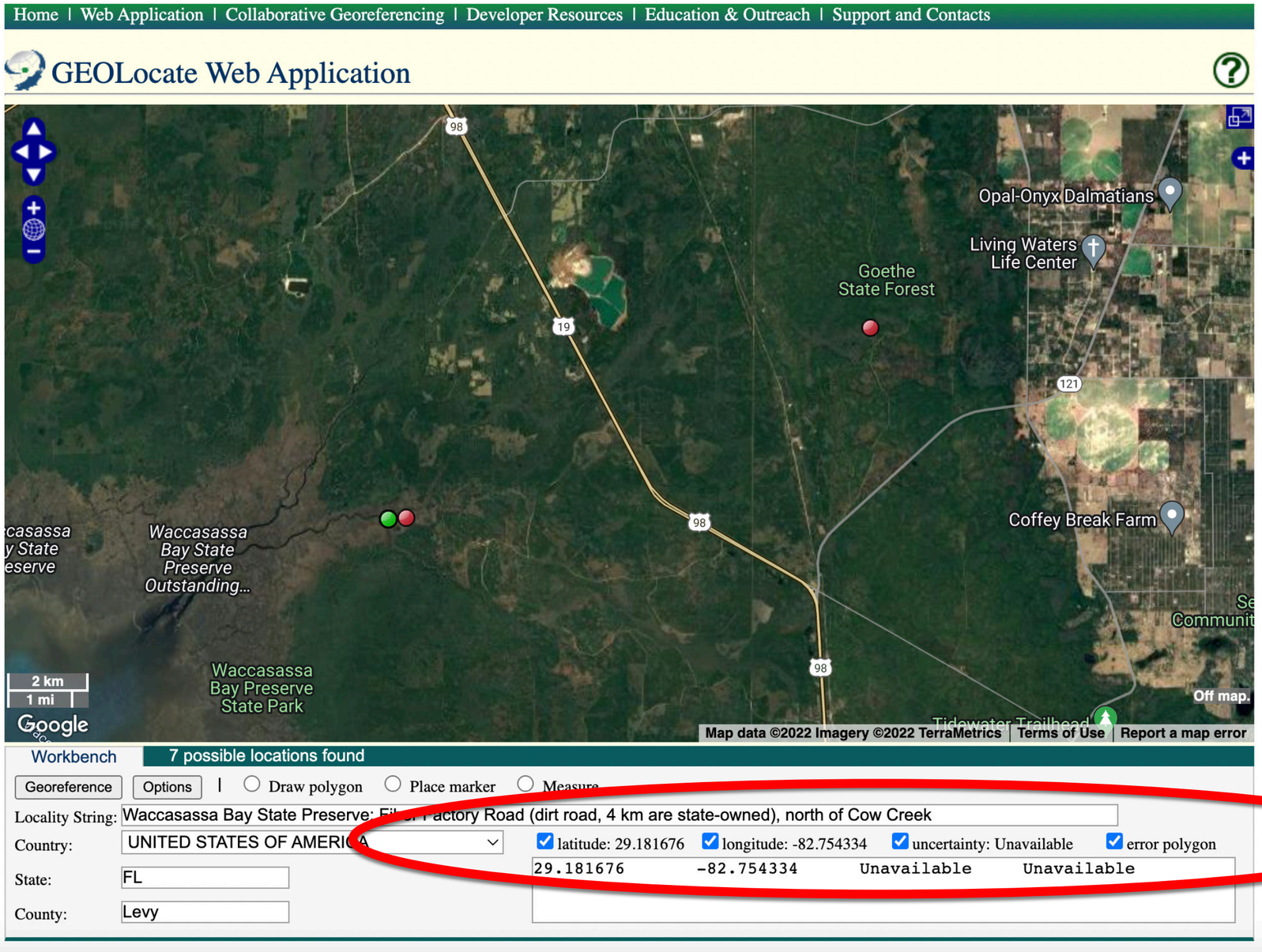


GEOLocate Web Application

Workbench | 7 possible locations found

Georeference | Options | Draw polygon | Place marker | Measure

Locality String: Waccasassa Bay State Preserve; Fiber Factory Road (dirt road, 4 km are state-owned), north of Cow Creek

Country: UNITED STATES OF AMERICA

State: FL

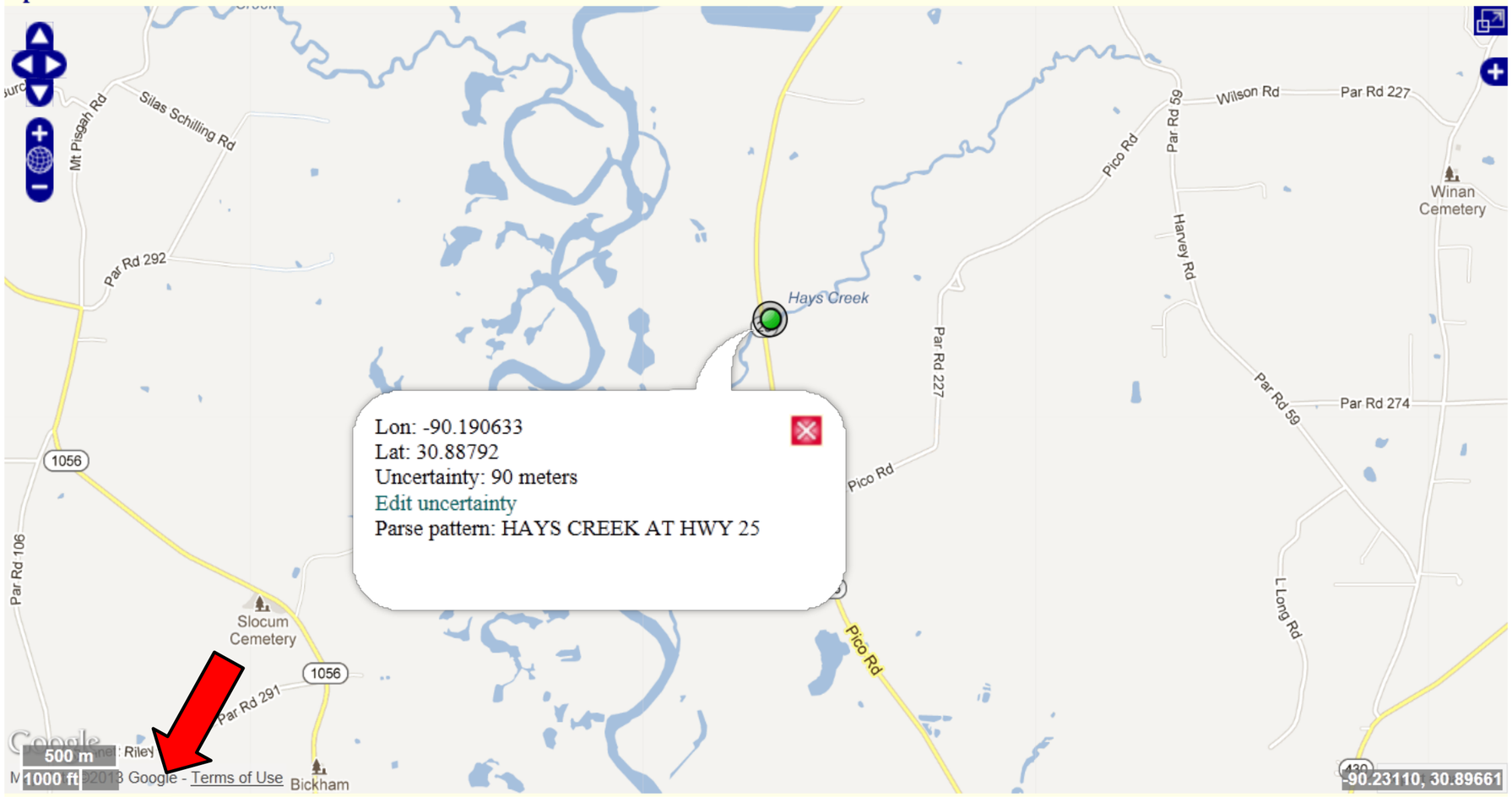
County: Levy

latitude: 29.181676 longitude: -82.754334 uncertainty: 210 m error polygon

```
29.181676       -82.754334       210       Unavailable
```

GEOLocate Web Application

1 possible location found.



Workbench | 1 possible location found

Georeference | Options | Draw polygon | Place marker | Measure

Locality String: Hays Creek, 3 mi. n of Franklinton on hwy. 25

Country: UNITED STATES OF AMERICA

State: La

County: Washington

latitude: 30.88792 | longitude: -90.190633 | uncertainty: 90 m | error polygon

30.88792	-90.190633	90	Unavailable

GEOLocate Web Application

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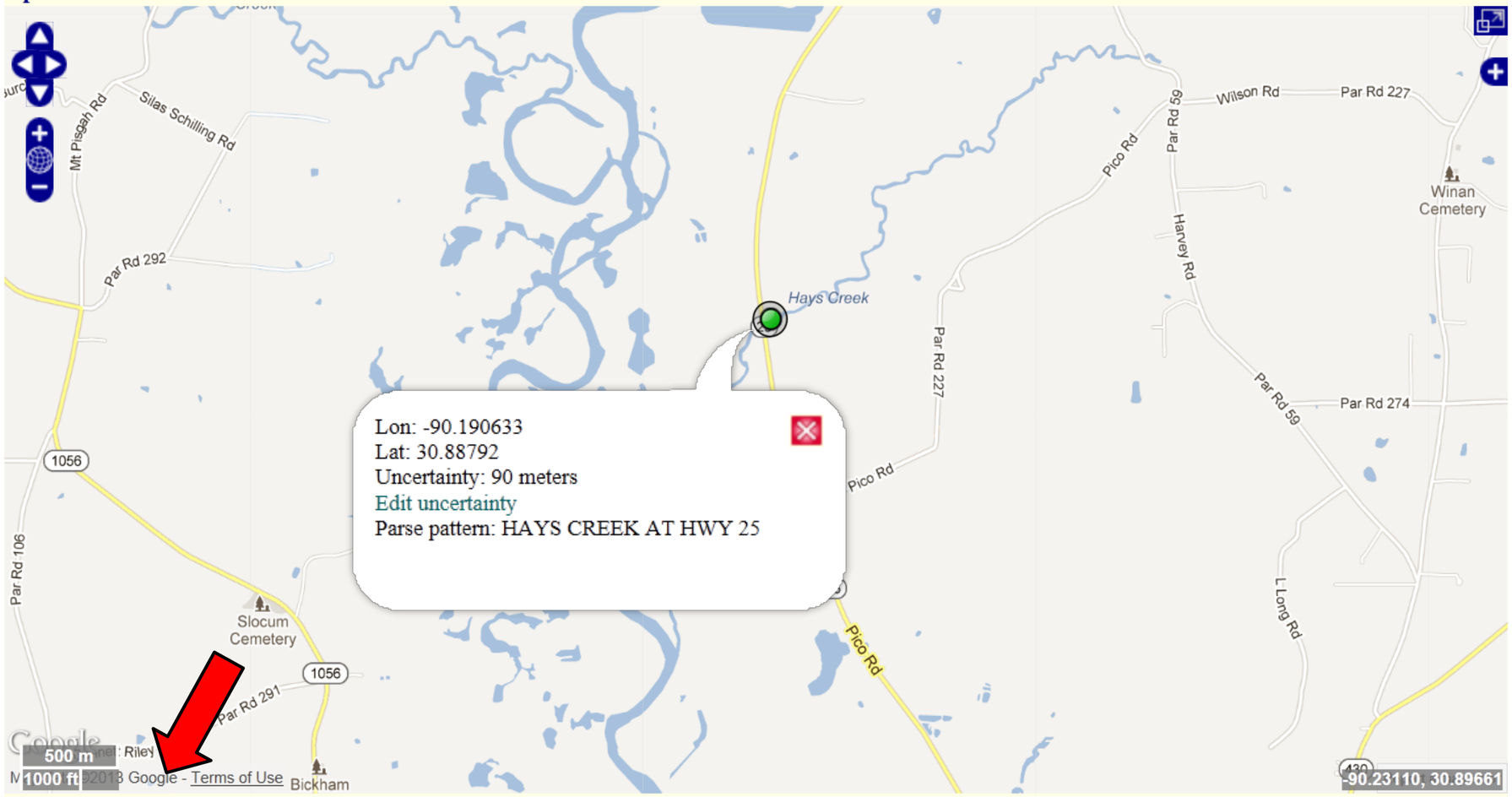

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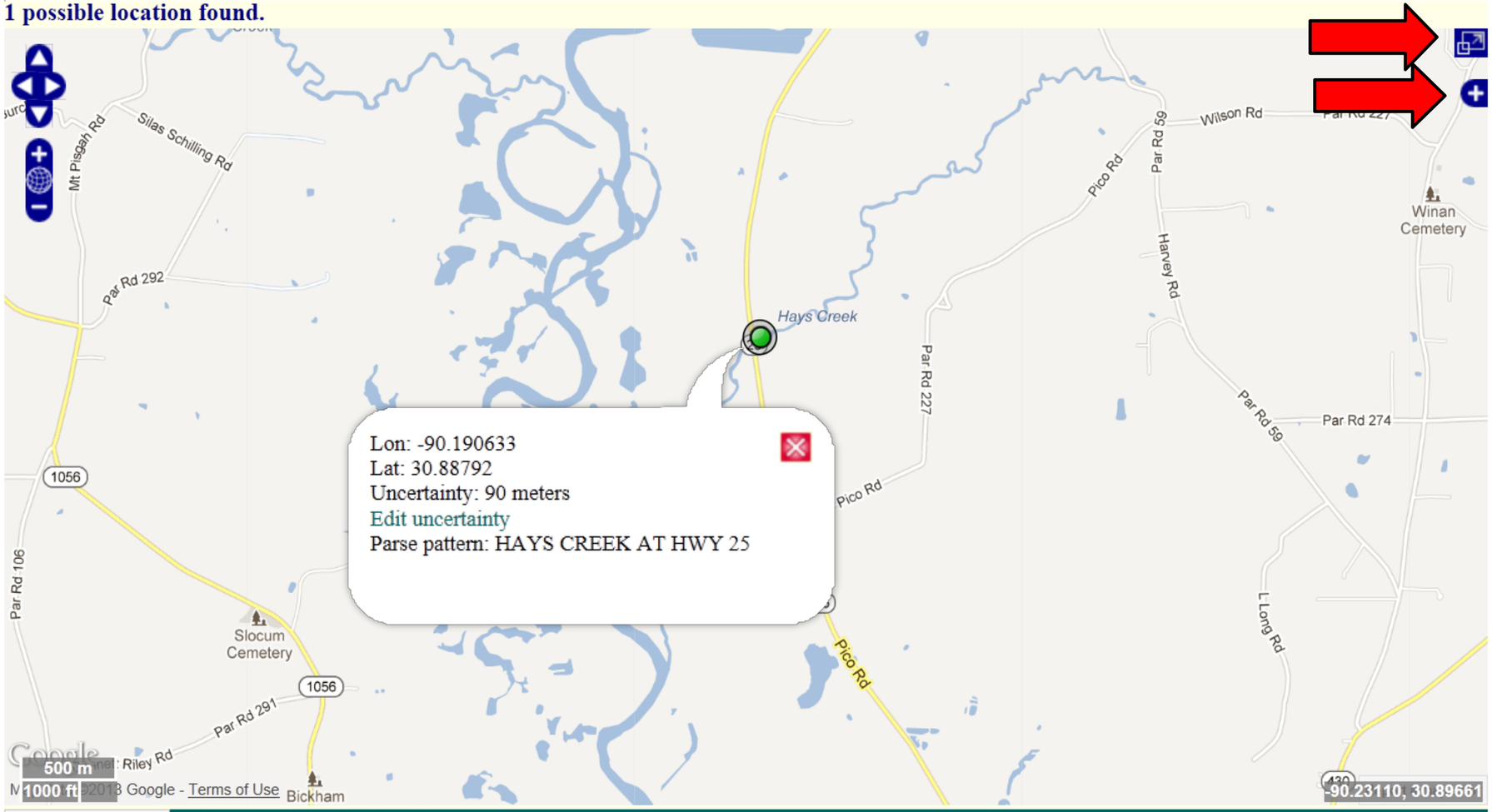

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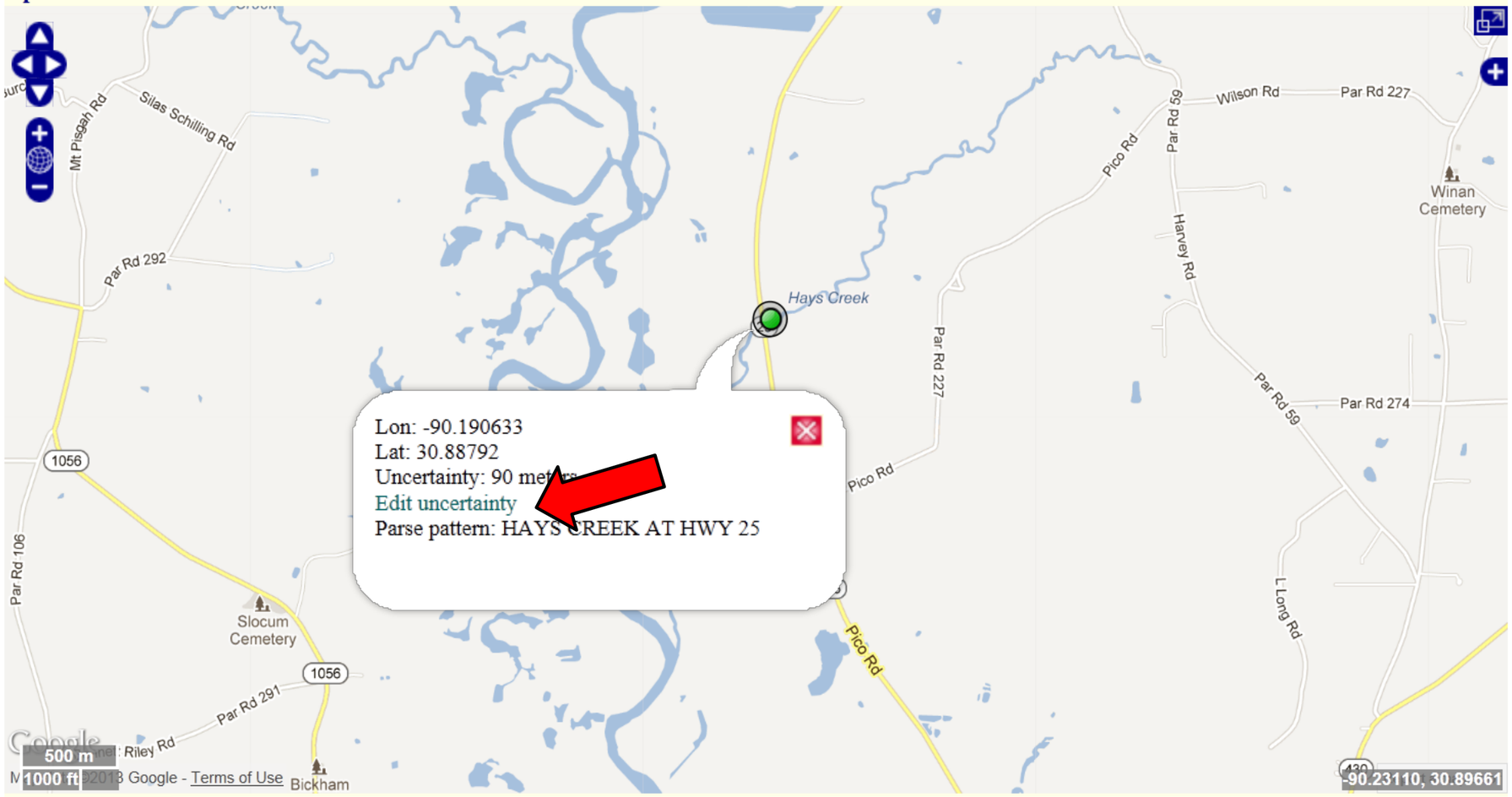

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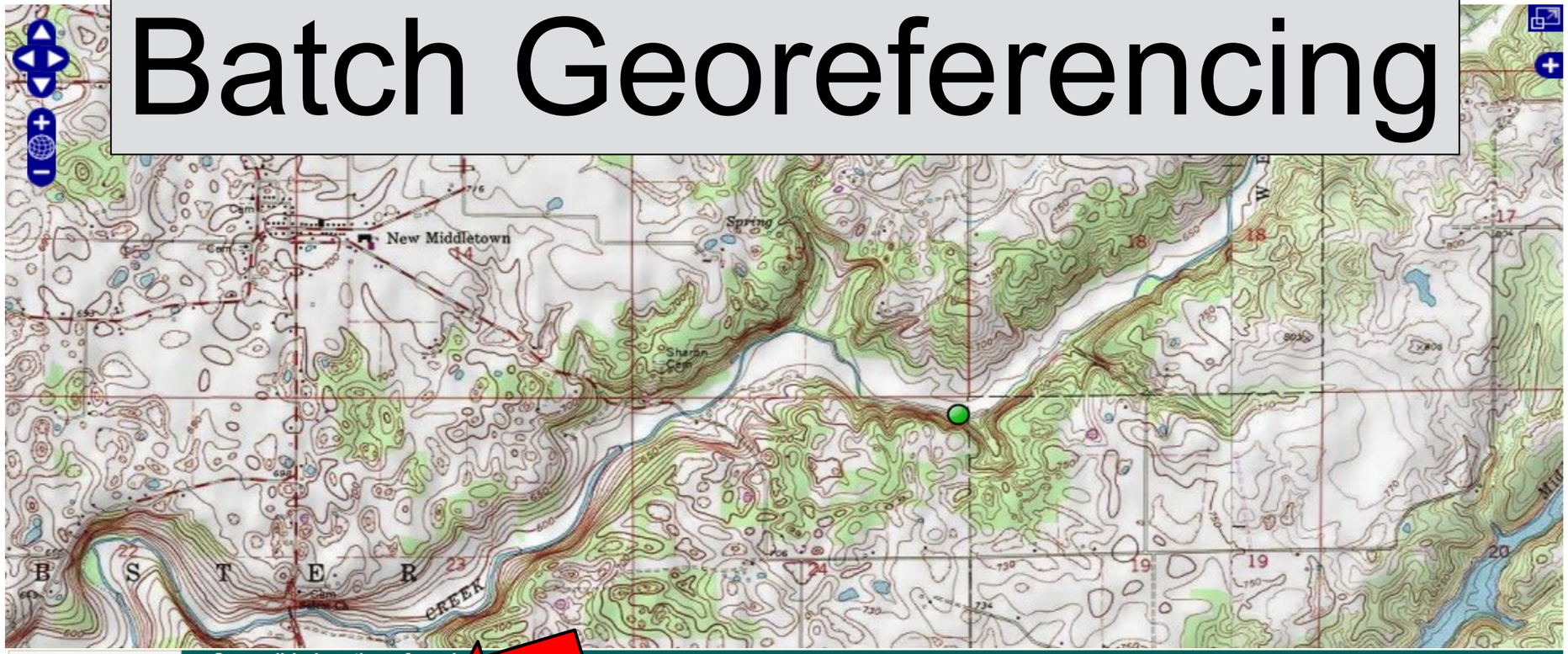


Workbench | 2 possible locations found

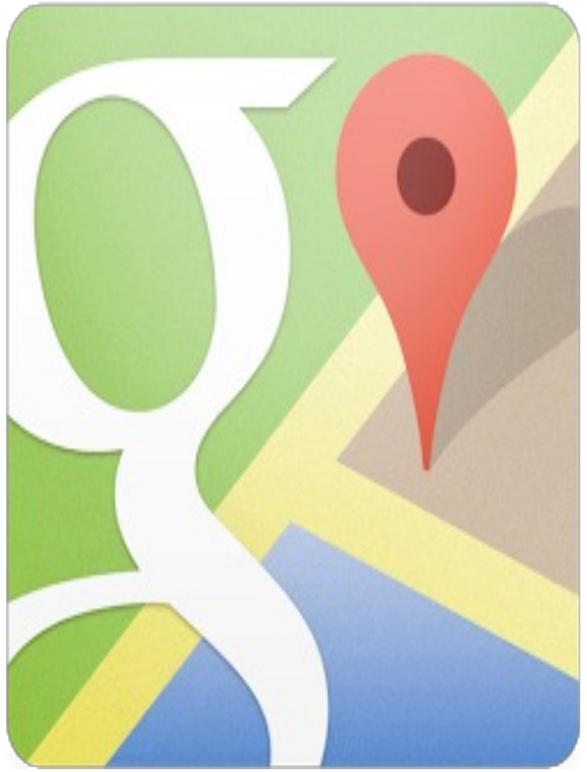
Show 8 records | Page Georeference | Georeference | Options | Correct | Draw polygon | Place marker | Measure

Locality	Country	StateProvince	County	Latitude	Longitude	Corrected	precision
Chambers Spring Road 2.5 km S of Hwy 412, 8.0 km E of Siloam Springs, T17N, R33W,	USA	Arkansas	Benton	36.188027	-94.451005	no	High(89)
Osage Creek, 1.0 mile N on gravel road to bridge crossing; gravel road jcts with	USA	Arkansas	Benton	36.189077	-94.395375	no	High(97)
Yocum Creek, near Oak Grove (Pass 11a), Sec. 30	USA	Arkansas	Carroll	36.454986	-93.322008	no	Low(35)
Village Creek State Park, S of driving range, Sec. 6	USA	Arkansas	Cross	35.16111	-90.70833	no	Low(39)
Sugar Creek, Hwy 163 at Bay Village, Sec. 4	USA	Arkansas	Cross	35.44909	-90.67533	no	High(100)
Buck Creek, 8.0 miles SE Corydon	USA	Indiana	Harrison	38.155118	-86.014724	no	High(88)
E Branch Mill Creek, Hessdale Road, 4.0 km S of Allendorph, Sec. 36	USA	Kansas	Wabaunsee	39.003564	-96.277745	no	High(88)
Blissdale Creek, Hillside National Wildlife Refuge, 500 m SW of Blissdale on Blis	USA	Mississippi	Holmes	33.083754	-90.224633	no	High(84)

Search: | File management | ...loxinus_erythrogaster_Locations_MMN... | Showing 1 to 8 of 44 records

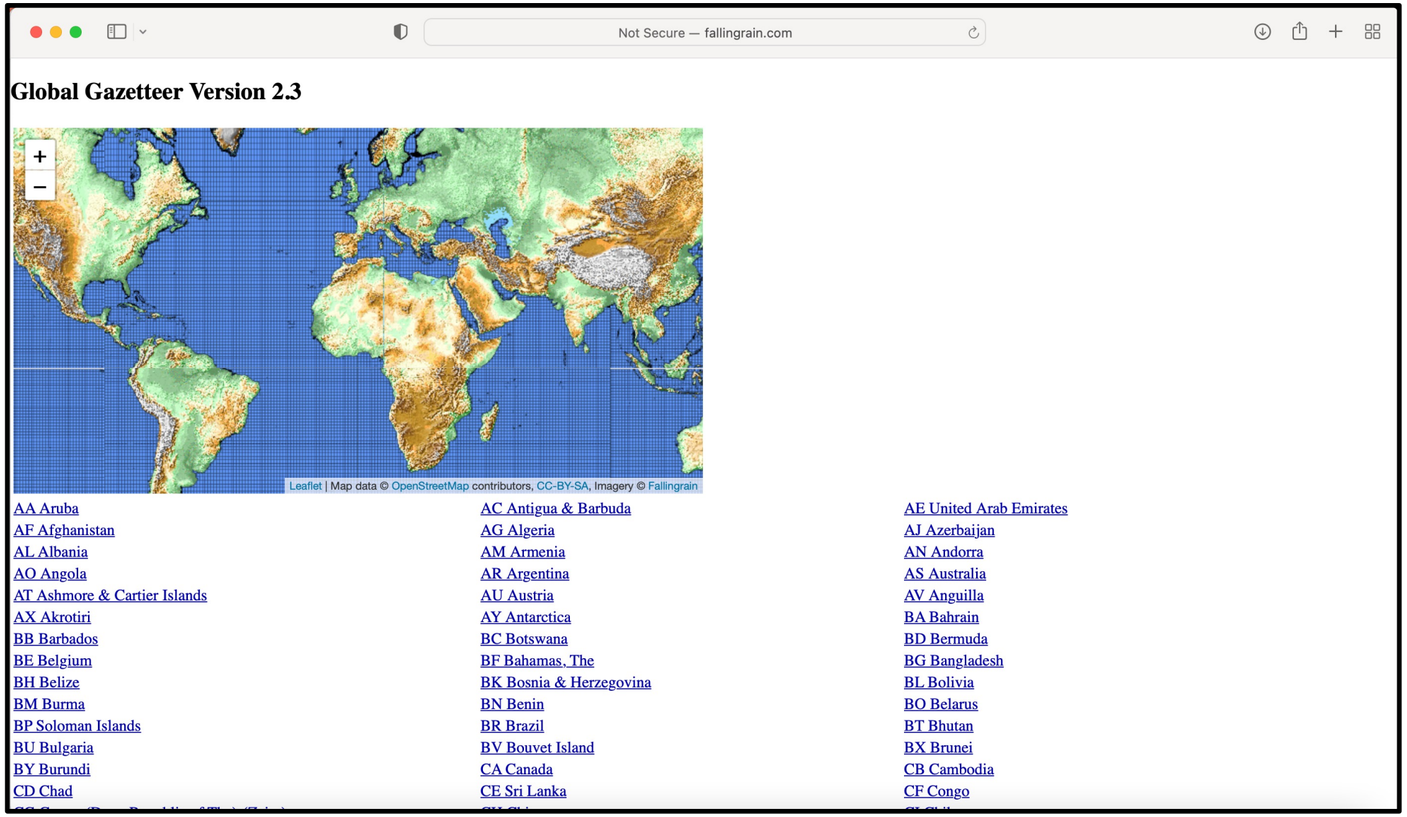
Google Maps

- **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



Falling Rain

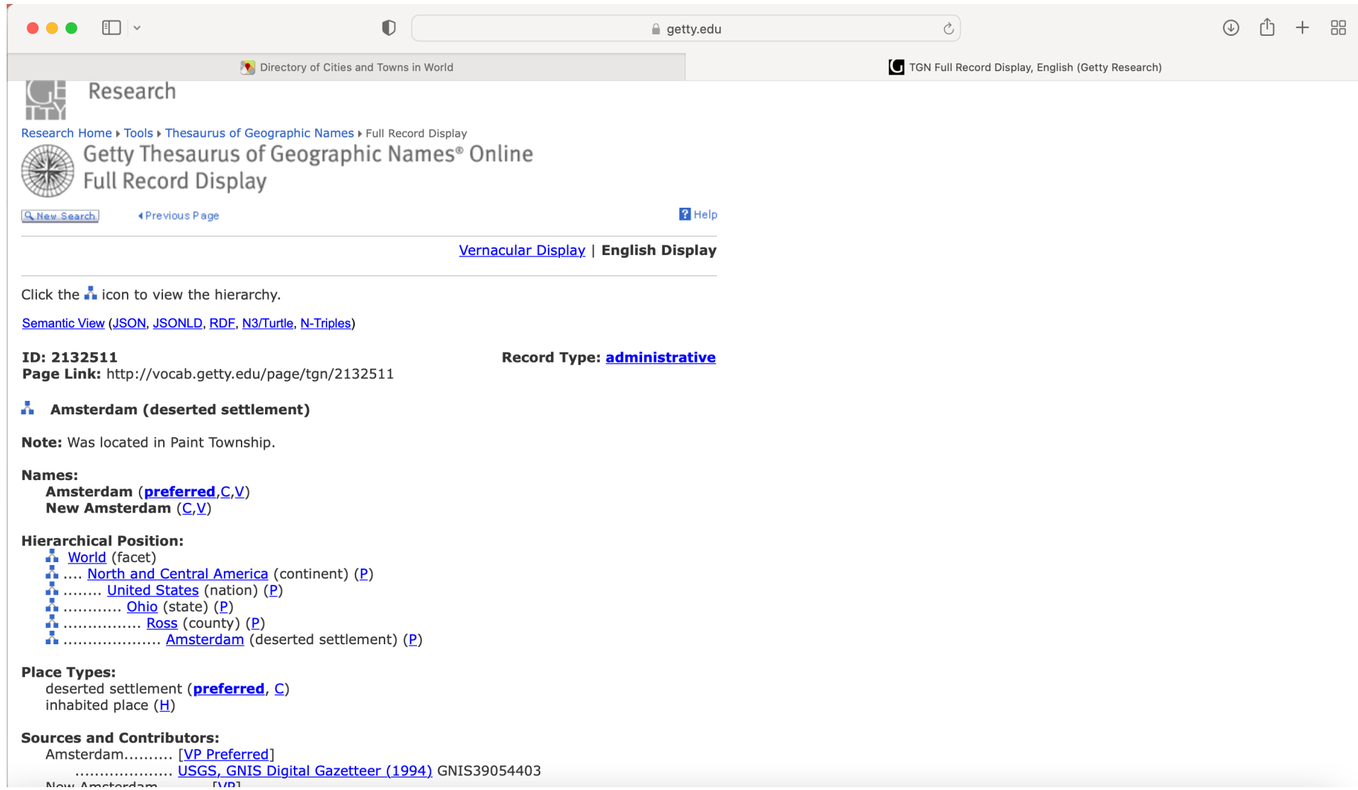
- Worldwide gazetteer for cities and towns
- Great for **hard to find localities, especially outside US**
  - No search
  - Provides hierarchy, alternative names, altitude, weather information, and location of nearby towns
  - Example: Qaryeh-ye Gol'alam, Velayat-e Lowgar, AF



www.fallingrain.com

Getty Thesaurus of Geographic Names (TGN)

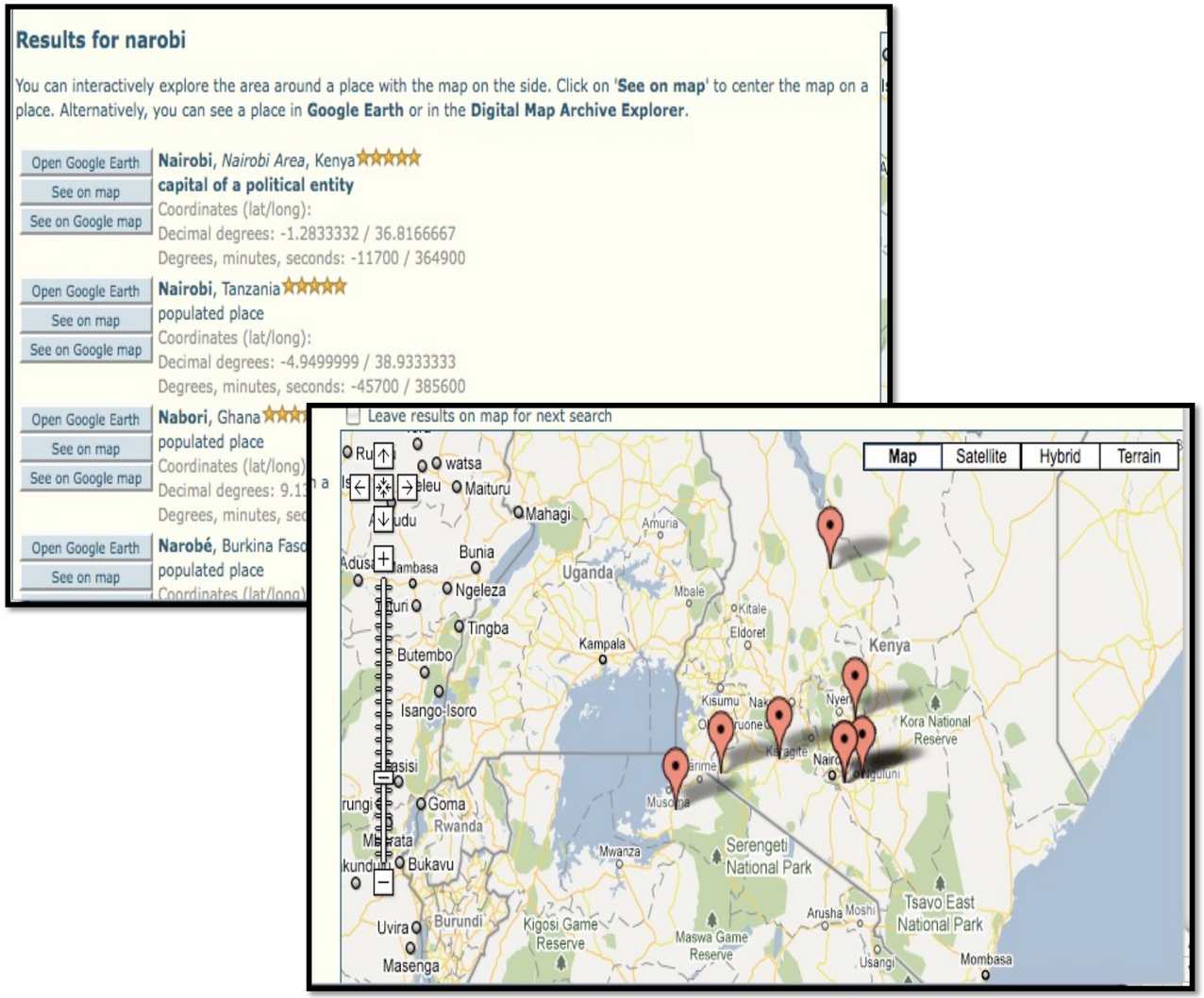
- Worldwide gazetteer by The Getty
- Useful for **alternative and old names**
  - Feature types
  - Geographical hierarchy
  - **Degrees-minutes**, not coordinates
    - Use recent name and search in Google Maps
  - Example: New Amsterdam, US



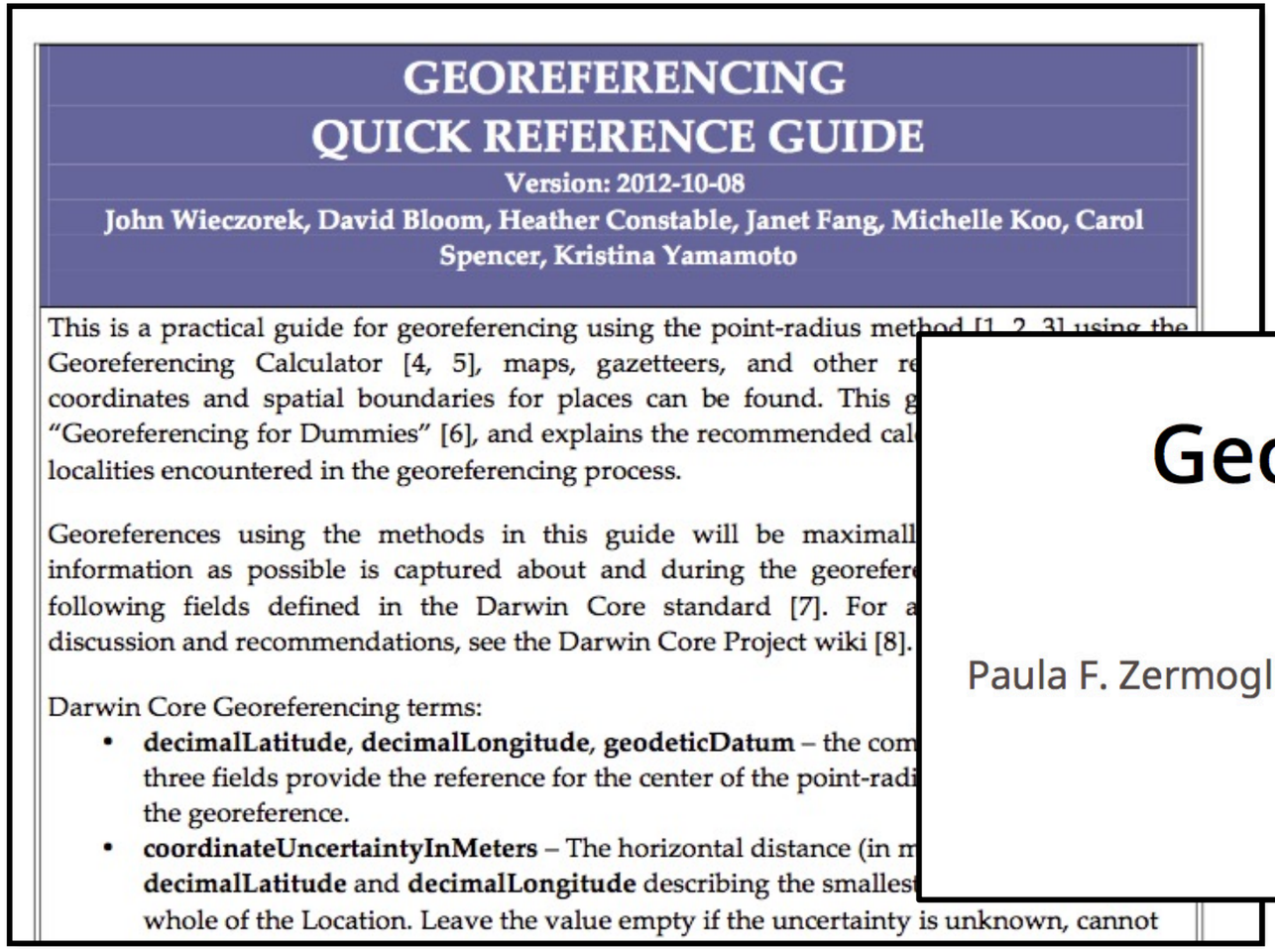
http://bit.ly/Getty-TGN

FuzzyG- JRC Fuzzy Gazetteer

- Worldwide gazetteer designed for **bad spelling**
- Critical for translating between languages
- Useful for finding **alternative, doubtful spelling, and old names**
  - Feature types, by continent
  - Degree-minutes, not coordinates
- Example: Narobi instead of Nairobi, Africa



Georeferencing
Quick Reference Guide



GEOREFERENCING
QUICK REFERENCE GUIDE

Version: 2012-10-08

John Wieczorek, David Bloom, Heather Constable, Janet Fang, Michelle Koo, Carol Spencer, Kristina Yamamoto

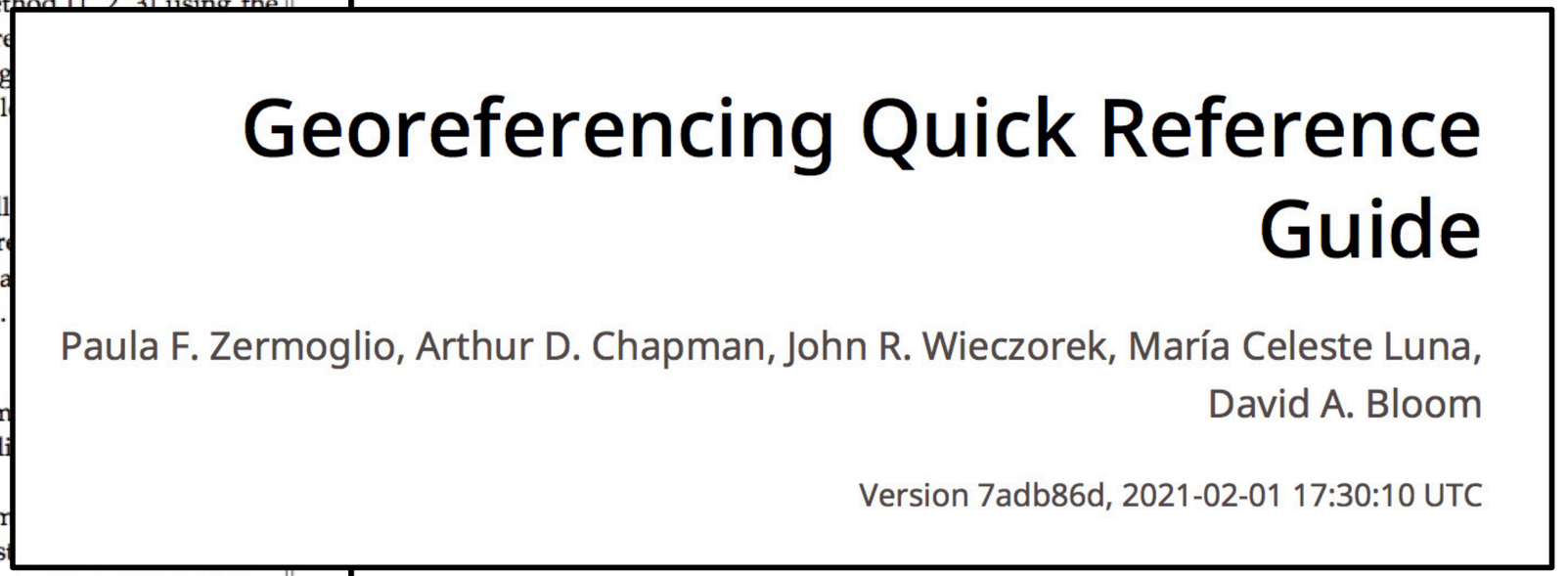
This is a practical guide for georeferencing using the point-radius method [1, 2, 3] using the Georeferencing Calculator [4, 5], maps, gazetteers, and other re coordinates and spatial boundaries for places can be found. This g "Georeferencing for Dummies" [6], and explains the recommended cal localities encountered in the georeferencing process.

Georeferences using the methods in this guide will be maximall information as possible is captured about and during the georefere following fields defined in the Darwin Core standard [7]. For a discussion and recommendations, see the Darwin Core Project wiki [8].

Darwin Core Georeferencing terms:

- **decimalLatitude**, **decimalLongitude**, **geodeticDatum** – the com three fields provide the reference for the center of the point-radi the georeference.
- **coordinateUncertaintyInMeters** – The horizontal distance (in m **decimalLatitude** and **decimalLongitude** describing the smallest whole of the Location. Leave the value empty if the uncertainty is unknown, cannot

https://docs.gbif.org/georeferencing-quick-reference-guide/1.0/en/



Georeferencing Quick Reference Guide

Paula F. Zermoglio, Arthur D. Chapman, John R. Wieczorek, María Celeste Luna, David A. Bloom

Version 7adb86d, 2021-02-01 17:30:10 UTC

Other Tools: Visualizing Data

GPS Visualizer

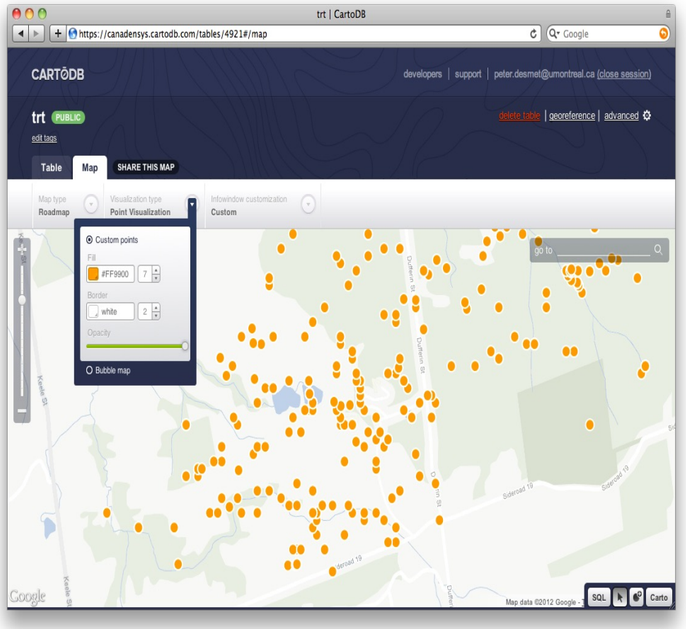
- Use to translate a file with coordinates into kml or a map

Carto

- Online geospatial database
- Drag and drop CSV upload
- Easy customization of map
- Share and embed map
- Powerful development tools

GPS Visualizer

http://www.gpsvisualizer.com/



Links with links

iDigBio
Integrated Digitized Biocollections

https://www.idigbio.org/wiki/index.php/Georeferencing

http://herpnet.org/Gazetteer/GeorefResources.htm

GEOLocate Practice

- Instruction sheet

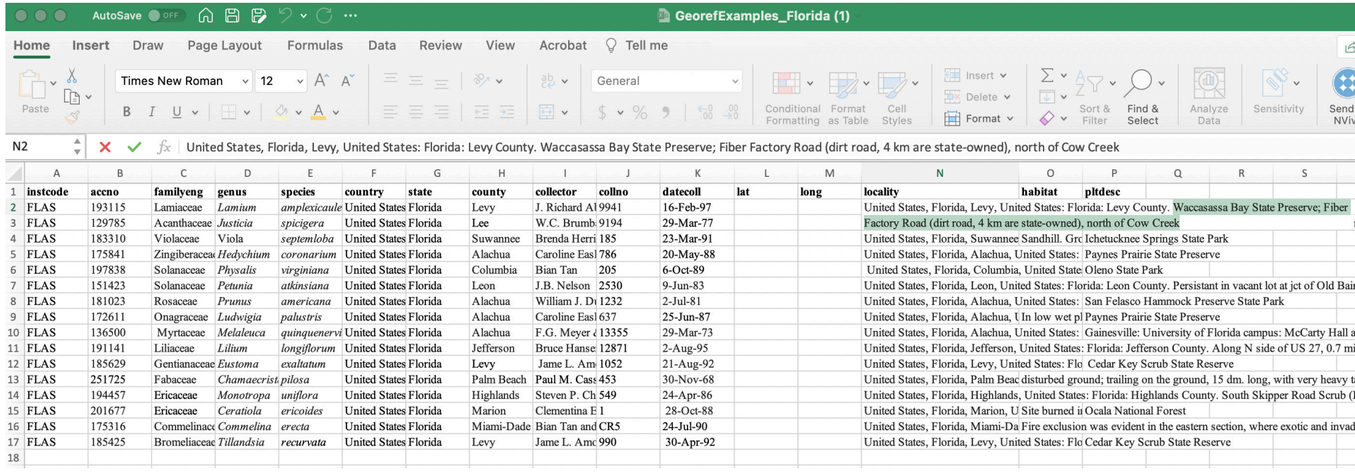
Georeferencing Demo

Resources:

GeoLocate: http://www.museum.tulane.edu/geolocate/web/default.html
GeoLocate – Web application: http://www.geo-locate.org/web/WebGeoref.aspx
Google Maps: https://www.google.com/maps
Falling Rain: http://www.fallingrain.com
Getty Thesaurus of Geographic Names (TGN): http://bit.ly/Getty-TGN
Fuzzy Gazetteer: http://dma.jrc.it/services/fuzzyg/

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.

- Excel sheet with localities



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	instcode	accno	familyeng	genus	species	country	state	county	collector	collno	datecoll	lat	long	locality	habitat	pltdesc			
2	FLAS	193115	Lamiaceae	*Lamium*	*amplexicaule*	United States	Florida	Levy	J. Richard Al	9941	16-Feb-97			United States, Florida, Levy, United States: Florida: Levy County. Waccasassa Bay State Preserve; Fiber					
3	FLAS	129785	Acanthaceae	*Justicia*	*spicigera*	United States	Florida	Lee	W.C. Brumb	9194	29-Mar-77			Factory Road (dirt road, 4 km are state-owned), north of Cow Creek					
4	FLAS	183310	Violaceae	Viola	*septemloba*	United States	Florida	Suwannee	Brenda Herri	185	23-Mar-91			United States, Florida, Suwannee Sandhill. Grc	Ichetucknee Springs State Park				
5	FLAS	175841	Zingiberaceae	*Hedychium*	*coronarium*	United States	Florida	Alachua	Caroline Eas	786	20-May-88			United States, Florida, Alachua, United States:	Paynes Prairie State Preserve				
6	FLAS	197838	Solanaceae	*Physalis*	*virginiana*	United States	Florida	Columbia	Bian Tan	205	6-Oct-89			United States, Florida, Columbia, United State	Oleno State Park				
7	FLAS	151423	Solanaceae	*Petunia*	*atkinsiana*	United States	Florida	Leon	J.B. Nelson	2530	9-Jun-83			United States, Florida, Leon, United States: Florida: Leon County. Persistant in vacant lot at jct of Old Bain					
8	FLAS	181023	Rosaceae	*Prunus*	*americana*	United States	Florida	Alachua	William J. Di	1232	2-Jul-81			United States, Florida, Alachua, United States:	San Felasco Hammock Preserve State Park				
9	FLAS	172611	Onagraceae	*Ludwigia*	*palustris*	United States	Florida	Alachua	Caroline Eas	637	25-Jun-87			United States, Florida, Alachua, U In low wet pl	Paynes Prairie State Preserve				
10	FLAS	136500	Myrtaceae	*Melaleuca*	*quinquenervi*	United States	Florida	Alachua	F.G. Meyer &	13355	29-Mar-73			United States, Florida, Alachua, United States:	Gainesville: University of Florida campus: McCarty Hall a				
11	FLAS	191141	Liliaceae	*Lilium*	*longiflorum*	United States	Florida	Jefferson	Bruce Hanse	12871	2-Aug-95			United States, Florida, Jefferson, United States: Florida: Jefferson County. Along N side of US 27, 0.7 mi					
12	FLAS	185629	Gentianaceae	*Eustoma*	*exaltatum*	United States	Florida	Levy	Jame L. Am	1052	21-Aug-92			United States, Florida, Levy, United States: Flo	Cedar Key Scrub State Reserve				
13	FLAS	251725	Fabaceae	*Chamaecrist*	*pilosa*	United States	Florida	Palm Beach	Paul M. Cass	453	30-Nov-68			United States, Florida, Palm Beac disturbed ground; trailing on the ground, 15 dm. long, with very heavy t					
14	FLAS	194457	Ericaceae	*Monotropa*	*uniflora*	United States	Florida	Highlands	Steven P. Ch	549	24-Apr-86			United States, Florida, Highlands, United States: Florida: Highlands County. South Skipper Road Scrub (					
15	FLAS	201677	Ericaceae	*Ceratiola*	*ericoides*	United States	Florida	Marion	Clementina E	1	28-Oct-88			United States, Florida, Marion, U Site burned in	Ocala National Forest				
16	FLAS	175316	Commelinaceae	*Commelina*	*erecta*	United States	Florida	Miami-Dade	Bian Tan and	CR5	24-Jul-90			United States, Florida, Miami-Da Fire exclusion was evident in the eastern section, where exotic and invad					
17	FLAS	185425	Bromeliaceae	*Tillandsia*	*recurvata*	United States	Florida	Levy	Jame L. Amo	990	30-Apr-92			United States, Florida, Levy, United States: Flo	Cedar Key Scrub State Reserve				
18																			