



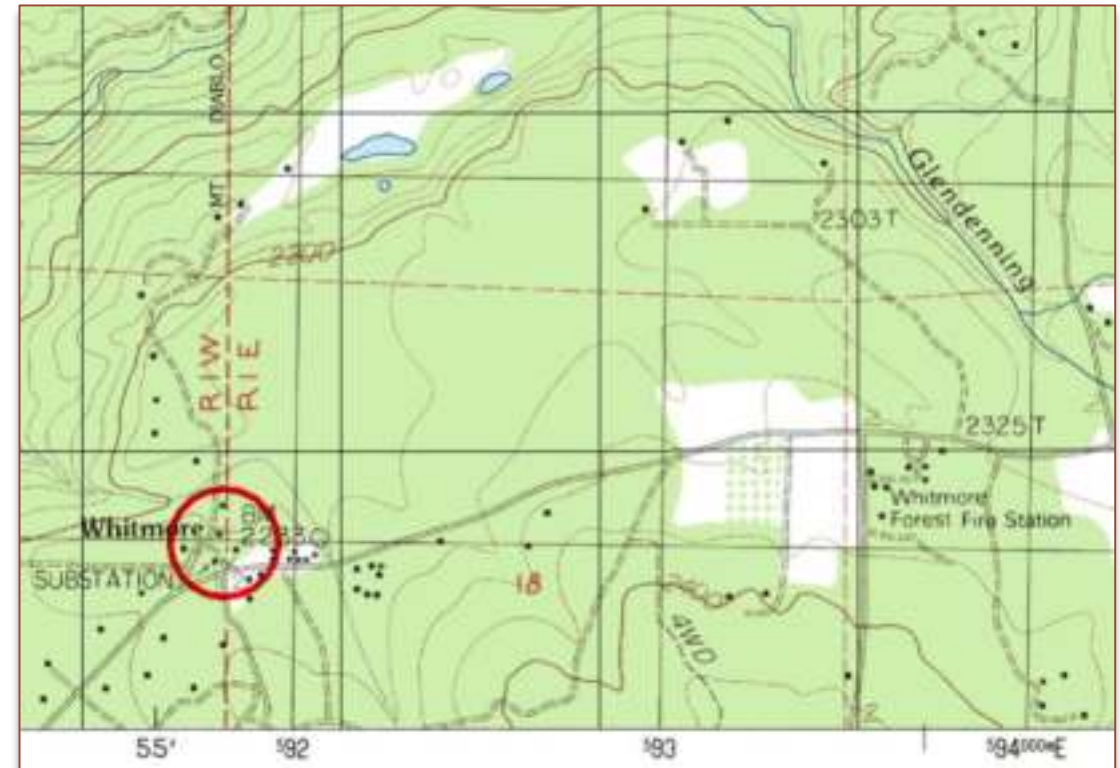
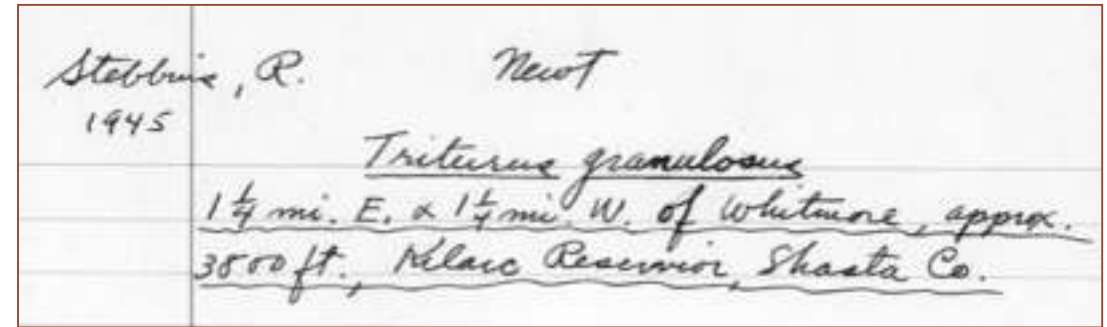
PART 1: INTRODUCTION & MAPPING TOOLS

WHAT IS GEOREFERENCING?

Interpreting a written description of a locality into mappable coordinates and an uncertainty radius in accordance with community best practices

Goals:

- Find coordinates as accurately as possible
- Calculate the smallest uncertainty radius that encapsulates entire area that the collection could have been within
- Capture proper metadata so that georeferencing steps can be retraced and process is repeatable



GUIDES

We follow community agreed upon best practices for georeferencing, which include stepwise instructions based on categorization of the locality type

[Georeferencing Quick Reference Guide \(2020\)](#)

[Georeferencing Quick Reference Guide \(2012\)](#)

[Best Practices Guide \(2020\)](#)



MAPPING TOOLS

To capture coordinates and uncertainty radii, we mainly use:

[Google Maps](#)

[GEOLocate](#)

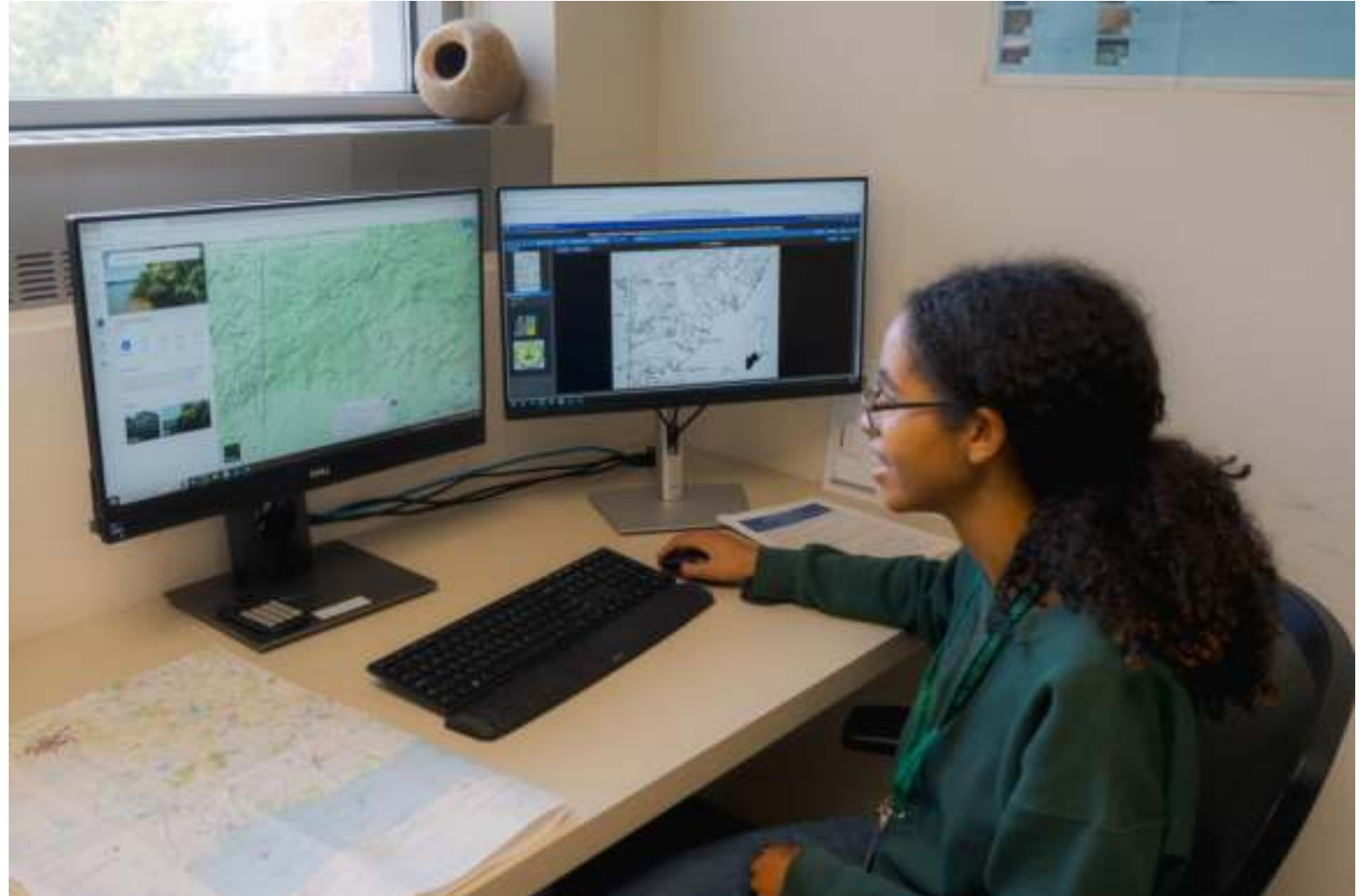
Also may be used:

[Google Earth](#)

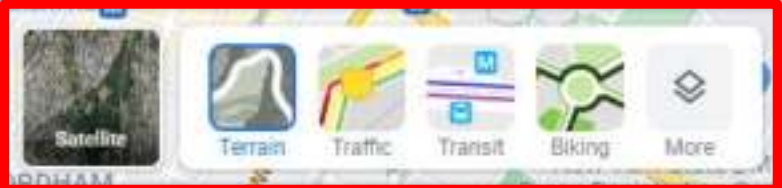
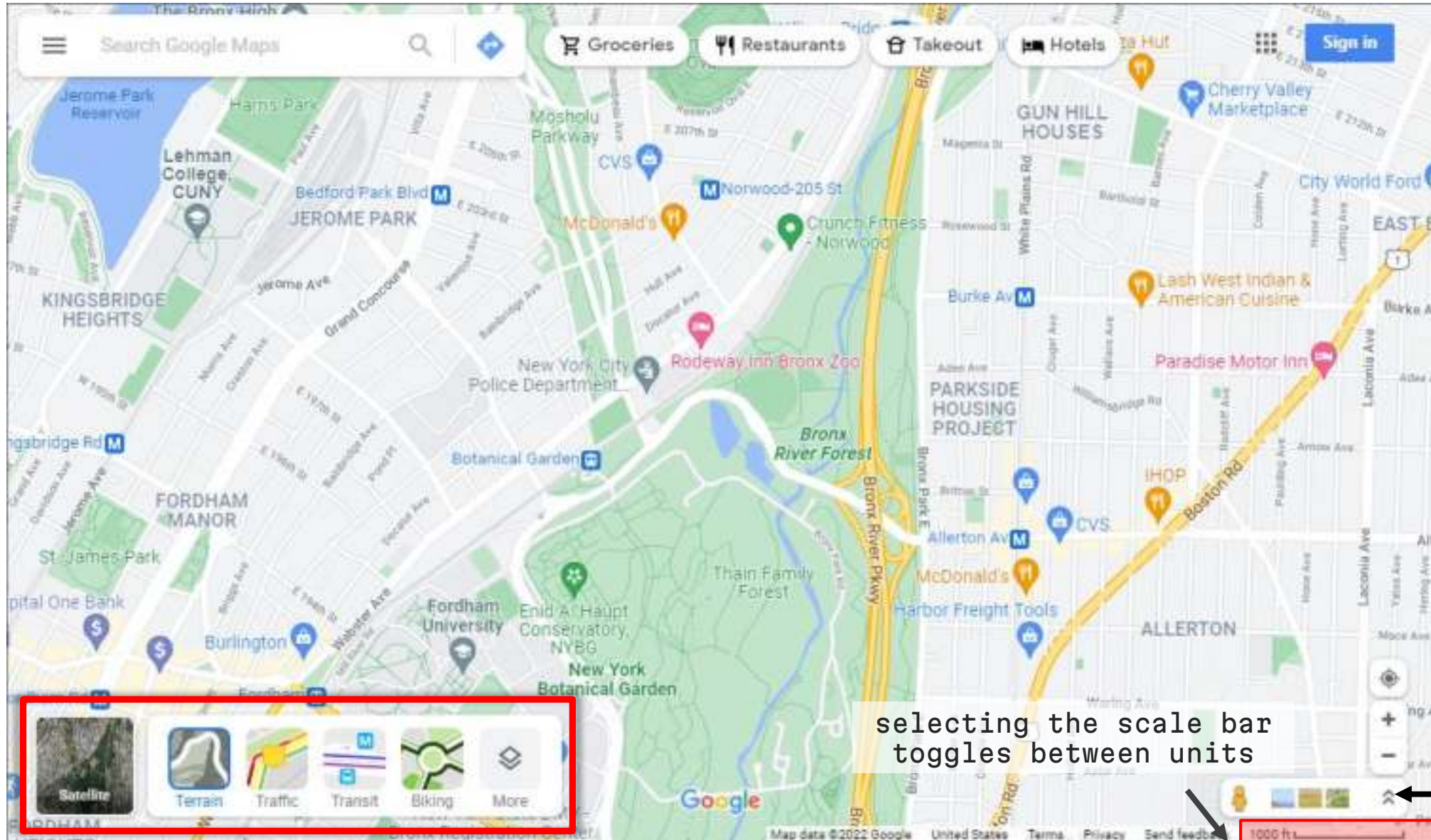
[Bing Maps](#)

[ACME Mapper](#)

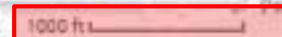
GIS software



GOOGLE MAPS: MAP LAYERS

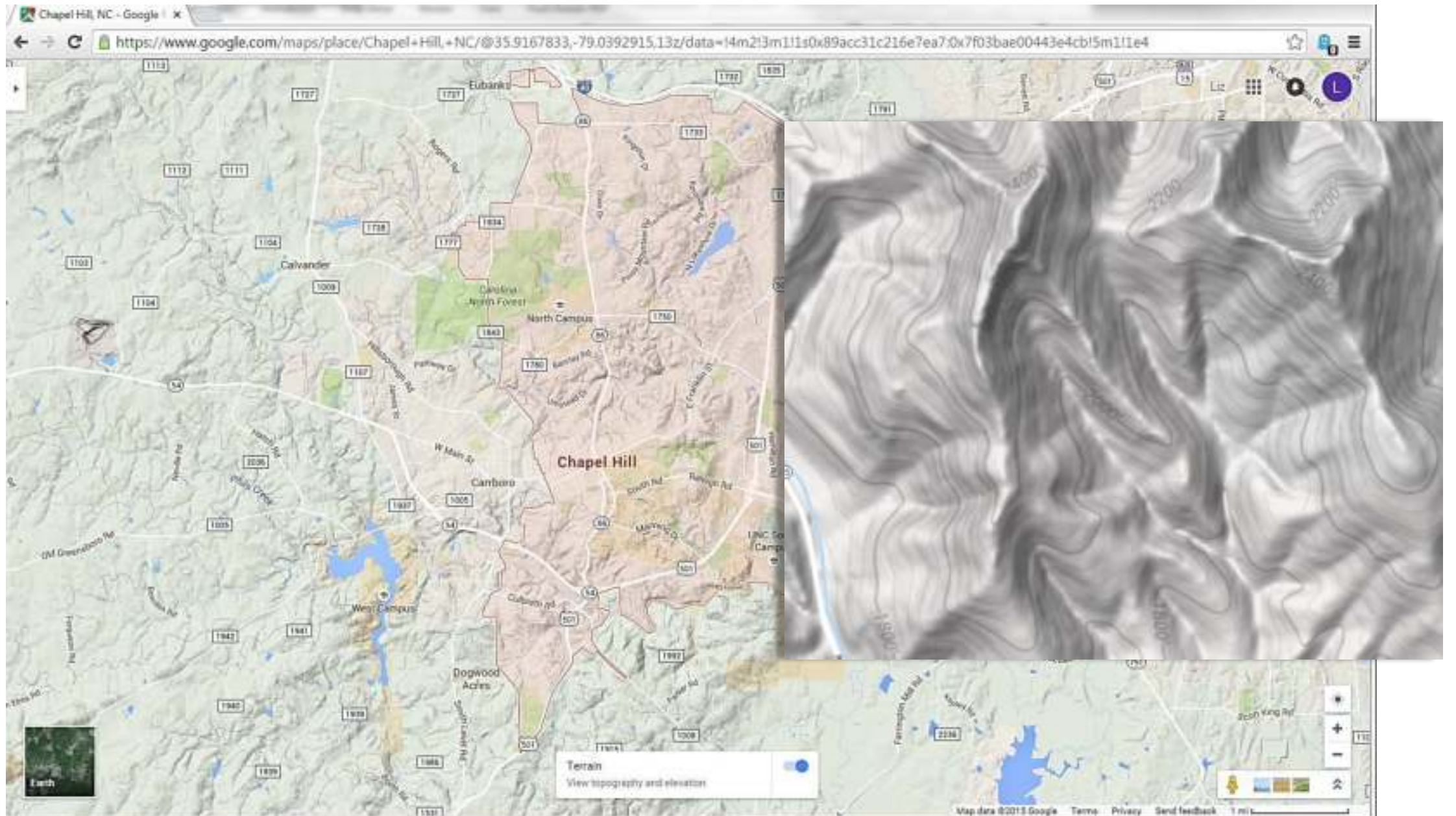


selecting the scale bar
toggles between units

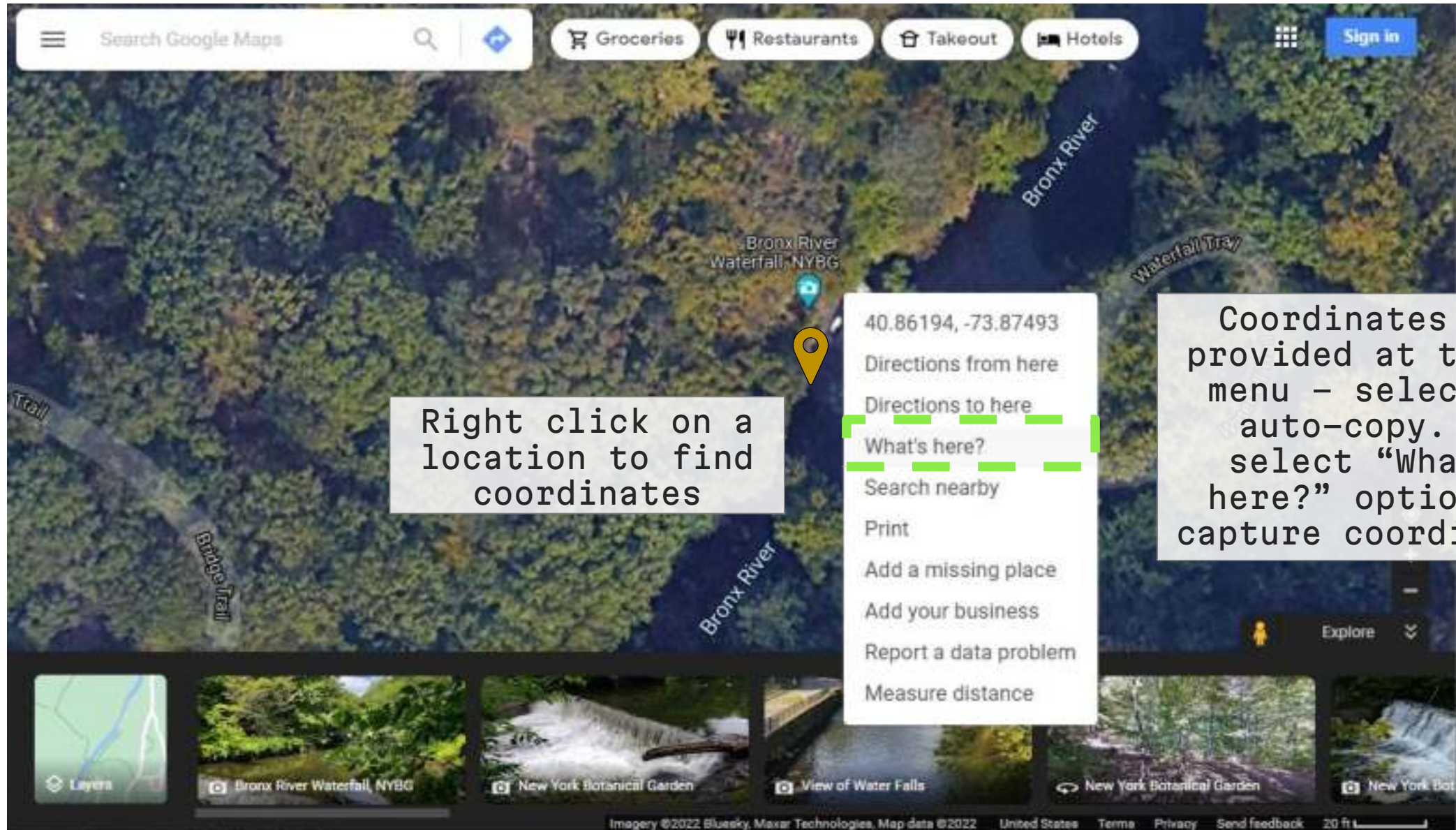


Geo-tagged photos

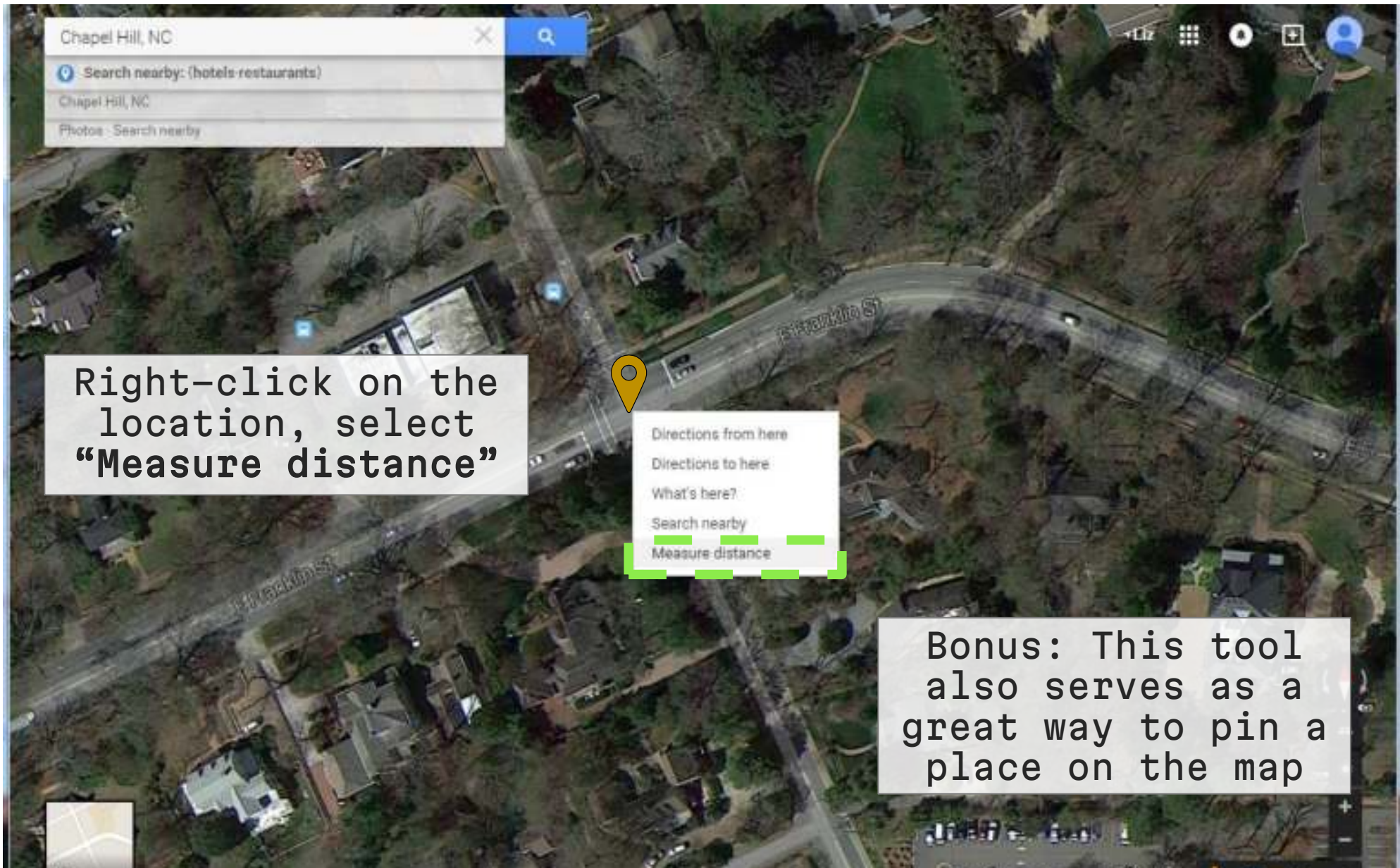
TERRAIN VIEW



CAPTURING COORDINATES



MEASURE DISTANCE



Right-click on the location, select “Measure distance”

Directions from here
Directions to here
What's here?
Search nearby
Measure distance

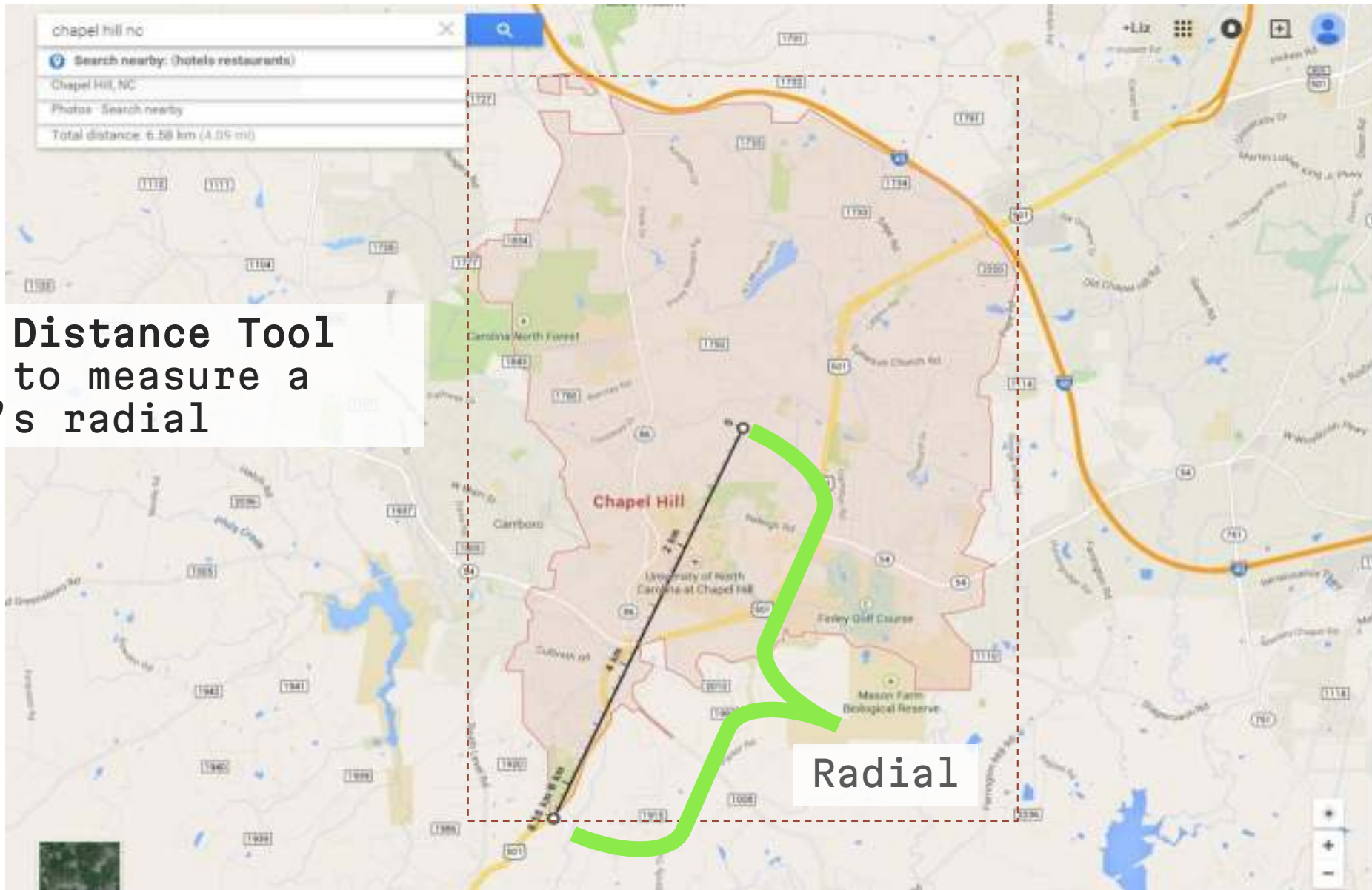
Bonus: This tool also serves as a great way to pin a place on the map

MEASURING DISTANCE



RADIAL

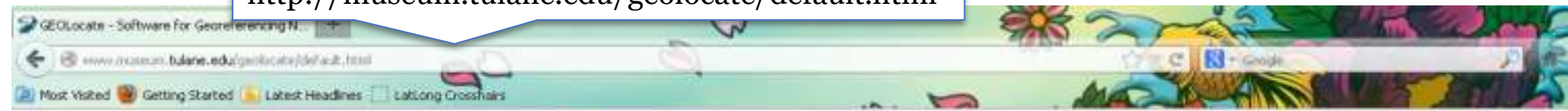
Measure Distance Tool
is used to measure a
feature's radial



GEOLOCATE



<http://museum.tulane.edu/geolocate/default.html>



Home | Web Application | StandAlone App | Collaborative Georeferencing | Developer Resources | Workshops | Support and Contact

GEOLocate

A Platform for Georeferencing Natural History Collections Data

For Users:

- Overview
- GEOLocate Web Application
- Collaborative Georeferencing
- GEOLocate 1.3x (standalone)
 - Global Expansion
- Education & Outreach

Brief overview (video) of the GEOLOCATE Project



For Developers:

- SOAP Services
- JSON/GeoJSON
- Embeddable Web Client

Works best for U.S., Canada, and Europe

Automates georeferencing



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

Web Services
Integrate georeferencing into your own database and applications using GEOLOCATE webservice.

Desktop Application
The original standalone desktop application.

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

GEOLOCATE WEB APPLICATION

Home | Standalone App | Web Application | Collaborative Georeferencing | Developer Resources | Workshops | Support and Contacts

GEOLocate Web Application

Full screen view

Pan around map

Zoom tool

Base layer and overlay options

Coordinates at cursor position

Map scale

Country drop-down list

Locality search fields

Workbench Results

Georeference Options | Draw polygon | Place marker | Measure

Locality String

Country: UNITED STATES OF AMERICA

State:

County:

latitude longitude uncertainty error polygon

The screenshot shows the GEOLocate web application interface. At the top, there is a navigation bar with links: Home, Standalone App, Web Application, Collaborative Georeferencing, Developer Resources, Workshops, and Support and Contacts. Below this is the application title "GEOLocate Web Application" and a help icon. The main area is a map of North America. On the left side of the map, there are navigation controls: a four-way arrow for panning and a vertical zoom slider. On the right side, there are icons for "Full screen view" and "Base layer and overlay options". At the bottom left, there is a "Map scale" indicator. At the bottom right, there is a "Coordinates at cursor position" display. Below the map is a "Workbench" section with a "Results" tab. It contains a "Georeference" button, an "Options" button, and radio buttons for "Draw polygon", "Place marker", and "Measure". There are also checkboxes for "latitude", "longitude", "uncertainty", and "error polygon". Below these are input fields for "Locality String", "Country" (with a dropdown menu showing "UNITED STATES OF AMERICA"), "State", and "County".

GEOLocate

GEOLOCATE WEB APPLICATION

The screenshot displays the GEOLocate Web Application interface. At the top, a navigation bar includes links for Home, Standalone App, Web Application, Collaborative Georeferencing, Developer Resources, Workshops, and Support and Contacts. The main header reads "GEOLocate Web Application" with a help icon. Below the header, it states "1 possible location found." The central map shows Topeka, Kansas, with a large grey circular area labeled "Radial" and a green dot labeled "Georeferenced point". A legend on the right lists "Base Layer" options (Google Hybrid, Google Satellite, Google Streets, Google Terrain, Bing Hybrid, Bing Roads, Bing Aerial, ESRU USGS Topo USA, Mapnik (OSM)) and "Overlays" (US Counties, Error Polygon, Uncertainty Circle, Results, Most Accurate Result). The bottom section, titled "Workbench", contains a "Georeference" button, "Options", "Clear Polygon", "Draw polygon", "Place marker", and "Measure" buttons. The "Locality String" is "Topeka". The "Country" is "UNITED STATES OF AMERICA". The "State" is "Kansas" and the "County" is "Shawnee". A red dashed box highlights the coordinate and uncertainty data: latitude: 39.04833, longitude: -95.67778, uncertainty: 10539 m, error polygon: 39.1020860198, -95.6874469244, 39.1020860198, -95.6853439244, 39.1020740198, -95.6834039244, 39.1020830198, -95.6825809244, 39.1020920198, -95.

UNCERTAINTY: AUTOMATED

GEOLocate Web Application

Click “Resize uncertainty to polygon” to snap the radial to the region of the city (available when polygon of the feature is present)

Let: 39.048334
Lon: -95.678037
Uncertainty: 10539 m
Parse pattern: TOPEKA

Edit uncertainty
Resize uncertainty to polygon
Pin here

Workbench 2 possible locations found

Georeference Options Clear Polygon Draw polygon Place marker Measure

Locality String: Topeka

Country: UNITED STATES OF AMERICA

State: Kansas

County:

latitude: 39.048334 longitude: -95.678037 uncertainty: 10539 m error polygon

39.048334	-95.678037	10539
39.1020860198, -95.6874469244, 39.1020860198, -95.6853439244, 39.1020740198,		
-95.6834039244, 39.1020830198, -95.6825809244, 39.1020920198, -95.6818049244		

UNCERTAINTY: MANUAL

GEOLocate Web Application

Let: 39.048334
Lon: -95.678037
Uncertainty: 10539 m
Parse pattern: TOPEKA

Edit uncertainty
Resize uncertainty to polygon
Pin here

Click "Edit uncertainty" to manually adjust the radial. This method is more time intensive.

Workbench 2 possible locations found

Georeference Options Clear Polygon Draw polygon Place marker Measure

Locality String: Topeka

Country: UNITED STATES OF AMERICA

State: Kansas

County:

latitude: 39.048334 longitude: -95.678037 uncertainty: 10539 m error polygon

39.048334	-95.678037	10539
39.1020860198, -95.6874469244, 39.1020860198, -95.6853439244, 39.1020740198,		
-95.6834039244, 39.1020830198, -95.6825809244, 39.1020920198, -95.6818049244		

GEOLocate

OFFSET AT A HEADING

7 possible locations found

green dot = best match

Workbench 7 possible locations found

Georeference Options Draw polygon Place marker Measure

Locality String: 20 km. north of Nantes

Country: FRANCE

State: Loire-Atlantique

County:

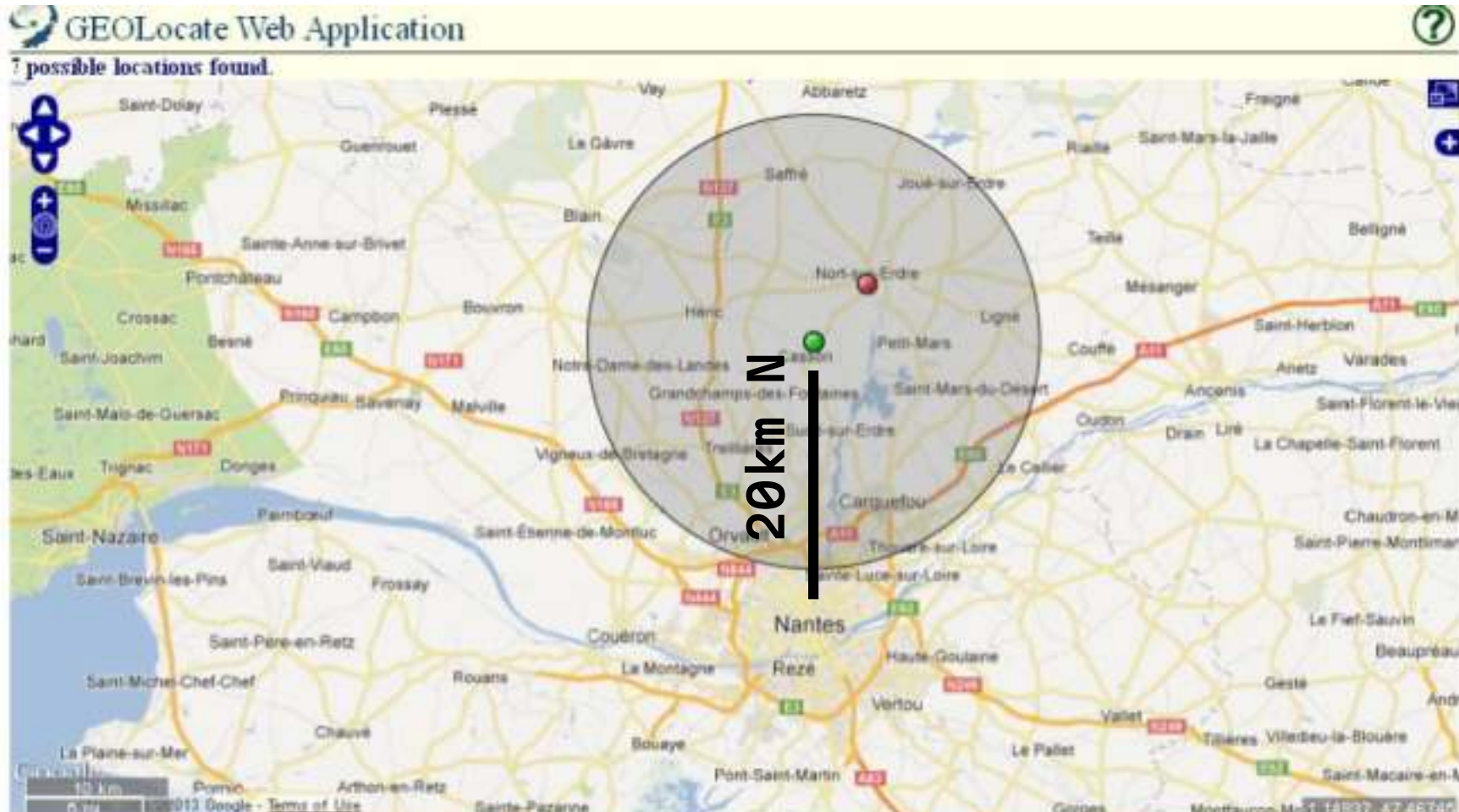
<input checked="" type="checkbox"/>	Latitude: 47.396454	<input checked="" type="checkbox"/>	Longitude: -1.55	<input checked="" type="checkbox"/>	Uncertainty: 15838 m	<input checked="" type="checkbox"/>	Error polygon
	47.396454		-1.55		15838		Unavailable

20km N of Nantes, France

OFFSET AT A HEADING

GEOLocate Web Application

7 possible locations found.



Workbench

7 possible locations found

Georeference Options Draw polygon Place marker Measure

Locality String: 20 km. north of Nantes

Country: FRANCE

State: Loire-Atlantique

County:

latitude: 47.396454 longitude: -1.55 uncertainty: 15838 m error polygon

47.396454 -1.55 15838 Unavailable

20km N of Nantes, France

REFERENCE MAP LAYERS

The image shows a screenshot of a web-based GIS application. The main map area displays a topographic map of Yonkers, New York, with contour lines and street names. A search bar on the left shows "Harlem" and "New York" as search results. A yellow arrow points to the search bar. A legend on the right lists various map layers, with "Historical USGS Topo (beta)" circled in yellow. A "Workbench" panel at the bottom shows search results for "Yonkers" in the "UNITED STATES OF AMERICA", "New York" state, and "County" field. The workbench also displays coordinates and a list of 3 possible locations found.

Search Results:

- Harlem 1897
- Harlem 1898
- Harlem 1900
- New York 1949
- New York 1954
- New York 1958
- New York 1969

Map Layers:

- Base Layer
 - Google Hybrid
 - Google Satellite
 - Google Streets
 - Google Terrain
 - Bing Hybrid
 - Bing Roads
 - Bing Aerial
 - ESRI USGS Topo USA
 - ESRI USGS Topo USA (leader)
 - ESRI World Topo
 - ESRI Ocean Base Map
 - ESRI Navigation Charts
 - Mapnik (OSM)
- Overlays
 - USGS State Geologic Maps
 - US Hydrography Dataset
 - NZ Topo50
 - US Counties
 - GEBCO 2019 Bathymetry
 - Error Polygon
 - Uncertainty Circle
 - Results
 - Historical USGS Topo (beta)

Workbench:

3 possible locations found

Georeference | Options | Clear Polygon | Draw polygon | Place marker | Measure

Locality String: Yonkers

Country: UNITED STATES OF AMERICA

State: New York

County:

latitude: 40.93121 longitude: -73.898747 uncertainty: 7222 m error polygon

40.93121 -73.898747 7222

40.9174990215, -73.9180809042, 40.9194990215, -73.9176809042, 40.9248990215, -73.9155809042, 40.9354990215, -73.9122809042, 40.9413990215, -73.9185809042

TRANSLATING COORDINATE SYSTEMS

- Geographic coordinates are sometimes provided on labels in various coordinate systems
- Decimal degrees format is the most convenient for mapping and is the standard format we capture in EMu (e.g., 40.866680, -73.878735)
- Coordinate systems can be converted between one another

More information on:

[Township, Range, and Section \(PLSS\)](#)

[UTM coordinates](#)

PUBLIC LAND SURVEY SYSTEM (TRS)

Township-Range-Section Coordinate System (TRS)

- Example: T21N, R1W, S5 = Township 21 North / Range 1 West / Section 5
- State must be specified, and sometimes a meridian if a state has more than one
- Datum: NAD27

For U.S. locations only, mainly in the West, Midwest, and South

Useful tools to convert TRS to latitude and longitude coordinates:
[GEOLocate](#) or [TRS Conversion Calculator](#)

GEOLOCATE TO CONVERT TRS

Sites (2) - Display

File Edit Select View Tools Tabs Multimedia Window Help

North America, United States of America, Missouri, Ca. 1 mile north of Preston. 268914

Locality Details

Ocean:		Elevation (Above Sea Level)	From:	(metres)	
Continent:	North America	To:	(metres)		
Country:	United States of America	Prefix:			
Province/State/Territory:	Missouri	Accuracy:			
District/County/Shire:		Determination Method:			
City/Town:		Locality Details (cont.)			
Nearest Named Place:		Township:	37N		
Special Geographic Unit:		Range:	21W		
		Section:	14		

Precise Location

Ca. 1 mile north of Preston

Site Size

GEOLocate Web Application

Workbench 1 possible location found

Georeference Options Draw polygon Place marker Measure

Locality String: T37N R21W S14

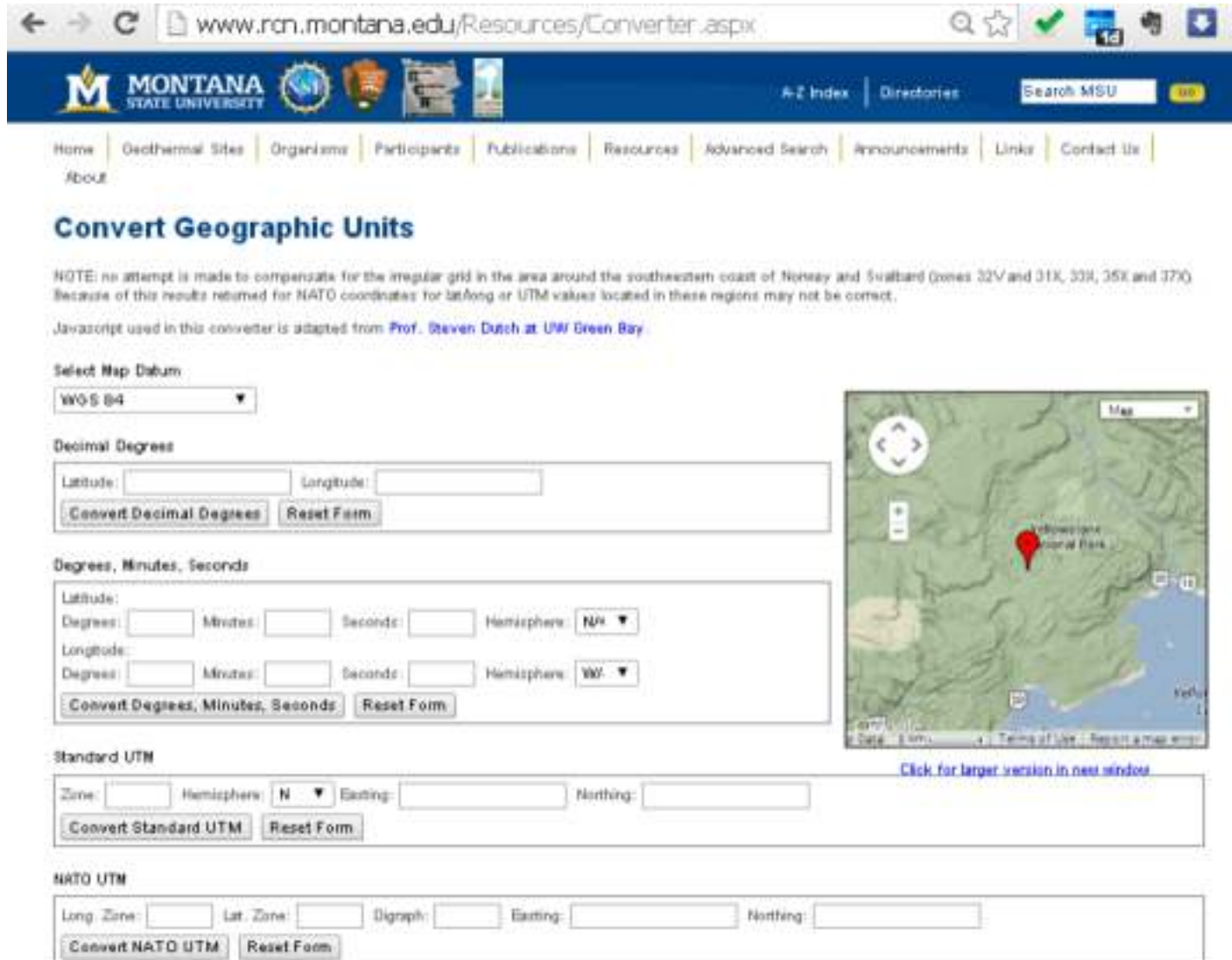
Country: UNITED STATES OF AMERICA Latitude: 37.955349 Longitude: -93.20735 Uncertainty: 969 m Error polygon: 37.955348 -93.20735 969 Unavailable

State: Missouri

County:

GEOLocate can translate TRS into decimal degrees if entered as: T(value direction) R(value direction) S(value), example: T37N R21W S14

UTM CALCULATOR



The screenshot shows a web browser window with the URL www.rcn.montana.edu/Resources/Converter.aspx. The page header includes the Montana State University logo and navigation links such as Home, Geothermal Sites, Organisms, Participants, Publications, Resources, Advanced Search, Announcements, Links, and Contact Us. The main heading is "Convert Geographic Units". A note states: "NOTE: no attempt is made to compensate for the irregular grid in the area around the southeastern coast of Norway and Svalbard (zones 32V and 31X, 33X, 35X and 37X). Because of this results returned for NATO coordinates for lat/long or UTM values located in these regions may not be correct. Javascript used in this converter is adapted from Prof. Steven Dutch at UW Green Bay." Below the note is a "Select Map Datum" dropdown menu set to "WGS 84". There are four conversion sections: "Decimal Degree" with input fields for Latitude and Longitude; "Degrees, Minutes, Seconds" with input fields for Latitude (Degrees, Minutes, Seconds, Hemisphere) and Longitude (Degrees, Minutes, Seconds, Hemisphere); "Standard UTM" with input fields for Zone, Hemisphere, Easting, and Northing; and "NATO UTM" with input fields for Long. Zone, Lat. Zone, Digraph, Easting, and Northing. Each section includes "Convert" and "Reset Form" buttons. A map of a region with a red location pin is shown on the right side of the form.

To use when coordinates provided on label in UTM format

**What is UTM?
Universal Transverse
Mercator coordinate
reference system**

[Conversion Website](#)

UTM CALCULATOR

www.rcn.montana.edu/Resources/Converter.aspx

MONTANA STATE UNIVERSITY

Home | Geothermal Sites | Organisms | Participants | Publications | Resources | Advanced Search | Announcements | Links | About

Convert Geographic Units

NOTE: no attempt is made to compensate for the irregular grid in the area around the southwestern coast of Norway and Svalbard (zones 32V and 33V). Because of this results returned for NATO coordinates for lat/long or UTM values located in these regions may not be correct.

Javascript used in this converter is adapted from Prof. Steven Dutch at UW Green Bay.

Select Map Datum
WGS 84

Decimal Degree
Latitude: Longitude:
Convert Decimal Degrees Reset Form

Degrees, Minutes, Seconds
Latitude: Degrees: Minutes: Seconds: Hemisphere:
Longitude: Degrees: Minutes: Seconds: Hemisphere:
Convert Degrees, Minutes, Seconds Reset Form

Standard UTM
Zone: Hemisphere: Easting: Northing:
Convert Standard UTM Reset Form

NATO UTM
Long Zone: Lat. Zone: Digraph: Easting: Northing:
Convert NATO UTM Reset Form

PLANTS OF ARIZONA
Flora of Grand Canyon NP, North Kaibab Solanaceae
Physalis hederifolia Gray
var. *fendleri* (Gray) Cronq.
USA. ARIZONA Coconino
Vicinity of Cliff Spring near Cape Royal.
UTM: 12S 414200E 1998050N NAD27
Elevation: 7600 ft
Associated species: *Pinus ponderosa*, *P. edulis*, *Ericameria nauseosa*, *Salix exigua*, *Ivesia arizonica*, *Quercus gambelii*, *Rosa woodsii*, *Abies concolor*
G. Rink 4542 9 August 2007
with: W. Hodgson, B. Phillips
Northern Arizona University (ASC)

Search fields

Standard UTM coordinates

NATO/Military Grid Reference System UTM

Note: This information is captured in the Mapping Tab of the Sites Module in EMu

[Conversion Website](#)

DIGITAL RESOURCES

Often necessary to reference gazetteers or other sources

- Historical places or ghost towns
- Remote areas
- Natural/geological features
- Spelling/translation variations



Example: [Merced Falls, California](#)

DIGITAL RESOURCES

[GeoNames](#): geographical database, crowdsourced

[Wikimapia](#): online editable map, crowdsourced

[OpenStreetMap](#): open geographic database updated and maintained by volunteers, crowdsourced

[Mapcarta](#): an open map that uses data from OSM, Wikipedia, and other sources

[Statoids](#): current/past administrative area names (generally up-to-date as of 2015)

[Peakery](#): sometimes useful for mountains, crowdsourced

[Traveling Luck](#): World Index, crowdsourced

[Geographic Names Info. System \(US data\)](#): maintains uniform geographic name usage U.S.

[Getty Thesaurus of Geographic Names](#): a comprehensive vocabulary of place names

[Falling Rain](#): Global Gazetteer

[Digitized Perry-Castañeda Library \(PCL\) Map Collection](#) digitized paper map collection

Also **Google Web and Image Search** and **digitized historical maps**