

Manual for the Georeferencing Calculator

The Georeferencing Calculator described in this document is a java applet created as a tool to aid in the georeferencing of descriptive localities such as those found in museum-based natural history collections. It was originally designed for the Mammal Networked Information System (MaNIS) and has been widely adopted in other large-scale collaborative georeferencing projects to supplement semi-automated georeferencing tools such as BioGeomancer and GeoLocate. The application makes calculations using the methods described in the MaNIS/HerpNET/ORNIS [Georeferencing Guidelines](#).

It will be useful to run the calculator while reviewing this document; to do so, either download the stand-alone version of the calculator (<http://manisnet.org/gci2.zip>) or use the online version at <http://manisnet.org/gci2.html>. When the application is finished loading it should appear as in Figure 1, below.

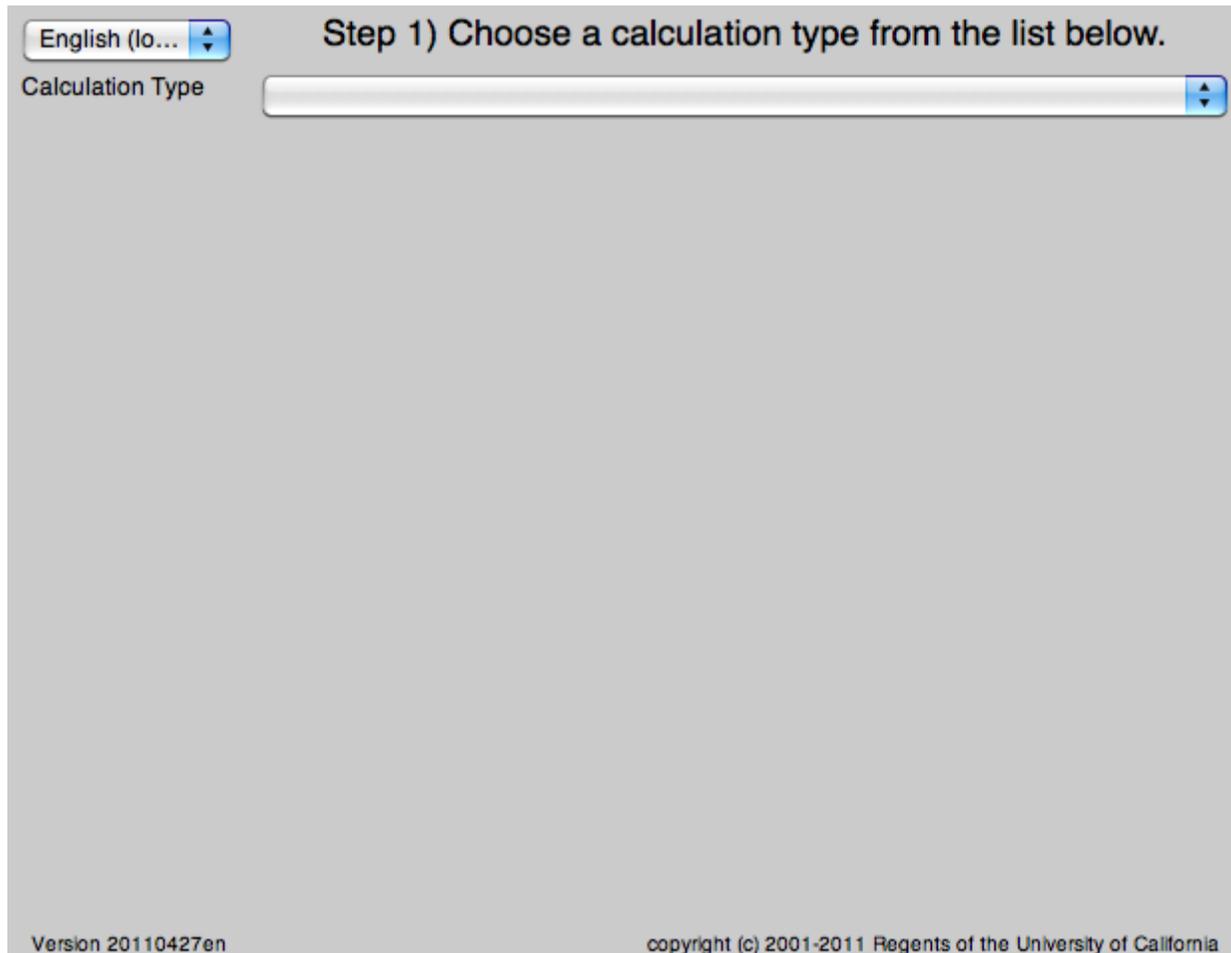


Figure 1. Screen image of the Georeferencing Calculator when it first opens.

The calculator is designed to show the user only what is needed to proceed from one step to the

next in the georeferencing process. The general work flow is:

Step 1: Select the type of calculation you want to perform.

Step 2: Select the type of locality best matches the one you want to georeference.

Step 3: Enter all of the parameters needed to make the calculation. The calculator will show text and selection boxes for only values that are needed for the calculation.

Step 4: Calculate.

Step 1

Click on the button to the right of “**Calculation Type**” to expand the list. When the list is expanded, the application should appear as in Figure 2, below.

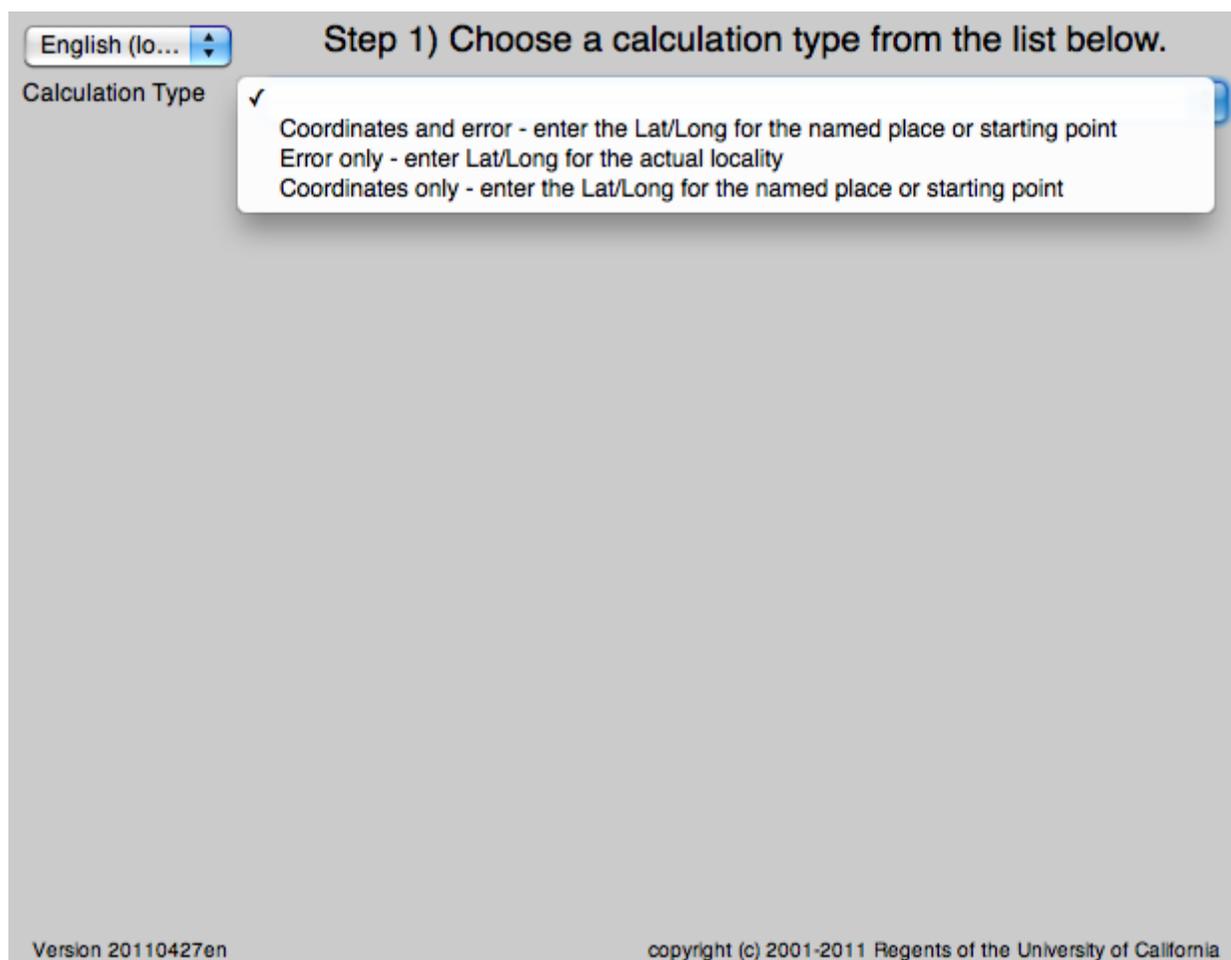


Figure 2. Step 1: Selecting a Calculation Type.

Select the calculation type you want to perform. If you want to figure out coordinates and errors based on a named place and offsets, select the "Coordinates and error" option. If you already have the coordinates for the final location and you only want to calculate the error, select the "Error only" option. If you need to determine the coordinates of a named place based on known reference coordinates, such as from the corner of a map, select the "Coordinates only" option.

NOTE: Selecting the "Error only" option, the calculator will always return the decimal latitude and longitude equivalent of the coordinates entered manually into the **Latitude** and **Longitude** fields. When using the "Coordinates and Errors" or "Coordinates only" options the calculator will always return decimal latitude and longitude different from those entered, because the locality description will have one or more offsets from those coordinates.

Calculating Coordinates and Error

After selecting the "Coordinates and error" calculation type, a new drop-down list box for **Locality Type** will appear on the screen. When this list is expanded, the application should appear as in Figure 3, below.

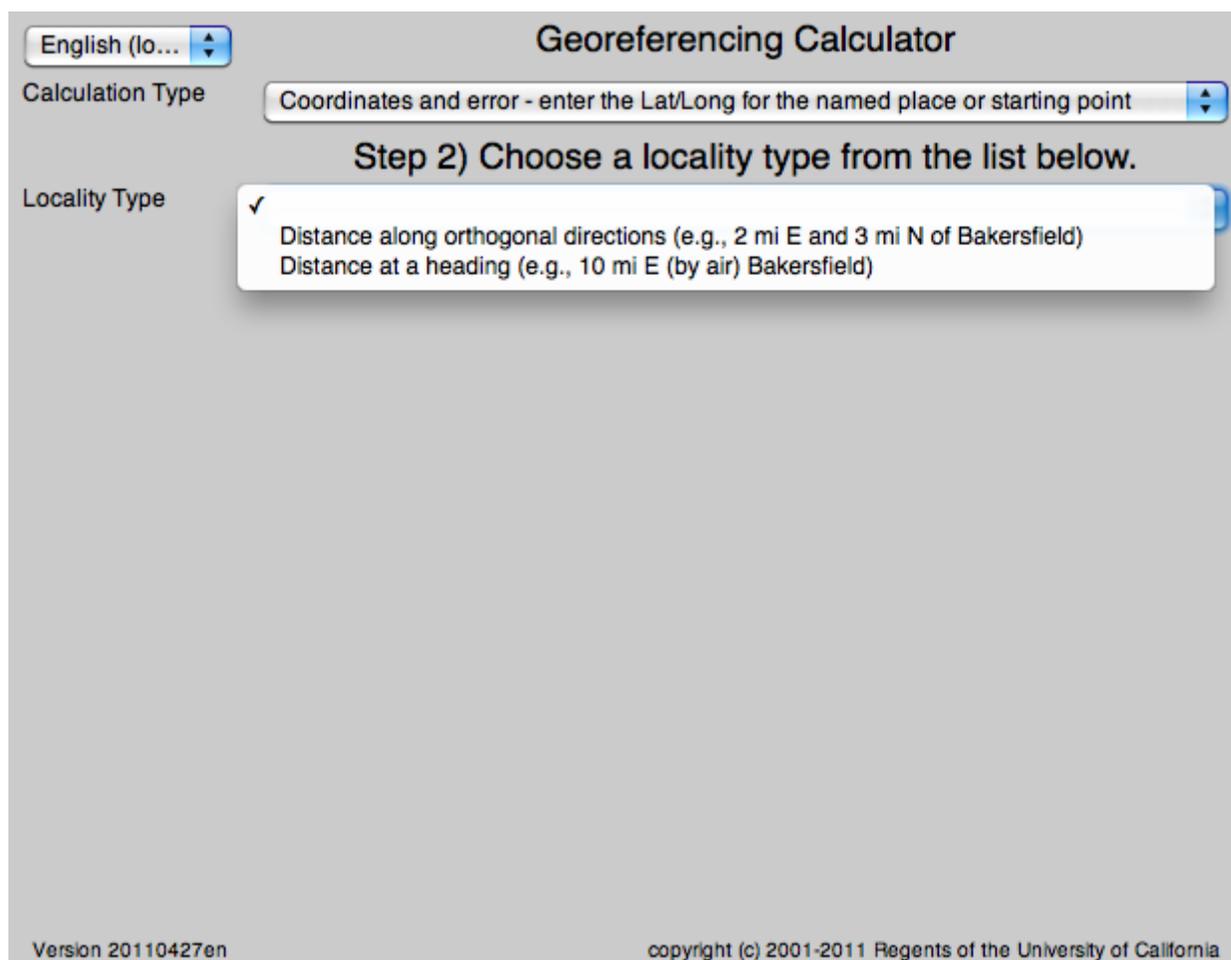


Figure 3. Coordinate Calculation Step 2: Selecting a Locality Type.

Select the locality type that best matches the locality for which you are trying to determine coordinates and error.

After selecting the locality type, a number of controls will appear on the page. These controls allow you to enter or choose values for all of the parameters relevant to the selected locality type. Figure 4, below, shows an image of the Georeferencing Calculator when a locality type of

"Distance at a heading" is selected from the **Locality Type** drop-down list.

The image shows a web-based "Georeferencing Calculator" interface. At the top, there is a language selector set to "English (lo...)" and a title "Georeferencing Calculator". Below this, the "Calculation Type" is set to "Coordinates and error - enter the Lat/Long for the named place or starting point". The "Locality Type" is set to "Distance at a heading (e.g., 10 mi E (by air) Bakersfield)". A central instruction reads "Step 3) Enter all of the parameters for the locality." The form includes several input fields and dropdown menus: "Coordinate Source" (gazetteer), "Coordinate System" (decimal degrees), "Latitude" (empty), "Longitude" (empty), "Datum" (datum not recorded), "Coordinate Precision" (nearest degree), "Direction" (N), "Offset Distance" (empty), "Extent of Named Place" (empty), "Measurement Error" (empty), "Distance Units" (km), and "Distance Precision" (1 km). At the bottom, there are fields for "Decimal Latitude", "Decimal Longitude", and "Maximum Error Distance", along with "Calculate" and "Promote" buttons. A "Distance Converter" and "Scale Converter" are also present at the bottom, with the scale set to 1:24000. The footer includes the version "Version 20110427en" and copyright information "copyright (c) 2001-2011 Regents of the University of California".

Figure 4. Parameters relevant to georeferencing a locality containing a distance at a heading.

Example

Suppose the locality you are trying to georeference is "10 mi E (by air) Bakersfield" as shown as the example in selection box for the "Distance at a heading" locality type. Suppose also that you've obtained the coordinates for Bakersfield (35° 22' 24" N, 119° 1' 4" W) by determining the center of town to the nearest second from the USGS Gosford 1:24,000 Quad map. To learn how to coordinates using offsets from a location with known coordinates, see the section **Calculating Coordinates Only**.

To begin, select "USGS map: 1:24,000" from the **Coordinate Source** drop-down list. Next, select "degrees minutes seconds" from the **Coordinate System** drop-down list, then enter the coordinates for Bakersfield in the **Latitude** and **Longitude** fields that appear. Make certain to select the correct cardinal directions from the drop-down lists to the right of each coordinate field.

NOTE: For this example, the coordinate system 'degrees minutes seconds' was selected

because the map showed coordinates in degrees minutes seconds, thus the coordinates determined for the center of Bakersfield were described in the same way. In some cases, coordinates on a map, or other resource, may be represented in degrees decimal minutes, such as 35° 22' N, 119° 0' W or 35° 22.4' N, 119° 1.066667' W. Coordinates also may be presented in decimal degrees, such as 35.3733333, -119.0177778. The coordinate system selected in the calculator must reflect the coordinate system used on the map or other resource.

The Gosford Quad map uses the North American 1927 horizontal datum, so select "(NAD27) North American 1927" from the **Datum** drop-down list. In most cases you can find the datum printed on the bottom of the map. Sometimes an ellipsoid is listed on the map instead of a datum. The calculator also includes ellipsoids in the **Datum** drop-down list. If you find a resource such as a map with a datum that is not listed in the Calculator, try to find the ellipsoid for that datum using online resources, then select the ellipsoid in the **Datum** drop-down list.

The coordinates in this example have been specified to the nearest second, so select "nearest second" from the **Coordinate Precision** drop-down list. The direction given in the locality description is E (east), so select "E" in the **Direction** drop-down list. The offset distance is 10 mi (miles), so type "10" into the **Offset Distance** text box.

Bakersfield is quite a big place and we don't know if the original locality meant 10 miles from the center of town or 10 miles from the city limit (or something else entirely), so, given that it is 3 miles from the specified coordinates to the east edge of town (as measured on the map), the **Extent of Named Place** should be 3 miles. Enter "3" into the **Extent of Named Place** text field.

NOTE: If you had measured this distance in kilometers you can convert kilometers to miles using the **Distance Converter** at the bottom of the calculator and enter the converted number into the appropriate field (see the **Distance and Scale Converters** section to learn how to use the converters). All distance measurements must be in the same system as the locality description for the calculator to return proper results.

The determination of the coordinates for Bakersfield is only as accurate as the tools the georeferencer used; the map, the size of the units on the measurement tool, and the georeferencer's ability to discern their placement relative to items on the map. Any error associated with the map itself is accounted for in the **Coordinate Source** selection. Error associated with the georeferencer's ability to measure on the map is accounted for in the **Measurement Error** field.

To complete the **Measurement Error** field, you must first determine (or estimate) the smallest distance that you can reliably (repeatably) measure on the map. Generally, people can distinguish features or locations to within about one (1) millimeter, given a ruler with millimeter divisions. If you use a ruler with English units, you may be able to distinguish to 1/16 of an inch. The quality of your measuring tool, eyesight, and technique may alter these suggested values.

Once you have determined your smallest distance at which you can measure consistently and correctly, enter that value and the units into the **Scale Converter** at the bottom of the calculator, select the scale of the map on which you made your measurement, and then select the unit of measure into which you want to convert. For example, if you used a digital measuring tool that

was able to measure to the nearest 0.1 mm on a 1:24000 map and you need to convert to miles, enter 0.1 into the **Scale Converter**, then select “mm” from the units drop-down list. Next, choose the “1:24000” scale option in the map scale drop-down list. Finally, select “mi” in the second drop-down list. Your answer to 0.1 mm at 1:24000 converted into miles will be displayed in blue (0.00149 mi). You can then type “0.00149” into the **Measurement Error** field, or move it from the **Scale Converter** using cut and paste keyboard combinations.

Next, make certain that "mi" is selected in the **Distance Units** drop-down list, since the locality is described in miles (“10 mi E...”). The distance component in this locality is 10 mi, which is precise to the nearest mile (see the discussion on this topic in the **Georeferencing Guidelines**). Select "1 mi" in the **Distance Precision** drop-down list. Now that all of the parameters for this locality have been entered, your calculator should appear as in Figure 5, below.