

# GEOREFERENCING FOR DUMMIES

An Elaboration of the MaNIS/HerpNET/ORNIS Guidelines

by Carol Spencer, Kristina Yamamoto, Janet Fang, Heather Constable, Michelle Koo and John Wieczorek

Note: The most important thing to remember is that all assumptions need to be stated in the LatLongRemarks.

LOCALITY TYPE	GEOREFERENCING PROCEDURE	DETERMINING EXTENT AND ERROR
<p><u>Named Places</u></p> <p><b>Named Place or Urban Area:</b> locality consists of a reference to a geographic feature having a spatial extent</p> <p>ex: "Las Vegas"</p>	<p>It is best to use the geographic center (the midpoint of both the latitude and longitude extremes) for the coordinates of named places. If the geographic center does not fall inside the shape of the shaded urban area, then pick the nearest point to the geographic center that lies within the shape.</p> <p>If you choose to use a gazetteer, keep in mind that many gazetteers record the coordinates of the main post office of a populated place. In the case of a county seat, the coordinates of the courthouse are recorded.</p>	<p><b>Extent:</b> Use the distance from the coordinates of the named place to the furthest point within that named place. Some gazetteers may give bounding boxes to describe the extents of large places.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type</i>: "Error - Enter Lat/Long for the actual locality" <i>Locality Type</i>: "Named Place Only"</p>
<p><u>Named Places</u></p> <p><b>Remote Named Place:</b> locality does not have a clear boundary shown on the map</p> <p>ex: "Dirty Socks": <i>The extent is 0.4 mi because the nearest named feature, Hot Springs, is 0.8 mi away.</i></p>	<p>For localities that do not have a shaded boundary or a topographic symbol for buildings shown on the map (especially for non-US localities), place coordinates at the dot for that locale on the map.</p>	<p><b>Extent:</b> The extent is half the distance to the nearest named place. (Make a note of this in LatLongRemarks.)</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Named Places</u></p> <p><b>Near a Named Place</b></p> <p>ex: "Near Las Vegas", "vicinity of Turrialba"</p>	<p>Use the geographic center of the named place for the geographic coordinates.</p>	<p><b>Extent:</b> The extent will be the distance from the geographic center of the named place to the halfway point between that geographic center and the center of the next nearest named place. (The named place entered into the spreadsheet should include "near", or "vicinity of", or another such modifier.)</p> <p><b>Error:</b> same as if it were a named place, except the extent is larger</p>
<p><u>Named Places</u></p> <p><b>Street Address</b></p> <p>e.g. "1 Orchard Lane, Berkeley, CA"</p>	<p>Locate the address using electronic gazetteers or websites, such as Maporama or Mapquest. Locate this address on a map or map software to get the coordinates if the electronic gazetteer does not display them automatically.</p>	<p><b>Extent:</b> The extent is the smallest area possible that cannot be mistaken for any other address. Oftentimes, the extent will be half the length of the city block, due to the scale of online maps.</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Named Places</u></p> <p><b>Ranch or Farm</b></p> <p>e.g. "Mathae Ranch", "Haskell Farm"</p>	<p>Treat ranches and farms as named places. If you are not able to locate them on gazetteers, use search engines such as Google to locate them in relation to nearby geographic entities.</p> <p>If ranches or farms appear on a map, usually only the building will be shown. Take coordinates from the buildings themselves, unless you can identify the exact border of the ranch or farm.</p>	<p><b>Extent:</b> If you can find exact boundaries, then treat the ranch or farm as you would a named place. Otherwise, the extent is half the distance between the buildings and the next nearest named place.</p> <p><b>Error:</b> same as for a named place</p>

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<p><u>Named Places</u></p> <p><b>Junction</b></p> <p>ex: "junction of Coora Rd. and E Siparia Rd.", "junction of Rio Claro and Rio La Hondura"</p>	<p>Locate the two roads or rivers on the map and obtain the coordinates of the point of intersection.</p> <p>Use Mapquest or Yahoo Maps to help locate the road names, as roads may not be labeled on the map you are using.</p> <p>Treat the junction as a named place and enter the full junction description as the Named Place in the spreadsheet.</p>	<p><b>Extent:</b> Measure the extent of the junction as if it were a named place. If the extent or a road junction cannot be measured on the maps available, use the following standards:</p> <p>The extent is 10 m for two-lane city streets and two-lane highways. The extent is 20 m for four-lane highways. The extent is 30 m for large highways with medians.</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Named Places</u></p> <p><b>Lake, Mountain, Cultural Land, or Other Geographic Entity</b></p> <p>ex: "Yosemite National Park", "Lake Mead", "Alameda County"</p>	<p>Place coordinates at the geographic center. If you are unable to locate the geographic center easily, you can make a rectangle, enclosing the entire area of the named place, and use diagonal lines to determine the center.</p> <p>Remember that the coordinates must be located within the geographic entity itself. If the locality is divided into more than one piece (such as a recreation area that is divided by private lands), make sure the coordinates are placed within an actual part locality and not in the midpoint between the two pieces.</p>	<p><b>Extent:</b> Use the distance from the coordinates of the named place to the furthest point within the named place or, if used, half of one of the diagonal lines.</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Named Places</u></p> <p><b>Cave</b></p> <p>ex: "Coonook Cave", "Carlsbad Caverns"</p>	<p>Georeference the entrance to the cave.</p>	<p><b>Extent:</b> The extent is usually the surface length of the cave.</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Named Places</u></p> <p><b>River, Mouth of River, or Head of River</b></p> <p>ex: "Sacramento River", "Mouth of Little Rock Creek"</p>	<p><i>River:</i> Make a straight line from the mouth of the river to the head of the river (or the most extreme points within the specified higher geography). Find the center of this line, and place the coordinates closest to the center of the line on the river itself. Do not use the coordinates given by gazetteers, as these points usually correspond to the mouths of the river, not the geographic centers.</p> <p><i>River Mouth:</i> Georeference where the river meets a larger body of water; this is usually the point of the river with the lowest elevation.</p> <p><i>River Head:</i> Georeference where the river starts (usually in mountains, canyons, or lakes); this should be the point of the river that has the highest elevation.</p>	<p><b>Extent:</b> The extent is half the length of the line drawn. Make sure to only include the portion of the river that is within the specified higher geography.</p> <p><b>Error:</b> same as for a named place</p> <p><b>Extent:</b> The extent is half the distance across the river mouth or head. (This is usually rather small.)</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Named Places</u></p> <p><b>Between two Places</b></p> <p>ex: "Between Missoula and Florence, Montana"</p>	<p>Georeference the midpoint between the centers of both named places.</p>	<p><b>Extent:</b> The extent is half the distance between the centers of both named places.</p> <p><b>Error:</b> same as for a named place</p>

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<p><u>Offsets</u></p> <p><b>Offset Only:</b> locality consists of an offset from a named place without any direction specified</p> <p>ex: "5 km outside Calgary"</p>	<p>Record the geographic coordinates of the center of the named place, just as you would for a "normal" named place</p>	<p><b>Extent:</b> Use the extent of the named place.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Error Enter Lat/Long" <i>Locality Type:</i> "Distance only" Enter the offset distance given in the SpecLocality.</p>
<p><u>Offsets</u></p> <p><b>Direction Only:</b> locality consists of a direction from or within a named place without any distance specified</p> <p>ex: "N Palmetto", "N of Berkeley"</p>	<p>If only a direction is given, such as "N Palmetto" and there is no town named "North Palmetto", then there is no way of knowing if the collector meant "northern portion of Palmetto" or "North of Palmetto." Find the distance from the center of the named place (Palmetto) to the center of the next nearest named place to the north. Place the coordinate at one half of the distance to the center of the next nearest named place in the direction specified. Alternatively, do not georeference this locality as it is ambiguous (i.e., you do not know how far in that direction they travelled.)</p>	<p><b>Extent:</b> For such localities, the extent is one half of the distance between the center of the named place in question and the center of the next nearest named place in the specified direction.</p> <p><b>Error:</b> same as for a named place</p>
<p><u>Offsets</u></p> <p><b>Offset at a Heading:</b> locality contains a distance in a given direction</p> <p>ex: "50 miles W of Las Vegas"</p>	<p>Unless "by road" is specified in the locality description, or unless there is an obvious major road that can be followed that complies to the direction and distance exactly, assume the collector measured the distance "by air." The easiest way to georeference this type of locality is to use the Georeferencing Calculator to directly calculate the coordinates, without measuring them on the map itself. (If there is no clear best choice between by road or by air, see the locality type: "More than One Possibility" below.)</p> <p>Use the coordinates of the geographic center of the named place as a starting point, and enter these coordinates and extent in the Georeferencing Calculator under the "Coordinates and Error" Calculation Type. Enter the distance and direction given, making sure the relevant parameters were filled in or selected (such as datum, distance units and precision, and coordinate source, system, and precision), and then click on "Calculate." The new coordinates that appear at the bottom of the calculator are the ones you can now enter in your database.</p> <p>These coordinates should be different from the coordinates you entered as "Latitude" and "Longitude." If they are not, check to make sure you have chosen the correct Calculation Type. You should also check the resulting locality coordinates in Topozone to make sure they make sense.</p>	<p><b>Extent:</b> Use the extent of the starting point.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Coordinates and Error - Enter the Lat/Long for the named place or starting point" <i>Locality Type:</i> "Distance at a Heading"</p>

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<p><u>Offsets</u></p> <p><b>Offset Along a Path, in One Direction:</b> locality describes a route from a named place</p> <p>ex: "7.9 mi N Beatty, on US 95"</p>	<p>If "by road" is specified in the locality description, or if there is an obvious major road that can be followed that complies to the direction and distance exactly, you can assume that the collector traveled by road. (If there is no clear best choice between which road you should use, see the locality type: "More than One Possibility" below.)</p> <p>Begin at the center of the starting point and use the measuring tool found in Terrain Navigator, or your appropriate application, to follow the road until you have traveled the distance given. The coordinates come from this ending point. (Be sure to make a note of the name of the road you followed.)</p>	<p><b>Extent:</b> Use the extent of the starting point.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Error - Enter Lat/Long for the actual locality" <i>Locality Type:</i> "Distance along a Path"</p>
<p><u>Offsets</u></p> <p><b>Offset Along a River, in One Direction</b></p> <p>ex: "3 km above Anita Grande on Rio Jimenez", "left bank of the Mississippi River, 16 mi downstream from St. Louis"</p>	<p>Treat the stream as you would a road.</p> <p>Above refers to upstream and below refers to downstream. Left and right sides of a river are determined from the perspective of facing downstream.</p>	<p><b>Extent:</b> Use the extent of the starting point.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Error - Enter Lat/Long for the actual locality" <i>Locality Type:</i> "Distance along a Path"</p>
<p><u>Offsets</u></p> <p><b>Offset in Orthogonal Directions:</b> locality consists of two orthogonal directions from a named place</p> <p>ex: "6 km N and 4 km W of Welna"</p>	<p>Always assume "by air" unless otherwise noted.</p> <p>In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Coordinates and error - enter the Lat/Long for the named place or starting point" <i>Locality Type:</i> "Distance along orthogonal directions"</p> <p>Use the center of the starting point as the coordinates and the extent of the starting point as the extent. Enter the distances and directions given, and click on "Calculate." The new coordinates that appear at the bottom of the calculator are the ones you can now enter in your spreadsheet. They should be different from the coordinates you entered as "Latitude" and "Longitude." If they are not, check to make sure you have chosen the correct Calculation Type.</p>	<p><b>Extent:</b> Use the extent of the starting point.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Coordinates and Error - Enter the Lat/Long for the named place or starting point" <i>Locality Type:</i> "Distance along Orthogonal Directions"</p>

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<p><u>Offsets</u></p> <p><b>Offset from Two Distinct Paths:</b> 2 orthogonal distances from 2 different paths</p> <p>ex: "1.5 mi E La. Hwy. 1026 and 2 mi S U.S. 190"</p>	<p>Treat this type of description as two supporting sets of directions "by air" that converge at a single point. These are directions to a place, instead of <i>from</i> one. One of the starting points in this example is some-where along LA Hwy 1026, which runs N to S. The other starting point is somewhere along US Hwy 190, which runs E to W. Your coordinates will be where the offsets meet.</p> <p><i>Locality Type:</i> "Distance along a path." Although this is not technically a distance along a path, this locality type will include all of the relevant parameters in the error calculator. Enter the extent as the 1/2 the width of the larger of the two highways (see above in Named Places: Junctions). In this example, set the precision to 0.5 mi., which is indicated in the description as the smallest unit used by the collector. This gives an extra 0.5 mile error in addition to the inherent error of the map used. See Also: <a href="http://mailman.nhm.ku.edu/pipermail/herpnet/2005-January/000130.html">http://mailman.nhm.ku.edu/pipermail/herpnet/2005-January/000130.html</a></p>	<p><b>Extent:</b> Use the extent of the larger of the two highways.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type:</i> "Error- enter Lat/Long for the actual locality." <i>Locality Type:</i> "Distance along a path."</p>

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<p><u>Coordinates</u></p> <p><b>GPS (Global Positioning System)</b></p>	<p>When georeferencing GPS coordinates, make sure to note whether the accuracy and the datum were reported. Always record coordinates in decimal degrees. Enter these coordinates as the Named Place in the spreadsheet.</p>	<p><b>Extent</b> is the accuracy of the GPS at the time the coordinates were recorded. If none was recorded, assume 30 m.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type</i>: "Error Only- enter Lat/Long for the actual locality." <i>Locality Type</i>: "Named Place Only"</p>
<p><u>Coordinates</u></p> <p><b>Latitude and Longitude Coordinates:</b> coordinates from unknown source, given in locality description</p> <p>ex: "36 31' 21.4" N; 114 09' 50.6" W;"</p>	<p>Coordinates may appear in the SpecLocality Field or in the LatLongText field. Always record coordinates in decimal degrees. Enter these coordinates as the Named Place in the spreadsheet.</p>	<p><b>Extent</b> is 0</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type</i>: "Error Only- enter Lat/Long for the actual locality." <i>Locality Type</i>: "Coordinates Only" The units field is available to choose what units you would like the error to be reported in</p>
<p><u>Coordinates</u></p> <p><b>UTM (Universal Transverse Mercator)</b></p> <p>ex: "UTM N 4291492; E 456156"</p>	<p>First, find the UTM zone by using: <a href="http://www.dmap.co.uk/utmworld.htm">http://www.dmap.co.uk/utmworld.htm</a></p> <p>Then fill in UTM data at: <a href="http://home.hiwaay.net/~taylorc/toolbox/geography/geoutm.html">http://home.hiwaay.net/~taylorc/toolbox/geography/geoutm.html</a>.</p> <p>Remember that x is easting while y is northing. Enter the UTM coordinates in the Named Place field.</p>	<p><b>Extent</b> is 30 m, to cover any degree of uncertainty given by GPS units.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type</i>: "Error - enter Lat/Long for the actual locality" <i>Locality Type</i>: "Named Place Only"</p>
<p><u>Coordinates</u></p> <p><b>TRS (Township, Range, Section)</b></p> <p>ex: "T3S, R42E, SEC.2"</p>	<p>TRS is a way of dividing up land in the western United States. Townships, ranges, and sections are ordered in decreasing size. Sections are 1 mi on each side.</p> <p>Enter in the appropriate data on the following website: <a href="http://www.esg.montana.edu/gl/trs-data.html">http://www.esg.montana.edu/gl/trs-data.html</a>. (Make sure to pick the correct state.) The website will give you the geographic center of the section.</p> <p>To georeference quarters of the section (such as "SW 0.25 Sec 15"), use BioGeomancer, which shows section boundaries. BG does not interpret quarter sections at this time, so you must estimate and put the new point in the appropriate portion of the section. If the section is further divided (SW 1/4, NW 1/4) read these divisions from smallest to largest if order is not indicated (SW 1/4 of the NW 1/4).</p>	<p><b>Extent:</b> For sections, the extent is half of the hypotenuse of the section, or 0.707 mi (square root of 2, divided by 2). For quarter sections, the extent is half of that, or 0.354 mi.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings: <i>Calculation Type</i>: "Error - enter Lat/Long for the actual locality" <i>Locality Type</i>: "Named Place Only"</p>

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<p><u>More than One Possibility</u></p> <p><b>Named Place Only, with No Direction or Distance Given</b></p> <p>ex: "Battle Mountain" (which is the name of both a city and a mountain), "Junction of Hwy 50 and Stem Road" (Hwy 50 and Stem Road intersect more than once)</p>	<p>Choose one of the possibilities and use its center for the coordinates.</p> <p>Do NOT use the midpoint between the two possibilities. Make sure your coordinates are actually located within one of the choices.</p> <p>Note: This type of procedure is only applicable if the two possibilities are somehow related, such as a lake and a town on the lake that share the same name. This type does not apply if the localities with the same name are not related. For example, if the locality reads "San Marcos" and there are two independent localities labeled as San Marcos" that are far apart from one another within the same province, then do not georeference it.</p>	<p><b>Extent:</b> Add the extent of the first possibility to the extent of the second possibility, and then to that value add the distance between the geographic midpoints of the two. This allows for a conservative extent.</p> <p><b>Error:</b> Same as named place. The error calculation will be as if there were only one possibility, even though the extent will include both.</p>
<p><u>More than One Possibility</u></p> <p><b>Offset Direction and Distance Given, with No Clear Choice between By Road or By Air</b></p> <p>ex: "15 mi W of Truckee"</p>	<p>If there is no clear, better choice between "by road" or "by air," then first obtain all sets of possible coordinates that match the locality description. Follow all possible roads, as well as the "by air" possibility, and plot each of the coordinate sets.</p> <p>Using your best judgment and all available information, decide which of these points seems most likely to be the actual collection spot and record its coordinates.</p>	<p><b>Extent:</b> Measure the distance from the best fitting coordinates to the farthest of the points. Add this distance to the extent of the beginning locality (most likely a town or junction) for the final extent.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings:  <i>Calculation Type:</i> "Enter Lat/Long for the actual locality"  <i>Locality Type:</i> "Distance at a Heading"                      Select this even if the coordinates chosen were actually on a road.</p>
<p><u>More than One Possibility</u></p> <p><b>Offset Direction and Distance Given with No Clear Choice between Roads</b></p> <p>ex: "10.2 mi E of Yuma by road"</p>	<p>If "by road" is indicated in the SpecLocality, but there is more than one road that could be used, then first follow each of the possible roads and plot the corresponding points according to the distance given.</p> <p>Using your best judgment and all available information, decide which of these points seems the most likely to be the actual collection spot and record its coordinates.</p>	<p><b>Extent:</b> Measure the distance from the best fitting coordinates to the farthest of the points. Add this distance to the extent of the starting locality (most likely a town or junction) for the final extent.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings:  <i>Calculation Type:</i> "Enter Lat/Long for the actual locality"  <i>Locality Type:</i> "Distance along Path"</p>

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<p><u>More than One Possibility</u></p> <p><b>Offset Direction and Distance Given with No Clear Choice between By Air or By Road and No Clear Choice between Two Named Places</b></p> <p><i>ex: "5 km W Battle Mountain" (there is a peak named Battle Mountain and a town named Battle Mountain town, and no indication how 5 km W was traveled)</i></p>	<p>For each of the possible named places, plot points according to the direction and distance given. Include all possibilities, including those arrived to via different roads.</p> <p>Using your best judgment and all available information, examine each of the points and decide which one is the most likely point meant by the collector. Record those coordinates.</p>	<p><b>Extent:</b> Add the distance from the most likely point to the point farthest away to the sum of the two extents of the named place choices. You want your extent to be as conservative as possible without adding extra uncertainty.</p> <p><b>Error:</b> In the Georeferencing Calculator, choose the following settings:  <i>Calculation Type:</i> "Enter Lat/Long for the actual locality"  <i>Locality Type:</i> "Distance at a Heading"                      Select this even if the point whose coordinates you chose were actually on a road.</p>

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<p><u>Do Not Georeference</u></p> <p><b>Dubious</b></p> <p>ex: "presumably central Chile", "Isla Boca Brava?"</p>	<p>Do not georeference if the locality data explicitly states that the information contained therein is in question.</p>	<p>N/A</p>
<p><u>Do Not Georeference</u></p> <p><b>Cannot Be Located or Ambiguous</b></p> <p>ex: "locality not recorded", "Bob Jones", "summit", "San Jose, Mexico"</p>	<p>Do not georeference if any of the following is true: the locality data is missing, the locality contains solely non-locality type information, the locality cannot be distinguished from among multiple possible candidates, or the locality cannot be found with available references.</p>	<p>N/A</p>
<p><u>Do Not Georeference</u></p> <p><b>Demonstrably Inaccurate</b></p> <p>ex: "Sonoma County side of the Gualala River, Mendocino County"</p>	<p>Do not georeference if the locality data contains irreconcilable inconsistencies.</p>	<p>N/A</p>
<p><u>Do Not Georeference</u></p> <p><b>Captive</b></p> <p>ex: "lab born", "bait shop"</p>	<p>Do not georeference captive animals. Put a "captive flag" or, in other words, assign a "1" instead of a "0" in the Captive Flag category on the spreadsheet</p>	<p>N/A</p>