PART 2: METHODS & PROTOCOLS
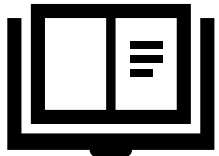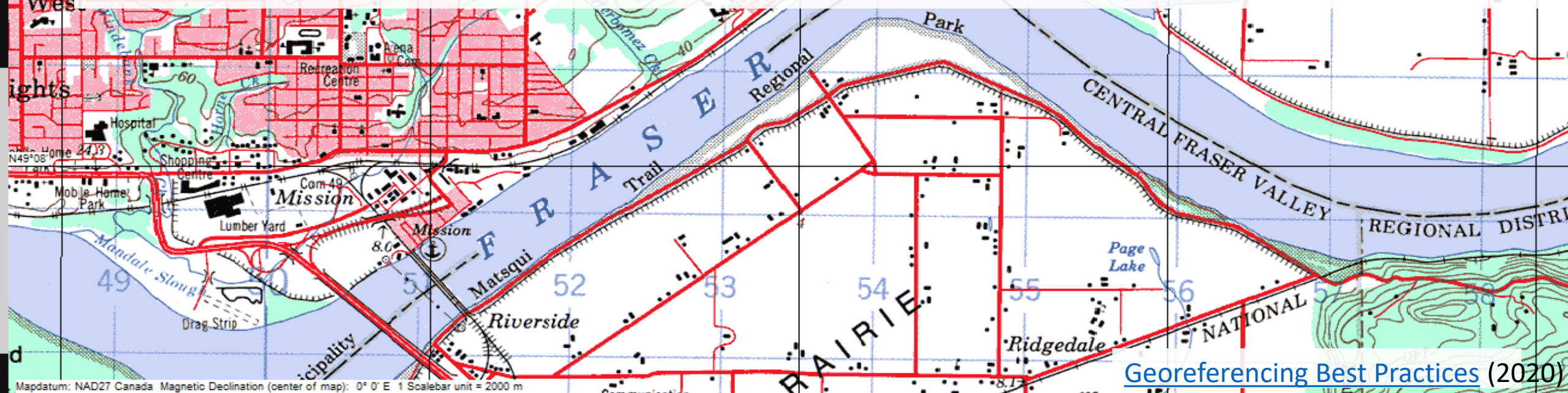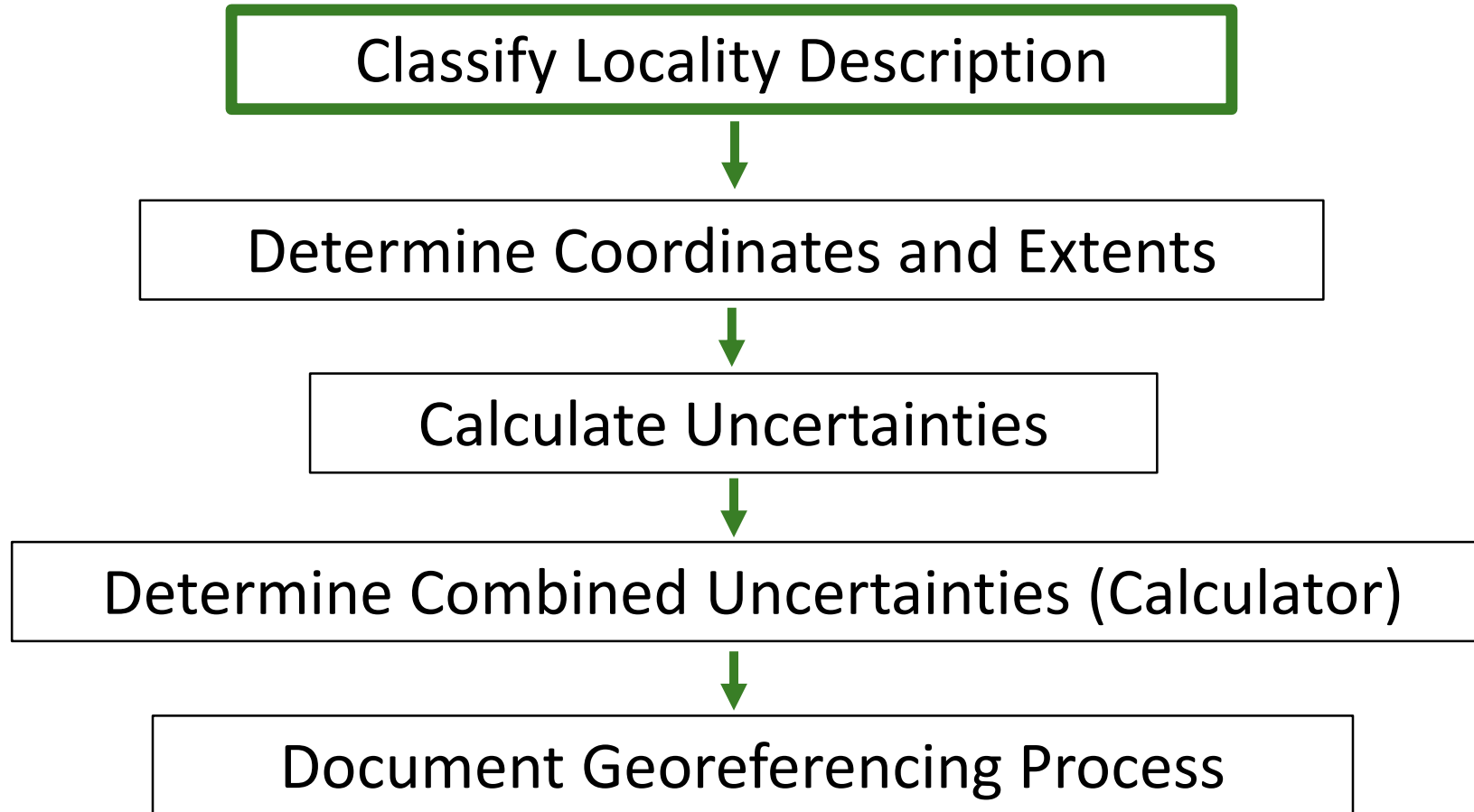
"To georeference poorly is worse than not to georeference at all."

Georeferencing Best Practices (2020)

General Workflow

Classify Locality Description

↓

Determine Coordinates and Extents

↓

Calculate Uncertainties

↓

Determine Combined Uncertainties (Calculator)

↓

Document Georeferencing Process

BioGeomancer Guide To Best Practices for Georeferencing (

Categorizing Locality

- There are a limited number of categories that locality descriptions can be placed into
- Category determines the **best method** of calculating coordinates and uncertainties
- Crucial first step in attempting a georeference
- Most specific part of the locality description should be used

Example: "Bridge over the St. Croix River, 4 km N of Somerset"

Georeference based on the <u>bridge</u> (Feature – with Obvious Spatial Extent) rather than Somerset (Offset – Distance at a Heading)

Locality Types

Simple Localities:

- Feature – With Obvious Spatial Extent (Defined Area)
- Feature – Without Obvious Spatial Extent (Undefined)
- Feature – Near a Feature
- Feature – Between Two Features
- Feature – Paths (River, stream, road, path)

Offsets:

- Offset – Distance only
- Offset – Heading only
- Offset – Distance along a path
- Offset – Distance along Orthogonal Directions
- Offset – Distance at a Heading

Coordinates Exist:

- Lat /Long Coordinates (leave alone)
- TRS Coordinates
- UTM Coordinates

Do not georeference:

- Dubious
- Can not be located
- Demonstrably Inaccurate
- More than One Matching Feature
- Cultivated

Google Maps

GEOLocate

Quick Guide: Appendix A - Key to Locality Types of the Georeferencing Quick Reference Guide

Uncertainty

Uncertainty radial encapsulates the total area from which the collection may have occurred

Sources of error:

- **Radial of the locality (majority)**

- Unknown datum (GPS, or paper map)

- Imprecision in coordinate or distance measurement (user error)

- Imprecision in direction measurement (from description)
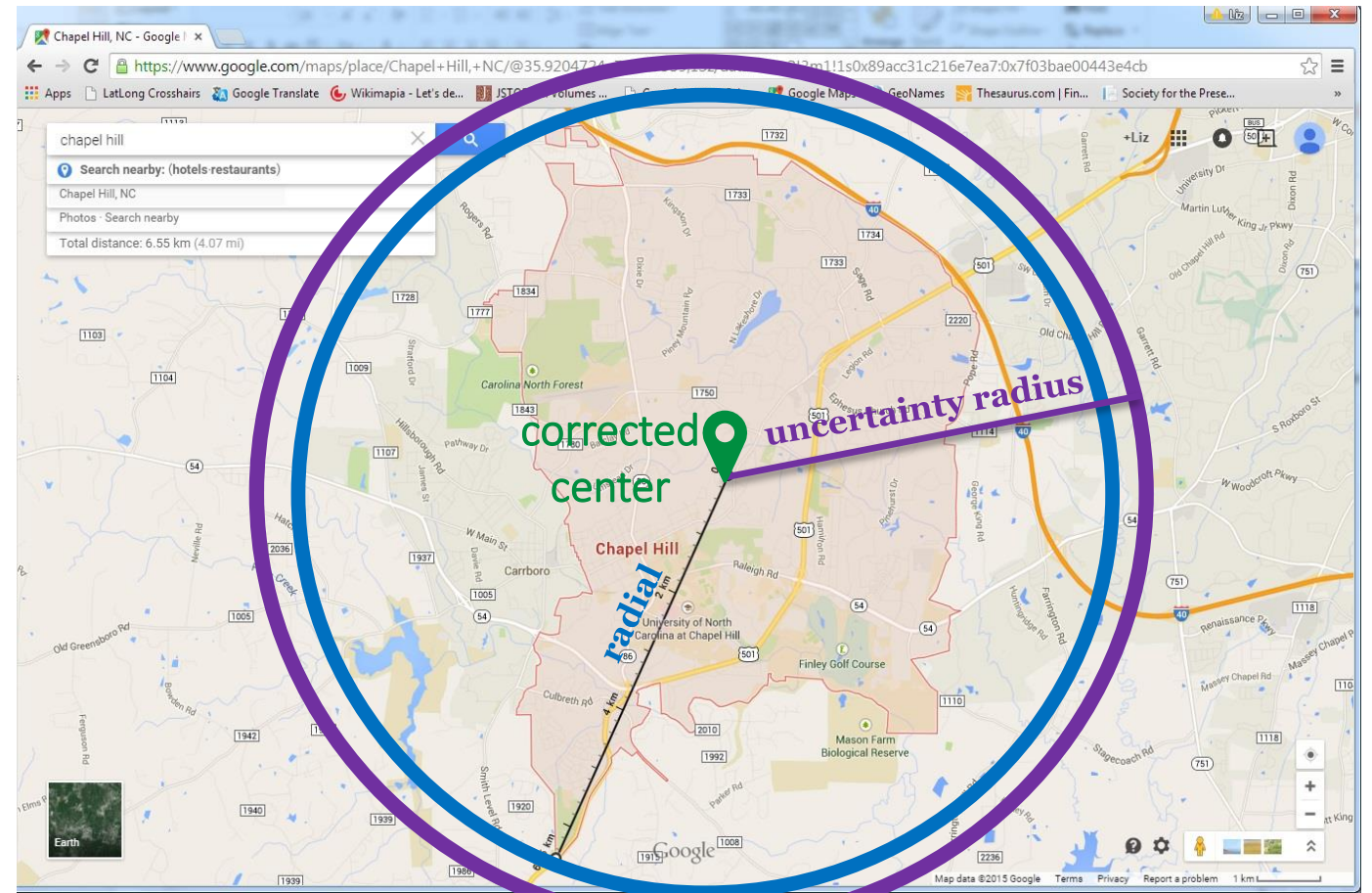
MaNIS Georeferencing Calculator used to find uncertainty radial except when using GEOLocate

Georeferencing Remarks

Notes are required if there is any deviation from the protocols or any assumptions are made during the georeferencing process.

Example:

Dr. Davies Farm, Clarkstown, NY

Situation: Cannot find farm. Move up the geographical hierarchy.

Sample notes: Unable to locate Dr. Davie's farm. Georeferenced to the corrected center of Clarkstown.

Georeferencing Remarks Document

Feature – with Obvious Spatial Extent

Previously: Named Place: Bounded Area (2012)

LOCALITY TYPE

Named Place

Bounded Area:
Locality refers to a geographic feature with discernible spatial boundaries

Examples: "Las Vegas", "Puerto Madryn", "San Fernando", "Verónica"

Feature categories include:

- ❏ city, town, county, suburb, populated place, or homestead
- ❏ spring, bore, tank, well, or waterhole
- ❏ island, reef, or cay
- ❏ port, bay, gulf, or harbor
- ❏ airport, buoy, dock, or jetty
- ❏ point, cape, or peninsula
- ❏ cave
- ❏ dam, or lock
- ❏ hill, peak, pass, or mountain
- ❏ trig point
- ❏ park, reserve, or forestry zone
- ❏ junction of two paths (roads, rivers, contour lines, boundaries, etc.)

Zermoglio PF, et. al (2020) Georeferencing Quick Reference Guide. Copenhagen: GBIF Secretariat. https://doi.org/10.35035/e09p-h128
Wieczorek J, Bloom D, Constable H, Fang J, Koo M, Spencer C & Yamamo K (2012) Georeferencing Quick Reference Guide, version 2012-10-08
https://www.idigbio.org/wiki/images/1/1e/GeoreferencingQuickReferenceGuide.pdf

LOCALITY TYPE

Named Place

Bounded Area:
Locality refers to a geographic feature with discernible spatial boundaries

Examples: "Las Vegas", "Puerto Madryn", "San Fernando", "Verónica"

Feature – with Obvious Spatial Extent

Examples:

1. "Bakersfield, Kern Co., CA"
2. "Point Lookout, Nassau, NY"
3. "Bennetts Waterhole, Australia"
4. "Uruçuca, Bahia, Brazil"
5. "Isla Tiburon, Mexico"
6. "Lorne Reef"
7. "Yosemite National Park"
8. "Mt Hypipamee"
9. "34th Street & 5th Ave & , NY, NY"
10. "State Forest Reserve 607, Queensland"
11. "Where Dalby Road crosses Bunya Mountains National Park Boundary"
12. "confluence of Labarge Creek and South Labarge Creek, […]"
13. "At 100 m contour line on Black street, […]"
14. "Victoria River Station" [Northern Territory, Australia]

NOTE: You may NOT be able to discern from the locality which level of geography is being referring to by the name (neighborhood, city, county, etc.). In these cases: ***choose the larger entity***

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an *obvious* spatial extent

Coordinates: Find the ***corrected center***, or the point within a location that minimizes the geographic radial, obtained by finding the smallest enclosing circle that contains the entire feature and then locating the center of that circle. If that center does not fall on or inside the boundaries of the feature, find the smallest enclosing circle that contains the entire feature, but has its center on the boundary of the feature.

Radial: Measure the ***distance from the selected coordinates to the farthest point within the named place***

Example 1:*"Isla Tiburon, Mexico"*

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an *obvious* spatial extent

Coordinates: Find the ***corrected center***, or the point within a location that minimizes the geographic radial, obtained by finding the smallest enclosing circle that contains the entire feature and then locating the center of that circle.

Imagine a box around the feature by finding the most northern/southern/western/eastern limits to help you visualize the corrected center

Radial: Measure the *distance from the selected coordinates to the farthest point within the named place*

Example 1:*"Isla Tiburon, Mexico"*

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an ***obvious*** spatial extent

Coordinates: Find the ***corrected center***, or the point within a location that minimizes the geographic radial, obtained by finding the smallest enclosing circle that contains the entire feature and then locating the center of that circle.

Imagine a box around the feature by finding the most northern/southern/western/eastern limits to help you visualize the corrected center

Radial: Measure the ***distance from the selected coordinates to the farthest point within the named place***

Example 1:*"Isla Tiburon, Mexico"*

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an *obvious* spatial extent

<u>Coordinates:</u> Find the ***corrected center*** (i.e., the midpoint of the extremes of latitude and longitude)

<u>Radial:</u> Measure the ***distance from the selected coordinates to the farthest point within the named place***

Example 2:*"Nantucket, MA"*

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an *obvious* spatial extent

Coordinates: Find the ***corrected center*** (i.e., the midpoint of the extremes of latitude and longitude)

Radial: Measure the ***distance from the selected coordinates to the farthest point within the named place***
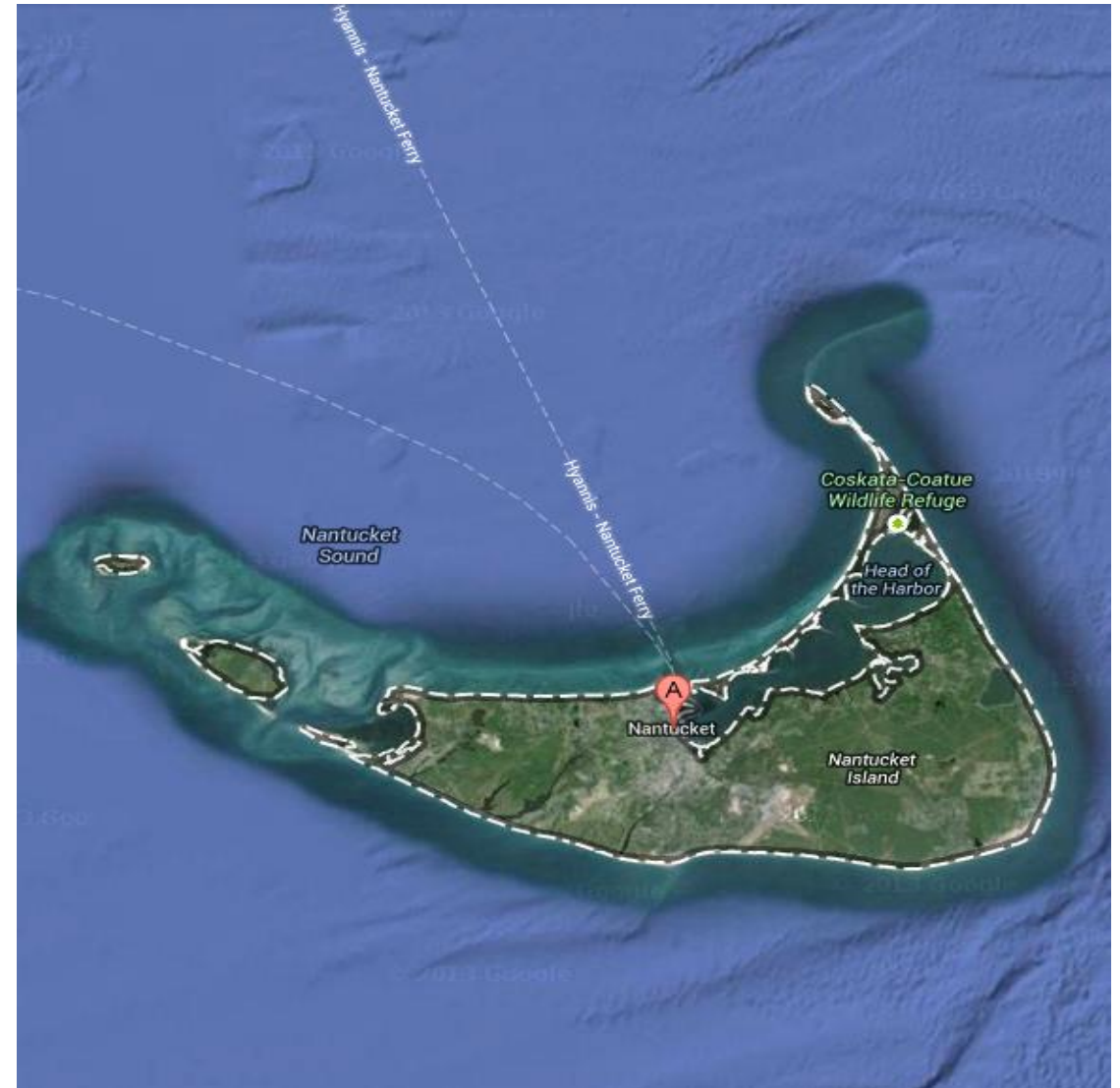

Example 2:*"Nantucket, MA"*

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an *obvious* spatial extent

Coordinates: Find the ***corrected center*** (i.e., the midpoint of the extremes of latitude and longitude)

Radial: Measure the ***distance from the selected coordinates to the farthest point within the named place***

*If the geographic center does not fall inside the shape of the feature, then **choose the nearest point to the center that lies within the shape***
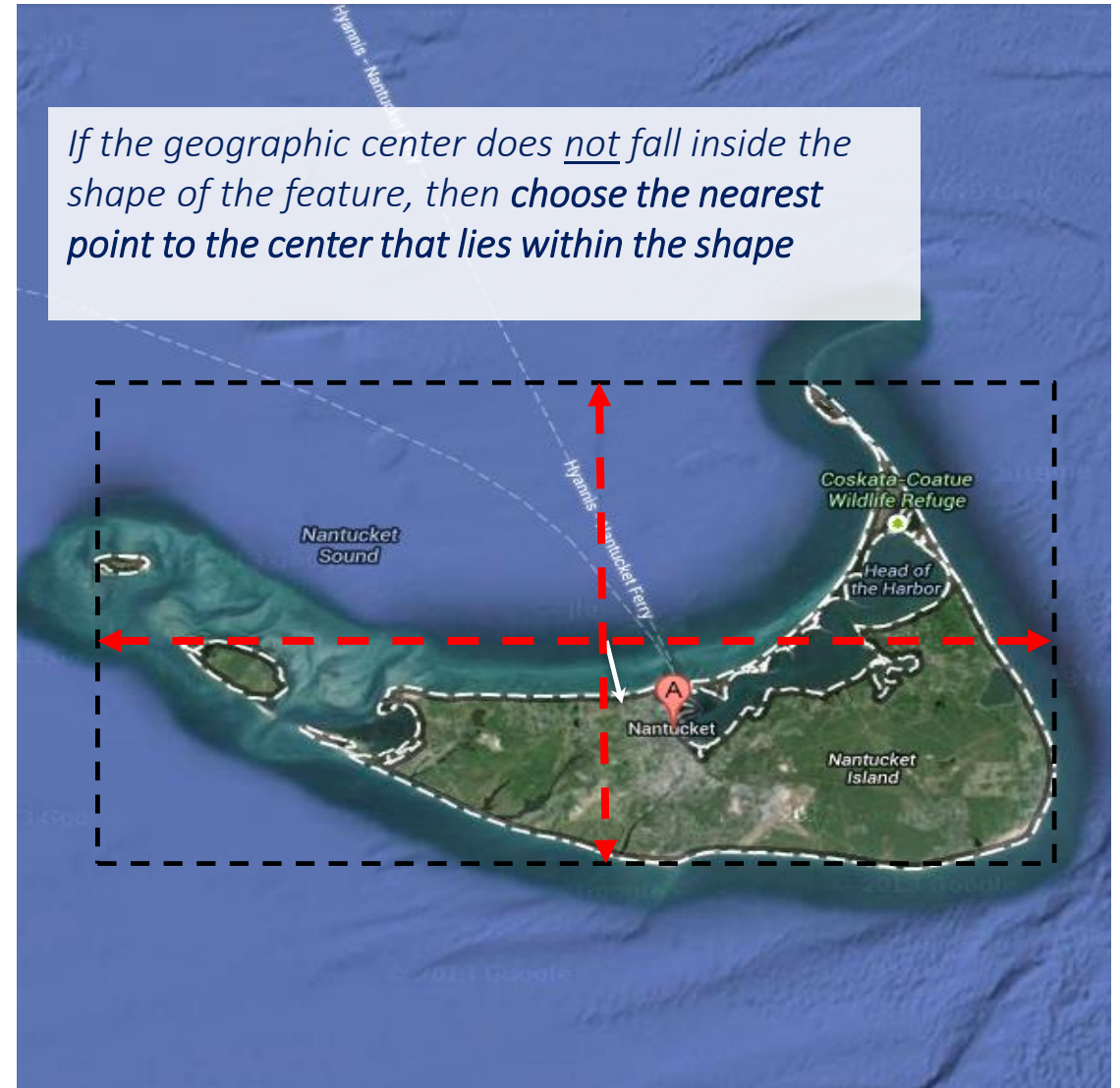
Example 2:*"Nantucket, MA"*

Feature – With Obvious Spatial Extent

Georeferencing Procedure:

A) Features **with** an *obvious* spatial extent

Coordinates: Find the ***corrected center*** (i.e., the midpoint of the extremes of latitude and longitude)

Radial: Measure the ***distance from the selected coordinates to the farthest point within the named place***
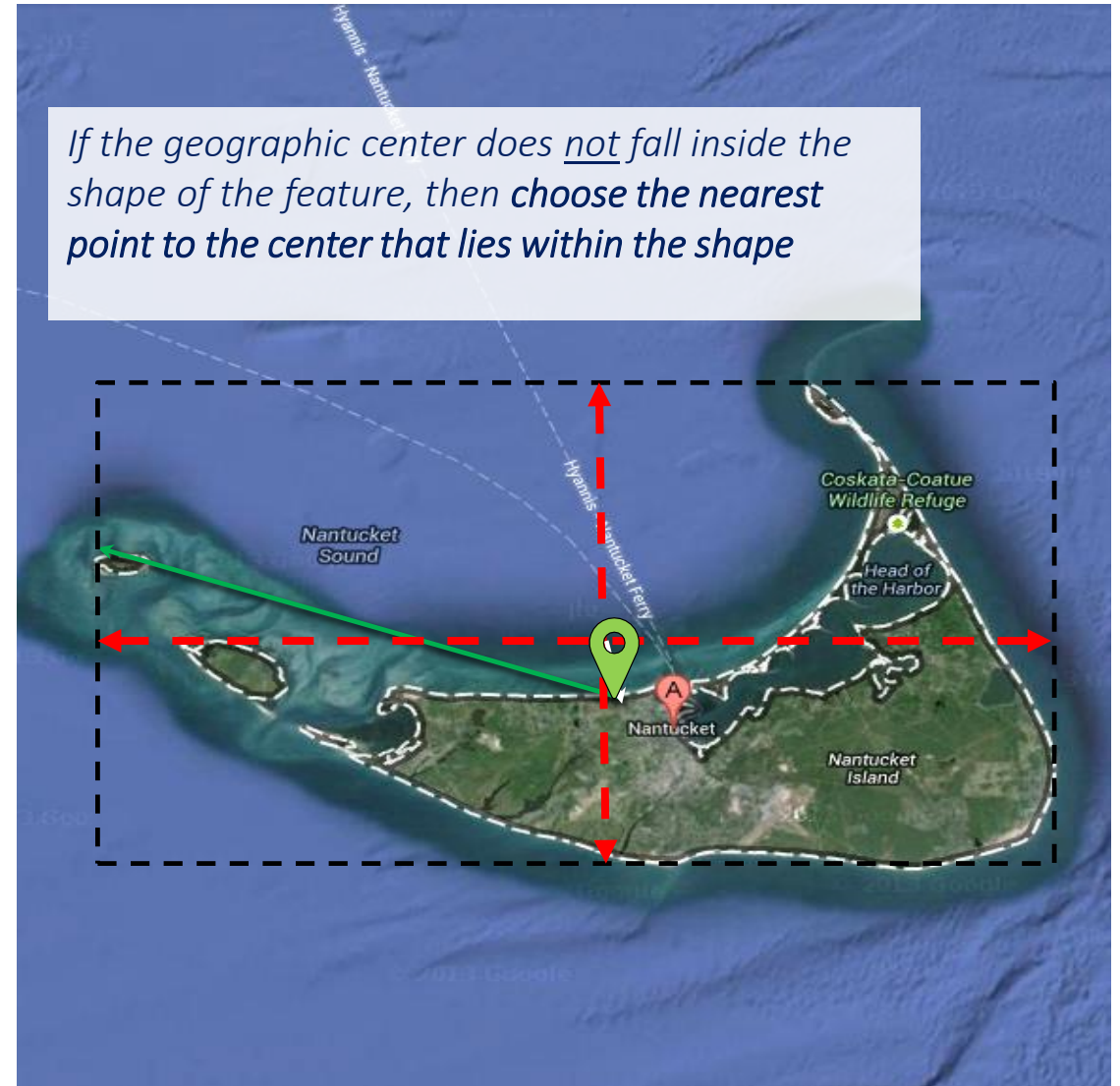

*If the geographic center does not fall inside the shape of the feature, then **choose the nearest point to the center that lies within the shape***

Example 2:*"Nantucket, MA"*

Feature – Without Obvious Spatial Extent

Previously: Named Place: Undefined Area (2012)

LOCALITY TYPE

Named place

Undefined Area: Locality refers to a geographic feature that does not have a clear spatial boundary

Example: "Pampa Grande" (the extent is 4.7 km given that the center of the nearest named place, "Colonia Mariano Sarratea" is 9.4 km distant)

Georeferencing Procedure:

B) Features *__without__* an obvious spatial extent

Coordinates:

?

Linear Extent:

?

- *__Populated places__ without __polygon__ when searched for in Google maps and boundaries that __cannot be reliably delineated__ from other sources or using visual cues*

- *__Complex__ or __amorphous__ __landscape features__ that are difficult to discern*

- *Features which are __contiguous__ with other nearby or subsidiary named places*

- *Features which __appear__ when searched on Google maps, but __no clearly defined settlement__ is visible __nearby__*

- *Names given to __small__ and/or __remote__ settlements which can be assumed to reflect larger, and more poorly defined territories*

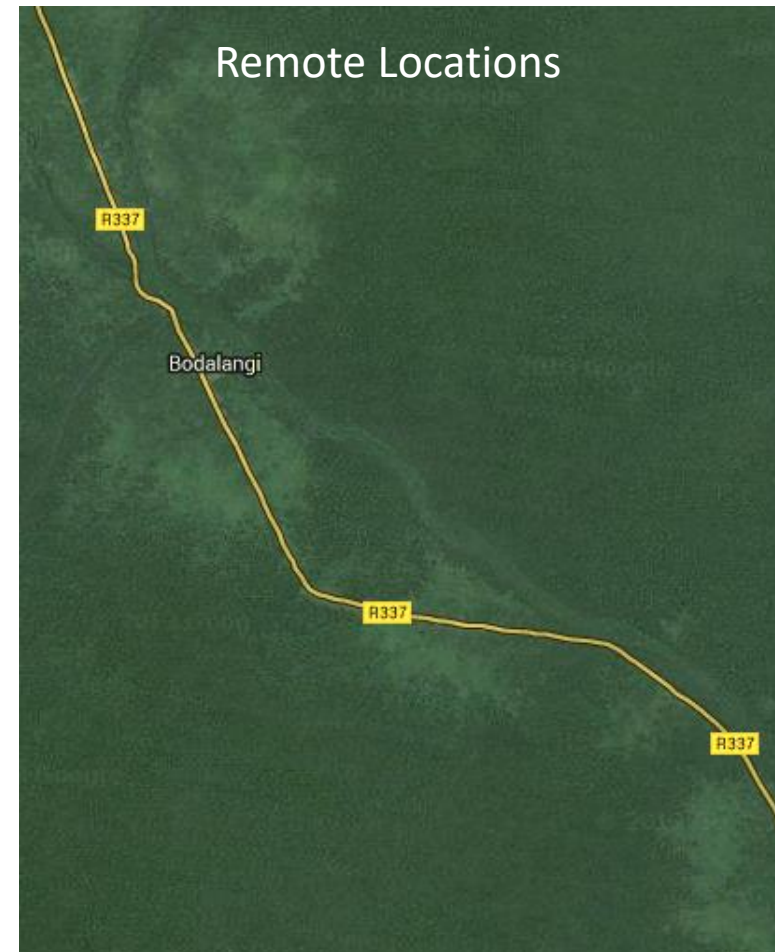# Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features *__without__* an obvious spatial extent

<u>Coordinates:</u> *Approximate* the ***corrected center***

<u>Radial:</u>

Updated Quick Reference Guide (Zermoglio 2020): approximate boundary based on visible clues, and document rationale. This is **not straight forward** and is **not easily repeatable**. Secondarily suggested: when there are no indicators for boundary, *use midpoint between the feature and nearest feature* of similar type, size, or importance to make a rough boundary (= halved distance between feature and nearest feature, as noted in the previous Georeferencing Quick Reference Guide, 2012). "Though this boundary may not

Example 4:*"Bodalangi, Democratic Republic of the Congo"*

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features _without_ an obvious spatial extent

Coordinates: _Approximate_ the **corrected center**

Radial:

When there are no indicators for boundary, **_use midpoint between the feature and nearest feature_ of similar type, size, or importance to make a rough boundary (= halved distance between feature and nearest feature, as noted in the previous Georeferencing Quick Reference Guide, 2012).**

Example 4:_"Bodalangi, Democratic Republic of the Congo"_
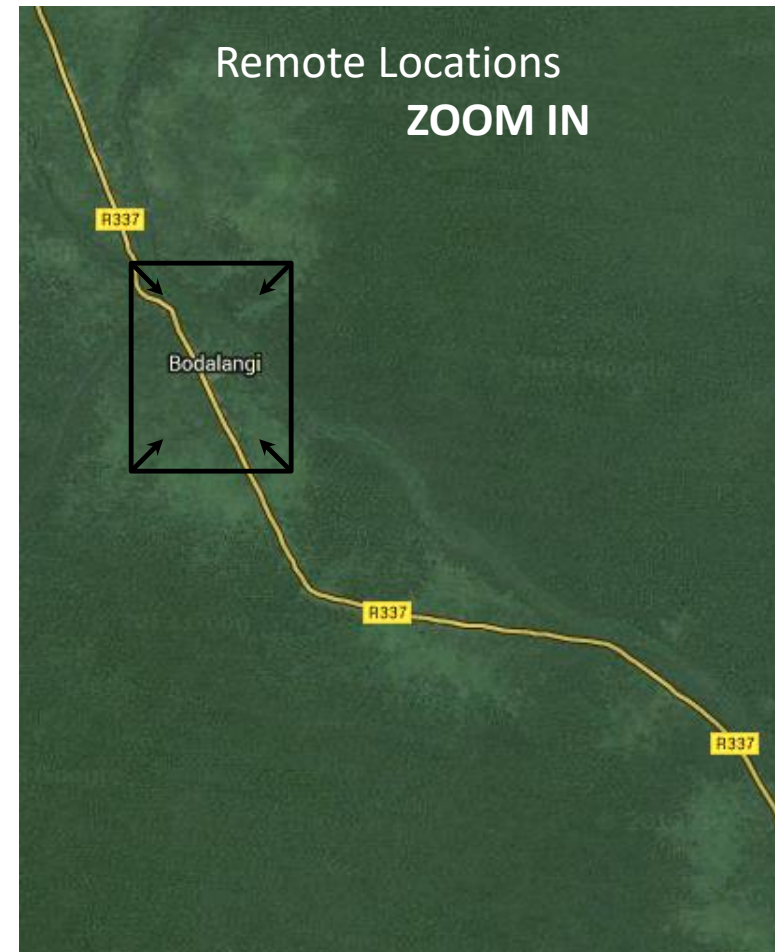
Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features _without_ an obvious spatial extent

Coordinates: _Approximate_ the **corrected center**

Radial:

When there are no indicators for boundary, **_use midpoint between the feature and nearest feature_** **of similar type, size, or importance to make a rough boundary (= halved distance between feature and nearest feature, as noted in the previous Georeferencing Quick Reference Guide, 2012).**

Example 4:_"Bodalangi, Democratic Republic of the Congo"_

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features *__without__* an obvious spatial extent

Coordinates: *Approximate* the *corrected center*

Radial:

1/2 of the distance from the selected coordinates **to the __nearest__ feature.**

This method is directly from the 2012 guide (Wieczorek 2012) but is in agreement with the updated guide (Zermoglio 2020)

Example 4:*"Bodalangi, Democratic Republic of the Congo"*

Feature – Without Obvious Spatial Extent

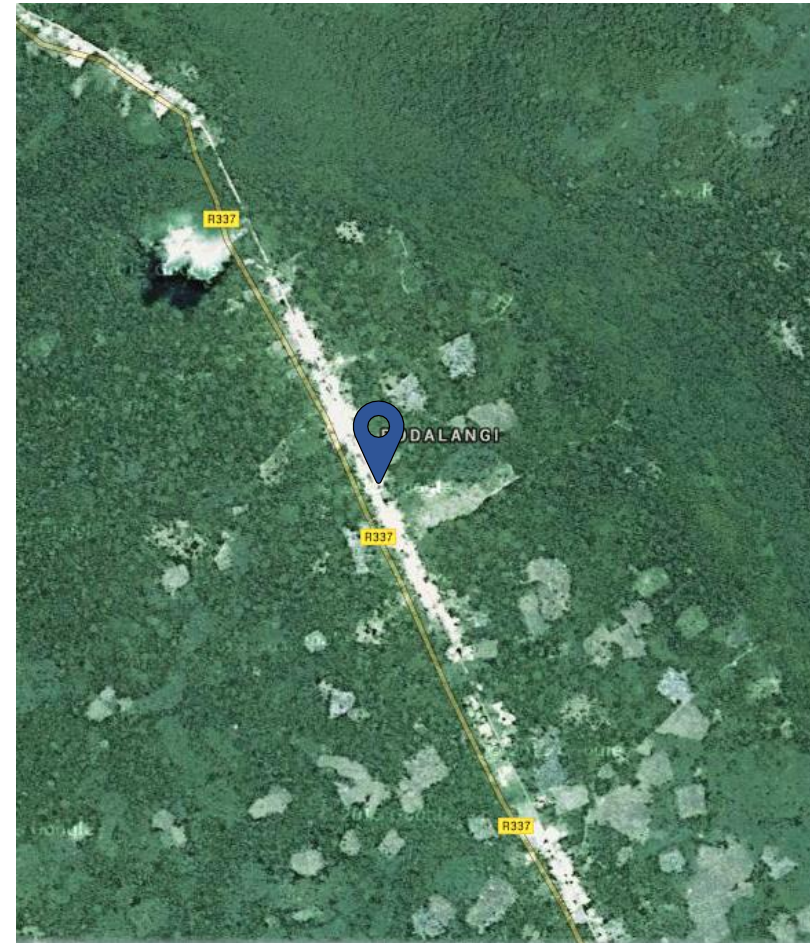Georeferencing Procedure:

B) Features _**without**_ an obvious spatial extent

Coordinates: _Approximate_ the _**corrected center**_

Radial: **1/2 of the distance** from the selected coordinates **to the** <u>nearest</u> **named feature.**

Example 4: _"Bodalangi, Democratic Republic of the Congo"_

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features *__without__* an obvious spatial extent

Coordinates: *Approximate* the ***corrected center***

Radial: 1/2 of the distance from the selected coordinates to the nearest named feature

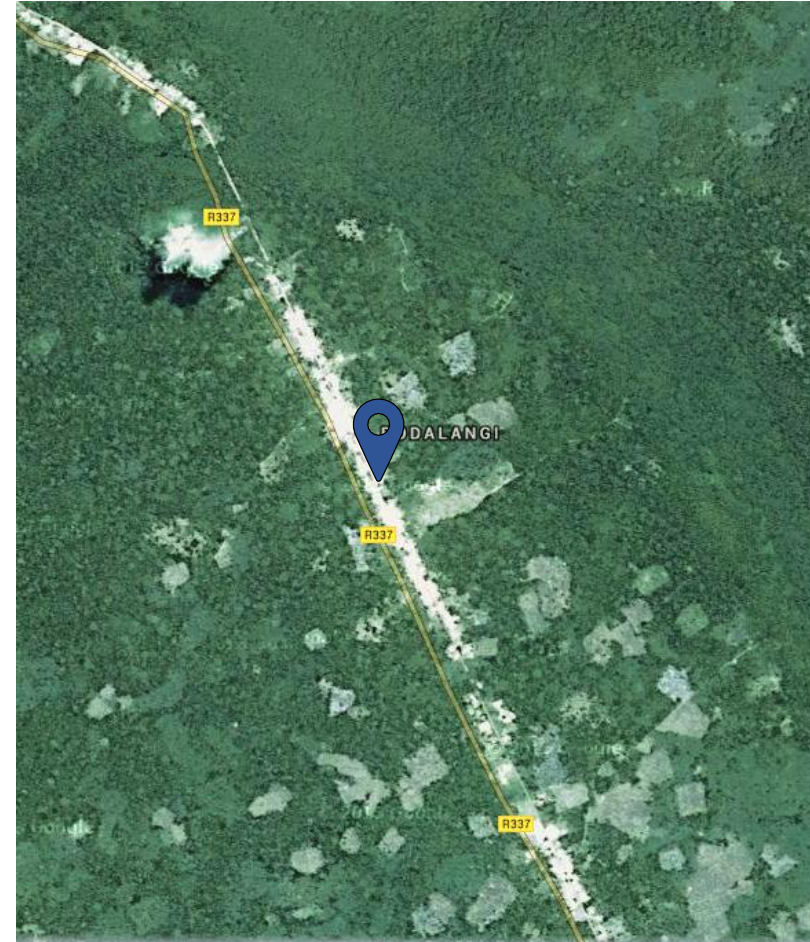**Example 4**:*"Bodalangi, Democratic Republic of the Congo"*

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features _without_ an obvious spatial extent

Coordinates: _Approximate_ the **corrected center**

Radial: 1/2 of the distance from the selected coordinates to the nearest named feature

Example 4: _"Bodalangi, Democratic Republic of the Congo"_

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features *__without__* an obvious spatial extent

Coordinates: *Approximate* the ***corrected center***

Radial: 1/2 of the distance from the selected coordinates to the nearest named feature

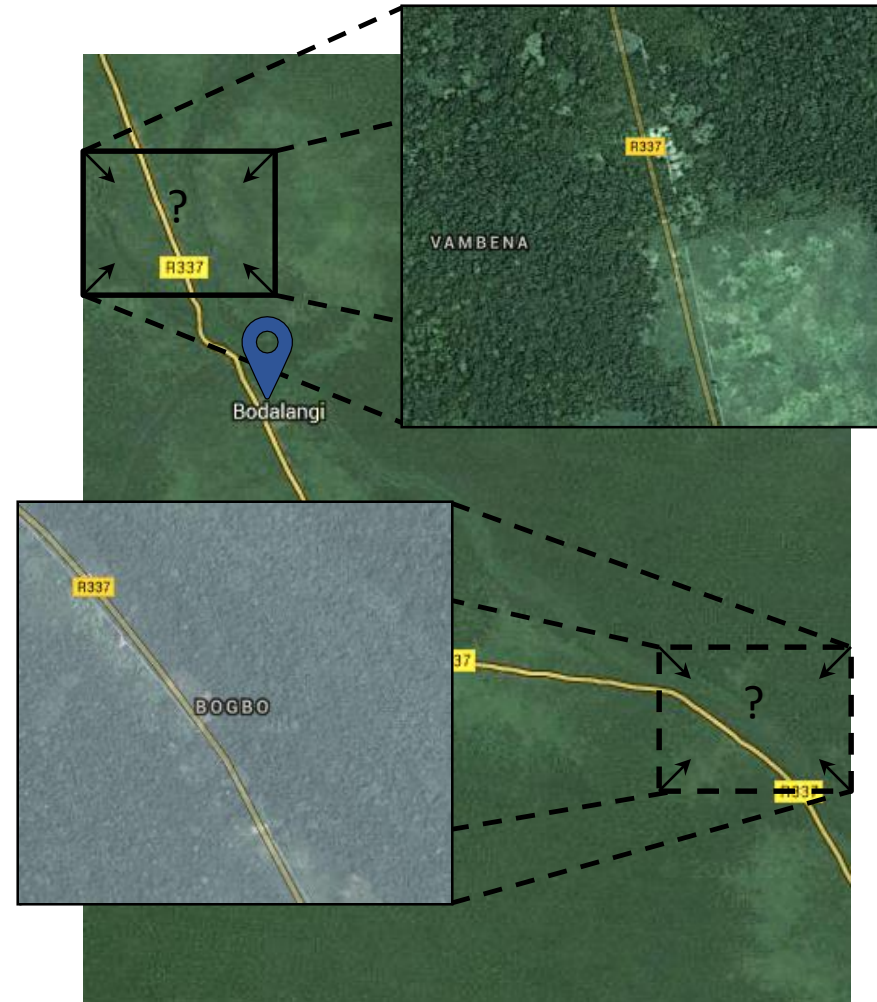**Example 4**:*"Bodalangi, Democratic Republic of the Congo"*

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features _**without**_ an obvious spatial extent

Coordinates: _Approximate_ the **corrected center**

Radial: 1/2 of the distance from the selected coordinates to the nearest named feature

Example 4:_"Bodalangi, Democratic Republic of the Congo"_

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features *__without__* an obvious spatial extent

Coordinates: *Approximate* the **corrected center**

Radial: 1/2 of the distance from the selected coordinates to the nearest named feature

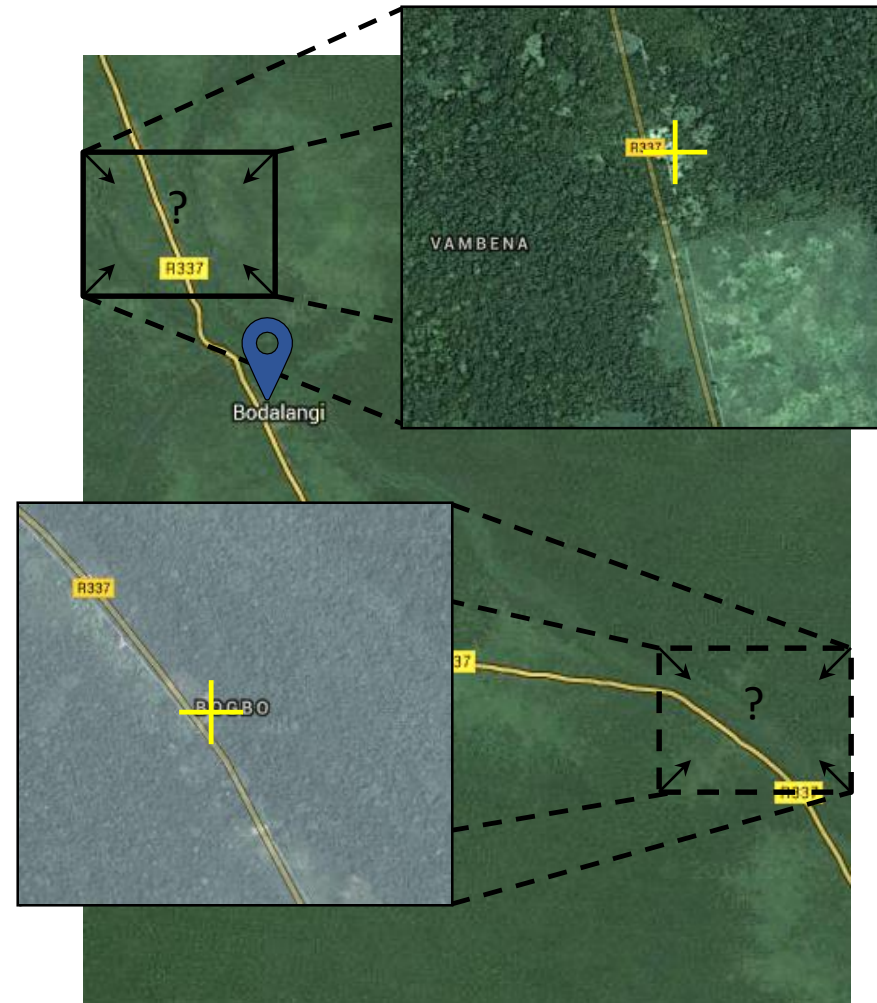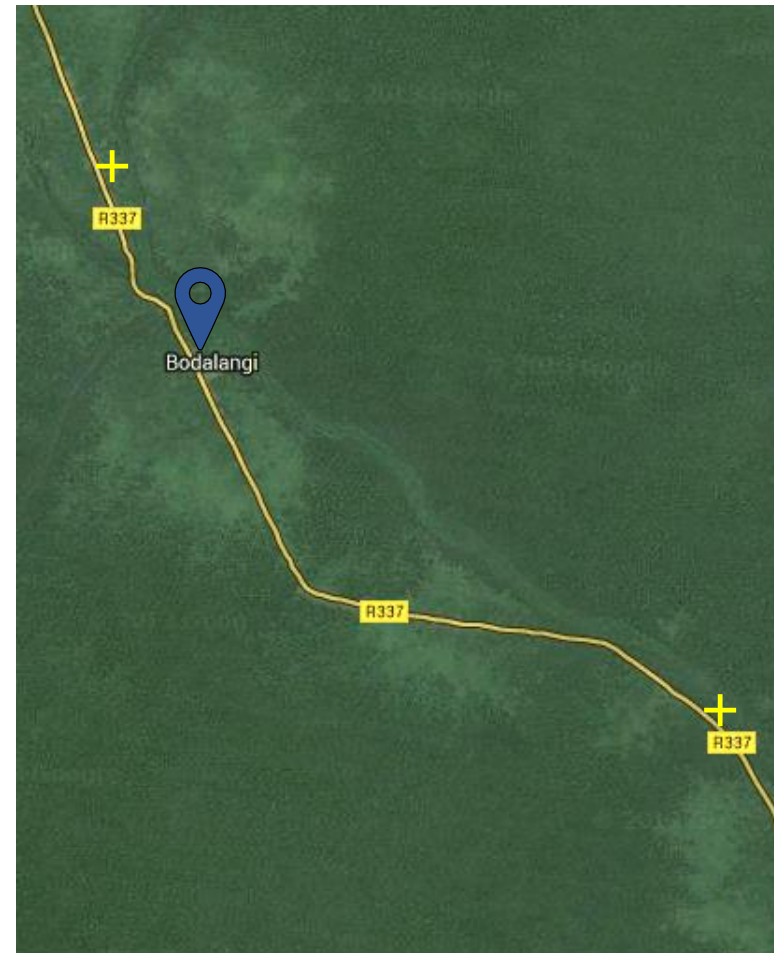**Example 4**:*"Bodalangi, Democratic Republic of the Congo"*

Feature – Without Obvious Spatial Extent

Georeferencing Procedure:

B) Features **_without_** an obvious spatial extent

Coordinates: *Approximate* the **corrected center**

Radial: **1/2 of the distance** from the selected coordinates **to the nearest** named feature

$$\frac{4.18260 \text{ km}}{2} = 2.0913 \text{ km}$$

Example 4:*"Bodalangi, Democratic Republic of the Congo"*

Feature – Special Cases

Subdivisions of a feature — such as "N part of Mono Lake" calculate the radial based only on the subdivision and proceed as you would with a location consisting of a named place with a spatial extent.

Properties (ranches, farms, stations, etc.) — if you are unable to locate in gazetteers or on regular maps, you may have to use a cadastral map, or carry out a search to see if you can locate them in relation to nearby cities or other geographic entities. If you are unable to find the boundaries, and thus determine the center, then use the coordinates of the next entity in the geography hierarchy (i.e. town, city that the property is located within)

Street Address — Radial is the smallest area possible that cannot be mistaken for another address. If you cannot determine the location and size of an address within a block, use half the length of the city block for the radial and make note of this in the georeferencing remarks.

Mountain — Use Google Maps (Terrain View), or other sources that display contour lines showing topographic relief to define the boundaries of the mountain.

Mountain

- If able to discern the mountain's boundary, treat as a **Feature – with Obvious Spatial Extent**

- If unable to delineate mountain's extent, treat as a **Feature – without Obvious Spatial Extent**, and measure to nearest mountain (if possible)

- Incorporate <u>elevation</u> if provided; locate coordinates at the elevation specified nearest to corrected center of mountain

The boundaries between mountains can be determined by using the terrain (valleys, saddles, and plains) that separate one mountain from others around it (Figure 5).

Always use `georeferenceRemarks` to document the decisions made and the reasons for them as well as possible, including the neighbouring features used for reference.
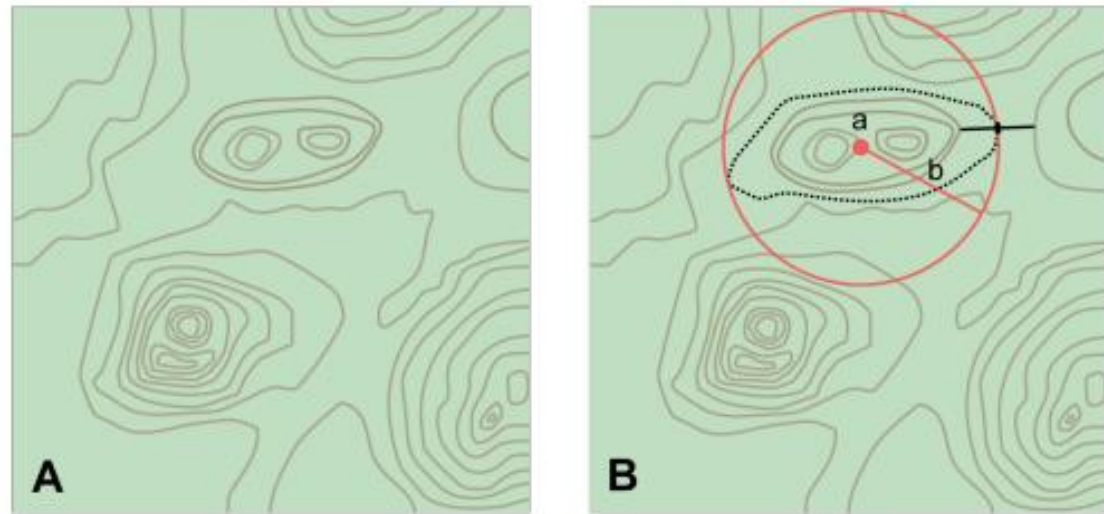

Figure 5. A. Topographic contours of a group of nearby mountains. B. Rough boundary, corrected center **a** and geographic radial **b** of a mountain determined by the surrounding valleys, saddles, and plains.

Feature – Near a Feature

Previously: Named Place: Near a Named Place (2012)

LOCALITY TYPE

Named Place

Near a Named Place

Examples: "vicinity of General Conesa", "before Ceibas", "near Dina Huapi"

Definition: A locality given <u>without an exact position</u>, but with ***"near"***, ***"in the vicinity of"***, ***"adjacent to"***, or some similar relation to a feature cited.

These locality descriptions imply an offset from a named place without definitive directions or distances.

Examples:

1. *"Near Las Vegas, NV"*
2. *"In the vicinity of Brooklyn, IA"*
3. *"Near bridge over Condamine River on Leichhardt Hwy, Australia"*
4. *"General area of confluence of Black and Oshetna Rivers"*

Feature – Near a Feature (2012)

Previously: Named Place: Near a Named Place (2012)

Georeferencing Procedure:

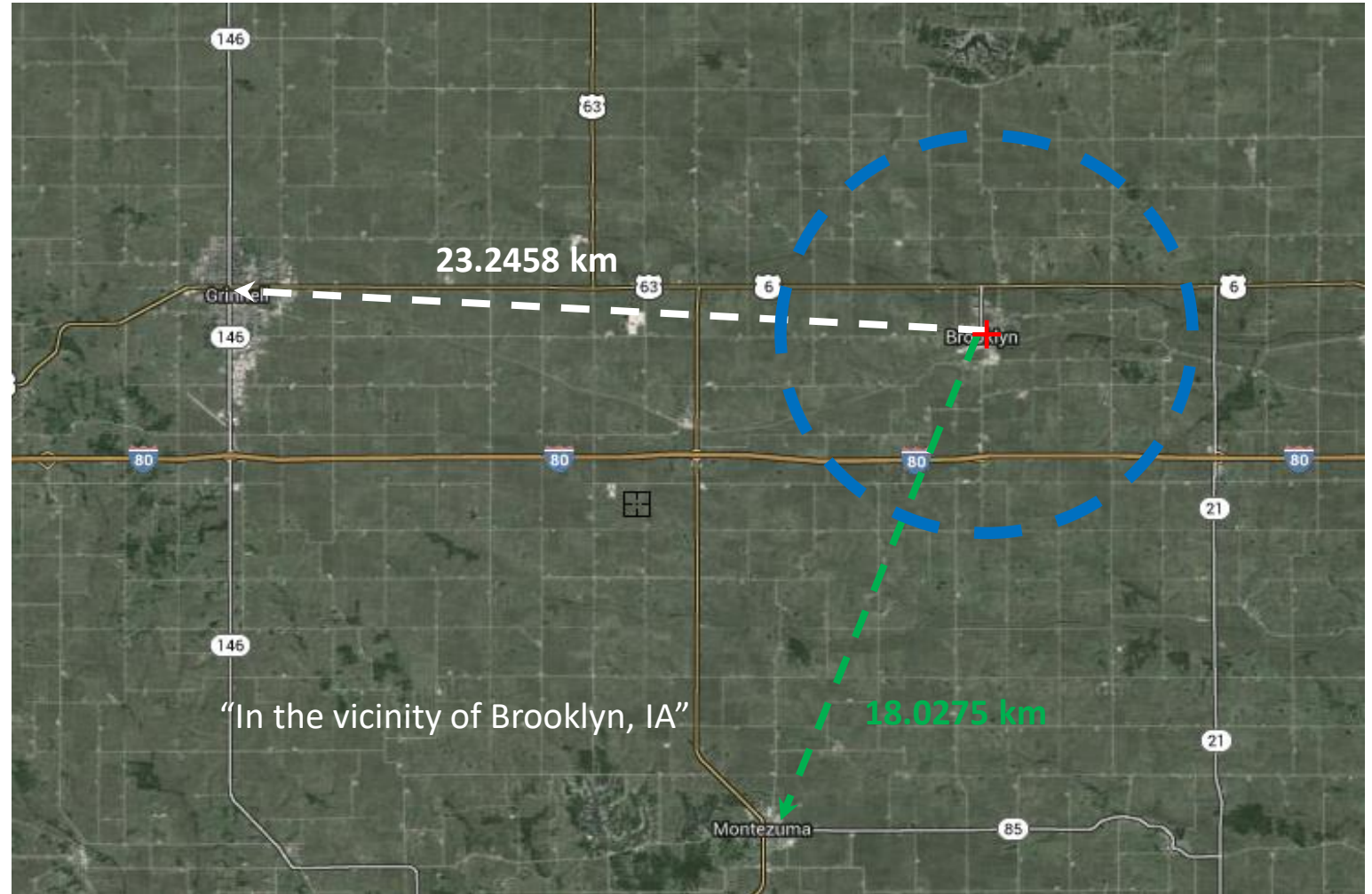Follow protocols for Feature – without Obvious Spatial Extent

<u>Coordinates:</u>
Approximate the *geographic center*

<u>Linear Extent:</u>
1/2 of the distance from the selected coordinates **to the** <u>**nearest**</u> named place

= 9.01375 km

23.2458 km

"In the vicinity of Brooklyn, IA"

18.0275 km

*It is assumed that **<u>if</u>** a locality was **further away** than that distance, it would be said to be **near a** **<u>different</u>** **named place***

*Feature – Near a Feature (BioGeomancer)

Geological/natural and unevenly spaced features

Georeferencing Procedure:

Similar to: FEATURE (NAMED PLACE) / Defined Area

Coordinates:
   Approximate the **center**

Radial:
   Which ever is greater: 1) **2 km** or 2) **200% of the radial** of the Feature (from **Biogeomancer Guide to Best Practices for Georeferencing**)

   "Near Bosque Estatal de Ceiba Natural Reserve, Puerto Rico"

Feature – Near a Feature (BioGeomancer)

Georeferencing Procedure:

Similar to: FEATURE (NAMED PLACE) / Defined Area

Coordinates:
   Approximate the **center**

Radial:
   Which ever is greater: 1) ***2 km*** or 2) ***200% of the radial*** of the Feature (from Biogeomancer Guide to Best Practices for Georeferencing)

   "Near Bosque Estatal de Ceiba Natural Reserve, Puerto Rico"

Feature – Near a Feature (BioGeomancer)
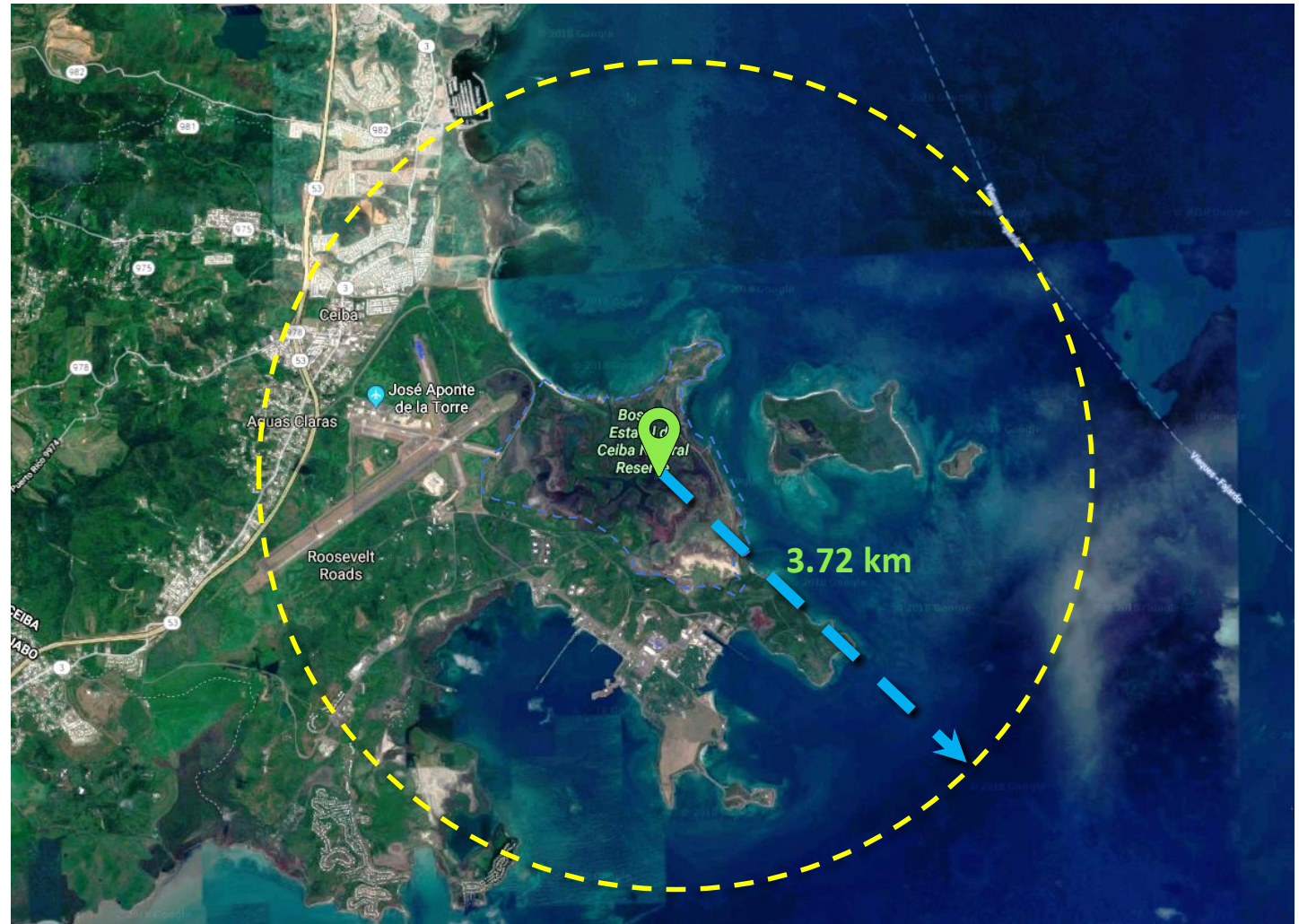
Georeferencing Procedure:

Similar to: FEATURE (NAMED PLACE) / <u>Defined</u> Area

<u>Coordinates</u>:
   Approximate the **center**

<u>Radial</u>:
   Which ever is <u>greater</u>: 1) *2 km* or 2) *200% of the radial* of the Feature **(from Biogeomancer Guide to Best Practices for Georeferencing)**

"Near Bosque Estatal de Ceiba Natural Reserve, Puerto Rico"

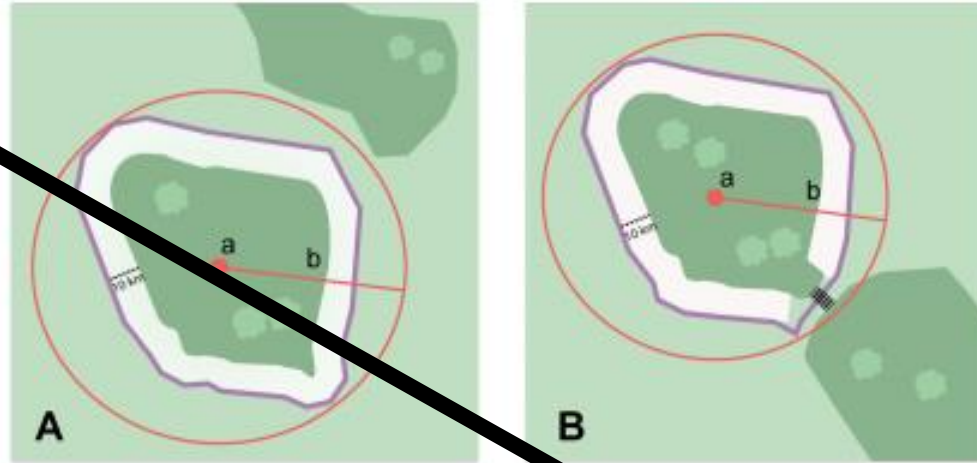3.72 km

Feature – Near a Feature (2020)

Figure 14. Boundary, corrected center **a** and geographic radial **b** of an interpretation of locality type "near a Feature" with a boundary extended a fixed distance in all directions, in this case 10 km. **A**: Boundary extended a fixed distance in all directions with no neighbouring conflicts. **B**: Boundary extended a fixed distance in all directions except in the area overlapping a similar feature, where it extends half the distance to the neighbouring feature.

Determine boundary of feature. To account for the proximity indicator, **extend that boundary outward for a fixed distance in all directions.** Call this the "extended feature."

The buffer distance for the extension is arbitrary – it is hard to defend any given value as a default. Make a judgement and imagine what the person who recorded the locality meant. Document the rationale and decisions made (Zermoglio 2020)

Feature – Between Two Features

Previously: Named Place: Between Two Named Places (2012)

LOCALITY TYPE

Named Place

Between two Places

Examples: "between Missoula and Florence, Montana", "Entre Pampa Blanca y Pampa Vieja, Jujuy"

Definition: A locality cited as '*between*' two features or named places.

Georeferencing Procedure:

1. ***Find coordinates for the approximate corrected centers*** *of the* <u>two</u> *named places* or ***features*** *that the locality is said to be located between*

2. ***Measure a straight line between the two coordinates***

3. ***Determine the MIDPOINT*** *of this this line. The lat/long coordinates for this point will be the* ***coordinates*** *for your final georeference*

4. *Use the* ***distance from the midpoint to each of the two endpoints*** *(at the geographic centers of the two bracketing named places/features) as the* ***radial***

Feature – Between Two Features

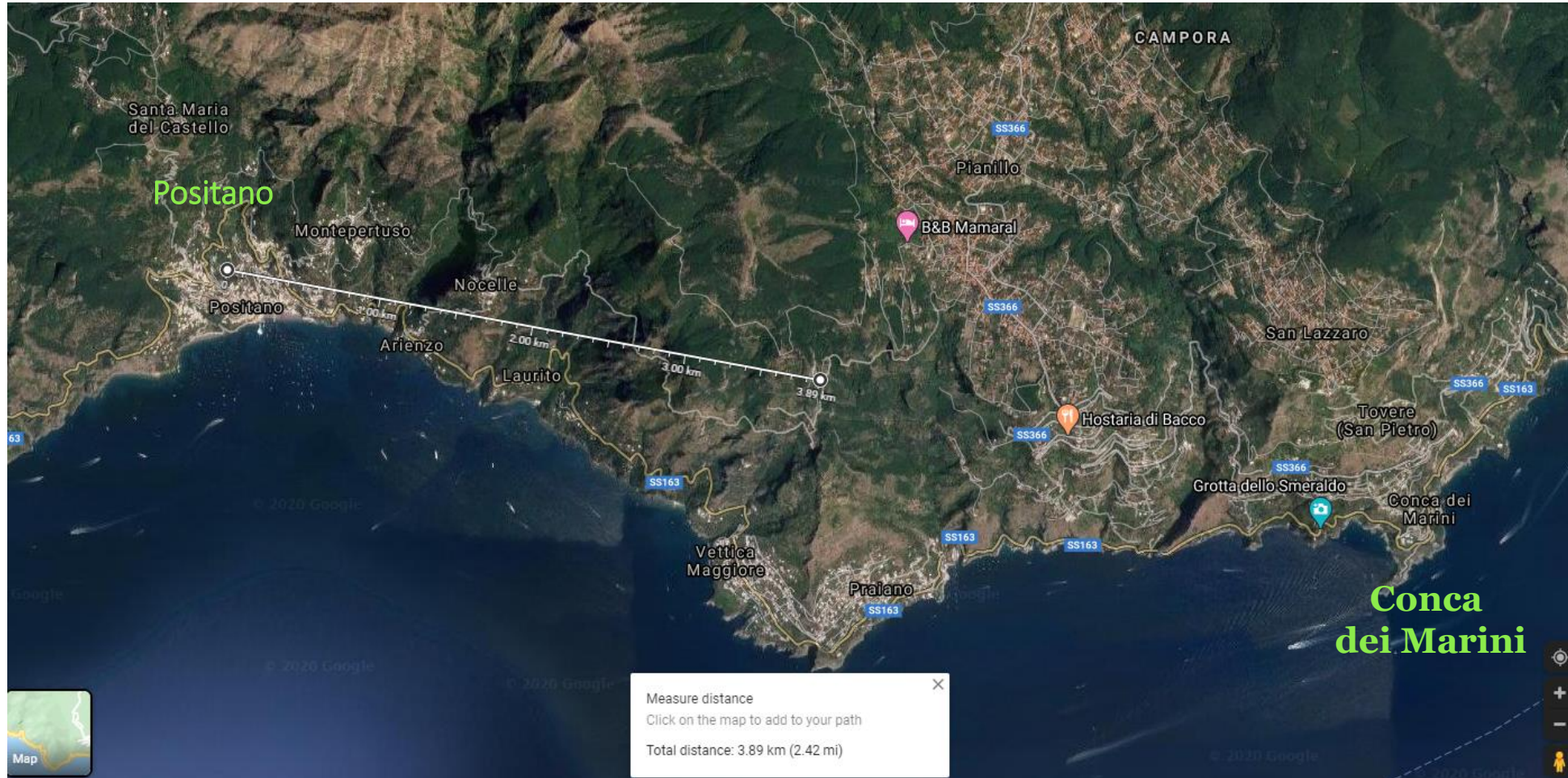Definition: A locality cited as '*between*' two features or named places.
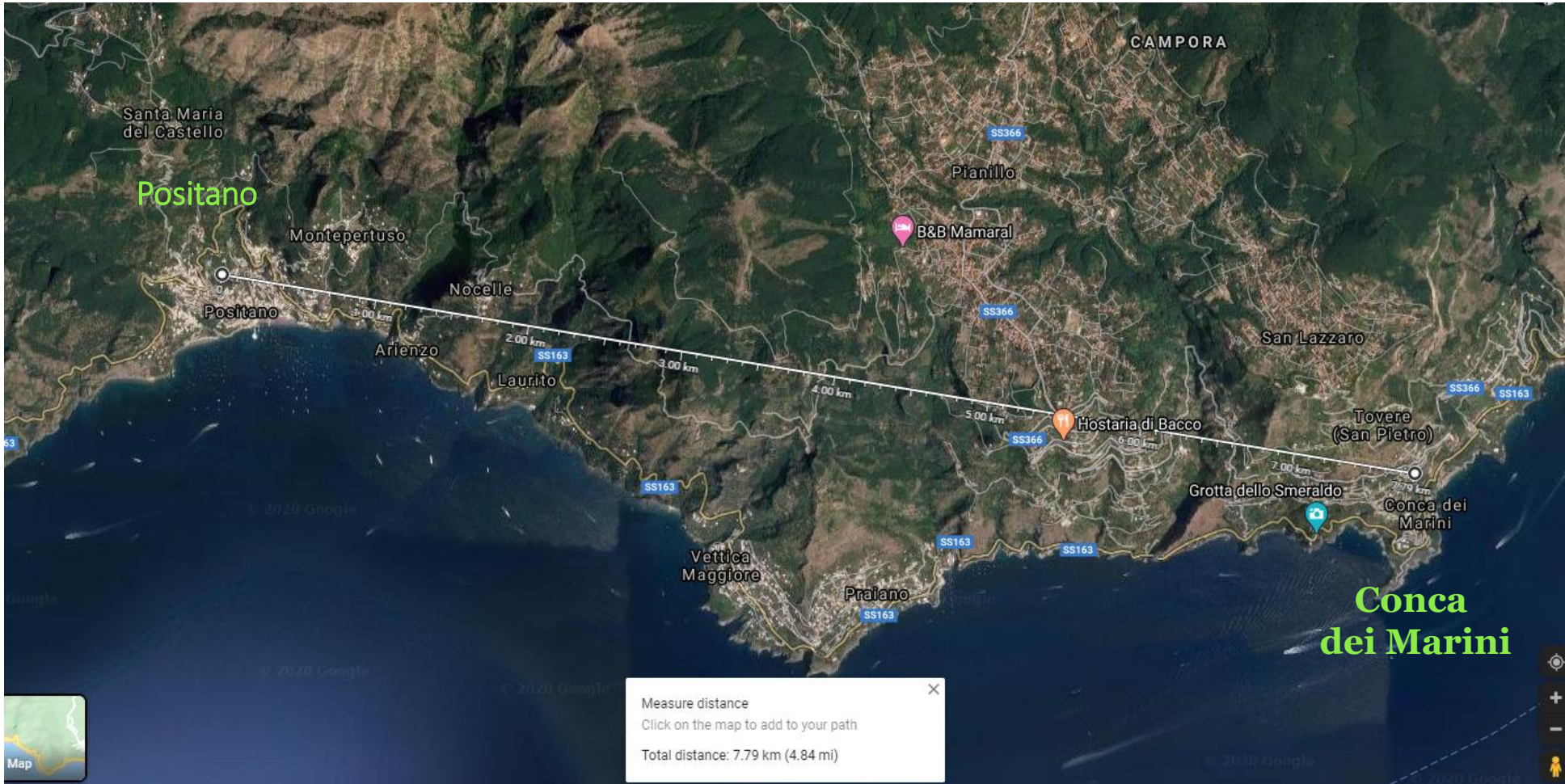
Find the total measurement between the geographic centers of both features (7.79km)

Description: "Between Positano and Conca dei Marini, Italy"

Feature – Between Two Features

Definition: A locality cited as '*between*' two features or named places.
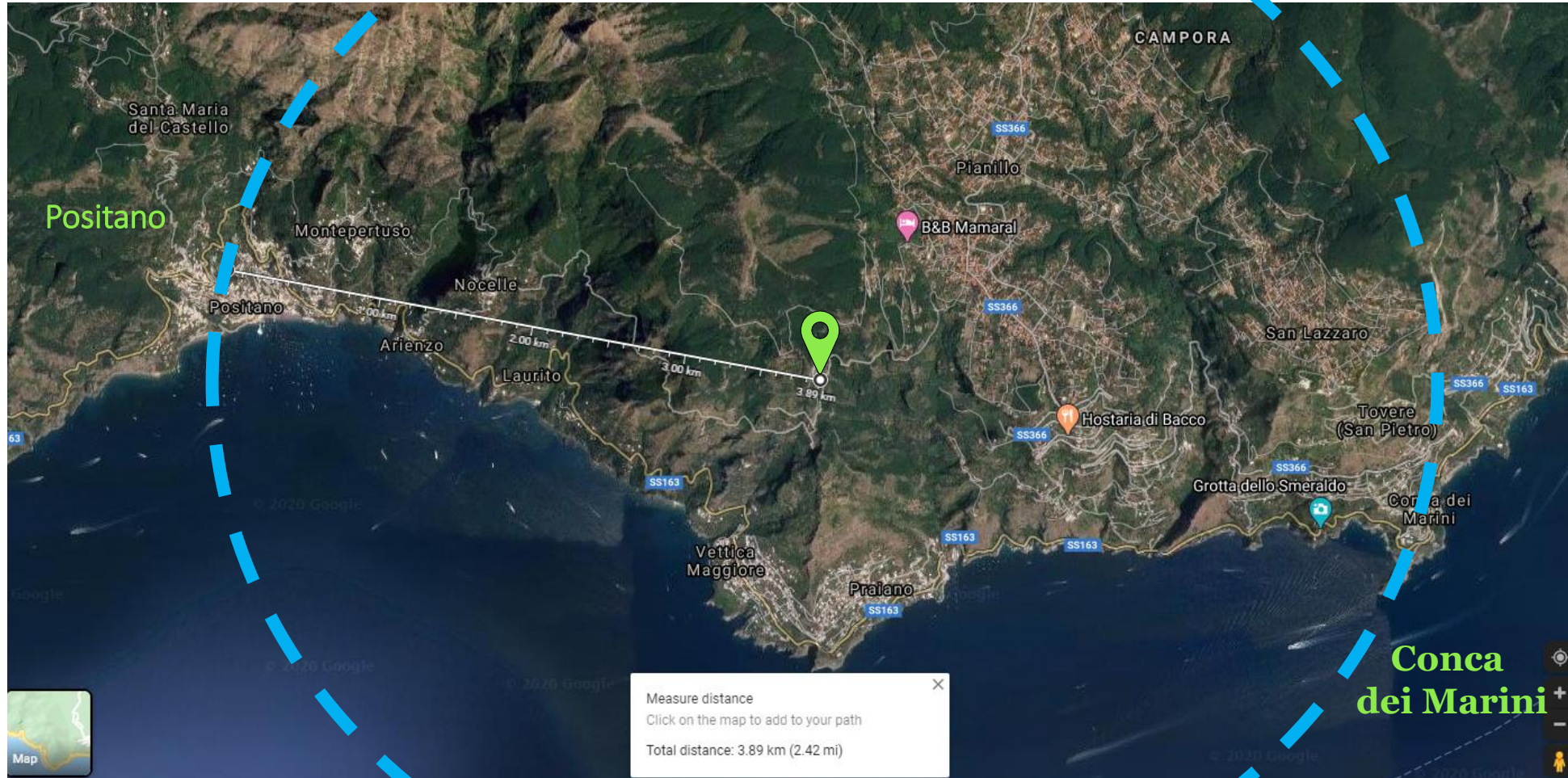

Description: "Between Positano and Conca dei Marini, Italy"

Click & hold the end node of the measurement tool to measure back to the ½ distance **(3.89km)** to find the midpoint

Feature – Between Two Features

Definition: A locality cited as '*between*' two features or named places.

Linear extent is the halved distance between the two localities (3.89km)

Description: "Between Positano and Conca dei Marini, Italy"

Feature - Path

LOCALITY TYPE

Named Place

River, stream, road, path

Examples:
"Sacramento River", "Jones Road", "Río Paraná", "Arroyo Urugua-í"

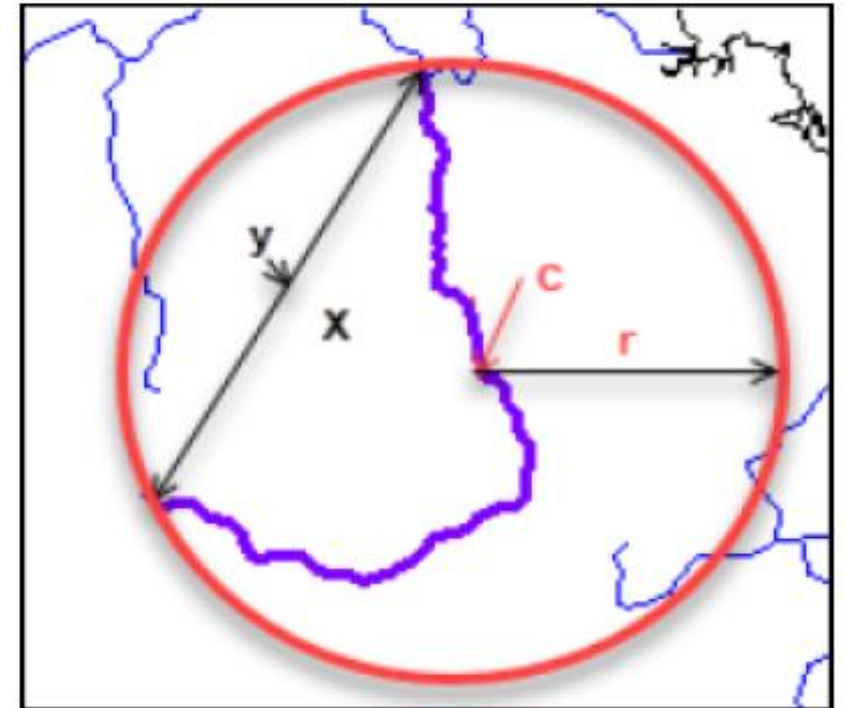**Definition:** The locality is a **linear feature** such as a <u>road</u>, <u>trail</u>, <u>boundary</u>, <u>river</u>, or <u>contour line</u>; or a specific **subdivision of a linear feature** that is bounded by other named places or features.

Georeferencing Procedure:

1. **Find coordinates for the endpoints** of the linear feature

2. **Measure a straight line between the two coordinates**

3. **Determine the MIDPOINT** of this this line.

4. **Find the closest point along the linear feature** to this midpoint → *Coordinates*

5. Measure the **distance from these coordinates to the** <u>farther</u> of the **two endpoints** → *radial*

A path (river) showing the center of the smallest enclosing circle, 'x', the mid point between the ends of the river 'y', the corrected center 'c' and the radial 'r'

Feature – Path

Definition: The locality is a **linear feature** such as a <u>road</u>, <u>trail</u>, <u>boundary</u>, <u>river</u>, or <u>contour line</u>; or a specific *subdivision of a linear feature* that is bounded by other named places or features.
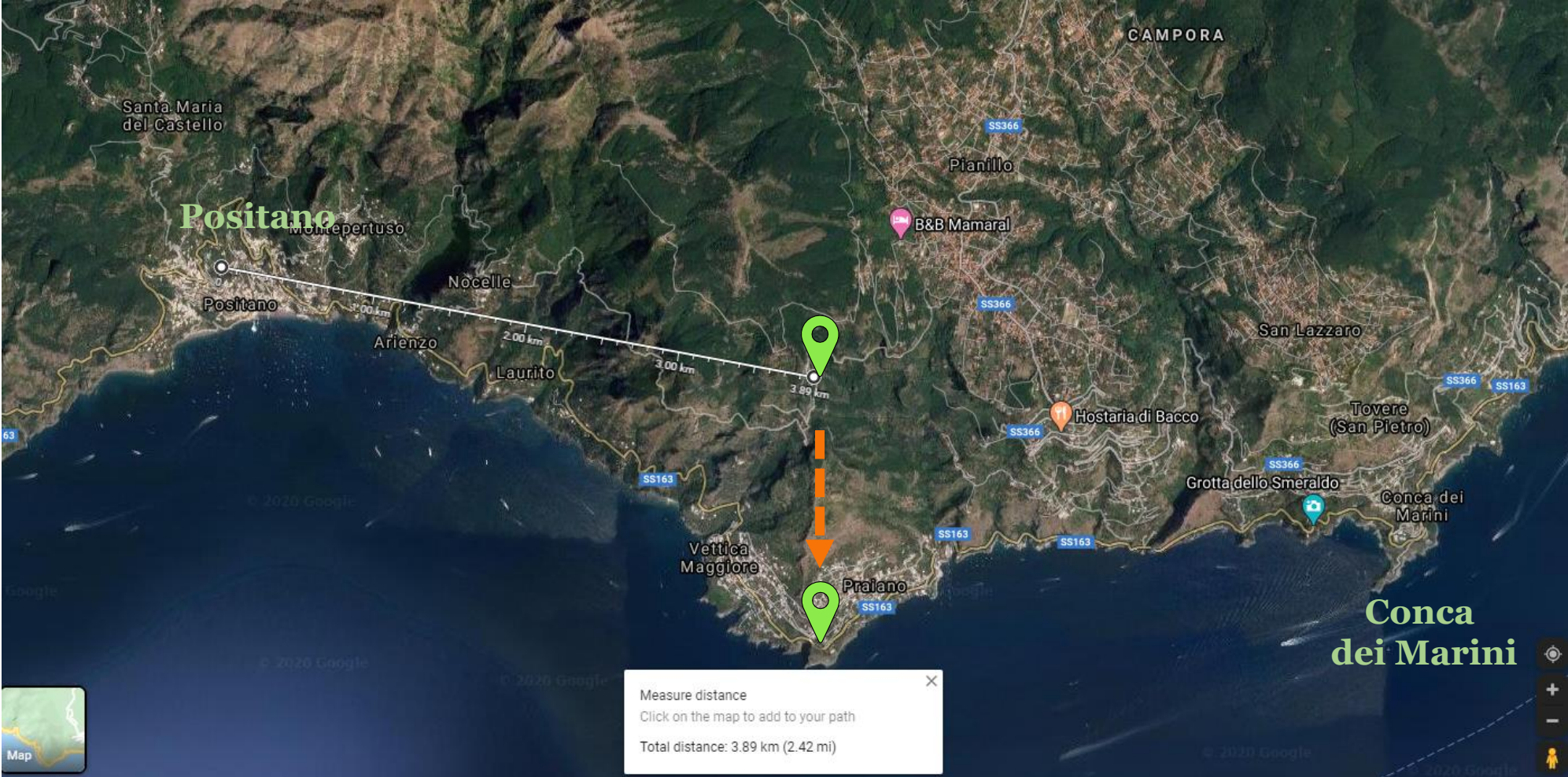

Measure a straight line between the location where the road comes closest to the centers of both cities, and half this distance

Description: "Along SS163 between Positano and Conca dei Marini, Italy"

Feature – Path

Definition: The locality is a **linear feature** such as a _road_, _trail_, _boundary_, _river_, or _contour line;_ or a specific _subdivision of a linear feature_ that is bounded by other named places or features.
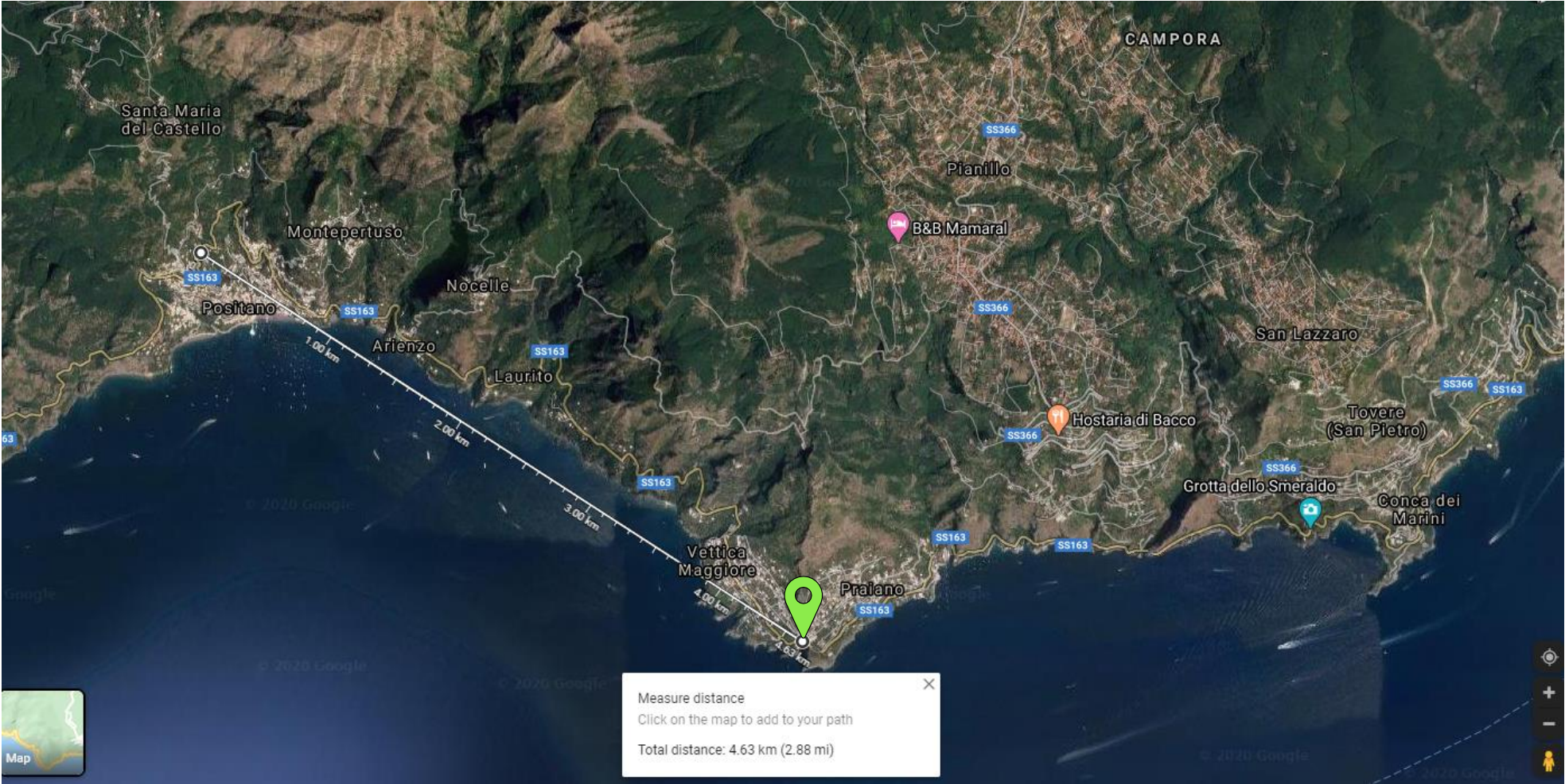
Move the midpoint location to the road. Measure again from the new coordinates on the road to the farther of the cities

Description: "Along SS163 between Positano and Conca dei Marini, Italy"

Feature – Path

Definition: The locality is a **linear feature** such as a _road_, _trail_, _boundary_, _river_, or _contour line;_ or a specific _subdivision of a linear feature_ that is bounded by other named places or features.

Re-measure from new midpoint (on road) to the farther of the two end points (either city), as moving the point will change initial halved distance

Description: "Along SS163 between Positano and Conca dei Marini, Italy"

Feature – Path

Definition: The locality is a **linear feature** such as a _road_, _trail_, _boundary_, _river_, or _contour line_; or a specific *subdivision of a linear feature* that is bounded by other named places or features.
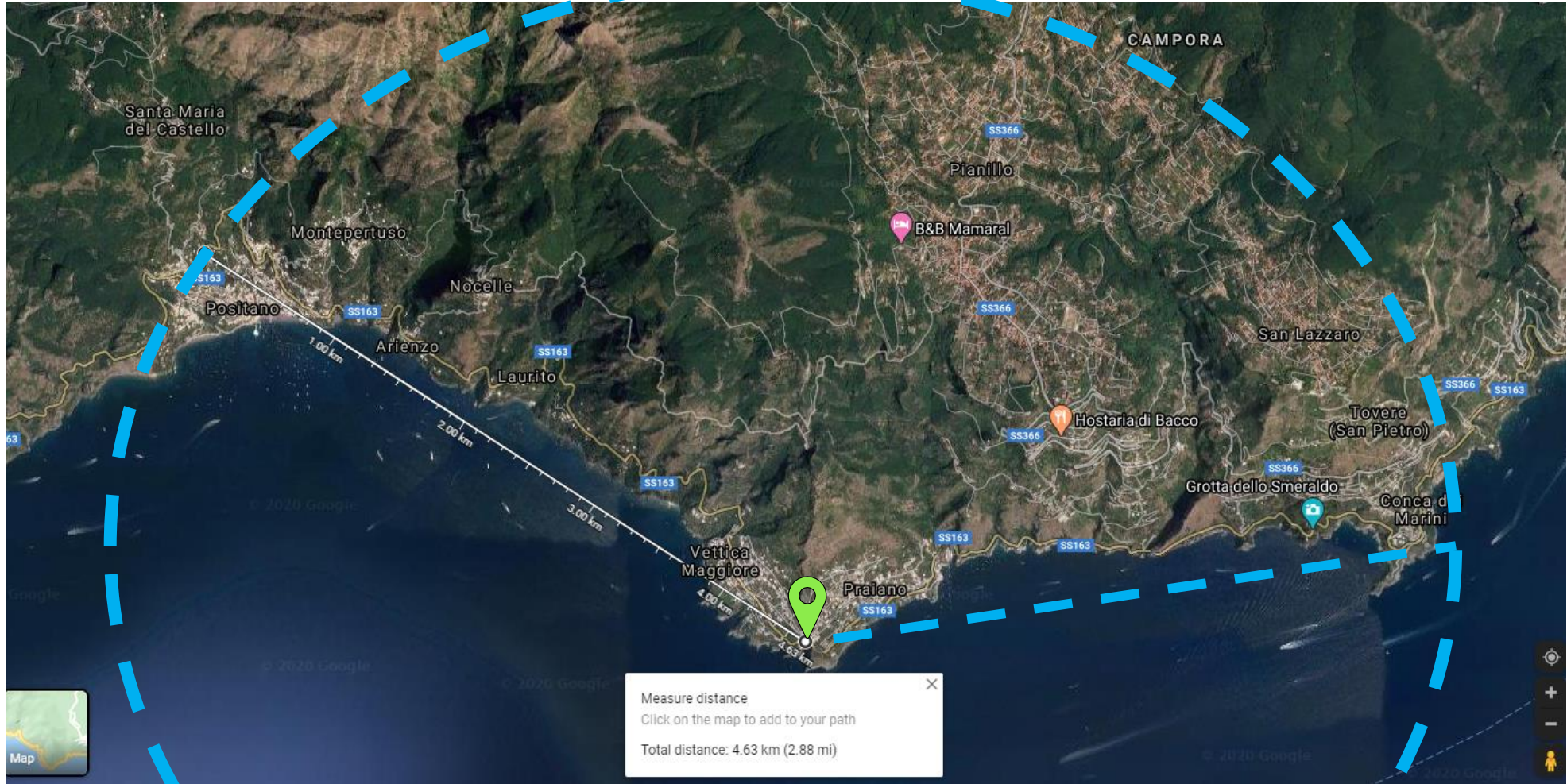
No specified boundaries??

Georeference the **entire** linear feature!!

EX.2 "Mataroni River, Cayenne, French Guiana

Feature – Path

Definition: The locality is a **linear feature** such as a _road_, _trail_, _boundary_, _river_, or _contour line_; or a specific *subdivision of a linear feature* that is bounded by other named places or features.

No specified boundaries??

Georeference the **entire** linear feature!!

mouth

headwaters

EX.2 "Mataroni River, Cayenne, French Guiana

Approuague River
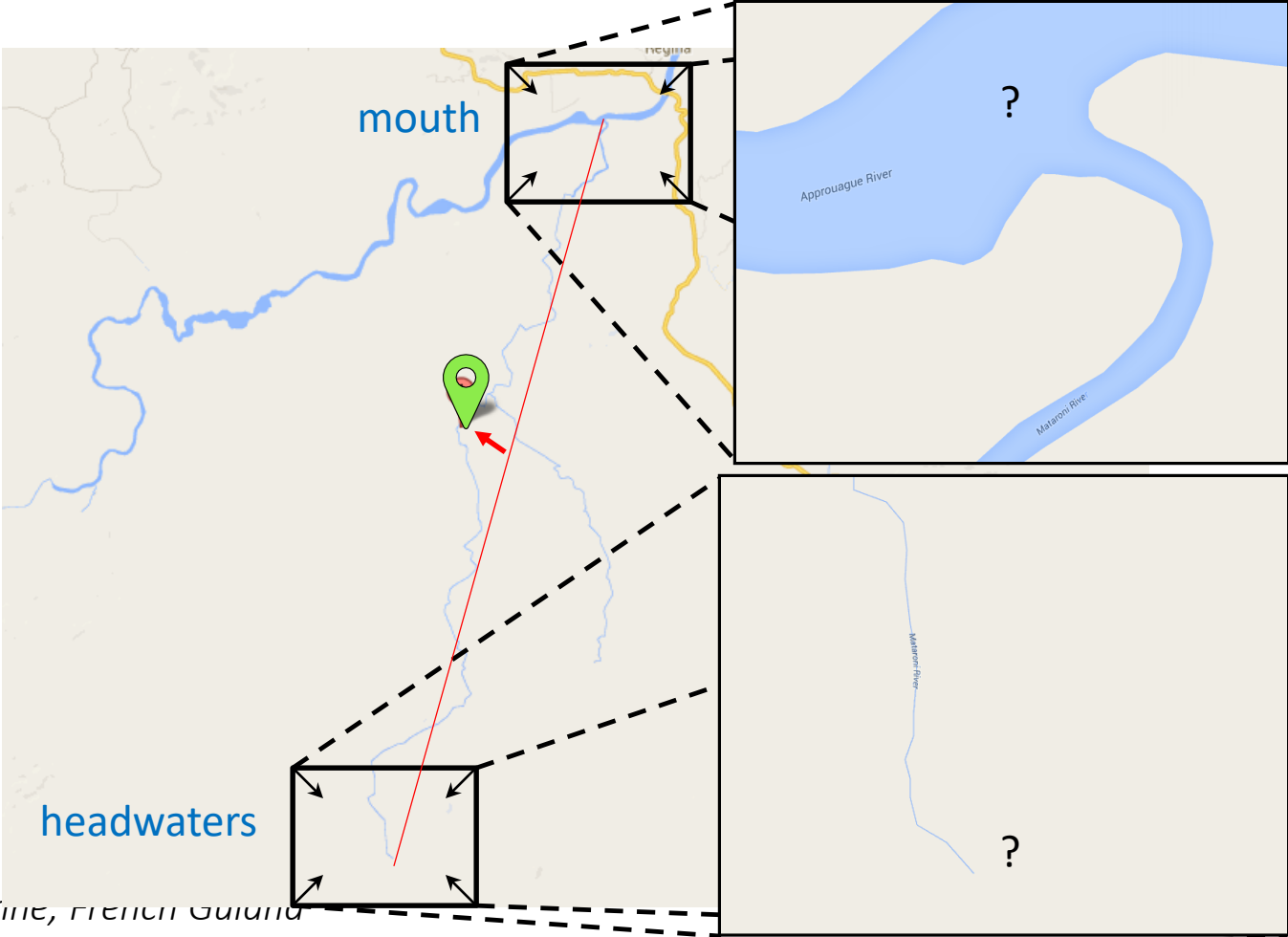
Mataroni River

Mataroni River

?

?

Feature – Path

Definition: The locality is a **linear feature** such as a _road_, _trail_, _boundary_, _river_, or _contour line_; or a specific *subdivision of a linear feature* that is bounded by other named places or features.
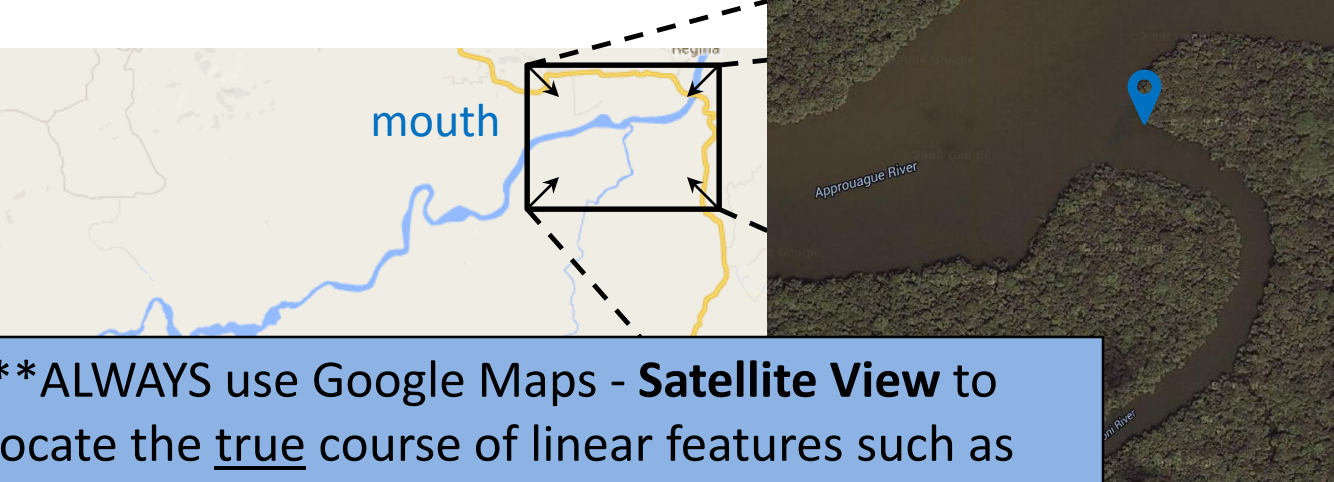
mouth

ALWAYS use Google Maps - Satellite View to locate the <u>true</u> course of linear features such as rivers, streams, and roads**

headwaters
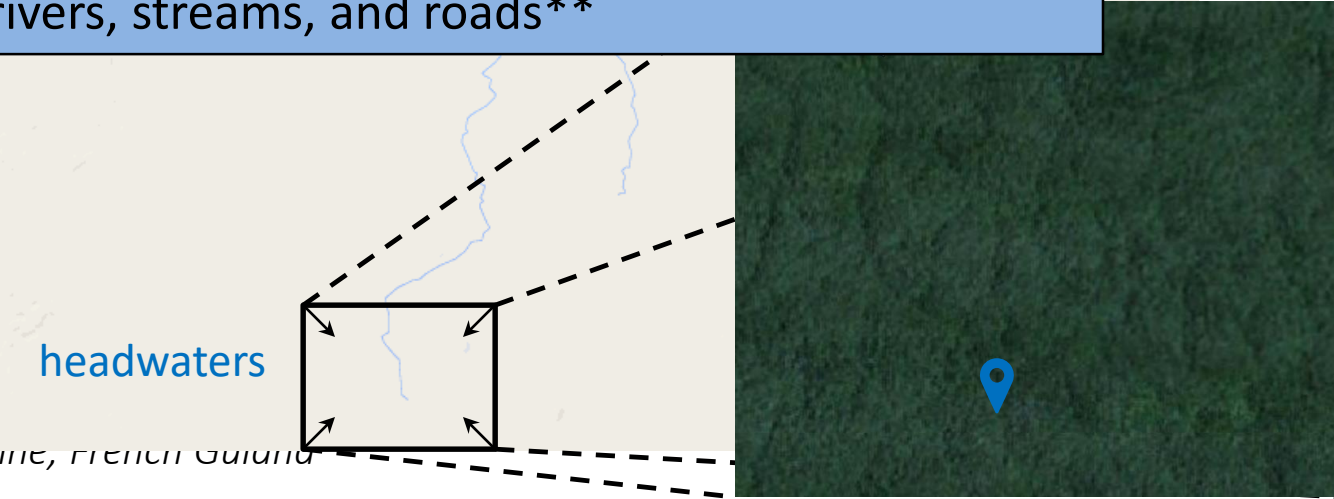
EX.2 "Mataroni River, Cayenne, French Guiana"

Offsets

An offset is a **displacement from a reference point**, and is generally accompanied by a direction

- When provided, **follow the path designated ('by road', 'by river', etc.)** as best as possible.

- It is sometimes **impossible to infer the offset path** from evidence in the locality description, in these cases **assume offset by air** ("offset at a heading" locality type).
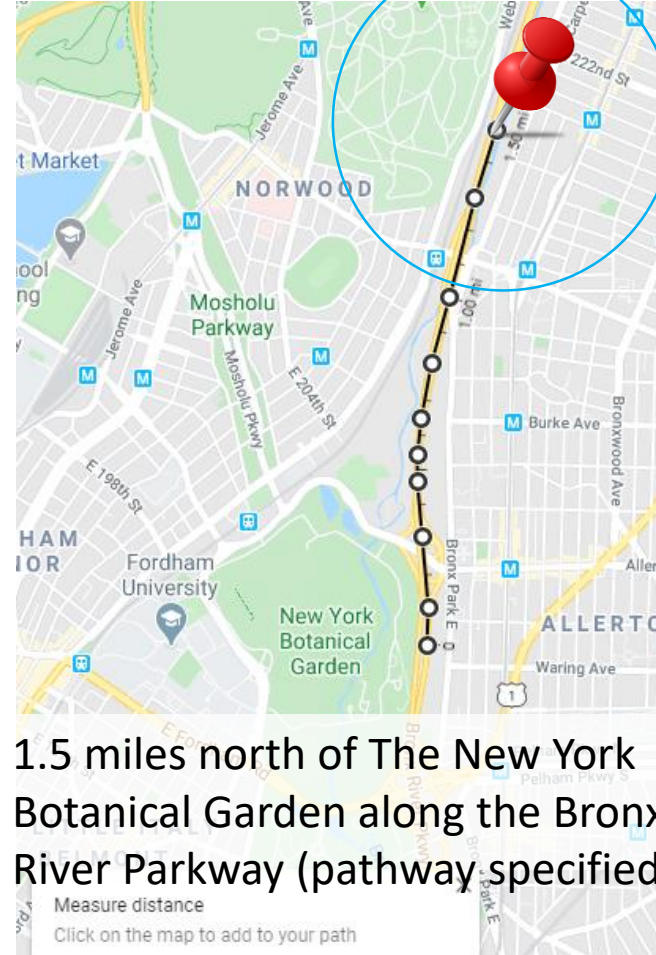
1.5 miles north of The New York Botanical Garden along the Bronx River Parkway (pathway specified)

Offset along a path
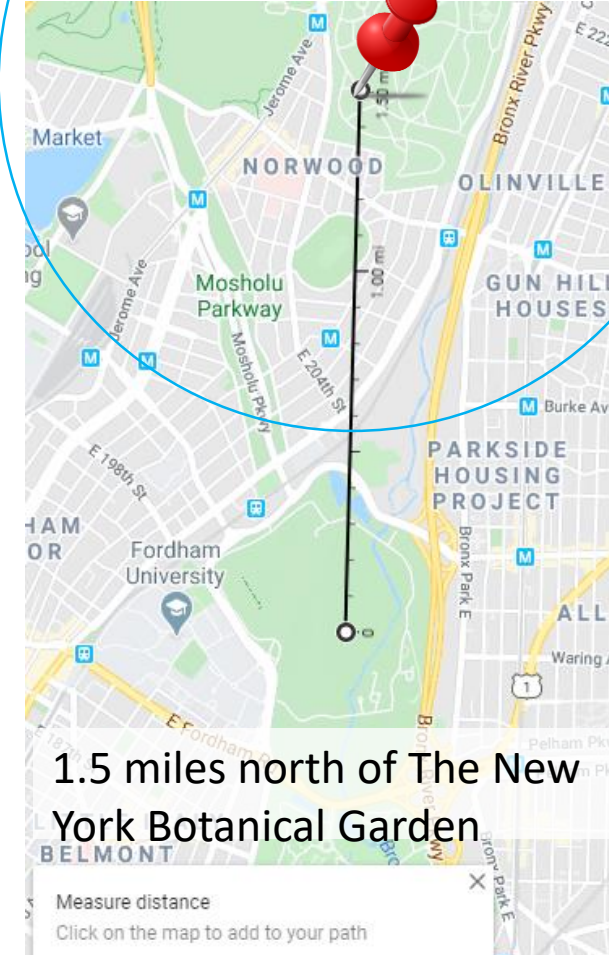
1.5 miles north of The New York Botanical Garden

Offset at a heading

Offset – Distance along a Path

Previously: Offset: Offset along a path (2012)

LOCALITY TYPE

Offset

Offset along a path

Examples: "7.9 mi N Beatty, on US 95", "3 km en el Rio Jimenez arriba de Anita Grande", "left bank of the Mississippi River, 16 mi downstream from St. Louis", "Ruta Nacional 81, 8 km W de Ingeniero Guillermo Nicasio Juárez"

Definition: The locality consists of a **specified <u>distance</u>,** and a **specified <u>route</u>** from a single named place; For example along a *road, river, path, stream,* etc.

Georeferencing Procedure:

1) **Determine the starting point** for the offset, begin measurement here.

2) <u>**Manually**</u> **Measure Distance** along the route from the starting point using Google MAPS – Distance measurement tool → **<u>Coordinates</u>**

3) **Return to starting location and determine the radial** for the chosen **starting point** as you would for a Feature – with Obvious Spatial Extent → *BIG PART* of final **<u>Uncertainty</u>**!!

5 miles north of Beatty on US 95

Beatt

Offset - Distance at a Heading

LOCALITY TYPE

Offset

Offset at a heading

Examples: "50 miles W of Las Vegas", "10 km E de Amamá"
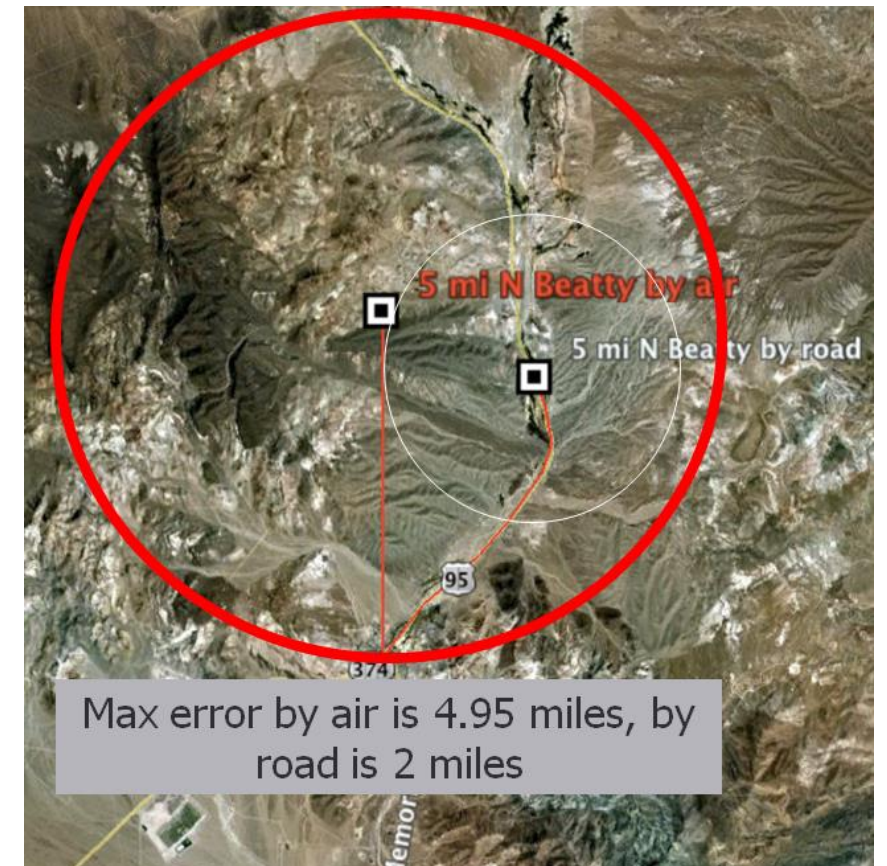
Definition: The locality consists of a **specified <u>distance</u>**, and a **specified <u>direction</u>** (Ex. "***N", "east", "SW"***, etc.) from a single named place.

Georeferencing Procedure:

1) **Determine the starting point** for the offset and find coordinates for the geographic center

2) **Determine the linear extent** for this chosen **starting point** as you would for a FEATURE (Named Place)

3) **MANIS CALCULATOR** → *Final* ***Coordinates*** & *Final* ***Uncertainty***

Can be automated by using GEOLocate (for U.S.A., Canada, and Europe)

5 mi N Beatty by air

5 mi N Beatty by road

Max error by air is 4.95 miles, by road is 2 miles

Offset – Distance along Orthogonal Directions

Offset: Offset in orthogonal directions (2012)

Offset

Offset in orthogonal directions

Examples: "6 km N and 4 km W of Welna"

Definition: The locality consists of a linear distance in each of two orthogonal directions from a feature.

Georeferencing Procedure:

Best and easiest method to approach these localities (for U.S.A., Canada, and Europe) is by using GEOLocate

Otherwise consult the Georeferencing Quick Reference Guide

Offset - Distance Only

LOCALITY TYPE

Offset

Offset only, no direction

Examples: "5 km outside Calgary", "12 km fuera de Purmamarca"

Definition: Locality consists of an offset from a feature without any direction specified.

Georeferencing Procedure:

1) **Determine the starting point** for the offset and find coordinates for the corrected center → *Final Coordinates*

2) Determine the boundary of the feature as you would for Near a Named Feature, except that the distance to use for the buffer is the distance given in the locality description (*add* the buffer distance to the radial of the feature)

3) MANIS CALCULATOR → *Final Uncertainty*

Extent = 22 km
Offset = 5 km
Radial = 27 km

5 km

Offset – Heading Only
Previously: Offset: Direction only, no distance (2012)
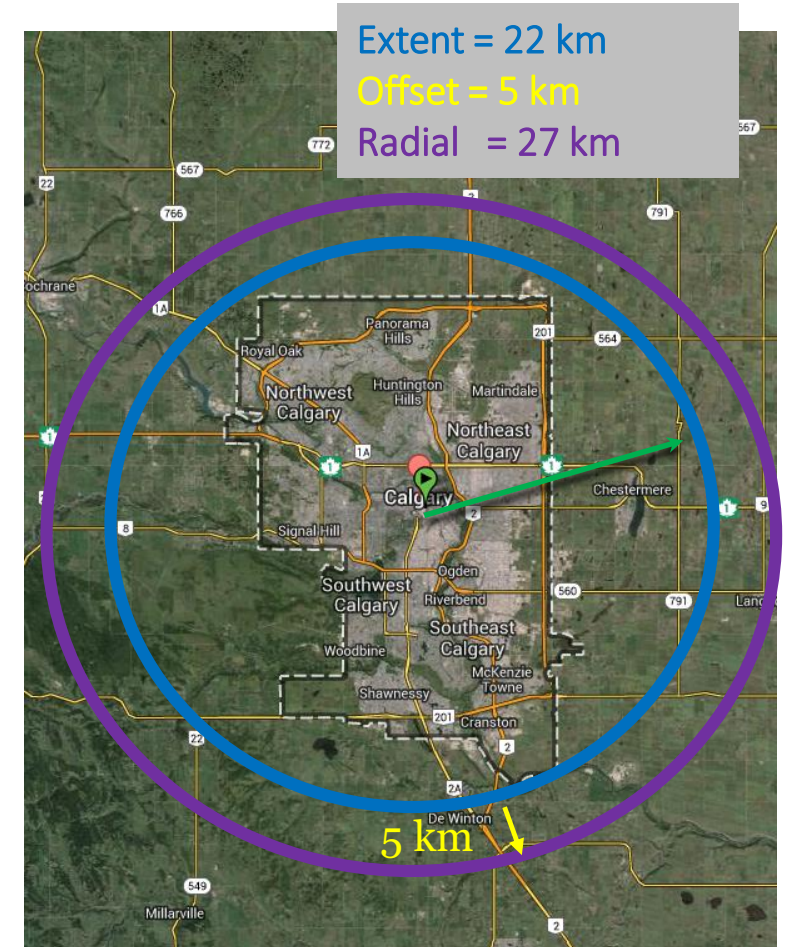
Offset

Direction only, no distance

Examples: "N Palmetto", "N of Berkeley", "Saladillo N", "Al N de Saladillo"

Definition: The locality consists of a direction from a feature without any distance specified.

Georeferencing Procedure:

1. ***Find coordinates for** the approximate center of: **the focal named feature** and **the nearest named feature <u>in the direction specified</u>***

2. ***Determine the MIDPOINT** between the two centers. The lat/long coordinates for this point will be the **<u>coordinates</u>** for your final georeference*

3. *Use the distance from the coordinates to the center of either locality as the **<u>radial</u>***

½ distance
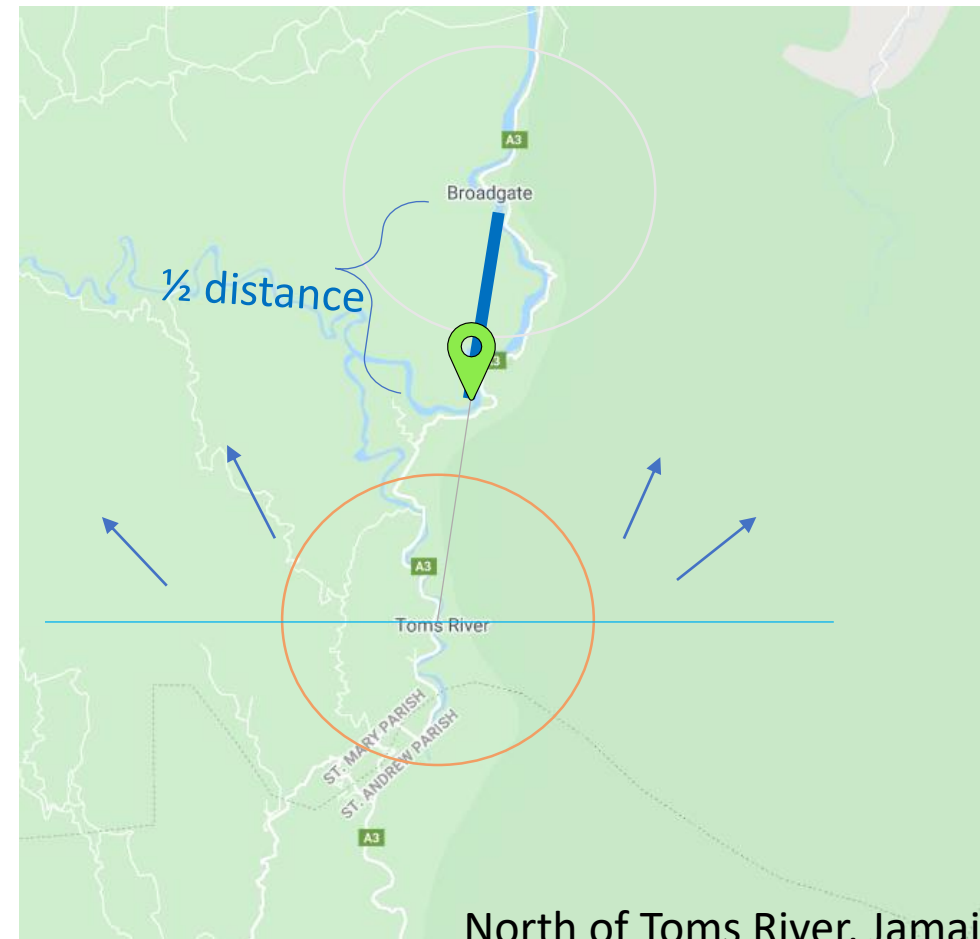
North of Toms River, Jamaica

SITES WHICH YOU SHOULD NOT GEOREFERENCE

SITES WHICH YOU SHOULD NOT GEOREFERENCE

"in planting beds..."

cultivated/cult.

CAPTIVE OR CULTIVATED

"Botanic Gardens from seed obtained from..."
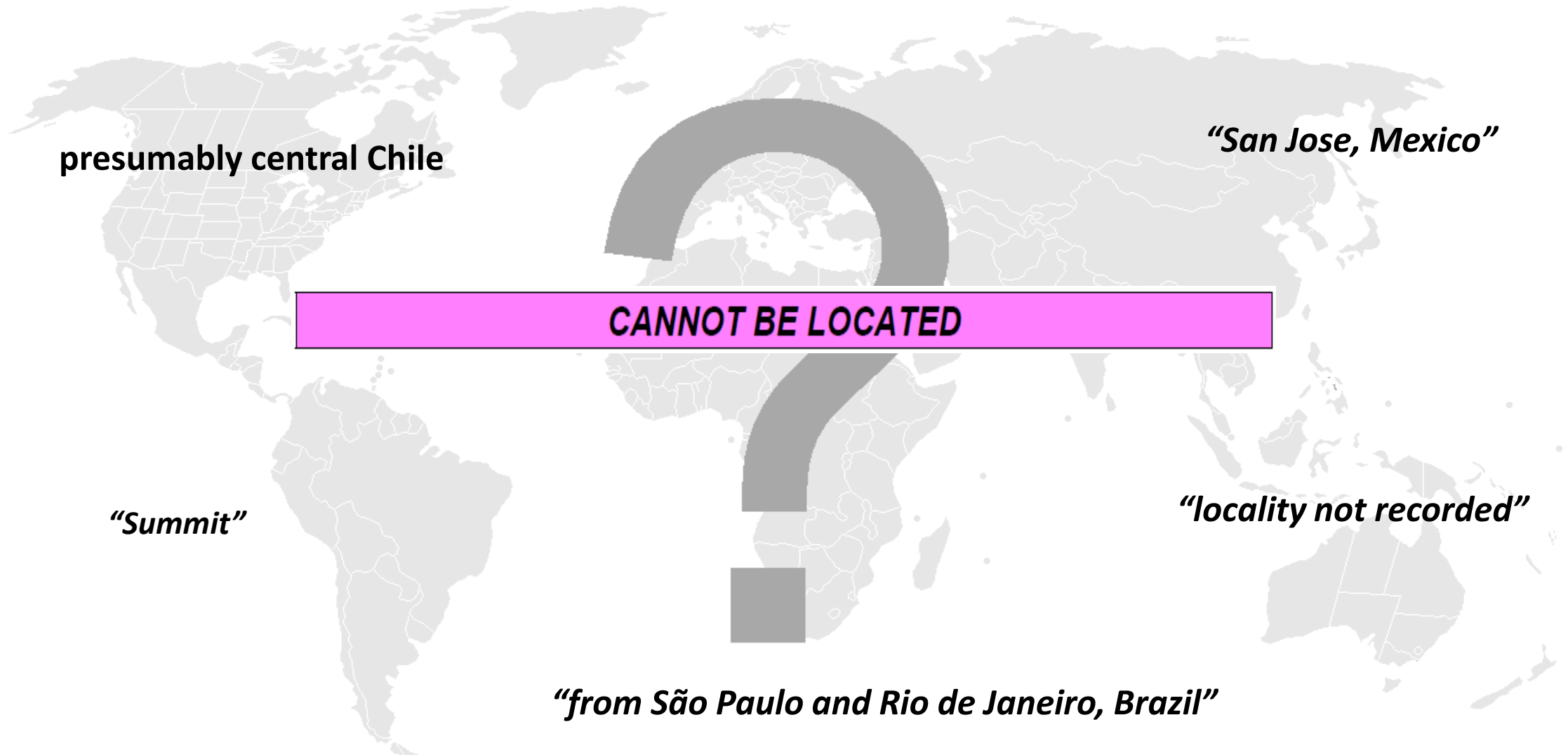
"growing in garden..."

"from nursery"

SITES WHICH YOU SHOULD NOT GEOREFERENCE

SITES WHICH YOU SHOULD NOT GEOREFERENCE

"Delano, Tulare Co." [Delano is in Kern Co.]

DEMONSTRABLY INACCURATE

"10 mi W of Bakersfield, 6000 ft" [No place in area at that elevation]

MaNIS Calculator

Used to *calculate* the final <u>uncertainty</u> radius for <u>EVERY</u> locality via the **Google Maps method** (not applicable for the GEOLocate automated method)

- Incorporates <u>radial</u> in addition to **all other sources** of error

- Also used to calculate final <u>coordinates</u> for "<u>Offset at a Heading</u>" localities

General Work Flow:
- Select the <u>Locality Type</u> that best matches the description of the feature that you are georeferencing
- Enter all of the <u>error parameters</u> needed to make the calculation
- **Calculate**

*workflow per each locality type is concisely outlined in <u>Georeferencing Quick Reference Guide</u> (2012)

Parameters

Georeferencing Calculator

English ▼

Locality Type: Distance at a heading (e.g., 10 mi E (by air) Bakersfield) ▼

Coordinate Source: Google Earth/Maps >2008 ▼   Direction: N ▼

Coordinate Format: decimal degrees ▼   Offset Distance: 70

Input Latitude: [ ]   Radial of Feature: 250

Input Longitude: [ ]   Measurement Error: 5

Datum: (WGS84) World Geodetic System 1984 ▼   Distance Units: m ▼

Precision: exact ▼   Precision: 10 m ▼

Calculate   Copy   Go here

Latitude	Longitude	Uncertainty (m)	Datum

Precision	Date	Georeferenced by	Protocol
			protocol not recorded ▼

Distance Converter: [ ] km ▼ = [ ] km ▼

Scale Converter: [ ] mm ▼ 1:24000 ▼ = [ ] km ▼

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Fields display depending on locality type:

Locality Type: Choose from the 6 choices provided; mainly: Coordinates and error, Error only, Coordinates only.

Coordinate Source: Google Maps > 2008

Coordinate Format: Decimal degrees

Datum: WGS84

Coordinate Precision: exact

Direction: (offset at a heading only) Dependent on locality description

North/South Offset & East/West Offset Distance: (orthogonal directions only)

Offset Distance: As stated in locality description, record and calculate in units provided

Measurement Error: Determine (or estimate) the smallest distance that you can reliably (reproducibly) measure on the map (we use 10 m)

Distance Units: Meters, unless offset provided in another unit (MUST convert to meters before entering into EMu – Calc. does this automatically)

Distance Precision: (for offset locality types) Dependent on precision of the offset distance (i.e. an offset of 2 km would have a distance precision of 1 km, 10 km would have a distance precision of 10 km, 11 km would have a distance precision of 1 km).

Online Resources

It may be necessary to reference gazetteers or other sources

Example: Merced Falls, California, was an industrial center served by the Yosemite Valley R.R. until the 1940s, after which the town faded (Merced Falls - California Ghost Town (ghosttowns.com)

- Historic sites

- Ghost towns

- Remote villages/regions

- Historical place names

- Natural/geological features (waterfalls, mountains, etc.)

- Spelling/translation variations or misspelled localities

MERCED FALLS
FIRST KNOWN AS CALIFORNIA RANCHE CROSSING, THEN AS BELT'S FERRY. THE SITE OF A LARGE INDIAN RANCHERIA. THE POST OFFICE AT MERCED FALLS OPENED SEPT. 4, 1856. THE FLOUR AND WOOLEN MILLS WERE BUILT IN 1854 AND 1867. THE TOWN WAS DESTROYED BY FIRE IN AUGUST, 1895. YOSEMITE LUMBER CO. HAD A LARGE MILL HERE FROM 1912 UNTIL 1943.

RICHARD L. BELT
NOBLE GRAND HUMBUG
ESTANISLAO CHAPTER 58
E CLAMPUS VITUS

ERECTED OCT. 17, 1970

present day

c.1900

Resources/Gazetteers

Please refer to these resources for help in finding more difficult localities:

- **GEOnet Names Server**: Worldwide data from the National Geospatial-Intelligence Agency & U.S. Board on Geogr. Names (https://geonames.nga.mil/geonames/GNSHome/welcome.html)

- **Falling Rain Global Gazetteer** (http://www.fallingrain.com/world/index.html)

- **Statoids**: Administrative divisions of countries (www.statoids.com)

- **GeoNames** (www.Geonames.org, crowd/open source*)

- **Wikimapia** (www.wikimapia.org, crowd/open source*)

- **OpenStreetMap** (www.openstreetmap.org, crowd/open source*)

- **Mapcarta** (www.mapcarta.com, crowd/open source*)

- **TravelingLuck** (www.TravelingLuck.com)

- Google **Web and Image Search**

- **Paper maps/ atlases**

Aim to confirm crowdsourced information with multiple sources

Best Practices/Guides

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

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

- [Georeferencing Best Practices (2020)](#)

- [Georeferencing Calculator Manual (2020)](#)

- [BioGeomancer Guide to Best Practices in Georeferencing](#)

- [MaNIS/HerpNET/ORNIS Georeferencing Guidelines](#)

Capturing Metadata

[The Darwin Core standard](#) defines all of the fields recommended for the capture of reproducible georeferences

- **decimalLatitude, decimalLongitude, geodeticDatum (EMu: Latitude, Longitude, Datum)** : these fields provide the reference for the center of the point-radius representation of the georeference

- **coordinateUncertaintyInMeters (Radius (Numeric))**: the distance from the given coordinates that describes the smallest enclosing circle that contains the whole of the location

- **georeferencedBy, georeferencedDate (Determined By, Determination Date)**: the individual(s) who last modified the georeference. These correspond to the final authority on the georeference in the current state.

- **georeferenceProtocol (Determination Method)**: Reference to the methods used to determine the coordinates and uncertainty of the georeference

- **georeferenceSources (Determination Source)**: A list (concatenated and separated) of maps, gazetteers, or other resources used to georeference the location

- **georeferenceRemarks (Notes)**: Notes or comments out of the ordinary about the georeference, explaining assumptions made in addition or opposition to those formalized in the guide followed