Georeferencing Tools
Traditional Tools

- Maps (Digital or Paper)
- Gazeteers (books and online)
- GPS
Maps

Google Maps

- Urban areas
- Single point locality
Maps

- Berkeley Mapper
  - Built on Google Maps engine
GIS Software

- ArcGIS, QGIS, DIVA-GIS
  - Toposheets (paper maps)
motivation for automation

► Correct geographic and specimen identification data = dependable occurrence record.

► Occurrence data validates the importance of biological collections to non-taxonomists.
  - Distribution of populations and species ranges
  - Phylogeography
  - Niche modelling
  - Conservation planning and biodiversity management

► Provides uncertainty data, which allows data to be evaluated with regards to its fitness for research application and resulting quality of output.

► Automation of the process speeds up the process, some limitations persist.
Georeferencing tools

Batch processing

► Geolocate

- Software for automated georeferencing and collaborative efforts
Georeferencing tools

Geolocate
Georeferencing tools

Geolocate

7 possible locations found.

Data CC-By-SA by OpenStreetMap
Georeferencing Calculator

21 km SE of Pietermaritzburg

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

**Step 3)** Enter all of the parameters for the locality.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinate Source</td>
<td>gazetteer</td>
</tr>
<tr>
<td>Coordinate System</td>
<td>decimal degrees</td>
</tr>
<tr>
<td>Direction</td>
<td>SE</td>
</tr>
<tr>
<td>Offset Distance</td>
<td>21</td>
</tr>
<tr>
<td>Extent of Named Place</td>
<td>14.23</td>
</tr>
<tr>
<td>Datum</td>
<td>(WGS84) World Geodetic System 1984</td>
</tr>
<tr>
<td>Coordinate Precision</td>
<td>0.00001 degrees</td>
</tr>
<tr>
<td>Distance Units</td>
<td>km</td>
</tr>
<tr>
<td>Distance Precision</td>
<td>1 km</td>
</tr>
<tr>
<td>Decimal Latitude</td>
<td>-29.631219</td>
</tr>
<tr>
<td>Decimal Longitude</td>
<td>30.360718</td>
</tr>
<tr>
<td>Maximum Error Distance</td>
<td>18.65</td>
</tr>
</tbody>
</table>

**Decimal Coordinates:**

- [-29.7651815, 30.5140543, 18.65 km]
- [-29.7651815, 30.5140543, 18650 (WGS84) World Geodetic System 1984 decimal degrees]

**Distance Converter:**

- km = km

**Scale Converter:**

- mm = 1:24000 = km
Example

21 km SE of Pietermaritzburg

18.65 km maximum error/uncertainty
Conclusion

► It’s important to determine the uncertainties present in current occurrence data.
► Uncertainties highlight limitations in the data’s application.
► These limitations ultimately determine the quality of the data, and as such the quality of results, as well as how we should interpret them.
Georeferencing Resources

► http://www.gbif.org/prog/digit/Georeferencing

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

► http://manisnet.org/GeorefGuide.html