Ecogeographic data acquisition and verification

Joana Magos Brehm, Shelagh Kell and Nigel Maxted
SADC Crop Wild Relatives

In situ conservation of CWR and diversity assessment techniques
Regional training workshop. 10-13 November 2014, Mauritius
Contents

- Ecogeographic data types
- Sources of ecogeographic data
- Digital recording of passport data
- Data verification
- GEOQUAL (CAPFITOGEN)
- International data sources
- Regional data sources
- National data sources
Main ecogeographic data types

- **Taxonomic**: genus, species, authority, infra-specific epithet, synonyms, vernacular names
- **Taxon biology**: pollination, phenology, seed dispersal
- **Related crop**: degree of relatedness to crop taxon (gene pool or taxon group)
- **Distribution**: location, coordinates
- **Population characteristics**: size, age structure, genetic diversity
- **Environmental data**: habitat, geological, topographical, climatic, edaphic, land use
- **Conservation**: threat status, *in situ* and *ex situ*, legislation
- **Characterization data**: e.g. leaf shape, flower colour, plant habit, seed colour
- **Ex situ evaluation data**: plant height, days to maturity
- **Utilization potential**: previous use as trait donor, potential use as trait donor
Sources of ecogeographic data for spatial analysis

FAO Resource Book (pp 141-161)

Figure 10. Ecogeographic study model for C. Mosed
Sources of ecogeographic data for spatial analysis

HERBARIA
- national and international
- online

GENEBANKS
- national and international
- online

SCIENTIFIC AND ‘GREY’ LITERATURE
- floras, monographs, recent taxon studies, scientific papers
- reports of Environmental Impact Assessment studies
- databases
Sources of ecogeographic data for spatial analysis

**EXPERT CONSULTATION**
- taxon experts
- geographic experts
- breeders

**FIELD SURVEY DATA**
- (especially important when not enough data available)

**GIS LAYERS – ABIOTIC DATA**
- bioclimatic (temperature, precipitation, indexes), edaphic, geophysic (altitude, slope, aspect)
- CAPFITOGEN (data and ELC maps)
Harbarium data

- Quality of data recorded
- Basic location but poor ecological data
- Hand written
- Foreign language
- Check identification
Digital recording of passport data - herbaria
Digital recording of passport data

BEFORE DIGITIZATION

- Obtain permission to photograph
- Be careful when manipulating specimens
- Offer to provide the host with the digitized photos

EQUIPMENT REQUIRED

- Digital camera (min. 6 MP)
- Storage devices (SD) cards
- Extra battery for camera
- External hard disk
- List of target taxa
- Notebook to record the process of data collation
- Paper tags ‘Fl’, ‘Fr’, ‘Inflo’ (Poaceae)
Digital recording of passport data

SELECTING THE SPECIMENS TO PHOTOGRAPH

- Identify the system the herbarium follows to organize the collection and plan the digitization within the time available
- Avoid over-digitization of some taxa at the expense of neglecting other priority taxa.
- Start with the highest priority taxa.

RECOMMENDATIONS WHEN TAKING THE PICTURES

- Use maximum resolution
- Photograph the label of the specimen folder in order
- Photograph the whole specimen sheet and include all annotations
- Photograph the herbarium label, determination label and any additional annotation in close-up
- Review the images after taking them and repeat when needed
- Use the “macro” option for taking the photograph
- Avoid the use of flash
- Make back-ups of all photographs taken
Digital recording of passport data

ORGANIZING THE IMAGES

- Herbarium_COL
- Herbarium_K
- Non-priority_taxa
- Priority_taxa
- Fabaceae
  - Cicer
  - Lathyrus
  - Lens
  - Phaseolus
- Poaceae
- Herbarium_P

Herbarium name folder
Non-priority taxa folder
Priority taxa folder
Family name folder
Genus name folder
Data verification

- Assess completeness of the data set
  - certain analyses not possible if it is incomplete
- Standardize data format

Table 2. Examples of location data and their corresponding level of accuracy.

<table>
<thead>
<tr>
<th>Level of accuracy</th>
<th>Location data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exact place (e.g. 21 km along the road between location x and location y).</td>
</tr>
<tr>
<td>2</td>
<td>Within a defined area of 1 km².</td>
</tr>
<tr>
<td>3</td>
<td>Within a defined area of 10 km².</td>
</tr>
<tr>
<td>4</td>
<td>Within a defined area of 20 km².</td>
</tr>
<tr>
<td>5</td>
<td>Within a defined area of 100 km².</td>
</tr>
</tbody>
</table>

FAO Resource Book (pp 150)
Data verification - example

Herbaria survey
- 10 Portuguese herbaria and 1 Spanish herbarium
- 3 online herbaria

Genebank survey
- 5 Portuguese genebanks
- 10 online genebanks
Data verification - example
### Data verification - example

#### Type of information obtained

<table>
<thead>
<tr>
<th>HERBARIA SPECIMENS DATA</th>
<th>GERMLAPLASM ACCESSIONS DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>❖ Acronym</td>
<td>❖ Authors</td>
</tr>
<tr>
<td>❖ Accession number</td>
<td>❖ Location</td>
</tr>
<tr>
<td>❖ Genus</td>
<td>❖ Latitude</td>
</tr>
<tr>
<td>❖ Species</td>
<td>❖ Longitude</td>
</tr>
<tr>
<td>❖ Infra</td>
<td>❖ Altitude</td>
</tr>
<tr>
<td></td>
<td>❖ Habitat</td>
</tr>
<tr>
<td></td>
<td>❖ Collectors</td>
</tr>
<tr>
<td></td>
<td>❖ Identify by</td>
</tr>
<tr>
<td></td>
<td>❖ Ecological data (type of soil, parent rock, ...)</td>
</tr>
</tbody>
</table>
Data verification - example

Total 603
Data verification - example

Geographic precision

Percentage (%)

14.4  4.1  19.9  42.6  14.1  4.8
Data verification - example

The diagram shows the distribution of total records, specimens without coordinates or locality, duplicates, and final records used in analysis for various plant species. Each bar represents a different species, and the colors indicate the different categories of data verification.
GEOQUAL - CAPFITOGEN

http://www.capfitogen.net/
GEOQUAL - CAPFITOGEN

- Assign a quality assessment value to each georeferenced accession with locality description
- Accession data in the modified FAO-Bioversity 2012 format
- SUITQUAL, LOCALQUAL, COORQUAL
- Parameters are summarized to obtain the parameter TOTALQUAL
GEOQUAL - CAPFITOGEN

- **SUITQUAL**: suitability to grow plants in the collecting sites, 0 - 20
- **LOCALQUAL**: compares *collecting site description* from the passport data and the site extracted from coordinates, 0 - 20
- **COORQUAL**: *intrinsic quality* value of the coordinates, 0 - 20
- **TOTALQUAL** = COORQUAL + SUITQUAL + LOCALQUAL (0 – 60)

\[
\text{TOTALQUAL}_{100} = \frac{\text{TOTALQUAL} \times 60}{100}
\]
GEOQUAL – CAPFITOGEN

- Visualize in Google Earth
International data sources

PLANT SPECIES OCCURRENCE DATA:


- JSTOR GlobalPlants - images of herbaria vouchers: [http://plants.jstor.org/](http://plants.jstor.org/) (need to be member to download info)


International data sources

PLANT SPECIES OCCURRENCE DATA:


- Virtual Australian Herbarium: http://avh.ala.org.au/search/#tab_advanceSearch

- United States Virtual Herbarium: http://usvirtualherbarium.org
International data sources

PLANT SPECIES OCCURRENCE DATA:


International data sources

ENVIRONMENTAL DATA:

- Worldclim Global Climate layers - 1km resolution grids of climate and derived bioclimatic datasets: http://www.worldclim.org/
- Climate Change Forecasts (IPCC) - future climate projections: http://www.ipcc-data.org/ddc_climscen.html
- Climatic Research Unit: http://www.cru.uea.ac.uk/data/
- DIVA-GIS: http://www.diva-gis.org/Data
International data sources

ENVIRONMENTAL DATA:


- ISRIC World Soil Information: http://www.isric.org/data/data-download

International data sources

ENVIRONMENTAL DATA:

- The CGIAR Consortium for Spatial Information (CGIAR-SCI) - STRM DEM 90m digital elevation dataset: http://srtm.csi.cgiar.org/index.asp

- UNEP WCMC World Database of Protected Areas: http://www.protectedplanet.net/
Regional data sources

PLANT OCCURRENCE DATA:

- SADC Plant Genetic Resource Centre: http://www.sadc.int/sadc-secretariat/services-centres/spgrc/

ENVIRONMENTAL DATA:

- SADC Regional Climate Data Processing Centre: http://www.sadc.int/sadc-secretariat/services-centres/regional-climate-data-processing-centre/
National data sources
Ecogeographic data acquisition and verification

Joana Magos Brehm, Shelagh Kell and Nigel Maxted
SADC Crop Wild Relatives

In situ conservation of CWR and diversity assessment techniques
Regional training workshop. 10-13 November 2014, Mauritius