LGA toolbox

Alliance Bioversity International and CIAT,
November 2024.

The Landrace Gap Analysis method

Passport data

+ Environment
+ Socio-economy

Potential distribution

Potential areas to be collected

Gaps identification

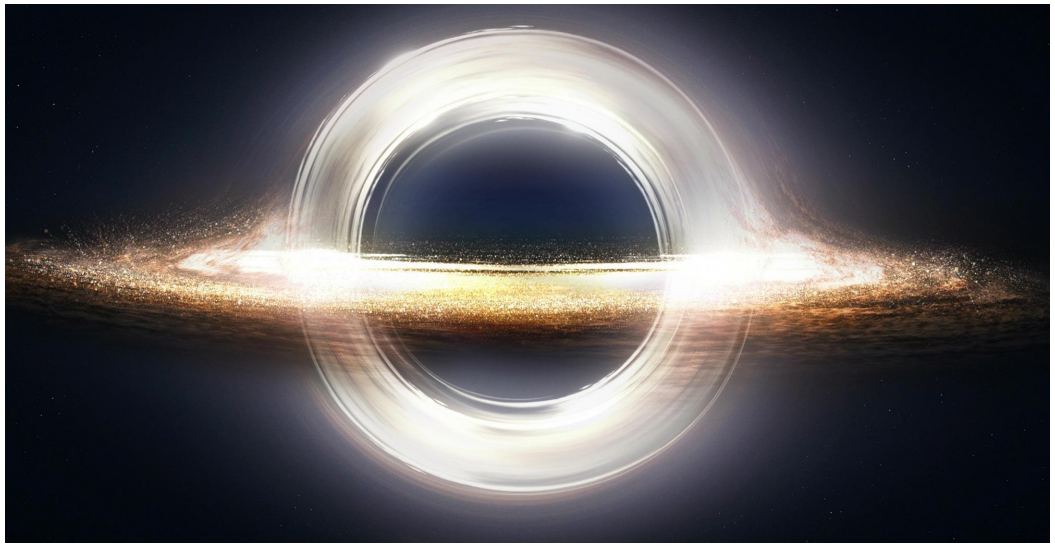
Accessibility
i.e., roads, railroads, etc.

Environmental
i.e., environmental uniqueness

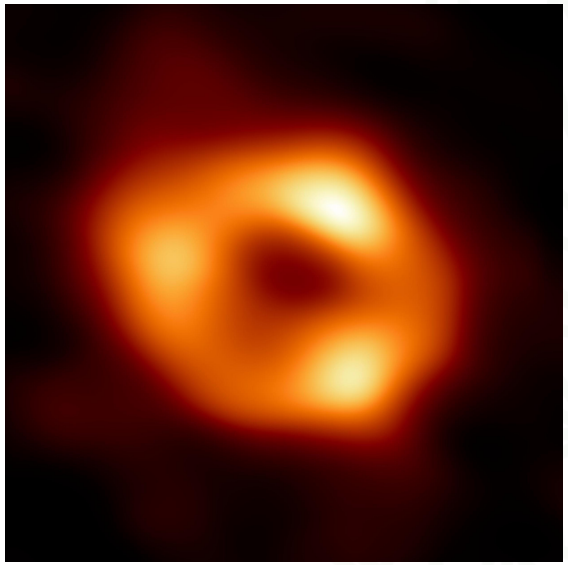
Connectivity
i.e., density of accessions

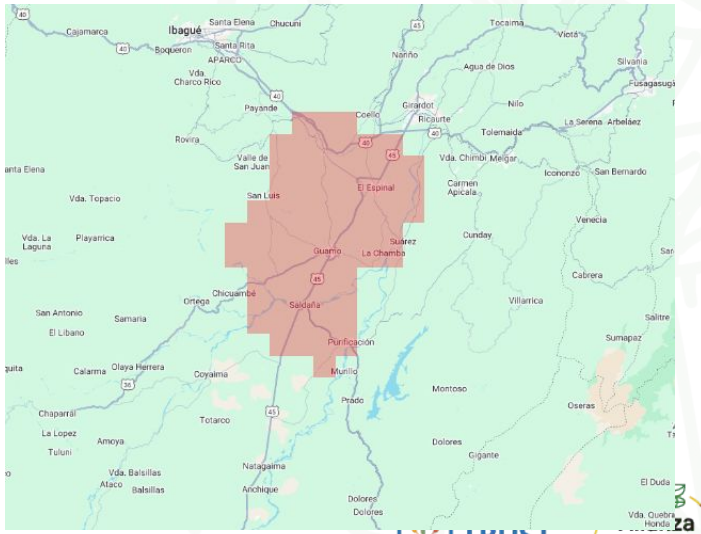
What is a model?

What we really want

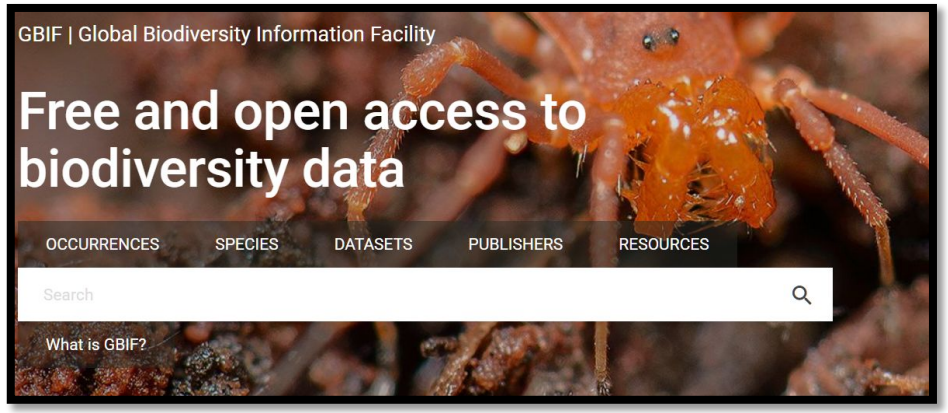


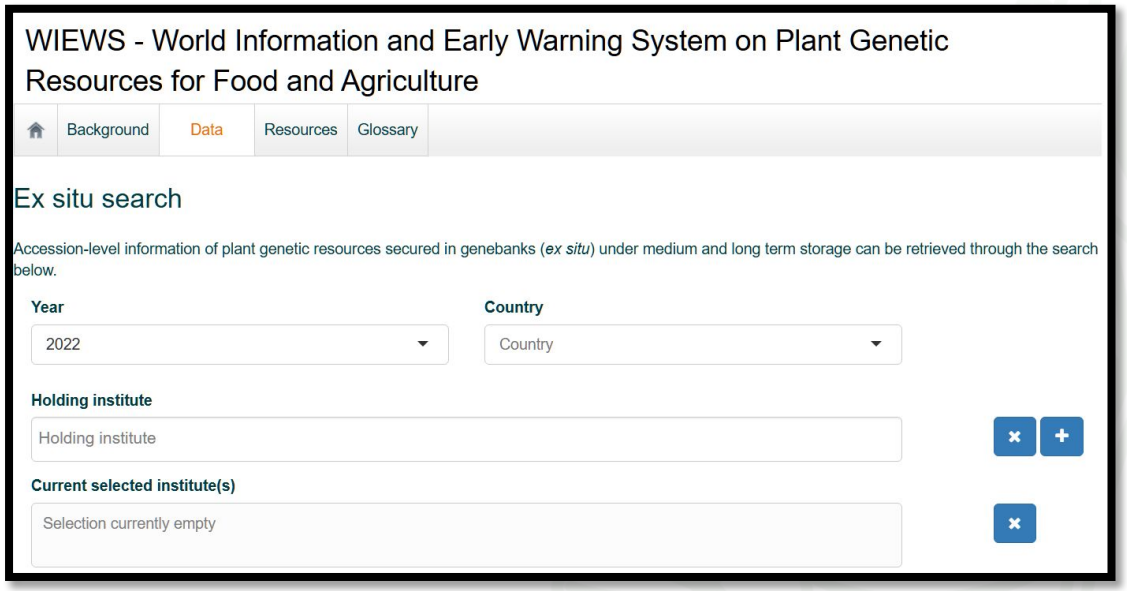
What we get

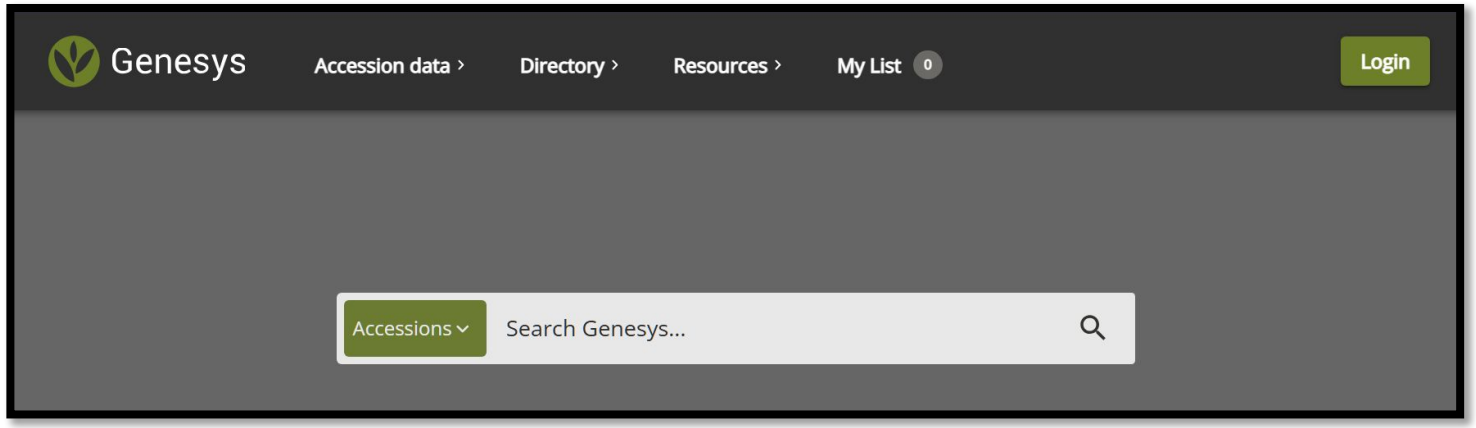


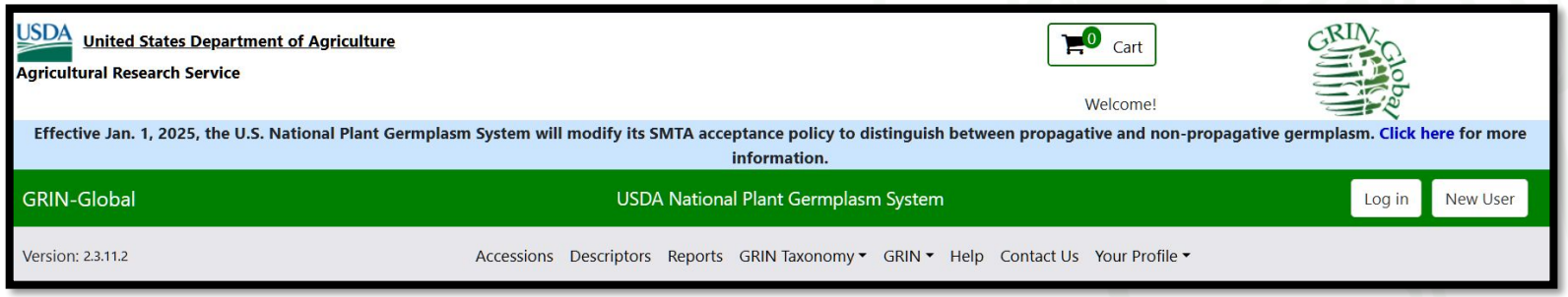


Occurrence data









The Datatable

CROPNAME	DECLATITUDE	DECLONGITUDE	status	source_db	database_i	issue_txt_desc
brassica_rapa	25.012526	102.700013	H	GBIF	gbif_1	Difference in ELEVATION and STRM (elevation) greather than 150 mts or missing; Missing Country admon level 1 in COLLSITE; Missing Country admon level 2 in COLLSITE
brassica_rapa	25.275367	103.003972	H	GBIF	gbif_2	Difference in ELEVATION and STRM (elevation) greather than 150 mts or missing; Missing Country admon level 1 in COLLSITE; Missing Country admon level 2 in COLLSITE
brassica_rapa	25.275367	103.003972	H	GBIF	gbif_3	Difference in ELEVATION and STRM (elevation) greather than 150 mts or missing; Missing Country admon level 1 in COLLSITE; Missing Country admon level 2 in COLLSITE
brassica_rapa	25.012526	102.700013	H	GBIF	gbif_4	Difference in ELEVATION and STRM (elevation) greather than 150 mts or missing; Missing Country admon level 1 in COLLSITE; Missing Country admon level 2 in COLLSITE
brassica_rapa	24.385833	102.806111	H	GBIF	gbif_8	Missing Country admon level 2 in COLLSITE

G: Germplasm accession

H: Herbarium, Human observation, botanical garden, other sources of occurrences.

Spatial predictors

ENVIREM

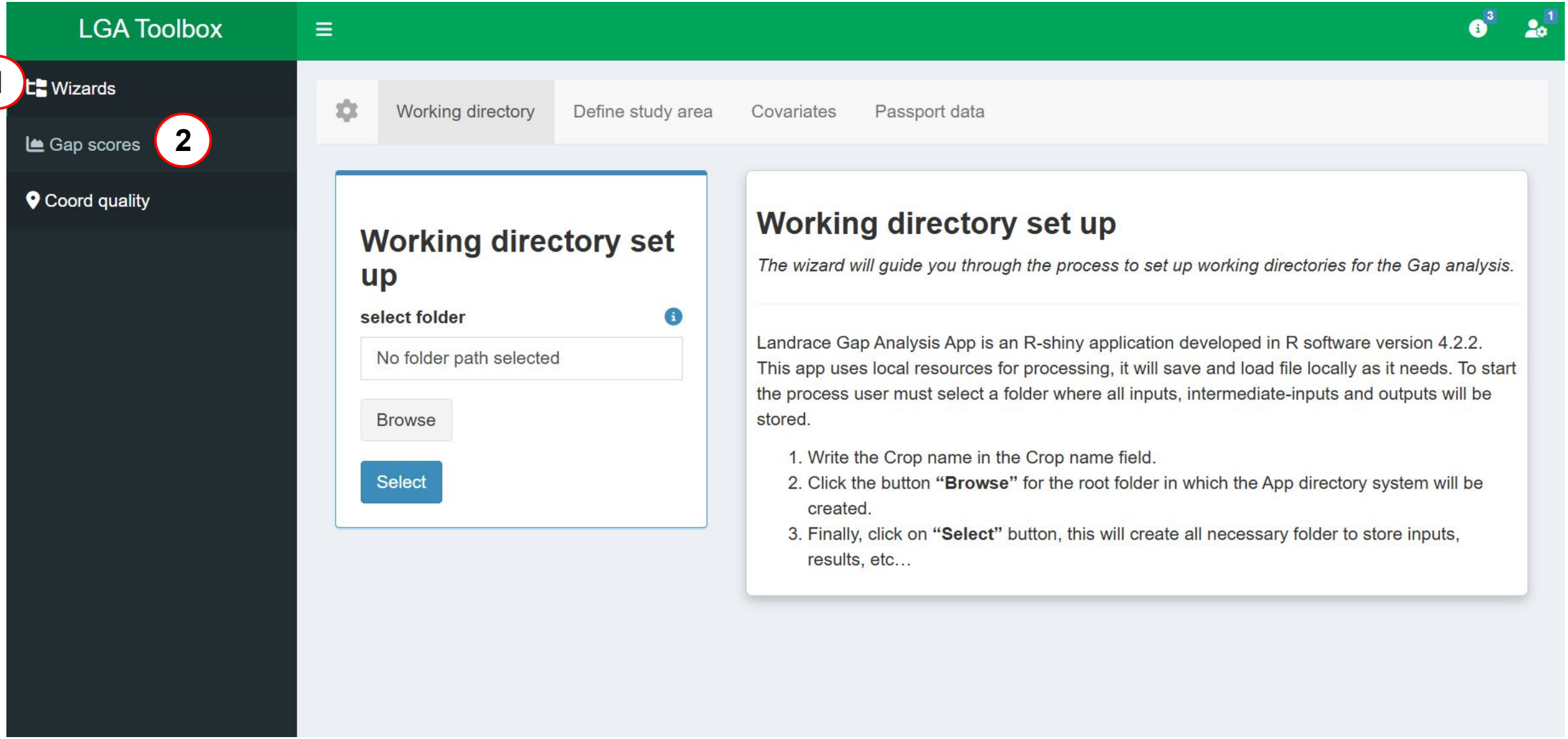
ENVIRONMENTAL RASTERS FOR ECOLOGICAL MODELING

WorldClim

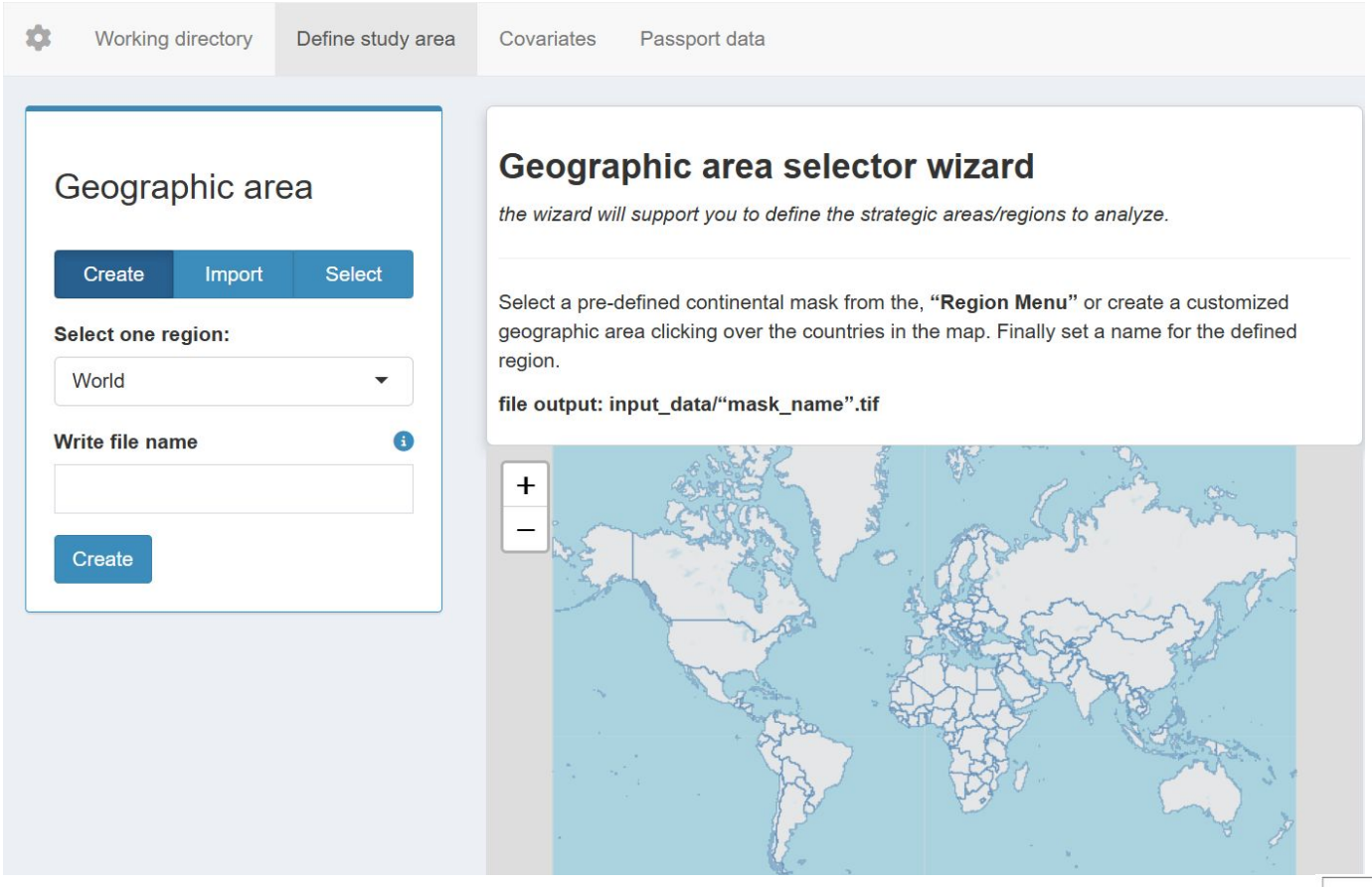
Maps, graphs, tables, and data of the global climate

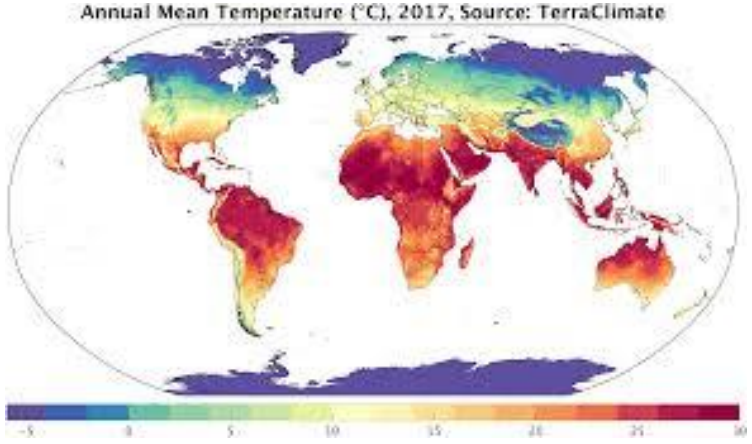
MAPSPAM

LGA toolbox

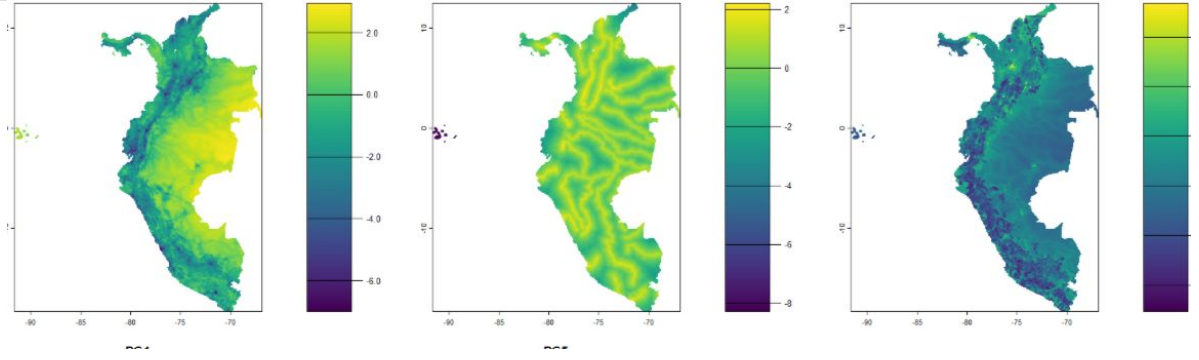

LGA Toolbox
1
Wizards
Gap scores
2
Coord quality
Working directory
Define study area
Covariates
Passport data
Working directory set up
select folder
No folder path selected
Browse
Select
Working directory set up
The wizard will guide you through the process to set up working directories for the Gap analysis.
Landrace Gap Analysis App is an R-shiny application developed in R software version 4.2.2. This app uses local resources for processing, it will save and load file locally as it needs. To start the process user must select a folder where all inputs, intermediate-inputs and outputs will be stored.
1. Write the Crop name in the Crop name field.
2. Click the button "Browse" for the root folder in which the App directory system will be created.
3. Finally, click on "Select" button, this will create all necessary folder to store inputs, results, etc…

Study area





Which GIS process are we applying ?



Occurrence data setting up

Working directory | Define study area | Covariates | Passport data

Data base set up

1. Select .cvs database

brassica_rapa_to_process.cs

Upload complete

2. Write response column number

1

Predict missing groups

Set up database

Description | Parameters | Preview data | Results

Show 5 entries

	crop_name	Latitude	Longitude	status	source_db	databa
1	brassica_rapa	35.35	75.63333333	G	PAK253	921
2	brassica_rapa	35.46666667	75.46666667	G	PAK253	922
3	brassica_rapa	35.35	75.5	G	PAK253	923
4	brassica_rapa	35.35	75.5	G	PAK253	924
5	brassica_rapa	36.36666667	74.83333333	G	PAK253	925

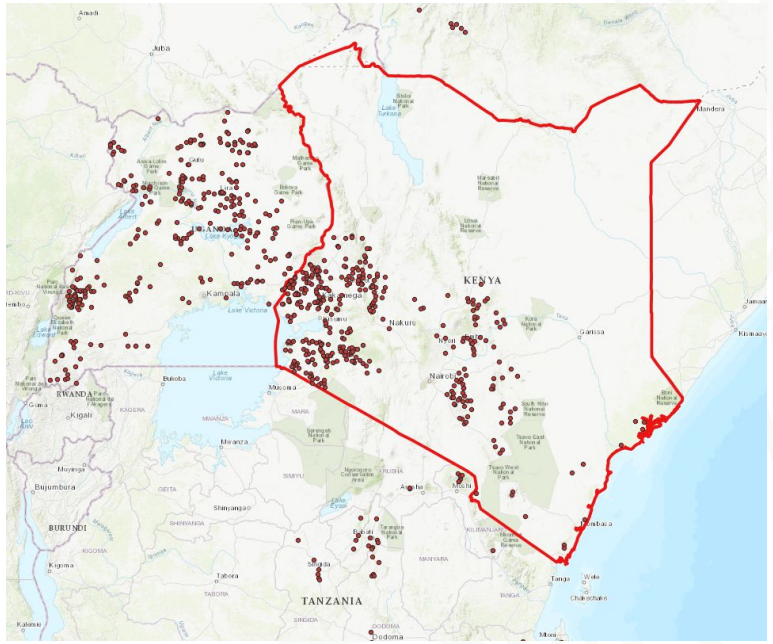
Showing 1 to 5 of 20 entries Previous 1 2 3 4 Next

787 Rows

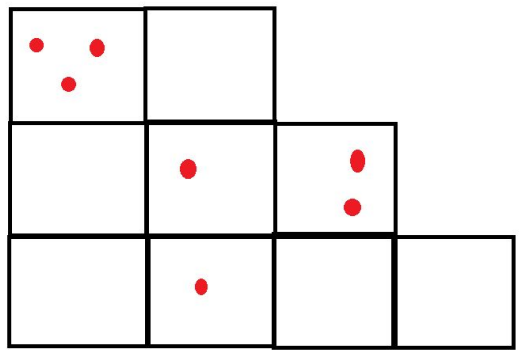
1 Groups

0% Missing Values

Remove coordinates outside study region



Remove duplicated coordinates by pixel



Gap scores

Wizards

Gap scores

Coord quality

SDM modelling | Geo-Scores | Geo score assessment

Landrace spatial distribution

Select Group/Class/Race to process:

none

Model settings

Number of cross validation folds:

5 10

5 6 7 8 9 10

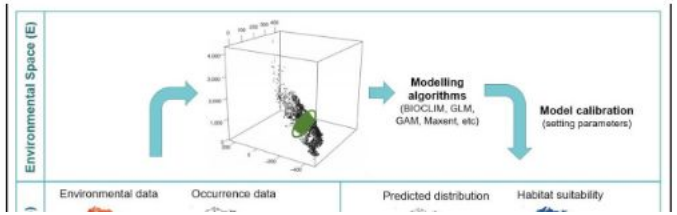
Run model

Description | Results

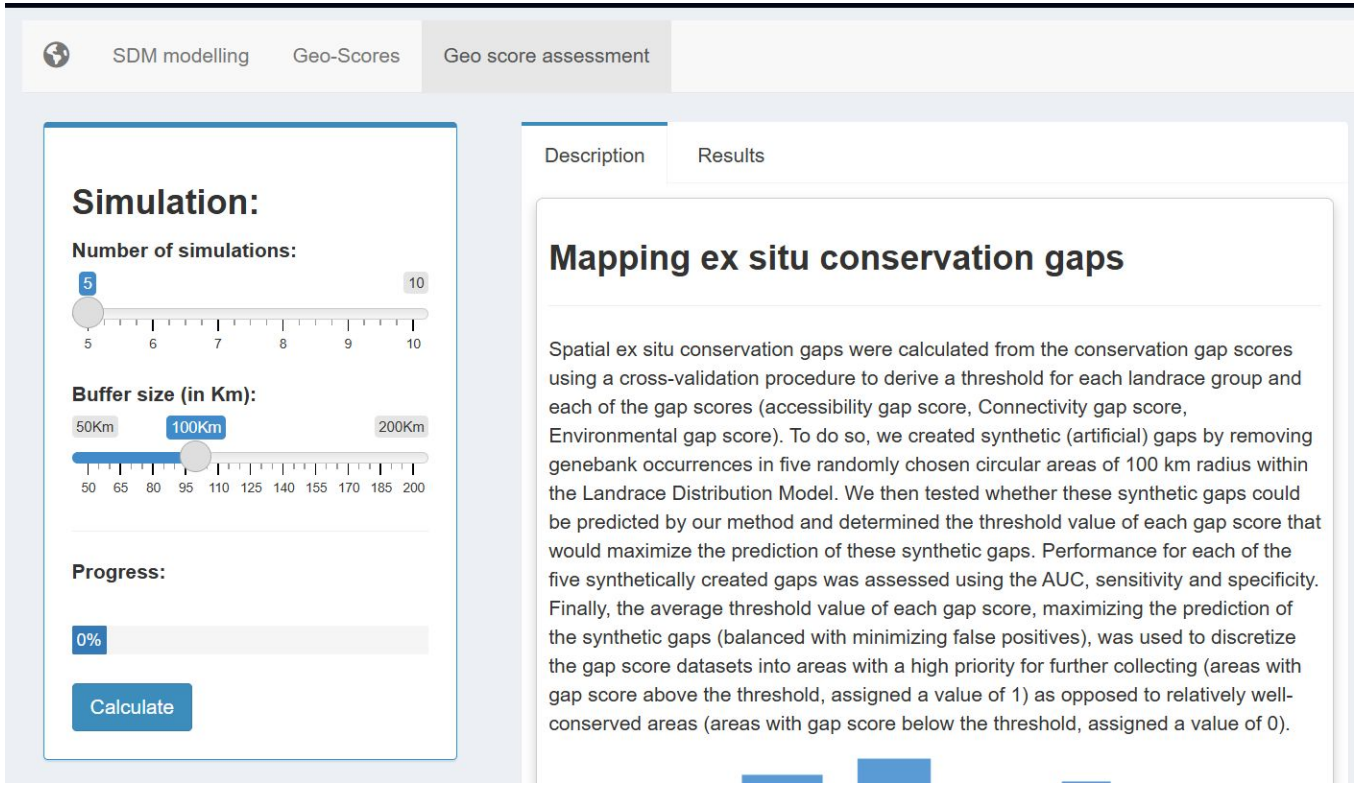
Spatial model distribution

To predict the probability of geographic occurrence for each landrace group, we generated MaxEnt models using the 'maxnet' R package. Group-specific spatial predictors were selected using a combination of the variance inflation factor (VIF) and a principal component analysis (PCA) to control for excessive model complexity and variable collinearity. We removed variables that did not contribute significantly to the variance in the PCA, defined as contributing less than 15% to the first component, and we further discarded variables with a VIF>10.

MaxEnt models were fitted through five-fold (K=5) cross-validation with 80% training and 20% testing. For each fold, we calculated the area under the receiving operating characteristic curve (AUC), sensitivity, specificity and Cohen's kappa as measures of model performance. To create a single prediction that represents the probability of occurrence for the landrace group, we computed the median across K models. Geographic areas in the form of pixels with probability values above the maximum sum of sensitivity and specificity were treated as the final area of predicted presence.



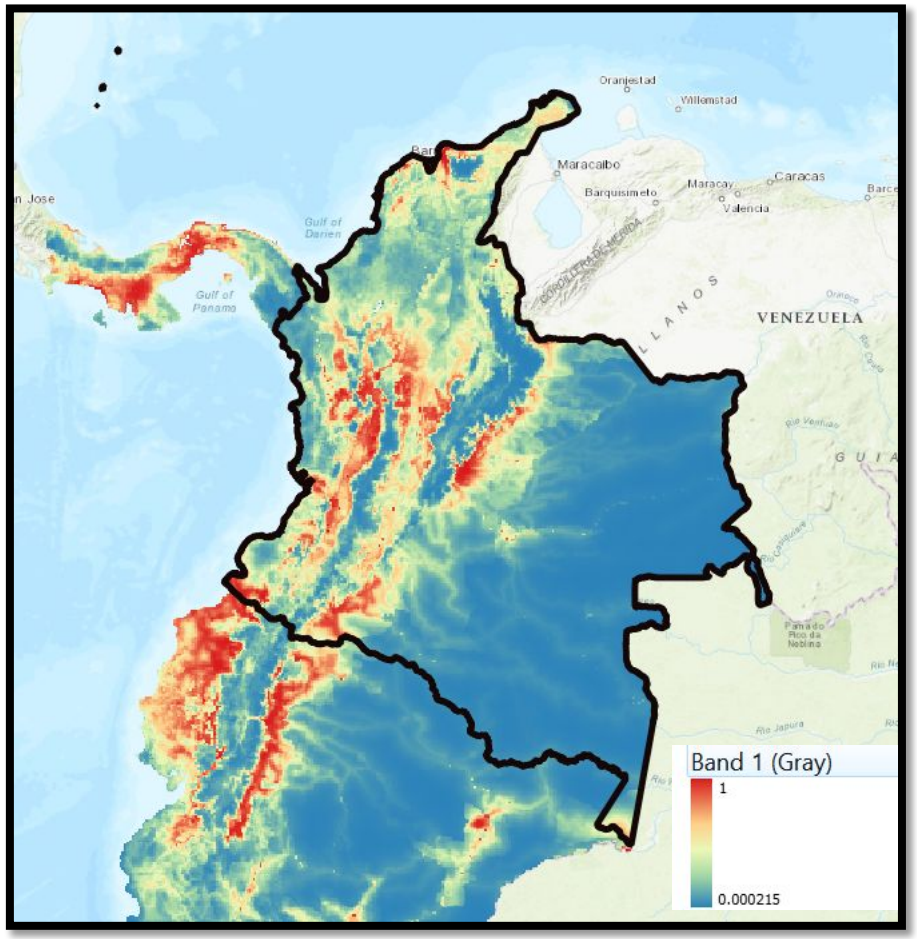
Geo score assessment



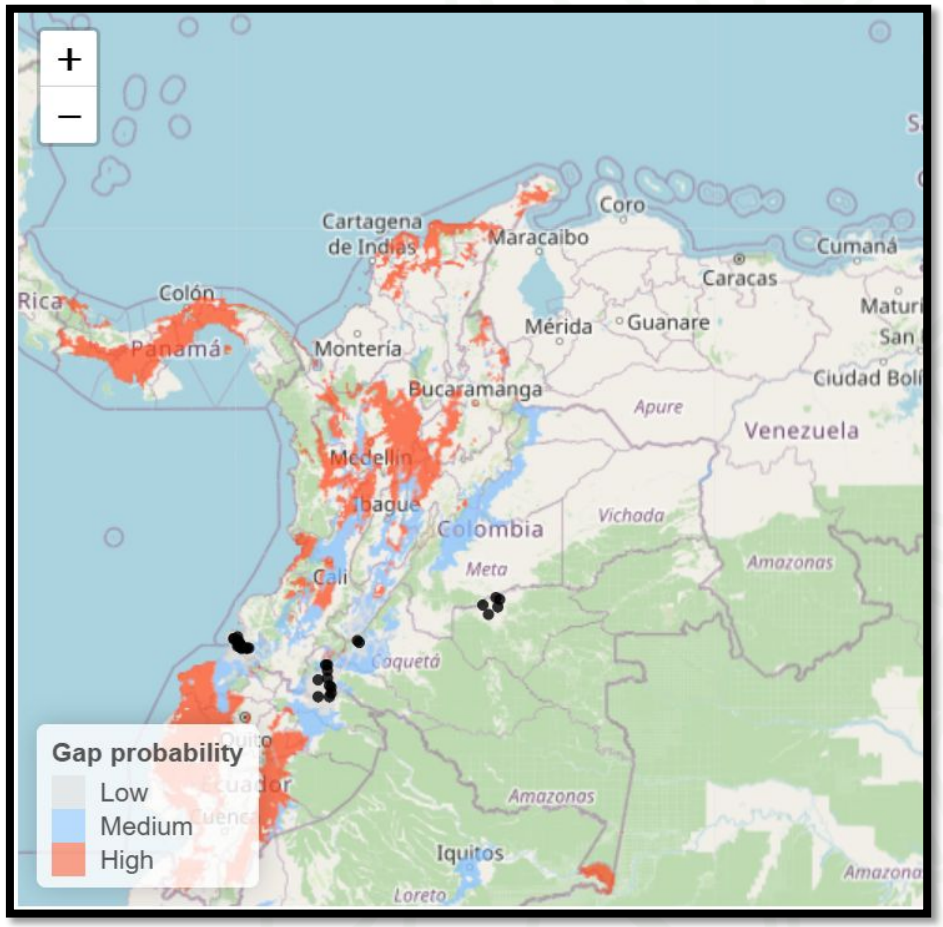
Aspects to consider:

1. Low number of G accession may make it impossible to calculate any of the gap scores
2. Low number of G accessions make it impossible to calculate any of the gap scores

How to prioritize areas for collecting ?



Geo score assessment



LGA output (html)

Gap Analysis Landrace Results

11-07-2025

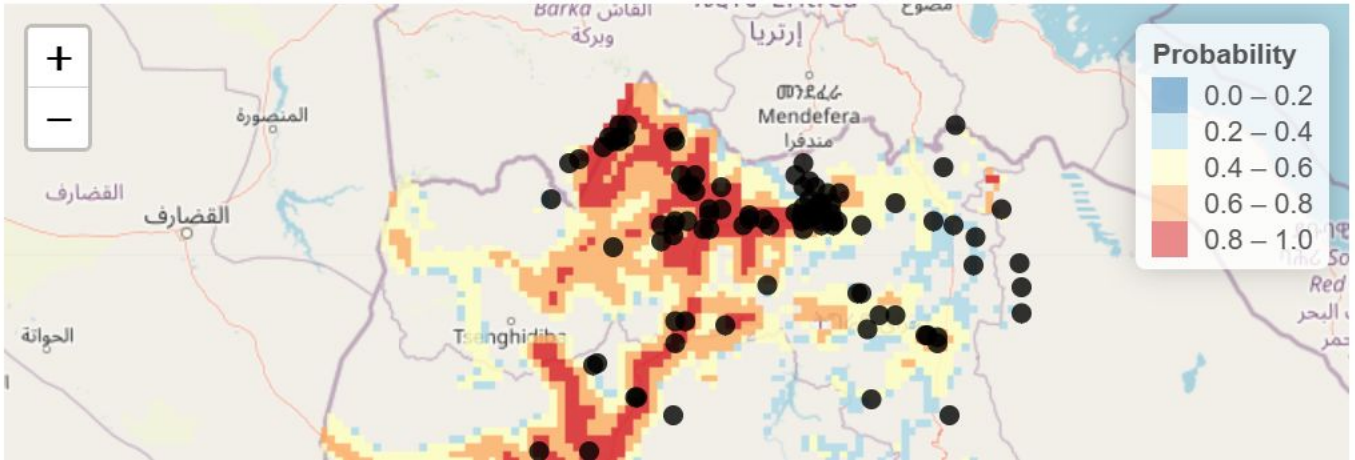
Summary

Crop landraces have been defined as “dynamic population(s) of a cultivated plant that has historical origin, distinct identity and lacks formal crop improvement, as well as often being genetically diverse, locally adapted and associated with traditional farming systems” . A landrace can be further classified as autochthonous when grown in the original location where it developed its unique genetic and socioeconomic characteristics through grower selection and allochthonous when introduced from another region and then locally adapted (Ramirez-Villegas, et al., 2020).

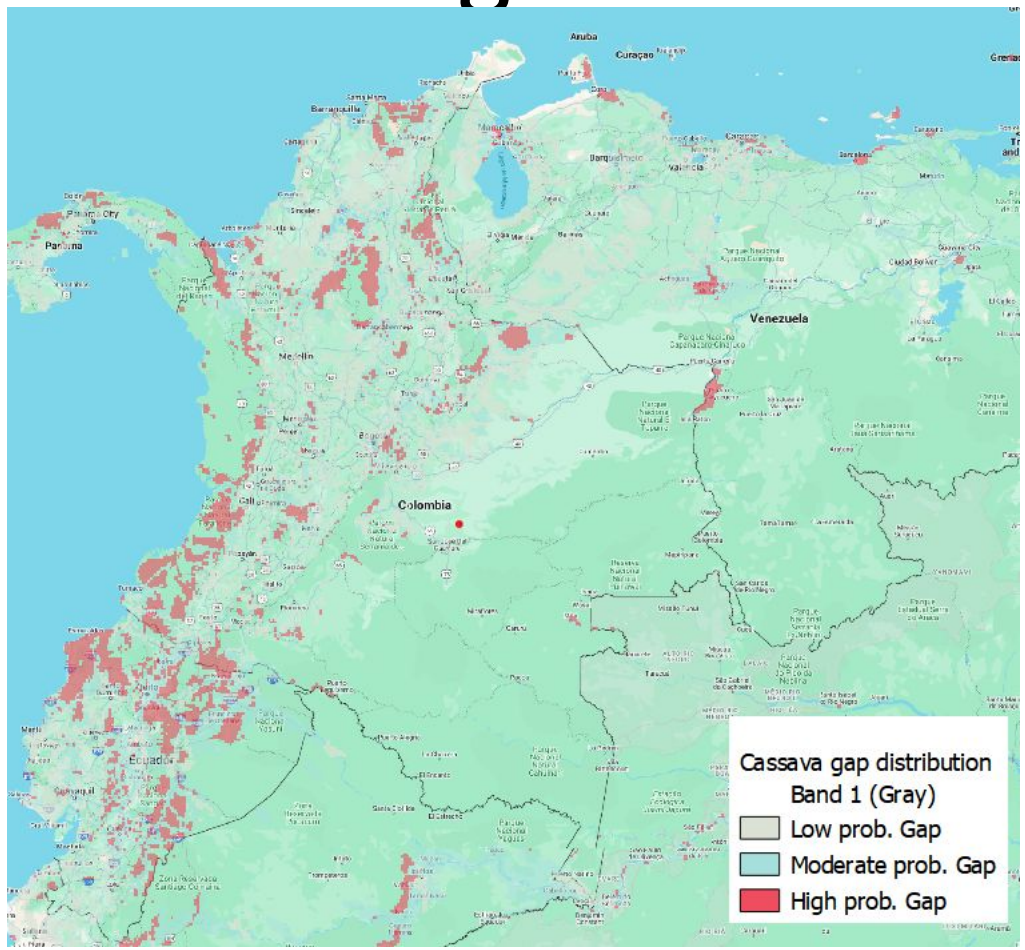
Results for Landracre Group: eleusine_coracana

1. Spatial distribution:

A data cleaning process was applied, during which accessions outside the continental mask and those with duplicated coordinates were removed. The cleaned passport data used for the gap analysis comprises a total of ***1060*** accessions out of a total of ***13760***, representing the ***8%*** of the records. The next graph shows the modelled spatial distribution for the specie. Used accession are shown as darker points.



What insights could we obtain from results?



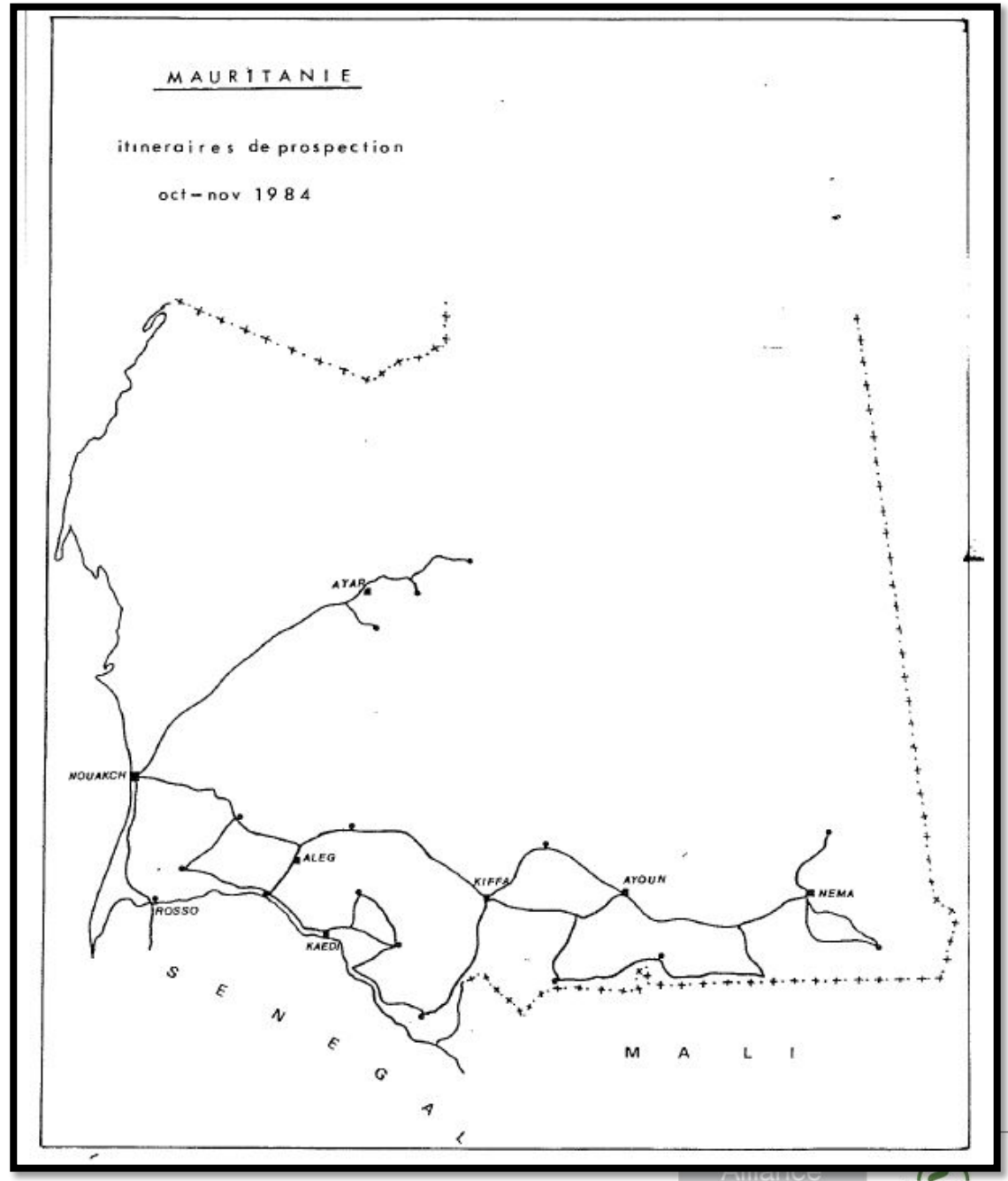
Metrics	Value
Coverage	68%
Total Gap Area	23.000 Km²
Average Elevation	635 Mts

- **Coverage**: The 68% percent of the specie distribution it is been covered by the germplasm collection (this mean that the 32% remaining it is missing. It's good or not ?).
- The total area highlighted as a gap are **23.000 Km²** (this is good bearing in mind that the whole country has more than 1.142 million km²).
- In average, the gap areas are in an elevation of **635 Mts** above sea level (is this elevation suitable for the crop to grow?)

What additional insights can we gain from this?

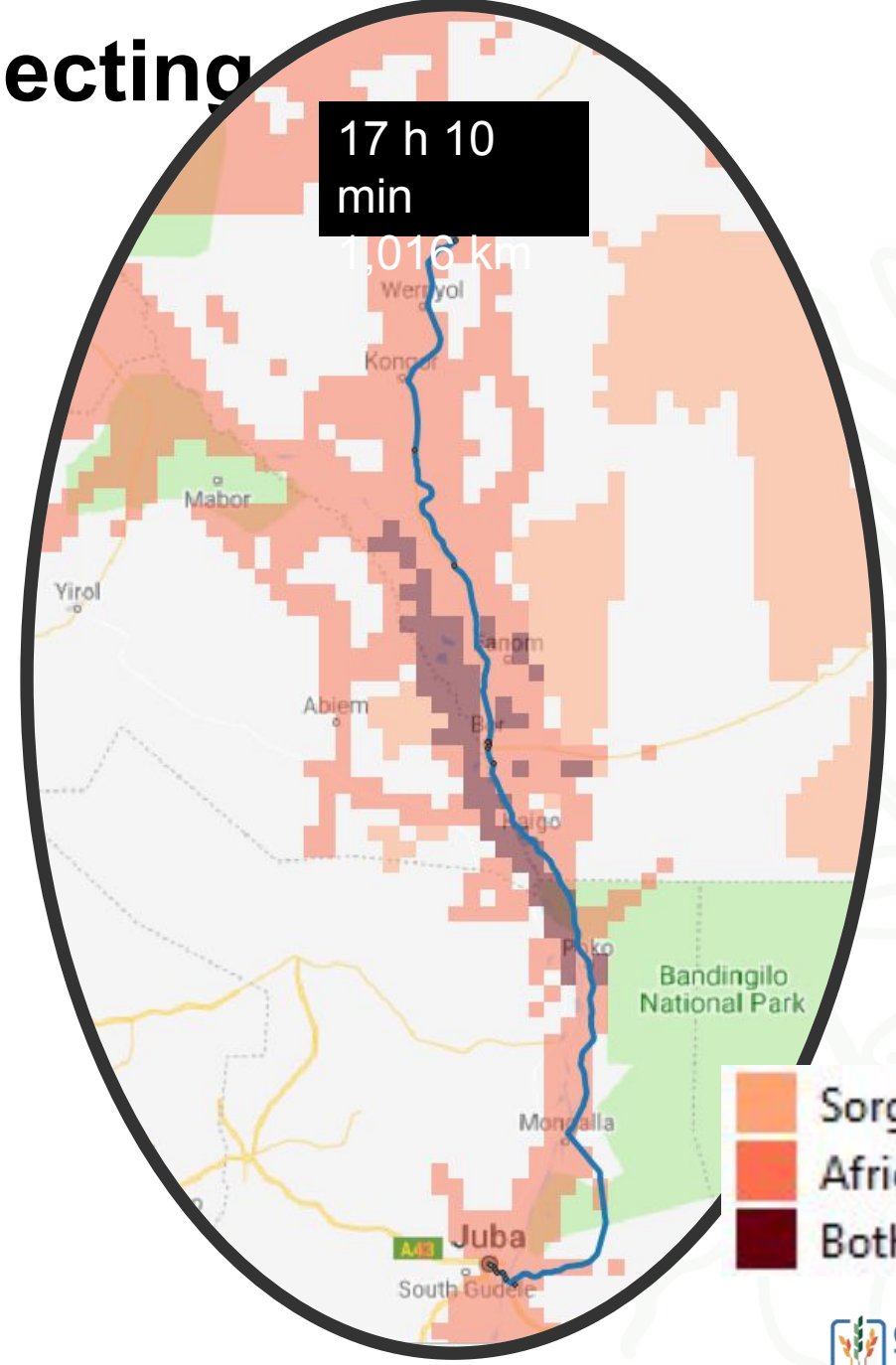
Considerations

- Final gap maps are not filtered by protected areas.
- Final gap maps are not filtered by Land use coverage.
- Spatial model did not use soil properties variables (possible enhancement).
- **Ensure an expert inspection over the results to refine even more the gap maps.**


MAURITANIE
itineraires de prospection
oct-nov 1984
ATAR
NOUAKCH
ALEG
ROSSO
KAEDI
KIFFA
AYOUN
NEMA
S E N E G A L
M A L I

Google Maps

Gap analysis can support collecting



Takeaways

- Something is better than nothing
- Our approach can give hints of current landrace distribution
- Comprehensive and reliable methodology
- Completely availability of gaps maps for crops
- Useful for planning future collecting mission

Thank you!