NASA - CI PARTNERSHIP: SUPPORTING GDSA GOALS IN SUB-SAHARAN AFRICA

BEF Team Meeting – Arlington, VA

May 2019

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NASA

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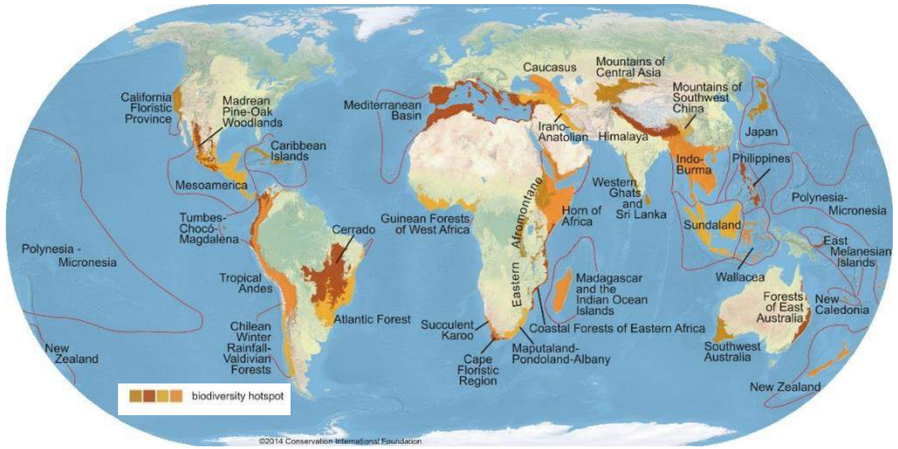

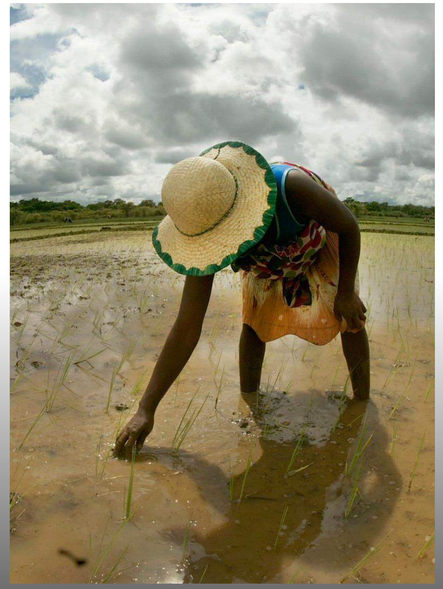

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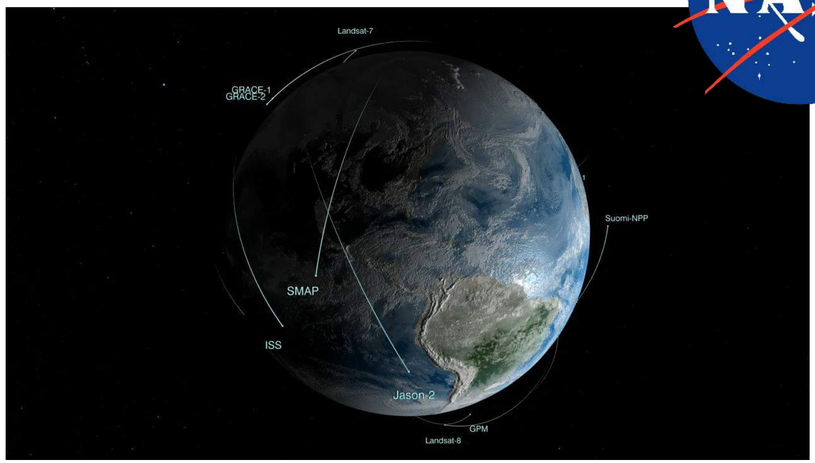
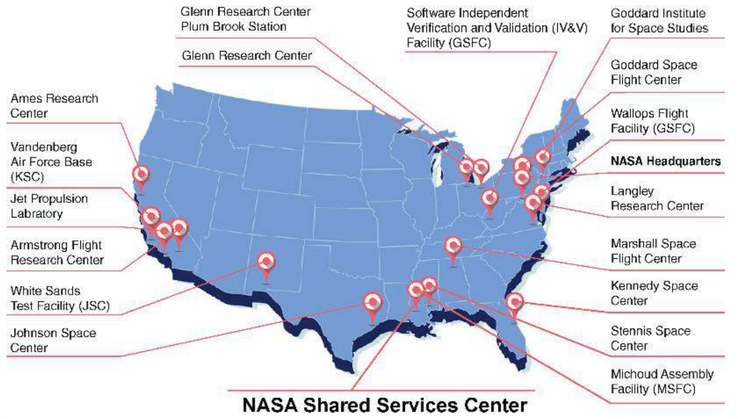
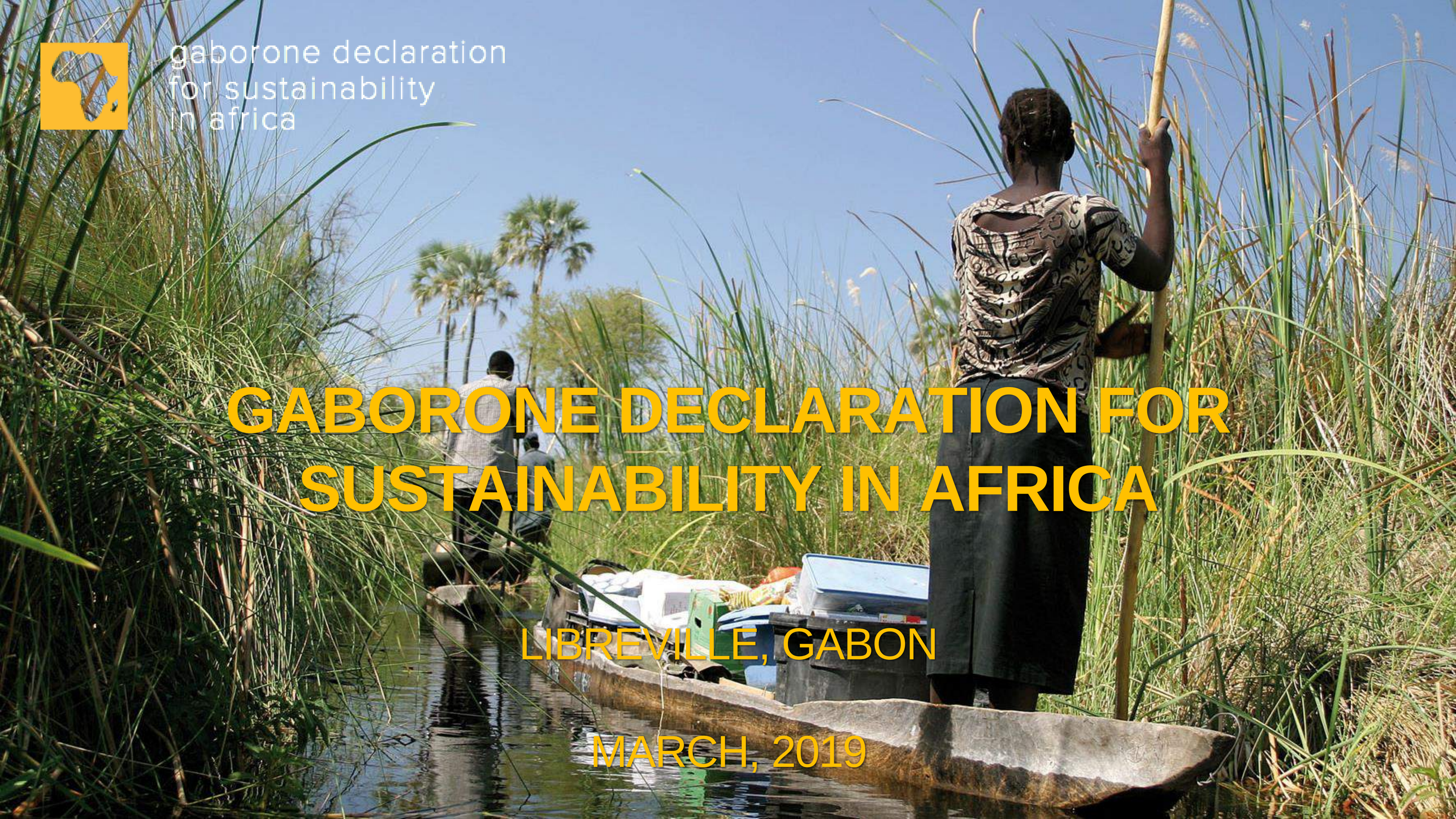




gaborone declaration
for sustainability
in africa



GABORONE DECLARATION FOR SUSTAINABILITY IN AFRICA

LIBREVILLE, GABON

MARCH, 2019

GHANA

LIBERIA

GABON

UGANDA

KENYA

RWANDA

TANZANIA

MOZAMBIQUE

NAMIBIA

BOTSWANA

MADAGASCAR

SOUTH AFRICA

INDIAN OCEAN

COMMITMENTS

1. Incorporating the value of natural capital in public and private sector policies and decision-making

2. Pursuing sustainable development and sustainable production – incl. agriculture, fisheries, and extractive industries - while maintaining natural capital

3. Generating data, undertake monitoring and build capacity to support policy and decision-making.

OUTCOMES

- Natural Capital Accounting
  - integrate the value of nature into decisions and policies
- Sustainable Development
  - sustainability reflected in national plans and production systems
- Environmental-Economic Monitoring
  - ensure decisions reflect change towards sustainability
- Corporate Leadership
  - accelerate the transformation to sustainability

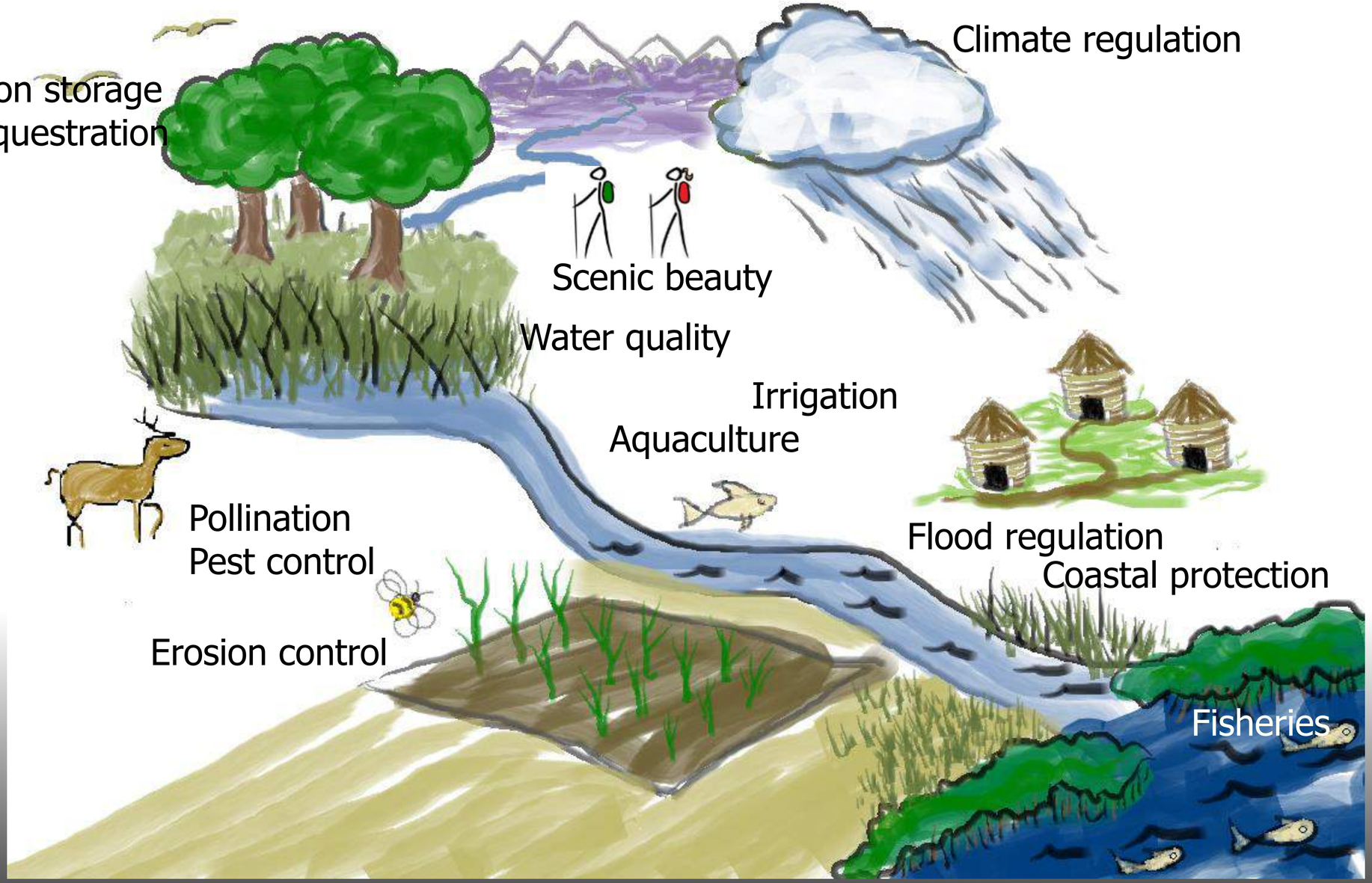
gaborone declaration
for sustainability
in africa

NATURAL CAPITAL ACCOUNTING

A **SYSTEMATIC** PROCESS FOR TRACKING NATURAL ASSETS, THE SERVICES PROVIDED BY THEM AND THEIR RELATIONSHIP TO THE ECONOMY

Adapted from World Bank, 2015

NATURAL CAPITAL AND ECOSYSTEM SERVICES



MAIN GOALS

- Support the GDSA countries in Natural Capital Accounting by developing a **repeatable method for ecosystem extent mapping**

- Pilot ecosystem extent mapping in **four GDSA countries** (Liberia, Gabon, Botswana, TBD)

gaborone declaration for sustainability in africa

ECOSYSTEM EXTENT
MAPPING

APPROACH

- Ecosystem extent maps need to move beyond land-cover and capture the underlying ecosystems that provide services

- The maps should be directly applicable and support the development of other SEEA accounts, such as the water account

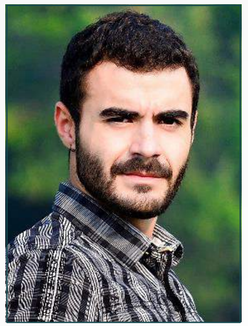
- The methods need to be replicable, transferable and easy-to-implement at low cost

WORK STREAMS

Lead: Woody Turner
Coordinator: Keith Gaddis
Technical Team:

Dr. Lola Fatoyinbo

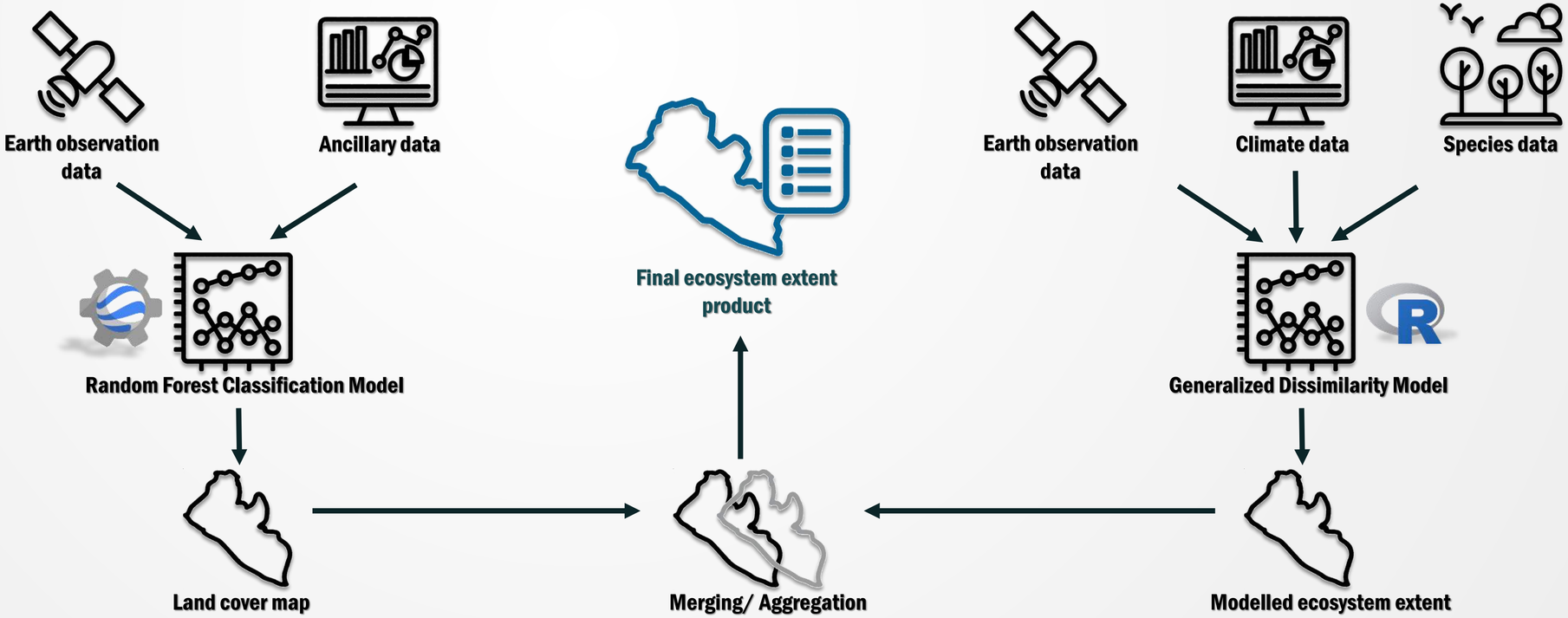
Dr. Chris Neigh


Dr. Celio Sousa

Lead: Daniel Juhn
Technical Team:

Dr. Miroslav Honzak

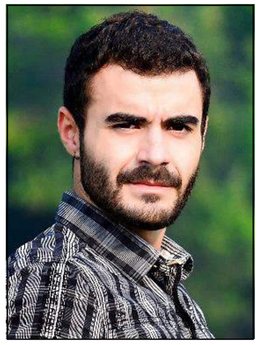
Dr. Trond Larsen



LAND COVER
MAPPING

Dr. Lola Fatoyinbo

Dr. Chris Neigh



Dr. Celio Sousa

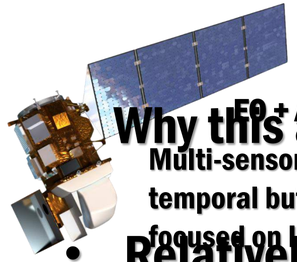
NASA is leveraging its technical capacity and extensive experience with earth observations data to support -

the quantification and monitoring of the spatial and temporal dynamics of the land cover within the ecosystem account framework -

for countries that committed to the Gaborone Declaration for Sustainability in Africa (GDSA): Liberia, Gabon, Botswana and TBD.

Methodology

Initial step → Mapping the extent of land cover classes. We propose an integrated method of pixel-based classification using Random Forest (RF) classifier and ancillary data using Google Earth Engine to develop a land cover map for the GDSA countries.



Compositing and Mosaicking

EO + Ancillary Data

Multi-sensor / multi-temporal but primarily focused on LANDSAT 8 data

Classification

Binary Classification

Each land cover class was mapped individually

Class masks

Post-classification

Map Composition and Accuracy Assessment

Our approach

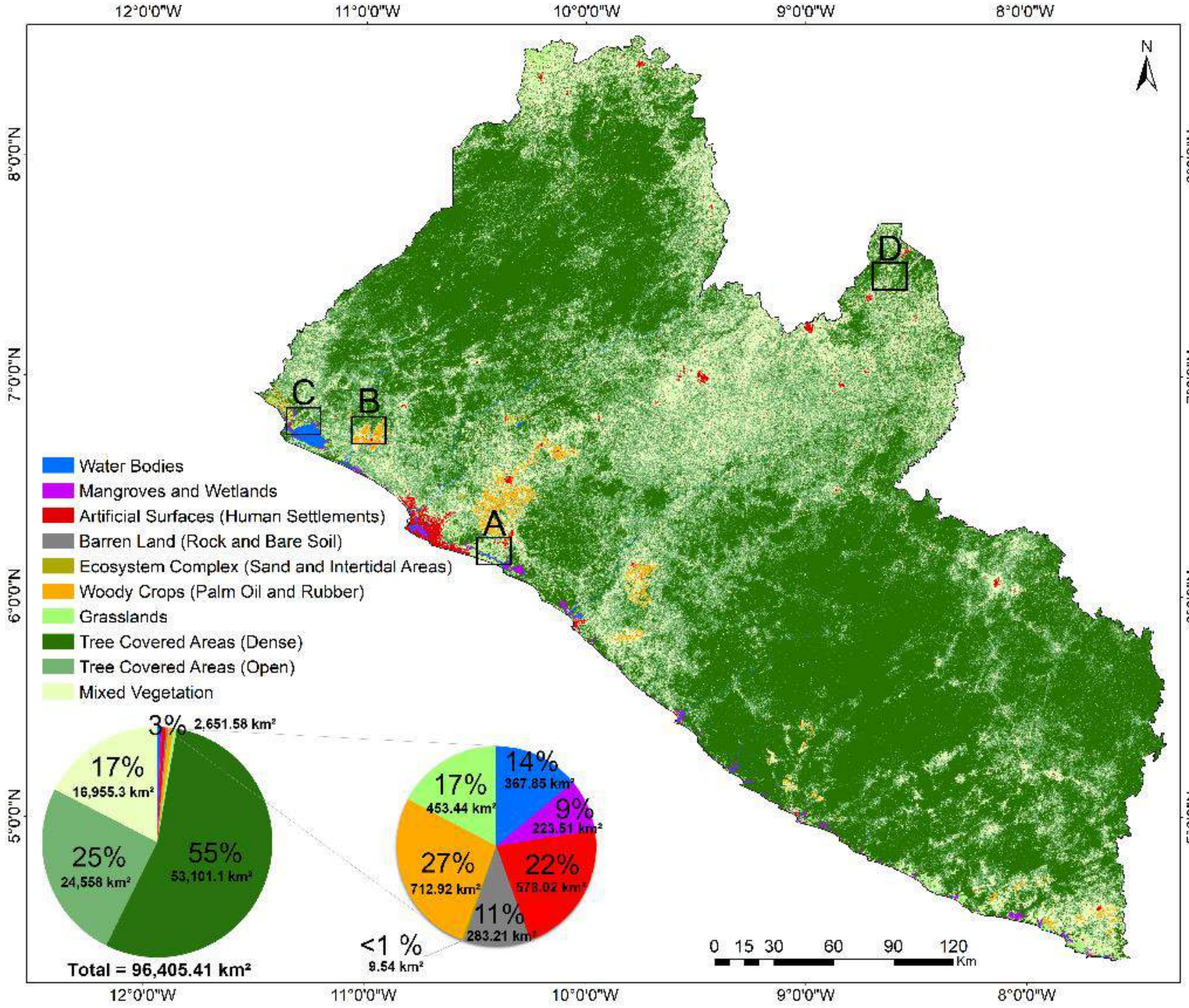
Robustness and Repeatability

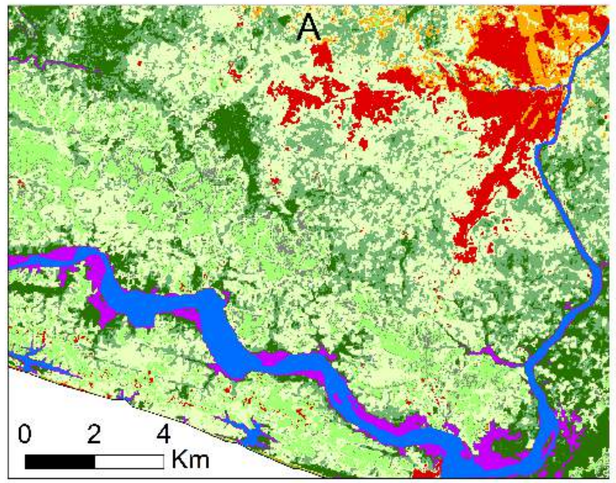
Quality

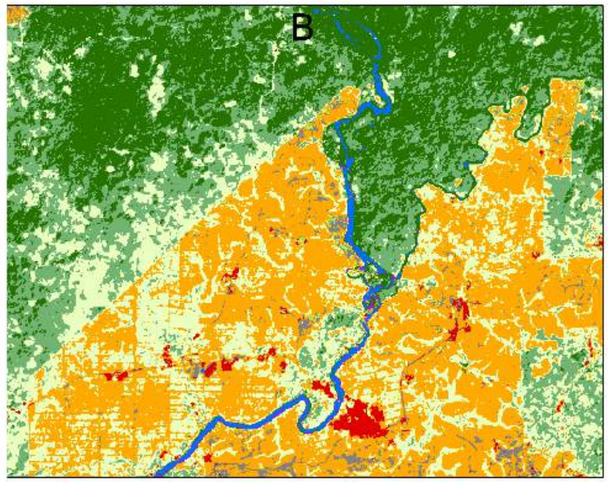
Why this approach using Google Earth Engine?

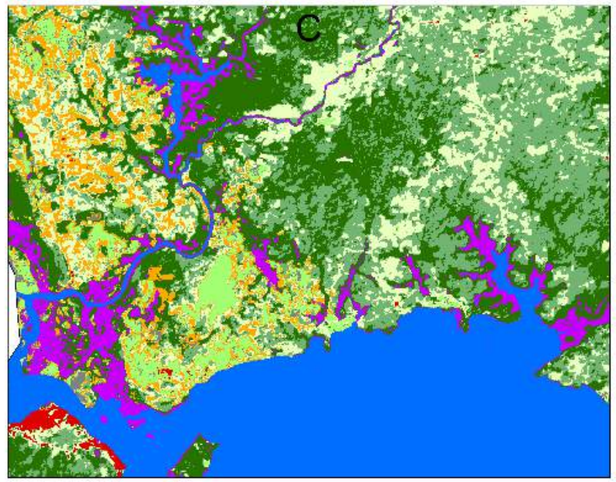
- Relatively "unlimited" computational power;
- Easily reproducible by any user with a computer and access to internet connection.

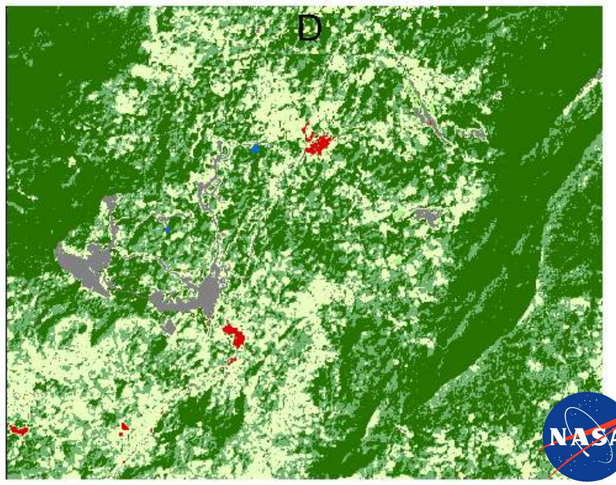
Liberia land cover map – 2015 epoch



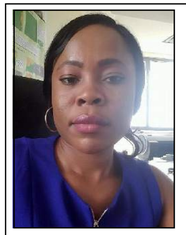








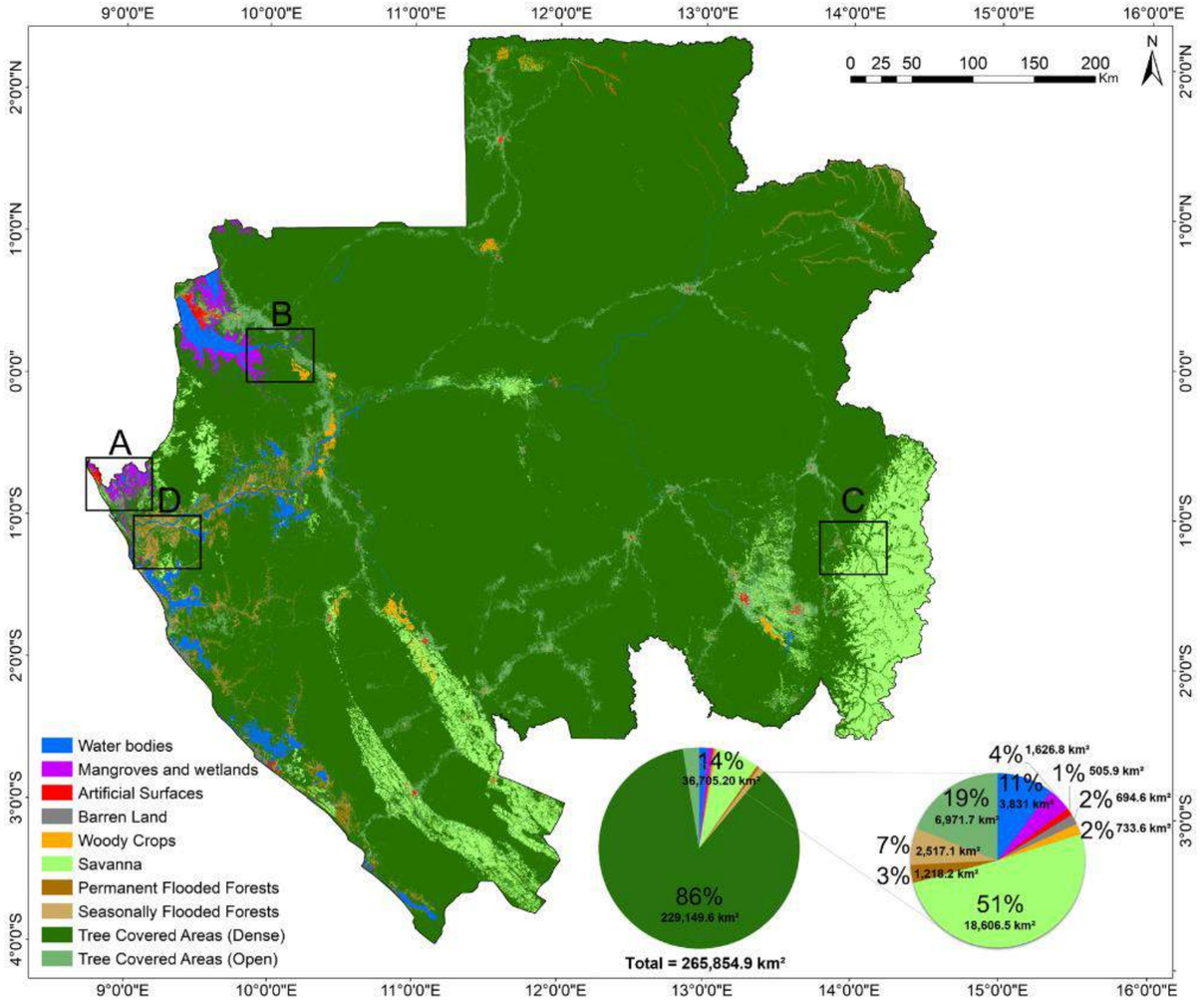
AGEOS
AGENCE GABONAISE D'ÉTUDES ET D'OBSERVATIONS SPATIALES

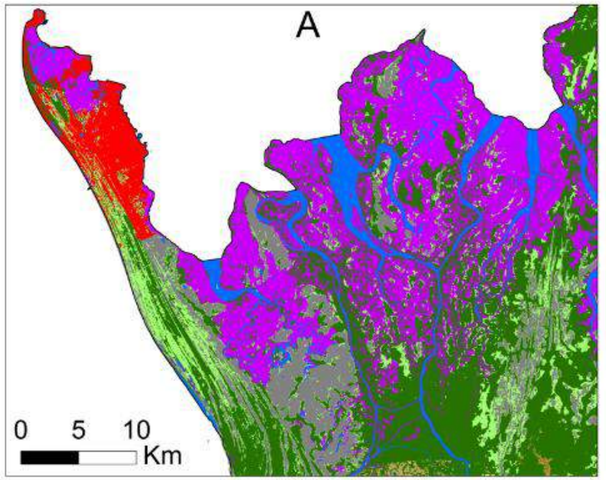

Vanessa Angoue

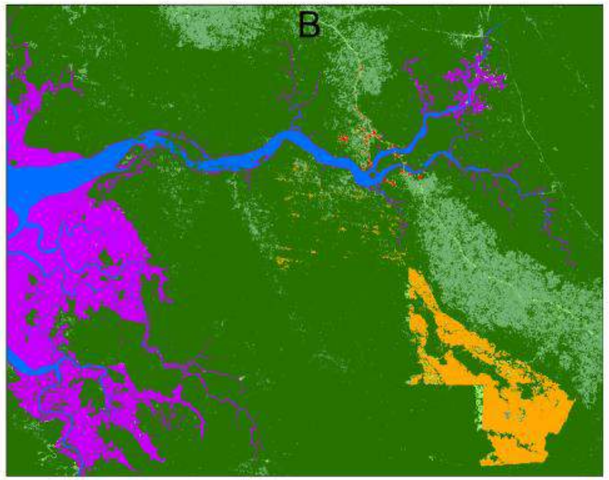
Farrel Boucka

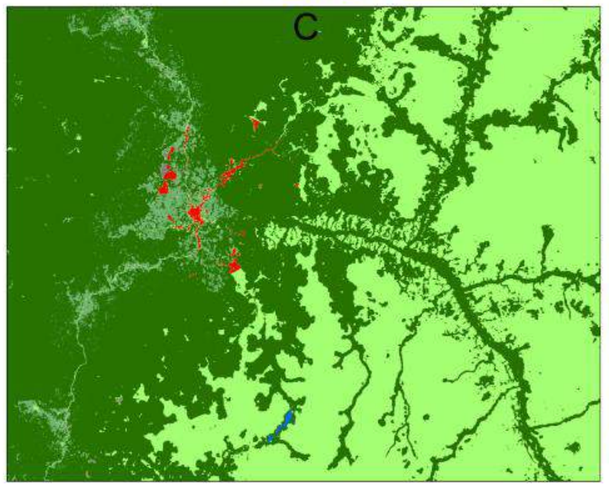
Dr. Ghislain Moussavou

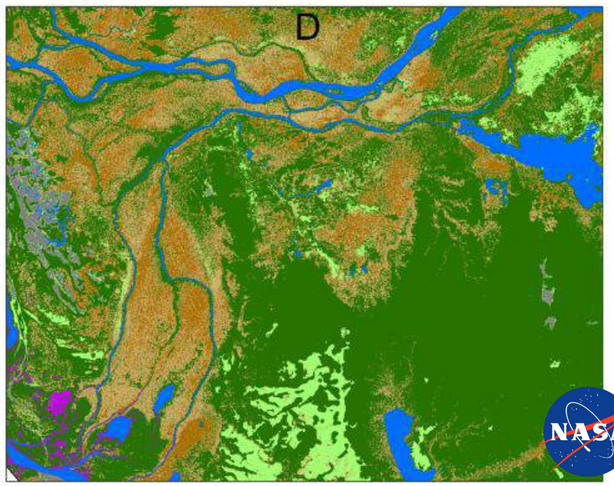
Gabon land cover map – 2015 epoch



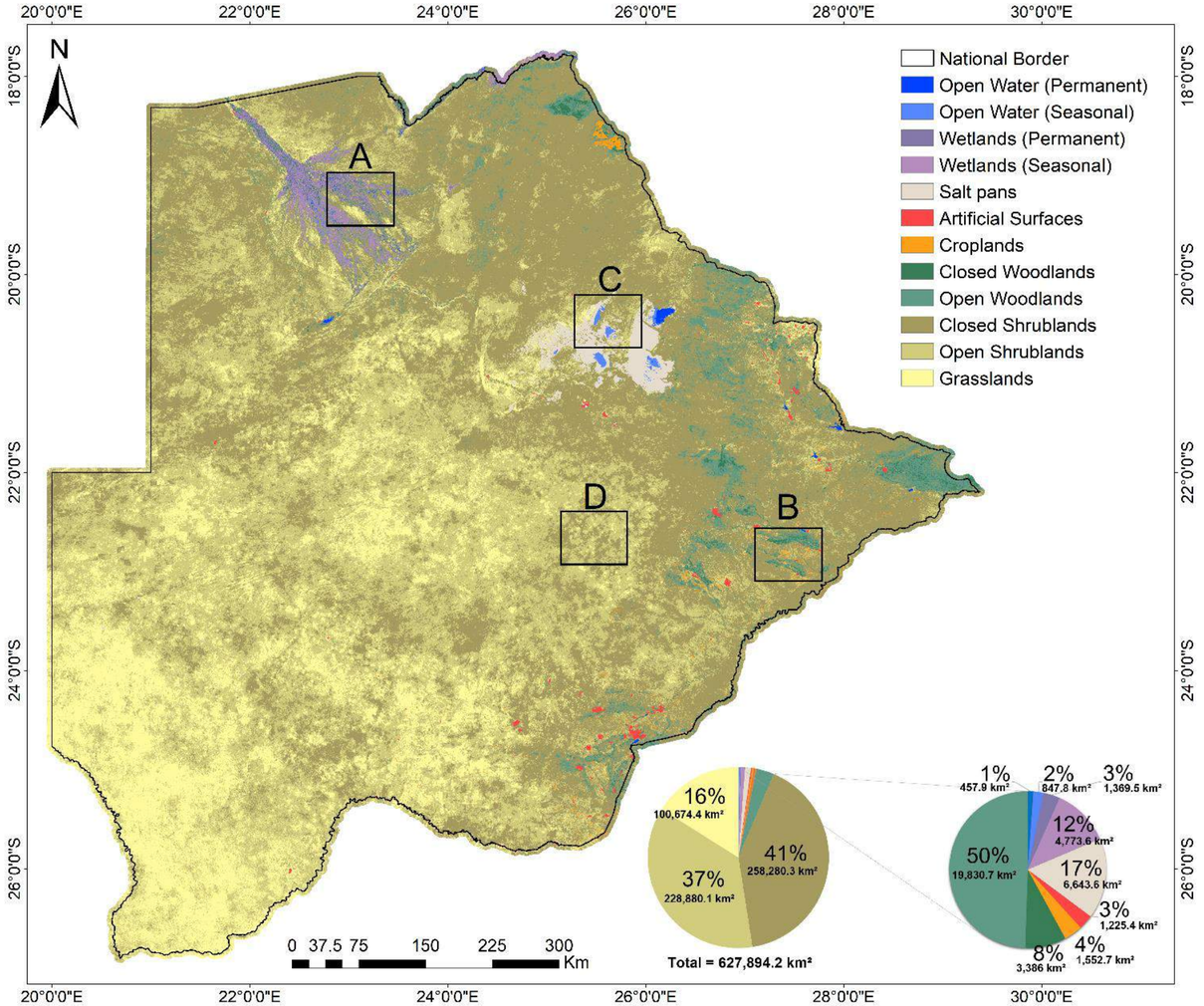


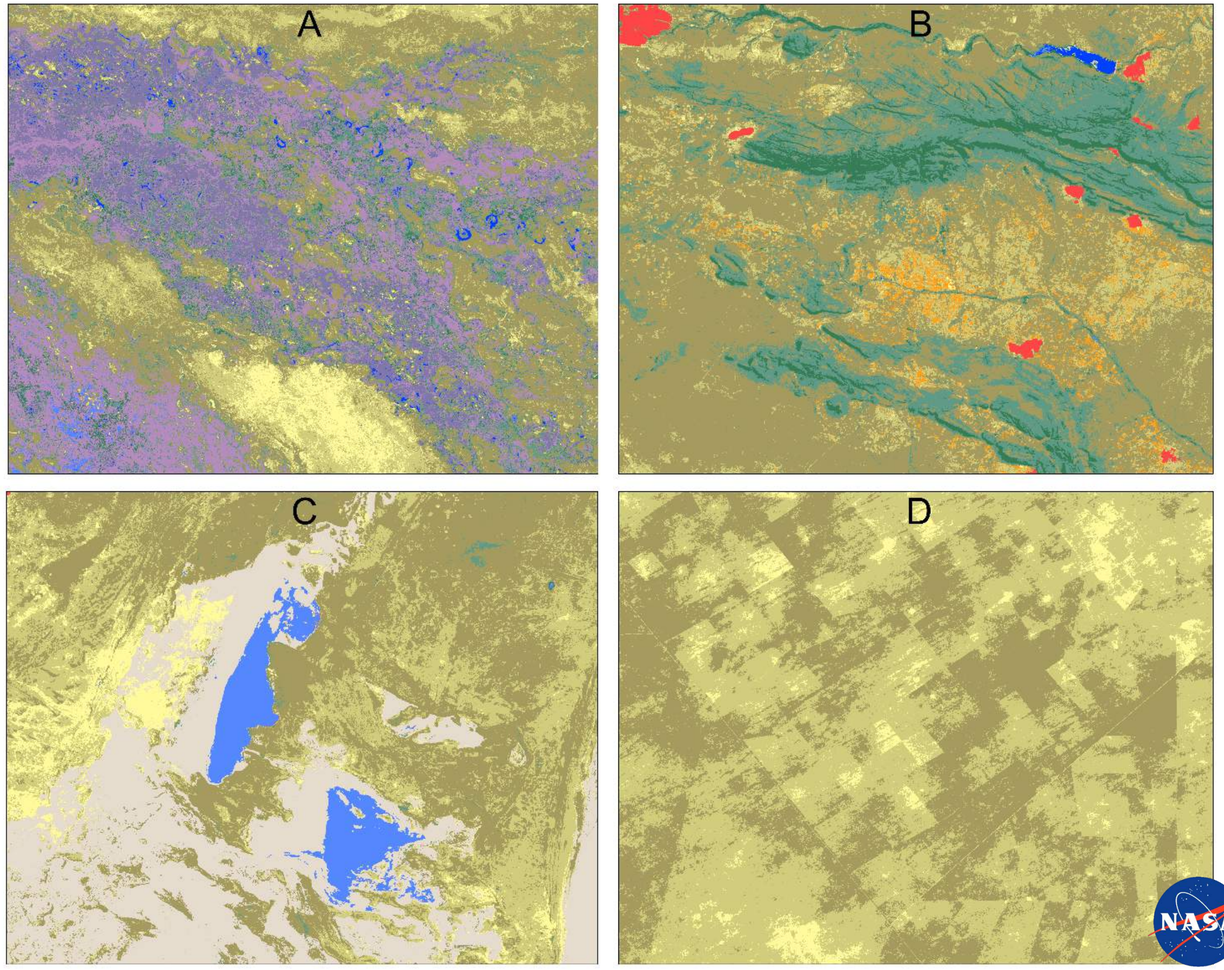






Botswana land cover map - 2018

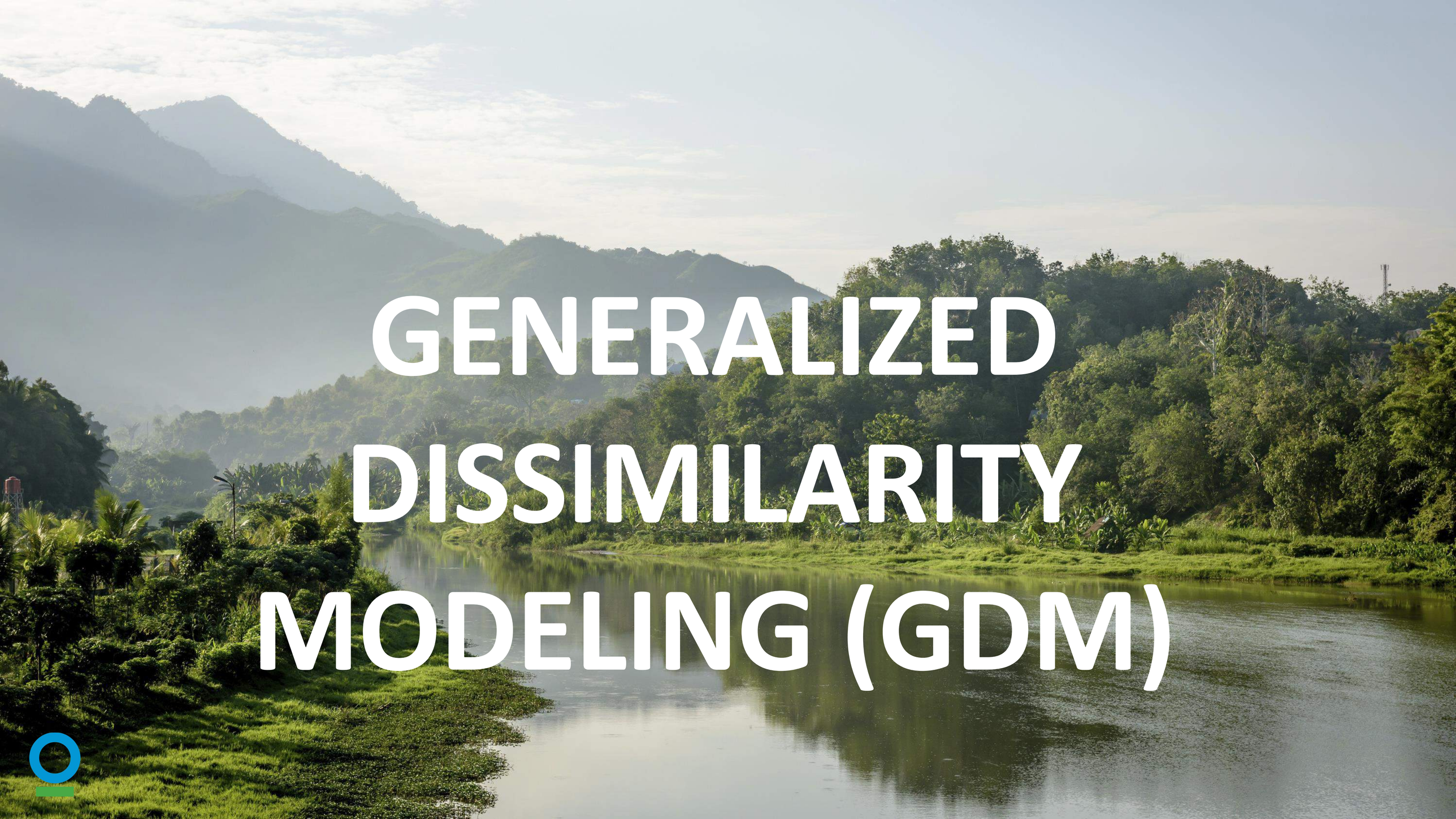




In-country engagement

Monrovia, Liberia - 9/2018

Libreville, Gabon – 3/ 2019


GENERALIZED
DISSIMILARITY
MODELING (GDM)

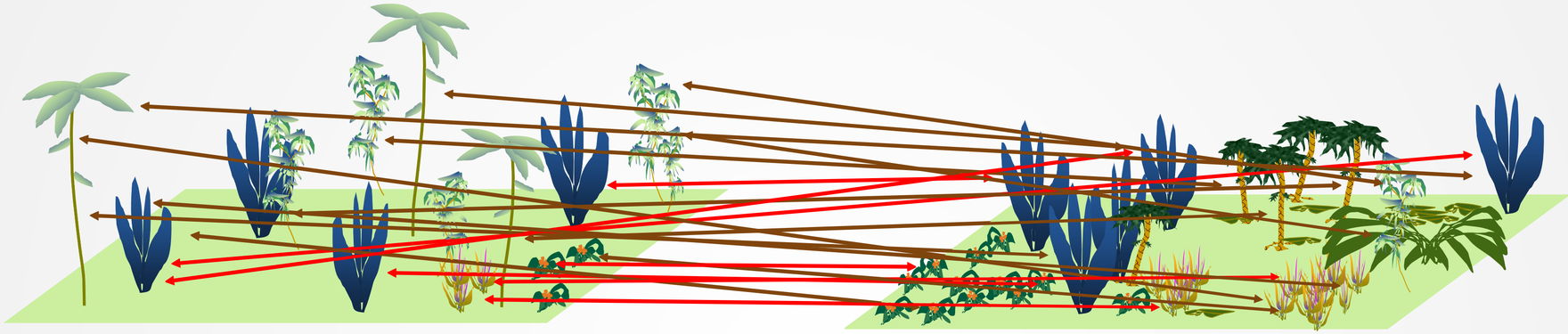
GENERALIZED DISSIMILARITY MODEL (GDM)

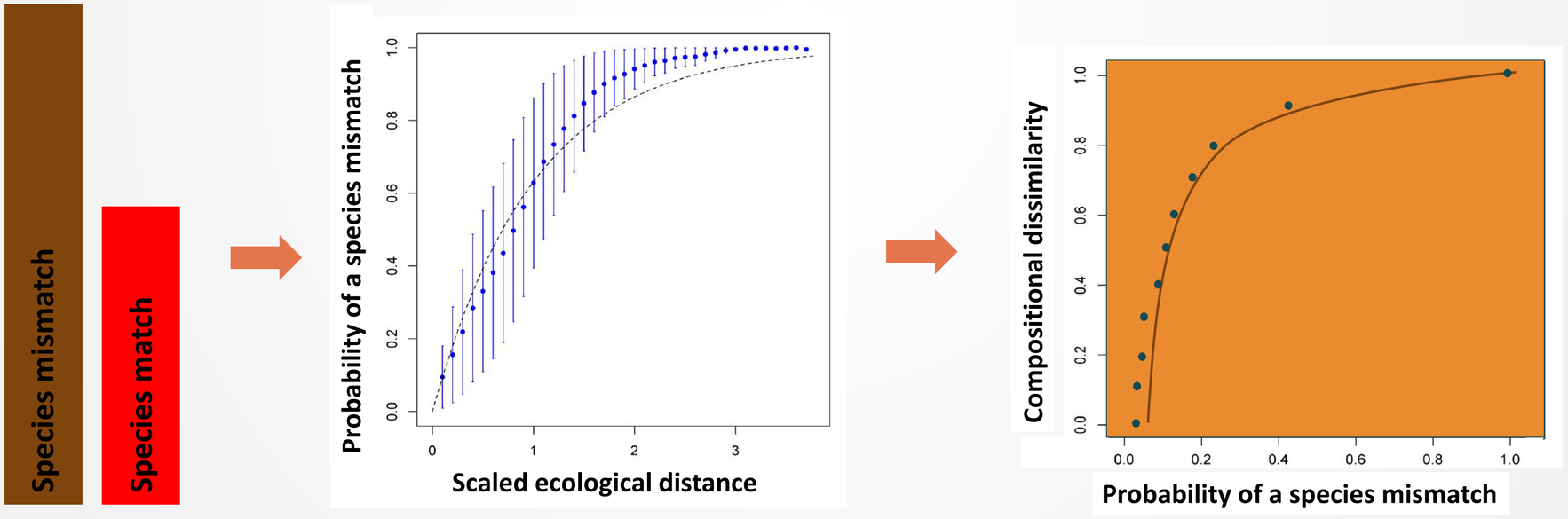
- GDM is a statistical technique for analyzing and predicting spatial patterns of beta diversity across large regions

- Using presence-only species data and environmental variables to predict the uniqueness of ecosystems and biodiversity

- Environmental variables include climate, distance, disturbance regimes, hydrology, topography, and direct earth observations

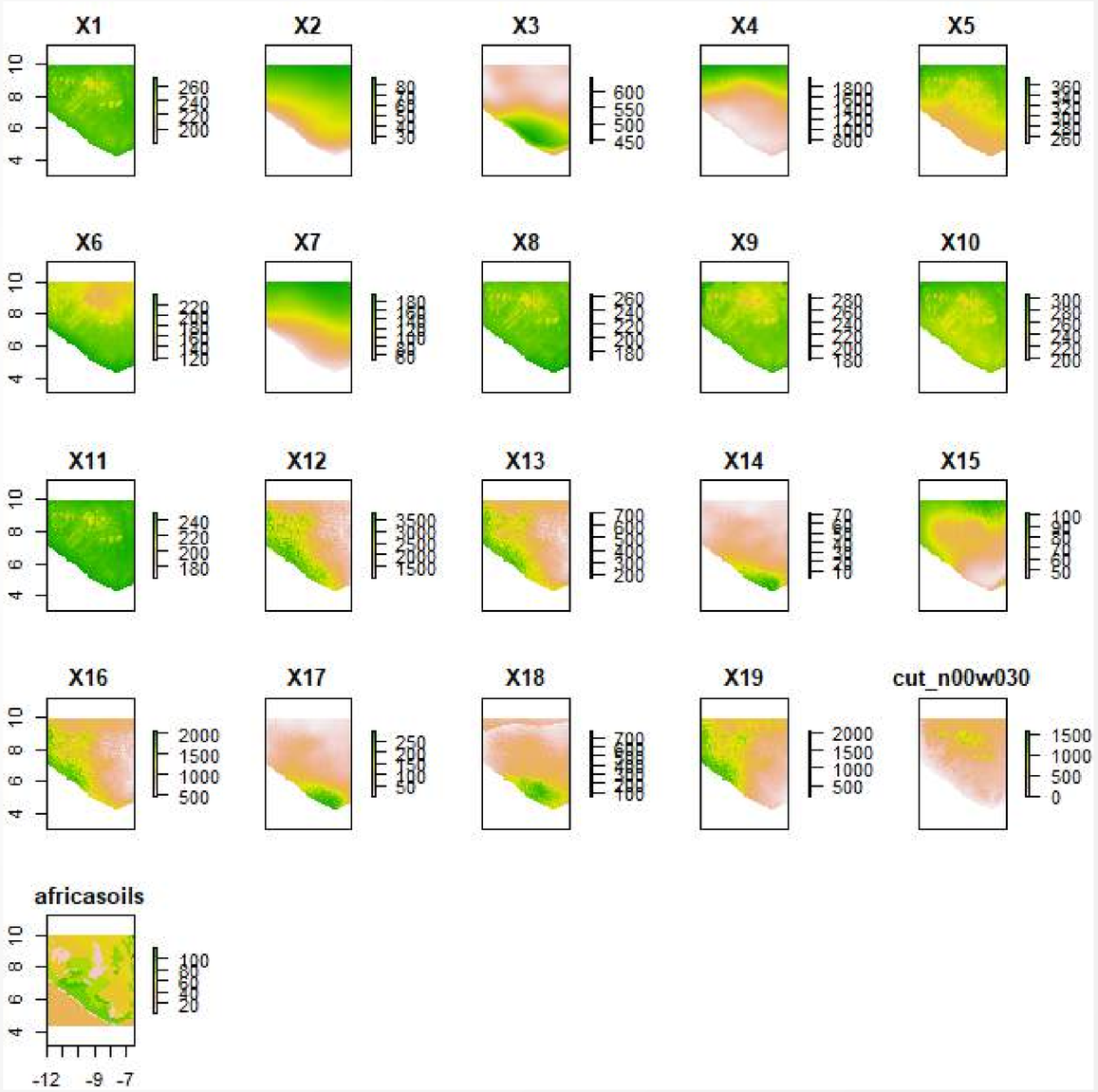
GENERALIZED DISSIMILARITY MODEL





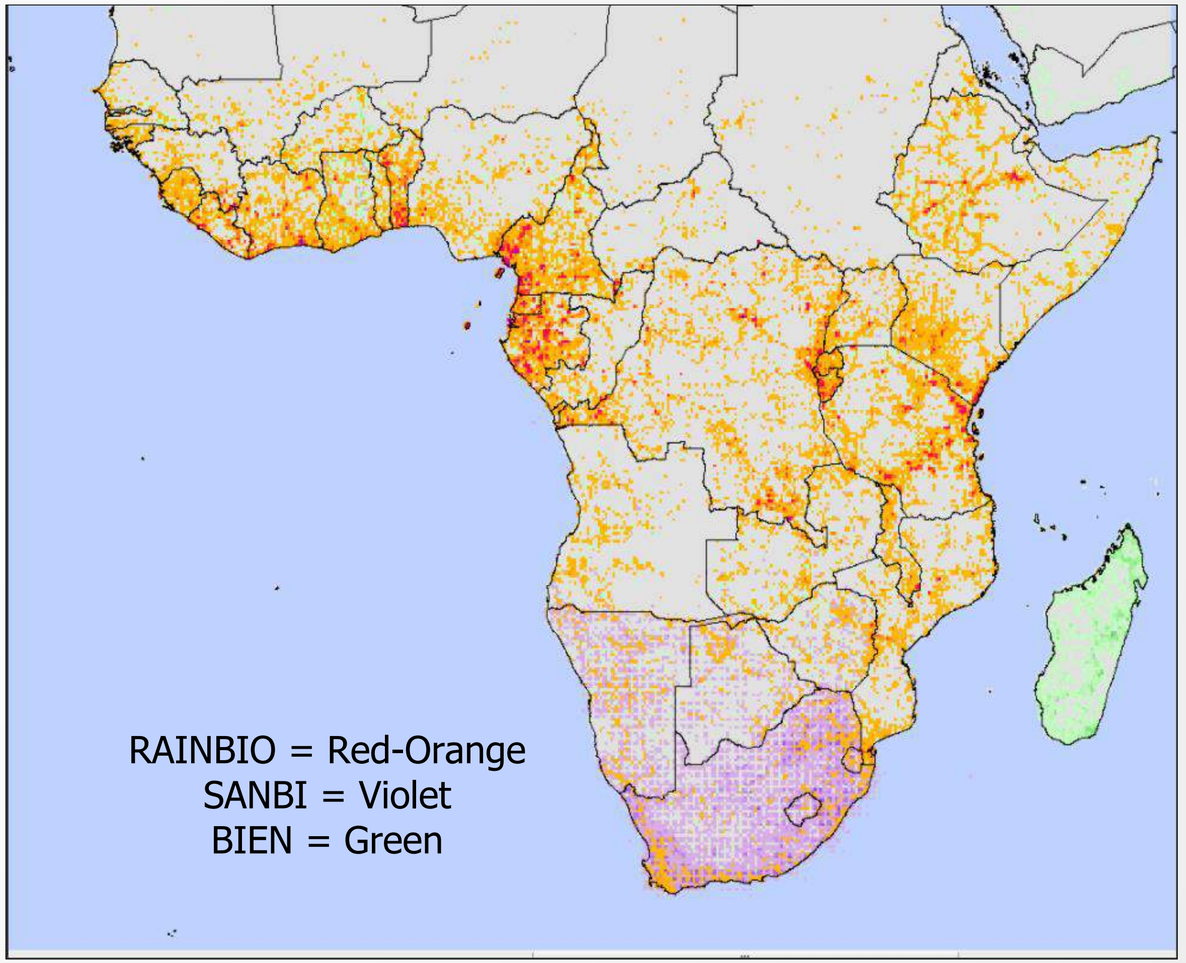
ENVIRONMENTAL VARIABLES

- Bioclimatic variables (CHELSA)
- Elevation (SRTM data)
- Soils map (Africa Soils Atlas)
- etc.



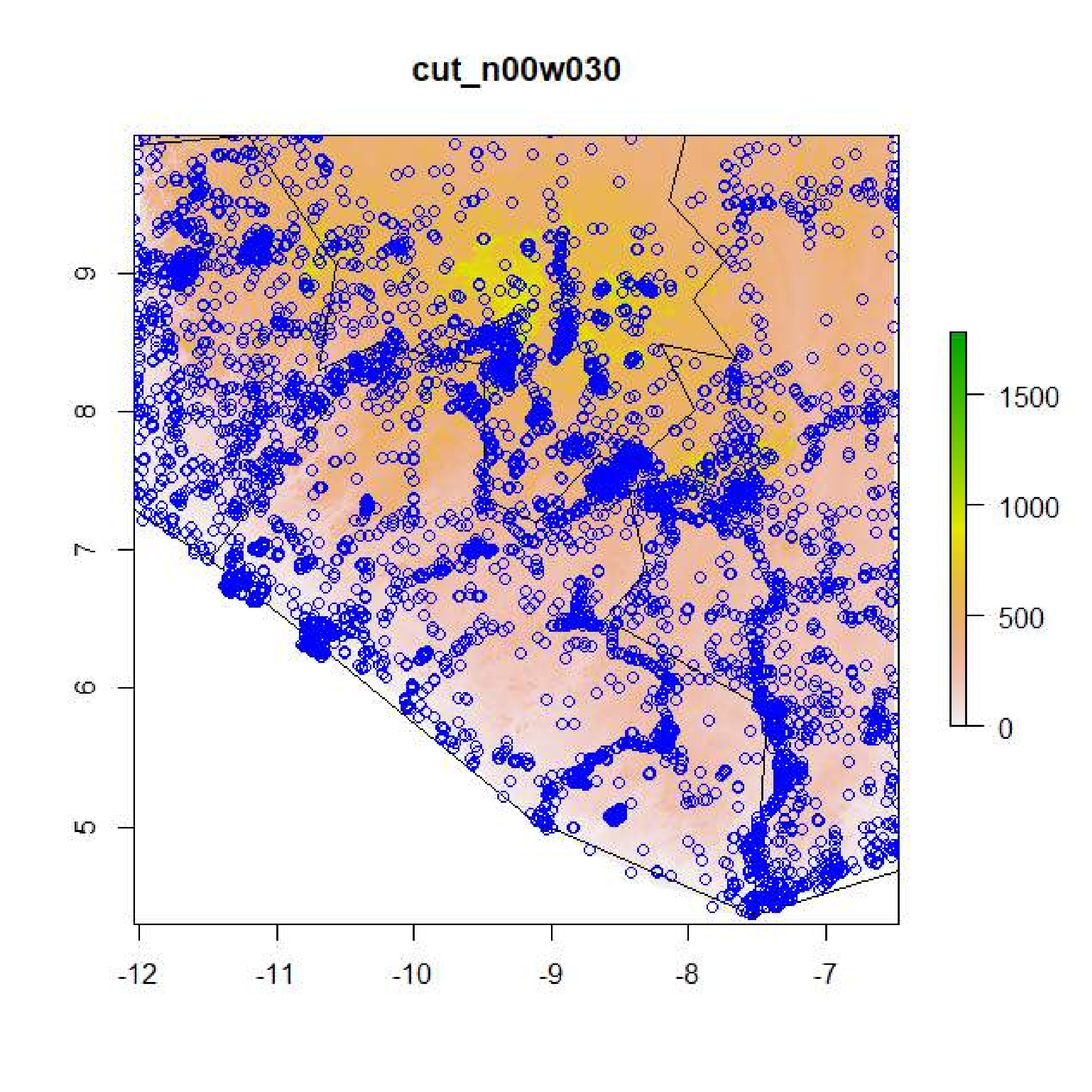
BIEN DATASET

- Large and growing database of taxonomically standardized and geo-validated occurrence records of plant species
    - globally 378,000+ species
    - 81 million+ observations
- Collection of botanical recordrs from many institutions



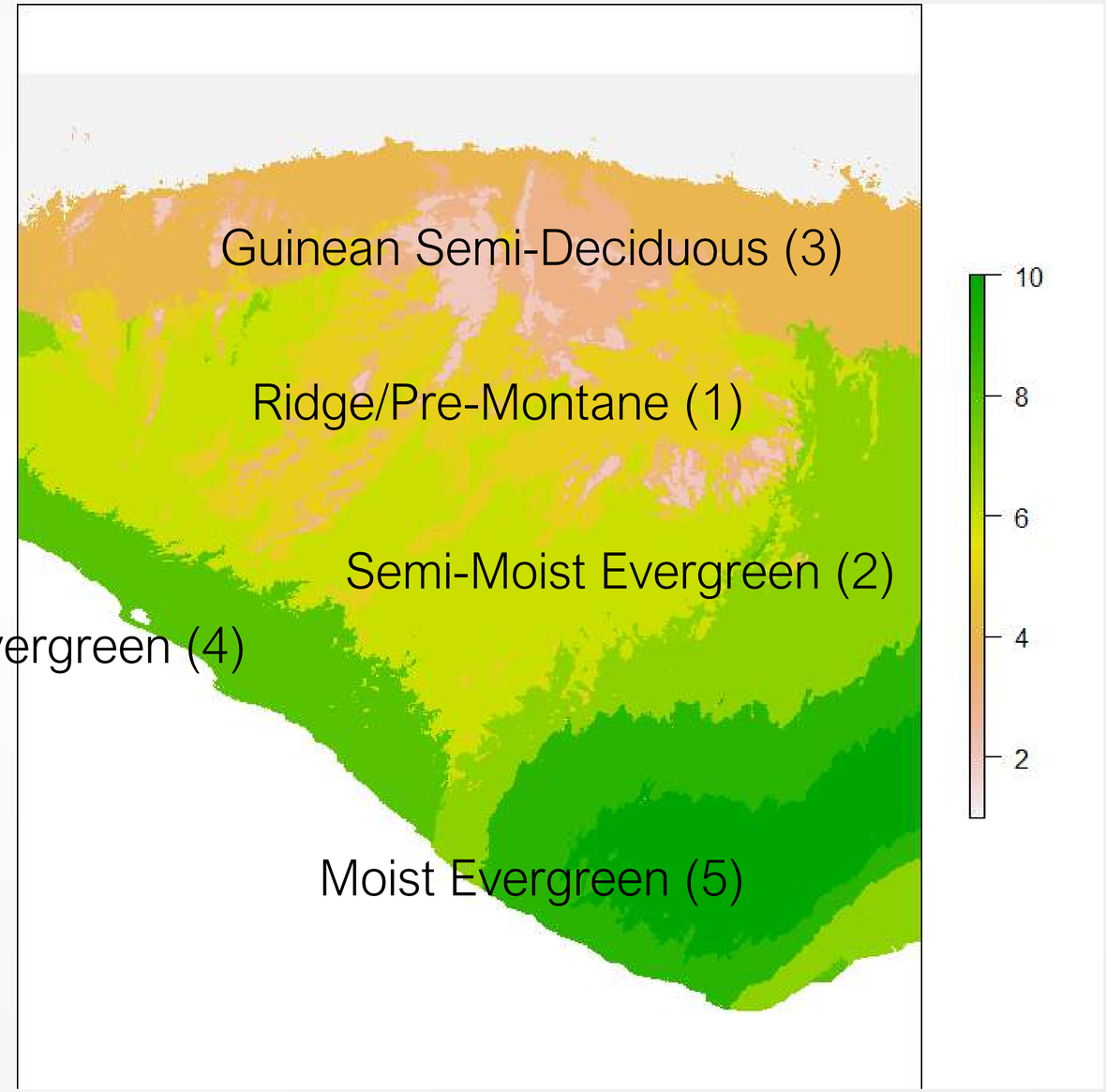
BIEN DATASET FOR LIBERIA

- The newest version available since October 2018 (Version 4.1) contain:
  - 57,452 observations
  - 4,166 unique species



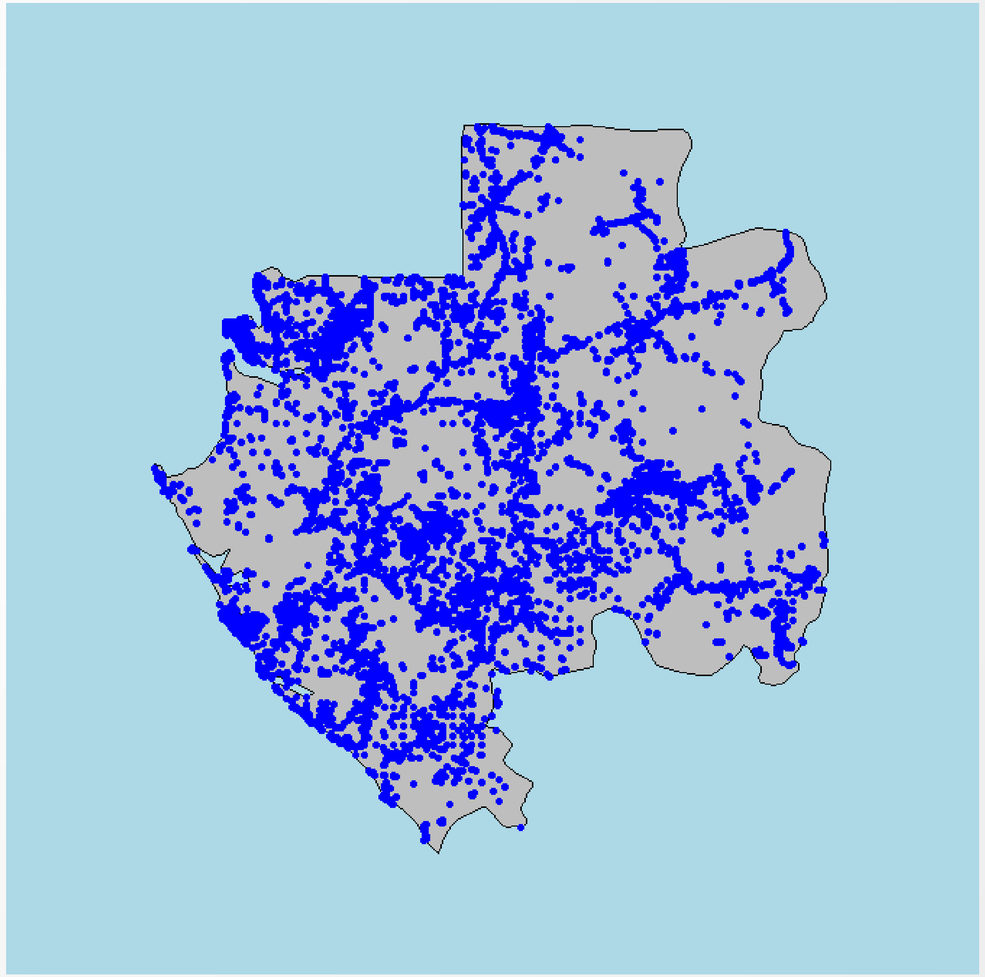
ECOTYPE VALUES/LABELS

- Unsupervised classification from May 2019 (n=10)
- Inputs: Records from private-access-BIEN, CHELSA bioclimatic variables, Africa Soils Atlas soil types map and NASA's SRTM terrain data



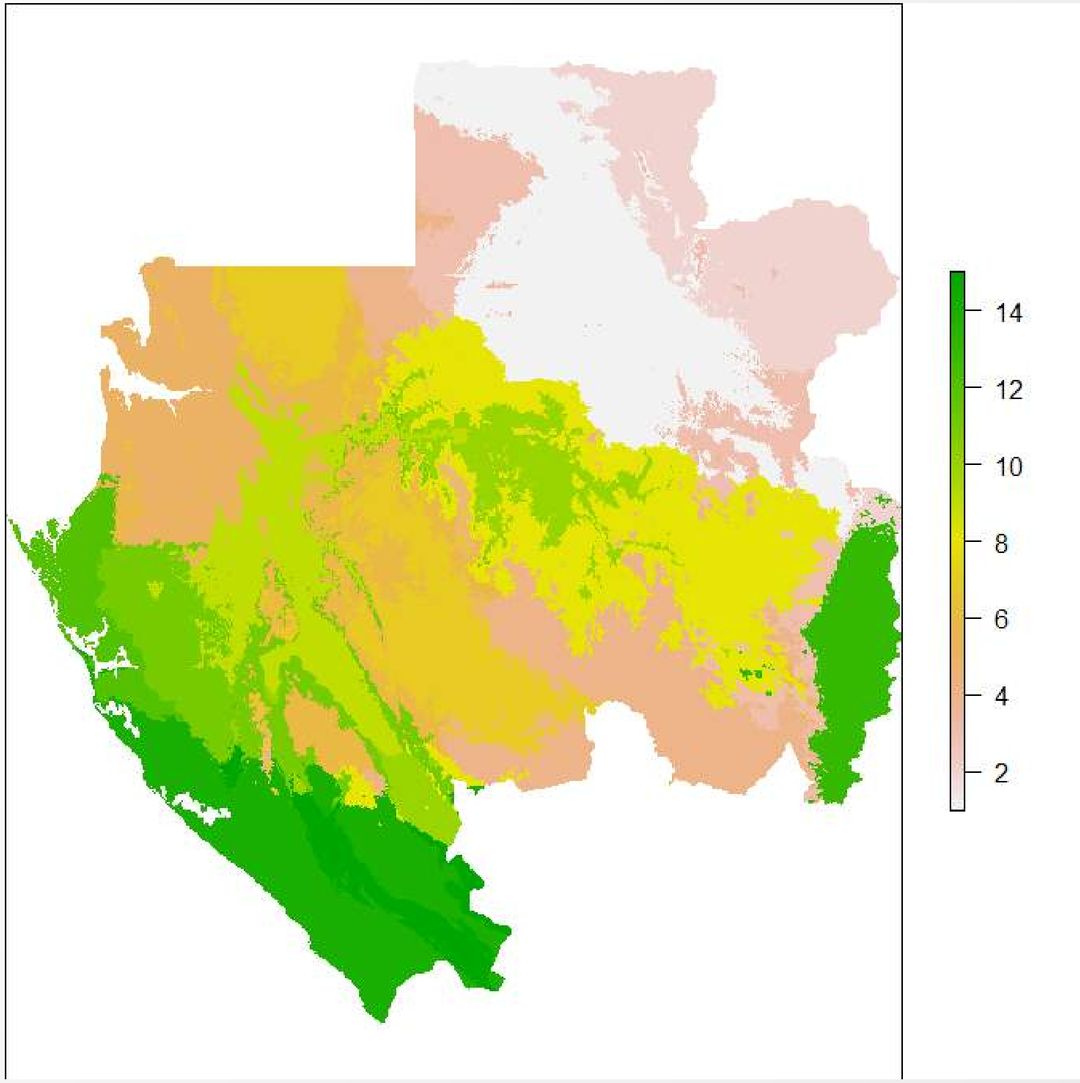
BIEN DATASET FOR GABON

- For Gabon BIEN version 4.1 (Oct 31, 2018) contains:
  - 109,722 observations
  - 5,525 unique species



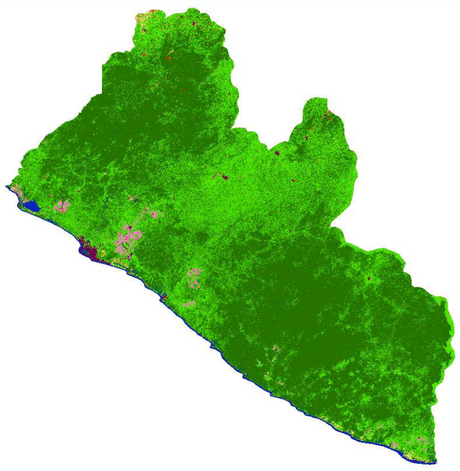
GDM OUTPUT

- Unsupervised classification fro February 2019 (n=15)
- Inputs: Records from public-access-BIEN, WorldClim bioclimatic variables, Africa Soils Atlas soil types map and NASA’s SRTM terrain data



COMBINING LC AND GDM OUTPUTS

- Inputs:
  - Land cover map V2 (Sep 2018)
  - Unsupervised classification of GDM output (5 clusters, public BIEN from Jun 2018)



Decision matrix

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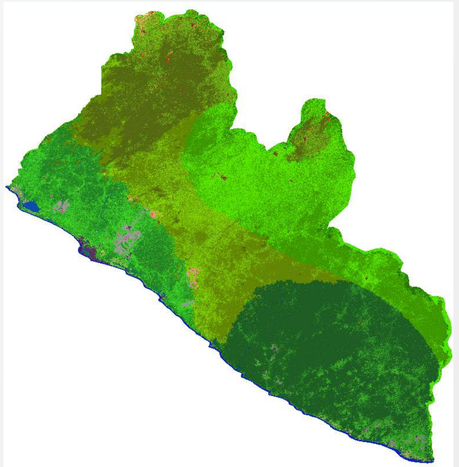

DECISION MATRIX

Land Cover V2		
Class Name	**Value** →	**New Value**
No Data (Masked)	0	No change
Water Bodies	1	No change
Tall Mangroves	2	No change
Scrub Mangroves	3	No change
Artificial Surfaces (Human Settlements)	4	No change
Barren Soil	5	No change
Inselbergs	6	No change
Ecosystem Complex (Sand and Intertidal Areas)	7	No change
Oil Palm Plantation	8	No change
Rubber Tree Plantation	9	No change
Grasslands	10	x 10 + GDM value
Tree Covered Areas (Primary)	11	x 10 + GDM value
Tree Covered Areas (Secondary)	12	x 10 + GDM value
Tree Covered Areas (Sparse/Degraded)	13	x 10 + GDM value

NEXT STEPS

- Finalize ecosystem extent map modeling for Liberia (May 2019)
- Produce draft ecosystem extent maps for Gabon and Botswana (summer 2019)
- Decide on the 4th country to be mapped
- Seek expert/stakeholder feedback throughout the process
- Build in country capacities and produce t2 ecosystem extent maps
- Use the maps to guide the development of national ecosystem extent accounts
- Make these products available to other projects (e.g., GEF project in Liberia, P4F)

THANK YOU!
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