UNESCO Biosphere Reserves in Africa

Scientific activities and collaborations
The Garden in figures

- 180 collaborators (Fl. & Fr. Community)
- 175 volunteers
- 25 guides
- 176 461 visitors in 2018
- 92 hectares (domain)
- 18 000 plant species
- 4 million collection items
- > 50 recent and historical buildings

Meise Botanic Garden
Our Mission

Discovery, study and conservation of plants and using this knowledge for a sustainable future
Botanical Collections

Research based on the collections and their valorisation

Living Collections: +25 000 accessions, 18 000 taxa

Seed banks

Herbarium: 4 000 000 specimens

Mass digitization

Botanical library

Meise Botanic Garden
Plant biodiversity research

Biodiversity research important in the context of the current biodiversity crisis

Botanic gardens are important knowledge centers for plant biodiversity research

**Taxonomic focus**

- Rubiaceae, Balsaminaceae, Musaceae, Poaceae
- Diatoms and green algae
- Fungi (incl. lichens)
- Myxomycetes

**Geographic focus**

- Belgium, Europe
- Tropical Africa (long tradition)
- (sub-) Antarctic region
- SE Asia

Meise Botanic Garden
Genetics

Extensive taxonomic expertise, combined with molecular approaches

- Speed up taxonomic research and yield more reliable estimates of biodiversity
- Phylogenetic relationships

Crop Wild Relatives

- Genetic diversity as potential resource for crop improvement
- Functional traits in wild coffee, bananas and beans
- Evolution and adaptation to climate and ecological niche

Conservation

- Build DNA reference banks (vouchers)
- Detect illegal traffic of species
- Detect invasive species
- Detect indicator species for bio-assessment
Unesco Man and Biosphere program
Biosphere Reserve zonations

**BIOSPHERE RESERVE ZONATION**
- Core area
- Buffer zone
- Transition area
- Human settlements
- Research station
- Monitoring
- Education/training
- Tourism/recreation

**Biosphere Reserve Zones**
- Core
- Buffer
- Transition
- Local Expert Data
- No Change

**Meise Botanic Garden**
African Biosphere Reserves

79 biosphere reserves in 28 countries (July 2018)

Where have we been active?

- D.R. Congo: Yangambi
- D.R. Congo: Luki
- Cameroon: Dja
- Gabon: Ipessa-Makokou
- Rwanda: Vulcano
- South Africa: Kogleberg
- South Africa: Cape Winelands

(+ World Heritage site Virunga in D.R. Congo)


Meise Botanic Garden
Democratic Republic of Congo

3 biosphere reserves:

- **Yangambi**
  - Declaration Date: 1976
  - Surface Area: 235,000 ha
  - Administrative Division: Province orientale

- **Luki**
  - Declaration Date: 1976
  - Surface Area: 33,000 ha
  - Administrative Division: Province du Bas-Congo

- **Lufira**
  - Declaration Date: 1982
  - Surface Area: 14,700 ha
  - Administrative Division: Province du Katanga.

Meise Botanic Garden
Yangambi the cradle of Central African agronomy, forestry, and botany
Yangambi zonation
Why Yangambi?

History and availability of content

- INERA (Institut National pour l’Etude et la Recherche Agronomique) largest research station

- L’INEAC (Institut National pour l’Etude Agronomique du Congo belge) 1933-1962

- Herbarium with more than 150,000 specimens, representing with its 6,500 species about 65% of the known flora of DR Congo and a xylarium with 1,250 samples.

- Collections, archives, data and publications kept in Belgian institutions

Meise Botanic Garden
Why Yangambi?

Biodiversity rich, well preserved (botany), natural ressources

- Semi-deciduous and riverine periodically flooded habitats
- Estimate 1500 plant species of which 40% are trees
- Home to the flagship tree species *Pericopsis elata*, the source of Afrormosia timber
- Economic activities:
  → agriculture, hunting, fishing, canoe production, and gold extraction. Palm Oil, manioc, coffee, cocoa and bananas are cultivated both for traditional food use and trade
Why Yangambi?

Long term research and monitoring

- Understanding carbon sequestration, plant species feedback on topsoil properties, and biogeochemical processes
- International networks following the carbon sequestration in rainforests
- 25 permanent 1-ha forest plots have been monitored since 2012
- Implementation of Flux towers in the reserve
- Presence of international multidisciplinary research teams
- Proximity of the University of Kisangani
Plant functional traits as indicator of plant responses to climate change

- COBECORE: Congo Basin eco-climatological data recovery and validation
- Stomatal density and specific leaf area as indicator of plant responses to a change climate and CO2 levels
FORETS Project: EC’s 11th European Development Fund (EDF)

5 years project lead by the Center for International Forestry Research (CIFOR) and supported by the European Union:

- Geographical areas: Yangambi and Kisangani
- Ensuring the conservation and sustainable management of the Yangambi Biosphere Reserve (YBR)
- Supporting rural development and sustainable forest management around YBR to the benefit of the surrounding population
- Refurbishing some infrastructure of the University of Kisangani (UNIKIS) and the Institut Facultaire d’Agronomie (IFA)
- Strengthening higher education programs in forestry and agronomy at UNIKIS and IFA
- Supporting research activities and projects with the beneficiary institutions
Understanding Ecosystems: Diatoms

- Water quality assessments
- Anthropogenic impact
- Inventory of diatom indicator taxa
- Surveys on water usages and waste management
- System for indication of water quality in the Biosphere reserves
New taxa from D.R. Congo

- Cavinula lilandae
- Eucinella ebalensis
- Eunotia rudis
- Eunotia fuseyi
- Gomphonema grande
- Eunotia leonardii
- Iconella congolensis
- Iconella ebalensis
- Navicula nielsfogedii

Garden
Trophic Diatom Index

First results

- Isalowe
- Bosambila
- Yangambi
- Makiso
- Kisangani

Meise Botanic Garden
Rehabilitation and restructuring of the *Coffea* reference collection

**INERA Yangambi**

- **Research**
  - effects of global change on phenology, disease resistance, ...

- **Collection management**
  - c. 100 genetic lineages, mainly Robusta (*Coffea canephora*)

- **Production**
  - c. 12 ha

- **Studying gene flow and genetic diversity**
Congo basin integrated monitoring for forest carbon mitigation and biodiversity (COBINFO, 2010-2015)

- Get baseline reference data on carbon balance and biodiversity
- In pristine and intervened dense tropical forests
- Increase the understanding of the relationships
- Apply for forest management
- Halt degradations
Plant.ID – Molecular Identification of Plants

- African Wood species
- Development of molecular identification tools against illegal logging
- Build a DNA reference bank
- Conservation
Ethnomycology

- Link between research, agro-industry and conservations
- Diversity and taxonomy of edible mushrooms
- Cultivation and production of local species for local and global market
- Ecosystem service leading to better conservation
- Revenue generating
- Collaboration with the private sector
- Creation of SMEs

Meise Botanic Garden
International dimension

- Flora of Central Africa and Fungus Flora of Central Africa
- Congo River Basin Partnership
- IUCN Red listing
- Botanic Gardens Conservation International (BGCI)
- Global Biodiversity Information Facility (GBIF)
- Taxonomic reference backbone for Botany
- Life Science Research Infrastructures (LifeWatch, DiSSCo, LTER ...)
- Convention on Biodiversity strategies (CBD)
...

Meise Botanic Garden
### CBD and Unesco MAB strategies

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Action</th>
<th>Outputs</th>
<th>Responsibility*</th>
<th>Time range</th>
<th>Performance indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1. Biosphere Reserves (BRs) recognized as models contributing to the implementation of Sustainable Development Goals (SDGs) and Multilateral Environmental Agreements (MEAs)</td>
<td>A1.1. Promote BRs as sites that actively contribute to achieving the SDGs</td>
<td>BRs have made measurable contributions in support of the achievement of the SDGs that can be replicated and scaled-up</td>
<td>Member States, National Authorities, BRs</td>
<td>2016-2025</td>
<td>Number of BRs with specific initiatives or activities contributing to SDG targets BR concept used in national development agendas</td>
</tr>
<tr>
<td>A1.2. Promote BRs as sites that actively contribute to implementing MEAs, including the Aichi Biodiversity Targets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1.3. Establish alliances at local, regional, international levels for biodiversity conservation and benefits to local people, taking into consideration the rights of indigenous people</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**A1.2. Promote BRs as sites that actively contribute to implementing MEAs, including the Aichi Biodiversity Targets**

- BRs need to be supported in their efforts to contribute to implementing the Aichi Biodiversity Targets.
- BRs should be recognized as models for achieving the Sustainable Development Goals (SDGs).
- Establish alliances at local, regional, and international levels to conserve biodiversity and benefit local people, including the rights of indigenous people.
Rehabilitation of infrastructure

- Rehabilitation of herbarium and forestry building
- Restoration of herbarium collection
- Digitization of collections and data repatriation

Meise Botanic Garden
Capacity building

- Joint programs with local institutions and populations
- Master and PhD programs
- Internships and training programs
- Citizen science
Vision for the future

- Sustain and broaden current research
  - Long time monitoring
  - Importance of complete time series without gaps in time and space

- Novel research orientations and innovation

- Fust expert group?
  - on research orientation and collaboration in African Biosphere Reserves (continent level?)
  - Expert group specifically on Central Africa?

- Belgian and African experts (+ international experts)
Funding sources

- European Commission programs:
  - DEVCO 11th FED (and previous programs)
  - Marie Curie ITN
- Belspo
  - BRAIN, Agora, Network programs
- FWO, VLIR, ARES
- Grants
  - GTI (Global Taxonomy Initiative)
  - FUST (2009)
  - GBIF Biodiversity for Development (BID) program
  - Sud Expert Pantes (French Ministries of Foreign Affairs)
- Foundations: Mellon Foundation, Koning Boudewijn Stichting
- Private sector in the food and drinks sector contributions or sponsoring
Partners Belgium

- RBINS Royal Belgian Institute for Natural Sciences
- RMCA Royal Museum for Central Africa
- ILVO Research Institute for Agriculture, Fisheries and Food
- All Belgian Universities

Partners in D.R. Congo

- INERA Institut National pour l’Etude et la Recherche Agronomique
- CRSN Centre de Recherche en Sciences Naturelles
- ICCN Institut Congolais pour la Conservation de la Nature
- WWF Congo
- ERAIFT Ecole Régionale Postuniversitaire d’Aménagement et de Gestion intégrés des Forêts et Territoires tropicaux
- CIFOR Center for International Forestry Research
- UNIKIS University of Kisangani
- RSD Resources and synergies development
- ....

Meise Botanic Garden