What it takes to build an ecoefficient genebank for the 21st century: experiences and lessons learned

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The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) is part of CGIAR – a global research partnership for a food-secure future.
Overview

• Motivation & goals
• Architects, fundraising & design
• Construction & inauguration
• Virtual tour
• Moving laboratories and collections (ongoing)
• Experiences & lessons learned
• The future
Old building, originally constructed as meat-quality lab, in dire need of renovation
2013 Decision to rebuild

Guiding principles:

• Functional
  • Staff & collection safety
  • Highest quality standards (QMS)
  • Growing importance of digital dimension of PGRFA

• Sustainable
  • Environmentally sound
  • Within budget constraints

• Open & Iconic building
  • Public awareness about PGRFA for food security
  • Contribute to training of next generation of PGR scientists
Functional

• Risks
  • Flooding: 1.5m above soil level
  • Lightening protection
  • Earthquakes: no 2nd floor, easily accessible emergency exits
  • Fire: non-flammable walls, ceilings & floors, sprinklers, emergency exits
  • Physical security: e-cards, video cameras
  • Insects in herbarium: -20C air pulses every few months

• Staff & visitors
  • Health-hazard controls: fume hoods, dust extractors, etc.
  • Interaction among staff: spaces to meet
  • Disability-friendly: ramps, toilets

• ‘Digital genebank’ module
Sustainable

• **Energy**
  - Reduced use of air conditioning by reducing solar radiation
  - Use of natural light
  - Good insulation of cold rooms
  - Solar panels

• **Water**
  - Use of rainwater
  - Surrounding gardens without irrigation

• **Green building certifications**
  - Leadership in Energy and Environmental Design (LEED)
  - Leaving Building Challenge (LBC)
Open & iconic

• Open to the general public
  • Areas for visitors with windows providing views of into laboratories
  • Museographic exhibition about conservation and the importance of PGR
  • Iconic nature: easily recognizable as a symbol for the importance of PGR

• Capacity-building
  • Workshops on genebank-related topics
  • Space for visiting researchers, researchers on sabbaticals, and students
  • Scholarship program for student theses
2014 Private tender: two finalists

*Monastral, Bogotá*

*AEV Arquitectos, Medellín*

Tender conditions: improved functionality, seek LEED and LBC certifications, ready for visitors
Winner: AEV Arquitectos

Parque Explora: science museum in Medellín
Starting in 2015 Fundraising & design

2015
2016
2017 ...
2022

Ongoing fundraising efforts

2015
2016
2017

Initial, optimistic design
Adjustments to fit budget envelop
2015-22 Fundraising

• Challenge: funding for infrastructure (not projects) in Latin America (not Africa)
• Total budget: $17.2M
  • Funders: $6.2M
  • Reserves: $11M
2015-17 Design

Open & iconic

Functional ↔ Sustainable

Technical-design specialists

Preparation for certifications

Genebank

Green-building consultant
Functional requirements

Modular design around workflows: cold/drying/growth rooms, laboratories, offices
Functional requirements

For each of the > 100 rooms:

- Temperature and humidity
- Staff working in the area
- Equipment list
- Differential pressure level
- Sterility level (HEPA filters)
- Fume and laminar-flow hoods
- Furniture needed
- Phones, LAN, WiFi
- List of reagents being used
- Types of waste being produced
Functional requirements

To determine thermal loads:

• Time of each staff working in each room each day of the week
• Power (W) consumed by each equipment
• No. of hours each equipment is used each day of the week
• Frequency with which each door is opened
Functional requirements

Additional private tenders:

- Custom-designed shelving systems
  - Five cold rooms (seeds)
  - Two drying rooms (seeds)
  - Herbarium
  - Three growth rooms (in-vitro)
  - Storage rooms in the basement

- Furniture
  - Laboratories
  - Offices
Sustainability: LEED

- Applying for Building Design and Construction (BD+C v4) certification at US Green Building Council
- Collect points for each of the categories
- Platinum level: 80+ points
LEED categories

Energy
- Use of renewable energy
- LEDs + lightening control system
- Canopy to reduce energy consumption
- Energy-efficient air-conditioning equipment w/o CFC

Water
- 100% of water consumed by the building is from the rainwater collection system (up to 4,200 m³ per year)
- Black and gray waters are treated and filtered on site to create a closed hydrological cycle
- Water efficient toilets, showers, and taps
- No irrigation for surrounding gardens and accession demonstration plots
LEED categories

Materials & resources

• Forest Stewardship Council (FSC) certified wood for canopy
• Paints, adhesives, sealants with lowest levels of volatile organic compounds
• Materials in contact with water without ingredients included in the Red List of building materials (harmful to health)
• More than 90% of waste generated during construction recycled or reused
• Waste storage & separation room

Air quality

• Filtered air-renewal system for closed spaces
• Monitoring and control systems for temperature and CO₂
• No smoking in closed or open spaces
Sustainability: Living Building Challenge

Seven ‘petals’

Place
Restoring a healthy interrelationship with nature.

Water
Creating developments that operate within the water balance of a given place and climate.

Energy
Relying only on current solar income.

Health + Happiness
Creating environments that optimize physical and psychological health and well-being.

Materials
Endorsing products that are safe for all species through time.

Equity
Supporting a just and equitable world.

Beauty
Celebrating design that uplifts the human spirit.
Open & iconic

- Inspired by native forests
- Easily recognizable, like the Svalbard Global Seed Vault
Oct 2018 – Dec 2021 Construction
Construction oversight committee

• Composition
  • Science (2) + Legal (1) + Finance (2) + Operations (1) + Procurement (1) + Fundraising (1) + Regional rep (1) + Secretary (1)

• Role
  • Financial control, legal clearance, coordination of private tenders, construction progress monitoring, technical oversight, coordination with fundraising efforts

• We met approx. 70 meetings during the construction phase
  • Detailed meeting minutes for auditors

• External audit
  • Construction process
  • Detailed plans for moving the collections
July 2021

6,429 m² canopy
7,035 m² construction
Solar farm on campus
Inauguration by Iván Duque, President of Colombia

Attended by Colombian Ministers of Ag and Science, Directors of Agrosavia, ICA and Humboldt Inst., OnCGIAR leadership, Crop Trust Director, Alliance leadership, BMGF, RE and BMZ representatives, ...

15 March 2022
Cristián Samper announcing a $17M donation of the Bezos Earth Fund and Jeff Bezos
A virtual tour

Seed vaults
-20C
5C
5C
dry

Seed labs

Herbarium

Germplasm
health

Visitor circuit
Atrium

Shared area
for staff

In-vitro
Growth
rooms

Seed viability

ICA

Digital
genebank

Meetings
Rooms

DNA lab

Offices

Offices

Offices

Offices

Visitor circuit
Atrium

Shared area
for staff
Seed conservation
- Threshing area
- Seed lab
- 2 drying rooms
- Two -20C rooms
- Two +5C rooms
- Distribution & packaging areas
RFID antennas in corridor

RFID antenna in cold room

RFID antenna in drying room

RFID tags + datamatrix barcode

Portable reader
Other seed areas
• Germination area
• Viability lab
• Herbarium
• ICA offices
• Exit towards greenhouses
In-vitro conservation
• Propagation lab
• Three growth rooms
• Cryo area
• Lab for media preparation
Germplasm health lab
- Central lab
- Areas for viral, fungal, bacterial assays
- Molecular diagnosis area
Digital genebank
- DNA lab
- Open office for students, visiting scientists
- Atrium for events
Moving laboratories & collections

- Germplasm health lab and DNA lab have moved
- Bean & forage collections: Oct 2022
- Cassava collection: Q1, 2023
Experiences & lessons learned: costs

• Genebank was built without a cost overrun
  • Lots of planning and monitoring; exchange rate helped!

• Costs of LEED certification
  • Approx. 10-15% additional material/building costs; should be amortized through approx. 20% reduced electricity & water utility costs
  • 25K for green-building consultants + 5K for certification

• Building features (canopy) that reduce environmental impact may entail higher maintenance costs
  • Par of Bezos funds for upkeep and maintenance

• Future purchases of certain consumables & equipment could be more costly
Experiences & lessons learned: staff time

• Genebank manager + 6 staff contributed to design, construction, and the commissioning of the building; everyone’s working to move labs & collections

• Challenge: competing priorities and emergencies, in addition to running the genebank:
  • Genebank financial (2017) and technical (2019) audits
  • COVID lockdowns (2020) and public unrest and campus closure (2021), requiring emergency responses to save the collections, particularly for cassava
  • Development of a business plan for a Long-term Partnership Agreement for bean & forages with the Crop Trust (2022)
  • Challenges related to the One-CGIAR restructuring process (2021/12)
Experiences & lessons learned: delays

- Delay in fully commissioning the building
  - Approx. 1 year instead of estimated 1-2 months
  - Initial estimates were unrealistic: impossible to get everything working correctly without any adjustments and corrective actions
  - Also: supply chain constraints

- Moving of collections substantially delayed
  - Distribution of accessions suspended for longer than anticipated
  - Space constraints for cassava collection in current building because of extra copy prepared for moving the collection
Experiences & lessons learned: publicity

- Lots of publicity: > 130 outlets
  - Interviews on Colombian radio and YouTube talk shows
  - Popular TV documentary
- Need to manage expectations
- 4-5-fold increase in visitors: outreach and science-education plan
The future

Conserve & distribute germplasm collections and host safety duplicates of other collections

Innovate to improve conservation methods and to enrich collections with actionable information to facilitate their use

Engage the public to raise societal awareness about the vital role of crop diversity, participate in the ongoing policy dialogue, and contribute to training the next generation of PGR scientists
Thank you!

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