Adapting to Climate Change: The Role of Genetic Diversity and its Conservation

Bangladeshi villagers flee their homes with possessions in hand on September 22, 2014. Source: Allison Joyce/Getty Images

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Origins of cacao diversity

- Genetic differentiation and geographical distribution of a number of other clusters seem to have been significantly affected by processes of human management.
- Criollos historically grown in Mesoamerica: central Mexico, Guatemala, Belize, Honduras, El Salvador and the Caribbean.
The Cocoa Route – how it moved around the world

- 1660-1670 - Mexico to the Philippines
- 1664 - Amazon to Martinique
- Philippines to Indonesian Archipelago
- 1757 - Amazon to Trinidad
- Early 19th century - Indonesian Archipelago to Ceylon
- 18th & 19th centuries - Amazon to Southeastern Brazil
- 1822 - Brazil to Principe
- 1840s - Dublin to Sierra Leone
- 1861 - Ecuador to Guatemala
- 1880-1881 - Trinidad (via England) to Sri Lanka
- 1883 - Trinidad (via England) to Fiji
- 1892-1893 - Trinidad to Nicaragua. Nicaragua to Trinidad.
- 1898 - Trinidad to Costa Rica and Colombia
- 1890 - Venezuela to Ecuador
- 1930s - Ecuador to Costa Rica and Panama
- 1880s - Trinidad, Venezuela and Ecuador to Sao Tome
- 1899 - Trinidad, Venezuela, Ecuador and Central America to Cameroon
- End of 19th century - Indonesian Archipelago to Samoa
Threatened cacao genetic diversity

Factors contributing to declining genetic diversity:

- Habitat loss due to natural disasters and extreme weather
- Destruction of the Amazon rainforests - centre of diversity and home of cacao
- Loss of traditional varieties grown
- Spread of pests and diseases
- Changing patterns of land use
- Climate changes causing shifts in production (areas and crops)
- Natural disasters and extreme weather
- Forest fires
- Civil unrest
- Vandalism
Cacao diversity in breeding programmes

- Compared to other crops, limited investment into scientific research towards improving cacao, and only a limited number of breeders.
- Evaluation of collections and farmers’ selections has shown that wide variation for disease resistance and quality exist:
  - Still, most of planting material provided to farmers remains susceptible to prevailing pests and diseases.
  - Only few varieties are selected for sensory quality for the specialty cocoa market.
- This underscores the importance of increasing the use of the diversity in the cacao collections in breeding programmes for all needs in the industry.
Actions needed?

Collecting, securing and improving access.

Provide scientists with greater opportunity to:

- access materials to produce more disease- and pest-resistant varieties, better adapted to climate change and quality requirements
- make these improved varieties available to millions of small-scale farmers.

Global Programme on Germplasm Evaluation and Conservation

Wild cocoa collected in Peru between 2008 and 2012, held in the ICT collection (E. Arevalo)
Increasing access starts with

- Safeguarding and protecting the diversity
- Documenting and sharing information
- Making it available through safe-movement such as through international and regional quarantine centers.
- Developing fair and equitable benefit sharing agreements
Sharing Genetic Resources

Access progressively more restrictive:
- Unclear who owns cacao diversity
- Countries have restrictive or unclear ABS rules
- Politics – north/south, competitiveness, national interest

Clear benefits from collaboration on cacao germplasm exchange

Global approach to unlock genetic diversity:
- Benefits for the country of origin and national programmes
- Global pests and disease risk assessment
- Cooperation agreements with countries such as Brazil, Colombia, Ecuador, Peru
- Screening methods for global threats e.g.. CSSV, FPR

www.cacaonet.org
Global Programme on Evaluation

- **2004-2010** - CFC/ICCO/Bioversity project on “Cocoa Productivity and quality improvement: a Participatory Approach”
  - Selected around 110 accessions of genetic diversity of key traits for introduction into national collections, virus-indexed at ICQC,R 2005-2010 and 2010 for distribution to countries.
- **2009** - following same procedure, USAID/USDA/Mars project introduced specific groups of clones into countries in West Africa
- **INGENIC-West African Cocoa Breeders Group** introduced from ICQC,R. clones with resistance to witches’ broom and frosty pod rot
- **INGENIC Asia-Pacific Cocoa Breeders Group** undertook breeding activities through exchange of selected hybrids and clones on high yield and tolerance to cocoa pod borer and vascular-streak dieback.
- **LAC Cacao Breeders Group** now convened for an agreed workplan
Quality and flavour traits MUST be included in breeding programmes
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Cacao can be this
But it is mainly this

Cocoa farmer in Venezuela (A. Eskes).

Cocoa farmer in Côte d'Ivoire (D. Pokou.)
Key questions may be

- Where do we want to be in 10-20 years time?
- What are the main gaps and constraints in the breeding of cacao today?
- What are proposed solutions?
- What can this group directly do about it?
THANK YOU