Securing Our Future: Why Cocoa Diversity Matters

Brigitte Laliberté
CacaoNet & Bioversity International

World Cocoa Conference, 19th – 23rd November 2012
Abidjan, Côte d’Ivoire
Cacao diversity in CATIE, Costa Rica. Credit: A. Mata/ W. Phillips
Cocoa diversity is necessary

- We cannot grow the same varieties everywhere
- There are different
  - Pest and disease pressures
  - Environmental conditions
  - Cultivation practices: organic, shade, inputs, etc.
  - Markets: quality bulk, fine flavour, single origin, etc.
  - Flavours
  - Farmer preferences
- There isn’t a perfect cocoa plant for everybody!
Why diversity matters?

• Demand is increasing rapidly with emerging countries consumption
• We need to increase production in an environmentally sustainable way (reduced inputs).
• New and improved planting material is an important part of the solution, optimized by good agricultural practices.
• Good quality, locally adapted planting material are continuously required, whatever country, region or farming system.
So…

- Access to a wide range of genetic diversity is critical to the success of breeding programs.
- It provides the variability needed to find solutions for:
  - Pests and diseases
  - Changing markets requirements
  - Adaptation to climate change
  - Need for environmental responsibilities
- The “Green Revolution” demonstrated the tremendous impact that genetic resources can have on increasing crop production.
- Breeding accounted for 50% of yield gain in the world’s major crops since the 1930’s (OTA 1987)
We don’t know the future

- What will be the characteristics required for the next generations of planting material?
- What will be the future concerns of the demand?
We don’t know the future

- What will be the characteristics required for the next generations of planting material?
- What will be the future concerns of the demand?
We don’t know the future

• What will be the characteristics required for the next generations of planting material?
• What will be the future concerns of the demand?

Yield
Quality
The future…

Pests and diseases will continue to evolve and spread…

- Affecting new cocoa growing areas
- With more aggressive strains
- New species will appear

Health safety will continue to put pressure…

- Residue levels
- Heavy metal uptake
Climate change
• Climate change
  – Current growing areas are already experiencing:
    • Droughts
    • Flooding
    • Higher temperatures
    • Higher CO₂ levels
  – Growing regions will vary

• Agricultural practices will change, such as uptake of modern / mechanized methods

• Cocoa diversity is crucial for developing the future varieties needed for all and different cocoa production systems
Where is the diversity?

In the wild - *the Amazon basin is the centre of diversity*

C. Lanaud, Ecuador
Where is this diversity?

In farmers’ fields - landraces and populations selected by farmers over generations for specific properties

K. Maharaj, Trinidad
Where is this diversity?

In the many genebanks around the world:

- Seeds of cacao cannot be dried and frozen like most other crops.
- Individual trees need to be maintained as living collections.
Cocoa diversity is threatened

• Destruction of the Amazonian rainforests - the centre of unique diversity
• 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
Urgency

- Every year we lose materials
- Collections in developing countries are at risk
- Lack of funding for adequate management standards
- Long-term funding basis for the management of the international collections is not secured, including the safe movement of germplasm, evaluation and use in breeding.
- Local varieties replacement is happening at a fast pace, in Ecuador, Peru for example.
- Little investment in research to improve cocoa compared to many crops.
- What if the well-known disease resistant clones (e.g. SCA 6) had been lost?
- Where will the next SCA 6 come from?
Where are we today?

• Over 35 collections maintain more than 24,000 samples of cacao diversity
• Wide variation for disease resistance and quality exists in *ex situ* collections and in farmers’ fields
Cocoa Research Centre of the University of the West Indies (CRC/UWI), Trinidad and Tobago (M. Gilmour)

Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Costa Rica (W. Philipps)

International Cocoa Quarantine Centre (ICQC), UK (A. Daymond)
But...

- Conservation is not secured
- Few collections have safety duplication of unique materials
- Use is not always optimized
- Access is often restricted by lack of legal & policy framework
- Most collections have duplications internally and with other collections
- Misidentification of trees within collections can be as high as 30%
- No targeted *in situ* and on farm conservation plans
Securing diversity for all, forever

All countries involved in the improvement and production of cocoa are highly dependent on genes and varieties conserved and evaluated in other countries and regions.

The efforts necessary to ensure the:

– effective conservation of the entire range of cacao diversity in situ and ex situ for the long term
– global system for the safe exchange of germplasm
– optimised use of diversity in improvement programmes

... can only be achieved and carried out:

– through international (inter-regional) collaboration
– by bringing together players in public and private sectors
A Global Strategy

• Developed by CacaoNet (Global Network for Cacao Genetic Resources)

• Result of a consultation process, drawing upon the global cocoa community’s expertise in all aspects of cacao genetic resources (over 75 individuals from 26 institutes contributed)

• Provides a clear framework to secure funding for the most urgent needs to ensure that cacao diversity is conserved, used and provides direct benefits to the millions of small-scale farmers around the world
Contributors

Y. Adu-Ampomah (Cocobod)
P. Aikpokpodion (CRIN)
A. Alias (MCB)
F. Aranzazu (FEDECACAO)
E. Arevalo (ICT)
E. Arnaud (Bioversity)
F. Amoah (CRIG)
F. Amore (INIAP)
I. Azhar (MCB)
V.C. Baligar (USDA)
F. Bekele (CRU/UWI)
D.M. Botello (FEDECACAO)
N.G.R. Braz (UESC)
P. Bretting (USDA)
D. Butler (consultant, formerly of CRU/UWI)
C. Campbell (consultant to ICQC)
M. Canto-Saenz (UNA la Molina)
J. Cascardo (UESC)
N. Coulibaly (COPAL)
N. Cryer (UoR)
A. Daymond (UoR)
AA de Paiva Custódio (UFLA)
M. Ducamp (CIRAD)
H. Dzahini-Obiaye (CRIG)
A. Ebert (AVRDC, formerly of CATIE)
M. End (CRA Ltd.)
J. Engels (Bioversity)
A. Eskes (Bioversity)
J. Flood (CABI)
M. Gilmour (Mars Inc.)
K. Gramacho (CEPLAC/CEPEC)
B. Guyton (WCF)
P. Hadley (UoR)
B. Irish (USDA)
M. Kolesnikova-Allen (formerly of IITA)
P. Lachenaud (CIRAD)
B. Laliberté (Bioversity)
K. Lamin (MCB)
S. Lambert (Mars Inc.)
C. Lanaud (CIRAD)
T. Lass (CRA Ltd.)
R. Lockwood (consultant)
R. Lumsden (consultant to WCF)
E. Luz (CEPEC/CEPLAC)
U. Lopes (CEPEC/CEPLAC)
R. Markham (ACIAR, formerly of Bioversity)
J.C. Motamayor (Mars Inc.)
C. Nicklin (CCD)
S. Nyassé (IRAD)
D. Pokou (CNRA)
W. Phillips (CATIE)
M. Resende (UFLA)
E. Rosenquist (consultant to WCF, formerly USDA)
M. Ruas (Bioversity)
B.B. Saripah (MCB)
Ray Schnell (Mars Inc. formerly USDA)
S DVM Silva (CEPEC/CEPLAC)
C. Suarez (INIAP)
S. Surujdeo-Maharaj (CRU/UWI)
M. ten Hoopen (CIRAD)
J-M Thévenin (CIRAD)
M. Thresh (consultant to ICQC)
B.L. Ttacca (ICT)
C. Turnbull (UoR)
P. Umaharan (CRU/UWI)
J. Wallace (CEPEC/CEPLAC)
S. Weise (Bioversity)
A. Wetten (UoR)
D. Zhang (USDA)
Securing existing *ex situ* cacao genetic resources, particularly those held in the public domain, and their distribution.
Developing a *Global Strategic Cacao Collection*

1. International & national genebanks
2. GSCC
3. Collecting expeditions
4. *In situ* & on-farm conservation
5. Safe movement
6. Germplasm identification, enhancement & breeding
7. Information Management
8. Networking & partnerships for global collaboration

**Wild & on-farm genetic diversity**

**Sustainable cocoa production**

**Improved varieties in farmers' fields**
Genetic diversity gap filling in *ex situ* collections and collecting

Wild & on-farm genetic diversity

1. International & national genebanks
2. GSCC
3. Collecting expeditions
4. *In situ* & on-farm conservation

Safe movement

5. Germplasm identification, enhancement & breeding
6. Improved varieties in farmers’ fields

Sustainable cocoa production

7. Networking & partnerships for global collaboration
Ensuring the *in situ* and on-farm conservation of important genetic diversity

1. International
2. & national genebanks
3. Collecting expeditions
4. In situ & on-farm conservation

Management

Wild & on-farm genetic diversity

Safe movement

6. Germplasm identification, enhancement & breeding

Sustainable cocoa production

7. Improved varieties in farmers’ fields

Networking & partnerships for global collaboration
Strengthening the distribution mechanism and safe movement of germplasm

Wild & on-farm genetic diversity

1. International
2. & national genebanks
3. Collecting expeditions
4. In situ & on-farm conservation

Information Management

GSCC

Safe movement

6. Gerplasm identification, enhancement & breeding

Sustainable cocoa production

7. Improved varieties in farmers’ fields

Networking & partnerships for global collaboration
Strengthening the use of the cacao genetic resources by providing support to breeders and key users through improved characterization, evaluation within collections and supporting population enhancement programmes
Improving the documentation and sharing of information on germplasm
Strengthening the networking and partnerships for global collaboration
We are not starting from scratch

Many components are present:

• 2 international collections part of the multilateral system of exchange (International Treaty):
  – More than 3,500 accessions freely available for use in research, breeding and training
  – Long-term commitment to conservation and use
  – Benefits arising from their use shared in a fair and equitable way

But… not complete, securely funded or linked to all the other key collections around the world.
Success stories

• In 2008, a storm damaged an important part of the international collection maintained by CRC/UWI
• Although some material was lost, the majority was safely duplicated (locally or internationally) and most of the varieties were recovered

D. Sukha, Trinidad
Success stories

- Genetic resources used for variety releases
  - CATIE
  - CRC/UWI
  - Cote d’Ivoire
  - Nigeria
  - Brazil
  - Peru
  - Ecuador
  - India
  - Indonesia
Success stories

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

<table>
<thead>
<tr>
<th>Nº</th>
<th>River</th>
<th>Nº wild cacao collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aypena</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>Marañon - Charupa</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>Ungurahui</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>Pastaza</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>Ungumayo</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>Nucuray</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>Urituyacu</td>
<td>33</td>
</tr>
<tr>
<td>8</td>
<td>Santiago</td>
<td>38</td>
</tr>
<tr>
<td>9</td>
<td>Morona</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>Chambira</td>
<td>20</td>
</tr>
<tr>
<td>11</td>
<td>Tigre</td>
<td>22</td>
</tr>
<tr>
<td>12</td>
<td>Napo</td>
<td>22</td>
</tr>
<tr>
<td>13</td>
<td>Urubamba</td>
<td>22</td>
</tr>
<tr>
<td>14</td>
<td>Ucayali</td>
<td>55</td>
</tr>
<tr>
<td>15</td>
<td>Madre de Dios</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>453</strong></td>
</tr>
</tbody>
</table>
What next?

- The diversity in the collections is critical to the world’s cocoa production.
- Conservation serves no purpose if the material is not accessible, or its potential evaluated and documented for use.
- Ownership must be resolved to ensure global access to these critical resources.
- The global effort to assemble, document and use this diversity is essential.
We have come a long way!

- We have collections, services and research

We still have some way to go but we cannot afford to wait and must move quickly and effectively
Global Network for Cacao Genetic Resources

• **Aims to optimize** the conservation and use of cacao genetic resources as the foundation of a sustainable cocoa economy,
• **by coordinating** and strengthening the research efforts of a worldwide network of public and private sector stakeholders,
• with member representatives from cocoa research institutes and organizations that support cocoa research.

[www.cacaonet.org](http://www.cacaonet.org)
MERCI
GRACIAS
THANK YOU!