MasAgro Biodiversidad:
A learning model towards effective and equitable use of genetic resources

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“In the next 50 years we will need to produce as much food as has been consumed over our entire human history.”  Megan Clark, CSIRO CEO
Population & demand are growing: we are **not** on-track for food security

It’s not only about food security: Increased productivity conserves land for other uses, e.g. biodiversity reserves

(Byerlee et al., Global Food Sec., 2014)
MasAgro Biodiversidad: the wealth contained in the world’s genetic resources is ‘unlocked’ for breeders globally to make new varieties.

- 28,000 maize
- 140,000 wheat

1. Identify useful genetic variation
2. Make crosses: add new to current best
3. Evaluate and select something better
4. Finalize and release a new variety

Genetic resources
Genetic resources have demonstrated their value for agriculture!

Use of crop wild relatives in the past 20 years in released cultivars of 13 crops of international importance

(Euphytica 2007, 156:1-13)
MasAgro Biodiversidad

Vision: Efficient and Equitable Use of Genetic Diversity
High-density genetic profiles

- 28,000 Maize
- 100,000 Wheat
Tar Spot Disease of Maize in Mexico

- Affects >800,000 ha in 11 States... spreading.
- Causes up to 100% yield loss
- If we assume 20% yield loss on 800,000 ha
  - US$62M lost
Impact of Heat on Wheat

- ~10% yield loss per 1°C increase in temperature
- If 10% of Mexico’s 615,000 ha affected…
  - US$57M lost

~70,000 wheat gene bank lines screened under heat stress (2011-2013)
Products of MasAgro Biodiversidad

- **Data**: genotypic and phenotypic
- **Software tools** (E)
- **Germplasm** = genetic diversity
  - Sources of resistance or added value (E)
- **Services** (E)
  - Genotyping (GbS)
  - Capacity development; workshops; visiting scientists, thesis projects
- **Knowledge** (E)
  - Publications, methodologies
Who are the principal users of MasAgro Biodiversidad’s products?

• **Breeders**: new diversity for improved varieties
  – Benefit farming communities, national production, world food prices
• **Researchers**: stimulate scientific discoveries
• **Students**: a new generation of agricultural scientists
• **Professors**: curricula to train the next generation of scientists
• **Genebanks**: optimize conservation of genetic resources
• **Policy Makers**: inform models for equitable use and benefit sharing
Capacity Development

• >290 researchers, professors, and graduate students in courses and workshops 2012-2015.

• Scientists are conducting research projects to apply MasAgro Biodiversidad’s products in their own programs.
More effective & equitable use of genetic diversity

<table>
<thead>
<tr>
<th>Maize &amp; Wheat Distribution From Mexico (2015)</th>
<th>To Developed Countries</th>
<th>To Developing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Packets</td>
<td>25,000</td>
<td>295,080</td>
</tr>
<tr>
<td>Percentage Packets</td>
<td>5%</td>
<td>63%</td>
</tr>
<tr>
<td>Total Shipments</td>
<td>181</td>
<td>485</td>
</tr>
<tr>
<td>Percentage Shipments</td>
<td>25%</td>
<td>66%</td>
</tr>
</tbody>
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Seed shipments from CIMMYT’s germplasm bank

Vision: The molecular atlas can assist them to make better use of the genetic diversity
Vision: Efficient and Equitable Use of Genetic Diversity

Before MasAgro Biodiversidad

With MasAgro Biodiversidad

Maize Molecular Atlas
Thank you for your interest!