The use of agro-biodiversity for sustainable economic development

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Since we started ...

• Agro-biodiversity at the center of human development and economic prosperity
  – Domestication / culture
  – Columbian Exchange
  – European food and environmental crisis
Since we started ...

• Agro-biodiversity at the center of human development and economic prosperity
  – Domestication / culture
  – Colombian Exchange
  – European food and environmental crisis
  – Great Famine in Ireland
Phytophthora infestans - Late blight
Pushing the barrow ...

• Agro-biodiversity as the base for “cheap” food for “workers” during the industrialization

• Today provision of food/nutrition at accessible prices to a growing urban population
  – Bread baskets
  – Subsistence farming

• But with growing environmental degradation and loss of biodiversity
What is Agro-Biodiversity ...?

• The Convention on Biological Diversity (CBD 2001) observes that “Agrobiodiversity is the outcome of the interactions among genetic resources, the environment and farmers’ management systems and practices”.

• Components of biodiversity that support the agricultural systems include a wide range of organisms that contribute to water and nutrient cycling, pest and disease regulation, pollination, climate regulation, carbon sequestration and other processes.

• This interaction is inclusive of the multi-functional and multi-sectoral nature of agriculture.
Agro-biodiversity ... more than just crops

• Genetic resource elements in agriculture:
  – Plants (crops, vegetables, spices, medicinal)
  – Trees (timber, fruits)
  – Livestock and forages
  – Fish
  – CWR
  – Micro-organisms (e.g. soil biota)
  – Insects (pollinators, natural enemies)
Genetic diversity and sustainability

• the deployment of different crops and varieties, and the use of genetically heterogeneous varieties and populations, can be adopted as a mechanism to reduce risk and increase overall production stability

• genetic diversity is the basis for breeding new crop varieties to meet a variety of challenges (source of traits and improvements) for food security.
# Economic valuation of CWR

<table>
<thead>
<tr>
<th>Study</th>
<th>Parameters</th>
<th>Figure (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Witt 1985</td>
<td>Annual benefits from disease resistance introgressed from wild wheat species</td>
<td>$50 million</td>
</tr>
<tr>
<td>Prescott-Allen and Prescott-Allen 1986</td>
<td>Annual contributions of CWR to US economy from domestic and imported sources</td>
<td>$340 million</td>
</tr>
<tr>
<td>Iltis 1988</td>
<td>Annual contribution of genes from <em>Lycopersicon chmielewskii</em></td>
<td>$8 million</td>
</tr>
<tr>
<td>Pimentel 1997</td>
<td>Annual contributions of CWR to US economy</td>
<td>$20 billion</td>
</tr>
<tr>
<td></td>
<td>Annual contributions of CWR to world economy</td>
<td>$115 billion</td>
</tr>
<tr>
<td>Hein and Gatzweiler 2006</td>
<td>Net present value of wild coffee genetic resources</td>
<td>$1.458 billion</td>
</tr>
</tbody>
</table>

Numbers will likely increase with time, as value of crops increases and technological advances allow us to use CWRs more effectively.

Source: Hannes Dempewolf
Ecosystem services categories

**PROVISIONING SERVICES**
- Products obtained from ecosystems
  - Food
  - Freshwater
  - Fuelwood
  - Fibre
  - Biochemicals
  - Genetic resources
  - ...

**REGULATING SERVICES**
- Benefits obtained from regulation of ecosystem processes
  - Climate regulation
  - Disease regulation
  - Water regulation
  - Water purification
  - Pollination
  - ...

**CULTURAL SERVICES**
- Non-material benefits obtained from ecosystems
  - Spiritual and religious
  - Recreation and ecotourism
  - Aesthetic
  - Inspirational
  - Educational
  - Sense of place
  - Cultural heritage
  - ...

**SUPPORTING SERVICES**
- Services necessary for the production of all other ecosystem services
  - Soil formation
  - Nutrient cycling
  - Primary production

**LIFE ON EARTH – BIODIVERSITY**

Source: Adapted from Ecosystem and human well-being: a framework for assessment by the Millennium Ecosystem Assessment. Copyright © 2003 World Resources Institute. Reproduced by permission of Island Press, Washington, DC.
Multipurpose legumes ...

• Hugh genetic diversity
  – Morphology
  – Adaptation

• Multiple uses
  – Human nutrition
  – Animal nutrition
  – Industrial uses
  – Soil conservation and enhancement
Multipurpose legumes and GCC...

• As forage:
  – reduce methane emissions

• As cover:
  – carbon sequestration / mitigation
  – N-fix – less fertilizer, less energy, less nitrous oxide
  – rehabilitation of degraded areas
  – Water use efficiency

• As element for integrated complex systems (time, space)

• Require management skills!
DSSAT maize yields (well managed soils – 2020s)

Source: Tortillas on the Roaster, 2012
DSSAT maize yields (poorly managed soils – 2020s)

Source: Tortillas on the Roaster, 2012
“Multi” - Challenges for the Caribbean

- Caribbean economies depend on geographically-constrained resources that are climate sensitive:
  - Agriculture
  - Forestry
  - Fisheries
  - Viable water supply
  - Tourism based on sharing natural resources & culture
Key messages ...

• Agrobiodiversity has been and is pushing to a great extent the economic health and prosperity during the development of countries

• Agrobiodiversity is inclusive of the multi-functional and multi-sectorial nature of agriculture and at the heart of sustainable development of agriculture

• Linkages to markets are essential for value generation

• Importance of CWR

• Think in systems and non-food benefits and plant-animal interactions
Key messages ...

- Need for better indicators/measurements to really assess the full value of PGRFA and agro-biodiversity
- Need for capacity building/human resources
  - for crop management / agronomy
  - For decentralized plant breeding approaches to provide varieties better adapted for specific production environments and socio-economic situation
Policy recommendations ...

- Invest in human capacity building
  - Education, universities, training, information exchange, extension services
- Invest in research
- Invest in integration and South-South cooperation
- Think beyond food production
  - Distinct development path?
  - Agriculture – environment
  - Food production - livelihoods