Agrobiodiversity and Resilience

Conserving **plant** and **animal genetic resources** as a key component of sustainable agriculture
Objectives

1. To identify biodiversity and agriculture biodiversity (ABD).
2. To assess the resilience of agrobiodiversity
Agricultural Biodiversity (ABD)
Rainforest

What is biodiversity / biological diversity?

Biological diversity – or biodiversity – is the term given to the variety of life on Earth. It is the variety within and between all living organisms and the ecosystems within which they live and interact.
Why is biodiversity important?

• **Ecosystem services, such as**
  • Protection of water resources
  • Soils formation and protection
  • Nutrient storage and recycling
  • Pollution breakdown and absorption
  • Contribution to climate stability
  • Maintenance of ecosystems
  • Recovery from unpredictable events

• **Biological resources, such as**
  • Food
  • Medicinal resources and pharmaceutical drugs
  • Wood products
  • Ornamental plants
  • Breeding stocks, population reservoirs
  • Future resources
  • Diversity in genes, species and ecosystems

• **Social benefits, such as**
  • Research, education and monitoring
  • Recreation and tourism
  • Cultural values
Why is biodiversity important?

Example of erosion prevention by stabilization of soils

Roots preventing erosion from happening

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Diversity fosters resilience; more diversity leads to more resilience
Biodiversity and agricultural biodiversity

Biodiversity

Variability among *all* living organisms and their ecosystems.

Agrobiodiversity

Variability among and within species (and ecosystems they are part of) *that are used directly or indirectly* for food and agriculture.

ABD is a *vital subset* of the global biodiversity!

Sources: UN (1992); FAO (2004)
Agrobiodiversity Loss
Main drivers for ABD loss:

- Farm
  - Variety replacement
  - Agricultural intensification

- Region
  - Land use changes
  - Environmental degradation

- Country/Global
  - Inconsistent policies
  - Economic pressure
  - Civil strife

Source: FAO (1998; 2010)
Crop species concentration
ABD is underutilized…

Only 4 species account for 60% of energy in human diets

~103 species account for 90% of energy in human diets

~150 species are commercially grown

~7000 edible plant species were used in history

Source: Padulosi et al. (2013)
The use of local varieties

Advantages

...are adapted to agro-ecological and production conditions such as:

- Hot/cold climate (e.g. heat tolerance of seedlings)
- Low soil fertility (e.g. low P)
- Variable rainfall conditions (e.g. drought, temporary flooding)
- Pest/disease pressure

Disadvantages

- Lower yields and slow growth
- Little selection and breeding
- Little knowledge and research

Source: Haussmann et al., 2013
Livestock genetic concentration

Domestication began over 12,000 years ago -> livestock diversity results from human intervention.

Only about 40 of the 50,000 known mammalian and avian species were selected as useful by different human cultures and domesticated.

14 species account for most of global livestock production, the so-called ‘big five’ show particularly large numbers.

In contrast to plant genetic resources for food and agriculture, animal genetic resources for food and agriculture comprise less species, have lower reproduction rates, and longer generation intervals.

Changes in livestock diversity
The use of local breeds

**Strengths in**
- Familiar with local conditions (feed, climate, high elevations..)
- High resistance and tolerance to specific diseases
- High tolerance of climatic extremes (heat, cold)
- Less fertility problems and longer life expectancy
- Multi purpose animals
- Cheap local breedings animals

**Deficiencies in**
- Lower yields and slow growth
- Low final size
- Little selection and breeding
- Almost no records
- Little knowledge and research
Changes in livestock production systems

**Low input – low output farming**
- Remote areas
- Less fertil environment
- Small to medium farms
- Local and crossbreeds
- Lower feed demand
- Robust animals
- Niche production
- Missing breeding strategies

**High input - high output farming**
- Close to urban areas
- High quality products
- Medium to large scale farms
- High yielding exotic breeds
- High feed demand
- Fragile animals
- Modern reproduction techniques
- Singular breeding criteria
Changes in livestock production systems

Local Breed: Kedah Kelantan

Imported high yield breed

Source: Department of Veterinary Services Malaysia
Land use changes

1. Cleared land or pasture
2. Commercial monocrop
3. 2-3 species cultivated (sparse trees)
4. 4-10 species cultivated (some trees)
5. Crop presence with multi-strata forest
6. Fully functional natural forest

Source: Perfecto et al 2009
Land use changes

Source: www.mongabay.com

Source: agronigeria.com.ng
Environmental Degradation

- Fragmentation -> Disruption of Metapopulations

Food, Water

Water, breeding sites

Food, breeding sites
Thank you!

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Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
Sustainable Agriculture Project
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany

Contact
E: naren@giz.de
I: www.giz.de/sustainable-agriculture