SCRIPT Agrobiodiversity and ecosystem services main concepts

**SLIDE 1**

I am now going to focus on the main aspects and concepts of Agrobiodiversity.

**SLIDE 2**

Four main parts will be dedicated to this section:

* An introduction about biodiversity
* Overview about agrobiodiversity
* Management of agrobiodiversity
* Holistic concepts of Agrobiodiversity and introduction to assessment methods

**SLIDE 3**

Let’s now start with an overview about biodiversity.

**SLIDE 4**

The 2019 FAO State of the World’s Biodiversity for Food and Agriculture reports that food diversity has been declining worldwide. For example likelihood of a bee, one of world’s

* primary crop pollinators, being found in any given place in Europe and North America
* Although the use of traditional crop varieties persists, of more than 6,000 different plant species cultivated for food, just 9 contribute around 66% of total crop production namely sugarcane, maize, rice, wheat, potatoes, soybeans, oil-palm fruit, sugar beet and cassava). The Food and Agriculture Organization’s (FAO’s) State of the World’s Biodiversity for Food and Agriculture 2019 report represents a major milestone in highlighting agrobiodiversity’s importance and decline, as well as the need for better agrobiodiversity monitoring to make the transition towards more sustainable and resilient food systems.
* Most global analyses of the state of agrobiodiversity to date focus on single components of agrobiodiversity (such as neglected species, crop diversity or fish richness) and do not integrate information on agrobiodiversity across the food system.
* Yet agrobiodiversity exists on our plates, in production systems and in conservation, in each place contributing to different food system sustainability outcomes and influenced by different management actions and policy decisions.

These were the reasons to evaluate an multicriteria and holistic assessment method named as Agrobiodiveristy index.

**SLIDE 5**

The Agrobiodiversity Index (ABDI) is an approach mainly focused on the food systems to collating agrobiodiversity data aimed at enabling policymakers, non-governmental organizations, civil society leaders and businesses to understand relationships between dimensions of agrobiodiversity across the food system, compare agrobiodiversity use and conservation across countries, and identify priority interventions to enhance agrobiodiversity for more sustainable food systems.

The Agrobiodiversity Index is comprised of a simple set of measures to:

* Apply across three interconnected dimensions of diets, production and genetic resources
* Use in different locations by different actors to provide insights into agricultural biodiversity trends
* Provide key data for allocation of financial resources
* Measure progress towards relevant targets in the Sustainable Development Goals and relevant UN Conventions.

The Agrobiodiversity Index is critical for decision-makers to measure and manage actions towards developing sustainable food systems:

• Companies implementing sustainable business practices that increase long-term shareholder value both by reducing risks in the supply chain and enhancing attractiveness to consumers

• Governments pursuing sustainable development by investing in progressive food, agriculture and conservation actions and monitoring country progress towards global goals

• Investors in green bonds contributing capital to sustainable environmental and climate focused development projects

• Farmers, consumer groups and local organizations wanting evidence to inform their decisions about sustainable practices and purchases.

**SLIDE 6**

Applying the ABDI involves selecting the unit and scope of analysis (step 1), identifying appropriate datasets for the 22 indicators (steps 2 and 3), calculating and scaling the sub-indicator scores (steps 4 and 5), and aggregating these scores into composite measures (steps 6–8) to explore the use and conservation of agrobiodiversity across the food system (step 9). The ABDI logo was designed by Biodiversity International.

**SLIDE 7**

ABDI uses 22 indicators designed to measure agrobiodiversity within each pillar of the food system (consumption, production and conservation) across three measurement categories (status, action and commitment).

Each 22 indicators, has one or more associated sub-indicators to assess the status of, and actions or commitments to enhance, agrobiodiversity’s contribution to sustainability outcomes across three pillars of the food system: consumption and markets, contributing to healthy diets (pillar 1); production systems, contributing to agricultural sustainability (pillar 2); and genetic resource conservation, contributing to safeguarding future use options (pillar 3).

Each pillar has specific indicators addressed to the types of diversity promoted within a certain context for example varietal, species, functional or by a certain ecosystem service provided like pollinators or soil biodiversity. Indicators are aggregated to provide composite status, action and commitment scores in consumption, production and conservation.

All scores generated from the ABDI are on a scale of 0 to 100, with 0 representing the lowest (least desirable) and 100 the highest (most desirable) score. High scores can be interpreted as showing where agrobiodiversity status, actions or commitments are high relative to a global threshold, which represents the ideal case for ensuring agrobiodiversity use and conservation to enhance food system sustainability. Conversely, a low score shows where agrobiodiversity is relatively poorly used and conserved, hindering sustainability.

Species diversity use Species diversity Shannon’s diversity index for its definition. Such indicators will be more deeply presented in the next part of the presentation.

Further information on how the datasets were selected, analysed, scaled and aggregated is provided in paper of Sarah K. Jones reported as further reading material where the study for 80 countries is proposed.

**SLIDE 8**

Agrobiodiversity Index calculations for 80 countries reveal a moderate mean agrobiodiversity status score (56.0 out of 100), a moderate mean agrobiodiversity action score (47.8 out of 100) and a low mean agrobiodiversity commitment score (21.4 out of 100), indicating that much stronger commitments and concrete actions are needed to enhance agrobiodiversity across the food system. Mean agrobiodiversity status scores in consumption and conservation are 14–82% higher in developed countries than in developing countries, while scores in production are consistently low across least developed, developing and developed countries. The study of Jones found an absence of globally consistent data for several important components of agrobiodiversity, including varietal, functional and underutilized species diversity.

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Let’s now start the section about using agrobiodiversity to provide multiple services in sustainable farming systems.

**SLIDE 10**

Looking on key aspects about using biodiversity as a driver for sustainable farming some key aspects should be considered:

* Managing farming systems sustainably means that agriculture needs to be about much more than yields of commodity crops in highly simplified and specialized landscapes.
* Agricultural biodiversity provides variety and variability within and among species, fields, farms and landscapes. This diversity helps drive critical ecological processes (e.g. soil structure maintenance) and allows a landscape to provide multiple, simultaneous benefits to people (e.g. nutritious foods, income, natural pest control, pollination, water quality).
* Agricultural biodiversity is used by rural communities worldwide in many time-tested practices that can confer increased resilience to farms, communities and landscapes.
* Using it more effectively and sustainably can help maintain and increase the flow of services and benefits agricultural biodiversity provides to communities.

**SLIDE 11**

Agriculture dominates global land use. Over 38% of the world’s land is used for agriculture, with 11% under arable production; signicantly more land can be converted from native vegetation and brought into production in the forthcoming periods

Before the 1950s, farmers often increased agricultural production by increasing the area they cultivated. The approaches associated with agricultural intensification, such as increased use of inorganic fertilizers and synthetic pesticides, increased mechanization, irrigation and increased use of monocultures, have been very effective in terms of raising gross yields. In the period

from 1961 to 2007 total global agricultural production tripled.

These widely adopted intensification practices have contributed to altering earth system biophysical processes to the extent that today genetic diversity loss (biosphere integrity) is the most surpassed of the nine ‘planetary boundaries’, which should not be transgressed if humanity wishes to remain within a “safe operating space”.

One of the key areas of biodiversity loss is the shrinking diversity of agricultural crops grown and consumed. In this context three crops (rice, wheat and maize) supply more than 50% of the world’s plant derived calories, and only 12 crops and live animal species provide 75% of the world’s food.

For this reason is needed the definitions of common agroecological practices based on agricultural biodiversity.

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These can be defined as

* Agroforestry: A production system in which trees are integrated with crops, thus providing many synergistic relationships, such as shade or nutrients.
* Cover crops: Crops which are sown for agroecological purposes, such as containing soil erosion, controlling pests or enriching the soil with nutrients. Green manure is one specific instance of a cover crop. Nutrient-rich plants (usually legumes) are planted and then ploughed into the earth to improve soil quality.
* Crop rotations: Different crops grown in succession in the same field (e.g. cereal followed by legume), often to reduce risks of pests and diseases or to add nitrogen to the soil.
* Intercropping: A mixture of crop species in the same field at the same time, often with synergistic effects, such as pest suppression.
* Live fences: Fences of herbs, shrubs or trees (e.g. hedgerows), either retained from existing native vegetation or deliberately planted.
* Non-cropped vegetation: This can be fields left fallow or patches of natural vegetation, such as forest patches, which are left on farm.
* Riparian buffers: vegetation planted or retained on river banks to protect river systems from adjacent agriculture.

**SLIDE 13**

Despite the difficulty, scientific evidence and long-term experiments are revealing the complex dynamics of diversified systems and the multiple benefits both from biodiversity to agriculture and from agriculture to biodiversity in terms of contribution to healthy farming landscapes.

Genetic diversity at crop level allows farmers to grow different varieties to suit different environmental conditions (e.g. poor soils) and

resist different weather conditions (e.g. frost, unpredictable rainfall). Planting different varieties of the same crop can decrease pest and

disease damage and facilitate staggered flowering times to attract diverse pollinators.

At farm and field level, selecting different species with different growth forms, leaf size and shape, plant heights, rooting depth and

nutrient uptake strategies, provides farms with more ways to respond to disturbances and shocks. Integrating livestock and crops

reduces the need for synthetic inputs while facilitating more efficient nutrient cycling and availability.

At landscape level, complex landscapes have multiple benefits, e.g. forest remnants can reduce pests borne by the wind, and reduce

soil erosion; patches of non-cropped vegetation also support beneficial plant and insect diversity, like pest enemies and pollinators.

Farmers manage trade-offs among benefits at many scales and across all levels, e.g. more biodiversity can lead to lower greenhouse

gases and better pest control, but may reduce gross yields in the short term.

**SLIDE 14**

In the picture is reported the example of a 6ha organic farm north of Montpellier France. Biodiversity provides many functions on his farm, including

reducing food waste, soil nutrient cycling and fertilization, carbon capture, pollination and pest control. More than 200 families benefit from the farm’s produce and share the risk of crop failure.

The farmer has several functions in mind: to build organic matter to increase nutrient and water-holding capacity (high root biomass), to sequester nitrogen to make it available for the principal cropping season (nitrogen fixation); reduce weed cover and soil erosion (complementary plant heights for total soil cover); and poultry forage (palatability).

The farmer obtains these functions through the careful selection of species with specific and complementary functional traits.