Agricultural biodiversity

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Agricultural biodiversity is a sub-set of general biodiversity. It includes all forms of life directly relevant to agriculture: rare seed varieties and animal breeds (farm biodiversity), but also many other organisms such as soil fauna, weeds, pests, predators, and all of the native plants and animals (wild biodiversity) existing on and flowing through the farm. However, most attention in this field is given to crop varieties and to crop wild relatives. Cultivated varieties can be broadly classified into “modern varieties” and “farmer’s or traditional varieties”. Modern varieties are the outcome of formal breeding and are often characterized as 'high yielding'. For example the short straw wheat and rice varieties of the Green Revolution. In contrast, farmer’s varieties (also known as landraces) are the product of (breeding and) selection carried out by farmers. Together, these varieties represent high levels of genetic diversity and are therefore the focus of most crop genetic resources conservation efforts. Agricultural biodiversity is the basis of our agricultural food chain, developed and safeguarded by farmers, livestock breeders, forest workers, fishermen and indigenous peoples throughout the world. The use of agricultural biodiversity (as opposed to non diverse production methods) can contribute to food security and livelihood security.

Unusual strains of maize are collected to increase the crop diversity when selectively breeding domestic corn.

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Scope

Although the term *agricultural biodiversity* is relatively new - it has come into wide use in recent years as evidenced by bibliographic references - the concept itself is quite old. It is the result of the careful selection and inventive developments of farmers, herders and fishers over millennia. Agricultural biodiversity is a vital sub-set of biodiversity. It is a use of life, i.e. ancillary biotechnologies, by Mankind whose food and livelihood security depend on the sustained management of those diverse biological resources that are important for food and agriculture.[1] As for everything, agricultural biodiversity can be used, not used, misused and even abused. Agricultural biodiversity includes:

- Domesticated crop and 'wild' plants (called: crop wild relatives), including woody perennials (see: forest genetic resources) and aquatic plants (used for food and other natural resources based products), domestic and wild animals (used for food, fibre, milk, hides, furs, power, organic fertilizer), fish and other aquatic animals, within field, forest, rangeland and aquatic ecosystems
- Domesticated livestock species and their wild relatives (http://www.fao.org/dad-is)
- Non-harvested species within production agroecosystems that support food provision, including soil micro-biota, pollinators and so on
- Non-harvested species in the wider environment that support food production agroecosystems (agricultural, pastoral, forest and aquatic ecosystems)

However, agricultural biodiversity, sometimes called Agrobiodiversity, "*encompasses the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agroecosystem, its structure and processes for, and in support of, food production and food security*".[2] It further "*comprises genetic, population, species, community, ecosystem, and landscape components and human interactions with all these.*"[3]

Aquatic diversity is also an important component of agricultural biodiversity. The conservation and sustainable use of local aquatic ecosystems, ponds, rivers, coastal commons by artisanal fisherfolk and smallholder farmers is important to the survival of both humans and the environment. Since aquatic organisms, including fish, provide much of our food supply as well as underpinning the income of coastal peoples, it is critical that fisherfolk and smallholder farmers have genetic reserves and sustainable ecosystems to draw upon as aquaculture and marine fisheries management continue to evolve.

Genetic erosion in Agricultural and livestock biodiversity

Genetic erosion in agricultural and livestock biodiversity is the loss of genetic diversity, including the loss of individual genes, and the loss of particular combinations of genes (or gene complexes) such as those manifested in locally adapted landraces or breeds. The term genetic erosion is sometimes used in a narrow sense, such as for the loss of alleles or genes, as well as more broadly, referring to the loss of varieties or even species. The major driving forces behind genetic erosion in crops are: variety replacement, land clearing, overexploitation of species, population pressure, environmental degradation, overgrazing, policy and changing agricultural systems.[4]

The main factor, however, is the replacement of local varieties by high yielding or exotic varieties or species. A large number of varieties can also often be dramatically reduced when commercial varieties (including GMOs) are introduced into traditional farming systems. Many researchers believe that the main problem related to agro-ecosystem management is the general tendency towards genetic and ecological uniformity imposed by the development of modern agriculture.[5][6] Pressures for that ecological uniformity on farmers and breeders is caused by the food industry demand for more and more raw materials consistency.

Human dependency

Agricultural biodiversity is not only the result of human activity but human life is dependent on it not just for the immediate provision of food and other natural resources based goods, but for the maintenance of areas of land and waters that will sustain production and maintain agroecosystems and the wider biological and environmental services (biosphere).

Agricultural Biodiversity provides:

- Sustainable production of food and other agricultural products emphasising both strengthening sustainability in production systems at all levels of intensity and improving the conservation, sustainable use and enhancement of the diversity of all genetic resources for food and agriculture, especially plant and animal genetic resources, in all types of production systems [7]
- Biological or life support to production emphasising conservation, sustainable use and enhancement of the biological resources that support sustainable production systems, particularly soil biota, pollinators and predators
- Ecological and social services provided by agro-ecosystems such as landscape and wildlife protection, soil protection and health (fertility, structure and function), water cycle and water quality, air quality, CO_2 sequestration, etc.

Research supporting these findings addresses multifunctional agriculture in Europe, home gardens from around the world,[8] smallholder farms in the tropics,[9] among others.

Comparisons of Cropping Systems

The general trend noticed by the analysis of biodiversity present in different cropping systems (e.g., industrial agriculture and organic farming) was that a greater the diversity of crops (temporally and spacially) resulted in a greater overall biodiversity of the agroecosystem, though this is not always the case. A meta-analysis of studies comparing biodiversity noted that, when compared to organic cropping systems, conventional systems had significantly lower species richness and abundance (30% greater richness and 50% greater abundance in organic systems, on average), though 16% of studies did find a greater level of species richness in conventional systems.[10] Another study found that cropping systems that required heavy use of chemical amendments (e.g., the widespread broadcasting of pesticides and glyphosate, a practice ubiquitously found throughout the United States and Canada) had significantly greater levels of pollination deficits, whereas organic fields of the same crop (Canola) witnessed no pollination deficits.[11] Other cropping systems like permaculture have undergone little study to determine relative levels of biodiversity compared to other cropping systems, but because they continue to reinforce the goals of increasing overall crop biodiversity, it can be extrapolated that an even greater level of biodiversity would be observed.

Agroecosystems vs natural ecosystems

Agricultural biodiversity has spatial, temporal and scale dimensions especially at agroecosystem levels. These agroecosystems - ecosystems that are used for agriculture - are determined by three sets of factors: the genetic resources (biodiversity), the physical environment and the human management practices. There are not many ecosystems in the world that are "natural" in the sense of having escaped human influence. Most ecosystems have been to some extent modified or cultivated by human activity for the production of food and income and for livelihood security. However, most agricultural areas can be returned to their natural landscape after subsequent generations.

International negotiations

- Convention on Biological Diversity CBD/COP 10 - Agricultural Biodiversity decision X/34 (http://www.cbd.int/decisions/?m=COP-10)
- Civil Society lobby at CBD/SBSTTA 15 including links to ECOs, the CSO newsletter and CBD meetings. (http://www.ukabc.org/sbstta15.htm)

See also

- Underutilized Crops
- International Centre for Underutilised Crops (ICUC)
- SAVE Foundation (Safeguard for Agricultural Varieties in Europe)
- Functional agrobiodiversity
- Biodiversity
- Natural landscape
- Globally Important Agricultural Heritage Systems (GIAHS)

Notes and references

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Video

- Diverseeds Videos on agricultural biodiversity (http://www.diverseeds.eu/DVD/Film_Clips.html)
- Diverseeds documentary film on the global importance of agricultural biodiversity for food security (http://www.diverseeds.eu/DVD)

External links

- Adapting Agriculture to Climate Change (http://www.cwrdiversity.org/)
- Agricultural Research Service (http://www.ars.usda.gov/Research/Research.htm)
- Commission on Genetic Resources for Food and Agriculture (http://www.fao.org/AG/cgrfa/default.htm)
- LinKS, a FAO project on biodiversity, gender and knowledge (http://www.fao.org/sd/links)
- FAO Corporate Document Repository: What is agrobiodiversity? (http://www.fao.org/docrep/007/y5609e/y5609e00.htm#Contents)
- Facilitating Mechanism for the Implementation of the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA) (http://www.globalplanofaction.org)
- European Cooperative Programme for Crop Genetic Resources Network (http://www.ecpgr.cgiar.org/)
- Bioversity International (http://www.bioversityinternational.org/)
- Crops for the Future (CFF) (http://www.cropsforthefuture.org/)
- International Treaty on Plant Genetic Resources for Food and Agriculture (http://www.planttreaty.org/)
- European Crop Wild Relative Diversity Assessment and Conservation Forum (http://www.pgrforum.org/)
- DIVERSEEDS (http://www.diverseeds.eu) - Networking on conservation and sustainable use of plant genetic resources in Europe and Asia
- Herbicide-resistant plants and agro-biodiversity: Efficient weed control leads to decline in biodiversity (http://www.gmo-safety.eu/archive/324.efficient-weed-leads-decline-biodiversity.html)
- COHAB Initiative: Cooperation on Health and Biodiversity (http://www.cohabnet.org) - Information about health aspects of agricultural biodiversity
- Platform for Agrobiodiversity Research (PAR) (http://www.agrobiodiversityplatform.org/)
- Agricultural Biodiversity weblog (http://agro.biodiver.se/)
- European Learning Network on Functional AgroBiodiversity (http://www.eln-fab.eu/)
- agroBIODIVERSITY, a cross-cutting research network of DIVERSITAS (http://www.agrobiodiversity-diversitas.org)
- The Web Portal for Indian Ocean Agriculture and Biodiversity (http://www.agriculture-biodiversite-oi.org)