Integrating wild and agrobiodiversity conservation

Attwood, S.J., Park, S.E., Marshall, P., Fanshawe, J.H., Gaisberger, H.

This research shows that both wild biodiversity and agrobiodiversity provide multiple ecosystem services that support food production, underpin food security and human wellbeing. We consider that biodiversity conservation efforts in agricultural contexts should better integrate wild and agrobiodiversity approaches.

Overview

Despite many linkages and interdependencies, the conservation of wild biodiversity and agrobiodiversity are largely being pursued separately in terms of research, policy, implementation and incentivised payment schemes (Fig 1). Arguments for wild biodiversity conservation have recently shifted from the primarily intrinsic to a utilitarian rationale based around ecosystem services. Meanwhile, there is a parallel process of conservation of agrobiodiversity, based largely on the many utilitarian values of intra and interspecific crop diversity and crop wild relatives (Fig. 2).

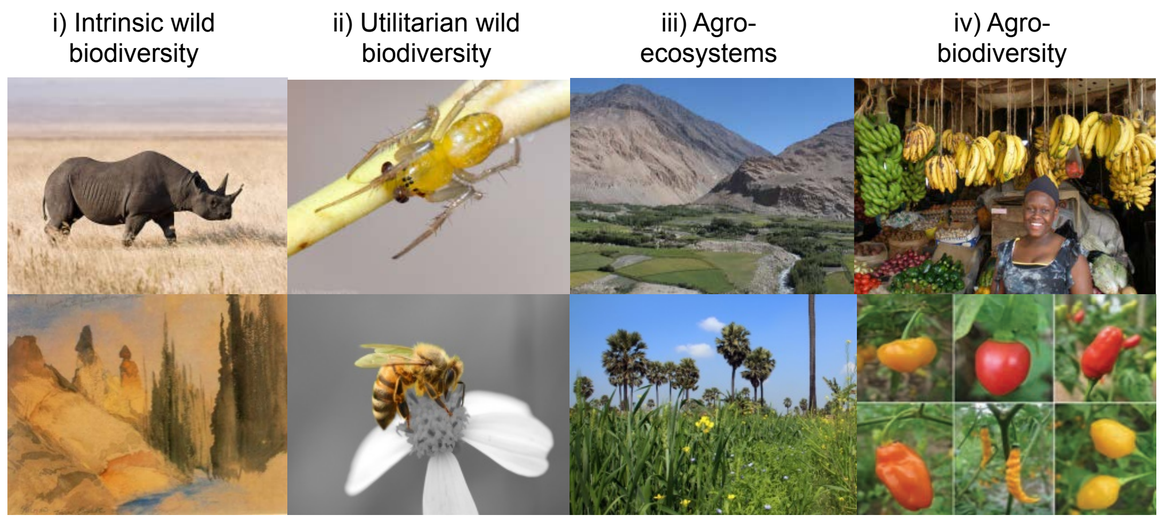

Fig. 1 A gradient of biodiversity reflecting i) intrinsic and ii) utilitarian values of wild biodiversity, iii) agroecosystems in which both wild and agrobiodiversity can proliferate, and iv) *in situ* agrobiodiversity that can underpin food and nutrition security and local livelihoods

Given that globally, 38% of land is now farmed, agricultural land management is increasingly important for wild biodiversity conservation. This needs to be reflected in research, policy, implementation and incentivised payment schemes, such as Payments for Ecosystem Services (PES).

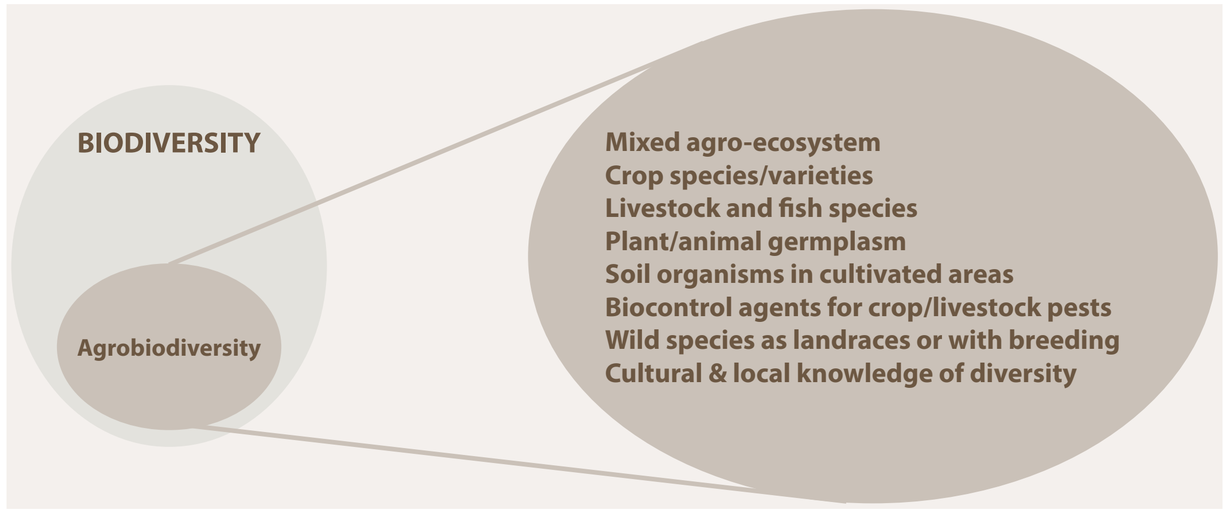

Fig. 2 Agrobiodiversity as a subset of wider biodiversity (from FAO, 2005)

Integrating agrobiodiversity and wild biodiversity conservation can:
a) Provide a more holistic, systems-based approach to biodiversity conservation
b) Determine relationships, capitalise on synergies and mitigate trade-offs among different elements of biodiversity
c) Enable biodiversity to be used more directly and effectively for food security and community well-being

Wild biodiversity and agrobiodiversity linkages:

- Geographical overlap of (wild) Biodiversity Hotspots and areas of high crop diversity (Fig. 3)
- Agricultural systems can support high levels of wild biodiversity
- Wild and agrobiodiversity are both impacted by threats from agricultural intensification
- Both wild and agrobiodiversity generate multiple ecosystem services (Table 1)
- Diverse cropping systems support greater wild biodiversity than simplified, agrobiodiversity-poor cropping systems
- Wild biodiversity provides many ecosystem services to farmers and underpins food security
- Agrobiodiversity use and agroecological management can reduce threats to wild biodiversity in agricultural landscapes
- Conservation of both can be achieved through Payment for Ecosystem Services type approaches

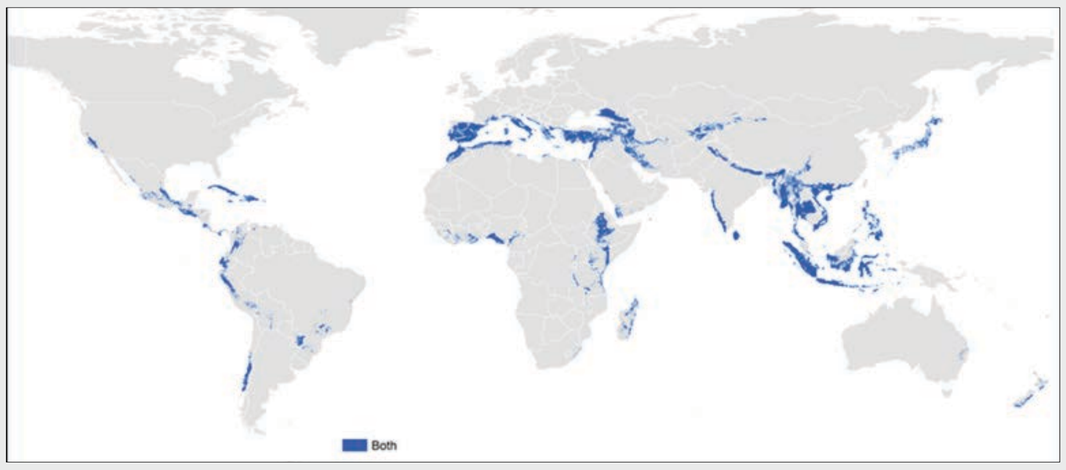

Fig. 3 Spatial overlap of areas of high crop diversity (>15 spp. crop harvested, from Monfreda et al. 2008) and Biodiversity Hotspots (Mittermeier et al. 2011)

TEEB ecosystem service categories:

The Economics of Ecosystems and Biodiversity initiative is focussed on making nature's values visible and mainstreaming these values into multi-level decision-making

TEEB has identified a wide range of ecosystem service types categorised under:

- Provisioning: services that describe the material or energy outputs from ecosystems (e.g. food, raw materials)
- Regulating: services that ecosystems provide by acting as regulators (e.g. quality of air and soil)
- Habitat or Supporting: services related to habitat for species and maintenance of genetic diversity
- Cultural: services that relate to recreation, tourism, artistic inspiration and sense of place

http://www.teebweb.org/resources/ecosystem-services/

Table 1 Examples of how wild biodiversity and agrobiodiversity contribute to selected TEEB ecosystem service categories (Attwood et al. in review)

Ecosystem service (TEEB classification)	How wild biodiversity generates ecosystem services	How agrobiodiversity generates ecosystem services
• Food provisioning	• Wild caught and farmed fish and other aquatic animals • Harvested wild plants • Other wild animals (e.g. mammals, birds, insects)	• Crop provisioning; livestock provisioning • Nutritional and dietary diversity; increased number of functional traits leads to more resistant and resilient crops
• Provisioning: Fresh water	• Native vegetation influencing local to global rainfall patterns; roles in global hydrological cycle; localized water purification	• Reduced need for pesticides due to agrobiodiversity-based pest and disease control; complex vegetation structure as filter of pollutants
• Regulating: Carbon sequestration	• Ecosystems storing and sequestering greenhouse gases. Biodiversity enabling adaptation to climate change	• Increased carbon sequestration through more continuous biomass; increased soil function and carbon sequestration; increased use of legumes reduces need for NPK use
• Regulating: Biological control	• Pests and diseases regulated through predators and parasitoids. Birds, bats, insects and other arthropods, frogs and fungi all act as natural controls	• Intercropping and interspecific crop diversity providing habitat and resources for natural enemies. Intraspecific diversity suppressing pests and diseases
• Cultural: Aesthetic appreciation	• Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of our art, culture and increasingly for science	• Landscapes, such as Globally Important Agricultural Heritage Sites (GIAHS)

Contact:
Simon Attwood: s.attwood@cgiar.org
Sarah Park: spark_devsci@hotmail.com

Photography credits:
Bioversity International Flickr and WorldFish Flickr; https://commons.wikimedia.org/wiki/File:Ngorongoro_Spitzmaulnashorn_edit1.jpg; https://en.wikipedia.org/wiki/Yellowstone_National_Park#/media/File:Thomas_Moran-Tower_Creek,_1871.jpeg

Bioversity International is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

Bioversity Headquarters
Via dei Tre Denari 472/a
00057 Maccarese, (Fiumicino)
Rome, Italy
Tel. (39) 06 61181
Fax. (39) 06 61979661
Email: bioversity@cgiar.org

www.bioversityinternational.org