6

Reconciling Agriculture and Wild Biodiversity Conservation:

Policy and Research Challenges of 'Ecoagriculture'

Conventional wisdom holds that farming is largely incompatible with wildlife conservation. Thus, policies to protect wildlife typically rely on land use segregation, establishing protected areas from which agriculture is officially excluded. Farmers are perceived as problems by those promoting this view of wildlife conservation.

This paper argues, however, that enhancing the contribution of farming systems is an essential part of any biodiversity conservation strategy. And this strategy requires new technical research, support for local farmer innovation and adoption of new agricultural and environmental policies at local, national and international levels.

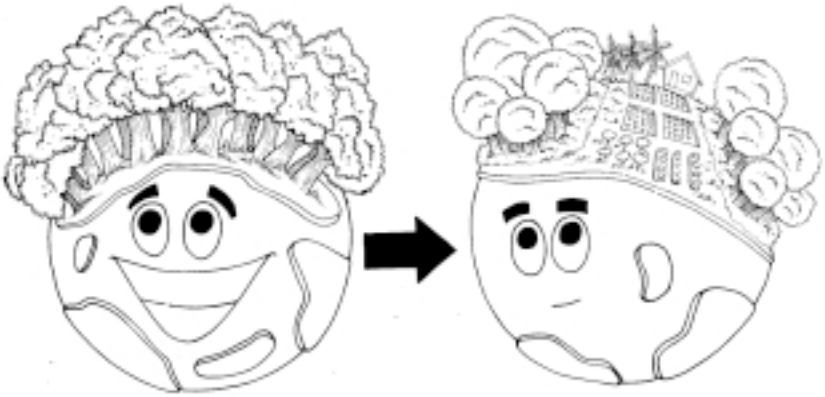
Key Challenges in Ecoagriculture

- Develop and fund a Global Program for Ecoagriculture Research and Development, in selected biodiversity hotspots. Undertake international and national policy research and innovation to develop cost-effective market, legislative and institutional interventions to promote ecoagriculture on a large scale.
- Develop networks of farmer innovators with technical specialists in agriculture and environment, who work in similar habitat types. The networking may be done through websites, e-workshops, and field tours in biodiversity hotspots of mutual interest.
- Fund basic research in biodiversity hotspots on interactions between agricultural systems and wildlife habitat and species, particularly in landscape ecology, agricultural ecology and wildlife behavior.
- Develop programs to educate farmers, agricultural researchers and policymakers in ecosystem management, and to educate wildlife biologists, ecologists and conservation policymakers in agricultural resource management.

Conflicts Between Agriculture and Wild Biodiversity

The scale of agricultural impact is much greater than had previously been recognized. In many countries, as much as 70 per cent of land area is in agricultural use. Over a third of the global agricultural land area is in high-intensity continuous cropping systems that use high levels of agrochemicals and reshape land and waterways. The rest of the agricultural area is under extensive farming systems that use far fewer inputs, but require relatively large expanses of land to produce relatively low crop and livestock yields. Both types of agriculture have had negative impacts on wild biodiversity, among which are:

- Nearly half of all temperate broadleaf forest and tropical and subtropical dry forest, and a third of temperate grass and shrubland, have been converted to agricultural use. Conversion has been greatest in Asia and Europe, with consequent loss of wildlife habitat.



- Irrigation is practiced on over 250 million hectares, and uses over 70 per cent of all freshwater - 89 per cent in low-income countries, often diverting water resources needed by terrestrial and aquatic wildlife.
- Globally, over half of wetlands -- among the planet's most valuable wildlife habitats--have been converted to agriculture.
- Farming has led to significant soil degradation on 16 per cent of all crop, pasture and forestland worldwide, and half of all agricultural land, thereby affecting the diversity of soil microorganisms.
- Excessive use and poor management of fertilizers, pesticides and livestock wastes are a major cause of habitat pollution that can kill wildlife directly or impair reproduction.

The distinction between agricultural land and protected areas maybe less useful than previously thought. Of over 17,000 major sites already devoted to conserving wild biodiversity, 45 per cent have at least 30 per cent of their land used for agriculture. Most of the rest are within predominantly agricultural landscapes. Currently, protected areas do not provide secure habitat for wildlife.

Can Ways be Found to Reduce, or Even Reverse, the Negative Impacts of Agriculture on Wild Biodiversity?

Initiatives to promote more ecologically sensitive farming systems (called 'sustainable', 'regenerative', or 'organic' agriculture) are expanding. Often, the impacts on wild biodiversity are positive, but they focus mainly on preserving 'useful' wild species, such as pollinators or beneficial soil microfauna.

While protected areas are still required, and need to be expanded, they ultimately will be successful only if surrounded by production systems of high environmental value that are also economically viable.

In Europe and North America, wealthy urban populations are able to transfer large financial payments to their small farming populations to take land out of production to preserve as wildlife habitat or to provide financial incentives for conservation farming. But in poor countries with large rural populations, this approach is less viable. Environmental planners must rely upon local support for agricultural conservation that meets food security and livelihood needs of the rural poor.

An essential strategy for conserving wild biodiversity, especially that found in highly populated, poor rural areas around the world, is to convert agriculture that is destructive of biodiversity into ecoagriculture. Ecoagriculture builds on the concept of 'ecosystem management' and refers to land-use systems that are managed both to produce food and to protect wildlife and other critical ecosystem services. For ecoagriculture, enhancing rural livelihoods through more productive and profitable farming systems becomes a core strategy for both agricultural development and conservation of biodiversity.

Ecoagriculture encompasses strategies for land and resource management. It increases wildlife habitat in non-farmed patches in agricultural landscapes, creating mosaics of wild and cultivated land uses by:

1) Creating new protected areas that also directly benefit local farming communities (by increasing the flow of wild or cultivated products, enhancing locally valued environmental services or increasing agricultural sustainability);
2) Establishing habitat networks and corridors in non-farmed areas (such as hedgerows or wind breaks that are compatible with farming);

3) Raising the productivity of existing farmland to prevent or reverse conversion of wild lands (where that is possible, given tenure, labor and price conditions; and efforts to protect or restore the biodiversity value of uncultivated lands are also undertaken);
4) Reducing agricultural pollution through new methods of nutrient and pest management, and farm and waterway filters;
5) Modifying the management of soil, water and natural vegetation to enhance habitat quality; and
6) Modifying the mix and configuration of agricultural species (especially perennials) to mimic the structure and function of natural vegetation.

In a joint study by IUCN and Future Harvest, at least 36 examples of ecoagriculture, from diverse regions of the world and types of farming systems, have been identified and documented to have significant positive impacts on wildlife populations, farm yields and farmer income. A quarter of these are already being practiced on millions of hectares (including wildlands re-established as a result of crop intensification on a smaller area; integrated pest management and organic production to reduce pesticide pollution; minimum tillage in mechanized cropping; trees grown in pastures; and species-rich agroforests). The rest are being used on a smaller or pilot scale.

Agricultural and environmental policies need to be modified to encourage these new approaches. In some cases, ecoagriculture systems can be developed by using available components and information from scientific and local knowledge, and by improving these through trial and error to design landscapes that address both local livelihood and conservation objectives. But in most cases major scientific initiatives will also be required, using sophisticated methods and tools from various disciplines. Indeed, ecoagriculture is feasible now in large part because of our greater capacity to find synergies through scientific management. Advances in conservation biology, agricultural ecology, plant breeding, ecosystem monitoring systems and modelling are revolutionizing our ability to understand and manipulate wildlife-habitat-agriculture interactions at farm and landscape scales.

New Technologies for Ecoagriculture

- New methods to monitor wildlife and analyze the spatial and temporal movement patterns and territorial requirements for wildlife allow for the design and placement of corridors and habitat patches in farmlands. Local farmers can organize themselves effectively to play a lead role in designing

landscape and farm interventions. Promising examples include LandCare groups in Australia, farmer federations in the Philippines, and forest user groups in Nepal.

- Scientists working in West Africa developed a natural biocide, from a strain of an environmentally friendly fungus (*Metarhizium anisopliae*). This was successful in controlling grasshopper and desert locust pests that were devastating grain crops in West Africa, and greatly reduced the need for insecticides that had been threatening stork and songbird populations.

- Veterinary research to develop a livestock vaccine against rinderpest, a viral disease, has not only greatly protected domestic cattle in East Africa, but also protected millions of wild buffalo, eland, kudu, wildebeest, giraffe and warthog that share rangelands and reserves, and that are also susceptible to the disease.

- Crop breeders in the U.S. are developing native perennial grains (such as bundleflower, leymus, eastern gamagrass, Maximilian sunflower) that can be grown more sustainably with much less environmental damage in dryland farming regions.

- In the humid tropics, research has demonstrated the benefits of farming systems that 'mimic' the structure of the natural forest ecosystems. Millions of hectares of multi-strata 'agroforests' in Indonesia produce commercial rubber, fruits, spices and timber, often in a mosaic with rice fields and rice fallows. The number of wild plant and animal species in these agroforests are often nearly as high as in natural forests.

- In Central America, modified systems of shaded coffee with domesticated native shade tree species, maintain coffee yields while also diversifying income sources and conserving wild biodiversity.

An ambitious policy and research agenda is needed to develop and promote the adoption of farming systems that increase production, protect wildlife and raise farm incomes in areas of high biodiversity value. Such research will require a full partnership of ecologists, wildlife biologists and agricultural researchers, working in association with operational-scale conservation and agricultural development programs. Priority areas for such efforts include biodiversity-rich regions threatened by agricultural development; regions where agricultural productivity growth depends on restoring environmental services critical for agriculture; and regions where biodiversity conservation will benefit the poor directly through ecosystem restoration and income opportunities.

How Can Resources for Such an Agenda be Mobilized on a Globally Significant Scale?

First, private research and development (R&D) by large-scale commercial food producers and agro-processors could play an important role. Private food processing companies that obtain a large share of their raw material from smallholder farmers located near protected areas may be motivated to encourage ecoagriculture (e.g., current trends to reduce agrochemical use in cocoa production). Private agricultural service companies might, for example, sell pest control services to farmers based on ecoagriculture principles rather than simply selling them products. Private tourism industry that benefits from wild biodiversity may be willing to help support ecoagriculture. Public and civic conservation groups can encourage this work, and monitor wildlife impacts of farming systems.

Public sector institutions and civic organizations can play a leading role in ecoagriculture development, because so much of the necessary research and investment is to provide 'public goods'. Wildlife conservation organizations will need to take the lead in developing ecoagriculture strategies and contracting for targeted research to support those strategies.

Ecoagriculture and Wildlife Conservation

Ecoagriculture and wildlife is a new research agenda that would require collaboration across sectors and disciplines. Some of the priorities are the need to:

1) undertake international and national policy research to determine cost-effective market, legislative and institutional interventions to promote ecoagriculture on a large scale;

2) develop networks that link farmer organizations with technical specialists in agriculture and environment who work in particular habitat types, through websites, e-workshops, and field tours in biodiversity hotspots of mutual interest; and

3) support national scientific institutions in 'mega-diversity' countries that have strong agricultural research capacity, to carry out research in biodiversity hotspots, on interactions between agricultural systems and wildlife habitat and species in landscape ecology, agricultural ecology, and wildlife behavior, etc.

In a world where human population may reach 9 billion by mid-century, it is not enough to 'leave wildlife alone'; 'wild lands' must be actively managed as we already do to our agricultural lands. This point can be taken a step further: agriculture itself needs to be reconceptualized as a producer of both food and key ecosystem services, such as biodiversity conservation. With such compelling evidence on the vulnerability of wildlife to agricultural expansion and intensification, and the dependence of much of the world's poor on agricultural development, ecoagriculture has become a pressing policy and research priority.

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For further information and example of ecoagriculture, see:
McNeely, J.A. and S.J. Scherr. 2002. Ecoagriculture: Strategies to Feed the World and Protect Wild Biodiversity. Island Press, Washington, DC.

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