



Ecosystem Services Sustain Agricultural Productivity and Resilience

Ecosystem services are defined as “the benefits provided by ecosystems to humans”. Many key ecosystem services provided by biodiversity, such as nutrient cycling, pest regulation and pollination, sustain agricultural productivity. Promoting the healthy functioning of ecosystems ensures the resilience of agriculture as it intensifies to meet the stress of growing demands for food production. Climate change and other stresses have the potential to make major impacts on key functions, such as pollination and pest regulation services. Learning to strengthen the ecosystem linkages that promote resilience and to mitigate the forces that impede the ability of agro-ecosystems to deliver goods and services remains an important challenge.

Food production will have to increase by 50 per cent to feed a population of nine billion people by 2050. This brings agricultural production under intense pressure. Alongside the demands on the agricultural sector for increased production, there are also increasing expectations and needs for cultivation practices to be sustainable. Increases in production to meet that demand have traditionally involved increased dependence on pesticides and fertilizers and overuse of water that can degrade soils and water resources.

Placed in the framework of ecosystem services delivered by agricultural ecosystems, the Millennium Ecosystem Assessment recognizes that the production

or harvest of crops, livestock and fish stocks have been vastly enhanced over the last 50 years, while the ability of these ecosystems to regulate pests, control erosion and maintain soil health has been diminished (see figure).

Cultivate change

Cultivation practices are undergoing a shift from dependency on non-renewable inputs and from chemical-based intensification to forms of biological intensification and other emerging technologies that draw on biodiversity and natural resources to increase the productivity of ecosystem services. The incorporation of

scientific principles of ecosystem management into farming practices, such as conservation agriculture or integrated pest management, has shown that intensified production can be enhanced through sustainable management of ecosystems.

Biodiversity support

The conservation and enhancement of biodiversity in cropping systems both above and below ground are part of the foundation of sustainable farming practices. Such measures also lead to improved biodiversity in other parts of the environment which are adjacent to but not directly part of the cropland – such as water bodies and the broader agricultural landscape.

Ecosystem Services	Degraded	Mixed	Enhanced
Provisioning	Capture fisheries Wild foods Wood fuel Genetic resources Biochemicals Fresh water	Timber Fibre	Crops Livestock Aquaculture
Regulating	Air quality regulation Regional and local climate regulation Erosion regulation Water purification Pest regulation Pollination Natural hazard regulation	Water regulation (for example, flood protection) Disease regulation	Carbon sequestration
Cultural	Spiritual religious values Aesthetic values	Recreation and ecotourism	

Policy support

In agro-ecosystems, people have the potential to undertake measures that can conserve and strengthen linkages and contribute to long-term stability. A supportive policy environment, with investments by governments and other stakeholders in supporting the practices that sustain ecosystem services and provide incentives for these practices, is key to the success of these measures.

PRODUCTION INTENSIFICATION THROUGH ECOSYSTEM MANAGEMENT

FAO's Agriculture Production and Protection Division recognizes the role of ecosystem services in sustaining agricultural productivity, protecting crop plants and providing resilience in the face of changing climates. Thus, FAO is undertaking work in the development of a comprehensive framework for assisting policy-makers in assessing strategies or options for sustainable crop intensification that increase farmer's productive capacity and improve their livelihoods. The examples of practices that reflect the shift from traditional inputs based on agrochemicals to biological intensification and where FAO has been involved in assisting member countries include the following.

Ensuring diversity and abundance of pollination services

Diversification into horticultural crops is becoming an avenue to poverty alleviation among many farmers around the world. The trade in horticultural crops accounts for more than 20 percent of developing countries' agricultural exports, more than double that of cereal crops. Unlike the historical increase in cereal production, the expansion of production in fruits and vegetables has come primarily from increases in the area cropped, not from yield increases. In agro-ecosystems, pollinators are essential for orchard, horticultural and forage production, as well as the production of seed for many root and fibre crops. Thus, maintaining and increasing yields in horticultural crops under agricultural development is critical to health, nutrition, food security and better farm incomes for poor farmers.

Horticulture development:

In horticultural development in Kenya, pollinators of eggplant were found to use primarily a diverse weed community along field edges and pathways for their alternate resources, including nectar that is not provided by eggplant. But during one month pollinators preferentially used the resources of the adjacent woodland, in addition to the weeds in the farm landscape. This shift in resource use occurred at the end of the dry season, when floral resources were scarce. This shows that the resource that may be the most critical may not be the most obvious. They may be resources that are used only for a brief period, but in whose absence, pollinators may be less able to persist in the ecosystem. Farmers growing eggplant in this area, in fields cleared from the woodland, recognize the value of the remaining remnants for conserving pollinators (along with other benefits such as providing Acacia pods for goats).

FAO's Plant Production Division provides technical guidance on managing pollination services and formulating enabling policies. FAO has worked with partners in countries such as Ghana, India, Kenya, Lao PDR and Nepal to build capacity and develop tools, methodologies, strategies and best management practices.

Creating pest-suppressive conditions

Abundant and well-distributed populations of generalist predators can be found in most tropical Asian rice fields. High populations of generalist predators are likely to be supported, in the early season, by feeding on abundant populations of detritus-feeding and plankton-feeding insects, whose populations consistently peak and decline in the first third of the season. This abundance of alternative prey may give the predator populations a head start on later-developing pest populations, suppressing pest populations and generally lending stability to rice ecosystems by decoupling predator populations

from a strict dependence on pest populations. A management strategy, proven in FAO-NARS pilot sites and their applied FAO promoted national IPM programs including 2 million farmers, has convinced policy-makers in a number of countries to reduce insecticide use.



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