Food and Agriculture Organization
of the United Nations

*DEMOCRATIC REPUBLIC OF CONGO - Women farmers working on a spinach crop of a Farmer Field School. The Farmer Field School, supported by FAO, teaches farmers improved techniques including the use of natural fertilizers and organic alternatives to pesticides. ©FAO/Olivier Asselin*

# AGROECOLOGY TO REVERSE SOIL DEGRADATION AND ACHIEVE FOOD SECURITY

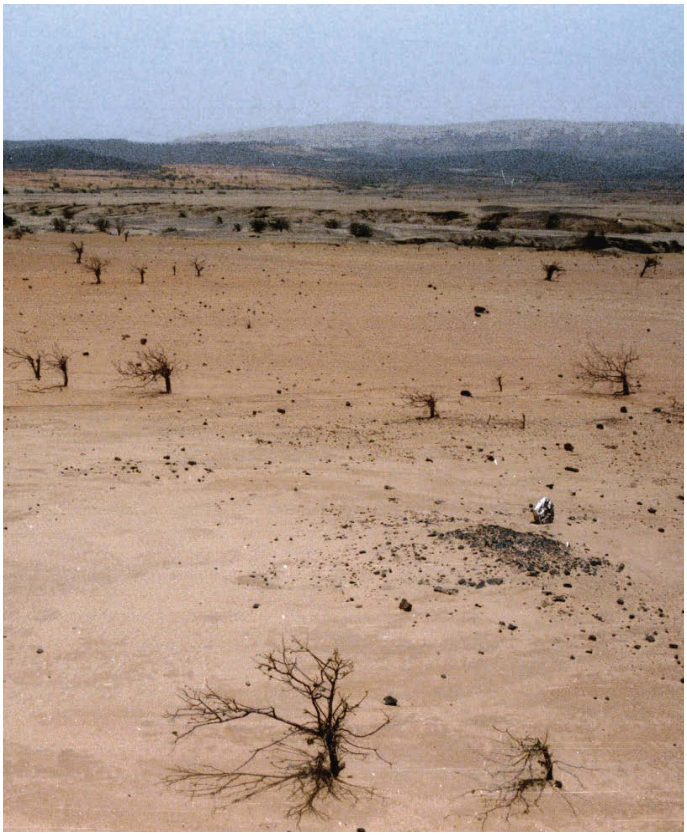
## Agroecology, which restores ecosystem functioning by maintaining soil health, is an effective strategy to achieve food security in the areas of the world where it is most needed.

2015
International
Year of Soils

### THE CHALLENGE

The dramatic increase in crop production of the last 50 years has reduced the number of chronically undernourished people. However, these massive production gains have come at high environmental costs, which have affected soil and ecosystem health.

Currently agricultural policy is increasingly expected to face the combined challenge of producing sufficient food for a growing population while guaranteeing environmental restoration. Therefore, **policy-makers are more frequently asked how to address the urgent need for soil and environmental restoration when millions of people are still hungry.**



*NIGER - Keita. ©FAO/F. Paladini*

## FOOD SECURITY AND SOIL DEGRADATION

*"The world produces more than enough food to feed every member of the human family, yet 1 in 9 people do not have enough to eat"*. This was the opening sentence by the UN Secretary General, Ban Ki-moon, for the launch of EXPO 2015 in Milan, Italy.

Despite hosting almost all food production, rural areas also hold the majority of the world's food insecure people. Soils that are well managed by family farmers help ensure the four dimensions of food security: availability, delivering nutrients for crop growth; access, by improving family farm income through more reliable harvests; stability, by conserving water to support nearly year-round cropping; and utilization, by harvesting healthy nutritious food from healthy soils.

Soil degradation consists of biological, chemical and physical degradation. Currently, about 33 percent of world soils are moderately to highly degraded. Forty percent of these soils are located in Africa and most of the remaining amount are in areas that are afflicted by poverty and food insecurity. The strong relationship between soil health and food security calls for strategic and immediate actions especially at the local level to reverse soil degradation, in order to increase food production and alleviate food insecurity in the areas where it is most needed and in the context of climate change.

*CENTRAL AFRICAN REPUBLIC - Dangala. Farmer in a peanut field. ©FAO/Riccardo Gangale*

## AGROECOLOGY AS A STRATEGY TO REVERSE SOIL DEGRADATION

By understanding and working with interactions among soil, plants, animals, humans and the environment within agricultural systems, agro-ecology encompasses multiple dimensions of the food system, including ecological restoration, political and social stability and economic sustainability.

*EL SALVADOR - A farmer holding two types of soil. ©FAO/Giuseppe Bizzarri*

The agroecological approach starts by restoring soil life in order to re-establish and/or enhance the multiple soil-based biological processes. This requires:

- **Increasing and monitoring soil organic matter:** Soil organic matter is considered the most common deficiency in degraded soils and the main indicator for soil quality. Practical, accessible indicators can support local decisions and larger landscape monitoring and analyses for district level implementation.
- **Facilitating and monitoring of soil biodiversity:** Soil biological communities are directly responsible for multiple ecosystem functions.
- **Build on local farmers' knowledge**: Participatory scientific approaches to soil ecosystem management, such as Farmer Field Schools, are of great importance to inform farmers' knowledge with researchers' scientific principles in order better locally adapt agroecological systems.

## FARMERS: THE ECOSYSTEM MANAGERS FOR SOIL RESTORATION

Degraded soils have lost their capacity to sustain food production as many ecological processes provided by soil biological communities such as maintenance of soil structure, soil-born pest regulation, nutrient and water cycling, have been overlooked or replaced by the use of external inputs. Many farmers across the globe have deep, experiential knowledge of their local soils. They have tested, adapted and discovered agricultural practices that restore soil life and the associated ecosystem services. These farmers are the main ecosystem managers and are at the centre of agroecology.

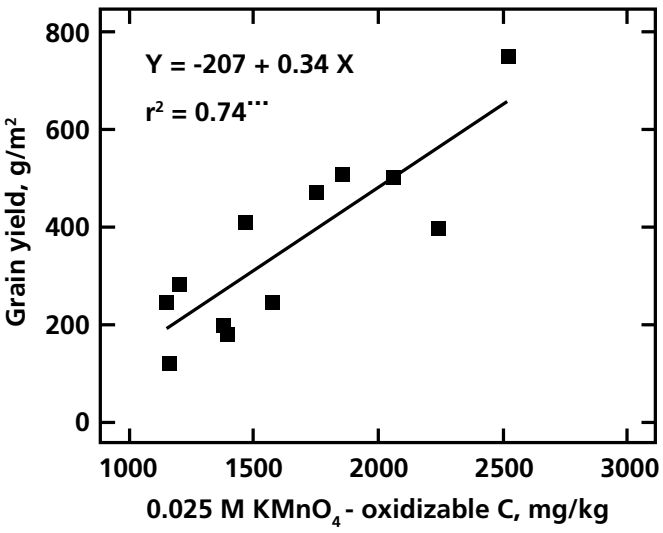



Figure 1 Relationship between corn grain yield and active fraction of soil organic matter. Source: Magdoff and Weil, 2004

*LAOS - Nakhong Village. Integrated pest management training at a farmers' field school: collecting pest specimens in the field. ©FAO/K. Pratt*

## AGROECOLOGY AS A STRATEGY TO RESTORE SOILS AND ECOSYSTEM STABILITY

Agroecology applies specific strategies based on temporal and spatial diversity, which guarantee local, stable and diverse year-round production and income. These strategies include:

**Polycultures and agroforestry systems:** The design of appropriate crop mixtures is more stable than monocultures as polycultures build on diverse crop resistance to soil pests and diseases and complementary uptake of soil nutrients and water in order to facilitate recycling of biomass and nutrients. The complementary traits of trees and crops enhance the efficiency of the whole systems, while litter mulch and the position of the trees along contour lines reduce erosion and soil degradation potential.

Sloping Agricultural Land Technology (SALT) is a specific agroforestry strategy in which annual and perennial crops are grown between contoured rows of leguminous species. SALT has been extensively tested and implemented in farmers' fields and experimental plots in Southeast Asia and has proven effective for reversing soil degradation while improving crop yields and farm's profitability.

*GHANA - Wendu. Hedgerow intercropping. Hedgerow of Laucaena leucocephala (Leguminosae) and maize as a companion crop in a field at Wenchi. Leucaena fixes nitrogen. ©FAO/Pietro Cenini*

**Cover crops:** Cover crops are usually leguminous crops grown to improve soil health by guaranteeing permanent soil cover, adding organic matter to soil and fixing atmospheric nitrogen. These help reverse soil degradation even in densely populated areas where long term fallows are simply no longer possible.

The use of Mucuna spp. as a cover crop in different African locations has increased soil organic matter, improved nitrogen availability in soils and positively affected yields.

**Crop-livestock integration:** Integrating livestock with crop production can tighten up nutrient cycles and diversify production, especially for smallholder family farms. In mixed farming systems, crop by-products are fed to livestock while manure is applied to cropland to sustain benefits from soil organic matter and nutrients availability.

In Ethiopia and Tanzania the design of mixed farming systems, which include multipurpose legume species such as Cajanus cajan (pigeon pea)–a drought tolerant multi-purpose legume–or Faidherbia albida –an indigenous leguminous nitrogen–fixing species with pods palatable for livestock, and leaves used as fertilizers-are well known to be effective in reversing soil degradation by controlling erosion, providing nitrogen-rich residues and increasing soil organic matter.

## TIME FOR ACTION

The design of diverse agroecological systems rooted in local ecological knowledge and based on system diversity and ecological synergies can significantly improve soil quality and reverse soil degradation while increasing the production of nutritious food.

*EL SALVADOR - Jocoaitique, Ladera area. Crop diversification: farmer working in maize plantation where henequen is also grown. ©FAO/Giuseppe Bizzarri*

Agroecology has already proven to be an effective strategy to address the global challenge that agriculture is facing as it accommodates the socio-political characteristics of food security with the need for restoring ecosystem functions.

Agroecology is part of the Strategic Framework of FAO, in particular the Strategic Objectives of making agriculture, forestry and fisheries more productive and sustainable, increasing the resilience of livelihoods and reducing rural poverty. To facilitate a dialogue about Agroecology, its benefits, challenges and opportunities focusing at regional and national level, FAO is involved in regional conferences (held in 2015 in Latin America and the Caribbean, sub-Saharan Africa and Asia and the Pacific). Furthermore, FAO supports farmers' research networks to integrate scientific innovations with traditional farmers' knowledge.

## KEY FACTS

- 12 million hectares of agricultural soils are lost globally through soil degradation every year.
- Soils with soil organic matter content lower than 0.8 percent are unproductive and often abandoned.
- Agroforestry systems can reduce soil erosion by as much as 100 times in steep slopes.
- Growing Faidherbia albida in association with millet (Pennisetum glaucum) increased grain yields by 50 percent in Burkina Faso and Senegal.
- In Honduras the adoption of soil conservation practices tripled or quadrupled maize yields for 1 200 families.

*RWANDA – Kiseny region. Slow-forming terraces and crop diversification including maize, banana, coffee and vegetable cropping. ©FAO/A. Odoul*

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