



Food and Agriculture  
Organization of the  
United Nations



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# Soils are the foundation for vegetation which is cultivated or managed for feed, fibre, fuel and medicinal products



2015  
International  
Year of Soils

**H**ealthy soils are crucial for ensuring the continued growth of natural and managed vegetation, providing feed, fibre, fuel, medicinal products and other ecosystem services such as climate regulation and oxygen production. Soils and vegetation have a reciprocal relationship. Fertile soil encourages plant growth by providing plants with nutrients, acting as a water holding tank, and serving as the substrate to which plants anchor their roots. In return, vegetation, tree cover and forests prevent soil degradation and desertification by stabilizing the soil, maintaining water and nutrient cycling, and reducing water and wind erosion. As global economic growth and demographic shifts increase the demand for vegetation, animal feed and vegetation by products such as wood,

soils are put under tremendous pressure and their risk of degradation increases greatly. Managing vegetation sustainably—whether in forests, pastures or grasslands—will boost its benefits, including timber, fodder and food, in a way meets society's needs while conserving and maintaining the soil for the benefit of present and future generations. The sustainable use of goods and services from vegetation and the development of agroforestry systems and crop-livestock systems also have the potential to contribute to poverty reduction, making the rural poor less vulnerable to the impacts of land degradation and desertification.



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## SOILS AND CROPS

The symbiotic relationship between soils and vegetation is most apparent in the agricultural sector: food security and nutrition rely on healthy soils. The nutrient content of a plant's tissues is directly related to the nutrient content of the soil and its ability to exchange nutrients and water with the plant's roots. Similarly, plant growth is influenced to soil physical properties such as texture, structure and permeability. However, the practices of intensive agriculture, monoculture and deep tillage put soil health at risk by depleting the soil of nutrients, causing soil pollution, altering soil structure and water retention capacity, fostering soil erosion and decreasing soil biodiversity, which is the basis of soil biological activities (e.g. organic matter decomposition and nitrogen fixation). Soil degradation in agricultural systems is directly related to the overuse of fertilizers and pesticides, the removal of the crop residues from the soil surface and the use of heavy machinery. Additionally, nutrient depletion is related to the absence of the fallow period in intensive agricultural systems and to the practice of monoculture (growing a single crop or plant on a field), which deplete soil nutrients due to static nutrient demand. Therefore, crop rotation is critical to preserving and eventually improving soil health. Crops protect soil against soil erosion agents (e.g. water and wind), improve soil structure by rooting, and enrich soil nutrients by providing organic matter and establishing symbiotic relationships with soil bacteria. Sustainable soil management is thus critically important to addressing the growing food demand caused by population growth.

## SOILS AND PASTURE

Pasturelands are areas covered with grass or other plants used or suitable for livestock grazing. Grazing occupies 26 percent of the earth's terrestrial surface, while feed crop production requires about a third of all arable land. Because of their land use, livestock grazing and trampling are the main threats to soil health in pasturelands.

Grasses found on pasturelands protect the soil against soil erosion agents (e.g. water and wind) and support soil biological activities, which are responsible for decomposing organic matter and fixing carbon in soil. Grazing and overgrazing remove the soil cover, fostering soil erosion and reducing important soil functions such as climate regulation. As the severity of soil degradation increases, soil gradually loses its capacity to store carbon and other molecules, eventually emitted in the atmosphere as greenhouse gases.

Livestock trampling also affects soil health by causing compaction, which alters soil physical properties and reducing the water infiltration capacity of the soil, thus hampering plant growth. However, the risk of compaction is lessened in soils with high organic matter content, as these soils are less sensitive to soil compaction. Vegetation therefore plays a crucial role in preserving soil health in pasturelands; particularly grass type and pasture rotation as they help to keep the soil system functional. As global demand for meat and dairy products continues to rise rapidly, soil protection and conservation on pasturelands becomes even more critical for maintaining livestock production and ensuring that the livestock sector does not encroach on land, forest and water resources.



## SOILS AND FORESTS

According to FAO's definition, 'forests' include closed forests, as well as open woodlands and savannas with at least 10 percent tree cover. Jointly with soils, forests play a key role in providing ecosystem services critical to life on earth. Among the most important services provided by forests and the underlying soils is climate regulation, which occurs through the release and absorption of greenhouse gases. However, deforestation driven by the use of wood for industry and fuel, and the expansion of agricultural lands puts at risk the capacity of forest soils to act as carbon sinks in the future. In fact, it is estimated that this capacity can decrease by 20-40 percent as a result of the conversion of forests and native grasslands to croplands. Without the adoption of proper conservation measures, deforestation leads to severe soil degradation as it leaves the soil bare and exposed to soil erosion agents. The preservation and improvement of soil health in forests relies on sustainable forest management, which must coexist with the agricultural, industrial and urban sectors.

## KEY CHALLENGES

Soil degradation is in many cases the direct result of poor soil management. The consequent decline in vegetation and its products such as feed, fibre, fuel and medicinal products has an adverse effect on soil productivity, human and livestock health, and economic activities. Conversely, vegetation cover, particularly dense and healthy vegetation, protects soil from erosion agents such as wind and water and can improve its productivity. A large portion of the population depends on vegetation for their livelihoods: about 80 percent of people in the developing world use non-wood forest products for health and nutritional needs and for income. Furthermore, an estimated 2.6 billion people worldwide are dependent on wood fuel, including charcoal, for cooking and heating. The livestock sector is by far the single largest user of land by humans. Grazing occupies 26 percent of the earth's terrestrial surface, while feed crop production requires about a third of all arable land. Expansion of grazing land for livestock is a key factor in deforestation, especially in Latin America: some 70 percent of previously forested land in the Amazon is used as pasture, and feed crops cover a large part of the remainder. About 70 percent of all grazing land in dry areas is considered degraded, mostly due to poor grazing practices. Sustainable management of pastures, forests and other vegetated land is therefore essential for preserving soils and consequently supporting rural livelihoods, maintaining livestock production, promoting the growth of vegetation and ensuring current and future use of raw materials.



## FAO IN ACTION

### Enhancing crop-livestock systems for sustainable production intensification in Burkina Faso

Despite its high productivity potential, the current agricultural land use in the moist savannah zone of Sub-Saharan Africa and its development potential for livelihoods and sustainability are met with serious constraints. These arise mainly from poor soil health and low soil productivity, due to a combination of poor soil tillage practices, inadequate crop and pest management practices, inadequate crop diversification and crop residue management, and poor integration of livestock in the production system. FAO assisted groups of farmers in five farming communities in the moist savannah zone of Burkina Faso to enhance their crop-livestock systems through conservation agriculture practices, including crop diversification, using an innovative farmer discovery process, to bring about agricultural intensification and improvement in livelihoods. Farmers experimented with expanding crop choices to increase the production of livestock feed while ensuring adequate biomass supply for soil quality recovery. This included diversifying and expanding the range of food, feed and tree crops and their integration with livestock into the existing cotton- and maize-based systems. Farmers also integrated conservation agriculture practices as a means to improve and optimize soil-crop-water-nutrient management for sustainable production intensification, given the poor current state of soil nutrient fertility, variable rainfall climate, and inadequate biomass availability.

## FAO IN ACTION



### Enhancing the contribution of Non-Wood Forest Products to food security in Central African countries

The Congo Basin is among the world's major reservoirs of biological diversity and is the home to some 100 million people, many of whom depend on the forest for their livelihoods. Non-Wood Forest Products (NWFP) are an important contribution to subsistence and income generation, with small-scale forest based enterprises playing a key role in commercialization. However, NWFP are hardly visible in the national economy statistics and the sector is mostly informal without proper legal, institutional and organizational frameworks. FAO is working to improve food security in the sub-region by promoting the use and regulation of NWFP. The Organization collaborates with governments in multiple Central African countries to strengthen institutional capacities, enhance knowledge on forest resources and agroforestry production systems and promote better coordination among all actors involved in activities related to food security and forest conservation through the sustainable use of NWFP.

### Forest rehabilitation and restoration in Asia and the Pacific

FAO is combating deforestation and degradation in Asia and the Pacific by promoting Assisted Natural Regeneration (ANR), a process of regenerating degraded grassland and shrub vegetation by protecting and nurturing mother trees and their wildlings.

ANR helps forests grow faster than they would naturally by removing or reducing barriers to natural forest regeneration such as soil degradation, competition with weedy species, and recurring disturbances (e.g., fire, grazing, and wood harvesting). Already well developed in the Philippines, ANR is now being used extensively throughout the region to restore former forested areas that have become degraded and covered by *Imperata cylindrica* grass. The same principles are also being used to address the problems of poor regeneration in logged over forests in several other Southeast Asian countries. FAO has been promoting these techniques widely in the region through long term demonstration plots, study tours and technology transfer.

### KEY FACTS

- 75–90 percent of people in developing countries depend on natural products as their only or main source of medicine.
- The use of solid biofuels – including wood – is predicted to grow by 300 percent between 2007 and 2030.
- Forests provide livelihoods for more than a billion people and are vital for conservation of biodiversity, energy supply, and soil and water protection.
- Forest products make a significant contribution to the shelter of at least 1.3 billion people, or 18 percent of the world's population.
- The livestock sector is socially and politically very significant in developing countries: it provides food and income for one billion of the world's poor.
- Deforestation affected an estimated 13 million hectares per year between 2000 and 2010.
- The capacity of forest soils to act as carbon sinks can decrease by 20–40 percent as a result of the conversion of forests and native grasslands to croplands.
- The consumption of industrial roundwood is expected to increase by 50–75 percent between the years 2000 and 2050.
- About 20 percent of the world's pastures and rangelands, with more than 70 percent of the rangelands in dry areas, have been degraded to some extent.

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