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Healthy Soils for Healthy Life

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*Soil is a part of the solution to the greatest dilemmas of our time. It plays a critical role in mitigating the effects of climate change, increasing farm productivity and food security, and may hold the answers to eradicating antibiotic resistance. If we truly want to achieve the **Sustainable Development Goals** we've set for ourselves, we can't afford to not focus on soil health. Healthy soils are crucial for ensuring the continued growth of natural and managed vegetation, providing feed fiber, fuel, medicinal products and other ecosystem services such as climate regulation and oxygen*

Humans are intricately tied to soil. 95 percent of our food and fiber come from the soil, and over 99.9 percent of our fresh drinking water passes through soil. We even define ourselves by our relationship to soil: the words “human” and “humanity” are linguistically rooted in “humus” – which is the fertile upper portion of the soil. In spite of the connections, many of us fail to consider the importance of preserving the health of the earth’s soils for generations to come. In sub-Saharan Africa, where the populations will more than double by 2050, an estimated 65 percent of soils are degraded. This translates to poor harvests, malnutrition, and chronic hunger for millions. When we think about the role of soil in the food security equation, it’s no wonder that the U.N. General Assembly chose to designate 2015 the **International Year of Soils**. With more than half the world moving to urban areas, it’s important that we take time to appreciate our relationship to soil, and talk about what we can do to keep it healthy.

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 agro forestry 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.

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, soil conservation and protection and maintaining pasturelands becomes even more critical for livestock production and ensuring that the livestock sector does not encroach on land, forest and water resources.

Pasturelands are areas covered with grass or other plants used or suitable for livestock grazing. 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.

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.

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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

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Forests' include closed forests, as well as open woodlands and savannas with at least 10 per cent 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 to 40 per cent 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.

Highlights

- 75 to 90 per cent 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 per cent 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 per cent 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 to 40 per cent as a result of the conversion of forests and native grasslands to croplands.
- The consumption of industrial round wood is expected to increase by 50 to 75 per cent between the years 2000 and 2050.
- About 20 per cent of the world's pastures and rangelands, with more than 70 per cent of the rangelands in dry areas, have been degraded to some extent.

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, fiber, 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 per cent 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 per cent 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

FAO has implemented a number of projects related to sustainable production and better soil management. In Burkina Faso, FAO assisted groups of farmers in five farming communities in the moist savannah zone 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. In Central African countries, FAO is working to improve food security in the sub-region by promoting the use and regulation of Non-Wood Forest Products (NWFP). While, in Asia and the Pacific, FAO is combating deforestation and degradation by promoting Assisted Natural Regeneration (ANR), a process of regenerating degraded grassland and shrub vegetation by protecting and nurturing mother trees and their wildlings.

INDIA IN ACTION:

Government of India has decided to issue 140 million Soil Health Cards over a period of three years. Such cards carry recommendations on nutrients and fertilizers required to help farmers improve crop-productivity while not exceeding with the use of inputs. Under this nation-wide initiative, soil testing laboratories will be set up at the district and village cluster level along with hundreds of mobile soil testing labs. Organic farming is another issue receiving special focus in India. We are confident that organic farming will help in maintaining productivity and help check the ill effects of unscientific chemical fertilizers, which have over the years contributed to the deterioration of soil health. FAO Director-General, José Graziano da Silva has appreciated our work in this area and agreed that “India's work in soil management will serve as a model for other countries.

WHAT NEEDS TO BE DONE?

1. *If we want to reduce global hunger, a healthy soil biosphere is crucial.* 70 percent of poor people in rural areas depend on agriculture for their livelihoods. These rural areas comprise large numbers of smallholder farmers, who cultivate less than 2 acres of land. Lacking access to quality inputs, tools, training, and financing, smallholder farmers are often at the mercy of unproductive soil. Promoting soil health, through strategies such as agro forestry, intercropping, and composting, is one important way to increase the productivity of these small plots of land. This in turn which smallholder farming communities increase their resilience to environmental shocks and grow their way out of hunger and poverty.

2. *Soil is the greatest reservoir and the last frontier of biodiversity.* Most known antibiotics come from organisms that were isolated from the soil. The soil biosphere controls the cycling of most major plant nutrients, such as nitrogen, phosphorus, and sulfur. What other secrets are held

in the soil biosphere? In 1 gram (one pinch) of soil, there are over 1 billion individual organisms and over 1 million unique species! We know less than 1 per cent of who they are and less than 1 per cent of 1 per cent of what they do.

3. Soil is a highly valuable—and in our lifetime, non-renewable—resource. According to The Land Institute, soil is every bit as non-renewable as oil, and it is essential for human survival. Soil takes thousands of years to develop just a few inches. A rich, deep soil that may have taken more than 100,000 years to form can be lost over night due to soil erosion. We can think of soils as a very thin skin that surrounds Earth, connecting the atmosphere, biosphere, hydrosphere, and geosphere. Frankling D. Roosevelt once said, “a nation that destroys its soils destroys itself.”

4. We can’t combat climate change without focusing on soil. Climate change is driven by atmospheric carbon. Surprisingly, soil can absorb nearly twice as much carbon as can be contained within plants and the atmosphere combined! Soil’s enormous capacity to absorb more carbon has additional benefits: adding carbon to the soil via plant materials (compost, green manure, animal manure, biochar) will actually reduce carbon (and thereby the amount of carbon dioxide) in the atmosphere. Increasing the amount of carbon in soil will also allow the soil to capture and hold more rainwater, which reduces the amount of soil erosion and increases the soil’s ability to filter ground water, which increases water quality.

5. Ensuring soil health involves innovation and perseverance. Agriculture for Impact recently released a Montpellier Panel report in which they call for a ‘big data’ revolution to amass helpful data on soil type and quality. AGRA has trained almost two million smallholder farmers in 13 countries in Integrated Soil Fertility Management practices, helping them acquire the inputs they need to revive their lands and boost their yields. One Acre Fund trains farmers in East Africa on intercropping and composting techniques, and offers loan products that have a positive environmental impact, such as grevillea trees and solar lights. These efforts to improve soil health may take time to produce results, but will ultimately ensure that existing farmland is more productive for generations to come.

EPILOGUE

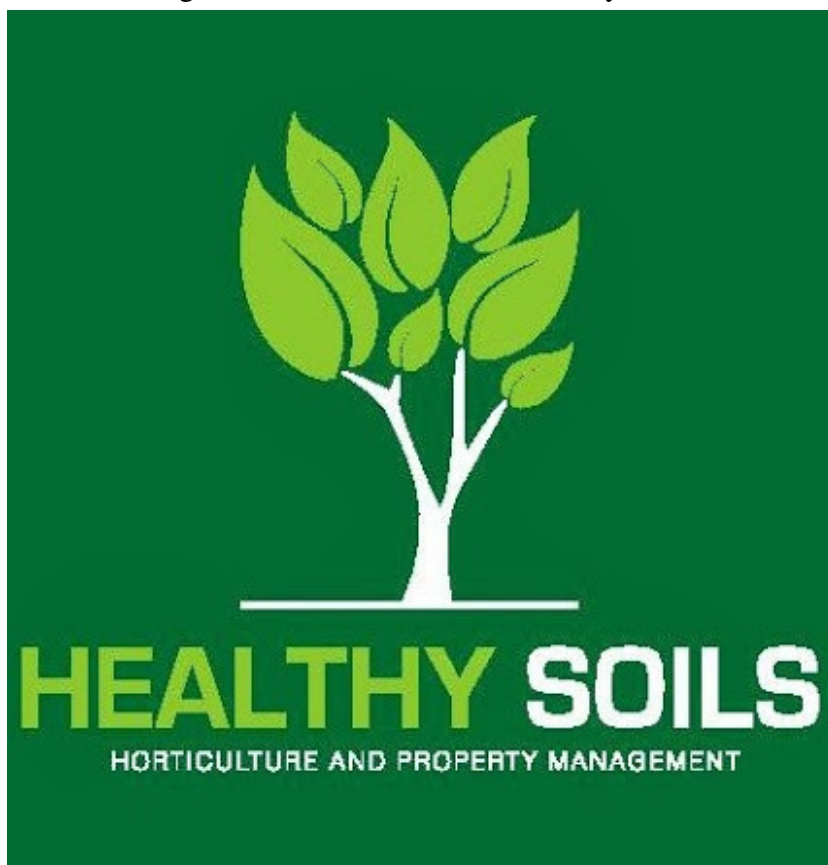
Despite its high productivity potential, the current agricultural land use and its development potential for livelihoods and sustainability are met with serious constraints. These arise mainly from poor soil health and low soil productivity, due to a combination of poor soil tillage practices, inadequate crop and pest management practices, inadequate crop diversification and crop residue management, and poor integration of livestock in the production system. Farming communities in such areas should 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 must integrate 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. Need of the time is to combat deforestation and degradation 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).

Soil is part of the solution to some of the greatest dilemmas of our time. It plays a critical role in mitigating the effects of climate change, increasing farm productivity and food security, and may hold the answers to eradicating antibiotic resistance. If we truly want to achieve the **Sustainable**

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economies depend on ecosystems "There is now broad appreciation of nature's values and we are learning how to incorporate that knowledge into policy and management decisions by governments, financial institutions and businesses. But with global environmental threats in the future and a world population that may approach 10 billion by 2100, the health of nature will literally become a life-support system that no longer can tolerate short-term production and consumption at the expense of natural stewardship. In recent years, we may be turning the corner toward approaches that could help the planet and all its natural inhabitants to live long and prosper.