

HEALTHY AND PRODUCTIVE SOILS ARE PRE-REQUISITE FOR SUSTAINABLE FOOD SECURITY

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Introduction

Considering the earlier soil education and looking at the soil resources capacity for ecosystem services, I have reached to the conclusion that over the past many years, the overexploitation of the Earth has shrunk the land resources to an unprecedented level and there is a growing concern that it may not be able to provide needed ecosystem services to the mankind in future, especially the food for the existing and ever growing population. In addition the impact of climate change will cause further food and water shortages, increased displacements of people, increased poverty and coastal flooding leading to significant infrastructure disintegration. Thus the sustainability in food security is at high risk. Sustainability requires that human demand for food is less than what the biosphere can produce. The Global Footprint Network (GFN 2015) promotes the science of sustainability measurement by advancing the Ecological Footprint (EF) and the Biocapacity (BC). The nationwide EF reminds us; to know if national infrastructure investments and innovative strategies are increasing or decreasing our long-term resource dependence; is national economy an “Ecological Debtor” or an “Ecological Creditor”?

In 2011, Earth’s BC was approximately 12.04 billion global hectares (gha) which is 1.72 gha per capita per year, whereas the EF was 18.54 billion gha equivalents to 2.65 gha per capita per year (GFN 2015). This revealed that humanity needs the regenerative capacity of 1.5 Earths to provide the ecological goods and services we use each year. This shows that currently our earth is ecological debtor, because since 1990 we have reached the overshoot by September each year, and between October-December humanity is on over draw and pushing up against the Earth’s limits. This shows that we are using the world’s resources as they were inexhaustible, continually withdrawing from an account, but never paying in and thus jeopardizing our and our children future (Shahid, 2015). Under business as usual (BAU) scenario, by 2050 agricultural production must increase by 60 percent globally – and almost 100 percent in developing countries – in order to meet food demand alone for 9 billion. These targets can be achieved by intensifying land uses to produce more food. Over many years humans have used soils to gain great economic rewards. However, many of the methods used to gain those benefits are now seen as unsustainable, because in many cases they lead to degrade land (Shahid et al 2015). Hence land degradation (loss or reduction of land functions or land uses) becomes a serious worldwide environmental problem, especially in the drylands that occupy one-third of the Earth’s land surface. The drylands have the potential for agricultural intensification if the soil health is properly maintained during the growing season. Trials on soil amendments for forage production (barley) at the International Center for Biosaline Agriculture (ICBA) have revealed a general increase, and in some cases a doubling of fresh biomass over the control treatment where amendments were not added (Shahid et al., 2015).

Threats to soils for food security

One of the options to improve food security may be bringing more soils under cultivation, however, this may not be feasible because land resources of most developing countries are already stressed and further expansion is virtually not possible, especially in Africa due to landscape constraints. Global data shows that 33 percent of soils are in a state of degradation (Wall and Six 2015). Globally over 24 billion tons of fertile soil was lost due to erosion in 2011 that is 3.4 tons per person per year, costing US\$70 per inhabitant, or US\$419 billion worldwide. Soil salinization is another major constraint to food production, currently, an estimated 20 per cent of irrigated lands are salinized to various degrees and the global annual cost of salt-induced land degradation in irrigated areas could be US\$27.3 billion because of lost crop production (Qadir et al 2014). With the current pace (1.6 million ha per year) of loss of irrigated area due to salinization, the global irrigated cropland area (250 million ha) that is now contributing to 40% world

food production (FAO 2000) will be at high risk if at all does go out of production in nearly 150 years — an alarming situation since by 2050 we have to produce 70 per cent more food to feed 2 billion extra mouths in addition to current 7.3 billion. Considering the current situation of precious soil resources, Rio +20 recommends achieving “*Land and soil degradation neutral world*” this can only be achieved through pivotal sustainable land management practices.

International efforts to improve food security

Internationally, loss of biodiversity, keeping global warming to 2°C, and reducing green house gas emissions are emphasized on every forum to ensure food security for everyone. On the other hand, soil scientists have warned that these objectives can only be achieved if the soils will remain healthy and productive. Moderate United Nations (UN) scenarios suggest that if current trends continue, by 2050 humanity would demand over twice as much as the Earth can renew. This stresses the need to effectively manage our ecological assets including soils to ensure sustainable economic growth and development. Therefore, we need a paradigm shift in soil management and need to adopt innovative ways to use our soil resources to minimize the gap between EF and BC and produce food to meet future demands. In addition, we need to adopt multi-pronged approach to balance “*Agri-food-water-energy-environment*” nexus. This requires development and implementation of new agricultural and food policies, and water, environmental and soil protection plans. The concept of “*Climate Smart Agriculture-CSA*” could be a right step in this direction (The CSA sustainably increases productivity, resilience (adaptation), reduces/removes GHGs (mitigation), and enhances achievement of national food security and development goals (FAO 2013). The Food and Agriculture Organization of the UN is of the view that sustainable soil management could produce up to 58% more food.

Soil education is must to appreciate ecosystem services and food security

Irrational use of soil resources has been carried out by powerful competing economic and social forces that have little knowledge about the potential of soil resources and little or no regard for the long-term care of soils. Therefore, there is a lot riding on the shoulders of the world soil scientists community (over 60,000 worldwide) to educate the potential soil information seekers about the importance of soils and to enable them understand, conserve and manage soil resources efficiently and sustainably. The International Year of Soils (IYS 2015) aims to increase awareness and understanding of the importance of soil for food security and essential ecosystem functions. The ICBA since inception in 1999 has been providing soil education through various tools and developing skills and knowledge across different continents. We strongly believe that one of the globally recognized tools for soil education is the Soil museum. Soil museums display and preserve the different soil structures, patterns, types and soil diversity and has been an effective tool used to promote knowledge about soil, its importance, and the role it plays. However, there are very few soil museums in the world, namely: the Smithsonian’s National Museum of Natural History, Soil Museum of Thailand, World Soil Museum-ISRIC Wageningen, and recently China has taken the initiative to house soil museum in Beijing. No soil museum exists in the GCC and Arab countries despite the huge soil losses and disruptions that the region has faced over the centuries due to the harsh climate. To fill this gap, the unique soil museum that will be soon launched at ICBA has a mandate to serve the community with information about the UAE soil resources to help address various issues related to agriculture, food security, desertification, environmental protection and national development. The soil museum will be a place where soil information seekers will be able to access soil information and learn the values of soils and their conservation for sustainable soil services and environmental protection (all under one ceiling – a stop soil shopping). Our vision is to sustain healthy and productive soils for future generations to have ecosystem services for many years to come.

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