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The need for Healthy Soils for Sustainable Food Security Where do we stand?

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Soils are under-pressure by a host of elements, including erosion, salinization, bourgeoning population, etc. Overexploitation of soil resources is making food security at risk. The question arises whether we will be able to feed our population in future? Food going waste is another neglected dimension juxtaposed with increase in population. Thus, maintaining soil health for sustainability of food production is sine qua non for food security. The subject has been scholarly discussed in the paper by the author from UAE – Editor

Overexploitation has shrunk the planet Earth to an unprecedented level and there is a growing concern that over years it may not be able to provide sufficient food to meet human demand. Rapid population growth, soil erosion, salinization, contamination, urbanization, overgrazing and biofuel production are the main factors to increase pressure on land resources.

- Worldwide over 24 billion tonnes of fertile soils are lost on croplands to erosion every year – that is more than 3 tons of soil for every person on the planet, costing 70 US$ per person annually. Without fertile soils, food security, poverty alleviation and climate change mitigation and adaptation will not be achieved.
- Global data shows that 33 percent of soils are degraded due to diversity of ailments, whereas 20 per cent of irrigated lands are salinized to various degrees. 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).
- The impact of climate change is another constraint to achieve sustainability in food security. IPCC synthesis report (IPCC 2014) has recognized the major impact of climate change as, food and water shortages, increased displacement of people, increased poverty and coastal flooding.

Global ecological footprint, biocapacity and overshoot

With the rapid population growth there is growing pressure on land. For example, in 1960, 2 peoples were fed on one-hectare land, increased to 4

peoples per hectare in 2005, and by 2030 more than 5 people will be fed by one hectare. This shows that land resource sustainability for future is at risk, and, therefore, its measurement and conservation is imperative.

Ecological footprint (EF) and Biocapacity (BC) are the indices which are usually used to measure resource sustainability. In 2011, Earth's BC was 12.04 billion global hectares (gha) which is 1.72 gha per capita, whereas the EF was 18.54 billion gha equivalents to 2.65 gha per capita (Global Footprint Network 2015).

This reveals that humanity needs the regenerative capacity of 1.5 Earths to provide the ecological goods and services we use each year (Figure 1 and 2).

By 2050 we will need to feed 2 billion more people. Would it be possible without overwhelming the planet?

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 soils as if they were inexhaustible, continually withdrawing from an account, but never paying in. Current practices show we are taking more

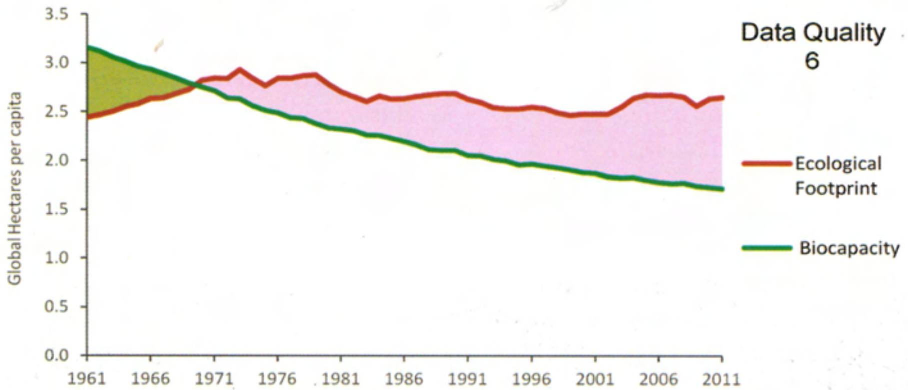
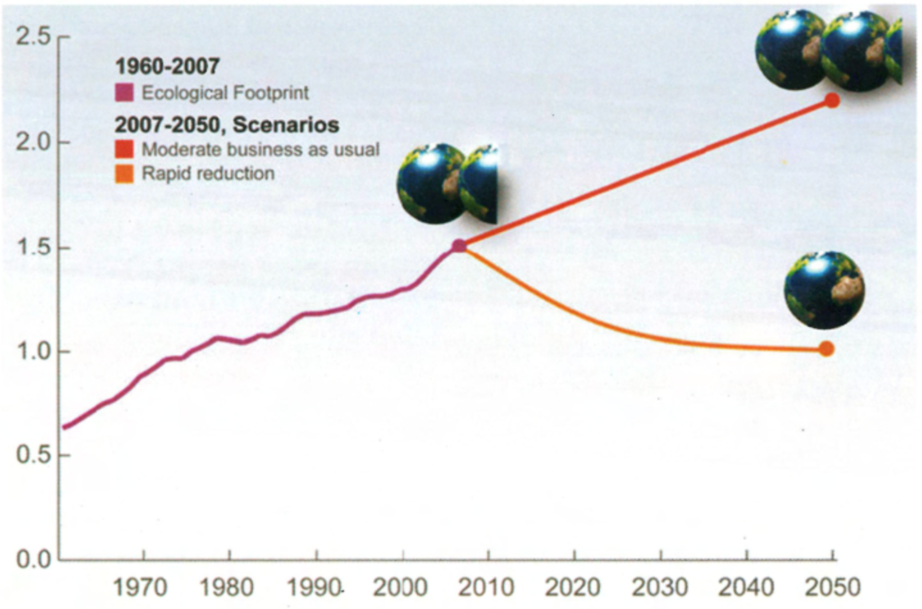


Figure 1: World resource demand (EF) per person and resource supply (BC) (GFN 2015 National Footprint Accounts 2015 Edition)



y-axis: number of planet earths, x-axis: years

Figure 2: Number of earth planets required by 2050 to feed 9 billion (Ewing 2010)

from our ecosystems and natural processes than can be replenished, thus we are jeopardizing our and our children future. Looking at the water situation, water use has been growing at more than twice the rate of population increase in the last century. It is projected that by 2025 there will be 50% increase in water withdrawal in developing countries and 18% in developed countries, whereas 1.8 billion peoples will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress condition.

Where Pakistan stands on Global Ecological Footprint and Biocapacity scale

The EF and BC of Pakistan since 1961 to 2011 is show in figure 3 revealing BC less than EF since five decades, and comparison with world average (global hectares per person) is shown in figure 4. This shows Pakistan demand on nature (EF 0.7 gha per person) is much less than the world average (2.65 gha per person), as well as it has lesser biocapacity (0.4 gha per person) compared to world average of 1.72 gha per person (Figures 1 and 4). There is net BC deficit of 0.3 gha per person within the boundaries of Pakistan, which has to be compensated through food import. These figures suggest that in order to feed Pakistani population it requires 1.8 countries in order to provide for the country's consumption footprint. The good sign lays in the fact that if everyone in the world lived the average lifestyle of a resident in Pakistan only 0.4 earth planet will be required, but this may not be good option as many live below poverty line.

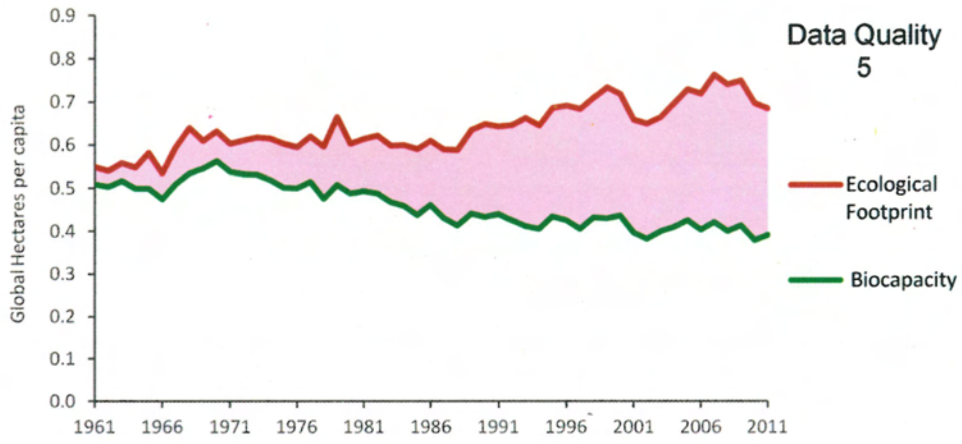


Figure 3: Resource demand (EF) per person and resource supply (BC) in Pakistan (GFN 2015 National Footprint Accounts 2015 Edition)

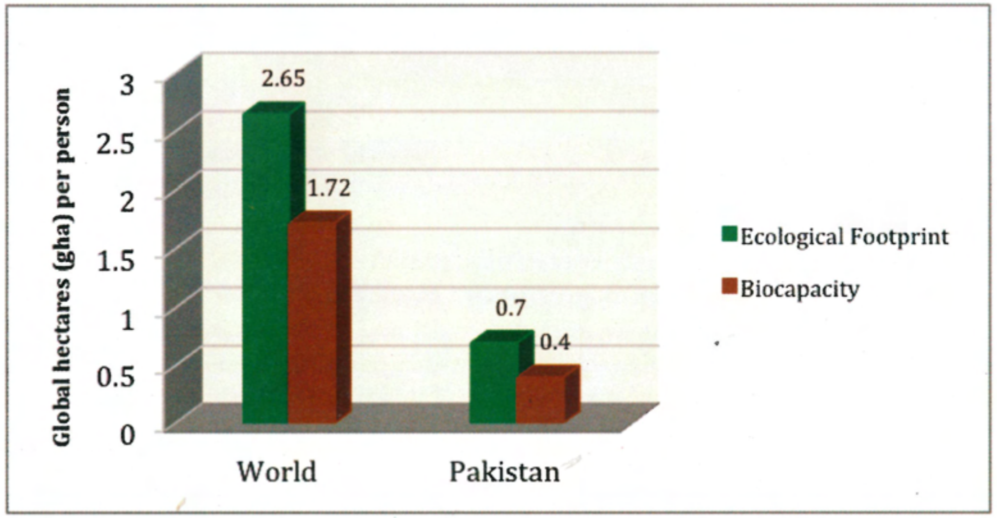


Figure 4: Comparison of EF and BC of Pakistan with world average (GFN 2015 National Footprint Accounts 2015 Edition)

Business as Usual scenario and food demand for 9 billion

Under business as usual 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. However this may not be feasible because land resources of most developing countries are already stressed and further expansion is virtually not possible. Globally there are 1500 million ha cropland including

250 million ha (17%) irrigated producing 40 per cent world food, and 1250 million ha (83%) rainfed agriculture contributing 60 per cent world food production. Using sustainable land management practices agriculture intensification in both irrigated and rainfed agriculture may be possible, however, looking at the other end to increase agriculture lands may not be a viable option in many countries.

Halving hunger and poverty by 2015 – MDG 1

The target of achieving Millennium Development Goal (MDG 1) "Eradicate extreme power hunger" by 2015, has already been achieved by halving poverty between 1990 and 2010. However, almost a billion people are still going hungry, while 1.2 billion peoples are still living in extreme poverty and 180 million young children are still suffering from chronic under nutrition, while we waste 1/3 of the food we produce, therefore, there is potential to improve storage facilities and decrease postharvest losses and enhance off-take through holistic extension services to farmers. To address global hunger completely, 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" matrix. This requires development and implementation of new agricultural and food policies, and water, environmental and soil protection plans. The concept of "Climate Smart Agriculture', could be a right step in this direction. The CSA is not a single specific agricultural technology or practice that can be universally applied. It is an approach that requires site-specific assessments to identify suitable agricultural production technologies and practices. This transformation of agriculture to CSA is being promoted by FAO.

How soil scientists view soil health

Soil scientists have warned that agriculture intensification can only be achieved if the soils will remain healthy and productive. Moderate United Nations scenarios suggest that if current trends continue, by 2050 humanity would demand over twice as much as the Earth can renew. Remember we have only one planet and there is no virtual Earth to import. Earth is the only planet known to have an atmosphere containing free oxygen, oceans of liquid water on its surface, and, of course, life. There is immediate need to effectively manage our soils to ensure sustainable economic growth and development.

How ICBA perceives the alarming situation and setting the way forward

ICBA has vast experience in managing marginal lands and introducing salt-tolerant production systems and has been working in many countries of SSA, CWANA, MENA, CAC, GCC, SA regions. ICBA scientists believe that it may be possible to keep the soils healthy and productive for long time when a strong link is maintained between the research-extension-farmers. Various features of maintaining soil health are listed in the box below:

How to maintain soil health for long term food rewards ICBA approach

- Publish national soil maps and use soil resources rationally through soil protection policies
- Invest in soil museums to promote soil education and the use of it for society and development
- Expand national agriculture based on irrigated agriculture suitability of soils
- Identify constraints to soil health through science based diagnostics and adopt site specific best land management practices
- Adopt conservation agriculture practices (low, no till and mulching) to conserve soil moisture and organic matter
- Adopt Integrated Soil Fertility Management practices including inorganic and biofertilizers as well as green manuring
- Educate farmers in adopting 4Rs (Right fertilizer, Right rate, Right place, Right time) concept of fertilizer management
- Where soils are saline and saline –sodic, adopt integrated soil reclamation program using physical, chemical, hydrological and biological methods based on the problem diagnostics
- Strengthen research-extension-farmers link for speedy delivery of new technologies at farm gate and link farmers to market for better pay offs.
- Witness the impact through determining livelihood improvement

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