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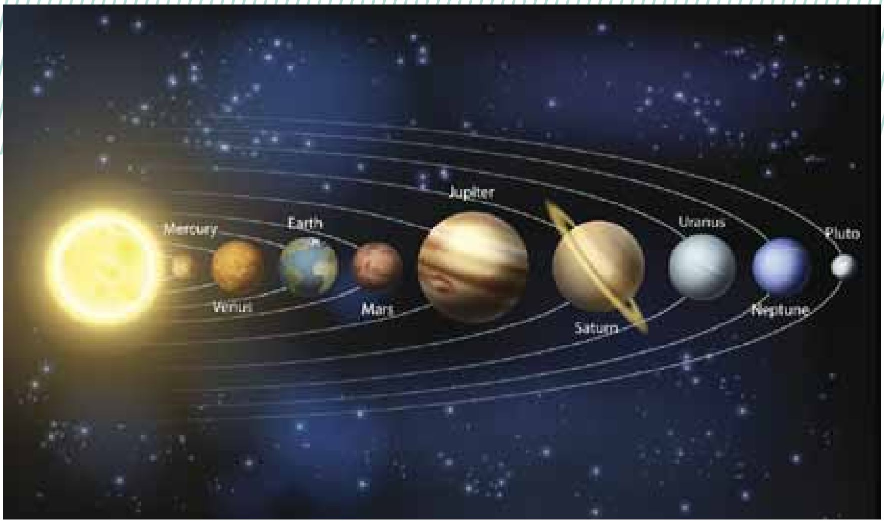

Solar system showing earth size and distance relative to other planets (source: www.engadget.com)

Earth is shrinking for Ecosystem Services – Where Do We Stand?

Among all planets in the solar system, Earth is a unique planet known to have an atmosphere containing free oxygen, oceans of liquid water on its surface, and of course, human life. Total land area is 148.94 x 10^6 km^2 (29.2 percent) whereas water occupies 70.8 percent area of the planet. The soils on Earth deliver ecosystem services such as food, fibre and fuel, construction material, human infrastructure, habitats for living organisms, nutrient cycling, climate regulation and carbon sequestration that enable life on earth.

Soil along with water is one of life's essentials and among the most fundamental of our natural resources

The Food and Agricultural Organization (FAO) of the United Nations (FAO-ITPS 2015) has released "*Status of the World's Soil Resources Report*" and celebrated 2015 as International Year of Soils. The report clearly states:

The majority of the world's soil resources are in only fair, poor or very poor conditions and that conditions are getting worse in far more cases than they are improving.

There are diversified constraints to soil, among others. The most serious threats are rapid population growth and subsequent urbanisation. In the year 1700, the world population was only 0.6 billion, which increased to 1.6 billion in 1900 and 7.3 billion in 2015. The population is projected to be 9.6 billion in 2050 and 10.9 billion by the year 2100. The rapid population growth has stressed the planet and the soil resources for ecosystem service. It is very wise to say "*rapid and continuing population growth and subsequent urbanisation are the biggest challenge for healthy and productive soils to sustain food security and ecosystem services on this planet*", knowing that there is only one Earth and no virtual planet to import to produce ever increasing food demand and provide ecosystem services.

Since the beginning of time, Earth has the capacity to provide ecosystem services more than the human demands. It is only in 1970 when the human demand to meet its diversified requirements was reached to one Earth planet, however, due to continuously diminishing earth resources, for the last 45 years humanity's demand has exceeded the planet's biocapacity. Therefore, humans required more than one planet to meet its demand. This is a serious concern for future generations.

The Earth resources are measured in global hectares-gha (a hectare of biologically productive land or sea area with world average bioproductivity in a given year), the gha is globally compared standardised unit. The human demand on the earth is measured as ecological footprint (EF), whereas Earth's supply is measured as biocpacaity (BC). The EF accounts track the biologically productive land and water area that human population requires to produce what it consumes and absorb its waste under prevailing technology. The BC is the capacity of the ecosystem to produce useful biological materials and to absorb waste materials (specifically CO_2) generated by human, using current management schemes and technologies. According to Global Footprint Network (GFN 2010) in 2010, global humanity's total EF was 18.1 billion (gha) with world population at seven billion people, the average EF was 2.7 gha per capita, with a 12 billion gha of biocapacity (1.7 gha per capita). It is apparent that currently humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste. This means that it now takes one year and six months to regenerate what we use in a year.

If we do not act urgently, we will require more than two earth planets by 2100

This is also reflected from the current global situation, that today more than 80 percent of the world's population lives in countries that use more resources than what is renewably available within their national boundaries. The figures of global distribution of BC and EF are astonishing - of 12 billion gha biocapacity, ten countries (Brazil, China, USA, Russia, India, Canada, Indonesia, Australia, Argentina, Democratic Republic of Congo) host 7.36 billion gha Biocapacity (61.3 percent). In contrast to five countries (China, USA, India, Brazil and Russia) who use 47 percent of global resources.

The global biocapacity has reduced significantly. In 1961 it was 3.2 gha per capita and 1.7 gha per capita in 2010

Highly degraded land due wind and water erosion

The soil resources are continuously stressed, and current figures reveal by 2050 the population of the developing world will be 64 percent urbanised, while in the developed world such a figure is 86 percent. Therefore more land will be occupied by infrastructures, houses, and soils. In Europe only, an area equivalent to the city of Berlin is urbanised annually. Globally 33 percent of land is in the state of degradation. Worldwide over 24 billion tons of fertile soils are lost on croplands to erosion in just 2011, that is more than three tons of soil for every person on the planet, costing 70US$ per person. By 2050 annual loss of crop yield due to erosion is projected to be 10 percent compared to 0.3 percent today. The world is losing 2,000 hectares of farm soil daily to salt-induced degradation. Salt-spoiled soils worldwide are 20 percent of all irrigated lands, an area equal to France, extensive costs include US$27 billion in lost crop value per year.

The world leaders gathered at Rio+20 (United Nations Convention on Sustainable Development) in Brazil in 2012 and passed a declaration "*land and soil degradation neutral world*". In order to achieve this sustainable land management practices are pivotal. Sustainability requires that human demand for resources is less than what the biosphere can renew. In order to achieve sustainability, by 2050, agricultural production must increase by 60 percent globally, and by almost 100 percent in developing countries in order to meet food demand alone. Agriculture expansion in many countries is not a viable option due to water scarcity and arable

Climate Smart Agriculture in the deserts of the United Arab Emirates

lands already under agriculture and no more arable land available, where land is available in sub-Saharan Africa and Latin America, more than 70 percent suffers from soil and terrain constraints. Desertification processes affect about 46 percent of Africa. Whatever food is produced globally, a third of the food goes to wastage due to poor management, such a wastage can be reduced through improved storage facilities, reduced post-harvest losses and enhancing off take. Saving these food losses can feed two billion extra mouths. In general, the present and future conditions do not look good for food sustainability. However, if the constraints are properly diagnosed and understood, a best soil management and uses strategy can be developed. Loss of soil resources and functions can be avoided through careful soil management, using proven methods and technologies that can increase the food supply.

There is hope to increase food to meet future demand if *Climate Smart Agriculture* (CSA) practices are adopted and farming community is educated. The CSA requires *site-specific assessments* to identify suitable agricultural production technologies and practices. The CSA is location-specific and knowledge-intensive, identifies integrated options that create synergies, identifies barriers to adoption and provides appropriate solutions, strives to achieve multiple objectives while prioritising benefits and strengthening livelihoods by improving access to services, resources and markets.

Farmer's education on soils is pre-requisite for technologies adoption, in general soil education is basic infrastructure for the nation and better knowledge reduces risks in decision-making. It is therefore important to strengthen the link between research-extension-farmer to assure the technologies reach the end users timely. It is believed, that if the farmers receive specialised training in soil and water management, nutrient management, crop management, pest management, post-harvesting and marketing, significant, agricultural intensification is possible leading to increased food production per unit area that will set the way forward to achieve food sustainability.

References

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