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Editorial

The Future of Agriculture and Climate Change: Sustainable Path is Imperative

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Editorial

Since the 1980s, globalization of production accelerated rapidly reducing the relative role of agriculture compared to manufacturing and service sectors. Further, industrial agriculture led to severe depletion of land and soils, water scarcity, and climate change. Globally agriculture is responsible for 25% of the CO_2 emissions. Sustainable agriculture balance food production, preservation of the production environment and social cohesion [1], conserve water, reduce the use of fertilizers and pesticides, and promote biodiversity in crops grown and maintain economic stability of farms and farmers quality of life. Global food production should increase to feed 9 billion people by 2050 [2].

Water scarcity, climate change and land degradation threaten the livelihoods of millions of poverty stricken farmers in Asia and Sub Saharan Africa. Asia as a net food and animal feed deficit region needs to lift its game [2]. Nearly 70 percent of the water is used for agricultural production, livelihood security and environmental sustainability. But climate change will result in frequent occurrence of extreme events [3]. Increased water scarcity, crop and livestock losses mean that freshwater resources need to be more carefully managed [4]. In Malaysia serious depletion of water quality from industry has occurred due to arsenic and chromium which exceed the WHO recommended safe minimum standards [5]. Analysis of Malaysian rice production also indicates that it is more vulnerable to rise in temperature than a fall in temperature [6].

By 2025, more than 30 million ha will suffer from water scarcity (both quality and quantity). Severe water stress has led to excessive abstraction of ground water simultaneously reducing water quality and drop in the water table in India, China, Bangladesh and Pakistan and many other countries [7].

The Mekong Delta region faces the prospect of lower rainfall and reduced valuable land due to climate change Extreme drought in the Mekong Delta in 2016 resulted in sharply higher salinity levels intruding into the delta. Rice production fell 1.1 million tons according to the Food and Agriculture Organization [2,8]. Climate change increase the amount of salt water in Mekong tributaries threatening the viability of rice farming. Australian Center for International Agricultural Research scientists say Vietnamese rice farmers successfully adapted to changes over the past 30 years, but this may be under threat due to agro-hydrological changes and farmers may need to restructure the rice sector from three rice crops a year to two crops, but grow a higher value grain.

Climate change has affected ecosystem functions and pollinators, such as bees, birds and bats. Between April 2015 and April 2016, beekeepers in the United States lost 44% of their colonies and in the UK, beekeepers reported losses of almost 17%, according to the British Beekeepers Association. In Europe alone, 84 percent of the 264 crop species are animal pollinated and 4,000 vegetable varieties exist due to pollination by bees [2]. Three-quarters of all food crops rely on pollination. In the UK alone, the free fertilization provided by pollinators is estimated to be worth $680 million a year to farmers [9]. Vietnam exported only 25,000 tons of honey in 2016 due to decline of bee populations.

International trade results in flows of 'virtual water'. Around 13% more of the water used for crop production in the world is not used for domestic consumption but for export (in virtual form). The countries with the largest net virtual water export are United States, Canada, Thailand, Argentina and India. The largest net import appears to be in Japan, the Netherlands, the Republic of Korea, China and Indonesia according to some studies.

Sustainable agriculture is holistic and integrates social, environmental and economic aspects of agriculture. industrialized agriculture, uses large quantities of pesticides, fertilizers, and genetically modified organisms. It encourages use of large amounts of fossil fuels and large machines to manage the farm land. The Green Revolution is has made it possible to produce large quantities of food but spawned serious challenges [1]. Sustainable agriculture uses 30% less energy per unit of crop yield in comparison to industrialized agriculture reducing pollution, maintain soil quality, reduce soil degradation and erosion, and save water. Sustainable agriculture will contribute to increasing biodiversity of the area and health of the natural environment.

Future research on agriculture should focus on poorer farmers in developing countries to include growing plants that can create their own nutrients to reduce the use of fertilizers and minimizes pesticides. Farmers must utilize water management systems, such as drip irrigation, that uses less water. Crops grown through sustainable agriculture limits the risk of people becoming ill from exposure to these chemicals and more nutritious because the overall crops are healthier and more natural. Brazil, for example, invested heavily in breeding soybean varieties which could grow in semi tropical conditions and poor soils and resist pests and diseases; this has contributed to it being a major soybean exporter today [10]. Research needed to develop rice varieties that can cope with rising salinity when water levels are too high or dry conditions, aimed at sustainable solutions for all delta rice production regions. More prudent strategies are required to manage water resources if we are ensure its sustainable use.

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Major changes in policy decision making is necessary in supporting appropriate adaptation and mitigation mechanisms for climate change. For example, groundwater irrigation require contextualized understanding of climate inputs using location specific empirical information on how farmers understand climate change. The subsidy policy for electricity needs to be rationalized by promoting diversification of livelihoods away from groundwater irrigation. Short duration drought tolerant rice varieties, construction of water harvesting structures that can conserve water facilitate the process.

India must bring back the tank system with its pristine ecologically sustainable properties by restoring and harnessing social capital which can be enhanced by linking group wells which collectively managed by farmers. This social-ecological approach including social capital in determining access to water resources is important because of the deeply interactive relationships between water resources and social systems in India. Viewing water management using modernist aggregates such as profit and efficiency instead of focusing on the ecological, social, cultural and economic consequences of intensive surface and tube well irrigation is unsustainable. The tank system is a social ecological system which is ecologically sustainable and the locus of community life which has been put under stress due to excessive groundwater draw down from electric and diesel tubewells.

Agriculture and food security requires urban planners to exploit the under-utilized space to produce vegetables on rooftops, public space between buildings, and underground space. Increasing consumption of indigenous vegetables could avert food crises of the 1960's. FAO estimates that in urban areas, agriculture contributes up to 20 percent to the world's food supply. New ways of urban farming in Asian countries like Korea, Japan, and Singapore have complemented to rural farming, especially supplies of vegetables and dairy products. Commercial farms based on vertical vegetable farming and indoor artificial lighted farms should be an explicit part of the food security policy of all countries and should receive Government support. Food waste during transport and processing can reach up to 50 percent, and new technology to reduce losses can halve food losses.

Sustainable agriculture must be examined using broader analytical frameworks within a multidisciplinary platform that explicitly recognizes natural resources scarcity (eg. Water scarcity) and climate change. This will lead to more environmentally benign, socially equitable and sustainable forms of development and achievement of the MSDGs ratified by 193 countries in 2016.

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