

# Biodiversity and Food Security in India: A Perspective through Agricultural Practices

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## Introduction

The recent unseasonal rainfall in the month of March - April 2015 across the northern region of India raised serious concerns regarding the unpredictability of weather condition and its adverse impact on food grain production. The subsequent suicides of the farmers in various parts of the country have further deteriorated the situation and the issues pertaining to the food security are becoming more critical and alarming. India enacted the National Food Security Act (NFSA) in 2013 in order to provide accessibility of food to around 67% of her population which requires around 61.23 million tons of food grain per year. This requirement under NFSA along with other operating food security schemes of state governments and the open market demand of food grains necessitates the record production of food grains every year. The efforts made by India through Green Revolution paved way for food self-sufficiency in the 80's which provided government both central and states to launch various food security schemes meeting the demand of the rising population. The food grain production and food security heavily depends upon agriculture. Agriculture being a nature dependent activity relies on conditions provided by ecosystems for producing food and it is also true that the well being of our ecosystem is dependent upon the biodiversity. There are two ways through which the relationship between agriculture and biodiversity can be explored. The first is **agriculture farm land biodiversity** which includes billions of different soil microbes that help in recycling of nutrients and in decomposing organic matter. It also includes wasps and bats that help reduce crop pests, to birds

and insects that pollinate crops, biodiversity helps farmers to successfully grow food and maintain sustainable farm landscapes. But not only does the maintenance of biodiversity help ensure viable crop production, many organisms and species have come to rely on particular agricultural landscapes for their very survival. **It can be argued in brief that not only agriculture supports biodiversity, but also is supported by biodiversity.** The second is agro biodiversity which includes the genetic diversity of varieties of crops and of cattle breeds. It is the result of thousands of years of human intervention in selectively breeding traits in animals and crops for particular agricultural benefits. This diversity is important for food security in case a crop variety fails due to drought, flooding or a disease, another variety might survive to avoid food deficiency.

## Indian Biodiversity Scenario

It is indeed important to have diversity of life which includes both flora and fauna on our planet earth for maintaining the basic life. Biodiversity plays a crucial role in cycling of water, pollination, nutrient cycling, climate control, crop harvesting. It is the biodiversity which is also crucial in providing medicinal products from various plants for ensuring the human well being. Biological diversity, or biodiversity, encompasses the variety of life at all levels of organization, from genetic diversity within a species to diversity within entire regions or ecosystems. Biodiversity is increasingly under continuous threat due to various reasons such as increasing urbanization, increasing deforestation, over exploitation of natural resources both terrestrial and marine, increased industrial agricultural, climate change and





increased human interference in the name of development. India is one of the 17 mega-biodiversity countries with 2.4 per cent of the global land area and 4 per cent of water. It accounts for 7 to 8 per cent of the recorded species of the world. So far, 45,968 species of plants and 91,364 species of animals have been documented. Over 5,650 microbial species have been described. India is one of the eight primary centers of origin of cultivated plants with about 375 closely related wild species including rice, pulses, millets, vegetables, fruits and fibre plants. There are nearly 255 breeds of animals such as cattle, sheep, goat, camel, horse and poultry found in India. India is also rich in cultural diversity and in traditional knowledge available with tribal communities. This clearly reflects India's rich biodiversity and also indicates India's potential of being global biodiversity hot spot. In this regard the policy initiatives which have been taken by Government of India have given further impetus to the conservation of biodiversity the Biological Diversity Act was enacted in 2002 and later on the Biodiversity Rules were notified in 2004.

### Food Security

The National Food Security Act, 2013 defines food security as *"To provide for food and nutritional security in human life cycle approach,*

*by ensuring access to adequate quantity of quality food at affordable prices to people to live a life with dignity and for matter connected therewith or incidental thereto."*

The World Bank defines food security as *"Access by all people at all times to sufficient food for an active, healthy life"* (Maxwell and Wiebe 1999: 828). However the most commonly accepted and used definition for food security, agreed upon at the World Food Summit is *"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life"*. (Pinstrup-Andersen 2009: 5).

### Applying Biodiversity in Food and Agriculture

There is a wide and varied range of agricultural practices that achieve the aim of improving system production in sustainable ways using biologically-based approaches. These usually involve improving the use of biodiversity for food and agriculture, combining inter- and intra-specific diversity in ways that increase production. The various aspects of agricultural biodiversity are (a) genetic resources for food and agriculture; or genetic factors (b) a biotic factors and (c) socio-

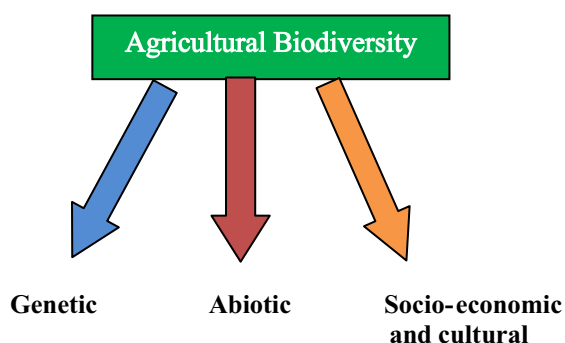


**Figure: 1** showing Mustard field with surrounding trees in Gomikhera Village (Lucknow). *Source: Author*



**Figure: 2** showing water body in Gomikhera Village (Lucknow). *Source: Author*





**Figure: 3** Depicting Agricultural biodiversity.  
Source: Author

economic and cultural factors which are required to incorporate in to the agricultural practices for having sustainable agriculture.

### Global Concerns: Some Reflections

Over the last ten years there has been increasing evidence that production and productivity are increasingly influenced by the changing frequency and intensity of extreme weather events (IPCC, 2007). It has been observed also that volatility in food provisioning due to unpredictable weather condition would lead to growing food insecurity. The 2008 food crisis reflected some of these concerns. As per the FAO during the last century, 75 percent of crop genetic diversity has been lost, a phenomenon referred to as genetic erosion.

### Rising Population and Rising Food Demand

The world population is expected to grow by over a third, or about 2.3 billion people, between 2010 and 2050. Increases in agricultural productivity will be needed throughout this period, although probably at a declining pace as the rate of population increase slows. Increased demand for meat, dairy, vegetable oils and other products will accompany the need to feed a larger population. Taking all these factors into account, FAO has suggested that global food production will need to increase by about 70% by 2050 relative to production in 2005 (Bruinsma, 2009). Although globally the agricultural food system has the potential to cope with the expected demand from

currently cultivated land, given sustainable management and adequate inputs (Fischer *et al.*, 2002), to meet the expected demand especially in countries having high population will be a huge challenge.

### Scarcity of Water

Agriculture accounts for about 70% of all water use globally and physical water scarcity is already a problem for more than 1.6 billion people (IWMI, 2007). By 2025, 1.8 billion people will live in countries or regions with absolute water scarcity and two-thirds of the world's population could be under water-stress conditions. Over-pumping of groundwater aquifers is a serious concern in many countries throughout the world, especially in China, India, Mexico, Pakistan, and most of the countries in North Africa and the Middle East (Seckler *et al.*, 1999).

### Nutrients Overuse

Overuse and mismanagement of mineral fertilizers have polluted groundwater to different degrees in almost all developed countries and, increasingly, in many developing countries. This affects downstream agricultural and natural systems and results in high costs of purification to obtain drinking water.

### Climate change

The Fourth Assessment Report by the Intergovernmental Panel on Climate Change indicates that crop yield losses will occur with minimal warming in the tropics, due to decreased water availability and new or changed insect pest incidence (Easterling *et al.*, 2007). Southern Africa could lose more than 30% of its main crop, maize, by 2030, while in South Asia losses of many regional staples, such as rice, millet and maize, could exceed 10% (Lobell *et al.*, 2008). In contrast, crops in mid to high latitudes may benefit from a small amount of warming (up to +2°C) but plant health will eventually decline with additional warming. Fish resources and the fishing industry will also be severely affected, through greater incidence of diseases and algal blooms.





## Conclusion

There are some vital statistics which deserve considerable amount of attention in this context for instance only 12 plant crops and 14 animal species today provide 98% of world's food needs with wheat, rice and maize alone account for more than 50% of the global energy intake (Ehrlich and Wilson 1991, Thrupp 2000). The FAO suggests that three-quarters of the varietal genetic diversity of agricultural crops has been lost in the past 100 years (FAO 2008). Since the 1960's it is estimated that China and India have lost thousands of landraces of rice and Mexico more than 80% of its maize diversity (Tuxill 1999). Diverse and genetically unique livestock species, those that are probably more resilient to emerging diseases, are also being lost at an alarming rate (Pilling 2010). The genetic erosion of our nutritional base has considerable implications for food security, nutrition and health (Vinceti *et al.* 2008). Although food security is dependent on issues of sustainability, availability, access and utilisation, and not production alone, it is evident that a "new agriculture" (Steiner 2011) needs to be found to feed the world's population both efficiently and equitably. The Declaration of the World Food Summit on Food Security (FAO, 2009) stated that not only should there be increased investment in agriculture to meet the challenge of achieving food security but that this investment should be directed more consistently towards sustainability.

In fact despite the rising food production in India and the world over the non availability of food and its nutritional deficit is a serious cause of

concern. In India around 47% children are malnourished this reflects a poor scenario of the grim situation of food availability and its nutritious value. It is highly pertinent in this context that the agricultural practices should be altered in coming decades so that the adverse impact of agriculture on the environment is reduced along with maintaining the productivity and sustainability.

The overall objective of food security can be successfully achieved by focusing upon the biodiversity of food and agriculture. This entire change in the approach requires policy, social and financial support and continuous efforts involving the entire stake holders. In order to make agriculture practices friendlier to biodiversity conservation, it is required that agriculture is oriented towards some of the identified measures are Integrated pest management, soil management, water management, conservation agriculture, eco agriculture and organic agriculture. Therefore agricultural practices should be changed according to the changing climate and biodiversity patterns. The emphasis should be on shifting to more sustainable ways of agriculture India adopted Green Revolution in late 60's in order to secure food self-sufficiency however the adverse impact of Green Revolution on the environment raised serious questions regarding the success of Green Revolution. Hence all the efforts directed towards food security and food self sustainability should not ignore the unfavourable impacts on our environment. In this regard serious and sincere efforts are required for sustainable agriculture through conservation and expansion of India's rich biodiversity heritage.

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