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LINKAGES BETWEEN AGRICULTURAL DEVELOPMENT AND ENVIRONMENTAL SUSTAINABILITY IN INDIA

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ABSTRACT

The resources like food, water, and a healthy environment which are essential to human well-being are threatened in developing countries like India. Increasing agricultural productivity and ensuring environmental sustainability are interconnected and essential elements. In this paper an attempt has been made to identify and assess the mitigation of negative impacts of agriculture in addition to other issues. Main objective of this study is to address the question of the environmental impacts of agriculture, assessing environmental impact of the farm level taking into account environmental objectives like soil erosion and water quality etc. The impacts may vary with farming system, technologies used and other choices of individual products. In this study the linkages between agriculture and environment would be built on the strength of existing studies and secondary data at the national level.

KEYWORDS: Agricultural, Environmental

INRODUCTION

Agriculture has a significant role in socio-economic fabric of India. Unsustainable farming practices have negative environmental impacts like pollution, soil erosion, climate change, land conversion and habitat loss etc. It aims to produce food while establishing an ecological balance to prevent soil fertility or pest problems. The impact of organic agriculture on natural resources favours interaction within the agro-ecosystem those are vital for both agricultural production and nature conservation. The biggest challenge in India is to increase production, while minimizing environmental impact. The introduction of modern technology based agriculture systems, meant the application of inputs like chemical fertilizers, chemical pesticides and high yielding varieties. Imbalanced proportioning of chemical nutrients is a major problem associated with fertilizer application in India.

India cannot avoid the use of chemical fertilizers as the demand for food for the ever growing population is very high. The present annual production of food grains is about 191 million tonnes. A rapid increase in agricultural production is possible only by increasing the application of chemical fertilizers. Over 9 million tonnes of nitrogen is used for crop production annually in India, but there is still a great shortage of nitrogen to meet the requirement of crops; hence the gap between demand and supply is very high. The demand for processed food items is increasing therefore the application of nitrogen in food industries will also increase in the near future.

Land degradation is one major constraint for Indian agriculture. Although, the Indian Government has recognized the necessity of managing and conserving resources for agricultural development since the first Five Year Plan, the measures initiated have been inadequate. The environmental challenges are posing problems for the future of Indian agriculture. Differential approaches and policy instruments will be required to address these problems. The shift from input

intensive to sustainable, particularly organic farming is a difficult task as it involves a number of policy measures dealing with a variety of issues ranging from the transfer of information and technology to the development of markets. Our purpose is to look at various environmental impacts arising from agriculture in the domains of soil, water, air and biodiversity with the specificities occurring in each agro echo system. Different policies on agriculture and environment and their possible impacts are also presented.

OBJECTIVES OF THE STUDY

- To identify and assess the mitigation of negative impacts of Agriculture.
- To focus on local effects taking into account farmer practices.
- Identifying and implementing better management practices that protect the environment as well as producers' interests.

MAJOR IMPACTS OF AGRICULTURAL DEVELOPMENT

Regions throughout India differ in types of farming they use; some are based on horticulture, ley farming and agro forestry etc. Due to geographical diversities and different climates in different regions affect each region's agricultural productivity and environment. Despite the study decline in agriculture's contribution to the country's GDP, Indian agriculture is the biggest industry and plays a key role in the socio-economic growth of the country. A system perspective allows in understanding each system according to its features in a particular region. Environmental impacts dependent on resource utilization patterns, so we need to look beyond an agro-climatic approach that enables us to characterize agriculture according to the various production patterns.

Imbalance in Ecosystem

A doubling of global food production would have major impacts on the ability of non-agricultural ecosystems to provide services vital to humanity. Existing non-agricultural ecosystems provide, at no cost, pure drinkable water. In contrast, the groundwater associated with intensive agricultural ecosystems often contains sufficiently high concentrations of nitrite and nitrates or of pesticides and their residues as to be unfit for human consumption. Expensive treatment is required to make it portable. Agriculture depends on soil fertility created by the ecosystems destroyed when lands are converted to agriculture. Especially on sandy soils, the best way to regain soil fertility lost because of tilling is to allow reestablishment of the native ecosystems. The brief overview of ecosystem services demonstrates that society and agriculture, depend on many services provided by non-agricultural ecosystems. Although it is difficult to establish economic values for such services, it is clear, that when possible, technological substitutes for lost ecosystem services can be extremely expensive. This highlights the need for public policy to consider the short term and long term costs of actions that decrease the ability of non-agricultural ecosystems to provide vital ecosystem services to society.

NEGATIVE CONSEQUENCES OF AGRICULTURAL DEVELOPMENT

Habitat Conversion and Loss

The main impact from farming comes from clearing natural habitats for many wild plants and animal species. However, rising demand for food and other agricultural products has seen large scale clearing of natural habitats to make

room for intensive monocultures. This ongoing habitat loss threatens entire ecosystems as well as many species.

Soil Erosion and Degradation caused by Indian Agriculture

Erosion commonly occurs following conversion of natural vegetation to agricultural land carrying away fertile soil as well as fertilizers, pesticides and other agrochemicals. Loss of nutrient rich fine soil not only reduces productivity, but also results in silting of water bodies and streams and induces release of soil carbon from particulate organic material. India is losing about 8.2 million tons of nutrients every year as a result of soil erosion [Prasad and Singh, 1990]. According to National commission on Floods, the country suffered losses totalling Rs3180 crores during 90's. Soil erosion is a major problem in the arid, rain fed and hill regions in India.

Table 1: Extent of Soil Degradation (Human Induced) Under Different Degradation Types

Degradation Type	Degree of Degradation (Million Ha)					Area Affected
	Slight	Moderate	Strong	Extreme	Total	%
Water erosion	27.3	111.6	5.4	4.6	148.9	45.3
a. Loss of topsoil (Wt)	27.3	99.8	5.4	-	132.5	40.3
b. Terrain(Wd) deterioration	-	11.8	-	4.6	16.4	5
Wind erosion	0.3	10.1	3.1	-	13.5	4.1
a. Loss of topsoil (Wt)	0.3	5.5	0.4	-	6.2	1.9
b. Loss of topsoil/terrain deterioration (Et/Ed)	-	4.6	-	-	4.6	1.4
c. Terrain deformation/over blowing (Et/Ed)	-	-	2.7	-	2.7	0.8
Chemical deterioration	6.5	7.3	-	-	13.8	4.2
a. Loss of nutrient (Cn)	3.7	-	-	-	3.7	1.1
b. Salinization (Cs)	2.8	7.3	-	-	10.1	3.1
Physical deterioration					16.6	3.5
a. Waterlogging (w)	6.4	5.2	-	-	11.6	3.5
Total (affected area)	36.8	137.9	8.5	4.6	187.8	57.1
Land not fit for agriculture					18.2	5.5
Soils with little/ no degradation problem					90.5	27.5
Stable terrain- Under natural condition (Sn)					31.2	9.8
Total geographic area of India					328.7	100

***Source**: Sehgal and Abrol (1994)*

The above table presents the details of human induced soil degradation in India. As can be seen from the table above, *water erosion*is far the most important soil degradation problem in India. 45% of the area is affected by it. Water erosion is distributed throughout the country. The chemical processes include salinization, alkalization, pollution and nutrient depletion. The biological process on the other hand are related to the reduction of organic matter content in the soil.

Wasteful Water Use and Decline in Water Tables

Between 15-35% of water use by agriculture is estimated to be unsustainable. Unsustainable water use harms the environment by changing the water table and depleting ground water supplies. Excessive irrigation can also increase soil salinity and wash pollutants and sediment into rivers causing damage to freshwater ecosystems and species. The main cause of wasteful and unsustainable water use are:-

- Leaky irrigation systems
- Wasteful field application methods
- Cultivation of thirsty crops not suited to the environment.

The problem is made worse by misdirect subsidies, low public and political awareness of the crisis and weak environmental legislation.

Pollution and Health Hazards Arising From Indian Agriculture

In India the use of pesticides, fertilizers and other agrochemicals has increased hugely since the 1950s. For example, the amount of pesticide sprayed on fields has increased 26 fold over the past 50 years. Some pesticides are suspected of disrupting the hormone messaging systems of wildlife and people and many can remain in the environment for generations. Unlike, pesticides, fertilizers are not directly toxic. However, their presence in freshwater and marine areas alters the nutrient system and in consequence the species composition of specific ecosystems. Earlier large emissions of methane from rice fields have been ascribed to India because of large area (42.5m ha) under rice. According to US-EPA estimation the annual methane emissions from Indian rice paddies were 37.8Tg. Now, According to the measurements made by Indian researchers annual methane budget of 3-4Tg is ascribed for Indian rice fields.

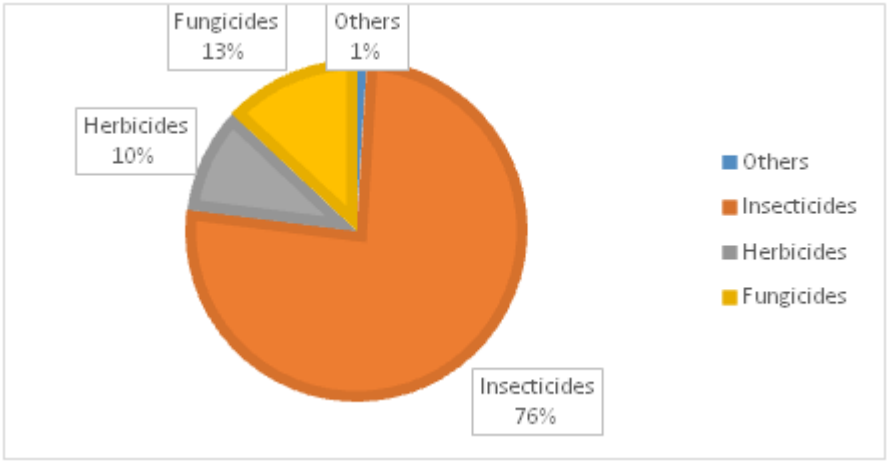

Figure 1

The above diagram describes the scenario of application of different pesticides in India. *(Source: J.Water Resource & Protection, 2010, 2, 432-434)*

SUGGESTIONS

The consumption patterns existing within society must be based on the clear understanding of the carrying capacity of the land.

New systems of learning are needed, using participatory methods and criteria for trustworthiness. The New understanding and solutions can only arise with wide public and scientific participation.

Organic farming is a multifaceted sustainable agriculture set of practices that can have a lower impact on the environment. Biodynamic agriculture and Permaculture are the methods that help to develop a holistic understanding of agricultural processes.

CONCLUSIONS

Agricultural ecosystems have become incredibly good at producing food, but these increased yields have environmental costs that cannot be ignored, especially if the rates of nitrogen and phosphorus fertilization triple and the amount of land irrigated doubles. It is critical that agricultural practices be modified to minimize environmental impacts even though many such practices are likely to increase the costs of production. When practised without care farming presents the greatest threat to species and ecosystems while sustainably managed, they can help preserve and restore critical habitats and improve soil health and water quality. Our efforts should include investigations of outbreaks, accidental exposure to pesticides and correlation studies.

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