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Intensive Farming, Land Degradation and Food Security Issues in India

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Abstract: Intensive farming is a method of production under which cultivation is practiced and producer tried to maximize yields from available land by increasing ratio of variable factors in per unit land area. Intensification one hand increase per hectare productivity of land and feed the increasing demand of food buton the other hand it poses soil, water and ecosystem health problems. How to come out of these problems which are facing the world? There is only way to promote sustainable farming practices have less soil and water degradation, organic farming may be help to come out these problems. How organic farming may be solution for soil and water degradation along with food security issues are examined with the help of existing literature.The analysis shows that intensive farming has polluted large extent soil, water and resultant food that are the cause of various human daisies.

Keywords: Intensive Farming, Land degradation and Food Security.
JEL Code: Q16, Q24, Q18.

Introduction

There is big debate on the issue of intensive farming and environmental domains degradation in across the world and it is proved that modern conventional farming has greater degree of negative impact on land

degradation than other farming methods such as organic farming, natural farming etc. As Alarcón and Bodouroglou (2011) pointed out that the modern intensive agricultural practices are a major source of GHG emissions, land degradation, biodiversity loss, and water scarcity and pollution. Degradation of environmental domains reduces the capacity of rural communities, women and vulnerable groups to meet minimum food needs, which will enforce the problem of food security. For strengthening the productive capacity and protecting environmental domains degradation need to provide financial and technical support of small-scale farmer's country like India, including rapid diffusion of sustainable agricultural technology and practices with the necessary supporting services to increase food production would make a remarkable contribution to improving food security and environmental sustainability. Furthermore, another gain of this strategy is to assigns a prominent role of small-scale farming community into translates faster economic growth and poverty reduction in large agricultural sector-based economy like India.

For achieving the twin goals simultaneously environmental sustainability and food security is only possible by promoting appropriate farming technology which will make minimum loss of environmental domains loos maximum output of food grains. For preventing future food security problem need to incorporate sustainable agriculture farming practices first in those areas, where farmers are doing organic farming by default, these regions are rain fed district of the county and north east state. For above transformation require a clear cut national policy framework, which will protect the financial loss of small scale farmers and provide technical supports in registration, training of compose formation, information soil and seed, and water related issues. So, the for making a "actual green revolution" which will protect the health of nature and human being along with producing enough food for growing population is need strong will power of politicians and farming community along with demand side support of business community. For achieving above twin goals need to increase public investments in rural

areas, secure property rights and expanding access to organic productive assets and inputs in support of small scale production.

Land is a finite natural resource and there is no alternative option to replace it by other resource. How to measures the degradation of land, generally it is measures by soil ingredients. The degradation of land is the result of both natural and biotic factors. Natural calamities like drought, floods and earthquakes are major factors responsible for land degradation and biotic factors consider human and animal activities by which over exploitation of soil and water resources, unscientific land use. Intensive farming craft salinity and alkalinity of soils, soil acidity and waterlogging in the command area where high inputs is practiced. These soil contaminations are affecting the agriculture production along with damaging the eco-system. Besides, intensification of agriculture, mining and shifting cultivation are also recognized as factors of land degradation in India.

In this paper tried to explain causes of discard intensive farming and greedy to adopt nature friendly farming system. What are the economic factors which pull the consumer and producer both to adopt nature friendly farming technology? This is appropriate time to recall for nature friendly technology in agriculture. The sustainable agriculture practices can help to achieve 'nutritional security' and ecosystem sustainability all rather than 'food security'.

Intensive Farming and Land Degradation

Intensive farming is a method of cultivation under which cultivation are conducted by using machines such as tractors for ploughing, showing; harvester for crop cutting; pump set for irrigation using drip or spring system along with using chemical fertiliser, pesticides and HYV seeds. This method leads to excess or over used the seed, chemical fertiliser, water and energy etc. The result as the water level reduced and the land, water both have polluted by using chemical and fertiliser continuously in increasing proportion. This intensification process finally affects the quality of produce

and some amount of chemical content reached in food grains through plants those are harmful for us and produces new kind of deceases. It means the intensive farming polluted the overall food chain system and the ecosystem. This greedy of making agriculture productive and profitable gives the birth of all kinds of environmental and human health problem.

Land degradation usually categorized into three categories i.e. one is physical degradation which refers to deterioration in physical properties of soil. Whereas second is biological degradation which refers to reduction in soil organic matter, decline in biomass carbon and decrease in activity and diversity of soil fauna. And the third is chemical degradation, which refers to the nutrient depletion. According to the National Bureau of Soil Survey and Land Use Planning (2004) nearly 146.8 Mha is degraded. Water erosion is the most serious degradation problem in India, resulting loss of the top fertile soil and terrain deformation. Based on first approximation analysis of existing soil loss data, the average soil erosion rate was ~16.4 ton per ha annually, resulting in an annual total soil loss of 5.3 billion tons throughout the country (Dhruvanarayan and Ram, 1983).Nearly 29 percent of total eroded soil is permanently lost to the sea, while 61 percent is simply transferred from one place to another and the remaining 10 percent is deposited in reservoirs (Bhattacharyya et al., 2015).

The land degradation estimated by different organisation for the different years. The land degradation problem arises after 1980s when the green revolution adopted the high yielding varieties of seeds, use of chemical fertiliser and pesticides. Table 1 present the continuous increase in the degradation of total land area after 1980s and highest was in 1994 study by National Bureau of Soil Survey and Land Use Planning. After 2000s the government of India started soil health and management programme resultant the 2004 study declined the total degradation area. The loss of soil ingredients varies from state to state in India. The States like Punjab, Maharashtra, Gujarat, Rajasthan and Madhya Pradesh has higher loss of soil ingredients than other states (Vasisht et al., 2003).

Table 1 *Land Degradation in India after 1980s*

Organisation and Source	Assessment Year	Degraded Area (Mha)
Department of Environment, Vohra (1980)	1980	95.0
SPWD, Bhumbla and Khare (1984)	1984	129.6
National Wasteland Development Board, (1985)	1985	123.0
Ministry of Agriculture, MoA (1985)	1985	173.6
Ministry of Agriculture, MoA (1994)	1994	107.4
NBSS&LUP (1994)	1994	187.7
NBSS&LUP (2005)	2004	146.8
ISRO, et al. Ajai (2009)	2009	105.48

Source: Various Studies on Land Degradation

The ultimate resulted of land degradation is Desertification. It is a process under which the moisture and organic component of soil are reduced through land degradation in arid, semi-arid and dry-sub humid areas. The recent use land degradation measurement methodology is called Satellite Mapping, which was carried out at with 1: 500,000 scale using multi-temporal Resources at AWiFS data. Table 2 presents the results of 2009 mapping

results of land degradation across the states in India by different activities[1]. A similar study is conducted by Sharma et al (2015) on land degradation, water erosion and vegetal degradation. He found around 90 percent of land degradation in most of the states and water erosion and vegetal degradation are within the range of 10 percent. So, the policy point views the soil erosion by water and vegetal activates pin point of policy makers.

State wise depredated land of area has been accounted; Rajasthan has the largest area 21.77 percent of the total gradated geographical area of the country under land degradation, followed by Jammu & Kashmir 12.79 percent, Gujarat 12.72 percent and Maharashtra 12.66 percent. As per study of Ajai et al. (2009) the total area under desertification is 81.45 mha, which constituted by water erosion (26.21 mha), followed by wind erosion (17.77 mha), vegetal degradation (17.63 mha) and frost shattering (9.47 mha) are the major processes of desertification.

Table 2. *State wise land degradation in India*

State	% Water Erosion	% Vegetal Degradation	% Other Activities[2]	Total (ha)	% of TGA
Andhra Pradesh	41.99	51.30	6.7	4964892	4.70
Arunachal Pradesh	9.60	58.37	32.0	1816788	1.72
Assam	35.00	63.10	1.9	2419086	2.29
Bihar	26.16	25.27	48.6	414783	0.39
Chhattisgarh	26.84	71.88	1.3	2635392	2.45
Goa	18.77	0.00	81.2	6245	0.01

[1] For detail of different activities see paper on 'Desertification/Land Degradation Status Mapping of India' by Ajai et al. (2009).
[2]Other Activities Includes; Eolian, Forest Shattering, Salinity/Alkinity, Mass Movement, Water Logging, Rocky barren and others.

Gujarat	50.62	20.41	29.0	13415308	12.72
Haryana/Delhi	0.00	0.00	100.0	235110	0.22
Himachal Pradesh	3.52	69.45	27.0	2762746	2.62
J&K	1.54	2.32	96.1	13497518	12.79
Jharkhand	63.82	35.25	0.9	1818986	1.72
Karnataka	40.38	55.23	4.4	1692736	1.60
Kerala	32.02	67.53	0.5	89977	0.01
Madhya Pradesh	37.93	60.12	2.0	3465458	3.28
Maharashtra	69.25	30.20	0.5	13359277	12.66
Manipur	20.65	78.78	0.6	1496806	1.42
Meghalaya	10.75	89.07	0.2	876898	0.83
Mizoram	0.06	99.94	0.0	1665153	1.58
Nagaland	0.00	0.00	100.0	1065678	1.01
Orissa	58.63	36.77	4.6	5469336	5.18
Punjab	58.28	41.72	0.0	10380	0.01
Sikkim	6.29	46.57	47.1	328449	0.31
Rajasthan	16.72	9.31	74.0	22966267	21.77
Tamil Nadu	21.02	76.54	2.4	451028	0.42
Tripura	0.00	97.84	2.2	681843	0.63
Uttar Pradesh	29.00	7.49	63.5	2237603	2.12
Uttrakhand	2.80	69.11	28.1	2983612	2.83
West Bengal	67.27	23.25	9.5	2660667	2.50
India	33.08	29.46	37.5	105488322	-

Source: Access data form Ajai et al. (2009)

Nearly one third (32.07 percent) of the country's land area is undergoing processes of land degradation. The process of land degradation occurs about eight major activities in the country. The Mapping analysis, water erosion is the most pronounced process, followed by vegetal degradation and eolian processes. Total area under land degradation is 105.48 mha. Area-wise Rajasthan, J&K, Gujarat and Maharashtra have high proportions of land

undergoing degradation. 81.45 mha land area of the country is undergoing the process of desertification.

Cause of Soil Degradation by Intensive Farming

The cause of land degradation either may be due to natural or by manmade. Natural causes include earthquakes, tsunamis, droughts, avalanches, landslides, volcanic eruptions, floods, tornadoes, and wildfires etc. The manmade cause is more serious than natural, the agriculture practices is the major cause of fertile land degradation. The Royal Commission on Agriculture in India Report (1928) predicted that "most of the area under cultivation in India has been under cultivation for hundreds of years, and had reached its state of maximum impoverishment many years ago … In this connection it must be remembered that deficiency of combined nitrogen is the limiting factor throughout the greater part of India". Agricultural activities and practices are the major cause of land degradation. It influenced soil degradation in ways such as land use, crops grown, input use, farming method and management practices. Some common cause of land degradation by agriculture and its related activities are; cultivation in fragile deserts and marginal sloping lands without any conservation measures, agricultural depletion of soil nutrients through poor farming practices, overgrazing, excessive irrigation, over drafting [3].

Unbalanced use of Fertiliser

Intensive farming practices, particularly in case of wheat (Triticumaestivum L.) and rice (Oryzasativa L.) system in India recorded more vulnerable in terms of soil nutrients. Indian farmers already practiced imbalanced consumption ratio of 6.2: 4: 1 (N: P: K) in 1990–1991, which has widened to 7:2.7:1 in 2000–2001 and 5: 2: 1 in 2009–2010 compared with a target ratio of NPK 4:2:1. As food grain production increased with time, the number of soil elements deficient increased in India. In 1950 there was only nitrogen

[3] Process of extracting groundwater beyond the safe yield of the aquifer

(N) deficiency and now the nine (N, P, K, S, B, Cu, Fe, Mn, and Zn) in 2005–2006 (Bhattacharyya, et al., 2015). Though the use of fertilizers has increased several folds, but the overall consumption is continuing low in most of the states. Wide spread Zn deficiency, followed by S, Fe, Cu, Mn and B in are common throughout the country. Nearly 20 Mt of the three major nutrients are removed by growing crops annually (Tandon,1992). The nutrient loss was estimation made by Prasad and Biswas, (2000) through soil erosion is another reason for soil fertility depletion, for an annual loss of 8 Mt of plant nutrients through 5.3 billion tons of soil loss.

Pesticide Overuse and Solid/Liquid Waste

Indiscriminate use of pesticides together with sewage sludge and composted municipal wastes leads to contamination of soil and water with toxic substances and heavy metals. Heavy metal pollution is due to improper disposal of industrial effluents and use of domestic and municipal wastes. Some commercial fertilizers and pesticides also contain appreciable quantities of heavy metals, which have undesirable effects on the environment. Indiscriminate use of agro-chemicals, such as fertilizers and pesticides, is often responsible for land degradation (Bhattacharyya, et al., 2015).

Excess Use of Tillage and Machinery

The excessive use of tillage and heavy machinery for harvesting creates soil and environmental problems. It creates Soil Organic Matter (SOM) problem leads to limited soil life and the poor soil structure. Another problem identified in puddling of soil for paddy cultivation, which degrades soil physical properties and has negative impacts on soil biology. The poor physical condition of soil leads to poor crop establishment and waterlogging after irrigation (Hobbs, et al., 2008). Improper use and maintenance of canal irrigation has contributed significant soil degradation problems like waterlogging and salinization (Bhattacharyya, et al., 2015).

Crop Residue Burning

Burning of crop residues for cooking, heating or simply disposal in fields is a pervasive problem in India and contributes to soil organic matter loss. Sehgal and Abrol (1994) study shows that nearly 3.7 Mha areas suffer from nutrient loss/depletion or both soil organic matters. According to the Ministry of New and Renewable Energy (2009), nearly 500 Mt of crop residues are generated every year and burned 125 Mt. Crop residue generated largest amount 60 Mtin Uttar Pradesh followed by Punjab with 51 Mt and Maharashtra with 46 Mt. Among different crops, cereals generate 352 Mt of residues followed by fibre crops with 66 Mt, oilseeds with 29 Mt, pulses with 13 Mt and sugarcane with 12 Mt. Rice constituted 34 percent and wheat 22 percent are the dominant cereals contributing to crop residue generation (NAAS, 2012).

Poor Irrigation and Water Management

Improper planning and management of irrigation and extraction of ground water is the result of fall the water table in most canal command areas. Specific issues of concern are inefficient use of irrigation water, poor land development, seepage from unlined water courses, non-conjunctive use of surface and ground water resources and poor drainage. Expansion of canal irrigation has been associated with widespread waterlogging and salinity problems in the most fertile land, such as; the Indo-Gangetic Plains. In arid, semi-arid and sub-humid regions, large areas have been rendered barren due to the development of saline-sodic soils because of poor irrigation and drainage management. Cracking of soil from poor irrigation management leads to bypass flow of water and subsequent nitrate leaching (Barman et al. 2013).

Lack of Crop Rotations

Crop rotation process can manage the soil nutrients shortage and makes soil healthy. It fixes the deficiency problem of organic component and water conservation, which are important of crop rotation on soil erosion in lands under cultivation. In addition, cultivation of marginal lands on steep slopes,

in shallow or sandy soils, with laterite crusts, and in arid or semi-arid regions bordering deserts has resulted in land degradation. Agricultural production in marginal areas with low soil organic matter due to unsuitable cropping patterns has been the major cause of accelerated wind and water erosion. Wind erosion is a serious problem in arid, semi-arid and coastal areas with sandy soils, and in the cold desert regions of Leh (Bhattacharyya, et al., 2015).

Land Degradation and Yield Loss

The economic impact major of land degradation on productivity at the global level is not easy task, but the some had tried to estimate. In Canada, Girt, (1986) had conducted a study on-farm effect of land degradation and economic value of estimate was ranges from US$700 to US$915 million in 1984.Eswaran et al. (2001) were estimated the total annual cost of erosion from agriculture in the USA is about US$44 billion per year, about US$247 per ha of cropland and pasture. Vasisht et al. (2003) had accounted economic loss of yields due to land degradation Rs 285.51 billion annually at current price and Rs 89.38 billion at 1979-82 prices in India. UNEP, (1994), conducted a study in South Asia and accounted the annual loss in productivity was estimated at 36 million tons of cereal equivalent valued at US$5,400 million by water erosion, and US$1,800 million due to wind erosion. Similar efforts made by (Lal, 1998) at global level annual loss of 75 billion tons of soil which costs was accounted about US$400 billion per year, or approximately US$70 per person per year (at US$3 per ton of soil for nutrients and US$2 per ton of soil, for water).

The loss of productivity due to soil degradation had been made tremendous studies based on plot and field scales. Mbagwu et al., (1984) and Lal, (1987) had made field studies on soil erosion and found that yield reduction was about 30 to 90 percent in some root-restrictive shallow lands of West Africa. Another study conducted by Fahnestock et al., (1995) in Ohio and accounted 20 to 40 percent yield loss for row crops and Schumacher et al., (1994) in Midwest USA. Dregne (1990) had made field study in Africa and found a 50

percent decline of yields due to soil erosion and desertification. Lal (1995) accounted 2 to 40 percent; yield reduction in Africa due to soil erosion and mean loss of 8.2 percent for the continent. Annual reduction in total production for 1989 due to accelerated erosion was 8.2 million tons for cereals, 9.2 million tons for roots and tubers, and 0.6 million tons for pulses. Dregne, (1992) estimated 20 percent productivity losses caused by erosion in Asia, especially in India, China, Iran, Israel, Jordan, Lebanon, Nepal, and Pakistan.

Organic Farming and Food Security Issue

There are three causes behind the increasing interest of farmers to adopt organic farming; one is adverse effect of conventional farming on soil, water and food grains due to excess of chemical fertilisers and pesticides. Second is growing demand of organic food due to ill effect of conventional food on human health. Third is organic farming has accounted lower cost than the conventional farming. Organic farming can be sustained in the long run only, if is farmers receive higher premium price which compensate the loss of their productivity. The research and long scientific experiment quoted that the productivity of organic farming can be increased and produce similar as conventional one, but the consistent and scientific efforts are essential.

India has a lot of potential to produce all varieties of organic products in its various agro-climatic zones. The country has climatic advantage with its inherited tradition of organic farming. This status holds promise for the organic producers to tap the market which is growing steadily in the domestic market as well as global market. The total certified area was 0.002 million hectares in 2000-01. Area under organic farming was increased rapidly after the establishment of national and regional centers for the promotion of organic farming in 2004. The total area under organic certification is accounted 4.72 million hectares in the year 2013-14. The certified area includes 15 percent cultivable area with 0.72 million hectares and rest 85 percent (3.99 million hectare) is forest and wild area for collection of minor forest produces. India stands 10th position among the top

ten countries in terms of cultivable land under organic certification (APEDA, 2014).

Table 3 presents detail information regarding total citification area and number of organic producer under organic farming system. The annual certified area varies from year to year and some years showing negative growth rate as; 2002-03, 2008-09, 2010-11 and 2012-13. It was happening due to some farmers who have adopted earlier, now quit form organic farming, because the cost of certification and inspection is so high. In those years the certified area increases very fast it was due to Govt has started a piolet project in certain district in some states. Under these piolet project farmers can register free of cost and all the certification and inspection cost is met by government. All these years 2010-11 and 2012-13 was showing worst performance and on the other hand remaining year growth rate of certified organic area is satisfactory. The noteworthy point is that the numbers of organic growers are continuously increased except two years (2002-03 and 2010-11) since India started organic farming production and certification. In India total certified area classified into two categories wild collection and crop land.

Table 3. *Certified Area and producer in India during 2000-01-2013-14*

Year	Total Certified Area (ha)	Share of Ag land	% Growth of Area	No. Producers	% Growth of Pro
2000-01	2,775	0.00	-	1426	-
2001-02	41,000	0.02	1377.48	5661	296.98
2002-03	37,050	0.02	-9.63	5147	-9.08
2003-04	76,326	0.04	106.01	5147	0.00
2004-05	114,037	0.06	49.41	5147	0.00

2005-06	150,790	0.10	32.23	5147	0.00
2006-07	528,171	0.24	250.27	44,926	772.86
2007-08	1,030,311	0.57	95.07	195,741	335.70
2008-09	1,018,470	0.57	-1.15	340,000	73.70
2009-10	1,180,000	0.66	15.86	677,275	99.20
2010-11	780,000	0.43	-33.90	400,551	-40.86
2011-12	1,084,266	0.60	39.01	547,591	36.71
2012-13	5,00,000	0.28	-53.89	600,000	9.57
2013-14	5,10,000	0.29	2.00	650,000	8.33
CV	0.88	-	-	1.11	-

Source: *FiBL-IFOAM various annual reports*

In Indian most of the land falls under the category first it means that certified area of different crops is negligible. But, most of the farmers are growing organic crop in rain fed area by default. So, there is urgent need that the cost of certification and inspection should be burden by the government because those farmers have no money to burden theses heavy cost of certification and inspection. The percentage of certified area is very low as compare to total crop land in India and it is below 1 percent. The coefficient variation (CV) value 0.88 shows consistency in certified organic area growth whereas huge variation number of adopters with value 1.11.

A projected demand of global food for the next 50 years doubled, which poses huge challenges for the sustainability and food security to society (Tilman, et al., 2014). The issue of food security will arise when we talk about sustainable practice of farming such as; organic farming, natural farming etc. The question of food security rise by supporter of conventional farming and said that is organic farming feed the increasing demand of food,

when the production in this system is lesser than conventional farming. The recently the Food and Agriculture Organization (FAO) move from the goal of 'food security' to 'nutrition security', which is wider concept than food security. Organic farming is more near to 'nutrition security' than conventional farming because it maintains nutrients in both soil as well as food products. As David et al (2014), pointed out that organic farming increases nutrient-use efficiency, water use efficiency, maintain and restore soil fertility. If it adopted in proper way, first in purity areas, which are rain fed and semi rainfed district/region. As per Planning Commission Report (2012) on "Prioritization of Rainfed Areas in India", rainfed areas constitute 55 per cent of the net sown area of the country so firstly adopted in these rainfed areas then spared in other area at phase wise. For the growth of organic sector need to government facilitate cost effective certification and inspection for small and marginal farmers along with proper market facility of organic input and output.

India produces enough food to feed the domestic demand of all people and attain self-sufficiency in food grains after green revolution, but the number of huger people is still high due to poverty and inaccessibly of food. India's population is likely to reach 1.5 billion by 2030; the challenge facing the country is to produce more and more from diminishing per capita arable land and irrigation water resources and expanding abiotic and biotic stresses. India currently produces about 285 million tonnes of cereals to meet the needs of a population of 1.20 billion. While calculating food requirements, the needs of farm animals are often overlooked. It is predicted that cereal production must be doubled by 2050 in order to meet the needs of the expected population of 1.8 billion, in addition to meeting the needs of livestock and poultry.

Conclusion

The intensive farming feed the growing demand of food in India as well as world. But it has made tremendous loss of soil fertility, water scarcity, and

land degradation. Agriculture activity plays a significant contribution in environmental degradation, which is the cause of human and animal disease. Agriculture economists and scientists are the de fact managers of the most productive lands. Sustainable agriculture practice is required to protect natural resource, species and ecosystem simultaneously. The impact of recent climate change has been seen in terms of unseasonal rainfall, drought and increase normal temperature in India, which leads to food security.

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