# Food Security and Sustainability of Agriculture in India: A Human Right Appraisal

Dr. Alok Chantia*, Dr. Preeti Misra**
*Lecturer, Dept. of Anthropology, Sri Jai Narain Post Graduate (KKC) College, Lucknow, U.P.
** Senior Lecturer, Dept of Human rights, School For Legal Studies, Babasaheb Bhimrao Ambedkar University, Lucknow, U.P.

## INTRODUCTION

It very hard to imagine that a living creature can live without food. It may vary at the level of amount which it consumes but food is necessary for survival even every food plant get its food supplement from the earth. So it is a chain, which is woven at each and every moment. Herbivores are those who present themselves as food supplement before the carnivores. In the same way we can sketch a chain of herbivores, insectivores, carnivores as food security chain on this earth. Human being is omnivores but without proper food for herbivores and aqua creatures, it is not easy to maintain such quo status of him.

Sustainable development is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. Under this definition development is not just limited to economic growth but is made to encompass environment protection, and an equitable distribution of wealth and resources with the goal of improving and raising the standards and quality of living for everyone. The development practices followed the world over during the globalization era marked by a high level of market competitiveness often seemed to follow unsustainable development practices.

While elaborating the concept, the report, Our Common Future (1987) also brings out the requirements of "sustainable development". For a better understanding of the concept, some of the important requirements of "sustainable development" can be highlighted. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life… the promotion of values that encourage consumption standards that are within the bounds of the ecologically possible and to which all can reasonably aspire… that societies meet human needs both by increasing productive potential and by ensuring equitable opportunities for all…demographic developments are in harmony with the changing productive potential of the ecosystem…at a minimum, …development must not endanger the natural systems that support life on earth: the atmosphere, the water, the soils, and the living beings… the world must ensure equitable access to the pressure… that the rate of depletion of non-renewable resources should foreclose as few future options as possible… the conservation of plant and animal species… that the adverse impacts on the quality of air, water, and other natural elements are minimized so as to sustain the ecosystem's overall integrity.

Regarding suitable strategy, the report, 'Our Common Future' (1987), notes in its broadest sense that the strategy for sustainable development aims to promote harmony among human beings and between humanity and nature. In the specific context of the development and environment… the pursuit of sustainable requires : (i) a political system that secures effective citizen participation in decision making, (ii) an economic system that is able to generate surpluses and technical knowledge on a self- reliant and sustained basis, (iii) a social system that provides for solutions to the tensions arising from dis harmonious development, (iv) a production system that respects the obligation to preserve the ecological base for development, (v) a technological system that can search continuously for new solutions, (vi) an international system that fosters sustainable patterns of trade and finance, and (vii) an administrative system that is flexible and has the capacity for self correction. These requirements are more in the nature of capable of mitigating the effects of natural catastrophes and meeting the increasing needs of a growing also that should underlie national and international action on development.

## PROBLEM OF FOOD SECURITY IN INDIA

In the 1960s, India was characterized by a critical food shortage and the government singularly focused on increasing food production. That is when a concerned effort was made to introduce methods of increasing production. It is argued that the self- sufficiency achieved by the Indian government in the production of food grain is primarily due to its focus on improving irrigation facilities, increasing the area under cultivation and its output by the use of improved fertilizers and seeds. Without the introduction of modern techniques, which have been criticized by environmentalists for its debilitating and poisonous effect on the soil and on the health of general population, this feat would not have been possible. Thus the first criticism presented by the defenders of large dam is that the latter is necessitated by the sheer scale and requirement of irrigation and power in the country. The agricultural division of World Bank listed a number of arguments in support of large dams. The arguments summarize the views of a number of development planners and engineers in support of large dams. The context was their defense on the Sardar Sarovar Dam.

William F. Fisher's observations are quite illustrative in this context. He writes, "The proponents of the Sardar Sarovar Dam insist that sustainable development is compatible with large scale, ambitious, centrally controlled schemes, which are capable of mitigating the effects of natural catastrophes and meeting the increasing needs of a growing economy for food water and energy…From their perspective, the Narmada runoff is a perennially renewed resource that currently goes to waste. Dam advocates argue that domesticating this untapped resource would enable Gujrat to sustain its economic growth and the standard of living of its population. Project planners and supporters argue that the readily apparent and increasing needs of water in drought-prone areas, for both agricultural growth and a growing economy, justify the projected means and the costs damming the

Narmada and relocating those currently residing in the submergence area of the reservoir."

On the other hand, "critics of the Sardar Sarovar Project… question the portrayal of Sardar Sarovar as an example of sustainable development and see it instead as another project that will overexploit the available resources to the detriment of the poor and the benefits of the rich. They argue that by any measure the project is unsustainable and unjust. … they note that the size and comprehensiveness of schemes like Sardar Sarovar require that these schemes be initiated, financed and managed by the state as the guardian of the interests of the people. For these critics, sustainable development is not top- down but bottom-up. It requires that development efforts be decentralized and requires the involvement of local people at all levels of the design, appraisal, and implementation of projects. … for them sustainable development should be as concerned with justice and equity as it is with an ecologically sustainable use of resources. From the perspective advocated by these critics, large scale, centrally controlled schemes are incompatible with sustainable development…" (Fisher 1997)

While small dams have a role and are, indeed, a significant part of the overall development proposals for Narmada Basin, they do not, and can't approach the scale of the benefits of the larger dams. First they are not as low cost as is often claimed: a study of small "tanks" (as they are called) in India by an international Research Institution found most of them to be uneconomic (partly because of the amount of the land they inundate relative to the water stored). Second, while a few good small dam remains that could be developed at modest cost, the cost escalates greatly as in the search for the large numbers of small dams needed for storing significant volumes of water, one is compelled to tackle increasingly less suitable sites. Third, they fail to fill in the every year, the dry year, when they are needed the most. Fourth, they inundate relatively massive areas of land, in the upper parts forest. Typically small "tanks" of around 40 to 100 hectare size almost as much land as they irrigate, around 0.9 of a hectare

For every 1.0 hectare( usually irrigating one crop only, whereas large dams irrigate much more than one, apart from also providing power). Sardar Sarovar will inundate only about 1.6% of the area irrigated. Thus even if it were technically possible to find enough small dam sites to store the same amount of water, the land lost to inundate could well be over one million hectares as opposed to about 37000 hectare for Sardar Sarovar Reservoir.

An important issue raised by the defenders of large dams is the over exploitation of ground water for irrigation purpose. The small dams have according them proved to be poor substitutes, as people still continue to rely on ground water for their most essential and regular requirements. With regards to the detrimental consequences of large dams, the dams, the proponents of large dams admit that large dams do submerge large tracts of forests, but also draw attention to the fact the loss of forest in the Narmada Basin has been at the rate of about 20000 hectare per annum without the large dam in place or any other mega development project. This is a significant observation not only about the state of forest management in the country as whole, wherein forest products are being extract indiscriminately by encroachers and commercial interests, bur also the increasing pressure on forests to fulfill subsistence needs of the people. This brings out the levels of corruption, malpractice and inefficiency that exist in India, with or without large dams. Development initiatives thereby get a bad name, as the discrepancy in the implementation process is passed on the plan itself. Also, they are of the opinion that planting trees in the irrigation area, which can also supply far grater supply of wood, can easily make up the loss. The regular supply of water from the large dams can improve general health conditions of the people, while the chances of getting water borne diseases from the dam site can be controlled through appropriate preventive measures.

For instance, in India the replacement of native seeds by imported hybrid seeds or cash crops resulted in more and more exploitation of ground water through tube-wells since these crops need more water. The over exploitation of the groundwater in turn resulted in the depletion of ground water level leading to famines and poverty. The high yielding hybrid seeds are vulnerable to pest attacks resulting in more use of pesticides. The indiscriminate use of chemical-based fertilizers, especially subsidized fertilizer, has created an imbalance between the essential mineral contents such as Nitrogen and potassium. There is a growing realization of the degradation of land, water and sustainability among the people (Chand 1999). The export oriented policy of Indian government in the fisheries sector opened up the waters of the Exclusive Economic Zone to MNCs and TNCs for trawling. This resulted in the indiscriminate destruction of the marine eco system and the livelihood of the traditional fishing community. Sustainability of resources are at nadir and it will be cleared in following examples. United States multinationals own 90 soft drinks factories in India, Coca-Cola 52 and Pepsi 38. They describe these are bottling plants; actually they are pumping stations, each of which extracts up to 1.5 million litres of water a day from the ground. It takes nine litres of clean water to manufacture a litre of coke. The processes used in manufacturing these soft drinks are inherently damaging. The extraction of ground water deprives poor people of their fundamental right of access to clean water. The factories spew out toxic waste that threatens health and environment. And the products themselves are harmful. The Indian parliament has set up a joint committee to inquire into the presence of pesticide residues in soft drinks. In march 2000 Coca-Cola opened a plant at Plachimada, a village in the Palakkad district of southern state of Kerala, intended to produce 1.2 million bottles of Coca-Cola, Fanta, Sprite, Limca, Thums up, Kinley Soda and Maaza every day. The conditional licence granted by the local panchayat authorized the use of motorized pumps, but the company drilled more than six wells and illegally installed high powered electric pumps to extract millions of litres of pure water. The level of water table fell from 45 to 150 metres below the surface.

Coca-Cola then polluted what little water was left for the community. It started so by dumping waste outside its premises. During the rainy season, this spread into paddy fields, canals and wells causing a serious health hazard. The company abandoned this practice and began pumping dirty water into dry boreholes that had been drilled on-site for the disposal of solid waste. This contaminated the aquifers. As the water supply deteriorated, the local adivasi (tribal) women had to travel about 5 kilometer to fetch drinkable water. The women organized a Dharna outside the factory gate to protest the depletion of the ground water.

Because of Coca-Cola's activities, 260

wells- sunk by the authorities to supply drinking water and meet irrigation needs-have run dry. This part of Kerala is known as the rice bowl but agricultural yields have plummeted. Worse, Coca-Cola has been distributing the toxic waste from its factory to the villagers as free fertilizer. Analysis has shown that sludge is rich in cadmium and lead, both carcinogenic.

In 2003 the district medical officer advised the people of plachimada that their water was so polluted that it was unfit for consumption. The Adivasi ( tribal) women were the first to denounce Coca-Cola's hydro-piracy with their sit-in. Their initiative sparked national and international expressions of solidarity. In February 2004, the Kerala government finally ordered the closure of the Coca-Cola plant. (Vandana Siva 2005)

Groundnut was once regarded as the "wonder crop" that allowed small farmers in dry areas to use their family labour productively and earn good cash profits. It spread rapidly during the 1960s in the drought prone Rayalseema region of Andhra Pradesh, and has been credited with breaking the system of bonded labour in the area. But the profitability of groundnut, like many other crops, has fallen over the 1990s due to rising input costs and drought. Lately diseases such as a bud necrosis have also led to heavy losses. In several parts of Ananthapur and Chitoor districts of Andhra Pradesh, groundnut used to be the first choice of dry land farmers during normal monsoon years. A common ex- ante coping strategy followed by dry land farmers in these area was to plant horse gram or foxtail millet if they expect the rains to fail. But they continued with groundnut farming even through worsening drought and disease because just one good crop in three years would be enough to feed a family.

However this form of livelihood could not survive the added stress introduced by the liberalization of edible oil imports. The import duty on edible oils was reduced from 65% in the mid 1990s to 15% by the end of the 1990s, palm oil primarily. The share of imported edible oil, mainly palm oil, has increased from less than one percent in the early 1990s to about 45% by 2001. The government responded by increasing import duties but international prices declined further and other countries gave their exporters further concessions in order to capture locked into credit-sale agreements could not repay their debts. Hundreds of farmers in Rayalseema have committed suicide because they could not recover their costs and pay back money that they had borrowed. A few with sufficient capital, skills and contracts diversified into mango orchards. Many more started migrating out to the cities in search of work. (www.dbindia.gov.in)

**RIGHT TO FOOD AS HUMA RIGHT**

Like other components of human rights, the right to food has its underpinning in, and derives its force, content as well as implementation from the universal Declaration of Human Rights (UDHR) which was adopted by the United Nations General Assembly in 1948, and the International Covenant on Economic, Social and Cultural Rights (ICESCR) of 1966. Article 25(1) of the UDHR states that "everyone has the right to a standard of living adequate for the health and well being of himself and his family, including food, clothing, housing and medical care and necessary social services… "Under ICESCR Article 11, states "recognize the right of everyone to an adequate standard of living himself and his family, including adequate food, clothing and housing…" Moreover, the state parties to the covenant recognize the fundamental right of everyone to be free from hunger, and list the steps to be taken individually and through international co-operation to end hunger. These steps are:

" to improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilization of natural resources"; and

"Taking into account the problems of both food- importing food exporting countries, to ensure an equitable distribution of world food supplies in relation to need".

Thus the important points spelt out are to do with increasing supply of food through increased production by making use of scientific techniques, and also using principles of nutrition.

In India a paradoxical situation has been the production of a high level of food but very poor access to that food by a large section of the population. This is the situation obtaining in many developing countries as well. Ever since the Green revolution in India, food production has more than doubled, but a growing number of people are unable to meet their basic food requirements. Adding to the problem is a huge and growing income disparities and rising prices of food grains. About 63% of children below the age of five suffer from malnutrition. In India the main initiatives of the state to provide cheap and adequate food to the people have been the public Distribution System, anti poverty programmes and employment generation programmes which pay at least a part of the wages in the form of food grains. There are a few other nutrition schemes, particularly for children, such as the mid- day meal schemes or the integrated Child Development Schemes. A large vulnerable group, which is poor and likely to be unable to meet its entire food needs, is that of workers in agriculture. Landless labourers, small and marginal farmers and small peasants often face unemployment or fluctuating incomes, or receive wages which are below the legally stipulated minimum levels.

Per capita availability of food grains has also gone up over the years, but in the absence of food security, a big proportion of the people still lack access to food. Since they have low purchasing power, if we take per capita availability of cereals., it was 384.1 grams per day in 1960, which went up to 403.1 gram in 1970, to 415.6 grams in 1985, to 453.3 grams in 1990 and to 436.4 grams in 1994. For pulses, was 65.5 grams per day in 1960. Subsequently, it has suffered . going down to 51.9 in 1970, to a low of 30.9 in1980, recovering to 38.4 in 1985 and 41.1 in 1990 and again going down to 37.4 in 1994. Availability of cereal and pulses is important because nutritionists contend that in India food habits, a diet with adequate cereals and pulses is sufficient to meet protein- energy requirements, with the proteins of good quality.

**EFFECT OF GREEN REVOLUTION ON FOOD SECURITY**

Has the Green Revolution been successful in meeting the food requirements of people? The Government, the media and a large section of a academics would have us believe so. The usual image about the Green Revolution is that it transformed India from having a ship-to-mouth existence to becoming a breadbasket. It focused on the impression that distress imports of food grains from developed countries, particularly the USA. However, food grains out put con-

tinued to be high, till the mid seventies.
The Green Revolution is based on high yielding varieties of seed, particularly in wheat. But, if we look at actual data for production, we find that while the compound annual rate of growth of foodgrains over the period 1949-50 to 1964-64 was 2.98% per annum, it declined to 2.4% per annum over the period 1967-68 to 1977-78. It is true that the rate of growth of production of wheat increased from 3.07% on the period of 1949-50 to 1964-65 to 5.73% in the period 1967-68 to 1977-78. However, the rate for rice fell from 3.37% to 2.21%, and that for pulses from 1.62% to 0.20%. The story was the same in the case of non- food- grains as well which fell from 3.65% to 2.70%. For all crops( food grains and non-food grains combined), the figures are 3.20% and 2.50% respectively.
The figure for yield tells an interesting story. While the increase in yield in wheat was at the rate of 1.24% per annum in the period 1949-5- to 1964-65 and went up to 2.53%min the period 1967-68 to 1977-78, that the rice declined from 2.09% to 1.46% in the two period respectively. Thus the success of Green Revolution in terms of increase in yield was limited to the case of wheat. Not only this, at the very time that farmers growing wheat were witnessing a rather dramatic spurt in yield rates. Those growing rice saw the growth in yield fall. Even though, the figures for pulses show a rise from 0.24% to 0.42%, it is a reflection of the weightage of rice in the total basket of food grains that figures for food grains as a whole showed a decline from 1.61% to 1.53%. The post Green Revolution period does not seem to have contributed much to India's food security.
The Green Revolution has had other effects as well. It has increased inequality among farmers, may even accentuated existing inequalities, since only large farmers were in position to take advantage of the Green Revolution. It involved purchased inputs of the seeds, of nitrogen, potassium and phosphorus based fertilizers, pesticides, and required large tractors and harvester, threshers. Naturally this increased the dependence of farmers on the market. The smaller farmers were adversely affected. Those farmers who were unable to repay loans were often caught in a debt trap. The Green Revolution has had serious effects on the environment as well. It has led to worsening of the soil quality and reduced the water content.

**AGRICULTURAL REFORMS AND BARRIERS TO FOOD SECURITY**

There are fears that the adoption of the process of liberalization, certain sections of the people will be more vulnerable to hunger and deprivation, both because declining availability of food grains and the shifting of cultivation to commercial crops for exports under the impact of globalization.
Two factors assume importance here: food security and agrarian reform that is reform in the production and cultivation process in agriculture. Over the last several years, food production as well as exports has increased, but the rate of rise in food production lags behind that of population.
Large agricultural tracts of Indian subcontinent are starved of fossil fuel, electricity and government subsidies. They have to depend on intrinsic resources, draught power and rainwater where the farmers practice traditional methods of forming. The practice of traditional agriculture does not depend upon energy-intensive inputs or so much on purchasable items. Traditional agriculture, which is practiced in most part of the rural India, is afflicted with low production, poor drainage and unorganized cropping pattern. The practice of traditional agriculture has caused deforestation, soil erosion and depletion of macronutrients from the soil. Traditional agriculture is mainly affected by deforestation and ultimately food security
Clearing of forest cover for cultivation exposes the land surface to abrasive agents such as rain torrents, water flow, strong surface winds and unstable atmospheric temperature. These agents cause erosion of the land depending upon direction of tilling, steepness of land slope, type of implements used and kind of crops sown. The intensity of erosion of a land mass measures adopted. In traditional agriculture no measures are taken for soil moistures management. The losses of land can thus be enormous. The worst form of erosion prevalent in agricultural lands is wash off erosion or sheet erosion. It is a steady phenomenon and generally is not so spectacular in plains. However, when the water flows over land on the steep slopes, it becomes erosive and can cause rills. With heavy and recurring flow through rills, there develop gullies. AS much as 99 million hectare of cultivated land in India, which includes about 75 million-hectare rain fed areas, is affected by soil erosion. The rate of erosion is defined by the rate of soil lost in this process. Up and down slope cultivation to potatoes on steep; slopes in Nilgiris caused a recorded loss of 39.3 tonnes of soil per hectare per annum. Jhum(shifting) cultivation is also a major culprit. It causes an average soil loss of 41 tonnes per hectare per annum on steep slope in north- eastern hilly parts of India. Under worse conditions, the soil loss resulting from erosion under shifting cultivation can be high as 201 tonnes per hectare per annum. Loss of soil in cultivated lands results in:

- Loss of finger grades of particles
- Disappearance of lattice structure
  Depletion of inorganic nutrients and organic matter
- Hydrologic degradation of the area affected

Different crops cause different levels of soil losses. Soil erosion is the greatest danger to country's future plans of agricultural production. According to a study, if erosion is allowed to proceed at the present rate, by 2010 AD, the rain fed area in 16 south-east Asian countries, including India, will shrink by 38% and production of land will decline by 36%. As a result, total production for the country will fall by 12% in spite of increased use of other inputs including irrigation and fertilizer but population is not decreasing accordingly, so food security will be affected naturally.
Nutrients are mandatory for plants growth but these are decreasing by the soil erosion. The plant nutrients exist in soil particles in the form of inorganic salts or minerals. Minerals are prone to leaching if the soil is exposed to erosion. Traditional agricultural lands which are more exposed to onslaughts of flood are more susceptible to soil erosion. Essential elements as macronutrients (Nitrogen, Potassium, Phosphorus, Carbon, Hydrogen, etc.) are needed by the plants in reasonable large quantities. Micronutrients (Zinc, Manganese, Copper etc) are needed in trace amount. Estimates of loss of macronutrients such as Nitrogen, Phosphorus and potassium, through soil erosion in India ranges from 5.37 to 8.4 metric tonn per year. It is estimated that this represents a loss of about 30 to 50 metric tonn of agricultural produce per annum. However, managing the cropping system or land use pattern can reduce this loss. The nutrient loss under shifting cultivation has been compared to those under terrace cultivation. Following table shows the amount of

**Tab.1 - Nutrient losses under different land uses and with Various Conservation Measures in the North-Eastern Hill region of India**

| Land use | crop grown | soil and water Conservation measures | Nutrients Lost during average of 5 years in kg/ha |
|---|---|---|---|
| Shifting 702.9 | Paddy, Maize | | Org C |
| Cultivation145.5 | tapioca, cucurbits | | $P_2O_5$ |
| 7.1 | Yam, vegetables | Nil | $K_2O$ |
| Agriculture 35.1 | Paddy, Maize | Bench terrace | Org C |
| In 1/3 lower 11.2 | Lemon, pineapple | Halfmoon terrace | $P_20_5$ |
| Slope horti 0.5 | Cowpea | | $K_20$ |
| Culture in 2/3 of the upper slope | | | |
| Agriculture 260.8 | Maize, tapioca | contour | Org C |
| In entire 95.7 | on upper plane | Bunds on | $P_20_5$ |
| Area 3.6 | terraces followed by yam, mustard | slopes | $K_20$ |

*Source: Shifting cultivation in North Eastern India, ICAR Research project on NEH Region, Shilong*

nutrients lost per hectare land and it was studied under a combination of various land use pattern and soil water conservation measures, over a period of 5 years. (Tab. 1).

In the post world war II period, new technological option, such as, chemical fertilizers, mechanization of implements, high yielding varieties (HYV) and plant protection chemicals were open to mankind to increase agricultural productivity. These purchasable inputs made agricultural capital and energy- intensive and market oriented. Excessive inputs of these were made in agriculture to boost production. The outcome was two fold: on the one hand, initially the production increased but after a certain stage the returns started diminishing; further addition of inputs did not bring about the corresponding increase in production. On the other hand, increased use of these inputs caused multiple environmental problems, such as adverse side effects from the use of fertilizers, biocides, excessive irrigation and plant protection chemicals, eruption of diseases due to monoculture and depletion of genetic stock due to use of high yielding varieties.

To ensure food security, uses of fertilizers have increased. To get instant production and assurance of food security may give a pseudo picture of development but when it comes under the out lines of sustainable development, entire picture get many adverse stories of survival. Most of the chemical fertilizers used in modern agro ecosystems contain macronutrients, i.e. nitrogen, phosphorus and potassium (NPK). But excessive addition of NPK to the agro- ecosystems cause the plants to draw more micronutrients as well from the soil. It may be mentioned here that in this case the rate of growth of plants often exceeds the natural ability of soils to replenish the supply of micro nutrients. As a result, soil nutrient stress is caused. Thus, excessive addition of fertilizers causes micronutrient deficiency in soils. Zinc deficiency, for example, in large tracts of high yielding belt of Punjab and Haryana has depressed the productivity of the land. The main crops affected are rice, jowar, maize, cowpea, sunflower of excessive additio and chickpea. Similarly, iron deficiency has caused a drop in production of soybean crop.

Another adverse side effect of excessive addition of chemical fertilizers results from the fact that about one- fourth of the applied fertilizer is not used by crop plants and is leached down. These chemicals, usually nitrates, find their way into ground water aquifers, increasing the concentration of nitrates in drinking water. This has become a serious health hazard because excess of nitrates causes methaemoglobinaemia in bottle-fed infants.

The loss of nitrogen through leaching is as high as 30-45 kg per hectare per annum in Europe. This amount is alarmingly high and is more than the total amount being applied in many developing countries. The need of the day is to develop alternate low cost methods such as green managing for regenerating the biophysical status of agricultural soils and to reduce dependence of modern agro ecosystems on chemical fertilizers. It may be worth mentioning here that use of bio- fertilizers can be an alternative to chemical fertilizers.

There is still another way through which excessive application of chemicals can cause environmental degradation. The fertilizers, which are initially meant to increase the mineral content of agricultural fields, are often not fully utilized by the plants. The extra amounts are washed down with rainwater. The rainwater carries extraordinarily large amounts of nutrients into water bodies causing artificial eutrophication (enrichment of nutrients in a water body).

Another serious barrier in food security is excessive irrigation in high temperature zones. It causes salt affectation of soils. Water evaporates very fast, leaving behind the traces of salt on the soil. As more and more cycles of irrigation are repeated, the left over salt accumulates and forms a thick layer of gray or white effervescence on the surface. Sometimes the salts form an impervious crust comparatively less soluble calcium carbonate a few meters below the surface. As a result the general concentration of salts in the upper layers increases. The salt affected soils can either be alkaline or saline. Alkaline soils contain excessive sodium carbonate and sodium bicarbonate. These soils are dense and compact, containing a hard layer of calcium carbonate below the surface. The roots can not penetrate the crust of carbonate lining. The saline soils contain soluble sodium salts such as sodium chloride and sodium sulphate.

When the salt content of the soil exceeds 2000-3000 parts per million (ppm) the water solution of soil becomes toxic for most plants. In salt affected soils, the plants fail to absorb nutrients and face simulated water stress even amidst plen-

tiful soil moisture. Unlike alkaline soils, the saline soil are easy to reclaim, because in saline soils, salts can be leached out to recover the original fertile character. While alkaline soils need a series of treatments to remove carbonate and bicarbonates of sodium and to break the impervious calcium carbonate crust. Sometimes, sandy nature of soils along with alkalinity complicates the nature of the problem. Similarly, water logging is sometimes coupled with alkalinity in which case it becomes difficult to restore fertility of the soil and ultimately we suffer from the goal of food security and sustainable development too.

India has total of 3.58 million hectare of alkaline soils, 1 million hectare of saline soils in the arid land of Thar desert, 1.4 Mha of saline soils in the black cotton soil region and 3.1 Mha of coastal saline soils. This makes a total of 9.08 Mha of salt affected soil in India. Out of these, at least half, i.e. 4.05 Mha fall in the category of agricultural land but remain unproductive. With the national average productivity of 1.6 tonnes per hectare per annum the country is losing about 6.5 metric tons of agricultural produce every year because of salt affectation due to excessive irrigation. Excessive irrigation deprives the area of groundwater resources and accentuates desertification as in the arid zones of Rajasthan.

Livestock wealth plays a crucial role in rural Indian life but overgrazing is an associated problem with them which put its affect on food security. India teems with domestic animals. The livestock population in India has been continuously increasing. A total increase of 42% was registered during the thirty years period, from 292.02 million cattle heads in 1951 and 415.94 million in 1981. The land resources available in the form of permanent pastures and grazing lands for producing fodder declined from 145.45 million hectare to 129.26 million hectare in the same period, registering a shrinkage of habitat by 11.03 %. Thus land available per animal head declined from 0.51 to 0.32 hectare, a reduction of about 37%. These figures show that livestock density has increased during the past thirty years and it is very easy to estimate that after 1981 to till present, imbalance between livestock and availability of fodder would have serious condition. So the fodder lands are under a greater pressure today than they were 60 years ago.

Under normal grazing conditions one hectare of pasture or grazing land can support on an average 03 livestock heads in rain fed areas and 06 livestock heads in extensively irrigated areas. As against this, the actual number of animals that depend on each hectare of such lands is higher- anything from 2.4 to 4.5 times their carrying capacity. India is rural specific country and maximum farmers are dependent on livestock because of their poor condition and they know use of livestock in different ways. So they keep them instead of other available mechanical devices in scientific era. Food security in India is mainly concerned with livestock and Indian villagers are not so rich to have all modern facilities which could give better yield. It is also remarkable that more and more families are forced to share their shelters with their domestic animals. Since these animals act as host for many viruses, pests and bacteria, there is increasing danger of infection and direct transfer of disease. Animal excreta are finding easier path to ground and surface waters which form major sources of drinking waters which form major sources of drinking water for a large section of human population. Overgrazing and animal generated diseases among population make an adverse environment for sustainable development. For food security modern techniques should be used along with livestock, which will reduce the problem of overgrazing.

As a result of over grazing pressure microclimate becomes drier, mulch cover or humus decreases, and is heavily trampled producing pudding of surface layer, which in turn reduces the infiltration of water into the soil and accelerates its run off. This exposes, the land of erosion by rain torrents and surface runoff. This causes heavy soil losses through wash off resulting in the formation of rills and gullies. Consequently, silt loads of streams and rivers increase thus resulting in relatively much larger inputs into the reservoirs.

An important factor as a barrier in food security concept is Urbanization. Urbanization results in construction of a large numbers of buildings, more roads, factories, parking places, etc. For all these, land is secured either by diverting agricultural land or by cutting forest. There may not be even one example where a large urban center has been developed on barren land. It is always the agricultural land or forest land which is utilized. At some places beaches, lakes and rivers are filled to create land to accommodate the growing population. In these cases too, natural habitat is disturbed or destroyed. It is natural to locate cities and urban centers in agricultural regions. These regions supply food and other items of daily use. Seaport cities are usually at the mouth of a river where delta deposits are present. The deltas have rich soils. Similarly, highways follow the easy terrain of river basins. The river basins have the best agricultural soils. Later urbanization tends to follow the highways. So, urbanization agricultural land has serious conflicts. Still, every year thousands of hectares of land, which could support agriculture, is occupied by urbanization. It is also very difficult to convert barren and unvegetated land into agricultural land. So, this process always tends to encroach upon areas occupied by natural fertile eco systems.

Food security and sustainable development as well depend upon the availability of land. The most significant effect of soil erosion is in the form of loss of soil as wash off. An estimated 6000 metric tonn of soil is lost annually from the Indian subcontinent. Annual rate of soil loss into the sea through erosion is 5mm. This eroded material carries several valuable nutrients along with it, which are lost forever. Estimates about the quantum of such losses in terms of major plant nutrients (NPK) is reported to be ranging from 5.37 to 8.4 metric tonn per year. Several nutrients are lost during floods due to surface run off and also due to leaching. In the regions where water percolation is high, the potentiality for leaching is also high. Soil properties also have a definite effect on nutrient-leaching losses. There is a greater nutrient lose in sandy soil than clay, because of higher rate of percolation and lower nutrient absorbing power of the sandy soil. Thus, in Sandy soil, the nutrients in the top soil are lost due to wind erosion and also due to more rapid leaching.

A study of the potential population- supporting capacity of an area indicates that continuing soil erosion would render nearly 33% of the area insignificant in terms of productivity; while production in such eroded areas will fall by about 36%. Therefore, inspite of the increasing total productivity of the irrigated lands fall by 12% in India. When soil conservation is allowed to proceed in excess of permissible soil loss (12t/ha/year) over the years, the lands are relegated to lower productivity and finally to zero productivity. The land is classified in to eight pro-

ductivity classes on their capability of cultivation and need for conservation. The eight productivity classes are :
- Suitable for cultivation
- Requires good soil management practice,
- Moderate conservation practice necessary
- Intensive conservation practice necessary
- Unsuitable for cultivation
- No restriction in use
- Moderate in use
- Severe restriction in use.

Class I is flat or nearly flat land suited for cultivation but a few conservation practices are necessary. For II, III and IV lands artificial fertilization will be required, but special measures of conservational management must be added. Class V, VI, VII are grazing or forestry lands with varying degrees of restrictions on use. The eight class is suited for wildlife and recreation. Following table gives the relationship between the rate of soil erosion and long-term decline on land productivity. (Tab. 2).

Soil erosion is economically the most destructive phenomenon on the world. Not only is the productivity of the eroded land destroyed but the eroded soil reaches the productive land, which also loses its productivity. Expansion of the deserts is a prime example. The productivity of croplands lost annually is given in the table 3. Above table shows that at least 7.58 million hectare of cropland decreases every year. So shrinking land and increasing population is creating very serious problem of sustainable development in reality.

In the year 2000 in Warangal, Andhra Pradesh where farmers have also been committing suicide. Farmers who traditionally grew pulses and millets and paddy have been lured by seed companies to buy hybrid cotton seeds referred to by the seed merchants as “white gold”, which were supposed to make them millionaires. Instead they became paupers. (BBC 2000)

**Tab. 2 - Relationship Between rate of soil erosion and long-term decline in land productivity**

| Rate of soil loss (tonnes/ha per annum) | Anticipated long term productivity losses |
|---|---|
| Less than 12 | No change in land productivity |
| 12-15 | 50% of the area of very productive land downgrades to productive land, the rest remains unchanged |
| 50-100 | 100 % of all productive land downgrades by one productivity class |
| 101- 200 | 50% of the area of all productive land downgrades to not suitable, the remainder downgrades by one productivity class |
| More than 201 | All extents of productive land down grades to not suitable (non- productive land) |

**Tab. 3 - Annual Loss of Land Productivity (India)**

| Source | Loss ha/year |
|---|---|
| Loss of cropland by: | |
| (a) Encroachment of gullies and ravines in productive level | 8000 |
| (b) Areable land becoming unsuitable for production | 22,50,000 |
| (c) Diversion to settlements; town, cities, etc. | 15,00,000 |
| (d) Flood damage average | 38.20,000 |
| (e) Loss through mining activities by 2000 AD | 1440 |
| **Total** | **75,79,440** |

## CONCLUSION

Human being is the only creature on this earth whose number is increasing day by day without considering the availability of resources and this acceleration is putting a very serious problem before him to cope for survival. This effort gets more attention when it leads culture specific life which advocates about processed and cooked food habits. Human being is not meant for an eater of raw flesh and as grazing animal, it has developed a complicated life in the process of evolution for creating differentiation from other creatures on this earth. Now human being is helpless to manage its basic requirements while it has done several experiments on reproductive organs to check its population but it is not an easy task because natural feeling alike any creature, human being also wants to be genitor and wants to put himself in the frame of kinship as father and mother. So population control is very difficult and it becomes more and more serious when it plays a role as an alternative of poverty to produce many working hands in the form of children. Decreasing resources and increasing population is making a passage for inflation and hike in prices, which is keeping away required food as balanced diet form the hands of those who produced it in the field. Malnutrition is also a worldwide problem. All these situations are alarming and put an attention for food security before us but we can’t forget sustainable development, which will assure for the smooth existence of coming generations. It is well studied that all attempts for development is affecting food security in many which is clearly defined in this article and it is also alarming that we should think again about flora, fauna, land and development schemes around us, if we want to assure our food security.

**References**

Lokayan Bulletin, Editorial Piece, 1991. Dams on the River Narmada: A Call to Conscience, May-August Vol.9, No.3 and 4 pp 1-10

Mc Cully, Patrik, 1998, Silenced Rivers. The Ecology and Politics of Large Dams, Orient Longman Ltd, Delhi.

Fisher W.F. 1997, “Development and Resistance in the Narmada Valley”. In Fisher W,F.(ed) Towards Sustainable Development- Struggling Over India’s Narmada River, Rawat Publication, New Delhi

Our Common Future (1987) quoted in Sociology of Development, pp 66-70 IGNOU Study Material, New Delhi

Siva, Vandana 2005 “India: Soft Drinks, Hard Cases”. Le Monde Diplomatque, March (http://www.mindfully.org)

www.dbtindia.gov.in

Universal Declaration of Human Rights Charter 1948

International Covenant on Economic, Social and Cultural Rights (ICESCR) 1966

Sen Amartaya 1981 Poverty and Famines, Oxford, New Delhi

Lawson , Edward (ed) 1996 Encyclopaedia of Human Rights (second edition). Taylor and Francis: Washington DC.

Right to Development CHR-01, Block 4 IGNOU, New Delhi

Human Activities and Environment-I Block 2 & 3, AHE-1 Human Environment, IGNOU, New Delhi

http://news.bbc.co.uk/hi/english/static/reith_2000/lecture5.stm