

POPULATION EXPLOSION-FOOD SECURITY SCENARIO AND SUSTAINABLE DEVELOPMENT IN RURAL INDIA: ISSUES AND CHALLENGES

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Abstract

India has been perceived as a development enigma. Food security, in general, is increasingly affected by global economic and environmental phenomena. Under this, the food prices are affected due to food scarcity which causes social and political instability, and can escalate humanitarian crisis. The definition as per the Rome Declaration 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 an active and healthy life.” Indian as well as global agriculture will face several challenges over the coming decades because it must produce more food to feed affluent and growing population. On the same guidelines India’s initiatives to ensure food security for its citizen’s ranges from concerted efforts to boost agricultural production to far-ranging market interventions aimed at price stabilization. The problem of underinvestment in agriculture as far as the status of India w.r.t. world is compounded during economic turmoil, because when both private and public budgets contract, investments tend to be cut to a greater extent than other expenditures in all sectors – including agriculture. Improving agricultural productivity while conserving and enhancing natural resources is also another problem in Indian agriculture. The solution of aforesaid problem in changing scenario is sustainability in agriculture production. In India, rural economy suffers from poverty, unemployment, malnutrition, limited diversification of farming and degradation of natural resources such water, land and forest. Livelihood diversification is essential for poverty reduction, food security, rural livelihood security and improved income for rural farming community. This study paper mainly focused on food security and sustainable agriculture, its roles in rural livelihood security, and major issues in sustainable agriculture. The purpose of this paper is to explore how sustainable agriculture policies can better serve the goal of poverty reduction as well as rural livelihood security. The efforts to stimulate and support to the sustainable agricultural growth are essential for the rural livelihood security and rural development in India.

Key words Food security, Agriculture productivity, Sustainability, Degradation of natural resources, Population explosion.

Introduction

The majority of the people in India makes out their existence directly or indirectly from farm related economic activities because agriculture is an integral part of everyday life in Indian sub-continent, not only for it employs about 70 percent of workforce of the country, but also for it provides food to the population, raw materials for the industries, wood for fuel and shelter, herbs for medicines, and above all means of sustenance and livelihoods [1]. Agriculture sector for developing economies like India is primary source of livelihood in both farm and non-farm sectors and sustainability in agriculture sector means boosting up the rural livelihood system. Livelihood refers to adequate stock and flow of food and cash with an individual to meet their basic needs and livelihood security means secured ownership of, access to, resources and income earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies [2]. A rural livelihood is defined as "The capabilities, assets and activities that rural people require for a means of living." It is considered sustainable" when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets-both now and in the future while not undermining the natural resource base." Sustainable agriculture and rural development are integral and necessary components of sustainable development. Sustainable agriculture involves all three pillars of development-economic, social and environmental. Agriculture and rural development are sustainable when they are ecologically sound, economically viable, socially just, culturally appropriate humane and based on a holistic scientific approach. This means that sustainable agriculture and rural development action programmes, including farming, forestry, and fisheries must meet the nutritional requirements and other human needs of present and future generations, provide durable and decent sustainable growth.

Max Muller, the celebrated German Scholar once wrote 'if we were to look over the whole world to find out the country most richly endowed with all the wealth, power and beauty which nature can bestow - in some parts a veritable paradise on earth - I should point to India'. What he wrote of India, in fact, is truer for the Rural India which is a unique depository of all those beautiful things that God and human hands created for the posterity to draw inspiration for a better tomorrow. India is a country of villages. As per 2001 census, on the average 72.22% people lives in villages. In some states more than 85% people live in villages (Himachal Pradesh, 90.21%, Bihar, 89.53%, Sikkim, 88.9%, Assam, 87.28% and Orissa, 85.03%). The livelihood options and rural economy in Indian villages are largely bio-resource based, especially on agriculture, home garden, fishery, goaterly, piggery, poultry, diary and artisan work based on bamboo, cane, wood and other bio-resources. In view of this, conservation of traditional ecological knowledge and management of bio-resource is most important to make India Sustainable for achieving the goal of zero hunger. This paper reviews the bio-resource and livelihood options in rural India. Since the management of bio-resources is linked with land, soil and water, these aspects are also reviewed in this paper.

Resource classification

Resources are basically of two kinds, (a) renewable, and (b) non-renewable. Some resources, such as plants (crops, forests, medicinal plants etc.) and animals (milk and meat producing) are renewed from time to time because they have a lifecycle, and a continuous harvest is possible provided these resources are well managed. These resources sustain life. Bio-resources become extinct if not managed properly. These resources require land, soil and water for their growth and continuance. (Dash and Dash, 2009) Land resources India with a land area of 3,28,8000 km² (about 2.4% of the world), supports 16% of the world's population. Land is now under great pressure due to the huge increase in population. There were about 238 million people in India in 1901 and have grown five times in 100 years (about 1200 million). With the present rate of population growth the per capita land resource in India may be reduced to areas and roads and so on. 14% of land is barren and about 7% is used for miscellaneous purposes. The rapid increase of urbanization and migration of population from rural area to towns and cities has led to conversion of agricultural land for housing, construction of office buildings, industries, and so forth. The rational use of land resources is possible only by adopting an integrated land-use policy through scientific survey of all land resource taking the village as a unit and apportioning land for both short and long-term requirements for agriculture, forestry, grazing, water bodies and fisheries, human settlements, roads, industries, and so on. The state governments play important role. There should be legislative control of land use. The fourteen physiographic zones of India are listed below:

1. Western Himalayas (WH)
2. Eastern Himalayas (EH),
3. North East (NE),
4. Northern Plains (NP),
5. Eastern Plains (EP),
6. Western Plains,
7. Central Highlands (CH),
8. North Deccan (ND),
9. East Deccan
10. South Deccan (SD),
11. Western Ghats (WG),
12. East Ghats,
13. West Coast (WC),
14. East Coast (EC).

These physiogeographical zones provide the livelihood support to large majority of the population. All the Bio-resources are located in these zones. However each zone is unique with regard to bio-resource and availability of water and other resources.

Forest resources

The forest cover is important bio-resource for the people, especially for the village people and ecosystem people. Forest cover includes all lands which have a tree canopy density of 10 percent and above with area 1 ha or more. The minimum mapped area of 1 ha of the forest cover corresponds to the cartographic limit (a polygon of the size 2 mm x 2 mm) on a map at 1:50,000 scale. This definition is based on the scale of interpretation (1:50,000), the optimum size of cluster of pixels, resolution of digital satellite data used for the mapping (pixel size 23.5m x

23.5m) and the technique employed for image interpretation (State Forest Report, 2005-Government of India). The forest cover mapping presented in the 'State Forest Report' does not make any distinction between the origin of tree crops (natural or man-made) or tree species. Also, it does not recognize the type of land ownership or land use and legal status of land under the forest cover. Thus, all species of trees (including bamboos, fruits, coconut, palms, etc.) and all types of lands (forest, private, community or institutional) satisfying the criteria of canopy density of more than 10 percent have been delineated as forest cover while interpreting the satellite data. The basis of classifying forest cover, the ministry of Environment and Forests follow the principle given in Table 1.

Table 1: The Basis of Classification of Forest Cover

Very Dense	
Forest	All lands having tree cover with canopy density >70%
Moderately	All lands having tree cover with canopy
Dense Forest	density between 40% and 70%
Open Forest	All lands having tree cover with canopy density between 10% and 40%
Scrub	All lands with mainly small and stunted trees with canopy density < 10%
Nonforest	Any area not included in the above classes

A closer analysis of this reveals that a sizeable part of the country's area lies in high altitude mountainous region under permanent snow/glaciers, steep slopes and rocks which are not available for tree planting due to climatic and physical reasons. As per a recent study of FSI, about 1, 83,135 km² areas in the States of Arunachal Pradesh, Himachal Pradesh, Jammu Kashmir, Sikkim and Uttarakhand have been found above 4,000 m altitude where climatic and edaphic conditions limit tree growth. If this part of the geographical area of the country is excluded for the purpose of forest cover analysis, the forest covers of the country in terms of percentage to the geographical area is much less. Forest cover in hills is essential to maintain

Dependence of the rural society on forests Forests provide timber, firewood, nuts, fruits, and seeds, medicinal plants etc. to the villages in India. Forests shape natural environment of villages by providing ecosystem services like prevention of soil erosion, flood, etc and influencing such factors as temperature, humidity and precipitation and as a sink for green house gases and some pollutants. Forests provide suitable habitats for a number of plant and animal species. They help in maintaining a broad genetic base from which future strains and varieties could be developed. Nearly 23% of the total land area of India (328.8 million hectare) is occupied by forests, amounting to about 74.8 million hectares. However, analysis of satellite photographs indicates that the forest cover may now only be 14% (11% closed forests and 3% degraded woods). It has

been estimated that since independence, India has lost about 45 million hectares of good forests, of which only 6 million hectares have been replaced (Sharma, 1987). The principal factors for deforestation are an increase in human population and livestock and consequent increased demand for timber, fuel wood, and grazing. Urbanization and industrialization are important factors causing the destruction of forests. Other important causes are the construction of roads and mining activities. The construction of hill roads, particularly in the Himalayan region, has destroyed many forestlands. One estimate shows that some 683,672 hectares of land were under mining activity in 1973. Mining activities are still continuing in many states in full swing – the bauxite, coal, iron ore, chromites, lime stone, dolomite-mining in Orissa, Jharkhand, Chhatisgarh, Rajsthan and some other states is a case in point. Wood consumption worldwide amounts to >3.2 billion m³. Of this total some 46 and 54% respectively are consumed by industry and as firewood in developing countries. The corresponding figures for developed countries are 84 and 16%, and most of the wood being consumed as firewood. In India, fuel wood production was 213 million m³ in 1983, about 23% higher than the figure for 1973. (FAO year book of forest products, Rome, 1985). Paper industries consume a huge amount of bamboo, which is now in short supply in peninsular India. Paper mills now depend upon supply from North-east, especially Arunachal Pradesh (Sharma, 1987). The Himalayan mountain areas amount to 12,49,000 km² which form about 38.4% of India's land resource. Deforestation is now a major problem in the Himalayan regions. It has caused soil erosion and other damages. Besides, a number of wood-based industries have come up in this region as raw materials are easily available. The growth of industries has also caused air and water pollution. No detailed survey on the rich wealth (fauna, flora, minerals, water resource, etc.) of Himalayan ecosystems has been made. Recently WWF(2009) have reported 350 new species of biota from eastern Himalayas. Village ecosystems in general and mountain village systems in particular are under severe stress. Fast depletion of forests including mangroves by illegal felling, practice of Podu in many areas without taking remedial measures create stress among village people, especially in tribals. Social forestry involves plantations on government, private and village panchayat land, roadsides, canal-banks, along railway lines, land not suitable for agriculture and so on. The aim is to grow fast growing trees, which are commercially valuable. These trees are meant to raise firewood for people, pulpwood for the paper industry, and fodder for cattle and act as windbreaks or shelterbelts. Social forestry also involves the participation of people on a large scale, so that natural forests are not destroyed. It helps create plant resource genetic banks, nurseries, recreation gardens, and so on. Although a few years ago monoculture (culture of one species of trees) was practiced for social forestry, polyculture (growing more than one tree species in the same land) is now considered better and practiced. Polyculture is based on indigenous or exotic species of plants which can provide not only timber but also much required fodder and fix nitrogen to increase soil fertility. The following species of plants are now widely used for social forestry: Acacia, Lukens, (Subabul), Prosopis (Jand), Sesames (Agastha), Casuarina, Tectona (Teak), Dalbergia (Shisham), Moringa (Shajan), and Azadirachta indica (Neem) in rural India. Eucalyptus plantation was once considered a panacea for our economic

ills. It is a quick growing tree which is used in the paper pulp industry. But it is not very afforestation suitable as firewood or timber, nor can it be used as fodder or for consumption of fruit. The eucalyptus has lost the popularity it once had. Social forestry also aims to provide a good income to the farmer. Therefore plants which grow faster and reach a marketable size in 3-8 years should be chosen. A modified version of social forestry is called agro forestry. Woody perennials are grown on the same land management units as annual agricultural crops and farm animals. These are grown either simultaneously or sequentially and the purpose is to maximize output on a sustained basis. Community forestry/ village forestry/gramya jungle is practiced around villages and panchayats. The three terms, social forestry, agro forestry and community forestry have much in common and are considered more or less the same thing. The social forestry programme has made the people conscious of the importance of afforestation and is gaining in popularity. Compensatory afforestation is stipulated by the Indian Government, while approving proposals for dereservation or diversion of forest uses. Compensatory afforestation is insisted over equivalent area of non-forest land. The purpose is to compensate the loss of forest cover due to its diversion so that the net area under forest cover remains the same. If non-forest lands are not available or is available in less extent to the forest area being diverted, compensatory afforestation may be carried over degraded forests twice in extent to the forest area being diverted or to the difference between forest land being diverted and available non-forest land, as the case may be. The nonavailability of non-forest land for compensatory afforestation is however, accepted by the Central Government only on the certificate from the Chief Secretary to the State/Union-Territory Government to that effect. However the compensatory afforestation has not been practiced vigorously and requires effective management strategy to support rural economy and livelihood options. Agriculture Agriculture is the main source of livelihood in villages. Agriculture employs 73% of the main work force in the country, although contribution of agriculture to NSDP has declined from 67 per cent (1951) to 30 per cent (2002). Small farmers and marginal farmers (owner of 1.3% and hence the production and productivity of food grains are to be enhanced. Prasad (2009) suggests many useful methods and the fact is that India needs another green revolution to cope with the demand of growing population. Animal resources India's fish production data is given in Table 4. The total production was about 7.31 million tons in 2007, out of the total fish production, aquaculture amounted to about 3.355 million tons and the capture fishery (both marine and fresh water) amounted to 3.95 million tons. The per capita fish protein consumption is not much and there is good scope to increase the aquaculture facility and capture fishery considering 7500 km of coastline and a huge continental shelf. Productivity. The animals are important for providing organic manure for agriculture, dung-fuel for rural homes, and byproducts like bone meal etc as manures etc. However with reduction in grazing land and monetary constrains for stall feeding by the small and marginal land owners, government subsidy and Fish, prawn, and turtle form part of the livelihood support in Indian villages. Some of the ST and SC people also consume frogs, molluscs etc. The area under ponds, tanks, beels and fresh water lakes etc amounts to 3.42

million hectare. There is need of renovating village ponds for water harvesting and fish culture. The length of rivers and canals is 171334 km. The cleaning of rivers and

canals for fish culture will boost the village economy. The animal resources are utilized for different purposes and can be grouped under (i) milk group comprising cow, buffalo, goat and some minor contribution from camel and sheep, (ii) draught group comprising bullock, buffalo, horses, ponies, mules, camels etc, (iii) meat supplier group comprising buffaloes, cattle, sheep, goat, pig, rabbit etc, (iv) wool group comprising largely sheep, (v) egg group comprising fowls, and ducks. Marginal and small land owners are the owners of 71% of cattle, 83% of buffaloes, 88% of small ruminants, 70% of pigs and 74% of poultry (government of India-publication, 2005). In view of this the village livelihood sustainability is dependent on animal resources. As per the statistics, India produced about 89.35 million tonnes of milk (96% from buffaloes and cows, and 4% from goat), about 39092 million numbers of egg (2001-2002) and 4.91 million tonnes of meat including poultry meat (2001-2002) and the estimated annual growth is 5%. The live-stock products contributed 5.51% to the gross domestic product of the country in 1999- 2000. The live-stock contributes about 25% of the agro-sector of the country in terms of money. This is the important sector for scientific research to increase the milk, egg and meat production. There is good scope to enhance this production and other welfare measures are required. Genetic selection of animal breeds, feed and nutrition aspects, health and disease aspects and opening of veterinary dispensaries and hospitals in villages are the priority areas. India is very rich in domestic animal resources and their management is the most important aspects for sustainable rural economy. Rural livelihood options The rural livelihood options in India have centered around on agriculture, collecting fire wood, sal (*Shorea robusta*) or broad leaves (*Tectona grandis*) for making plates, kendu leaf for making cigarettes (bidi), Sal and Neem seeds for oil extraction, from nearby forests/Gramya jungle, fishing in ponds and rivers, and in sea in coastal villages, vegetables from home garden, meat, egg, and milk from domestic animals and (cattle, buffalo, goat and sheep), poultry etc from bioresource based cottage industries (bamboo, cane and wood for basket and furniture making) and small entrepreneurship (tea stalls, hotels, bakery and preparation of pitha, kiosks, cycle-motor cycle repair, tailoring, small laundry) etc. The environmental liability of these livelihood options is either low or medium, but never assessed or looked into. My association in some World Bank funded projects, (Government of Orissa Project, 2007) field work for EIA report preparation for some industries in Angul and Denkanal districts, some coastal districts and in some districts of western part of Orissa is summarized below. The non-farm activities center on goatery, poultry, dry fish trading, diary, rearing of wild boars, and piggery, and the forest based activities are leaf plate making, basket making, kendu leaf collection, firewood collection etc. Environmental sustainable indicators The forest provides firewood, house building material, fodder, fruits, medicinal plants and other utility materials to the villages with some control by village Panchayat. The runoff water from the slopes of the mountain forest/Gramya jungle is stored in the water harvesting village ponds. These ponds provide surface water for the use of the villages throughout the year as some ponds do not dry up fully in summer. In view of this the village forest forms the life line for the

villagers. A garland drain connecting to water harvesting ponds is usually constructed. The villagers depend upon the buffaloes and cows for milk, goat and sheep, poultry for meat and eggs and use the bullocks and buffaloes in the crop field for ploughing. The goat rearing is a profitable business for many village households. The village forest and grasslands are also used extensively for grazing of domestic animals of the villages. In the changed situation of industrialization, the reduction/complete loss of grazing lands, villagers have problems of providing grazing land and unable to afford stall feeding. Domestic animals provide livelihood support to the people. However, employment opportunities for villagers in the changed scenario may increase their income, which will help to partially stall feed the animals. Cropping pattern: Paddy, pulses and vegetables are the main crops. Pulses are grown followed by paddy. Brinjal, tomato, leafy vegetables, ladies finger, and vegetable banana are widely grown. Mango, Banana & Gauva are the major fruit plants grown by the villagers. The home gardens are also productive resources and are to be managed well. The core poverty group is the landless wage earners, marginal and small farmers, (less than 1 acre land holding), ecosystem people (Dasmann, 1988; Gadgil and Heda, 2009) (forest dependent and other bioresource dependent- largely SC, ST, and some OBC). Poverty is chronic as income is erratic (Table 3). The livelihood pattern in villages vary according to cast, ethnicity and financial condition of the families. Since the livelihood pattern is largely bioresource based, government schemes should protect these resources and funding should be done to enhance bioresource productivity and management. The income from these occupations is subsistence level and do not meet the family expenditure. In view of this migration to urban centres in the state or to distant places in search of work to augment family income happens. Environmental aspects Most of these livelihood options cited above have some environmental liability for people and these are never addressed in Indian situations. Table 4 gives an account of such environmental liability. In coastal belt industrial pollution has affected growth of coconut, Bamboo, Kaju production largely due to SO₂ pollution. Environmental impact assessment (EIA) Since 1994 EIA study has become mandatory for all new projects or expansion or modernization of existing projects which have substantial stake on environment. As per 14 September 2006 notification of Ministry of Environment and Forests of Government of India, the generic structure of environmental impact assessment document and check list of environmental impacts have been stipulated. The purpose is to assess the expected impacts and to address them through an environmental management plan if the developmental project is allowed to operate. The check list includes land environment, water environment, vegetation, fauna, air environment, aesthetics, and socio-economic aspects, building materials, energy conservation and environmental management plan. The check list is a reflection of livelihood options prevailing in India. However there is a big gap between the EIA stipulations and implementation. The sustainability concerns of Indian villages have not been adequately addressed. The interest of multinational companies and big industrial houses of the country have received more attention than the natural resource management or furtherance of traditional livelihood options conserving the 'traditional ecological knowledge' available in village systems.

Conclusion

Ramakrishnan (2009) points out emphatically that ‘very traditional societies living close to nature and natural resources around them may have to have traditional ecological knowledge being brought in to a much larger degree so as to avoid social disruptions setting in, compared to the more modern societies who may need traditional ecological knowledge only to be brought in so as to create buffering mechanisms within the socio-ecological system and thus cope up with the ill-effects arising from excessive use of energy intensive technologies.’ I have had the opportunity of getting involved in some World Bank funded projects and projects of big industrial houses to understand socio-ecological systems in some villages of Orissa. My understanding is that sustainable development in Indian villages canters on creating facilities to enhance the existing livelihood options, adopting effective community participatory approaches, and sustainable management of bio-resources. This does not prevent opening of new avenues which will have minimum environmental impacts and can be addressed by application of science and technology and will create livelihood options of youth. The judicious implementation of EIA provisions is need of the time to address environmental uncertainties and to conserve bioresource based traditional ecological knowledge and rural livelihood options.

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