



Agriculture:- Food land and Biodiversity,Crises and Challenges

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Introduction:

Ever since the dawn of history, man has been dynamic to change over the conditions and circumstances and has reached to the present state of affair. In his early development, he gave first attention to the state of art of discipline of food and food security which later on converged into AGRICULTURE. After satisfying hunger, he established laws of reform aiming to promote the free choice of individual related to market forces leading to prosperity of society. He experienced the pleasure and pain by accepting some and rejecting others, and choosing right and wrong events. He framed the tradition that is referred to as "SCIENCE"-The Agriculture. Thus, the entire events of surrounding i.e. air, water, land, plants and animals, etc. are the scientific phenomena of natural resources existed and will continue to exist.

As human knowledge on nature increased, he began to classify it into various branches of science and the several scientific fields came into being. The agriculture is one of them.

In this endeavor, the man has seen the countless breakthrough in science and scientific fields. The journey which he has traveled from:

- Bow to bomb
- Wandering state to settled life
- Cutting for caves to building of palaces
- Burning fire to capturing solar energy
- Metallic era to plastic world
- Seeing the objects beyond the eye vision
- Natural thinking to artificial intelligence
- Free lancer to Governance

And further, he may expect many more such break through, "Searching and exploring for the new place of settlement in the space atmosphere". The dream of today may be a reality of tomorrow and can be achieved through scientific discoveries and inventions.

We are now living in 21st century. And it has been said that this century is a century of challenge and opportunity., however there are crises too . Everyone in the country is expecting better quality of life and has a greater hope to scientific phenomena which can make it possible.

Better Quality Of Life

It means :

- Requirement of less muscle power (as minimum as possible) to accomplish the task.
- Quality in hygienic conditions

- Quality of food energy
- Global Marketing
- Pollution free atmosphere
- Life span longevity
- Deriving the possible benefits at will, from natural system
- Universal automation
- Abolishing Terrorism
- Feeling of oneness World over

Whatever we aspire, but without food energy, it is impossible to get the task accomplishment. The food is the first requisite in the hierarchical needs of man. And hence, harnessing the Agriculture for achieving the goal of adequate food to all, is the greatest **challenge of 21st century**.

Agriculture and Society:

Around 65 per cent of our population is engaged in agricultural sector as indicated by the population census(2011). The way of life of this section of people in general, is much below the minimum standard set for normal continual of life in present scientific era and in comparison to urban dwellings. On this basis there is a necessity for development of a broad guidelines for using the tools and techniques of fundamental sciences and framing of policies for rewarding, remunerative and sustainable agriculture so that people under farming sectors can harness the benefits and advantages as similar to that of the people engaged in non-agriculture sectors.

Agriculture and Food Security:

India, (in 1950) from food importing country has progressed to a state of self sufficiency. And the foundation is laid for it, to become food exporting country. The historical database on Agriculture in the country indicates that we had 50 m tonnes of food grains production during 1950, and now we achieved 210 m tonnes of food grains production by 2001-2002; and 256 m tonnes by 2013-14 and 267 m tones by 2015-16. This is adequate to feed the current population of 1260 m people (2014-15) besides keeping 60 m tonnes of food grains in buffer stock. The another significant achievement in agriculture is the availability of milk ,eggs , fish and fruits even in the smallest and remotest village in the country . This is the result of notable teamwork by a large number of people including the farmers, the scientists, the administrators and the policy makers, who have made remarkable contribution to this agricultural revolution. In the country. Customarily it is referred to as **Green Revolution**. Credit goes to Dr. M. S. Swaminathan, the then Leader of Green Revolution in India. He brought a few kg of wheat germplasm from Mexico with the support of Nobel Laureate Honorable Norman E Borlaug, and

modified and multiplied it suiting to Indian environment. . The great advance in production has been firmly based on solid scientific foundation for creation of new genotypes, which smashed the old yield barriers, introduction of integrated agronomic techniques, plant protection measures, timely recognition of plant-nutrient deficiencies in soil (N, P, K, Zn, S, Fe & Cu) and ensurement of optimum utilization of soil and water resources. The network of ICAR-Agrovarsity and State Agri-departmental Agencies are closely and intimately linked in the basic and applied research, and extension methodology in as integrated strategy.

Futuristic-Food and Land Scenario Crises:

The present time, however, is difficult and crucial one. On the one hand the very large human population (1250 m people) (2013-14), is increasing @ 1.6 per cent per annum. The demands for food, fuel, fodder and other resources are increasing in a proposition of expanding population. It is presumed that the population may likely to stabilize around 1500 m people by 2040 demanding around 350 m tonnes of food grains, besides the other necessities, from shrinking area of agricultural land. The per human available agricultural land today is about 0.114 ha and it will be 0.094 ha by 2040 (30m x 30 m or 100 feet x 100 feet) if the present status of 142 m hectare land under Agriculture remains the same. It has been envisaged that during next one or two decades there will be a great pressure for diverting 20-25 m ha agri-land for other non-agricultural uses and devebping related infrastructure thus leaving about 120 m ha land for agricultural purposes. Then per capita agricultural land available would be around 0.08 ha or 8700 sq. feet(28.3 m x 28.3 m Or 93 feet x 93 feet). Already soil degradation process has set in According to ICAR- NBSS & LUP(2002) estimate about 152 m ha of country’s total land including 90 m ha of agriculture land needs immediate attention for its resilience and restoration. And therefore, our scientific and agricultural activities need to proceed in such a planned manner that there is least possible damage to the soil environment which sustain us. The studies at NBSS & LUP on Soil Resource Inventory at the state level on 1:250,000 scale, at district level on 1:50,000 scale and at village or watershed level on 1:10,000 or 1:5,000 scale will help in deciding proper land use planning at agriculture and non-agricultural sectors.ICAR-NBSS & LUP 2002 has already earmarked the major soil groups numbering 1649 in the country. It will help to decide the plan and measures for sustainable land use .

India, after achieving self sufficiency in food grain production in 1980-90, has been striving hard to meet the growing demands further for food requirements and other related goods and services from its total land resource of 329 m ha. But still a large section of population about 26 per cent (below poverty line) faces food inse curity and unable to meet the needs for both the ends. They

Table 2. Loss of productivity in different groups of soils caused by soil erosion

lack to get a reasonable livelihood, and are suffering from malnutrition and poor quality of life. Their land quality is also very marginal. This factor accelerates the degradation of land and deterioration of quality of environment which include soil, water, forests and the climate. This has also disturbed the equilibrium and recycling pathways for water, plant-nutrients, oxygen and carbon dioxide between soil surface and the atmosphere. Because of deterioration of physical, che mical, hydrological and biological attributes of land, incorporation societal wastes into soil is not appropriately neutralized resulting a polluted environment.

The increasing population pressure reduces per capita availability of total landmass. Immediately after independence we had 0.66 ha of total land per person. It was reduced to 0.37 ha in the mid 90s and is expected to reduce further to 0.24 ha by 2020. It will remain 0.21 ha per person by 2040. It is of serious concern to agricultural planners as to how the ever increasing population in the country will be fed with. The quantity of availability of land is one issue and its quality is another. The quality of land is found deteriorating as the land is being over exploited and, oftenly it is misused and abused (Table 1). It is estimated that nearly 57 per cent of our land is reported to be degraded due to human influence. Of these, 45.3 per cent land have problems related to water erosion, 4.1 per cent land affected by wind erosion, 4.2 per cent land have chemical degradation and 3.5 per cent land suffered from physical deformation.

Table 1: Land Degradation Due human Intervention

Type	% of total land
Water erosion	45.3
Wind erosion	4.1
Chemical degradation	4.2
Physical deforming	3.5
Total	57.1

It is noteworthy that water erosion not only creates problems for the land but also decreases the water availability for the crops and thus is a double edge weapon. Land degradation not only takes away the physical land that is used for agriculture purpose, but also it decreases the productivity. The estimate of loss of productivity in different groups of soils indicated (Table 2) that the loss of soil per hectare per year is accounted to the range of 5 to 40 tonnes depending on soil type, environment and its use and misuse. In normal course, the loss of soil upto 5 – 10 tonnes/ha/yr is of common observation. This reduces the productivity upto 5 per cent in alluvial soil, upto 10 per cent in black soil and upto 25 per cent in red and lateritic soils. Increasing the level of soil loss, increases the percent loss in productivity in that order. At this juncture, it is unaffordable to let the soil to loss and productivity to reduce.

Soil erosion class	Soil loss (t ha ⁻¹ yr ⁻¹)	Loss of Productivity (%)		
		Alluvial Soils	Black Soils	Red Soils
Very slight	< 5	Nil	< 5	< 10
Slight	5 – 10	< 5	5 – 10	10 – 25
Moderate	10 – 20	5 – 10	10 – 25	25 – 50
Strong	20 – 40	10 – 25	25 – 50	> 50
Severe	> 40	25 – 50	> 50	-

India has 2 per cent of world’s land, 4 per cent of fresh water resources, carrying 16 per cent of worlds population and 10 per cent of cattle. Of the total geographical area of 329 m ha, 45 per cent is under cultivation, 23 per cent is under forest, 9 per cent is under non-agricultural uses and 23 per cent is barren and unculturable land. Though, a massive afforestation programme for the waste land has already been initiated in the country by the Waste Land Development Boards. Yet it is very difficult to bring whole of barren land as usable asset. Besides, there are alarming signals in terms of cultivated land which need to be protected for maintaining inherent soil characteristics of the region.

Fortunately in the country, the barrier of 150 m tonnes of food production during the period of early 90s, has been broken down and today we have produced 256 million tonnes of total food grains (2013-2014). It needs to be raised further at the rate of 3 million tonnes per year, in order to feed the increasing population. How to achieve this increase target? And where from it is to obtain are the crisis. The problems of limited irrigation has yet not been solved. Only 37 per cent of crop lands are irrigated which contributed to 55 per cent of total food grain production. The remaining 45 per cent food grain production comes from the 63 per cent crop lands covering under rainfed agriculture. An appropriate adoption of soil and water conservation techniques in rainfed areas can help to improve the production strategy. The loss of top soil which is to the tune of 8 – 10 tonnes per ha per year in our country needs to be prevented.

Water erosion not only takes away the top soil but also takes away a large quantity of nutrients from soil. It has been estimated that for every tonne of food grain production in our country, 105 kg of nutrients are removed. The recycling of the nutrients is not met with to the extent as it is withdrawn by the crops and getting lost with soil and water erosion. The solution to all these problems lies in adopting suitable measures to conserve the land resources. People’s participation and awareness training programmes are very essential. This will help to spreading the knowledge on soil database to all stakeholders about various aspects of this precious resources and its sustainable use. National Bureau of Soil Survey and Land Use Planning, Nagpur is working in this direction. An inventory of soil resources of the country has been completed on 1:250,000 scale. The resource maps were printed and passed on to the respective states for their use in planning and development.

A new concept of Agri-Clinic has been introduced whereby farmers can obtain soil health cards for understanding the problems of soil acidity, soil salinity, nutrients deficit and the ameliorative measures there for. Now the time has reached to look at the land resource more critically in the context of increasing population pressure and their increasing needs for basic requirements. The land is considered as integrated natural resource on which the society depends for almost all life activities. The trend and the status of the physical land use and land qualities are essentially understood for framing land use policies for agriculture and non-agriculture purposes. (Land includes soil and water).

Production Constraints

Land: In normal geological pace, nature requires about 1000 year to build up 2.5 cm (1 inch) layer of surface landmass (soil). Thus it is said to be non-renewable, and also a limited asset. It support biosphere – human, animals and plants and microbes for their generation and growth. In India, it accounts to 329 m ha of which 142 m ha is under agriculture. 75 m ha is under forest. The fallow and culturable waste land accounts to 37 m ha. Thus the total area under biomass production constitutes to 254 m ha (142 + 75 + 37 = 254), around 77 percent of the total country’s area. It is stated that around 30 m ha area is under water bodies (i.e. rivers and water reservoirs etc). The area under barren land constitutes to around 20 m ha and area under settlement etc. is accounted to 25 m ha. Thus the total area not available for biomass production is estimated to (20 + 25 = 45) 45 m ha. This figurative statement appears very good to those who deals with mathematics and statistics and the taxing departments, but to those who involves in societal development and welfare of the human beings, is a cause of great concern. There is continuous tug of war between the organizations dealing in ecology, forest, agriculture, national water boards, river valley projects, industries, highways, railways, airways and urban developments for want of their share of landmass. It is a fact that at many instances, the land under forest and/or agriculture is being diverted for meeting other competing needs of goods and services in order to achieve economic development leading to improve the quality of life. However, there is a limit and it has to set rather than going liberally and keeping ends open. It is thus a high time for an objective examination of available natural land resource, its quality and capacity to produce, and its sharing for other different competing demands for human sustenance keeping in view the present and

future goal more rationally. It has been reported that the processes of degradation of natural resources have already set in. The degraded land mass is estimated to 147 m ha consisting of 90 m ha of agricultural area and 57 m ha area under other biomass including forest (39 m ha) (NBSS & LUP 2005). The total soil loss due to water is reported to 5330 million tonnes with an average annual rate of 16.35 tonnes/ha/year, which is four folds higher than ideal permissible limit (4-5 tonnes/ha/year) of soil loss (Agri. Hb. ICAR page 232; 2006). The corresponding loss of plant nutrient is in the extent of 5.4 to 8.4 million tonnes every year, resulting in loss of crop productivity varying 5 to 50 per cent. This stated amount of soil loss due to water erosion in a year, equal to about 2 mm of surface layer to which nature takes about 8 – 10 years for its formation. Besides the water, the other causes of soil degradation are salinity, sodicity and acidity, physical deformity and the loss in inherent properties of soil fertility. This is a matter of great concern to agriculturists for ensuring sustainable replenishment of required quantity and quality of soil available water and regeneration of inherent fertility of crop land through re-enrichment of plant nutrients and soil organic matter. In addition to land degradation, flooding and land slides cause the large scale damage to human, animals and phytosphere. It has been observed since last couple of years that soils have shown the signs of fatigues. Its production capacity remains stagnated and somewhere fell down beyond expectation. This causes a great concern to fill up food grain basket of the country for future needs.

Land and Fragmentation:

From time immemorial the owning of the arable land in India, is rested with the individual households. It is bitter truth that the owning of ancestral property is the birth right of the progeny. In this context the land is subjected to fragmentation from generation to generation. This prevalent system has been a constraint in developing the land and other associated resources namely water and biodiversity for achieving sustainability in food production through technology upgradation and management of inputs. The owners of unviable piece of land and other land workers do not have the motivation to take advantage of productive forces and energy. The law of inheritance leads to fragmentation of holdings into a small parcels of lands to become unviable for its maintenance and utility. The small and marginal land holdings have rising trends in numbers. In the country there are 150 millions of total holdings of which 58 per cent constitutes to marginal, 20 per cent small, 14 per cent semi medium, 7 per cent medium and 2 per cent larger holdings. The marginal and small land holders constitutes to 78 per cent of holdings owning less than 2 ha of land (ICAR data book 2004). (Each land holding is comprised of 5-6 members). To this group of land owners, it is not conducive rather very difficult to extent financial and other related support and to

provide linkages within and outside the institution for obtaining sustainable production and upscaling socio economics status of these farmers.

Agriculture- Rural Work Force:

Agriculture has been the main source of employment and work force. It can created opportunities to engage youth and old people as well. About 65 per cent of the countries population engaged in this sector. However the present trend indicates less interest in agriculture and to go away from it. Agricultural Universities including universities on animal sciences numbering 73 and that of Agri and Allied colleges numbering 350, were established upto 2014-15, to provide qualified and knowledgeable manpower to agricultural sectors to improve the productive capacity of land. But the well qualified farm graduates are drifting away from their main goal of guiding the farm communities. They are searching job in nonagricultural sectors instead of joining with their parents to improve the age-old agriculture. What to talk about nonagricultural graduates. Are they willing to do farming? Consequently, rural migration and seasonal distress and unemployment continue to be increasing and resulting the creation of social and economically backward pockets. This has been the major cause of inadequate attention to the land, water and the forest. The adverse effect of it is the increasing economic vulnerability, disturbing peace, causing turmoil, unrest and hooglism which lead to negligence to Agriculture.

Land Administration:

The current land laws provide legal entity and social standing to the land holders. Owning the land is a matter of societal prestige and dignity and honour. However, it is not directly oriented to land quality in term of maintenance of soil fertility, preventing soil and water runoff, and providing viable income, employment and food security. It fails to make people understand the intrinsic and fragile nature of land. Which hinders the raising of soil productivity and its sustainability? There are several administrative and legal bottlenecks to forego the ancestral right on land and no one is willing to do so.

Land Availability and its Demand:

The land is required for many purposes. Therefore a holistic views need to be taken up to examine its availability, its potential and quality and then its deployment. The production of biomass is the prime concern when one thinks of Agriculture.

The projected demand of food items and other livelihood necessities (per annum) by 2020 A.D. is estimated as below:

Particulars	m tons*
Food grains (500 g/per head/day)	288.0
Sugar & gur	20.0
Veg. Oil	14.0
Cotton and other fibre	2.5
Tea, coffee, tobacco, etc.	1.1
Vegetables & fruits	80.0
Total	405.6
Other Bio-mass	
Fodder	700.0

Fuel wood	450.0
Industrial wood	95.0
Other raw materials, etc.	100.0
Total	1345.0

*** million tonnes**

In order to produce the food required by projected population of 1300 m by 2020 AD, around 236 m ha land is necessary with the present rate of productivity (1.6 ton per ha.), otherwise the productivity of the existing land resource to be augmented almost double from prevailing status. The current rate of productivity is 1.6 tons per ha which is to be raised to 3.5 tons per ha. How to achieve this targeted figure??? Of the total arable land (142 m ha), about 90 m ha is rainfed and 52 m ha is irrigated. The rainfed land shares 35 per cent of production and that of irrigated lands 65 per cent production. The total food grains production during 2014-15 was 256 m tonnes. The availability of water for increasing the area under irrigated agriculture is a big bottleneck. Uncertainty of rainfall, shrinking water table, silting of dams and small water reservoir and changing pattern of climate affect adversely agriculture production system.

The land and its associated natural resource have been continuously losing their potential of biomass production so also the ecological attributes. In other words, the land-the base for all developmental activities is literally shrinking in the context of per capita availability. It was 0.91 ha in 1950-51, remained 0.35 ha in 1996-97 and will reduce to 0.23 ha in 2020 AD. In that, the cultivable land will reduce from 0.14 ha (1950-51) to 0.09 ha by 2020 AD per capita i.e. (30 m × 30 m or 100 ft. × 100 ft.). According to the estimates provided by Hon. A. P. J. Kalam, the former President of India (26th January, 2006 speech) the arable land of 120 m ha only, will remain available for cultivation by 2020. Besides this, the land degradation has been on the top of it. The area is continuously subjected to desertification. Hydrologic distortion and deficiency of organic matter. Secondly, the urbanization and the industrialization will result the change in land use system. And it will destroy natural pathways of hydrologic replenishment. Further, the incorporation of the solid and liquid waste has made considerable land mass contaminated. The metros and class I cities of India, account for over 110 m tonnes of solid waste per year requiring 1150 ha land per year to fill it up to a depth of 3 meter. It is estimated that on an average a city of a million populations requires 4 ha area per year for disposal of solid waste.

Water Availability:

The water is another important asset. It is most essential component for biotic and abiotic activities and reactions. The per capita total renewable water resource is declining gradually. In 1985, it was 2011 m³, which came down to 1820 m³ in 2001 and will further reduce to 1300 m³ in 2020. Per capita availability of water less than 1700 m³ is considered as a stress level and

has a severe constraint on socio-economic development, biodiversity and environmental quality. Historians believe that the great civilization such as 'Harappa, Mehjodaro, Sumerian, Mesopotamia, Egypt and others fell because of the then scarcity of water. About 2500 years ago the Holy Soul young Buddha at the age of 29 years, had to leave the livelihood palace in search of peace to stop war like situation arose between Sakyas and Non-sakyas tribes for sharing the water from **Rohini river** flowing through their regions.

Hon'ble Padma Bhushan, Dr. Madhaorao Chitale, former Chairman of Water Board Commission, GOI, has cautioned that there appears to be danger of third world war for want of water. In most of the states and also in Maharashtra, the ground water level is decreasing upto 1 m depth every year. The water budgeting has already initiated in Punjab, Haryana, Tamil Nadu and also in Maharashtra. The scarcity of water will be a one of the major cause to jeopardize the progress in Agriculture and in turn the economy and social well being of the people.

Our Socio economic development is dominated by the agricultural system. There is, therefore, the compulsion of ensuring the attainment of the water needs for agriculture and also for human being under the constraint and uncertainty of rainfall and adversity of climate accelerating degradation processes. It is possible, if natural resource complex (land, water, forest/plant) is kept stable to adjust and to maintain a dynamic equilibrium. The soil and water erosion take place as natural phenomena. However, human intervention intensifies it, due to faulty land use operations and uncaring of natural rainfall. It has a great impetus on agriculture and thereby on social nature and their impact on well being of the people. It is stated that there is positive function between the status of soil erosion and poverty of the people. In some studies at Madhya Pradesh, it is reported that the status of poverty increases with increasing the soil loss. In Vidhyan region, the soil loss accounts to 40-80 tonnes per ha per year resulted corresponding poverty to the extent of 53 per cent (NBSS & LUP, 2002). It is utmost necessary to control and prevent the erosion to protect the ability of land to support over generation to generation, and generation There has to be harmony between the continued availability of required water supply and yielding attributes of the land.

Biodiversity:

The second important basic aspect of human well being is the biological diversity. It is the sum total of diversity in the biosphere around us. It is in term of number, variety and variability of all living organisms (plant, animal and microbes). It includes terrestrial, marine and other aquatic ecosystems and ecological complexes. These diverse biological entities facilitate the processes of renewal of the biomass and the soil, and the purification of water and the air. It ensures the co-existence of living host organisms together with their friends and foes (scavengers, predators,

pests and pathogens). It is significantly related to agriculture (Agro-biodiversity). India is one of the 12 mega biodiversity hot spots of the world. It supports to major forest types varying from alpine pastures in Himalayas to mangroves in coastal areas. It is reported that the total species in world are estimated around 10 – 13 million in number, of which 1.72 million species are scientifically named. It includes 0.42 million species of plants and 1.3 millions species of animals.

In India, nearly 127 thousand species have been identified so far, out of which 45.4 thousand belong to plant kingdom and 81.3 thousand to animal kingdom.

The man has selectively domesticated several species and provided them alternative environment under agriculture, maintaining biodiversity in terms of mixture of crops and the farming systems for winning over the adverse situation caused by vagaries of climate and incidence of pests and diseases, and failure of crop(s) due to one reason or the other.

India figures amongst the biodiversity rich countries in the world, having about 7.5 per cent of identified biological species from 2.5 per cent of global land mass. India supports 16 per cent of human population (2011 census) and 18 per cent of livestock population in the world. Its cultural ethnic diversity includes more than 550 tribal communities of 227 ethnic groups spreading over 500 odd forest villages representing diverse ecosystem across the humid tropics, to semiarid temperature and alpine regions. In term of plant species, about 175000 species of higher plants are estimated to occur in the country in 16 major vegetation (forest) types. About 33 per cent of which are endemic.

By the standard means of biodiversity, the land mass around 30-33 per cent is to be kept under the forest cover. India on an average has 18 per cent of forest cover. In Punjab and Haryana, the forest cover is almost nil. In Maharashtra about 22 per cent area is identified under forest. Per capita availability of forest in India is one of the lowest in the world (0.08 ha or 90 ft. × 90 ft.) against 0.5 ha for developing countries and 0.64 ha in the world. In India forest meets nearly 40 per cent energy need of the country of which about 80 per cent goes to rural areas. It also meet 30 per cent fodder requirement of the cattle population.

More than two dozen crop-plant species and farm animals were domesticated by Indians. There are 380 crops species and 130 breeds of domesticated animals and poultry in the country.

Based on the richness and variation within the species, the country has been grouped into 20 agroeco-zone and 60 subzones encompassing 1649 important groups of soils (NBSS & LUP 2002). This zonation is delineated on the basis of climate, soil characteristics and average length of growing period of annual crops.

Significance of Biodiversity

It contributes to the human well being in several ways, such as:

- Disease management
- Plant and animal health
- Lowering soil temperature
- Protecting soil against erosion
- Improving soil texture
- Enrichment plant nutrient and organic recycling
- Reducing weed menace
- Improving drainage
- Fertilization and forest control etc.
- Nutrition and food for human and animal resource
- Provides essential raw materials and services such as fibers, fertilizers, fuel and pharmaceuticals to the industrial network.
- Sustaining agro-ecosystem including the forest and the forage management.
- Purifying the atmosphere.

Besides the above it generates 1.67 kg of oxygen with the production of per kg of dry matter. The phytosphere contributes to 49 per cent, crop land 8 per cent and ocean 43 per cent to the generation of total oxygen pool in the nature.

Ethnic botanical survey indicated that traditional doctors and vidyas used about 7500 odd species and varieties of plants in local medicinal practice. The agro-biodiversity has been utilized to produce more than 2800 high yielding varieties and more than 300 horticultural crops which together helped in attaining self-sufficiency and food and nutritional security.

Deterioration of Biodiversity: Its Causes and Effects

It would be of a great concern that the natural habitats of crop-plant and forest-plant and also the traditional/ethnic agro-ecosystems are losing diversity therein, due to the expansion and intensity of agricultural practices, industrial development, improper disposal of industrial and urban effluents and unscrupulous felling of trees and clearing of forest. By disturbing the eco-friendly habitat of wild animals, the later enters into nearby areas of city and town and get killed by the people. These lead to the extinction of many economically importance forest and crop plant species and also associated animals and microbes.

There are reports of a decline in the population of wild animals and several indigenous cattle's, goat, soil biota, aromatic and scented traditional rice, minor millets and several kinds of indigenous vegetables.

The important plants like teak, sal, movha, garadi, dikamali, arjuna, oomber, palas, bija, bhira, char, khair, doha, salai, tendu and many other including local jamun and mangoes, etc. are gradually vanishing from Indian market. The availability of local mango fruits in the market during summer season to reduce the adversity of intense heat and temperature, is almost vanished. It was once upon a time considered as **King of Fruits** as each one of us had easy access to enjoy it. The societal bondages related with mango season are hardly seen now a days.

Similarly, there are extinction of many crop varieties e.g. Rice-Tumsar and Sokoli 'Luchai', in Bhandara – Gondia districts of Maharashtra. Howrah-wheat, Deshi papaya, etc. The availability of local (deshi) tomatoes in the market is also almost vanished. It is most important ingredient and vegetable in culinary of every household in India. Similar case rested with the animal too. The country originally had wildlife habitat in 30.2 lakh km² area which now remained only 6.2 lakh km² area (80% loss). The population of tigers and lions as indicated by Lokmat Samachar (22-1-2007) are tremendously reduced. It has been reported that the population of striped tiger in Vidarbha region has declined by 149 within 17 years. It was 417 in 1989-90 and remained 268 in 2005-06. These situation must have been further worsen by now.

Natural earthworm and many symbiotic and asymbiotic microbes, nitrogen fixing bacteria and fungi from soil atmosphere are getting reduced so much so that soil losses its natural quality and self rejuvenation. It is due to the drastic effect of a heavy use of agro-chemical and fertilizers. The monoculture, heavy tillage with farm machinery, declining use of organic manure, devoid of intercropping, rotation and deforestation disturb the soil structure. The heavy Lands and Hills slide associated with very high rainfall and floods killing several thousands people and desurfacing many villages, townships and pilgrimage in Uttarakhand in June-July 2014, possibly the cause of faulty exploitation of natural resource and biodiversity.

There is a considerable reduction in pollinator bees and other insect particularly natural enemies of pest and diseases. Vulchers, crows and house sparrows are very rarely seen. So also, there is a depletion in timber and nontimber forest, and medicinal and aromatic plants. The cattles are gradually drifting away from agriculture. In Punjab and Haryana almost no cattle is used for agri-operation.

There is great important to **"Dung economy"**. Cattles could provide approximately 100 m tonnes of dry dung every year worth Rs. 5000 crores. It is calculated that to replace 73 m animals, we required 7.3 m tractors each costing Rs. 13 lakhs which equals to the investment of Rs. 2,19,000 crores, in addition to 2.5 crores tonnes of diesel (Rs. 67,000 crores) (based on Hitvada, Nagpur edition 28.01.2007). Such reduction leads to increasing the cost and declining the productivity in agriculture.

There is an increasing tendency of pollution of environment, rivers and water reservoirs. The loss of greenery reduces the carbon sink and hastens the concentration of carbon dioxide (CO₂) and other green house gases in the atmosphere and thereby depleting the ozone layer-the barrier for penetrating ultraviolet rays from solar system to the earth surface. This may have adverse effect on health. It also increases atmospheric heat and temperature. It is reported that a steady rise of temperature at lower atmospheric region by about 1 – 2^o C would cause to recede ice-caps and

glaciers in Green lands and Antarctica and corresponding rise in the level of sea. Incidentally, such rise of 60 m, would flood vast thickly populated territories of India that is Mumbai, Chennai and Kolkatta and towns and villages on sea coastal region.

The use of pesticides and insecticides also leads to killing of beneficial insect along with the targeted pest(s). It thus, alter the normal structure and function of agro-eco system.

Biodiversity Amiralative Measures

The co-existence of important biota in agro-ecosystem is equally important. The conservation of biological diversity on on-farm and non-farm sectors need to be ensured for enabling the use and utility of variable genetic resources for the sustainability and well being of humanity. This can be achieved by adopting ex-situ (gene bank pool or repositories) and in-situ (at places it exists) conservation measures.

For this purpose, all concerned institutions, universities and college students in the respective regions should be mobilized in collaboration with local people on highest priority for integrated approach of germplasm collection and its conservation and maintenance. Necessary training, logistic support and conservation facilities should be provided for in-situ and ex-situ conservation of biosphere. The sustainable use of bio-resources should be ensured through appropriate institutional support and awareness raising. The gene and germplasm sanctuaries in respect of phytosphere and zoosphere for selected species should be established and managed judiciously.

The Challenges :

In order to achieve higher productivity on sustainable basis with least damaging to soil, environment and biodiversity, some challenges are to be faced with they are listed below.

- Increasing biomass productivity under the constraints of shrinking land resource and depleting biodiversity
- Balancing availability of land and forest with projected demand of agriculture, industry, urban and civil development
- Maintenance of land and environmental quality
- Motivation to the people about sustainable land use.
- Bringing awareness in people about an ill effect of biodiversity degradation
- Increasing peoples motivation towards agriculture and forest management

Aspiration on Youth:

Now it is high time to stress upon to undertake an integrated effort by the youth (below 35 yrs age) amounting to 540 millions (54%) in the country to plan the strategy for protecting and safeguarding the land and biodiversity as these two attributes are highly vulnerable. The action and activity should be in equilibrium with the human well being at present and in future. Awareness and sensitization to the people are made through seminar, symposium and workshop organized

more frequently in each agro-eco region. The administration has to be cautioned about the delicacy (fragile nature) and ill effect of these parameters for sustenance of humanity. The priority is to be accorded especially targeting the youth as they are torch-bearer for future generation. Hon'ble A. P. J. Kalam, former President of India, while delivering valedictory address on National Youth and Cultural Festival at Pune (16.01.2007) opined that we have 54 per cent ignited minds of youth between 15 to 35 years of age group. This group of youth will suffice to surmount any obstacle to see fully developed India technologically, economically, socially, culturally and free from hunger.

\Epilogue:

In our country, security with respect to agriculture and biodiversity covering soil, water, crops, trees, forest, microbes and farm and aquatic animals are of greater importance since it relates to livelihood security of more than 65 per cent population, and food, health and trade security of the Nation. This is accomplished by maintaining synergetic relationship between the people, animals, trees, crops and land. To fulfill this goal, there is a need of **Second Green Revolution and Biosecurity** measures. The

possible constraints arising out of misuse and mishandling of the land and biodiversity are to be addressed properly through our educational, research and developmental programmes. Failing which, we may live in the world of conflict in dividing the human societies by differences. In that case, the people will resort to assert for their rights.

Now, notwithstanding that the land is limited and fixed resource. Its continuous utilization with best available technology and skill, the ability to support biosphere is declining. Hence land quality required to be preserved and enhanced to keep pace with increasing demands. Land cannot be taken for granted or captive resource by any user sector, any more. We should be more careful and cautious otherwise, new generation may ask the older generation, "**Here is the land and where is the soil?**". Turmoil may arise endangering human society and civilization.

The Lord Buddha, Jesus Christ and Gandhiji always remind us the power of love and peace which come only after fulfilling the basic needs of man for food, clothes and shelters for which maintaining equilibrium between Land and Biodiversity is the utmost necessity.

