INTRODUCTION

CHAPTER 1
INTRODUCTION

A speech of the U.N. Secretary General, Kofi Annor, in a summit of the World Economic Forum on February 5, 2002, reflected the realization of the hard fact: "The reality is that power and wealth in this world are very unequally shared and that for to many people are condemned to lives of extreme poverty and degradation" (Shridhar 2002). Challenges before the world in general need to be comprehended carefully in view of the history of progress that the world has witnessed to take stock of the fact in the light of the practices across the country on the globe is essential in the context. A quick look at the balance sheet of human development suggests that about 24 percent of the populations of the developing countries are living below the poverty line. If they are reduce the halves by 2015 as per United Nation declaration, there will still be 900 million people living in extreme poverty, 826 million people undernourished and nearly one billion people will still lack access to improved water resources (UNDP Report 2001).

Presently the world is striding ahead to face the gigantic triple challenges of sustainable increase in agricultural productivity, environmentally sustainability and poverty alleviation, which are further aggravated by unfavorable environment, global competition and rapidly advance technology. Therefore it is the most appropriate time to ponder over various issues for consolidation of gains and realistically plan for future generation in term of sustained production increase, protection of environment, conservation of natural resources and social equitability of gains. As the developmental goals of agriculture comprise complicate and complex issues like sustainability, food security, environmental safety, balanced eco-system, value addition and so on. All of these can not be worth true without proper utilization of ever shrinking, most valuable resource. A fact that has always been stressed is the need for the development of village in order to develop the country as a whole.
If we take stock of the recent situation, particularly of about two decades which are pertinent in term of inter decade comparison of pre and post liberalization it may through up some light in understanding the issue and level of social justices. Physical planners strongly feel that the regional imbalance in the economic development cannot be removed unless regional plans for physically, socially and economically viable unit are prepared. The following aspects were considered for delineation of region, topography, type of soil and vegetation, climate, cropping patterns, minerals resources, social and ethnic group, social custom and tradition, population density and variation, urbanization and settlement patterns, communication lines, economic linkage as reflected by flow of commodities and administration boundaries.

Man has continually and at an increasing rate, been changing the form and modes of his interaction with the environment. On the one hand population of the earth is growing rapidly, while on the other hand, with the technological and scientific revaluation, development activities have accelerated to such an extent that in certain areas they have become a threat to the environment. The utilization of natural resources is growing at an alarming rate, causing great concern for their conservation. In this relation, the term sustainable development was used at the time of the Ccoyo Declaration, “an environment and development” in the early 1970’s. Since then it has become the trademark of international organization dedicated to achieving environmentally benign or beneficial development.

1.1 SUSTAINABLE DEVELOPMENT

The question of sustainable development has emerged due to over exploitation of resources as well as due to mis-management of technology. Swaminathan (2003) has identified nine principles for desired success in promoting ecological sound agriculture. These are land, water, energy, nutrient supply, genetic diversity, pest management, post harvest system, system approach and location specific research development. FAO (1991) defined in
term of agriculture, the sustainable development is "the management and conservation of the natural resources base, and the orientation of technological and institutional change, in such a manner as to ensure the attainment and continued satisfaction of human need for present and future generation. Such sustainable development conserves land, water, plant and animal genetic resources is environmentally non-degrading technically appropriate, economically viable and socially acceptable."

As per Greenland (1994) the sustainable land management system is one that does not degrade the soil significantly contaminate the environment, while providing necessary support to human life. As per the Swift et al. (1991) a cropping system is not sustainable unless the annual output shows a non-declining trend and is resistance, in term of yield stability, to normal fluctuation of stress and disturbance. In the term of economic the Turner (1988) says that an optimal sustainable growth "policy would seek to maintain an acceptable rate of growth in per-capita real income without depleting the national capital asset stock or the natural environment asset stock".

In reference of ecology the Conway (1987) express their view the sustainability is "the net productivity of biomass (positive mass balance per unit area, per unit time) maintained over decades to centuries". In the term of sociology the Bartelmus (1994) express that sustainable development can be advanced as the set of development programme that meet the targets of human needs satisfaction without violating long term natural resources capacities and standards of environmental quality and social equality".

1.2 LAND AND ITS CLASSIFICATION

Land is one of the crucial natural resources that control the economic condition of a country and support life thereon. The population pressure on the limited resources is wounding. Consequently, there is a need to grow more and
more from less of land. On the other hand soils are depleted at an increasing rate due to soil erosion soil salinity/alkalinity, water logging etc. The above phenomenon causes for agricultural advancement. The adoption of improved technologies and at the same time conservation of the vital land and soil resources is difficult task. Some of the important factor responsible for soil and land degradation is unplanned population growth, expansion of farming into marginal land.

Land use is a synthesis of physical, chemical and biological system and process on the land and human / social process and behavior on the other. The monitoring of such system includes the diagnosis and prognosis of land use changes in a holistic manner at various levels. In recent year various sustainable land use initiatives are being taken at national and global level under the tropical forestry action plan, World Food Program and UNCD initiated, forest principle agenda, 21. The government of India initiated the agro-forestry programme as an integrated sustainable land use management system.

Soil is the most important natural resources for agricultural development. However, with the repeated use over the years our soil is losing its vital characters. Salinity is a natural characteristic in some semi-arid and arid soil. But human have increased the extent and degree of salinity in different way. The extension of irrigation and different techniques used for water abstraction, can lead to a buildup a salt level in the soil through the mechanism of raising ground water level.

Till 1949-50, the land area in India was classified into five categories which is known as the five fold land utilization classification. These categories were (i) forest (ii) area not available for cultivation (iii) other un-cultivatable land, excluding the current fellow (iv) fellow lands and (v) net area sown. The technical committee on co-ordination of Agricultural Statistics, set up in 1948 by the Ministry of Food and Agricultural recommendation a 9 fold land use classification
replacing the old five fold classification and also recommended standard concept and definition for all the state to follow (Anon 2006).

<table>
<thead>
<tr>
<th>Old classification</th>
<th>New Classification</th>
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<tbody>
<tr>
<td>Forest</td>
<td>Forest</td>
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<tr>
<td>Area not available for cultivation</td>
<td>Land put to non-agricultural uses.</td>
</tr>
<tr>
<td>Other uncultivable land, excluding current fallow</td>
<td>Barren and un-cultivable land</td>
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<tr>
<td>Fallow land</td>
<td>Permanent pasture and other grazing lands.</td>
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<tr>
<td>Net area sown</td>
<td>(i) Miscellaneous tree crop and groves, non included in the net area sown, (ii) cultivable waste, (iii) fellow land, other than current fallow, (iv) current fallow, (v) net area sown</td>
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The need for WRM has widely been recognized as the ever increasing population leads to pressure on the available resources, and lead to their depletion and degradation. Resources degradation through erosion of valuable layer of the earth surface, change in flow regions of river and other phenomena are frequently worst events faced by the present day world. The management of water resources seems to have only the limited impact in abating these adverse processes. The lack of adequate information, database and proper documentation are few of the reasons for its limited impact (Ayachi 2003).

### 1.3 REMOTE SENSING AND GIS TECHNIQUE

Remote sensing refers to the science of identification and classification of earth surface feature using electromagnetic radiation as a medium of interaction. Every object reflects / scatters a portion of the electromagnetic radiation incident on it. In addition, it also emits radiation depending upon its temperature and emissivity. Reflectance/emittance patterns at different wavelengths for each
object is different and this patterns is used to identify and discriminate objects. Remote sensing system broadly comprises the platform, sensors, data acquisition system, per processing, and data interpretation and analysis. Remote sensing system having the capability of providing regular, synoptic, multitemporal and multi spectral coverage of the country are playing an important role in natural resources survey. Successful launching of the Indian Remote Sensing Satellites carrying liner imaging self scanning sensors (LISS III and IV) provided a much required impetus to agricultural application. Some of the agricultural application areas wherein considerable progress has been made in the last few year in country are (i) Crop production forecasting (ii) Drought monitoring and its assessment (iii) Soil mapping (iv) Mapping of waste land (v) Land use / cover mapping (vi) Monitoring of surface water bodies (vii) Ground water exploration (viii) Flood mapping and damage assessment (ix) Watershed development.

Remote sensing technology forms a powerful tool for continuous monitoring of forest and land resources, both in space and time domains, because of its unique capability in providing timely, repetitive and synoptic coverage over large area across various spatial scales. Remote sensing inputs are very useful for locating different types of bio-resources to identify appropriate corridors, surrounding natural habitats and protect them from human interventions and other harmful influences that endanger the existence of these habitats. Using different landscape ecological parameters along with restricted ground observations, biologically rich areas, hot spots etc. can be identified for conservation prioritization. Remote sensing combined with theoretical efforts in conjunction with socio-economic data provides a clear understanding of the problem associated with deforestation, land degradation and their proximate causes.

Application of remote sensing technology may be as simple as using an aerial photograph to evaluate the relative extent of hail damage, insect infestations, accidental herbicide damage, or uniformity of fertilizer or water application. Aerial photographs capture any number of landscape features or
crop growth patterns that may have practical solutions such as compaction patterns, areas in need of erosion control, and even identifying infertile areas that could possible benefit from manure application. From high elevations, images of multiple fields can quantify the acreage of different types of crops and to some extent assess yield potential.

GIS is a multidisciplinary technology involving geography, photogrammetry, cartography, remote sensing, surveying, GPS technology, statistics and other disciplines concerned with handling and analyzing spatially referenced data. With the recent advantages in the broadband and wireless technology, the reach and range of GIS user working in office, laboratory in the field at home is extended. Traditional GIS can only serve dedicated user with sophisticated user with sophisticated software and hardware resulting in limited aspect. Web-enabled GIS would facilitate decision making at the strategic, tactical and operational levels, support for performance of administrative operation and serve as a gateway for decision makers and general users to access the system conveniently and effectively.

A GIS data base is development to incorporate spatial information, which is an extremely important element in all levels of planning process. The window based customized software was developed keeping in mind to show the GIS component and attribute data in a way so that the village can easily interact with it. At the regional level, location of important resources like rivers, roads, forest, network of canal and many other such features in relation to a cluster of villages help the village committee members and planners to decide on alternative livelihood to plan various infrastructure/civic facilities and to design proactive steps for natural and / or man made disaster management.

The greatest amount of research attention in the land-use and land-cover change area has been dedicated to deforestation. Time series remote sensing imagery has been particularly valuable for this kind of research because
conversion of forest land to other uses is, in comparison to other conversions (e.g. residential, commercial uses, change in cropland to pasture land) and fairly easy to detect. The most widespread application is simply to monitor the amount and rates of forest cover change between two time periods (e.g., the forest resources assessment of the FAO).

1.4 DEMOGRAPHY

The term demography concerned with population statistics which deal with analytical interpretation of population dynamic covered the wide area. Demography is a statically study of the size, territorial distribution and composition of population change their in component of such changes which may be identified as natality territorial and social mobility. Over exploitation of natural resources by the ever increasing population is leading to serious environmental concerns. The continuous impact of anthropogenic activities reduces the quantity of forest and its structural diversity resulting in multiple ecological impacts.

As per the social science application, the needs to be some attention paid to the social determinants of deforestation, and not simply the rates of deforestation. This generally entails the combined analysis of remote sensing and socio-economic data. One approach has been to combine census data collected by administrative units with data from remote sensing satellites. For example, Wood and Skole (1998) used census data based on administrative units (municipios) in the Brazilian Amazon, together with forest cover change terms aggregated to those units, to identify and rank in importance the socioeconomic and demographic variables associated with forest clearing. They found little correlation between population density and deforestation, but when they added a variable for the number of migrants in rural areas, they increased significantly. Their model also included a proxy variable for conflicts between small land holders and ranchers, which was statistically significant, suggesting
that such conflicts might increase the likelihood of land clearing to establish de facto ownership of land.

In the present era the population pressure is increase day by day on land resources. The varied use of land, decrease the area of cultivable land. It is very necessary for developing the sustainable plan for overall development, the demography characters must be consider on priority.

1.5 INDIAN AGRICULTURE SCENARIO

At the time of our gaining Independence, Jawaharlal Nehru said, "Everything else can wait, but not agriculture". Unfortunately this profound truth is yet to be converted into concrete and action on an adequate scale. There have been several policy statements for agriculture and land management during the last fifty-nine year, including the comprehensives report of the National Commission on Agriculture Policies (1979). However we are yet to place faces before figures and the problems of farm families as human being and citizens of the country are yet to receive the attention they need and deserve (Swaminathan 2006).

In India, agriculture is being practiced from many thousand years. Our ancestors convert the forest and grasslands into fields and started growing crops. The land use pattern is intensifying because of the increasing demand of land for food grains production, houses, transport etc. for this increasing population. Accordingly, the net sown area of the country increased up to 14.5 crore hectares (1998-99) from 11.9 crore hectares in 1950-51, most of which is converted from forest land pasture and other lands. Food grain production in country has also increased from 58 million tonnes in 1951 to 204 million tonnes in 2005.
Farming is both the way of life and principle means of livelihood to 65 percent of India's population of total 110 crore. Our farm population is increasing annually by 1.84 percent. The average farm size is becoming smaller each year and the cost-risk-return structure of farming is becoming adverse with the result of the farmers are getting increasingly indebted. Agricultural growth has declined during the last decades. This had led to a decline in real per capita income in rural India, in comparisons to the rapid growth in urban income.

India is the seventh largest country in the world. In India land resources constitute the fundamental base for all human activities. It is one of the most important natural resources of the country as the agriculture sector is more predominated than the industrial sector. The way and the extent, to which the land resources are utilized, decide the country socio-economic development. Hence the proper utilization of land according to its use potential is important not only for producing food material (cereals, fruit and vegetables) but also for developing industrial sector, transport and communication network and other social need and public amenities.

The existing land use patterns in different region in India has develop due to the action and interaction of various factor, such as the physical characteristics of land and industrial framework, the availability of the infrastructure of the other resources and of economic development of the region. Out of total geographical area of 328 million ha of the country, the land use statistics are available for about 306 million ha, constituting 93 present of the total area. According to the year 1999-2000, the arable land (the net sown plus the current and other fellow land) was established at 166.14 million ha (54.2 present) of the total reporting area. The area under forest was accounted at 69.02 million ha (22.6 percent of total geographical area). Land put to non-agricultural uses was estimated at 22.97 million ha (7.5 percent) and the barren and un-cultivatable land at 19.44 million ha (6.4 percent) permanent pasture and other grazing land were estimated at 11.04 million ha (3.6 percent), land under miscellaneous tree crop and groves,
not included in the net sown at 3.62 million ha (1.2 percent) and cultivable waste land at 13.83 million ha (4.5 percent).

The area remains under forest in the country is only 22 percent (1998-99). However, the ideal condition for a country is to have 33 percent of its area under forests. The area under fallow land was 9.9 percent in 1998-99. Therefore, the percentage of cultivable useless land has also declined from 8.05 to 5.00 percent. If the area of fallow land and land under gardens etc. is added to the net sown area of India, then the total area under cultivation becomes 51.6 percent of the total area of the country. Thus India has the highest percentage of cultivable land as compared to other large countries of the world. It indicates that there is no or least possibility remains to further increase in the cultivated area. Therefore the only alternate remains to feed the even increasing population are to increase the productivity from all the macro and micro crop environments.

1.6 ABOUT CHHATTISGARH STATE

Chhattisgarh, came into existence on November 1, 2000. Chhattisgarh is situated between 17° to 23.7° North latitudes and 80.15° to 83.38° East Longitude. Chhattisgarh abounds with hilly region and plains. The total geographical area of Chhattisgarh is 1.35 lakh sq. km., occupied 4.14 percent area of the country. Uttar Pradesh and Jharkhand to the north east, Orissa to the east, Andhra Pradesh to the south-east and south, Maharashtra to the south-west, Madhya Pradesh to the west and north-west from its boundaries. The Chhattisgarh state consists of three agro climatic zones viz. Bastar plateau (Jagdalpur and Dantewada districts), Chhattisgarh plain (Bilaspur, Korba, Raigarh, Durg, Kawardha, Champa, Raipur, Dh jamtari, Mahasamund, Rajnandgaon and Kanker) and northern hills of Chhattisgarh (Jashpur, Sarguja and Korea districts) including 3 division (Raipur, Bilaspur and Bastar), 16 District, 10 Nagar Nigam, 16 Zila panchayat, 29 Nagar Palika, 40 Nagar Panchayat, 98 Tahsil, 146 Blocks, 146 Zanpad Panchayat, 9810 Gram Panchayat and 20308 villages.
The total population of this newly created State, Chhattisgarh, as at 0:00 hours of 1st March 2001 stood at 20,795,956 as per the provisional results of the Census of India 2001. The population of the state rose by 18.06 percent during the decade 1991-2001, as against the national average of 21.34 percent during the same period. The sex ratio (i.e., the number of females per thousand males) of population was recorded as 990, which has increased from 985 in the previous census. Total literacy of the State rose to 65.18 percent from 42.91 percent in 1991.

Out of total sixteen district, the district Bilaspur is western part of the state with district head quarters at Bilaspur, falling under Bilaspur division. It is bounded in the North by Ambikapur and Shahdol districts in the east to south-east by Korba and Janjgir district and in the south by Raipur, Durg districts and in the west Kawardha district of Chhattisgarh state and Dindori district of Madhya Pradesh. The Bilaspur district is located between 21'03" to 23'17" N latitude and 82'09" to 83'36" E longitude. The district is divided into 8 tehsils viz. Lormi, Mungeli, Takhatpur, Kota, Bilha, Masturi, Pendra and Bilapur comprising 10 blocks. There are 1679 village out of which 1598 are inhabited villages and 81 un-inhabited villages in the district.

With all major minerals including diamonds in abundance, it is the richest state in mineral resources. There are mega industries in steel, aluminum and cement. Its large power surplus is attracting power-intensive industries, and the state is poised to become the power-hub of the nation. Its central location helps easy power transmission to any part of the country. Bilaspur's Railway Division is the most profitable in railway operation in the country, contributing 17 percent of the revenues of Indian Railways.
1.7 STATEMENT OF THE PROBLEM

After five decades of agricultural development some pertinent questions have arisen challenging the effectiveness of the approaches adopted so far. The most important question raised with the leveling down of the green revolution euphoria was the priority of concentrating on resources endowed farmers of irrigated tract with capital intensive technological option for a few crops only. This approach has led towards social inequality by creating prosperity in hardly thirty per cent of the area of the country, while tenant, small and marginal farmers logged far behind in gains from application of new technology than the larger farmers. It is the time to think of the small and marginal farmers. Mahatama Gandhi very aptly said, "The poor people cannot be helped by mass production, but they can be helped only by production by the masses." Therefore, we have to strive both for mass production and production by masses through appropriate technology.

A farming practice obviously is very complex and that's why, any agricultural technology is well suited to a particular agro-ecological situation may not be adapted to other area farmers. Research and extension efforts were stressed for development and delivery of scientific and improved technologies for the cause of agriculture development. In this regard, a vast networking of infrastructure for the development and dissemination of relevant improved agricultural technologies were designed since the very inception of the planned economic change. It is incredible to note that with all the technological advancement, the technological gap was found up to the extent of 75 percent in tribal areas (Anonymous, 1981).

Chhattisgarh is the relatively under developing with regards to agricultural productivity as compared to most of the Indian States. This state has varied soil types, large tribal population, surplus manpower and favorable agro-ecological conditions through which we can attain sustainability in the agriculture sector.
The total agricultural land of Chhattisgarh is about 58 lakh ha with less than 30 percent irrigated area. The cropping intensity is 134 percent. The state is a well known “rice bowl” of the country and an area of about 35 lakhs ha is under rice cultivation. The state is completely dependent on the monsoons for rains. The annual average rainfall is 1200-1600 mm. with limited protective irrigation for rice crop up to 20 percent.

Agriculture is the primary occupation of the people of Chhattisgarh. About 80 percent of the population depends on it for their livelihood. The previous study shows that the majority of the Chhattisgarh state farmers are belonging to the small categories. They are the owner of the total 65.7 percent cultivable land area of the state. These farmers are growing only one crop (paddy) and their average production is very low. The average rice production of the state is 18.34 quintal per ha, that is very low in comparison to India's average rice production. Chhattisgarh has sufficient water resources, but this resource largely remains untapped. In terms of the irrigation potential, it is estimated that 43 lakh hectare area can be irrigated as against the existing irrigation potential of 1.34 lakh hectare. Forestry has a significant role in the economic development of Chhattisgarh. Nearly 44 percent of the State is covered with forests, ranking it third in India in terms of forest cover. The State boasts of an abundance of minor forest produce like Tendu leaves, Sal seed, Mahua seed, gum, etc., which have enormous economic potential. But the status of the large majority of farmers is very poor. To uplift the situation of farmer it is very necessary to increase the per ha productivity of agricultural crop.

To meet the ever increasing challenges, the entire concepts and culture of farming in the Bilaspur has to gradually change from sustainable livelihood to commercial one and competitive enterprises with marketability and profit earning.

Based on the above fact the present study entitled "A study on land use patterns and demography for sustainable agricultural development in Bilaspur
(C.G.) through remote sensing and GIS techniques" has been planned for analyzing the land use pattern and population demography with the following specific objectives –

1.8  OBJECTIVE OF THE STUDY

1. To analysis the present status of natural resource in the selected area.
2. To asses the land use pattern in the selected area.
3. To evaluate the demography with selected parameter in the selected area.
4. To find out the relation ship between land use pattern and demography in selected area.
5. To develop the sustainable agricultural development strategies based on the opinion of respondents.

1.9  SIGNIFICANCE OF THE STUDY

The monoculture farming system are get the adverse effect to farmers due to less and erratic rainfall in the state. The position of farmers is very critical in present farming situation. So it is necessary to change the farming system of basically small and marginal farmers of the state.

But since last two year the steep fall in rain, occurs many problems among the rice growers. The state government decided to change the cropping patterns of whole state. The state agricultural department has developed some plan for encouraging the farmer for adoption of innovative techniques with crop diversification. It requires some change in the existing farming pattern. Another problem of the state is labour migration. After rainy season, the land less and some marginal farmers shift to other state for getting employment other than agricultural occupation. So the major workforce of the area is migrated for eight month. Land is the crucial resources among the farmers, so the study related to
the land use pattern and demographic characteristics are very important to
develop the sustainable development plan.

Thus, the present study will be helpful to the planner, policy maker and
farmer for suitable land use planning for the area to enhance the crop production
of the area as well as develop suitable strategies on the basis of obtained
suggestion from the local farmer. To achieve the target of crop diversification and
reduce the labour migration, it is necessary to develop such sustainable plan for
employment generation and effective growth in agriculture sector. The policy
maker and the authorities of DRDA will also benefited from the study to chalk out
their plans for the better of the farmer, as they will get lot of information such as
soil erosion, degradation of forest, crop production, water harvesting etc. from
this study. The use of remote sensing and geographical information system help
to develop a large area development for plan land use patterns and analysis the
actual field problems.

1.10 LIMITATION OF THE STUDY

The study was confined to the Bilaspur district and therefore the
inferences drawn from this study would be applicable to other similar areas. The
study did not suffer due to any unusual limitation other than common one like
time, finance, mobility and physical facilities. In spite of these efforts was made
by the researcher to conduct the study as possible, deliberately following all
norms of the scientific research by carrying out the investigation in the actual
place of programme implementation involving systematically selected tribal and
non-tribal farmers and selected socio-economical and socio-psychological
variables in the selected area of the study. Hence the findings of the study can
be generalized in all such regions where similar condition exists.
The thesis work has been presented into five chapters as here under:

1. Introduction
2. Review of literature
3. Research methodology
4. Results and discussion
5. Summary, conclusion and suggestion

ORGANIZATION OF THE THESIS