

# Study of Land Use Pattern in Jammu and Kashmir

Chandra Mohan Rajoriya<sup>1</sup>, Ram Gopal Choudhary<sup>2</sup>, Syed Makhmoor Hussain Razvi<sup>3</sup>, Dr. Bhanwar Lal Jat<sup>4</sup>

<sup>1,2</sup>Department of Geography

<sup>3</sup>Department of Botany

<sup>4</sup>Department of Agriculture Biotechnology

<sup>1,2</sup>SPC Govt. PG College (MDS University), Ajmer, Rajasthan, India

<sup>3,4</sup>Bhagwant University Ajmer, Rajasthan, India.

**Abstract-** *The way people handle and use land resource is decisive for their social and economic well-being as well as for the sustained quality of land resources. India with only 2.3 percent of world's total land area supports 18 percent of human and 15 percent of livestock population in the world. According to the National Remote Sensing Agency's (NRSA) report, there are 75.5 million hectares of wastelands in the country of which around 58 million hectares of wastelands in the country of which around 58 million hectares are treatable and can be brought into productive levels through appropriate measures. Agriculture is the main occupation for the people of Jammu & Kashmir. About 65 percent of the people are directly or indirectly dependent on agriculture and allied activities for their livelihood. Agriculture and its allied activities are the predominant sector of the economy of Jammu & Kashmir and this sector contributed more than 31.29 percent of Gross Domestic Production (GDP) in 2007. The cropping land use in the state also underwent drastic changes which led to the decrease in area under food crops and increase in area under cash crops/plantation agriculture. The study of this shifting land use was necessary for the sustainable agriculture of the state. Knowledge of cropping land use helps in maximization of productivity and conservation of land. The study has revealed a major shift of land from the desirable to undesirable land-use classes. There has been an increase in the net area sown in Jammu and Kashmir on account of various land reclamation measures adopted till early-1980s, but later this land-use class has shown an unfavorable decline towards 2004-05. Cropping intensity has been lower in the Kashmir than Jammu province due to unfavorable climatic conditions prevalent in the valley. No significant association has been found between irrigated area and cropping intensity, indicating lack of location-specific technological advancements and their respective channelization. It is required more so due to altitudinal variations that demand short duration varieties for increasing cropping intensity. The state largely comprises small and marginal farmers (about 94%), and the per capita availability of cultivated land in the state is only 0.072 ha, which is a major constraint in agricultural development in the state.*

**Keywords-** Fisheries, Livestock, GDP, Irrigation, Sericulture

## I. INTRODUCTION

The dynamics of shift among different land-use classes has been studied in the state of Jammu and Kashmir. A significant decline has been observed in the total reported area, which necessitates a proper land-use survey through remote sensing. A declining trend has also been observed in the area under forests. The unfavorable increasing trends in the area put to non-agricultural uses and barren and uncultivable land are likely to have serious implications on ecological balance. Inter-sectoral land budgeting analysis has revealed that shifts in area are occurring from desirable ecological towards undesirable ecological sector. The estimates of regression analysis have revealed that the net irrigated area, literacy and area not available for cultivation have significantly improved the cropping intensity in the state agriculture, whereas agricultural density and area under rice are significant determinants of current fallow lands. The study has emphasized on the evolution of suitable institutional mechanism for scientific management, conservation and development of land resources in the state. Indian agriculture is a prelude to economic development and a pre-requisite for poverty alleviation and overall economic development (Ravallion and Dutta, 1996; Singh and Baleka, 1999; Anonymous, 2007). In view of this, Indian agriculture is now poised for technical transformation for ensuring food security, export earnings, and decentralized development to reduce rural poverty, owing to the severe population pressure on the natural resource base of land, water, bio-diversity and other resources to meet its growing food and development demands. Agriculture is a land-based activity and as such land and water have been the basic elements of life-support system and an important resource for the economic life of a majority of people in the world. The way people handle and use land resource is decisive for their social and economic well-being as well as for the sustained quality of land resources. India with only 2.3 percent of world's total land area supports 18 percent of human and 15 percent of livestock population in the world. According to the National Remote Sensing Agency's (NRSA) report, there are 75.5 million hectares of wastelands in the country of which around 58 million hectares of wastelands in the country of which around 58 million hectares

are treatable and can be brought into productive levels through appropriate measures. However, the per capita arable land in the country is only 0.15 ha, which is expected to come down to nearly 0.08 ha by 2025 (Kanda, 2007). It is a paradoxical situation that on the one hand more production is required from the scarce soil resources for meeting the demand of ever-expanding population, while on the other, cultivable areas are being shifted towards non-agricultural uses. India has experienced a considerable shift under different land-use classes during post-independence period. Land-use is a highly dynamic process. It implies that policy discussions and development planning have to be based on a sound understanding of these dynamics. Therefore, it is imperative to make a comprehensive study of the pattern and magnitude of land-use shifts for sustainability and productivity of agriculture in an area.

There are a wide variations in the distribution and utilization of land resources across different states of the country, based on topographic, geographical, political and other factors. Jammu and Kashmir, one of the north-western hill states, has a total reported area 2416 thousand hectares, of which only 31 percent is available for cultivation and the rest is either under demarcated forests or other land-use classes. Moreover, due to urbanization and infrastructural development, there is all the possibility of a shift among land-use classes in the state. While some land-use shifts have occurred in the desirable direction, some others might have been in the undesirable direction. In this back drop, the present study was undertaken to investigate the dynamics of land-use pattern in Jammu & Kashmir (J&K) with the following objectives: (i) To analyze the trends and dynamics of shift among different land-use classes in J&K and (ii) To study the extent of productive and unproductive land-use pattern and their determinants in J&K. the objectives have been accomplished to test the hypothesis that although there has been a shift among land-use classes, no shift has occurred in the undesirable direction. Land use is a dynamic process and it keeps on changing with the change in economic returns, agro-climatic conditions, farm programmes, conservation strategies and environmental regulations. The state of Jammu and Kashmir experienced a change in the cropping land use though with varying degree of intensity across its spatial units (districts). The analysis of the data reveals that net sown area has increased by 3.36 percent though it increased more in Jammu district (19.73 percent), but it decreased in Srinagar, Budgam and Pulwama. The state average of -29.92 percent decreases from 1980 to 2008. The highest decrease has been observed in Srinagar district (-48.95 percent) followed by Udhampur (-46.64 percent). The area under maize crop registered a net decrease from 229925 ha in 1980 to 198464 ha in 2008 (-13.68 percent). At district level, the highest decrease

is found in Rajouri and Udhampur (-28.78 percent), while as area under maize increased in Budgam, Baramulla and Kupwara districts. Wheat also registered a negative growth of -21.47 percent in its area during these twenty eight years with highest decrease in Udhampur district (-43.46 percent). The area under orchards has increased in all the districts of the state though maximum increase has been experienced by Kashmir valley than Jammu and Ladakh provinces of the state. Land use is the human use of land and it involves the management and modification of natural environmental into built environment such as fields, pastures and settlements (FAO, 1997a; FAO/UNEP, 1999). Land use is a synthesis of physical, chemical and biological systems and processes on the one hand and human/societal processes and behavior on the other. The monitoring of such systems includes the diagnosis and prognosis of land use changes in a holistic manner at various levels (Singh, 1992). One of the first land use patterns that geographers studied is the pattern of crops across an agricultural landscape. Difference crops represent different agricultural land uses (Bednarz, 2005). Cropping pattern refers to the proportion of the area under different crops at a point of time. It also reveals the rotation of crops and the area under double cropping pattern is determined by various factors, viz; physical factors such as soil, climate, technological factors like irrigation, improved varieties of seeds, availability of fertilizers and plant protection chemicals; Institutional factors like land reform, consolidation of holdings, credit facilities, price structure, procurement policies and storage facilities and other factors like the rate of return, agro-climatic conditions, farm programmes, conservation programmes, and environmental regulations (Duffy, 1996; Shafi, 2000; Das, 2004; Adihikari et al., 2005). These factors are not watertight but inter-related. For instance, the adoption of crop technologies is influenced not only by resource related factors but also by institutional and infrastructural factors. Economic factors play a relatively stronger role in influencing the crop pattern in areas with a better market networks co-evolve to make the farmers more dynamic and highly responsive to economic impulses (Bhalla and Singh, 2001). The cropping system of any locality is the cumulative results of the past and present decisions by individuals, communities or governments and it keeps on changing in consonance with change in prices of goods, Govt. policies and other related factors (Gupta & Singh, 1979). The interacting driving forces of population increase, income growth, urbanization and globalization on food production, markets and consumption have changed food and agricultural system worldwide (Braun, 2007). The relative importance of crops, crop yields and farm size leads to change in cropping pattern of an area. The introduction of new agricultural technology especially during the period of green revolution in the late sixties and early seventies resulted in wide spread change in cropping land use

pattern in India especially from cereals to non-cereals (Hazra, 2006). Agriculture is the main occupation for the people of Jammu & Kashmir. About 65 percent of the people are directly or indirectly dependent on agriculture and allied activities for their livelihood. Agriculture and its allied activities are the predominant sector of the economy of Jammu & Kashmir and this sector contributed more than 31.29 percent of Gross Domestic Production (GDP) in 2007 (Digest of Statistics, 2007-08). The cropping land use in the state also underwent drastic changes which led to the decrease in area under food crops and increase in area under cash crops/plantation agriculture. The study of this shifting land use was necessary for the sustainable agriculture of the state. Knowledge of cropping land use helps in maximization of productivity and conservation of land (ICAR, 1980). The spatio-temporal change in the area under different food crops (Paddy, Wheat and Maize) and area under orchards etc. in the study area from the year 1980 to 2008 is presented in detail below.

**Study Area** The state of Jammu and Kashmir constitutes northern most extremity of India and is situated between  $32^{\circ} 17'$  to  $36^{\circ} 58'$  N latitude and  $73^{\circ} 26'$  to  $80^{\circ} 30'$  E longitude. It falls in the great northwestern complex of the Himalayan Ranges with marked relief variation, snow-capped summits, antecedent drainage, complex geological structure and rich flora and fauna (Raina, 2002). The state is 640 km in length from north to south and 480 km from east to west. It consists of the territories of Jammu, Kashmir, Ladakh and Gilgit and is divided among three Asian sovereign states of India, Pakistan and China. The total area of the State is 2,22,236 km<sup>2</sup> comprising 6.93 percent of the total area of the Indian territory including 78,114 km<sup>2</sup> under the occupation of Pakistan and 42,685 km<sup>2</sup> under China (Qazi, 2005).

Agricultural land occupies about twelve percent area. This in the world was originally under forest or grasslands. Grazing is ancient agricultural practice supporting very small population. Rapidly growing population needs more food and therefore it is necessary to study land resources, which has to be used very carefully and judiciously to solve the problem of food. This is possible through exhaustive land use survey. Land is suitably classified in different category (Stamp, 1954). The main objective is to uncover past and present agricultural land use pattern in this direction. The efforts have been made in abroad and a few in Iran by government and some scholars. This land use surveys have great significance for future land use studies. In this chapter attempt has been made to present a brief review of literature related to land use studies in the world and Iran.

**Conceptual Framework of land use:-** Proper utilization of land is essential to sustainable agricultural development. Land use is a function of four variables, namely, land, water, air and

man. Land use is continuously changing as a result of changes in pattern and magnitude of human activities. Food shelter and clothing are basic needs of human being. As the land resources are limited and increasing population is facing the problem of shortage of food grains. The concept of land use capacity refers to the ability of any given. Unit of land resource to produce a net return above the production cost associate with its use. The amount of this net return provides an index of land use capacity. Land areas with high use capacity normally have higher market values than those of lower used capacity. Farmers tend to use their land resources for those purposes, which promise them the measures to provide optimum return. A land utilization project aims striking balance between added mouths and land use capacity. The concept of land use, therefore, revolves round the man's accomplishments in conversion of land. Each stage of such change may involve many problems to pave the path for attaining equilibrium in use of land. Land use planning can be applied at three levels, namely, national, district and local. These are not necessarily sequential but correspond to the levels of government at which decisions about land use are taken. Different kinds of decision are taken at each level there is need for a land use strategy or policies that tackle these priorities and operational planning to get the work done. The concept of regional survey of land use making maps at the first evolved by concrete framework in world land use survey by volkenberg (1949). But practical work on land use study was carried out by late. L.D. Stamp in the year 1930. This is perhaps, the first land use survey, which was later on adopted by many geographers, economists and planners for land use studies. Among them notable work is done by Baker (1937) Agricultural.

**World Land Use Studies:-**The land use survey initiated by the sir Dudley Stamp in Britain (Stamp, 1950). This concept and plan of world land use survey was brought forward by Volkenberg. He proposed the world land use at the International Geographical Congress at Lisbon in April 1949. It was proposed that land use may be undertaken on a uniform scale of 1:1000000 and each map sheet be accompanied by an explanation text. In 1953 under the chairmanship of van volkenberg at the International Geographical Congress proposed to carry out land use survey in many parts of the world. Van volkenberg was In charge of American and L.D. Stamp was placed as In charge of countries of Eastern Hemisphere. This objective survey was to record the existing land use in all parts of the world on uniform system of classification and notation with such amplification as may be necessary locally and to publish the results including maps of land use only and memories. The detailed maps would only be published by the countries by the countries concerned. The proposed land classification by world land use survey commission is cited below (i) Horticulture include the

intensive cultivation of vegetables and small fruits. (ii) Settlement and associated non-agricultural land. (iii) Crop-land (iv) Improved permanent pasture (v) Unimproved grazing land, and (vi) Woodland (vii) Swamps and marshes. Other comparable land use surveys have been carried out in Britain, United States of America, Canada, India, Pakistan Nepal, Japan, Iraq, Burma, Malaysia, Australia, New Zealand, Sudan, Uganda, Kenya, South Africa, Cyprus, Poland China and Bangladesh Nigeria and many other European countries. These all reflect to some extent the ecological condition under which the crops are grown, but the past and present economic conditions of area have equally had their impact on present land use. A special kind of survey is the "Soil Use Survey" in which the quantity of crops grown is compared statistically with the types of soils in a given area. "Crop Disease Survey", in which particular crops are investigated in term of geographical distribution of diseases and crop damage are of major interest today. In other cases, one particular crop is surveyed to obtain an inventory of its present or future production under the existing management conditions. Field pattern surveys and land allotment surveys are concerned with different aspects of land use in particularly regarding the size and shape of the fields on which the crops are grown.

**Land use Studies in Developed Countries:-**The development of agriculture in advanced countries during the 1950s to the 1970s occurred largely because of increasing use of fossil fuel energy. It has been supported by increasing use of fertilizers and agricultural chemicals which produced with fossil energy sources and the breeding of new varieties of crops that responsive to and compatible with such chemical inputs and cultural practices (Pimental, 1973). The different land utilization studies have been carried out in United state of America and European countries. Developed nations like United State of American and USSR have completed extensive soil surveys and mapped out all types of soil. In U.S.A. state planning Board has make the culmination of land utilization surveys conceived on the broadest possible basis. The United Kingdom and Denmark applied industrial and agricultural economic base and brought out the land utilization survey on the list of countries in the world. The objective of land use study also goes to prevent soil erosion and facilitate economic use of the land. The methods used for these surveys were derived from stamp's system, described previously. Initially, the project was begun in Poland and from there developed into a coordinated effort in which other countries took part. i.e. Hungary, Czechoslovakia, Yugoslavia and the German Democratic Republic. The project was also coordinated with similar work including land evaluation being carried out in the USSR. This work has directed primarily towards a detailed study of the characteristic features of land utilization itself, tends towards a more thorough study of the

natural and socio-economic conditions. It is also points towards systematic research into questions of ownership and of organizational land technical matter leading to the elaboration of land utilization systems. The ultimate goal of this work is clearly not only to register how the land is being used at present, but to study this critically with a view to land evaluation. The latter includes a critical study of the relative suitability of existing types of land utilization on which they are being practiced. The Eastern European System is not directed exclusively towards agricultural land use. The main heading of the legend include:- (i) Ownership boundaries and administrative boundaries (ii) Agricultural land (Agrarian structures, rotations on arable land, perennial crops, permanent grasslands, animal breeding) (iii) Forests (Density, dominating species brushwoods) (iv) Water (Kind of water, water control, water utilization) (v) Settlements and non-agricultural land (Residential areas, industrial areas, commercial areas, communication areas, public utilities, recreation areas, other constructions of tourist interest) (vi) Unproductive land (Because of natural conditions, derelict lands) (vii) Special areas.

Thus simple land use system of stamp, has introduced structure for describing land use has developed. The Canada land use Inventory, although based partly on investigations of present land use, is primarily executed as an evaluation of land use capabilities. It is, therefore, primarily to be treated as a system of land evaluation (Mc Cormack, 1971). Survey of present land use constitutes a well-known part of land resources survey for development projects. They are particularly useful in areas where both irrigated agriculture and dry farming countries like, in soil use surveys represent a particular kind of the present land use. The soil use survey of the area around Wageningen in Netherlands made in 1955 (DEVISSER, 1956) as a methodological experience. In this survey, separate plot of each arable land the standing crop was noted. The actual condition of the crop was described roughly as being "good" "medium" or "poor". The coherent grassland areas as well as separate plots of grassland were also noted. The objectives and methods followed were quite different from one another, as they have been carried out under varying conditions, although broadly, all efforts were made to record the use of land on maps.

**Land use Survey of Britain:-**The land use survey of Great Britain stood as an example of the World Land Use Survey of the International Geographical Union. Later on, different parts of the world, e.g. Cyprus and Hong Kong. The original work done in Britain was by Dudley Stamp and his school workers. The single intention was to map land use data in order to obtain a better geographical knowledge of Great Britain. Stamp pioneered land use study in Britain. In the year 1930,

he established an independent research organization called "Land Utilization Survey of Britain". The main motive of the formation of the organization was to prepare land use map for Britain. He conducted land use and then maps were prepared. Maps of the size of 18 multiple 12 were made available because such maps were quite handy. Ultimately, he could prepare the land use map before the outbreak of First World War. On the bases of these maps a voluminous book entitled "The Land of Britain-its Use and Misuse" was published in 1962. The success of Stamp's land use survey was depended primarily, apart from the energy and talent of Stamp and small group of scientific co-workers, on the large number of volunteer workers, many of whom were school children who were recruited from all over the country. This pioneering work to a large extent was crowned with success with voluntary exercise from the students of schools and colleges of Great Britain. Within less than ten years the endeavor provided a detailed cartographic record of land in England, Scotland and Wales.

**Land use Studies in United States of America:-**The issue of comprehensive planning in the United State has been addressed since the birth of the country. Three major land use surveys were conducted in U.S.A. Firstly, a survey was conducted by Tennessee Valley Authority in 1936 proceeded by Michigan Land Economic Survey (1919) and second, Rural Land Classification programme of Puerto Rico (1952). Michigan Land Economic Survey, first of these government sponsored project was initiated in 1919 by the Michigan Academy of Science and it started functioning in 1922 with a view to evaluate merits of the Northern Michigan in respect of agricultural, recreational or other uses. This survey collected all natural attributes of Michigan Land and especially information related to soil, slope vegetation and similar natural features. The Project has been launched when the wasteland problem in Northern Michigan State became state began to feel the burden of supporting primary needs of the society (Barnes, 1929). The second major American Survey, namely, Tennessee Valley Authority was a lineal descendant of the Michigan Project. The technique of "Unit area" was adopted to classify the land of Tennessee valley by G. D. Hudson. This technique involves "long fraction" and "short fraction" that refer to the method of Land use its general characteristics, while the denominator indicates physical characteristics of the area. For example, a long fraction with the notation 56322/12113 denotes an area of subsistence farming with major emphasis on grain crops. Lastly, department of Geography, North-western University, Illinois in U.S.A. conducted Rural Land Utilization programme of Puerto Rico and collected in the aerial extents of minimum 323.75 to 748.5 sq kms. The American Land use Survey was taken in mainly for the purpose of land use planning on the countrywide

scales, which embrace the planning of both the physical and human phenomena.

**Land use Studies in Developing Countries:-**Land use studies in developing countries have carried out in highly crowded countries where land use planning is vital, i.e., China India, Pakistan, Cyprus, Poland, Hong Kong, Bangladesh, Japan Sri Lanka, Malaysia etc. In the second post war period the study of land utilization has been undertaken by many universities and research organizations. In some countries aerial photographs were used for preparing the land use inventories. The mapping technique has improved and new dimensions have been added in the study (Sharan, 1969), today one can find excellent land use maps in development countries, namely, Cyprus, Poland, and Hong Kong. Land utilization maps of Cyprus (1:2,500,000) have been prepared under the direction of R. R. Rawason and K. R. Sealy in the Department of Geography, London School of Economics in 1956. The maps were prepared from about 10,000 air photographs (1:10,000 to 1:13,000) taken in 1949 (Melamid, 1958).

**Land use Studies in China:-**In China Land use study was conducted by Johan Lossing Buck. The purpose of Buck's survey was threefold, namely, i) to train the students in the methods of research in land utilization, ii) to make available knowledge of China's agriculture and iii) to generate the interest among the people of other countries in China's welfare; land utilization, food and population problems. In China, data were collected on sampling basis from twenty-two provinces. Besides farm studies, several aspects related to agriculture such as food, standard of living, marketing and price level were also considered.

**Land use Studies in India:-**Land use studies conducted by Indian geographers in various parts of the country received inspiration from L. Dudley Stamp who had attended the 25<sup>th</sup> session of the Indian Science Congress at Calcutta in 1930. "Such studies range from inventories of land use surveys to isolate topical or regional descriptive accounts of land use variations, both in space and time. The land utilization survey of 24 parganas and Howrah districts conducted by S. P. Chatterjee and the land utilization survey in Eastern Uttar Pradesh conducted by M. Shafi have made in strong plea to carry out the land use survey combined with the survey of land capability. It was in the year 1940 that S. P. Chatterjee tried to organize the land use survey in India. In this presidential address before the Geography and Geology Section of the Indian Sciences Congress Association in 1940, he pointed out the necessity of understanding the land use survey. The Commission on World Land Use Survey pursued this matter and the Government of India established a National Committee for this Purpose under the direction of S. P.

Chatterjee. By that time, no systematic land use survey had been initiated for entire country. Some geographers were engaged in pilot surveys individually. S. P. Chatterjee surveyed 800 villages of West Bengal and brought out eleven land use sheet on the scale of four inches to mile. Under the guidance of P. Dayal and A. Sharan, Department of Geography, Patna University has surveyed three consecutive community development blocks, i.e. Biharsharif, Noorsari and Rahui in Nalanda district. Besides this R.N.P. Sinha of Patna University intensively studied the land use of Canal Irrigated Area of Patna District. In Bhagalpur University K. N. Das studied the land use of the Kosi Basin in North Bihar, while S. R. Roy prepared his Ph.D. thesis of Land use and settlement in the districts of Bhojpur and Rohtas Bihar. The Government of Andhra Pradesh has conducted a land use survey of East Godavari district. Similar studies have been made by the Government of Karnataka for the whole State. And for Tana. Taluka by the State of Bombay. M. Shafi has brought out a scheme based on sampling techniques for land use survey of a vast country like India. V.L.S. Prakasa Rao, suggested land use classification on the lines of soil survey technique. He applied his idea to the land use analysis of the Godavari region. B.K. Roy has attempted an analysis of crop association and changing the pattern of crops in the Ganga-Ghaghra Doab East. In Sagar University S. N. Mishra has studied land use in khaddar and ravines of the Lower-middle Gomati Valley. He has attempted land use planning for better adjustment of agriculture to the physical environment for optimum exploitation and conservation of natural resources. N. P. Ayyar has given statistical approach to the study of crop-combination regions. He has suggested maximum distance methods to group important crops into association. H.S. Sharma has tested the method of land capability classification based on Bennetts, method. According to Learmonth and Bhat agricultural land use has been studied in detail by several disciplines but its sharp regional contrasts need spatial analysis, which falls under the purview of economic geography. The Agricultural Atlas of India (1958), the National Atlas (1957) and the Census Atlases (1961) of different states contain choropleth and dot maps relating to land use and crops which are useful in the analysis of crop distribution and concentration in general way and which have potentiality for more rigorous analysis. In Ranchi University E. Ahmad has analyzed land use types in relation to physical elements. According to him slope of the land should be considered in preparing the development scheme of an Indian village. V.R. Singh presented his Ph.D. thesis on the Environs of Mirzapur Plateau in Banaras Hindu University and has computed the standard nutrition unit. B. Mandal has elaborated the Weaver's methods in analyzing crop combination regions with special reference to North Bihar. In analyzing the crop combination B.N. Sinha, has taken the help

of Weaver's and Nelson's techniques. P.C. Vat has studied land utilization and farming efficiency by applying the British method of land utilization. J.S. Yadav has interpreted the broad regional variation in cropland use in Rajasthan. L.S. Bhat has suggested the concept of planning for grassroot level, i.e. village, block and district level for land use planning. S. S. Sharma stressed the physical and human factors for determining land use patterns in Shahabad tahsil of Mathura. V. B. Tripathi of Kanpur and S. P. Garg has studied of crop combination, ranking and changing patterns. B. N. Jha studied problem of utilization in the Kosi basin which passes through the various physical and natural activities including the emerging problems of land utilization in the region.

**Land use Survey in Japan:-**Japanese land use planning started with the City planning Act enacted in 1919. However, until the end of World War-II, most planning was rudimentary in nature. In the beginning, only residential area, commercial areas and industrial areas were determined. Later, quasi-industrial areas were also determined. After World War-II war-damaged rehabilitation was temporarily implemented with the Special City Planning Act. The agricultural Promotion Act was enacted in 1969 and agricultural land was controlled within its framework by agricultural zoning to prevent loss of agricultural land to other uses. Today, the agricultural area in Japan is determined by an agricultural land use plan within an agricultural promotion area plan and farmland within agricultural areas cannot be converted into other uses. The National Land Use Planning Act, enacted in 1974, divides land into city area, agricultural area, natural park area and natural preservation area. Accordingly, agricultural land area is also assured from the viewpoint of national land use planning. Finally, Japan has more enthusiasm in the field of land use studies. Huge population and limited cultivated land are main motivating factors for the priority to land use survey.

**Land use Study and Agricultural Planning in Iran:-**There has never been a land use survey of Iran and the only land cover mapping was done using remote sensing data very recently by Government of Iran and some individual scholars but agricultural planning and researches were dated back to 1925. The three main scholars, A.K.S. Lambton, Vahid Nowshirani and Gad Gilbar have written about land tenure arrangement and fiscal aspects of agriculture, but did not deal with the other changes that were taken place in this sector. Nowshiravani and Gibar are among the very few authors who analyzed the structural changes that took place in the agricultural economy. They tried to make sense of what happened during the nineteenth century in Iran's economy. Among other things, they have argued that the rise of cash crops, the relative loss of economic autonomy of villages, the

changes in the pattern of land ownership and the creation of wage labor were structural in nature and heralded the fact that agriculture in Qajar Iran was changing agriculture from a subsistence to a commercial. One thing is clear. Agricultural development planning started in Iran after 1925 when the Razi Institute and Vaccine Research and Production Institute began its research activity by conducting research projects on the production of animal vaccines and the eradication of the contagious cattle plague disease. Agricultural research and crop improvement started as early as 1930 with the establishment of Sugar Beet Research Institute at Karaj (1933) and the Iran Tobacco Center in Tirtash (1937). In 1956, Cereal committee of the Ministry of Agriculture in co-operation with FAO initiated the first large-scale seed distribution to farmers. The great enterprise regards to Agricultural planning was White Revolution by the land reform. The Iranian Land reform program began in 1962 and it was officially terminated in 1971. Prior to 1962 land reform, half the cultivable land of the country was in the hands of great land proprietors (Khans) and held as strictly private property (melk). The reform was designed to give land to those villagers who cultivated land prior to the initiation of the reform and it was therefore assumed to benefit the villages equally. This limited the size of private holding upto 20 hectares irrigated land. As a result, large area was distributed to landless laborers (Beaumont, 1976). The comparative land evaluation of Iran has been elaborated by Mahler and others (1970) and by Beek and Bennema (1972). These systems are also related to older systems of land evaluation such as those of the U.S. Soil Conservation Service. The system used in Iran recognizes the possible approaches to the assessment of land suitability. Comparison of land suitability classification for different uses, Correlation with similar soils and land units, and capabilities of which have already be ascertained. The system also places a certain ranking on the various land utilization types which are relevant for Iran: When a land is placed in potentiality (Suitability) Class I or II for irrigation, its suitability for range should be disregarded and its land capability should be the one for irrigation. When a land is placed in class III or IV for irrigation, the land capability class should indicate both its classification for irrigation and its classification for range. When a land is placed in potentiality Class V or VI for irrigation, its land potentiality for range should be given as the land capability.” The preceding indications for the arid climates of the country have also been modified for application to the semi-arid and to the sub humid and humid parts of the country. The central aspect of their system lies in the use of the major land qualities either for correlating available experimental data leading to a semi-quantitative approach or for developing a systematic approach to comparative assessments. The main characteristics of land suitability classes which are used in this assessment are given

as bellow: - (i) Biological characteristics:- (a) Choice of adapted crops (wide/limited) (ii) Soil management characteristics:- (a) Timing of field operations (flexible/fixed), (b) Choice of adapted farm equipment (wide/limited), (c) Performance of farm Equipment (high/low) (iii) Diversification characteristics:- (a) Land resource allocation (enterprise proportions free/limited) (b) Degree of land use intensity (intensive/extensive) (c) Land resource use alternatives (many/few) (d) Elasticity in selection of farm size (free/limited) (iv) Human aspects:- (a) Labor productivity (high/low) (b) Labor absorbing capacity (high/low employment opportunities) (v) Economic aspects :- (a) Production cost (high/low) (b) Benefits (high/low) (c) Cost of land improvement/development/conservation (high/low) (d) Investment retribution (high/low, short/medium/long term). In Iran Soil survey and land evaluation studies were initiated in 1953 in-conformity with an agreement between the food and Agriculture Organization of the United Nations and the Government of Iran (Dewan, 1967). The Soil and water research Institute has been involved in mapping the soils or Iran for about 50 year. Up till now, about 20 million hectares of land of the country were surveyed at three levels i.e., reconnaissance, semi-detailed and detailed. The result of the soil survey studies are published in the form of reports and maps. This institute is responsible for producing the National Soil Maps at 1:2,500,000 scales (Dewan and Famouri, 1964) and at 1:1,000,000 scales in digital format and over a thousand soil maps with different resolutions. The data gathered through long-term soil surveys provide valuable information about the capabilities and limitations of the soil resources. Soil characterization and mapping were conducted by adopting the standards given in Guide for Soil Survey and Land Classification for Irrigation, prepared by the Soil Department of the Government of Iran and Ministry of Agriculture with the help of FAO expert (Mahler, 1970). Following the standards given in the above mentioned guide, lands were grouped into six classes depending on the capabilities and limitations of the soils for cultivation of annual crop under gravity irrigation, assuming that no land improvement works are made which would change the present limitations and qualities of the lands. Depending on the type of limitation land classes lower than class-I land were sub divided into sub classes by appending to the class number a letter showing the type of limitation. Soil nutrient losses were studied in Marvdasht plain (Fars Province) by A. Momeni and Zink J. Alfred, in 1998. He prepared soil nutrient map with geostatistical technical, Evaluation of prevailing irrigation practices and their relation to soil properties of Hamadan-Bahar area of western of Iran has studied by A. Moameni and A. Farshad in 1998. The aim of this study was to investigate the relationship between irrigation methods and the soils using remote sensing data and a geographic information system,

spatial distribution of soils, soil attributes and kind of land use/land cover were the main determinant factors for investigation. The prime agricultural policy objective in the 1980s has been self-sufficiency. All supports and subsidies on farm inputs and mechanization and guaranteed prices have been geared to this end through the activities of parastatal agencies in marketing and processing. Other key departments are the Agricultural Statistics and information Department responsible for the agricultural statistics service surveying 13,400 farms in 100,000 Villages; the Remote Sensing Service monitoring Land use and vegetation and the Data Processing Service operating the mainframe computers at headquarters and providing technical support to some 130 pcs in the Ministry of Agriculture.

## II. METHODOLOGY

Agriculture is the predominant sector in the economy of Jammu and Kashmir, Directly and indirectly, it supports about 80 percent of the population besides contributing nearly 60 percent of the state revenue, which adequately explains the over-dependency of the population on agriculture. The overall economic growth of the state depends largely on the progress of the agricultural sector, the development of which becomes even more important in the context of the very nominal progress it has made in the secondary sectors. With the introduction of planned development in the state during 1951-56, production of food-grains and fruits has increased considerably. During 1998-99, the state produced 15.50 lakh quintals of food-grains against 4.53 lakh quintal in 1950-51. Of this, Kashmir region contributed 27.20 percent Jammu region 72.14 percent and Ladakh and Kargil region 0.66 percent. Jammu and Kashmir is divided into three agro-climatic zones: Cold arid desert areas of Ladakh, temperate Kashmir Valley and the humid sub-tropical region of Jammu. Each has its own specific geo-climatic condition which determines the cropping pattern and productivity profile. In Jammu province, a small portion of the land lies in the plains along the borders of Punjab while the rest of the area is hilly. As per the Agricultural Census 1994-95, Jammu region dominates both in maize and wheat production. About 67 percent of the area is under maize and wheat production with the production of 21.25q/ha maize and 15.36 q/ha wheat. This region contributes 79.56 percent and 95.69 percent of total production of these two cereals respectively. Even though the yield is not high, the region makes appreciable contribution to the production of groups of cereals classified as 'other cereals and millets'. The second agro-climatic zone is Kashmir also known as 'cultivator's paradise'. The region practically depends on irrigation, which is easily available. A large area of level land has alluvial soil. Extensive elevated plateaus of the alluvial or lacustrine material (locally called karewas) also

exit in the Kashmir valley. These Karewas are productive only in the face of sufficient rainfall or adequate irrigation facilities. Rice is the chief crop of this zone, followed by maize, barley and wheat. According to the Census 1994-95, the Kashmir region accounted for 61 percent of total cultivable land under rice with the highest yield of 26.13 q/ha as compared to approximately 15.96 q/ha in the Jammu region. By and large, the soils are well suited for rice cultivation and 90 percent of the area under rice is irrigated. This region alone contributes more than 74 percent of total rice produced in the state. Ladakh zone is endowed with bare Rocky Mountains and bare gravel slopes. Villages are located near pockets of land with level ground and irrigation facilities, where cultivation is viable. In this region, barley is the major cereal crop followed by summer wheat. Millets and wheat rank second in importance and are grown in the warmer belt of the region. According to Agriculture Census 1994-95, the gross cultivated area under foodgrain crops is 64.12 percent. Fruits and vegetables occupy 2.18 and 0.35 percent respectively. The physical and climatic conditions act as inhibiting factors in some parts of the state. Further, the extremely small size of holding (average is 0.73 ha) and absence of further scope for extension of cultivation makes it imperative to put agricultural land to optimum use so that the limited land yields the maximum. This could be possible through the judicious application of modern technology adapted to local conditions. The disadvantage of limited land could be partially overcome through increasing the area under double cropping and by introducing a short-duration rabi crop in the valley, which has so far been growing only one crop a year. It is essential to exploit the potential of irrigation in the state. In the mean time other schemes consisting of new khuls, wells, pumping sets and renovation and repair of zamindari khuls should be given due attention.

Apart from this, the state legislation for agriculture has also contributed to the slow growth of agriculture in the state. There are two legislations that restrict the growth of agriculture and horticulture in the state, viz.,(a) Conversion Act, which restricts the cultivator from converting irrigated land into orchard and (b) Kuth Act, which restricts the cultivators from growing wild trees having medicinal value as this hampers the growth of some areas.

Once these aspects are taken care of, a major breakthrough could come through the adaptation of modern technology in the form of high-yielding varieties and large input of fertilizers. A detailed analysis of the existing state of agriculture and its development potential, as well as the implication of the government programme, is described below.

## III. LAND USE PATTERN OF JAMMU AND KASHMIR



The total geographical area of the state is 2, 22,236 km<sup>2</sup>. Net sown area accounts for maximum area under a particular land use type, followed by forest land put to non-agricultural uses, barren land and permanent pastures and other grazing land in the state (Table III.1). Total forest cover

in the state is far below the area prescribed by the 1952 Forest Policy according to region. However, barring Ladakh region, the state has only 50 percent of its area under forest cover.

Table- III.1 Area under different land use (Values for area are given in 1000 hectare)

Land use types	Area (1997-98)	Area (1998-99)	Percentage of area (1997-98)	Percentage of area (1998-99)
Forest	658	658	27.19	27.23
Net area sown	722	734	29.53	30.38
Land put to non-agricultural uses	339	291	14	12.04
Barren land	227	291	9.37	12.04
Permanent pastures and other grazing grounds	125	126	5.16	5.21
Land under miscellaneous tree and other groves	109	73	4.5	3.02
Cultivable waste	143	139	5.9	5.75
Fallow other than current fallow	8	8	0.33	0.33
Current fallow	91	96	3.75	3.97

Source: Digest of Statistics (1999-2000), Govt. of Jammu and Kashmir

The area under forest cover (27.2 percent) remained more or less the same during 1997-98 and 1998-99 (Table III.1). Net sown area (30.38 percent), land put to non-agricultural uses (12.04 percent), barren land (12.04 percent), permanent pastures and others grazing grounds (5.21 percent) accounted for major land use type apart from forested land. While land put to non-agricultural uses declined from 14 percent to 12.04 percent during 1997-98 to 1998-99, the cultivable waste declined from 5.90 percent to 5.75 percent during the corresponding period. On the other hand, the net sown area barren land permanent pastures and other grazing grounds increased by 0.85 percent 2.67 percent and 0.5 percent respectively during the same period. Increase in the net sown area can be attributed to the decline in the area of land put to non-agriculture uses land under miscellaneous trees and other groves and cultivable waste. The area under forest net area sown barren land permanent pastures and other grazing grounds and current fallow showed a marginal increase during 1984-85 and 1998-99. The area under non-agricultural uses, miscellaneous cultivable waste and other fallow land showed a marginal decline during the same period.

**Land holding:-**According to the state government data of 1995-96, marginal landholders (having land holdings below 0.05 to 1.00 hectare) comprised 77.97 percent of the total population. The categorization of land holding is based on area of holding, i.e., small (1.04-2.00 ha), semi medium (2.01-4.00 ha) medium (4.01-10.00 ha) and large (more than 10 ha). The small and middle range farmers comprised 18.77 percent 2.63 percent of the total land holdings, whereas the number of

farmers with high landholding is below 1 percent. The average size of small and marginal land holding show a declining trend and the number of bigger landholders is not increasing either. The average landholding size for the state as a whole is 0.76 ha. According to the Agriculture Census of 1985-86, average size of the marginal and small land holdings declined by 8.33 percent between 1970-71 and 1985-86. There is an inverse relationship between the size category of 10 hectare and above. There is a positive relationship between the size category and the land available for cultivation during both the periods. The average size of land holding is recorded maximum for Leh (1.38 ha) and minimum for Srinagar (0.37 ha). However, the value for total arable land is not the same, as the value recorded is maximum for Jammu (159.27 thousand ha) and minimum for Kargil (12.94 thousand ha). Such a difference in size of land holding of the people and total arable land exists chiefly due to an uneven demographic distribution pattern arising out of physio-climatic conditions. Ladakh district covering about 70 percent of the total geographical area of the state is high plateau devoid of any vegetation, hence has only 2.5 percent of the state's population living mostly in villages located near the rivers. This is the reason why general density of the population in the state as a whole is low, whereas the concentration of the population in some pockets is quite high.

Table III.2 District-wise Land holding pattern

District	Number of land	Area (1000)	Average land holding
Anantnag	166.39	81.34	0.49
Pulwama	103.61	66.28	0.64
Srinagar	87.99	32.39	0.37
Budgam	107.36	57.92	0.54
Baramull	165.33	95.77	0.58
Kupwara	87.51	48.30	0.55
Leh	12.04	16.59	1.38
Kargil	16.63	12.944	0.78
Jammu	165.20	159.56	0.96
Udhampur	113.56	125.56	1.11
Doda	108.94	91.48	0.84
Kathua	82.94	96.57	1.16
Rajouri	66.39	79.10	1.19
Poonch	51.88	49.02	0.94

Source: Statistical Abstract, 1999-2000, J&K

The figures also show that in Leh the number of land holdings is minimum among all the districts of Jammu and Kashmir, but the average holding is maximum. The same pattern is observed for Kargil, Poonch, Rajouri and Kathua. The aforementioned data shows that the land distribution in the State is quite disproportionate and unequal and that the number of marginal farmers has increased whereas the number of medium and small farmers has decreased. This indicates a considerably reduced concentration of landed property in the state.

**Cropping Pattern:**—Owing to variations in climate, soil and nature of irrigation, agricultural operations and the system of cultivation naturally vary from region to region. In the Jammu province, there are usually two crops a year, namely Rabi in winter and Kharif in summer. The winter crops, consisting chiefly of wheat and barley, are sown between mid September and mid January, depending upon the moisture in the fields. These are harvested in May-June in the low-lying areas and in July-August at higher altitudes. The summer crops like rice, maize and millet are sown from mid July, according to the geographical location of the place and character of the soil. They are harvested between mid-August and mid-November. As regards the rotation of crops, maize is often followed by wheat or sometimes by toria or barley and mustard, or by some fodder crop. The fodder crops are sometimes sown with cotton, especially on the irrigated lands. Sugarcane fields are frequently left fallow or a fodder crop is succeeded by two fallows and wheat, or one fallow and cotton or sugarcane. Cotton is generally preceded and followed by a fallow. Rice is generally grown on the same field year after year in the spring, the land being left fallow or some fodder crop being grown. Wheat is also sometimes grown on rich-manured fields but its output is generally poor. The rotation of crops is, however, often upset by scanty rainfall. In Kashmir province, land

generally produces one crop a year; therefore it is known as Ekfasli. There are of course exceptions. The highly cultivated garden lands in the neighborhood of Srinagar and in some other towns give more than one crop in a year. Ploughing for rice, maize and other autumn crops in the Kashmir province commences in the middle of March. In April and May, seeds of these crops are sown. In June and July and August, linseeds are harvested. Cotton picking commences in August and September. Maize rice and other autumn crops are harvested in September. Maize, rice and other autumn crops are harvested in September and October. In November and December, ploughing for wheat and barley is undertaken. During the winter months rice and maize as well as other autumn crops are threshed. In Ladakh, like Kashmir, no customary rotation of crops is followed. However, wheat is not grown on the same land for more than two or three consecutive years, as this process is believed to weaken the soil. Wheat is always followed by gram. If the soil were much improvised, Matar or Sarshaf is sown for a year as the roots and leaves of Matars are believed to strengthen the soil while sarshaf is a crop of very short duration. The rest is allowed to restore the exhausted strength of the soil. In some villages, land called Dofasli, gives two crops a year. Trumba, China or kangni give preference to gram. The time of sowing in the frontier districts differs from area to area. Generally, it commences early in the spring. In the low-lying areas, where the kharif crop maize follows wheat, the former crop is sown anytime from 15 November to 15 January when the soil is not frosty. Maize is sown in July and August. In the villages, where apples, but most of the area under fruit cultivation is concentrated in the valley. The upsurge of militancy in the valley has destroyed all the initiative taken by the government to develop these areas. Towards the end of 1990s, the optimism that prevailed before the militancy over the prospects of these areas was raised by the positive trends like

increase in the production and increase in the export of fruits. There was a marginal decrease in the area under cultivation for pulses, bajra and barley.

**Productivity:**-The region-wise classification of productivity of agricultural land differs throughout the state. In the case of Ladakh, the productivity of the land is on the lower side due to geographical limitation, at the same time the situation in the other region (Kashmir & Jammu) is completely reverse. Here the productivity of the land is on the higher side. So overall productivity of the state cannot be distinguished within the region. Even an important parameter for the crop production

in the region. In the Kashmir Despite climatic limitations, the agricultural production of one region substitutes for the other region. Another important aspect of the poor agricultural development in the region is that the climatic conditions of the region do not allow round-the-year cultivation. So in the case of J&K, despite knowledge and techniques of land-use management available at present, there are limited possibilities of raising agricultural output by increasing the area of cultivation without disturbing the ecological balance. Increase in the agricultural output would, therefore, have to be achieved only through intensification.

Table III.4 Productivity of Food crops 1998-99

Food crops	Area (000 hectare)	Quantity produced (000qtl)	Productivity
Rice	270.355898		21.82
Jowar	0.004		-
Bajra	10.70		-
Maize	311.465324		17.09
Wheat	242.663683		15.18
Barely	8.57		-
Millets	14.22162		11.39
Pulses	31.88186		5.83
Sugarcane	0.176.09		35.82
Condiments & spices	2.366.00		2.54
Fruits & vegetable	65.49267.70		4.09
Other food crops	0.459		-

Source: Digest of Statistics 1999-2000, Government of Jammu and Kashmir.

Table III.4 shows that the productivity for sugarcane is maximum (35.82 quintal/hectare), followed by rice (2.82 quintal/hectare), maize (17.09 quintal/hectare) and wheat (15.18 quintal/hectare). The productivity of total food grain was 12.49 in 1979-80, which increased to 15.22 in 1993-94 and further, increased to 16.18 in 1998-99, Productivity of rice has shown a marginal increase from 18.03 quintal/hectare to 18.57 quintal/hectare and up to 21.82 quintal/hectare in 1998-99. Productivity of wheat increased from 10.20 quintal per hectare to 14.19 quintal per hectares and it further increased to 15.18 quintal per hectare in 1998-99. Maize productivity went up from 13.48 quintal per hectare to 18.71 quintal per hectare and further increased to 17.09 quintals per hectare. The productivity of pulses decreased from 5.58 quintal per hectare to 5.51 quintal per hectare, then increased to 5.83 quintal per hectare in 1998-99. Table 4 it is clear that the production of three important food crops, namely, rice, maize and wheat, contributes a major portion of the food grain in the state. It is also clear from figures 2 and 4 that the same rate. Production of the food crops has shown consistency in the past twenty years. There was hardly any impact on the productivity of the crop during the upsurge of militancy. The data of the period before and after the green revolution shows hardly any change in the production of food crops.

**Use of Modern Agricultural Technology:**-Area under High Yielding Variety (HYV) Programmes. The introduction of

HYV seeds, use of fertilizers and provision of assured irrigation has given a boost to agricultural growth in the state. The gains show an impressive increase in the yields of important food and non-food crops. While cereal output has shown higher growth, non-cereal crops and allied farm activities have recorded improvements. Higher output of cereal and non-cereal crops has not, however, reduced the state's dependence on food imports. The period 1979-80 to 1998-99 has been chosen to analyse changes in the cropping pattern. The choice of the reference period has been mainly influenced by the availability of the comparable data. The period before 1986-87 shows important changes in the post-green revolution period. The latter period also shows important changes in the production of major crops. The available data indicates that the post-green revolution era has not shown any marked changes in the agricultural production.

Table III.5 Use of Modern Agricultural Implements in the State

Item	Number of Implements					
	1972	1977	1982	1987	1992	1997
Ploughs	638942	652592	809773	987311	808100	760457
Chaff Cutters	19418	28961	N.A.	65644	83890	103963
Pruning	12696	23477	N.A.	N.A.	NC	NC
Orchard	1871	4163	NA	NA	NC	NC
Diesel & Electric Driven	451	881	NA	2894	3678	7915
Paddy	196	169	104	200	15	664
Wheat	129	699	1062	2506	987	1061
Maize shellers	32	NA	159	33	35	149
Other	-	-	-	3020	597665	60756

Source: Digest of Statistics, 1999-2000, Government of J&K

The beginning of mechanization in Indian agriculture can be traced to the early 1960s. Since then it has progressed at a rapid pace. But certain important forms of farm mechanization are known to have remained largely concentrated in certain pockets commonly called green revolution areas. The estimates obtained from the NSSO clearly depict the modern machinery like tractors, power tiller and pump sets. These estimates indicate a rapidly rising trend in the range of modern farm equipment owned, but not necessarily their actual use. Source: Digest of Statistics, 1999-2000. Table III.5 and Figure 5 show agricultural implements used in the state during 1972-1997. The figures reveal a tremendous increase in the use of agricultural implements like diesel and electric pumps, ploughs and chaff cutter, and wheat threshers whereas the demand for the paddy threshers has not increased. There were 451 diesel and electric driven pumps in 1972, which increased to 7915 in 1997. The number of ploughs increased from 638942 to 760457 and that of chaff cutters increased from 19418 to 103963 during the same period.

**Government Initiative for Agricultural Development:-**The agricultural development in the state greatly depends on improving the crop intensity as well as the cropping pattern, both of which are interrelated. The one crop pattern of cultivation, predominant in the valley, is a serious limiting factor to agricultural growth. The farm output in the valley can be considerably increased if a Rabi crop which could be harvested early enough to allow the transplantation of the next paddy crop could be introduced. To determine the suitable crops and to evolve their appropriate varieties, considerable research is needed. The state government has, in all the Five-Year Plans, prioritized the development of agriculture and allied sectors and taken following initiatives:- (i) Providing seeds to the cultivator: It is estimated that an area of about 4 lakh hectare was covered with improved seeds of cereals by the end of 9<sup>th</sup> Plan. Till the 4<sup>th</sup> Five-Year Plan, the programme had been confined to paddy and maize. However, a major part of the requirements of improved seeds is met through buying

from outside the state. Only during the tenure of the 8<sup>th</sup> and 9<sup>th</sup> Plans, Jammu and Kashmir started selling seeds to other states. It has now become one of the potential sectors of the state economy. To reduce dependence on other states, certified seed production is envisaged through registered seed growers in seed villages. During 1997-98 a quantity of 14500 quintal of seeds of paddy, wheat, pulses and oilseeds were proposed to be produced and procured from seed village areas. For the Jammu region, an amount of Rs 300 lakh has been proposed during the whole period of 9<sup>th</sup> Plan. This amount is envisaged to be spent on subsidy on the seeds being procured for distribution among the farmers. During the year 1998-99, an amount of Rs 66.26 lakh was provided as subsidy on different crops. (ii) Increasing uses of fertilizers: The changes adopted in agriculture were confined to a limited number of farmers, but the major breakthrough in agriculture can come only when vast numbers of farmers throughout the state use inputs like fertilizers, seeds and pesticides. Use of fertilizers (inorganic) was introduced in the state during the 1<sup>st</sup> Five-Year Plan (1951-56). Initially the Department of Agriculture had to undertake a number of extension measures and provide incentives to farmers to make chemical awareness regarding the merits of the same, their use (consumption) has steadily increased over the years, especially of Nitrogen (N) touching an average level of 43 kg./ha against the highest of 143 kg/ha. In district Ludhiana (Punjab) and the national average of 76 kg./ha. (iii) Training Support: The Government Farmer's Training Centre, Ganderbal provides training to farmers, especially the womenfolk, in various districts of the Kashmir division. The NAEP provides enough opportunities to Agriculture Technocrats/officials for specialized periodic training. During 2001-02 the Department of Agriculture arranged 126 camps for training.

**Challenges for the Development of Agriculture:-**There is no law on minimum land ceiling for areas used for crop production. The State has not been enforcing a strict ban on use of irrigated land for non-agricultural purposes. State cultivation has not taken increasing cropping intensity,

average yield by way of optimal use of inputs, and full adoption of recommended production technologies. Less credit flow in the beginning of the cropping season for the farming community with a guaranteed minimum price support. Lesser emphasis on post-harvest technologies, including handling, storage, transportation, processing and marketing. Lack of facility for insurance cover for major crops.

**Forest Development in Jammu and Kashmir:-**Jammu and Kashmir has a total forest cover of 20441 sq. km out of which 11019 sq. km (53.9%) and 9422 sq. km (46.1%) are dense and open forest respectively. Forests are valuable ecological and economic assets for a hilly state like J&K. The very existence of human and cattle population is dependent on forests. There is a great diversity in the floristic regions of the state.

Table III. 6 Region wise forest area of J&K (Area in sq. km)

Region	Total area	Forest area	Percentage of forest area to total area
Jammu	26293	12066	45.89
Kashmir	15948	8128	50.96
Ladakh	59146	36	0.06
Total	101387	20230	19.95

Table III.6 shows the region-wise break up of forest area in the state. The overall area under forest cover is lower than the national average. This is due to the fact that the area under forest cover in Ladakh is less than 1 percent.

**Important Issues for Forest Development:-** (i) Approximately 48 percent of the rural populations are directly or indirectly dependent on forest. Due to the Forest Conservation Act, no green felling is allowed. Only dry felling is allowed which cannot meet the local need, hence illegal felling is widely prevalent in the area. (ii) Due to militancy the forest department does not have effective control on forests. (iii) The forest area is not properly demarcated. Due to population growth there is encroachment on the forest area for housing and extending the area under agriculture. (iv) Forest records are properly maintained. The revenue department and the forest department records do not match. (v) Forest fires are prevalent in the Jammu region. Generally in the summer, Chir forests succumb to forest fire. So far the forest department has been taken no concrete steps to prevent this.

**Recommendations:-**The state government should plan for higher production and productivity of each major cereal in order to achieve an annual agricultural department could adopt the following policy:- (i) State could shift its agricultural development strategy from food security mode to the value addition mode. The state should grow certain products like high-valued fruits, vegetables and some cash crops, which could give adequate monetary returns to the cultivations. Low productivity and decreasing returns from agriculture are the main reasons for low motivation among cultivators. (ii) For optimum utilization of the productive potential of the primary sector, diversification should be the main focus. However, the state should not follow a uniform policy of diversification for all the physiographic regions of the state. Agro-climatic crop planning for each physiographic region should be evolved

with the help of experts. This calls for in-depth studies to:- (a) Make a realistic assessment of the available resources, (b) Explore cost-effective means of transfer of technologies, (c) Work out forward and backward linkages. (iii) A few diversifications have taken place in the Kashmir valley, showing a positive trend in terms of returns. The cultivators in Baramulla have now started cultivating vegetable in the cereal fields, which gives them more return. Still, more initiative is needed in the agricultural diversifications. (iv) The agricultural economy of the state is a subsistence economy. The low return from agriculture is one of the reasons for the lesser participation of people in these activities. The state should formulate a strategy to bridge the gap between the agriculture research institute and the cultivator. Most of the cultivators hardly get any benefit from agriculture. Presently the state government has taken certain initiatives in this direction. The Kissan Behhud (welfare) committee is an interface programme between progressive farmers at the village committee level and agriculture research institute. Yet a lot remains to be done in this area. (v) The state government should provide adequate training to farmers about the use of modern technology in agriculture. (vi) One important aspect for the increase in productivity is credit to the farmers. In J&K this facility to the farmer is completely absent. The state should initiate this through the nationalized bank, so that the cultivators get adequate finance on credit for agricultural development. (vii) Availability of inputs, e.g., seeds, fertilizers, pesticides, credit, etc., should not only be ensured regularly but their quality extensively checked. There are already some provisions existing in the state but more needs to be done. (viii) Subsidy on the inputs should be targeted and selective. The state government should examine a suitable crop insurance scheme. These kinds of initiatives strengthen the confidence of the cultivators. (ix) The state government should encourage a mix of supplementing crops in each region. For instance, in the Valley floor and plain areas of

Jammu region, the crops which do not either compete with each other or can be grown off season should be the basis of diversification. The Karewas of Kashmir and Kandi areas of Jammu region are best suited for dry farming, horticulture and fodder crops. The side valleys should be earmarked for fodder cultivation and cultivation of medicinal plants. However, these examples are illustrative and demonstrate the need for evolving the micro-region specific diversification strategies. Comprehensive cost of cultivation studies needs to be conducted in each zone. (x) In the Ladakh region, seed production of cauliflower within one season using poly-green house technology has been a successful attempt. Through the same method, this region can produce seeds of cabbage, onion, raddish, karam saag, carrot and Swede. This can open up a new vista for the farming community of Ladakh, not only towards self-sufficiency but also for export of seed outside Ladakh. (xi) The farmers of the Ladakh region have successfully experimented the cultivation of vegetables in the poly green houses. Three varieties of tomato namely SL-12, PED and AC-238 and N-13 Nasik red onion has shown a positive result in production. Among other vegetables are brinjal, capsicum, broccoli, green chilli and paprika. This can ensure supply of vegetables to metropolitan cities during off-season and fetch a good price. From Ladakh the only viable mode of transport is airfreight. Hence there is a need for working out an arrangement so that quick transportation of these products can be organized. (xii) The Ladakh region has great potential in the field of floriculture as well. In a primary study conducted by SHUAST (K), it was observed that super class flower cuts bearing up to 23 florets can be produced through polyhouse technology in Gladioli. This indicates that floriculture can play a vital role in uplifting the socio-economic status of farmers.

The state government should also encourage the production of high-value, low volume crops like saffron, blank zeera and other spices. The Kashmir region is ideally suited for the cultivation of these kinds of non-traditional crops. It has been observed that during the past three years the area coverage and production of the spices has been constantly declining. Apiculture is another important area with a lot of potential. In the Kashmir division the fauna and flora required for nectar collection is available in abundance through existing orchards, field crops and wild flora. During the 8<sup>th</sup> Five-Year Plan the number of bee colonies in the valley was 15,400 which increased to 20,000 during the 9<sup>th</sup> Five-Year Plan and consequently honey production increased from 180 MTs to 240 MTs. The state government should encourage the people by way of distribution of beehives, bee-colonies and other appliances on subsidized cost with technical guidance. Adaptive research output should be the answer for agricultural development in the state. Research on multiple cropping,

improved seeds, crop rotations, water management and dry land farming should take the local factors into consideration and use the results of repetitive trials as the basic input for research studies. The research output of the State and Regional Research Institute of Kashmir and Jammu has not show any major achievements in the area. It is time to review the objective of this research institute. State government should also provide the infrastructure to the private investor to set up agriculture and biotechnology research institutes. The state produces very limited quantities of a specific variety of garlic in the Jammu division. This garlic is highly prized because of its anti-cholesterol nature and the cultivation of anti-cholesterol must be increased by expanding its area. The climate of the state is ideally suited for production of exotic, high-value vegetable crops like Broccoli and Mushrooms which can be grown profitably in the Jammu division. What is needed is a planned, integrated approach, which takes care of production as well as marketing of these perishable, high-value crops. The state has potential for agro-based industry which needs to be tapped. The food industry has a very high multiplier effect. Besides appropriate cost-effective technology, assured supply of quality inputs and uninterrupted transport facilities are crucial for the development of agro-based industries. In this respect, the development of all weather air, rail and surface transport should be given top priority. The monitoring of the various schemes physically against the target fixed by the department is an essential factor. The state government should involve non-governmental agencies for the evaluation of the schemes and encourage participation of the village community in the monitoring of the scheme. The Sisal Propagation Scheme (SPS) introduced in the 8<sup>th</sup> Five-Year Plan shall continue in the 10<sup>th</sup> plan because it is beneficial for the weaker sections of the society. It shall be upgraded and the technology evolved in the past utilized to educate the common masses in rural areas to implement it in the entire districts of Jammu region. Schemes like pasture development, Ladakh soil conservation programme and soil conservation programme on forest lands should continue and spread to vast eroded chunks in new areas so that direct and indirect benefits are received by the common man. The state government should pay attention to short-term soil conservation measures aimed at stabilizing smaller slopes, preventing under-cutting of nallahs, and gully control measures in the initial state of development. The gap between the national average and the existing status of the state forests can be fulfilled by social forest. The state government should take certain initiatives to develop social forestry in the state. The infrastructural facilities have improved during the past decade but more attention is required. The state government should increase the budget allocation for forest development. The state forest department should prepare some project for the entire state and approach funding agencies like the World

Bank, Ford Foundation and others for support. Presently only one project, i.e., integrated watershed development programme, in hills is running in the state. People's participation for forest conservation is limited and has not become a people's movement. The village committee needs to be strengthened for National forestation to be properly implemented. To increase the plantation on the wasteland the state government should promote the participation of voluntary and other agencies. Jammu and Kashmir has a lot of potential for the cultivation of medicinal plants for natural health care. The state government should approach the medicinal plant board to extend their support for the development of medicinal plants. Support and facilities for extraction, storage, value addition and marketing also need to be increased. Opportunities for training awareness and capacity building of the forest staff and village forest committee need to be increased. Many people are dependent on the Chir Forest. These forests need to be resurveyed. For plants which are ready, razing should be allowed.

**Allied Sectors:-Fisheries:-**Traditionally, fisheries in Jammu and Kashmir were developed and popularized as sport fisheries, primarily as a means of attraction for tourists. During the past few years, there has been a reorientation towards development of fisheries as a major food resource. The diverse agro-climatic conditions of the state are a tremendous potential for the development of both cold and warm water fisheries. This is an important activity allied to agriculture and can strengthen the productive base of the agricultural economy and generate self-employment, an aspect

which has not been explored properly and fully till now. The total number of fisherman population is around 9655. The length of 27781 km of rivers/streams facilitates the farming of more than 40 million tons of fish. Out of a total 27781 km of area under fisheries the state has only 0.07 lakh hectare under reservoir area. There are 1248 lakes and water bodies and the water is spread into 39921.8 hectare of area. The state has also reported 125 fish species, of which only 11 are commercially important. The total fish output amounted to one kilogram, i.e., less than three grams per day. (Godbole report, 1998). There is a big gap between demand and supply of fish. Fish is a valuable element of diet of the local people throughout the year, and there is also a demand for fish from the defence personnel and from tourists, especially during the tourist season. By harvesting the potential of fisheries in the state appropriately, considerable impact will be made in terms of fish production, revenue generation and employment creation as well as improving the nutrition level of the common man. The fish output is mostly confined to the valley- Baramulla (47 percent) and Srinagar (36 percent) districts, accounted for the major share of the state's fish output in 1998-99. Out of the total fish produce, about 80 percent of the fishing activity takes place in the lakes and the rest from rivers. There are four types of fish available in Jammu and Kashmir, viz., trout, mirror carp, country fish and Jammu fish. The predominant variety is mirror carp forming 61 percent of the total output. The other three contribute 40 percent of the total fish production (Table III.7). Trout fishing holds great potential in terms of increased income rather than output through proper harvesting.

Table III.7 Fish Production in Jammu and Kashmir (Quantity in Quintal)

Year	Buffaloes and cattle (Lakh)	Buffaloes and cattle per ha of cultivated area	Livestock population per 100 people
1956	21.32	3	132
1961	22.09	3	115
1972	25.49	3	90
1982	28.88	4	97
1988	33.61	4	104
1992	37.87	5	110
1997	39.63	5	100

Source: Statistical Digest of Jammu and Kashmir, 1999-2000

Due to state government initiatives, the output of fish has increased in the past few year. Fish production, went up from 135011 quintal in 1990-91 to 188510 quintal in 1998-99. In Kashmir and Jammu provinces in 1998-99, it was 158264 and 30246 quintal respectively. The state government claims that J&K has become self-sufficient in the matter of fry and fingerlings of mirror carp.

Infrastructure Facilities for Fisheries Development. There are 18 state-owned trout hatcheries located in the

districts of Srinagar, Anantnag, Pulwama, Baramulla, Budgam, Doda, Rajouri and Kargil and these have played an important role in boosting trout culture. The hatcheries have a dual role: one, as an agency for commercial production and two, as an agency for the stocking of the rivers and lakes and distribution of fingerlings to private farms. By developing trout hatcheries as agencies for distribution of fish seed, the state government can increase its income. Besides, the Department also runs a mahaseer hatchery at Anji and fish farms at Srinagar, Budgam, Anantnag, Pulwama, Baramulla,

Kupwara, Jammu, Kathua, Udhampur, Doda, Poonch, Leh, Kargil and Rajouri. This infrastructure gives considerable boost to the fisheries activities in the state. One of the important items under infrastructure is the fish farm. Under the Infrastructure Development Programme, 22 fish farms have been set up in the state. The state National Fish Seed Farms are located at Kathua, Anji, Muradpore, The population dependent on fishing is minimal (Table III.8), although the number of labour force engaged in fishing shows a

consistently increasing trend, figures nearly doubling from 5446 workers in 1972 to 1997. Fishing is important not only for the state's revenue generation; it also provides employment to the people. By improving the infrastructure and harvesting the new potential area, the state can increase both. Besides, the development of fisheries can also provide employment in the tourism sector and a lot of opportunities can be generated in the marketing and packaging of fish.

Table III.8 Labour force engaged in fishing

Year	Population dependent on fishing	Labour force engaged in fishing
1972	20340	5446
1977	34853	3779
1982	24044	7322
1988	21741	4588
1992	37222	9356
1997	25816	9655

Source: Digest of Statistics, Government of Jammu and Kashmir, 1999-2000 Potential Areas for development

Ladakh Region has vast water resources with a high potential for fish culture. Very few of these water bodies have been tapped. The steps taken by department of the state need to be accelerated. The panchayats in the state have nearly 500 ponds under their control which, due to lack of cooperation between the Department and the panchayats have not been properly utilized for fish production. Improving these ponds can augment fish production. The water of Jammu and Kashmir is suited for the fishing of carps-catla, rohu, silver carp and mirror carp. Properly harvesting of the potential in the area can fulfill the local needs. Fishing in manmade reservoirs is an important activity in many states and can become one of the important sources of revenue for the state. J&K however, has only one manmade reservoir in Salal. The state needs to give proper attention to this area to increase fish output.

**Challenges:-**One of the important challenges faced by this sector is the lack of training to fish farmers, only 1183 in J&K being trained annually as against over five lakh in the country. At present, the state has only two Fish Farmers Development Agencies as against a total of 414 in 26 States of India. Two, fish marketing faces several problems. Fish is a commodity of highly perishable nature requiring the provision of ice plants, cold storage and refrigerated vehicles. There is only one fish-marketing project in progress and more are required. Three, there is inadequate research support for development of paddy-cum-fish culture. Four, the fisheries reservoir is not sufficient to fulfill the demand for fish. Brown trout has a specific problem of being fed at the early fry stage. This stage is very crucial, as it does not accept artificial feed. More reservoirs are required. Policy Recommendations:- (i) The state has extensive inland water bodies, particularly in the

valley, which provide excellent habitat for almost any kind of temperate fish. The lakes cover an estimated 0.3 lakh hectare, predominantly in the valley (about 98 percent of total). River Jhelum flowing, over 162 km in the valley, with its extensive tributaries has enough potential to sustain fish production.(ii) The Indus river system has carps, catfishes, the exotic rainbow and brown trouts. The trouts of Kashmir are very rich and attract sport fish enthusiasts. (iii) The state offers a favourable habitat for sport-fish like trout in its cold-water streams, particularly in the Lidder and Sindh valleys. (iv) Paddy-cum-fish culture is gaining rapid ground in the tropics and subtropics but not in temperate climate. Fish farming as an adjunct to paddy cultivation has a lot of potential either as integrated simultaneous crops or as different crops in the same lands in alternate seasons. Such possibilities with particular reference to compatible fish species should be studied scientifically and a package of technical and management practices evolved for propagation among farmers. (v) To improve marketing of fish, particularly the fish harvested in Jammu region, which is closer to the Punjab, the possibility of selling fish in the neighboring Punjab districts of Gurudaspur, Amritsar, Jalandhar and Ludhiana should be explored and private enterprise encouraged for the marketing of fish.(vi) Infrastructure support by way of purchase of refrigerated containers or vehicles and working capital, should be extended to private sector. (vii) To attract fishing enthusiasts from within and outside the country, catch and release sport should be launched and fishing festivals or tournaments organized. In short, fishing should be made part of tourism promotion in the state.



**Livestock Sector:-**Agricultural development has been associated mainly with an increase in the production of cereals. In India majority of the people have less than one hectare of land. Due to small holdings, it is not possible to develop infrastructural facilities and these cultivators are unable to meet the basic requirements for their livelihood. Here the development of livestock plays an important role in terms of providing basic necessities. Livestock have formed an integral part of the farm economy. Animals are valued for their draft power, manure, dairy products and meat. In addition, livestock provide income and employment to the weaker sections in the rural areas. In Jammu and Kashmir animal husbandry constitutes a vital activity. From the point of view of the farmer, nearly 0.13 percent of gross state domestic product (SDP) is contributed by this sector which is an important sector. The state has a precious wealth of livestock in the form of cattle-buffalo, sheep, goats, poultry etc. About 79 percent of the population in Kashmir is based in rural areas and animal husbandry sector. Cattle and poultry amongst all livestock are considered the most important tool for the development of rural economy. Animals besides being the main source of draught force also provide essential foods like meat, milk, etc, and large quantities of animal by products such as hide bones, blood, guts and valuable organic manure.

The production of pashmina shawls, carpets, shawls and blankets of Kashmir earn handsome foreign exchange for the nation. Therefore, the animal industry in the state has vast scope for exploitation and quick economic returns.

**Livestock population:-**The state has different types of livestock the important being cow, buffalo, goat, sheep, rabbit, yak, etc. there is a total of about 91.751 lakh animals' livestock population. The estimated cattle population of J&K was recorded as 31.75 lakh (1997 census) constituting about 34.60 percent of total animal stock in the state. The sheep population comes second, constituting 34 percent of total animal stock population, followed by the goat population (19.71 percent of total animal stock). The distribution of livestock differs in different zones. For example, the goat is mainly distributed in Ladakh, Gurez, Karnath and hills of Baramulla. There are different kinds of sheep breeds like Baderwahi, Poonchi, Ramboulleit (Jammu region), Karnahi and Gurezi (Kashmr region), Changhthangi and some local breeds (Ladakh). The Kashmir region has about 55 percent of sheep population followed by Jammu (about 29 percent) and Ladakh (about 8 percent). Yaks are chiefly confined to the Ladakh region.

Table III.9 Total Animal Stock in 1997 (in lakh)

Types of Animals	Numbers
Sheep	31.695
Goat	18.095
Buffalo	7.878
Horses/ponies	1.505
Yak	0.33
Camel	0.037
Poultry	46.3
Cattle	31.75
Animals stock	91.75

Source: State Animal Husbandry Department

**Livestock production:-**In terms of livestock production there is a gap between demand and supply. Due to the climatic condition there is a great demand for meat and warm clothes

in the valley but the breeds of animals, available in the valley are unable to provide these components in sufficient quantities.

Table III.10 Production of Milk, Eggs, Wool, Fish and Mutton

Year	Milk (M.Tonne)	Eggs (Millions)	Wool (M.Kg)	Fish (Th. Tones)	Mutton (Lakh kg)
1990	0.56	283	-	-	-
1991	0.58	294	3.59	14.05	-
1992	0.6	289	3.6	14.3	-
1993	0.63	317	3.8	14.5	-
1994	0.65	320	4.01	16.1	-
1995	-	-	-	NA	-
1996	0.9	396	4.9	NA	199.47
1997	0.95	423	5.5	NA	219.13

Source: Animal/Sheep Husbandry Dept.

Table III.10 shows that in the past seven years, there has been constant increase in the products and by-products of livestock. However, the output vis-à-vis the number of animals is not sufficient. In other parts of the country, people are using different breeds of animals and getting more returns. In Kashmir, quantity of output from the new breed of cow is much more than the local one but it is advisable for the state government to modernize the sector to meet the domestic and outside demand for the livestock products. At present Jammu and Kashmir is supplement their poultry products and milk supply, despite the fact that the state itself has the potential to provide and meet the domestic demand.

**Challenges:-**The most important challenge for the animal and sheep husbandry sector is the problem of fodder in the winter season, particularly for the Valley. In the light of this, there is need to introduce non-conventional feed and fodder resources. The second biological component influencing animal development and growth is habituating under certain ecosystem, for instance, liver fluke disease of domestic animals which is prevalent in marshy humid climatic conditions, e.g., places around Wular Lake in Kashmir Valley. Certain disease foci are permanent. The third challenge is high livestock farming costs. And last, the poor research output available to develop this sector.

**Potential for livestock development:-**Sheep provide valuable manure for improving agricultural productivity. Their skin has high commercial value. The quality of wool of Kashmir sheep varies from the fine to the coarse type. Goat hair is used for making ropes, coarse blankets and namdas. The manure of about 5000 goats, produced in one night, is considered to be sufficient for one hectare of agricultural land as a valuable fertilizer. Pashmina or Changra goat produces softest and warmest animal fibre used for high quality fabric (Pashmina wool). This pastoral farming is confined to the highest belt called 'Changthang' area of Ladakh around 4300 meters above sea level. The initiatives taken by the state government to improve productive potential of goats despite lot of scope for the same have so far been inadequate. Yak meat also has a demand among the local people. Yak hide is used for making leather, hair, ropes, grain bags etc. while its fine undercoat is used for making tents called 'Rebo', shoes and sweaters, and tail hairs are used for making ceremonial fly whisks (chauri). Jammu and Kashmir also has a great potential for production of rabbit meat, fur and wool. About 15-20 rabbits can easily be raised and managed by a farmer's family without any additional cost. There is also demand for biological research.

**Policy Recommendations:-**(i) The use of non-conventional feed and fodder resources is one of the important areas for

development of livestock in the state. The Agriculture University of Kashmir has done some research work to convert the agricultural waste into cattle feed. What is needed is that the state government should commercialize this research output either through its own or private initiatives. (ii) Jammu and Kashmir provides a suitable climate for cattle breeding. In other parts of the country, one has to create an artificial climate for cattle breeding and the success rate is also low. In Kashmir this initiative gives an added advantage and the success rate is also high. The state government should take steps to establish cattle breeding centers. It should open frozen semen centers in remote areas to cover all local cattle population. (iii) The demand for poultry products is constantly increasing. Due to climatic conditions, it has become the part of the regular diet. The state government should encourage the development of poultry through modern technology and take up some short-duration projects along with NGO development. (iv) Improvement of local sheep by crossbreeding with fine wool breeds (Kashmir Merino, Russian Merino, Starapol, Caucasian Marino, Rambouillet) can improve wool production qualitatively as well as quantitatively. (v) Sheep crossbreeding with Polled Dorst (Mutton breed) has remained confined to selected pockets in the Valley such as Hajan block. Corriedale breed has shown good adaptability and performance in the orchard belt of Kashmir, i.e., Shopian area. The government should promote this initiative in other areas of the state as well. It is advisable to develop biotechnology research for enhancing animal productivity. (vi) The state Sheep Husbandry Department has considerably improved wool production in the state but the increase in mutton production has not been impressive. The state is largely depended on adjacent states for its ever-growing demand for mutton and steps to increase its production are warranted. (vii) The Kathua and Jammu districts, which are contiguous to Poonch and Rajouri districts and also to the Punjab where Gujjar population predominates, are ideally suited for dairy development. By forming Gujjar co-operative societies and giving them technical and financial inputs, the milk yield can be improved. (viii) The state government needs to introduce low-cost village level technology for better use of animal products, processing and marketing.

**Dairy Development:-**Jammu and Kashmir is ideally suited for dairy development. The state has registered a steady growth in milk production. The State's milk production in 1995-96 was 3.69 lakh metric tons which stood at 6.66 lakh metric tons in 2001-02. The per capita milk consumption is 325 ml/day and national average milk consumption is 240 ml/day vis-à-vis the actual requirement of 283 ml/day. In 2000-2001, J & K become a milk surplus state.

**Cattle profile:**-Table III.11 shows a constant increase in the number of buffaloes and cattle. The number of buffaloes and cattle per hectare of cultivated area has also increased, while

the number of livestock population per 100 people has decreased from 1956.

Table III.11 Profile of cattle and Buffaloes in Jammu and Kashmir

Year	Buffaloes and cattle (Lakh)	Buffaloes and cattle per ha of cultivated area	Livestock population per 100 people
1956	21.32	3	132
1961	22.09	3	115
1972	25.49	3	90
1982	28.88	4	97
1988	33.61	4	104
1992	37.87	5	110
1997	39.63	5	100

Source: Indicator of Economic development J&K, 1998-99

**Milk production:**-Table III.12 shows constant increase in the quantity of milk production from 1974 to 1998. This growth is not at par with other states like the Punjab and Gujarat, which are the pioneers in the field of dairy development. These are need for more emphasis on the dairy development in the state, the Jammu region having lot of potential for dairy farming.

What is needed here is the introduction of some new breeds. In the Punjab the number of local breed of cattle is less than in Jammu and Kashmir but in terms of crossbred cow gives three times more milk than the local breed.

Table III.12 Milk production in J&K

Year	Milk Production in (Lakh tone)
1974-75	1.85
1980-81	2.4
1984-85	3.53
1987-88	4.28
1989-89	4.5
1989-90	4.86
1995-96	8.7
1996-97	9.92
1997-98	11.79

Source: Indicator of Economic development J&K, 1998-99

The Jammu region has the potential to increase production of milk and also market the surplus milk to other regions of the state. Up to 1999-2000 the demand for milk and milk products in the valley was fulfilled by the Punjab but through proper initiatives and planning state government can sustain self-sufficiency in milk production.

**Employment Opportunities:**-Dairy farming is a household activity largely done by domestic labour. The majority of families have two to three domestic labourers. Very few people have engaged hired labour for dairy development. This shows that in Jammu and Kashmir, dairy development activity is still a subsistence activity but income and employment opportunities can be increased through the modernization of this sector.

**Policy Recommendations:-Privatizing Specific Animal Husbandry Services:**-Presently, the government's Animal

Husbandry Department provides animal husbandry services. However, due to lack of adequate funding the department has not been able to provide these services effectively. Almost 70 percent of its expenditure has gone towards veterinary services and animal health while other important activities such as breed and fodder development, and extension and training have received only small allotments. The solution lies in allowing qualified private parties to provide some of these services. At the same time, some services will have to be provided by the government. Selective privatization of animal husbandry services would be the preferred approach. Services in which public interest is greater than individual interest, e.g., eradication of diseases, programmes for weaker sections, extension and education for weaker section/areas, would continue to be provided by the government. Where the state government continues its services (for example, in areas where no private investor comes forward), it will do so purely on a cost-recovery basis.

**Creating Feed and Fodder Development Programme:-**In Jammu and Kashmir, feed and fodder which forms 60 percent of milk production cost is a major constraint to the growth of dairy development. In the Kashmir and Ladakh region there is no fodder available for animals during winter. So the government should spearhead a programme to develop this area.

**Building Infrastructure:-**The development of the dairy sector needs to be based on the provision of specialized infrastructure such continual supply of power and water. Providing a cost-effective and continual supply of water to procurement and processing units needs to be top priority. This well reduces costs and improves milk quality considerably. The government will also need to upgrade rural roads leading to milk collection centers (or even, as a first step, from milk collection centres to milk processing units). This will increase the frequency of collection, reduce logistical costs and improve the quality of the raw milk. Most of the specialized infrastructure required will be built by investors themselves, whether corporations or cooperatives. However, the government can play an important facilitating role. For instance, it could lobby the centre to reduce duties on refrigeration and cold storage equipment. This would reduce the high capital costs that make it unviable to set up this infrastructure today.

**Focusing on traditional strong regions:-**The development effort will initially be focused on Pulwama, Kupwara and Srinagar districts of Kashmir region and Doda district of Jammu region and Ladakh in which dairy activity is established. In these regions the number of cattle, availability of fodder, proximity to large markets and working co-operative structures are fairly well development. Once this area is developed, the system can be relicated in other parts of Jammu, Kashmir and Ladakh regions.

**Sericulture:-**India is the second largest producer of silk in the world, after China. It has the unique distinction of producing all four varieties of silk: mulberry, eri, tasar and muga.

Mulberry accounts for 92.5 percent, Eri 5.3 percent, Tasar 1.7 percent and Muga 0.5 percent of the total raw silk production in the country. The rearing of silk worms on mulberry trees for the production of raw silk is known as sericulture. Mulberry silk is produced mainly in Karnataka, West Bengal, Jammu and Kashmir, Assam, the Punjab, Tamil Nadu and Andhra Pradesh. Sericulture is one of the traditional occupations of Jammu and Kashmir. It is the only traditional univoltine belt in India, capable of producing silk comparable to the fine qualities of raw silk imported in the international market. Kashmir introduced far better silk both in quality and quantity than Italy and Japan 60 years ago. The climate of Kashmir is temperate and congenial for rearing both univoltine and bivoltine silkworm species for cocoon production. These cocoons are far superior to the multivoltine ones produced in the rest of the country. It is disheartening that the silk industry of J&K, which has seen a glorious past, is on decline. Still a large section of the population is dependent on sericulture. In the year 1999-2000, as many as 25.28 thousand families were engaged in extraction of silk fibre. During the same period, 2.15 thousand villages were engaged in sericulture production. The state has about 1402 thousand mulberry tree, of which 883 thousand are in Jammu division and 519 thousand in Kashmir division. During 1999-2000 about 80 thousand kg of raw silk was produced at the cost of around Rs. 3.5 crores. Still the state is not able to harvest its new potential area and protect its existing trees. Inadequacy of mulberry leaves and damage caused by insects and pests are the major problems in the development and expansion of mulberry trees. The Sericulture Development Department is laying stress on raising dwarf mulberry trees to supplement and replenish the traditional tall mulberry trees.

**Area under Mulberry Cultivation:-**The State has 2,850 hectare of land under mulberry plantation, out of which 1,990 hectare are in the Jammu division and 860 hectare in Kashmir division. The area has been calculated on the basis of 1800 trees per hectare as the plantation is in highly scattered form (Godbole Report).

Table III.13 Number of mulberry trees in Jammu and Kashmir

Years	Mulberry trees (000 nos)	Seeds Produced (000/oz)	Seeds Imported (000/oz)
1980-81	601	24.8	10
1985-86	724	24.75	7.62
1999-00	1402	17	27.12

Source: Statistical Abstract, Government of Jammu and Kashmir, 1999-2000

Despite several initiatives taken by the state government, the number of mulberry trees is still very low. During 1980-81, there were 601 thousand trees, which increased up to 1402 thousand in 1999-00 (Table III.13). The

number of seeds imported shows a major increase in the past twenty years but the production of the cocoon is not showing the same trend. According to the Godbole Report, the Sericulture Department annually used to provide 14 lakh, one-

year old mulberry saplings for planting either in the farmer's land or in community lands. Since the planters do not give proper attention to the plantation at the establishment state, the survival rate is very low. This is one of the reasons for the slow growth of mulberry trees in the state. The other reason for the slow growth of mulberry plantation is the low return from this activity. Due to geographical limitation, the rotation of the cocoon production in Jammu and Kashmir is not possible. It is produced only once in a year (in the month of March in Jammu and May in Kashmir). Whereas in Karnataka the mulberry cultivation and the cocoon production is not a seasonal activity for the cultivators.

**Silkworm Rearing:-**The cocoons produced by hybrids are used for extracting the silk fiber. For preparing the hybrid silkworm eggs, rows of silkworms are raised in separate areas. The cocoons are preserved properly in the egg-producing factories, popularly called silkworm grain ages; the moths are allowed to emerge. Due to climatic conditions in Jammu and Kashmir, the rearing of silkworms is practiced once a year, during May-June. Presently the average cocoon production per ounce of silkworm seed is 31 kg in Jammu division and 20 kg in Kashmir division, which is low compared to the national average of about 38 kg, per ounce.

Table III.14 Production of cocoons in Jammu and Kashmir

Year	Production of Cocoons (000 Qtl.)
1980-81	10.36
1985-86	6.42
1990-91	7
1995-96	5.81
1996-97	7.67
1997-98	7.83
1998-99	8.29
1999-2000	8.25

According to Table III.14 quantity of cocoon production is inconsistent, one of the reasons being the climatic limitation of the state. Low productivity may be attributed to inadequate rearing equipment. As a result, proper growth and development of silkworms does not take place. Through certain initiatives of the state government, the state can overcome from the problem like (a) Assistance for rearing kits (b) Assistance for rearing sheds ;(c) Demonstration of technologies; and (d) Replacement of traditional silkworm races with improved varieties. The state government is negotiating with the Central Silk Board and Universities to get more productive silkworms. During the 10<sup>th</sup> Plan the state government has proposed to provide proper rearing accommodation, manpower and mulberry leaf to the rearers.

**Production of Raw Silk:-**In Jammu and Kashmir, due to improper disease management, the production of raw silk is not consistent. During the years 1985-86 to 1995-96, production of raw silk showed a gradual declining trend. In 1985-86, the silk production was 33.70 thousand quintal coming down to 9.50 thousand quintal in 1995-96. From 1996-97 onwards it shows an increasing trend. In the year 1996-97 the production of raw silk was 85.10 thousand quintal, which increased to 92.10 thousand quintal during 1998-99 (Table III.15). In terms of value of raw silk produced, the trend has been declining.

Table III.15 Production of Raw Silk in Jammu and Kashmir

Year	Quantity (000 kg)	Value (Rs 000 lakh)
1980-81	75.85	234.98
1985-86	33.7	291.28
1990-91	20.74	155.35
1995-96	9.5	140.16
1996-97	85.1	1076
1997-98	86.13	1205
1998-99	92.1	1208
1999-2000	80	960

Source: Statistical Abstract, Government of Jammu and Kashmir, 1999-2000

**Employment in the Sericulture sector in Jammu and Kashmir:-**Table III.16 indicates that number of household dependent on sericulture has shown a gradual decline, from 38.50 thousand in 1980-89 to 25.28 thousand in the year 1999-2000. One of the important reasons of this decline is the low

return from cocoon production. Due to climatic conditions mulberry cultivation is a subsidiary occupation. Only 20-30 percent of the produced cocoons were used within the state.

Table III.16 Number of people dependent of Sericulture

Year	No. of Sericulture Villages (000 nos.)	No. of Sericulture Households (000 nos.)
1980-81	2.7	38.5
1985-86	2.26	32.5
1990-91	2.59	29.19
1995-96	2.36	23.53
1996-97	2.24	25.52
1997-98	2.3	27
1998-99	2.307	22.737
1999-2000	2.15	25.28

Source: Statistical Abstract, 1999-2000, Government of J&K

Due to open competition from other countries like China the same product is available at a cheaper price outside the state. Since 1989, the government has not assured a minimum rate to the cultivator, a factor contributing to the restricted participation of the cultivator in mulberry cultivation. By developing this sector, a lot of employment opportunity can be developed in the rural and semi-urban areas. It has greater implications for absorbing family labour which otherwise would have remained unemployed or underemployed. Ramana (1987) is of the opinion that both mulberry cultivation and silkworm rearing employs mainly household labour; the latter providing domestic occupation for ladies even in the upper agricultural class. So by effective management and proper attention, sericulture development can lead to a substantial increase both in the net return and employment.

**Government Initiatives for Sericulture Development:-** (i) Silkworm seed production:-The Ninth Plan period saw an increase in average cocoon productivity from 24 kg per ounce to 33 kg per ounce of silkworm seed. This alone has contributed to about 1.5 lakh kg. The seed-producing units/stations are proposed to be equipped properly and provided with modern facilities so that the quality of silkworm seed is further improved. In Jammu region to the extent of 100 percent. The department is expecting the release of more productive silkworm from Central Silk Board and Universities. During the Tenth Plan, all those rearers who have proper rearing accommodation and with whom man-power and mulberry leaf availability is not a constraint will be given these varieties. (ii) Production of Mulberry Plants:-The department at present annually produces 15 lakh standard mulberry saplings from its nurseries spread over an area of 4317 hectare. During the Tenth Plan, emphasis will be laid to double the out-turn of plants (from about 6000 plant/ hectare

to 12000 plants/hectare). For increase in plant productivity, the following steps will be taken:- (a) Provision of proper irrigation facilities wherever lacking or insufficient. (b) Proper fencing of nurseries (c) Application of inputs and full adoption of package of practices. (d) Optimum man-power utilization and management. The yearly turnout of standard plants shall be raised to 20 lakh. By the end of the Tenth Plan, efforts will be made to produce 5-10 lakh plants in private nurseries (Kissan nurseries) for massive field plantation. Attention shall continue to be paid towards popularization of only improved mulberry varieties recommended by different research institutions and universities. Overall production of nutrition leaves in bulk to meet the demand will be a major area of attention for the department of sericulture. A scheme to ensure that every family must grow one mulberry plant should be popularized.

**Policy Recommendation:-** (i) Silkworm seed is the sheet anchor of the sericulture industry. The local seed produced and distributed to rearers in Kashmir gives lower cocoon yield compared to foreign seed. The import and distribution of foreign seed that was stopped in the year 1984 in J&K and re-started in 1995 needs more attention. Therefore, the first step towards boosting silk production is to evolve superior varieties of disease-resistant silkworm races which should suit local conditions. In this context, the research output of Sher-I-Kashmir University of Agriculture Science and Technology is not very encouraging. It is time to review the activity of the university and the state government should provide infrastructure to private investors in this area. (ii) Profitability from sericulture depends largely on the production of mulberry leaf at an economic cost. Hence there is an urgent to improve mulberry leaf both qualitatively and quantitatively. Due to geographical limitations, multi-crop cultivation of mulberry is not possible. It is suggested that the state

government encourage the farmers to plant mulberry trees on the edges of their rice fields and orchards on a large scale. These plants must also be properly maintained for ensuring higher leaf yield. (iii) The department of sericulture should produce improved varieties of mulberry plants in their farms and then distribute them to the rearers. The social forestry department should be involved in the plantation programme. The department has a large number of workers on daily wages who can be replaced by motivated farmers for planting better varieties of mulberry plants on a large scale. However, these farmers should be given adequate incentives. As a consequence, there will be higher leaf production and rearers can go in for large cocoon production and receive more benefits. (iv) Cocoons are the end product of a mulberry farm. The rearers should arrange proper equipment for carrying out silkworm rearing scientifically. Wooden trays must be prepared for self-rearing and traditional floor rearing be discarded. The rearers should pay adequate attention to the artificial adjustment of environmental factors like temperature humidity, light, air and food to create a conducive environment for silkworm rearing. (v) Cocoon markets in Kashmir need to be established in such a way that large-scale buyers from outside the state can participate. Wide publicity should be given about the sale of cocoons in these markets before starting the actual sale. Participation of purchasers from outside the state is necessary because silk reeling units in private sector have not yet started functioning in Kashmir. Besides, arrangements should be made by the department of sericulture for taking the cocoons of rearers to the markets at an appropriate time. This will result in higher price for cocoons for rearers of Kashmir. (vi) Sericulture is an important agro-based industry with considerable potential for income and employment. Therefore, by integrating mulberry cultivation with farm and horticulture activity, it will provide more income and employment to the rural agricultural labour force. (vii) Marketing of the cocoon has been a neglected area requiring proper attention. Despite certain measures taken by the state government, more steps should be taken. Cocoon auction markets should be started at Jammu, Mandalli, Udhampur, Sunderbani, Rajouri, Poonch, Ramban, Banilal,

Doda, Anantnag, Srinagar, Kupwara, Pulwara and Baramulla, where private as well as other states could participate in the bidding, besides government. This will help the people to get cash returns at competitive rates and inculcate quality consciousness among the people. (viii) The upgradation of seed stations also needs the attention of state. The poor silk content needs to be replaced by productive breeds and the technical staff to be imparted training to prepare good quality and disease resistant silkworm seeds. (ix) The number of nurseries needs to be increased. In the Tenth Five-Year Plan, the department has proposed that 60 nurseries should be set up in the state, of which 40 should be set up in Kashmir and 20 in the Jammu division. But this target seems on the lower side and needs to be raised. (x) Silkworm seed production during the past twenty years shown consistency. (Table III.12). In 1980-81 the silkworm seed produced was 24.80 thousand and during 1999-2000 it was 27.33 thousand the growth indicating that this sector needs proper attention for improvement. (xi) In spite of its congenial climatic, the average cocoon production per ounce of silkworm seed is 31 kg in Jammu division at present and 20 kg, in the Kashmir division. This is low compared with the national average of about 38 kg, per ounce. The reasons for low productivity are: inadequate rearing equipment and rearing space with the rearers. As a result, proper growth and development of silkworms does not take place. This problem can be overcome by providing assistance for rearing kits, rearing sheds and demonstration of new technologies.

**Irrigation:** Irrigation is one of the indicators for measuring the development of agriculture in any state. It affects agricultural productivity directly. In Jammu and Kashmir the total net area irrigated by different sources (canals, tanks, wells and others) was about 2.61 lakh hectare (41.96 percent) in the year 1950-51 (Table III.18). Table III.17 shows that there is a constant increase in the net irrigated area during fifty years. The area sown more than once is very low. In 1998-99 the area under this category was 3.48 lakh hectares, which is 47.19 percent of the total area sown.

Net Area Irrigated by (1000 ha.)					
District	Canals	Tanks	Wells	Other Sources	Total
Anantnag	44.041.30		0.02	4	49.36
Pulwama	33.340.48		0.04	0.1	33.96
Srinagar	16.500.11		0.1	0.5	17.21
Budgam	31590.08		-	0.08	31.75
Baramulla	37.210.04		0.7	2.19	40.14
Kupwara	14.480.55		-	0.21	15.24
Leh	8.48-		-	-	8.48
Kargil	9.32-		-	-	9.32
Jammu	51.720.01		0.026	2.1	54.09
Udhampur	4.15-		-	1.02	5.17
Doda	6.46-		-	0.78	7.24
Kathua	15.86-		0.25	5.75	21.86
Rajouri	2.08-		-	3.39	5.47
Poonch	3.12-		-	0.68	3.8
J&K	278.352.57		1.37	20.8	303.09

Source: Digest of Statistics, 2000-01, Government of Jammu and Kashmir

The state can be divided into 3 hydro-geological units, namely, (i) outer plains of Jammu & Kathua districts, (ii) Kashmir Valley, and (iii) Ladakh region. Brief description of all the units is as under. The outer plain unit is located at the foothills of Shiwalik Hills. The altitude varies between 260 and 440 metres above mean sea level. Innumerable streams are crossing the area. These streams are locally called khads and are laid by boulders and have water only in the rainy season. These plains are further divided into Bhabar and Tarai region. Because of deeper water level conditions, the Bhabar region has ground water only in under-water level condition, whereas in the Tarai region it occurs both in under-water level and confined conditions. Jammu area receives surface irrigation facilities from the following canal systems:- (i) The Ranbir canal system (ii) Partap canal system (iii) The Kashmir canal system (iv) The High canal system (v) The Ravi-Tawi irrigation system. About 90 percent of the above-surface irrigation facilities are available to the Tarai area and only 10 percent to the Bhabar area. There is considerable scope for extending irrigation facilities through tubewells in the Bhabar area, which has not so far been covered by surface irrigation. The second hydro-geological unit is the Kashmir valley, located at an elevation of 1600-1900 meters above mean sea level with its trend in NW-SE direction. The Pir Panjal range along south and southwest and Great Himalayan range of the north and northeast encircle this valley. It seems that inland independent ground water region of the valley is plain. A Karewas level land is a conspicuous feature of the valley. There are several hard rock ridges, which about into the valley plain from the flanks and are responsible for marking almost separate hydro-geological sub basins. Low-lying areas, especially those around the surface water bodies are marshy. The Dal, the Wular and the Mansbal lakes occupy about 300 sq. km of the valley portion. The lakes act as balancing reservoir for storing flood water and save downstream areas from watercourse. The valley fills of Jhelum River and the upper Karewas form the main hydro-geological units of the valley. The upper Karewas have distinctive boulder beds from potential aquifers whereas lower Karewas are argillaceous in

nature and wells have to be carefully designed for tapping these formations. Sand occurring in lower Karewas takes up a lot of time during development. The high area level lands, which have not been covered so far by surface irrigation, are irrigated only by tubewells. The third one is the Ladakh region. The sediments of Leh plain consist of morainic material overlain by varied living and silts of lacustrine. The entire zone receives irrigated water for cultivation from the Indus and its tributaries as well as Nallah, Drass, Suru, Kangi and Wakha. In this region the construction of tubewells is possible on the thickness of rocks.

**Area Irrigated from different sources:** Out of 2, 22,236 sq.km of total area of the state about 3000 sq.km area of outer plain of Jammu & Kathua district and 5,000 sq. km area of Kashmir Valley covering parts of districts of Srinagar Pulwama, Badgam, Anantnag, Baramulla and Kupwara has been considered for the purpose of the ground water resource estimation by the Central Ground Water Board (CGWB). The ground water estimates are available at the district level, whereas the same has not been segregated at the block level. It has been established by the CGWB that the entire out plain area of Jammu region and the valley portion of Kashmir region fall in the white category. The present state of ground water development is 1.33 percent.

Canal irrigation constitutes the largest single source of irrigation, accounting for 93.75 percent. Tanks wells and other miscellaneous sources contribute the rest (Table III.18). Some estimates indicate that the gross irrigated area is 4.27 lakh hectare of the gross cultivated area of 11.02 lakh hectare. As such the percentage of gross irrigated area was about 40.94 percent for the state as a whole. However, the situation in various regions is different from the state average. In the Jammu region the gross irrigated area is 75.14 thousand hectare, mostly irrigated by canals like gross irrigated area is Ravi lift irrigation system covering about 21.06 percent area only. This assumes significance in view of the fact that Jammu region has the largest gross cropped area of the state.

Table III.18 Trend in Net Area Irrigated from different sources

<b>Net Area Irrigated (1000 ha)</b>					
<b>Years</b>	<b>Canals</b>	<b>Tanks</b>	<b>Wells</b>	<b>Other Sources</b>	<b>Total</b>
1950-51	244	3	3	11	261
1960-61	256	-	5	13	274
1968-69	252	-	1	11	264
1980-81	285	2	4	13	304
1990-91	278.58	1.98	1.33	16.2	298.09
1995-96	284.86	2.57	1.42	17.73	306.26
1996-97	284.25	2.57	1.42	25.02	313.26
1997-98	284.31	2.52	1.3	20.64	308.77
1998-99	283.81	2.6	1.32	21.42	309.15
1999-2000	278.35	2.57	1.37	20.8	303.09

Sources: Digest of Statistics, 2000-2001, Government of Jammu and Kashmir



In Kashmir, gravity canals mostly provide the region with irrigation. Canals like Martnod, Dedi, Nandi, Maw, Zainapora, Wopzan and Zoora and lift stations like Lethpora, Padgampora, Marwal, Quill and Rajpora are the main sources of irrigation for southwest and southeast of Kashmir. Canals like Lar, Power, Ded Zaingeer, Lalquell, Babul and Aehji and lift stations like Sumbal, Rajiabad cater to the irrigation needs of northeast and northwest Kashmir. Gross cropped area is 255.14 thousand hectare constituting 63.11 percent. In Anantnag district of Kashmir region, most of the land has irrigation facilities followed by Baramulla and Pulwama. In Leh and Kargil district, the entire cropped area is irrigated from the Indus and its tributaries and Nallah, Drass, Suru, Kangi and Wakha and wherever possible, also through gravitational canals, as field crop production is not possible without assured irrigation in the limited cropping season of

this arid region. The total area under irrigation in this region is about 18.76 thousand hectare, constituting 82.60 percent of the total cultivable area. Kurbathang canal in Kargil. A few more canals are under construction in the region.

**Irrigated Area under different Crops:-**Table III.19 shows that rice maize cultivation get maximum share of available water sources. The Kashmir region gets maximum irrigation facility for rice cultivation despite the fact that the rice produced in this region is not sufficient. Wheat after rice is the second important crop which receives a big share of irrigation facility in the Jammu region, but in the Kashmir region it has been neglected not because there is no water for wheat cultivation in Srinagar division, but due to different food habits. The Kashmir region is giving more attention to rice cultivation and the Jammu division to wheat.

Table III.19 District-wise Irrigated area under different crops 1999-2000 (1000 ha)

District	Rice	Maize	Wheat	Barley	Other cereals pulses & millets	Other food crops	Other Non crops	Food	Total area under crops irrigated
Anantnag	0.4	0.03	-	-	Neg	Neg	Neg	Neg	0.43
Pulwama	0.25	0.04	-	-	Neg	-	Neg	Neg	0.29
Srinagar	0.12	0.02	-	-	Neg	-	Neg	Neg	0.14
Budgam	0.27	0.02	-	-	Neg	-	Neg	Neg	0.29
Baramulla	0.28	0.10	-	-	Neg	-	Neg	Neg	0.38
Kupwara	0.1	0.05	-	-	Neg	-	-	-	0.15
Leh	-	-0.03	Neg	-	Neg	Neg	-	-	0.15
Kargil	-	-0.02	Neg	-	Neg	-	-	-	0.03
Jammu	0.44	0.44	Neg	-	-	-	-	-	0.86
Udhampur	0.05	0.05	-	-	-	-	-	-	0.05
Doda	0.04	0.04	Neg	-	Neg	-	-	-	0.06
Kathua	0.23	0.23	Neg	-	-	-	-	-	0.35
Rajouri	0.05	0.05	Neg	-	-	-	-	-	0.07
Poonch	0.04	0.04	Neg	-	Neg	-	-	-	0.05
Total	2.27	0.28	Neg	-	Neg	Neg	Neg	Neg	3.17

Neg: Negligible Source: Digest of Statistics, 2000-2001, Government of Jammu and Kashmir.

#### IV. CONCLUSIONS

The study has revealed a major shift of land from the desirable to undesirable land-use classes. There has been an increase in the net area sown in Jammu and Kashmir on account of various land reclamation measures adopted till early-1980s, but later this land-use class has shown an unfavorable decline towards 2004-05. Cropping intensity has been lower in the Kashmir than Jammu province due to unfavorable climatic conditions prevalent in the valley. No significant association has been found between irrigated area and cropping intensity, indicating lack of location-specific technological advancements and their respective channelization. It is required more so due to altitudinal variations that demand short duration varieties for increasing

cropping intensity. The state largely comprises small and marginal farmers (about 94%), and the per capita availability of cultivated land in the state is only 0.072 ha, which is a major constraint in agricultural development in the state. Therefore, a high priority needs to be accorded for exploring the potentialities of crop diversification in different agro-climatic zones of the state with a view to maximizing the returns per unit of land to the year, is still over 500 thousand hectare which need to be brought under cultivation through effective measures. The study has suggested that the following policy options could be considered for the management of land resources of the state. The declining trend in the reported area of the state needs to be checked by land surveys through remote sensing under GIS. Since irrigation is an important determinant of agricultural growth, low gestation irrigation

projects should be funded to expand irrigation capacities. Moreover the existing irrigation structures should be made functional to improve efficiency of the existing capital stock. Desirable land-use pattern could be achieved through sectoral approach/plan linkages and there is a need to apply modern science and technology to enhance productivity on a sustainable basis. Further fragmentation of holdings should be strictly prohibited. There should be a suitable institutional mechanism for scientific management, conservation and development of land resources. There is an immense requirement of preserving agricultural land. The land reform measures should be strictly implemented and the construction of residential buildings and other establishments on agricultural land should be banned. Reform policies should be supported by strict laws and regulations. Diversification of agriculture should be encouraged in the state because it not only enhances income and protects from risks, it also enhances soil properties and prevents degradation of land.

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