Introduction

1.1 Introduction

Land, water and vegetation are the most precious natural resources and their importance in human civilization needs no elaboration. In fact, life on earth is impossible without land, water and vegetation. However, degradation of natural resources is increasing due to fast pace of biotic pressure through anthropogenic activities. The needs of agriculture, industrial, domestic and others often result in diversion of water from one use to other. In rural areas, livelihoods and natural resources such as land water and vegetation are interlinked. Therefore, it is essential that natural resources are managed optimally for sustenance of life and development.

Sustainable and efficient management of water, land, vegetation and agriculture is an increasingly complex challenge in India. Increasing population, growing urbanization and rapid industrialization, combined with the need for raising agriculture production, generate competing claims over water. This phenomenon is further aggravated by temporal and spatial distribution of precipitation in the Indian subcontinent. This often causes floods and droughts in India. These conditions occur either due to excess or inadequacy of rainfall, lack of irrigation facility or over-exploitation of ground water.

Rain-fed agriculture in India's semi-arid tropics is characterized by low productivity, degraded natural resources and widespread poverty. The people of semi-arid tropic areas mostly depend upon agriculture and natural resources management for their livelihood.

As a result of green revolution, India achieved the objective of achieving self-reliance in food production, but, it was confined primarily to irrigated tracts. A major part of the country, which is rain-fed, was by - passed by the green revolution and experienced little or no growth in agriculture production for several decades. These regions have been victims of neglect on policy front. Now it is being realized that the development of these regions, in terms of enhancing the crop yield, hold the key to future food security of the country, because the areas where green revolution...
took place do not show any further improvement in agriculture productivity. Optimum and plateau productivity levels in these regions have been achieved and their potential in meeting future demand is limited.

Green revolution in Asia increased the cereal production tremendously by intensification of agriculture. This intensification has met the world’s demand for food, but, mal-distribution has not reduced hunger and poverty dramatically, while intensification has also brought environmental problems of its own. Intensive cropping, excessive and inappropriate agro-chemicals pollute, poison and alter the natural ecosystem. Wasteful irrigation has contributed to scarcity of water, unsustainable pumping of water and degradation of prime agricultural land.

Now it is being realized that optimal management of natural resources, land water and vegetation, with minimal hazard, is essential for human survival and sustainable development.

Adopting the principle and strategies of sustainable development is of paramount importance for a developing country like India. This is particularly so because a traditional agriculture society is trying to hit the path of rapid economic growth by adopting the industrial route followed the developing nations. The consequent resource depletion and waste accumulation could destroy the natural ecosystem of a country. Sustainability in agriculture has been a declared target in India and agriculture development strategy was revised in 1999 as the National Sustainable and Agriculture and Rural Development (SARD) strategy. Agricultural growth rate of 4.5 percent per annum was targeted for Ninth Five year Plan (1997-2000), which was to be achieved through a regionally differentiated strategy, based on agro economic climate and environmental conditions however, 2.5% only could be achieved (Planning Commission Government of India 2005). The thrust is on sustainable use of biotic resources land, water and vegetation, so that it provides growth, employment, and alleviates hunger. Major activities under the SARD strategy are:

i. Development of crop based on regional conditions.

ii. Development of horticulture crops.

iii. Adequate and timely delivery of crop inputs.

iv. Integrated pest management.
v. Use of bio fertilizers and biotechnology.
vi. Rain fed farming and watershed management.
vii. Soil and water conservation.
viii. Development of fisheries.
ix. Agriculture research and education.
xi. Human resource development.

India is the seventh largest country in the world, with total land area of 3287263 sq. It measures 3214 from north to south and 2993 from east to west. It has a land frontier of 15200 km. and coast line 7517 of km. Out of India’s total geographical area 328.73 Mha, 306 Mha comprises the reporting area in which 146.82 Mha is degraded. (Ministry of Environment & Forests Government of India – 2009)

Figure -1.1

Land degradation is occurring due to natural and human induced causes. Like wind erosion, water logging is one of the priority concerns of India. The varying degrees and types of degradation stem mainly from unsustainable use and inappropriate land management practices.

Land degradation problem could be tackled by suitable policies that would internalize the issue in proper decision making. In addition, indirect pressure such as land shortage, short term or insecure land tenancy, open access resources, economic status and poverty of agriculture dependent-people which are also instrumental to a
significant extent for degradation of land. Land degradation is mainly increasing as a result of change in land use pattern, shifting agriculture practices, excessive irrigation and chemical usage and change in forest cover etc.

Watershed management programmes have been taken up extensively since 1995, for reclamation of nearly 147 Mha of existing degraded land in the country and development of 60% rain-fed area of country.

India has, over the past five decades, increased its annual food production from 50 million tones in 1950-51 to 255.36 million tons in 2012-13 (Department of Agriculture & Cooperation, 2013). The increase in production and productivity was the result of increased inputs, mainly nutrients, and water, high yielding varieties, and partly because of an expanded cultivated area.

In 1994, a technical committee under the chairman of C. H. Hanumantha Rao was appointed to assess Drought Prone Areas Programme (DPAP) and Desert Development Programme. The committee, after careful appraisal, opined “The degradation of environment in dry land areas is basically attributable to increase in biotic pressure on the fragile ecosystem in the absence of adequate investment and appropriate management practices to augment and conserve the land and water resources. Population growth and poverty on one hand and rising demand from affluence on the other have been exerting powerful pressure on ecosystem. The macroeconomic policies which provide inducement to the over exploitation of natural resources, that is, at a higher rate than the rate of regeneration, are also responsible for denudation of environment. For example, in the dry land areas, the pumping of water has been proceeding at faster rate than the rate at which ground water is being recharged. The traditional community based institutions have given place so for to individualized or market driven exploitation of natural resource without any regard to adverse externalities of such action. Numerous official programmes for development of land and water resources which are dependent entirely on top-down bureaucracy have very little participation from village communities”

Optimal use of scarce natural resources was advocated (2013) to active sustainable development. "The national environment policy 2006 articulates that only such development is sustainable which respect to ecological constraint and imperatives of social justice. The National Agriculture policy (2000) focuses on sustainable development of agriculture by promoting technically sound and economically
viable, environmentally non-degrading, and socially acceptable uses of country’s natural resources”.

Watershed programme is one of the means to address regional resource management programme for addressing the shortage of water and it will also solve temporal and spatial distribution of rainfall over the Indian subcontinent. Watershed development programme is addressing the problem of rain fed agriculture of India. Watershed management has emerged as new paradigm for planning development and management of land, water, and biomass resources with a focus on social and environment aspects, following a participatory approach. It aims at integration of social resource management with natural resource management. The approach is generally preventive, progressive, corrective and creative. Watershed management involves the judicious use of natural resource with active participation of institutions organisation in harmony with the ecosystem.

Watershed is a geo hydrological area that drains at a common point. The watershed approach is a project based development plan that follows a ridge to valley approach for water harvesting. Water conservation and other related economic and social activities that seek to enhance the production potential in an area on sustainable basis. The watershed programmes implemented by different ministries usually take up micro- watershed of about 500 hectares each.

The Drought Prone Area Programme (1973-74) was first major programme aimed at soil and moisture conservation. The basic objective of the programme was to minimize the adverse effects of drought on production, crops, livestock and productivity of land. The programme also aims at promotion of overall economic development and vulnerable sections.

The desert development programme (DDP), was introduced 1977-78 and major objective of the programme are to restore the ecological imbalance, conservation of soil and water and to arrest the promotion of deserts through shelter- belt plantation.

The integrated wasteland development programme started in 1989-90 seeks to develop government wasteland and common property resource (CPRs) based on village/micro watershed plan. The I.W.D.P. is aimed at overall economic development and improving the economic condition of resource poor population.

To involve village communities in implementation of watershed project under all the areas development programmes namely, Drought Prone Area Programme and Desert
Development Programme, Integrated Waste Land Development Programme, the Government of India has issued new guidelines for watershed development w.e.f. 1995 and subsequently it was revised in August 2001. The new guideline “Hariyalli” 2003 was issued to further simplify procedure and involve Panchyati Raj Institution more meaningfully in planning, implementation and management of economic development activities in rural areas.

1.2 Framework of Watershed Development

The watershed management has become the main intervention for natural resources management. The watershed development is now accepted to be the natural home for managing the resource trinity, land, water and biomass in sustainable manner. Besides promoting conservation of natural resource, it improves the social and economic life of people, protects and conserves the environment and contributes to livelihood security. The depleting level of water tables subsequent to excessive exploitation of underground water and massive deforestation, has forced policy planners to evolve strategic management, encompassing different models of development into an integrated system of development.

Watershed development includes all soil and water conservation measures and vegetation. Soil and water conservation works include bunding, trenching gully plugs, rock fill, check dam, percolation tanks, sunken ponds etc. The execution of these works depends upon the slope, type of soil and topography of area, etc.

Watershed is the area of land where all the water that is under it or drains off of it goes in same place. Powell (1878) defined it as "that are of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of community".

Watershed is a geo-hydrological unit comprised of all land and water within the confines of drainage divide. Essentially, a watershed is all the land and water area which contribute runoff to a common point. It is land area that captures rainfall and conveys over land the overflow or runoff to an outlet in main channel. It is a topographically delineated area draining single channel. Watershed may be nearly flat or may include hillocks hills or mountains. Each and every water and land area is a part of one watershed or other. Frequently, the following distinction is made to
indicate the size of watershed; micro watershed; sub watershed, watershed catchment basin in order of increasing size.

Magrath and Doolette (1989) defined watershed as “the upper watershed as land having a slope exceeding 30 percent and lower watershed as land with slope of 8-30 percent, flatter areas with slope of less than 8 percent excluded”.

“Watershed management provides the basis for dealing effectively in an integrative fashion with the biophysical and social economic aspect of natural resources and environmental problem. It provides a logical framework for organizing development activity involving land and water resources. The watershed management approach incorporates soil, water, vegetation conservation and land use planning, into broader logical frame work by focusing on sustainable development” (The Working Group of Watershed Management and development)

Watershed programme is land based programme, which is increasingly being focused on water, with its main objective being to enhance agricultural productivity through increased in-situ moisture conservation and protective irrigation for socio-economic development of rural people. An important concept in watershed development is the equitable distribution of benefits and sharing of the cost of the land and water resources development and consequent biomass.

Easter et.al.(1986) stated that the modern concept of watershed management includes not only physical and hydrological unit but it also focuses on watershed component and links with social and economic issues. Modern concept of watershed management places greater emphasis on social interaction among watershed community. People’s participation in maintenance and formulation and implementation are necessary of very success of watershed management

The three main components in watershed are land management, water management and biomass management.

1.2.1 Land Management

Land characteristics like terrain, slope, formation, depth texture, moisture, and infiltration rate and soil operability are major determinants of land management activities in watershed. The brood categories of land management intervention are as follows.

- Structural measures.
- Vegetative measures.
• Production measures.
• Protection measures.

Mechanical conservation measures may became necessary in watershed management in the initial stages. Structural measures of watershed management intervention consist of:

**Contour bunding**

It consists of building earthen embankment areas on the slope of the land, following the contour as closely as possible. It is carried out to conserve the soil and moisture of land.

**Graded bunding**

Graded bunds, graded terraces or channel terraces are the bund is used for safe, disposal of excess runoff of high rainfall areas and regions where (clay) soil is relatively impervious.

**Gully plugging**

Gully plays, also called check dams, are mainly built to prevent erosion and settle sediment and pollutant. Furthermore, it is possible to retain soil moisture due to infiltration. It reduces silt load going down stream and increases ground water recharges.

**Check Dams**

A check dam is small dam, which can either temporary or permanent. It is built across minor channels. Check dams reduce erosion and gully in to the channel. They also lower the speed of water flow during high rainfall. The stored water in check dam improves soil moisture of adjoining areas and allows percolation to recharge the aquifers.

**Percolation Pond**

Percolation acts like an irrigation tank, has structure to impound rain water flowing through watershed. Percolation pond increases the soil moisture content in adjacent area and boosts the aquifer water tables

Watershed may contain natural ecosystem like grassland, wetland land, mangrove, marshes, water bodies, all ecosystems which have specific roles in nature. Vegetative measures include vegetative cover, plant cover, mulching, vegetative
hedges, grassland land management, fencing, agro forestry, etc. The production measure include intervention aimed at increasing productivity of land, like mixed cropping, strip cropping, cover cropping, crop rotation, cultivation of shrub and herb, contour cultivation, conservation of tillage, land leveling, use of improved varieties of seeds, horticulture production, etc.

Measures like slide control, gully plugging, runoff collection, etc. can also be adopted. Adoption of all the interventions mentioned above should be done strictly in accordance with the characteristics of land taken for management.

1.2.2 Water Management

Water characteristics like inflow (precipitation, surface water flow, ground water inflow), water use (evapotranspiration, irrigation, drinking water) out flows (surface water out flow, ground water out flow), storage (surface storage, ground water storage, root zone storage) and are principle factors to be taken care of in sustainable water management. The broad interventions for watershed are:

- Rain water harvesting
- Ground water recharge
- Maintenance of water balance
- Preventing water pollution
- Economic use of water

Rain water harvesting forms the major component of water management. The rainwater collected can be used to recharge ground. Roof top water harvesting, diversion of perennial springs and streams into storage structure, farm ponds, etc. are the methods widely used for rain water harvesting.

Water scarcity is becoming a global problem. We face challenges in water sector in the form of reducing per capita availability of water to increasing population, deterioration in quality, over-exploitation of ground water resources leading to decline in the ground water table in some areas. Water is prime natural resource responsible for human survival. It is also necessary and prerequisite for agriculture and husbandry sector. The spatial and temporal distribution of rainfall over Indian subcontinent increases due to vagaries of drought and flood. Therefore, water conservation through various methods of rain water harvesting is prerequisite condition of sustainable agriculture.
The government of India adopted National Water Policy in Sept. 1987. The policy guided the formulation of programme for water resource development and management. The government of India reviewed the National Water Policy in the face of new challenges and adopted modified National Water Policy in 2000. The policy states that there is need of adequate emphasis must be placed on participatory conservation of water resource and planning of water resources development projects should as far as possible, multipurpose with an integrated and multidisciplinary approach having regard to human and ecological aspects including those of disadvantaged section of society.

Some simple and cost effective rain water harvesting structures are following.

- Percolation pits/tank
- Recharge trenches
- Recharge wells
- farm ponds
- V ditch
- Bench terracing

Economic use of water and avoidance of affluence use of water at individual and community levels may be major concern for watershed management in the years to come.

1.2.3 Biomass management:

Major interventions of biomass intervention are indicated below:

- Eco Preservation
- Biomass regeneration
- Forest management
- Plant protection and social forest
- Increased productivity at animals
- Income and employment generation activities

The agro forestry practices in watershed management will improve the productivity of land on sustainable basis. Therefore, an effort must be made to present the importance of watershed management through agro forestry measures, which will not only help in improving soil and water conservation practices through different type of vegetative cover but also improve the vertical productivity of land, besides
Adoption of agro forestry practices will help in conservation of soil and water from land surface and will always add to productivity of resource for poor small and marginal farmer of the state. Agro forestry is a collective name for land use system in which woody perennial (trees, shrubs) are grown in association with herbaceous plant or live stock in a spatial arrangement, or a rotation of both. Agro forestry has both productive and service functions.

“Agro forestry is a medium combination of agricultural forestry technologies to create integrated, diverse and productive land use system. While agro forests are typically less diverse than natural forest, they do contain a significant number of plant and animal species. This diversity may, in time, provide ecological resilience and contribute to maintenance of beneficial ecological function. Similar to plantation forest, agro forest can help relieve some of the pressure to harvest native forests”.

1.3 Community Participation in Watershed Development

People’s participation and collective action are critical ingredients for watershed management. Sustainability, equity and participation are three basic elements of participatory watershed management. The focal point of any programme is the betterment of people. Thus, the wider socio economic concern of any package of technology is to influence the size of population, population of ethnic groups or communities, composition and structure of household, basic and secondary needs of the people. There is a close relationship between community and environment and people which depends upon food, water and other resources. These conditions can be further improved by life style change, in order to improve the condition of tribal and ethnic people of concerned areas.

The concept of watershed is broadened to focus on poverty alleviation, environmental management and changes from being strong top down, government controlled activity to one decentralized and participatory with the involvement of different stakeholders.

In order to promote participation process, the first important activity is to organize the watershed committee (W.C.) into different groups. The second step is facilitating process in group planning of group activities. A programme must be owned by the concerned group so that they participate in its implementation and provide support and maintenance in future. The entire exercise of group planning and decision
making transparency, regarding and responsibilities and mapping of the problems before the entire communities should be transparent to garner good results.

The Parthasarthy Committee (2006) opined that community participation was sought to achieve by entrusting the responsibility for all aspect of programme to Panchyati Raj institution. The committee recommends that village watershed committee (V.W.C.) will be a committee of Gram Panchayat elected in a meeting of Gram Sabha. Since watershed development affects all members of the community, Gram Sabha is the appropriate authority to decide on priorities for the use of common output and equitable sharing of benefits among different segments. The functional responsibility for preparing implementing and managing watershed action plan will be vested in V.W.C.

This process in an effective way of bringing in people’s knowledge of local conditions, problem and possible solution as well as the community's prioritization into process of implementation of programme. There is close relationship between the environment and community living in that area, as the community derives sustenance from it. Increase in biotic pressure leads to over exploitation and degradation of natural resources. Paucity of resources also leads to internal conflict, giving opportunity to others to exploit the situation. It is thus necessary for people to realize the intrinsic relationship among population, poverty and degraded environment in which they live. The poor in developing countries like India are left with no option but to degrade their own environment for their own survival.

Still, it is only who they can restore environment, because outside actors only facilitate, but never substitute, for stakeholders. Hence, there cannot be sustainable natural resource management unless it involves all inhabitants of the affected areas in an active manner and development plans are formulated and executed for them.

Integration of indigenous technologies is vital in development of rain-fed farming system in India. Rural people’s knowledge and technological advancement are complimentary in their strengths and weakness. Combined together, they may achieve what neither would achieve. Low cost locally-available technology, with suitable intervention by latest advancement, yields best solution.

It is clear that watershed development cannot be done in isolation. It is natural entity and may contain different types land, namely government lands or private lands, forest land, community lands. These lands can be treated on ridge- to- valley
approach. A land lying in valley cannot be improved if the land at upper reaches is not treated. Treatment of land in scatted manner will not lead to wasteland development. Mere treatment of land is not enough. Land and people cannot, and should not, be viewed in isolation. So the best possible strategy would be in treating the land by empowering the people who live on it. It is watershed plans approach which takes care of holistic development.

Therefore, the entire watershed community is to be involved for integrated development of watershed. People's participation also ensures conservation and development of common property resources. Besides, when people decide what they have to do, their stake in development becomes more pronounced, leading to their intense involvement. This involvement in decision making is key to success which brings sustainable development. Hence, people's participation is the right approach for the purpose of sustainable development.

**Role of N.G.O**

Non-Government Organizations (N.G.O.) have to occupy an important place in India. The spread of N.G.O. activities in the country, as in many part of the world, are manifest in number of sphere and in wide spectrum of programme. In welfare-oriented programmes, development oriented initiative, empowering woman and weaker section, protecting the right of marginalized section, protecting the environment through watershed, spreading literacy and education, participation of N.G.O. sector has been impressive.

Many N.G.Os in India have set example in the mobilization of rural communities in direction of development of disadvantaged section of society As the National advisory council states "The N.G.Os are in general better equipped to undertake the task of creation of awareness, social mobilization and capacity building. However, the revised guidelines of Hariyali have severely restricted the role of N.G.Os as Project Implementation Agency(P.I.A.) in watershed development, notwithstanding the mounting evidence that performance of watershed, in the implementation of which N.G.Os have involved, has been distributed better than those which have been executed by the government agencies alone (N.AC. 2005).

The voluntary sector is seeing proliferation of agencies, many of which are of dubious nature. It is not clear that a commitment to serve the poorest has brought them to this field. It appears that larger cloud of corruption, enveloping society in
India, has made its entry into the voluntary sector as well. The identification of the genuine N.G.Os with quality has become a difficult task. A very interesting innovation in this regard has been attempted by Council for Advancement of People’s Action and Rural Technology (CAPART). CAPART is semi-autonomous body registered under the societies registration act, working under the aegis of the Ministry of Rural Development of India.

CAPART has sought to overcome the problem of quality of agency and operation scale through the concept of the Support Voluntary Organization (SVO). The responsibilities of S.V.Os are to search for and screen prospective partners with good track record, promote watershed programme among them by proactively seeking them out, orienting them into the programme, assist them in preparing watershed action plan, to impart training on watershed development to agencies engaged in the programme, to provide technical and other required support through field visits to the watershed area at regular intervals, to act as institutional monitors for the watershed programme, evaluating the performance of agencies in the programme or those wishing to join it, and conduct research on various aspects of watershed development to disseminate widespread awareness by acting as ambassadors of watershed approach.

Poor women’s survival and that of their household, depends upon access to and control of natural resources. However, limited access to these resources is intensifying the cycle of poverty, gender inequality and poor living standard. Women and men have distinct responsibility and different stakes in using and managing natural resources in watershed. As economic providers, care givers and house hold managers, women are responsible for ensuring that their families have basic resources for daily lives. They are often managers of community natural resources and have learned to protect these resources in order to preserve them for future managers of sustainability. They have extensive knowledge, experience and common sense of use and management of natural resources for their daily life.

Increasing women's participation in watershed projects is critical to long term sustainability of development efforts. There is need to sensitize policy makers and staff on project implementing agencies to the core issue affecting women's participation. There is need to progress from an attitude where women are treated as
a "disadvantaged group" to a point where they are treated as integral members of the community.

Parthasarthy (2006) suggested that for real participation of women in watershed management, Women Watershed Committees (W.W.C.) should be formed and the duty of the watershed development team (W.D.T.) should be to mobilize women to actively participate in meetings of the W.W.C. and ought to give requisite attention to women's perceptions and priorities in watershed action plan.

TK Sridevi et al (2010) stated that both males and females participation in soil, water and vegetation conservation is *sin qua non* for very success of every watershed management. The use of a gender sensitive approach to watershed management ensures that women’s and men's unique needs, priorities and knowledge are incorporated into management plan and policies.

**1.4 Objectives of the Study**

The objectives of present study are to make a comprehensive assessment of economic effects of watershed Development Programme in Allahabad district to consider the change in:

1- Production of various crops-Wheat/Rice/Coarse Cereals/Oilseeds/ Milk/ Vegetable.
2- Consumption of various crops.
3- Sale of various crops.
4- Productivity of various crops.
5- Fodder availability and milk production.
6- Cropping intensity and cropping preferences.
7- Economic status of farmers.

Researcher evaluated the watershed impact on production of wheat, rice, and coarse cereal, pulses, vegetable, oilseed and milk production and also effect on productivity of various crops. The study also compares effect on production and productivity before and after the completion of programme. The study also covers effect of programme on irrigation facility, fodder availability, cropping intensity, crop preferences, etc.
1.5 Hypotheses

1. \( H_0 \) - Watershed development programme in Allahabad district has no impact on agricultural production.
   \( H_1 \) - Watershed development programme in Allahabad district impacts agricultural production

2. \( H_0 \) - Watershed development programme in Allahabad district has no impact on agricultural productivity.
   \( H_1 \) - Watershed development programme in Allahabad has positive impact on agricultural productivity.

3. \( H_0 \) - Watershed development programme in Allahabad district has no impact on cropping intensity.
   \( H_1 \) - Watershed development programme in Allahabad district has positive impact on cropping intensity.

4. \( H_0 \) - Watershed development programme in Allahabad district has no impact on improvement in availability of water for livestock.
   \( H_1 \) - Watershed development programme in Allahabad district impacts improvement in availability of water for livestock.

5. \( H_0 \) - Watershed development programme in Allahabad district has no impact on fodder availability for livestock.
   \( H_1 \) - Watershed development programme in Allahabad district has impact on fodder availability for livestocks.

6. \( H_0 \) - Watershed development programme in Allahabad district has no impact on level of water source.
   \( H_1 \) - Watershed development programme in Allahabad district impacts on level of water source.

7. \( H_0 \) - Watershed development programme in Allahabad district has no impact on economic status of farmers.
   \( H_1 \) - Watershed development programme in Allahabad district impacts on economics status of farmers.

1.6 Methodology of Study

The present study is based on primary and secondary data. Secondary data obtained from Department of Land Resources, Ministry of Rural Development, Govt. of India, Department of Land Development and Water Resources U.P, Uttar Pradesh
Researcher prepared a structured schedule for pilot survey. The schedule was pre-tested with 80 respondents in five selected villages. Twenty respondents each were selected from Ankoria, Pagwar Bakuliha and Bhatauti villages and 10 respondents each selected from Pataidandi and Jhariyati. Pilot survey resulted in certain modifications and corrections and, after that, final schedule was prepared. The final interview schedule contained multiple choice questions on various likert scales. The final schedule was prepared to observe the economic impact of watershed development after the programme. For impact evaluation of watershed development programme, 2006-07 was considered as before the programme and after the programme reference year.

Interviewee schedule contains 57 questions on different likert scales. Schedule was divided in 5 sections. First section contains personal information, type of house, annual agriculture income before and after the programme and size of land holding, etc. The second section is related to effect of watershed development on production of wheat, rice, coarse cereals, production of pulses, oilseed, vegetable production, etc. Section 3-A of schedule is related to the effect of watershed development programme on productivity of wheat, rice, coarse cereals, pulses and oilseed on five point likert scale. Section 3-B contains questions related to effect of watershed development programme on cropping intensity and effect of programme on crop preference.

Section-4 is related to the information of effect of watershed development programme on household items, education of children, health expenditure. Last Section-5 is related to information about water availability, level of water source, fodder for livestock, etc. Economic status of the farmer defined as annual agriculture income of the farmer which means that increase in income shows improvement in economic status of farmers.

Data were computed from Uttar Pradesh Statistical Abstract-2008 to the select top five districts, where agriculture land holdings depend upon the monsoon: Banda (63.1%), Bahraich (48.5%), Jhansi (41.1%), Jalauan (33.3%) and Allahabad (23.8%). One district was randomly selected out of these five districts and which
was Allahabad where, incidentally, land holding was least dependent on the monsoon among five districts, at the same time, it had fourth rank in terms of land holdings (3, 15, 648). Further, regarding sampling among three districts Banda, Bahraich, Allahabad, Banda clearly should have been selected, as it had the highest percentage of rain-fed holding dependent on least actual rain fall. But Allahabad was randomly selected.

**TABLE-1.6.1**

RAIN-FED LAND HOLDINGS IN UTTAR PRADESH

<table>
<thead>
<tr>
<th>Districts</th>
<th>Number of Land Holdings</th>
<th>Rain Dependent Land Holdings</th>
<th>Rain Deficit Actual Normal ×100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jalaun</td>
<td>342675(II)</td>
<td>113248 (33.3%) (IV)</td>
<td>(78.4%)</td>
</tr>
<tr>
<td>Jhansi</td>
<td>305847 (V)</td>
<td>125750 (41.1%) (III)</td>
<td>(71.3%)</td>
</tr>
<tr>
<td>Banda</td>
<td>347737 (I)</td>
<td>219640 (63.1%) (I)</td>
<td>(57.7%)</td>
</tr>
<tr>
<td>Allahabad</td>
<td>315648(IV)</td>
<td>75126 (23.8%) (V)</td>
<td>(64.2%)</td>
</tr>
<tr>
<td>Bahraich</td>
<td>324862 (III)</td>
<td>157538 (48.5%) (II)</td>
<td>(66.5%)</td>
</tr>
</tbody>
</table>


Allahabad district is also one of the wasteland affected areas of Uttar Pradesh. In Allahabad district, Shankargarh, Meja, Karchhana, Koraon, Kaundhiyara, Jasra are worst affected by wasteland and drought prone problem. Therefore, watershed development programme can play an important role in enhancement of production and productivity in these areas. Researcher has chosen Shankargarh and Meja blocks randomly to examine the impact of watershed development programme, which commenced in 2006-2007 in both blocks.

The Allahabad district is divided in 20 development blocks. Watershed development programme was operational in 6 blocks in 2006-07. Shankargarh, Meja, Karchhana, Koraon, Kaundhiyara, Jasra. Researcher selected two blocks randomly, namely, Shankargarh and Meja. The number of households in Shankargarh and Meja are 22745 and 22590 respectively, with ratio being approximately 1:1. Sample size was kept at 400 for 5 % error margin (Niles, 2006). Therefore, 200 respondents from Shankargarh and 200 from Meja were randomly selected on proportional basis.
Watershed Development Programme was operational in five villages of Shankargarh block and in 11 villages of Meja block and their ratio was approximately 1:2 in 2006-07. Therefore, researcher selected two villages through proportionate random sampling, namely, Pagwar Bakhuliha and Ankoria from Shankargarh and four villages Bhatauti 1st, Bhatauti 2nd, Jhariyati, Pataidandi from Meja block. There are 200 households in Pagwar Bakhuliha and 138 households in Ankoria in Shankargarh block. 118 respondents were randomly selected from Pagwar Bakhuliha and 82 selected from Ankoria, according to their household ratio of 1:0.7.
In Meja block, there are 563 households in Bhaututi (comprising both I & II), 134 household in Jhariyati and 156 in Pataidandi. Therefore, researcher selected 132, 31, and 37 respectively from Bhatuti, Jhariyati and Patidandi, according to their household proportion of 1:0.24:0.28.

The respondents in each village were selected through systematic random sampling. SPSS 20.0 was used and hypotheses tested by Regression, Z, t, X², and F-test, along with finite population correction factor where necessary, and interpretations were drawn accordingly.