Chapter – I

Introduction

Water is unique substance and it is essential for human animal as well as plants for survival. Agriculture requires vast quantity of water. It is fact that water is an important source of energy and it provides an important means of irrigation and input for agricultural production. Neither the supply of water nor its distribution is uniform throughout surface of the earth. This has resulted in an uparent in balance between water demand and water supply. Some areas are blessed with a fairly uniform and more than adequate supply of water for human and agriculture purposes. Generally water is in a great demand in dry areas. The planners have to spent considerable time to supply water to dry regions. The country is affected in different parts by droughts and floods havoc. This situation can be reminded only by availing water policy at national level resorting to comprehensive planning. rainfall is an important factor for evaluation of surface water resources. rainfall plays an important role in determining the water balance, water resources, and cropping pattern of a region.

Drought is defined as a condition when the rainfall is half less than normal. It is a natural hazard. It denotes a state of in inadequacy of rainfall, defficiency of soil moisture and it plays a balance between soil moisture and evapo-transpiration. It is Meteorological Phemenon. Some times it is disastrous
calamitus and even catastrophic. Drought is also man made too because of soil erosion, de-forestation and desertification, due to man’s reckless action trigger environmental degradation and disturbance of harmony of nature. The National Agricultural Commission Classified drought in a 3 types. They are 1 meteorological droughts, 2 agricultural droughts 3 hydrological droughts. The meteorological droughts occur when there is more than 25% decrease of rainfall from the normal over an year. Agricultural droughts occur when soil moisture and rainfall are in adequate during a growing season to support normal crop growth. Hydrological drought occurs when a meteorological is drought prone for a long period throwing marked depletion of surface water and consequent drying up off surface and sub surface water resources leading to fall of ground water levels. Water balance is the comparative of rainfall and evopo-transpiration and plays an important role an agriculture and water resource studies.

A Watershed is a geo-hydrological unit draining at a common point by a system of streams. It is a topographically delineated area draining into a single channel.

Watershed has a third dimension height which extents top of the vegetation to the confining geological strata beneath. Watersheds strictly refer to the divide separating one drainage basin to another. It is a catchment area. The size of a watershed varies from a few square meters to thousand of square Kilometers.
The size become important depending up on the objective of the watershed. For large irrigation projects watersheds of 1000 k.m.\(^2\) may be considered. On an average 5000 hectares is considered as a milli watershed and 500 hectares as a micro watershed. It is a functional watershed. Watershed has physical characteristics like size, shape, land, slope, drainage patterns, and drainage density. The size of watershed is an important determining factor for the peak rate of run-off. The rate of volume of run-off increases with increasing size of watershed area.

Watershed is a biological, physical, social and economic unit.

The present study has been taken keeping in view the physical and climatic, lithological, and hydrological parameters of the Anantapur District to study the distribution of rainfall, droughts, water balance and watershed development.

**Study area:-**

Anantapur district lies in between 13\(^0\) 40’ and 15\(^0\) 15’ North latitudes and 76\(^0\) 50’ and 78\(^0\) 30’ East longitudes (Fig.1.1 & Fig.1.2.). The district is bounded by Y.S.R Kadapa and Chitoor districts towards east, Kurnool District towards north and Karnataka State towards south and west. The total geographical area of the Anantapur district is 19,225 k.m.\(^2\). The district is divided into 63 Mandals and has 3 Revenue divisions with head quarters at
Anantapur, Dharmavaram and Penukonda. According to 2011 Census the population of Anantapur district is about 40 lakhs.

**Objectives:**

The main objectives of the present study are

1. to analyze the pattern of the rainfall over a period of 100 years, on monthly, seasonal and annual basis,

2. to study the rainfall intensity, rainfall variability and rainfall ratio on monthly seasonal and annual basis,

3. to analyze the occurrence of the droughts, drought intensity, drought classification and desertification, if any over period of 100 years on seasonal and annual basis,

4. to study the water balance elements namely potential evapotranspiration, actual evapo-transpiration, water deficit, water surplus, moisture adequacy and Aridity Index on monthly, seasonal and annual basis,

5. to map the macro and micro watersheds of the Anantapur district and analyze the prioritization of watersheds and

6. to study the selected micro watershed pertaining to different geological formations and bring-out the impact of watershed development programmes over a period of time.
Methodology

1. The data pertaining to monthly rainfall over a period of 100 years is collected from 30 rainguage stations of the districts. The data is used to analyze the rainfall distribution on monthly, seasonal and annual basis, rainfall variability and rainfall ratio applying different statistical techniques.

2. The data pertaining to mean monthly temperature for about 30 stations is collected and is used to workout thermal efficiency and potential evapo-transpiration, adopting Thornthwaite and Mather (1955) water balance method.

3. Based on monthly rainfall and monthly potential evapo-transpiration the monthly actual evapo-transpiration, water deficit and water surplus are worked out using Thornthwaite and Mather (1955) water balance book keeping procedure.

4. Based on monthly actual evapo-transpiration and potential evapo-transpiration the monthly moisture adequacy is worked out.

5. Based on monthly water deficit and potential evapo-trasnpiration the monthly Aridity Index is worked out.

6. Based on monthly water surplus, and potential evapo-transpiration, monthly humidity index is worked out. The Moisture Index is worked out
basing on humidity index values as given formula \( Im = Ih - 0.6 \) Ia. Where Ih is humidity index, and Ia is Aridity index. Based on monthly Moisture Index values the climatic classifcation is brought out.

7. Using Survey of India topography sheets and IRS IB Geocoded data on scale 1:50,000 macro and micro watersheds of the Anantapur District are delineated. Prioritization of watersheds is worked out basing on intensity of erosion, soil removal and nature of land degradation from the watersheds.

8. One micro watershed is selected to study land resources, water resources, land use, irrigation, cropping pattern and watershed development programmes implemented in the Watershed.

**PHYSICAL SETTING OF ANANTAPUR DISTRICT**

**1. HISTORICAL BACKGROUND:**

Anantapur District was formed in the year 1882. It was separated from Bellary District. Later on, it was expanded with the addition of Revenue Mandals of Kadiri, Mudigubba, Nallamada, Nambula Pulakunta, Talupula, Nallacheruvu, Obula Deva Cheruvu, Tanakal, Amadagur and Gannapenta (previous Kadiri Taluk) from Cuddapah District in the year 1910. During the year 1956, the present Revenue Mandals of Rayadurg, D.Hirehal, Kanekal, Bommanahal and Gummagatta of Bellary District were added to Anantapur District. The District has been divided into 3 Revenue Divisions consisting of 63 Revenue Mandals (Anantapur Division 20, Dharmavaram Division 17 and Penukonda Division 26).
2. BOUNDARIES AND TOPOGRAPHY:

Anantapur District lies it is bounded by Bellary, Kurnool District on the North, Cuddapah and Kolar Districts of Karnataka on South East and North respectively. The District is roughly oblong in shape, the longer side running North to South with a portion of Chitradurg District of Karnataka State intruding into it from west between Kundurpi and Amarapuram Mandal.

The district is divided into 3 Natural Divisions. They are 1) Northern Mandal of Rayadurg, Kanekal, Beluguppa Gooty, Guntakal, Vajrakarur, Urvakonda, Vidapanakal, Yadiki, Tadipatri, Putlur and Yellanur containing larger areas of Black Cotton soils (2) Kalyandurg, Kambadur, Settur, Brahmasamudram, Ramagiri, Kanaganapalli, Chenne Kotha Palli, Dharmavaram, Bathalapalli, Tadimarri, Mudigubba, Anantapur, Kudair, Pamidi and Peddavadugur in the center which are mainly made up of arid Treeless, expense of poor red soils, (3) High Level Land of Penukonda, Roddam, Somandepalli, Hindupur, Lepakshi, Chilamathur, Madakasira, Rolla, Gudibanda and Agali which connects with Mysore plateau at higher elevation of the rest of the District. This part has average sandy red soils of normal productivity.

3. FORESTS:

The Forests in the district are thin and scanty. The Muchukota Hills are about 35 Kms. in length, run from north of Gooty Town upto extreme southern corner of Tadipatri and Yadiki Mandal. Another line of hills starts from west of
Gooty Mandal and run 80 KMs. called by name Nagasamudram hills. The Malappakonda Range begins at Dharmavaram and runs into Karnataka State.

The Penukonda Range which starts in the south of Dharmavaram through Penukonda and Hindupur proceeds to Karnataka state.

In Madakasira, the hills divide Rolla and Agali Mandals into southern and northern portions.

There are numerous isolated peaks and rocky clusters which are devoid of any vegetation. The height of some of these hill ranges are given below:

Mallappakonda four Miles to

<table>
<thead>
<tr>
<th>Location</th>
<th>Height (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North of Bukkapatnam</td>
<td>915.24</td>
</tr>
<tr>
<td>Penukonda</td>
<td>942.38</td>
</tr>
<tr>
<td>Kundurpi Durgam</td>
<td>913.41</td>
</tr>
<tr>
<td>Madakasira</td>
<td>895.12</td>
</tr>
</tbody>
</table>

4. RIVERS:

i) PENNAR: The important river in the district is Pennar. It has its origin in the Nandi hills of Karnataka State where it is called “UTTAR PINAKINI” and enters this district in the extreme south of Hindupur Mandal and flows through Parigi, Roddam, Ramagiri, Kambadur, Kalyandurg, Beluguppa, Uravakonda, Vajrakarur, Pamidi, Peddavadugur, Peddapappur and Tadipatri Mandals and finally enters Cuddapah District.
ii) JAYAMANGALA: The river has its origin in Karnataka state enters this district in Parigi Mandal and joins Pennar River at Sangameswarampalli of Parigi Mandal.

iii) CHITRAVATHI: Another significant river in the District is “CHITRAVATHI” of Kodidonda village of Chilamathur Mandal and flows north over Rocky and Hilly uplands of Gorantla, Puttaparthi, Bukkapatnam, Kothacheruvu, Chenne Kotta Palli Dharmavaram, Bathalapallil, Tadimirri and Yellanur Mandals and falls into Pennar River at Gandikota in Cuddapah District.

iv) VEDAVATHI or HAGARI RIVER: It is an important river in the district and has its origin in Karnataka State and flows through Gummagatta, Brahmasamudram, Beluguppa, Kanekal and D. Hirehal Mandals and enters Bellary District of Karnataka State. Bhairavanithippa Project (B.T. Proejct) is constructed on this river.

v. Apart from these streams like KUSHAVATHI in Chilamathur Mandal, SWARNAMUKHI in Agali Mandal, MADDILERU in Nallamada, Kadiri and Mudigubba Mandals, PANDAMERU in Kanaganapalli, Raptadu, Anantapur B.K. Samudram, and Singanamala Mandals, PAPAGNI in Tanakal Mandal are important water supply sources to various large and medium irrigation tanks in the district.

There is one Major Irrigation Project T..P.H.L.C., and 6 Medium and other Irrigation Projects they are 1. Upper Pennar Project, 2. Bhairavanithippa

5. RAINALL AND CLIMATE:

The district of Anantapur has a fairly good elevation which provides the district with tolerable climate throughout the year. It has a gradual fall from the south north towards the valley of the Pennar in Peddavadugur, Peddapappur and Tadipartri mandals. There is a gradual rise in Hindupur, Parigi, Lepakshi, Chilamathur, Agali, Rolla and Madakasira Mandals in the south to join the Karnataka Plateau where the average elevation is about 609.75 meters is above the mean sea level. It is about 335.36 meters at Anantapur and the lowest 274.39 meters is at Tadipatri.

The geographical position of the Peninsula rendered Anantapur district as the driest part of the State and hence, agriculture conditions are more often precarious. Monsoons also evades this part due to its unfortunate location. Being far from the East coast, it does into enjoy the full benefits of north east monsoons and being cut off by the high western Ghats, the south west monsoon are also prevented from penetrating and punching the thirst of these parched soils. It is therefore seen, the district is deprived of both the monsoons and subjected to droughts due to bad seasons. The normal rainfall of the district is 553.0 mms. by which it secures least rainfall when compared to Rayalaseema and other parts of Andhra Pradesh. The normal rainfall for the south west monsoon period is 338.0 mms which forms about 61.2% of the total
rainfall of the year. The failure of the rains in this south west monsoon period of June to September will lead the District to drought by failure of crops. The rainfall for north east monsoon period is 156.0 mms. only, which forms 28.3% mms. of the total rainfall of the year (October to December). The other months are almost dry. The March, April and May are warm months when the normal daily maximum temperature ranges between 31.7°C to 38.9°C. The November, December and January are cooler months when the temperature falls about 14.5°C. The Hindupur, Parigi, Lepakshi, Chilamathur, Agali, Rolla and Madakasira Mandals being at high elevation are more cooler than the rest of the mandals in the district.

6. SOILS

The soils in Anantapur District are predominantly red except Kanekal, Bommanahal, Vidapanakal, Uravakonda, Vajrakarur, Guntakal, Gooty, Pamidi, Peddavadugur, Yadiki, Tadipatri, Yellanur, Peddapappur and Putlur mandals. In these Mandals red and black soils occur almost in equal proportion. Thus 76% red soils, 24% are black soils.

Habitations:

There are 929 inhabited villages, out of 964 total Revenue villages of the District. The number of villages in size group of 500 to 1999 forms 36.71% of the total inhabited villages. The size group of 2000 to 4999 forms 38.64% and the size group of 5000 to 9999 forms 12.81% only out of total villages, while 84
villages (9.04%) of total inhabited villages are having population less than 500. There are 26 villages with more than 10,000 population excluding towns. There are 10 towns in Anantapur District as per 2001, Census.

The density of population of the District is 190 per Sq. k.m², against (277) of the State. The population of Rural and Urban to the total population of the District work out to 75% and 25% in 2001 Census as against 76.5% and 23.5% of 1991 Census. There are 958 females per 1000 males in 2001 Census.

The working force in the total population of District forms 48.83% as per 2001 census out of which 26% are in the Agriculture Sector.
8. LAND UTILIZATION:

The total geographical area of the district is 19.13 lakh Hects. The land utilization pattern as available in the district during the year 2009-2010 shows that the net area sown is 8.25 Lakh Hects. The total cropped area is 9.01 Lakh Hects and the area sown more than once is 0.76 Lakh Hects.

The cultivated area of the District is 9.01 Lakh Hects. out of which 7.05 Lakh Hects. is under Kharif and 1.96 Lakh Hects., is under Rabi Season during the year 2009-2010.

The District occupies the lowest position in respect of Irrigation facilities with only 17.65% of the gross cropped area during 2009-2010. Out of the gross irrigated area of 1.59 Lakh Hects. during 2009-2010 canals accounted for 11.09%, tanks 2.47%. Tube wells 79.73%, wells 5.11% and other sources 1.33%. All the principal sources except canals are non-precarious.

9. NATURAL RESOURCES:

a. FORESTS:

The District is not rich in the forest wealth. The Name ‘Forest’ in Anantapur District does not indicate any dense tree population with thick foliage of variform of pastures.
b. MINERAL RESOURCES:

i) GOLD: At Ramagiri village in Ramagiri mandal, gold is found to occur in the Cholite Schist’s and phylolite along with western part of Dharwar Schist’s Belt in the district. The place extends over a length of 14 kms Exploratory mining in the area is pruned about 467 meters of ore shoots with an average width of 100 cms Tonne. The mining operations are expected to be conducted by Bharat Gold Mines Limited.

ii) DIMANDS:

Diamonds are know to be available near Vajrakarur. They mainly occur in kimberlite formations.

iii) ASBESTOS:

The asbestos are chrysolite variety cross fibre type are found near Pormamilla. Barytes High Grade Line Stones, Iron ore and steatite are the minerals occurring in the district. There are however no large sized minerals occurring in the district. There are 2 large scale Cement Factories (Ms. L&T Ltd., and Ms. Penna Cement Ltd.,) in Tadipatri Mandal and producing lakhs tones of cement in private sector.
**REVIEW OF LITERATURE:**

Water balance is a comparative study of rainfall and evapotranspiration and plays an important role in agriculture, drought studies and water resources development. The variations in monsoon rainfall is causing hardship to the farmers due to frequent crop failures. It is well established that water supply to a region is primarily through precipitation and water loss is almost entirely due to evapotranspiration. The wetness and dryness of a place is determined by the relative magnitudes of precipitation and potential evapotranspiration. The rainfall is measured through a systematic network of raingauge stations. The evapo-transpiration is a difficult parameter to measure experimentally. Thorntwaite (1947 and 1948), Penman (1956), Van Bavel (1956) and Ojo (1969) have developed empirical formulae to estimate the potential evapotranspiration. In India the book keeping procedure given by Thorntwaite and Mather (1955) have been used to workout potential evapotranspiration, actual evapotranspiration, water deficit, water surplus, moisture adequacy, Aridity Index, and Moisture Index. Late Prof. V.P. Subramanyam is the father of water balance in India. He had carried out a number of water balance studies at basin, district, state and national level (Subramanyam 1956, 1957, 1963, 1967, 1982 and 1983). A number of doctoral thesis have been submitted in Andhra University in application of water balance studies in drought Climatology, water resources and agriculture by Subramanyam (1961), Sastri (1969), Ram Sastri (1973), Sarma (1974), Bora
Sutides on water balance and its applications are also carried out by Rajeswari (1984), Kalavathi (1985), Joice Swaroopa Rani (1985), Padmini (1987), Vasthala (1987), Rajeshkanna Ratnakumar (1988), Prabhakar Ratnam (1988), Madhuramma (1990 and 1992), Krishna Reddy (1990) and Purushotham Babu (1994). Drought is defined by various authors taking into consideration rainfall, rainfall and mean temperature, soil-water-crop parameters, Aridity Index and other climatic indices. Some of the important drought climatologists who carried out studies at regional, state and national levels are Palmer (1957), Richard (1966), and Lamb (1983). In India the studies on drought climatology on different parts of the country are carried out by Subramaniam (1961), Sastri (1969), Sarma (1974), Bora (1976), Ram Mohan (1978), Hemamalini (1979), Prabhakara Ratnam (1988) and Suresh Babu (1993). The Indian Meteorological Department, Government of India has classified droughts into disastrous, severe, moderate, and low based on the amount of rainfall received in an year. If the rainfall is less than 20% of the normal it is considered as disastrous, 20% to 40% of the normal rainfall as severe, 40% to 60% of the normal rainfall as moderate and 60% to 80% of the normal as low.

A National Symposium on Drought Prone Areas of India was organized in January 1978 by the Department of Geography, Sri Venkateswara University under the steward ship of Late Prof. N. Balakirshna Reddy. The Symposium has focused on the themes of conceptual and historical aspects, regional studies, planning and development, rainfall and agriculture, hydrology and
Irrigation, socio-economic aspects, techniques and problems and review of Drought Prone Area Programme. About 72 papers were presented in the symposium. The symposium has identified four important aspects concerned with the development of drought prone areas. They are a) Identification of drought prone areas based on rainfall and water balance studies, b) the state government should appoint a technical committee to make indepth studies, c) long term and short term strategies based on resource potential for mitigation of droughts and d) sponsoring of periodic workshops to monitor the strategies formulated by state and central governments for mitigation of droughts.

Cropping pattern means the proportion of the area under various crops at a point of time. A committee constituted by the Government of India in 1960 under the Agricultural Commissioner of Government of India determined cropping patterns according to relative acreage of various crops in a district or a group of districts. The committee divided the whole country into 130 cropping zones based on homogenous regions such as physical, climate and agronomic.

The concept by land use has been defined by Saver (1919) as the use to which the entire land is put. Vink (1975) has described land use as any kind of permanent or cyclic human intervention to satisfy the human needs, either material, or artificial resources which together are called the land. A few of the researchers who contributed to the studies on various aspects of land uses and cropping pattern are Saver (1919), Sinha (1954), Deshpande (1959), Shafi (1960), Goswamy (1960), Mavi Harpal Singh (1963), Cppoock (1964), Roy (1964), Ganguli (1964), Bhatia (1965), Ahmed and Siddiqui (1967), Hussain
(1970), Kostrowicki (1970), and Kanwar (1972). Jasbir Singh (1976) has prepared an agricultural atlas of India and described the agricultural geography of India. Sarvanan (1979) has studied the crop concentration, crop diversification and crop combination of Madurai district of Tamilnadu. Santra Kuumri (1980) has made an attempt to study the cropping pattern and water potential of Madurai district. Sambasiva Rao (1983) has studied the land, water, cropping pattern and water balance studies of the Madurai district. Ramanaiah (1984) has studied the land use, cropping pattern and crop regions of Andhra Pradesh. Kalavathy (1985) has made cropping pattern of Chengalpattu district, Tamil Nadu. Krishna Reddy (1990), Madhuramma (1992) and Suresh Babu (1993) have studied the land use and cropping pattern of Cuddapah, Nellore and Anantapur districts respectively. The water balance, land use, cropping pattern and development of agriculture, a study of Kurnool district has been carried out by Purushotham Babu (1994). An analysis of water balance, water resources and agriculture of Madurai, Ramanad, and Puddukkottai district is studied by Rajeswari (1995). A study on drought climatology, water balance and development of land and water resources of the Kurnool district has been carried out by Samnel Raju (1997). The water balance, land use, cropping pattern and agricultural development of Chittoor district, Andhra Pradesh has been studied by Gangadri (1994). The water balance and watershed development of the Papagni River Basin using remote sensing techniques has been carried out by Krishnaiah (2004). Raveendra (2010) has studied the elements of water balance and development of land and
water resources of the Kuderu watershed of Anantapur district, Andhra Pradesh, India.

A watershed is a geo-hydrological unit draining at a common point by a system of streams. It is topographically delineated area draining into a single channel (Brooks 1985). A watershed has third dimension height which extends from the top of vegetation to the confining geological strata beneath.

The term watershed strictly refers to the divide separating one drainage basin from another. Watershed has been identified with drainage basin or catchment area. Watersheds of the small streams are the sub-watersheds of the watershed of a larger stream.

The size of watershed varies from few square meters to thousands of square kilometers. The size becomes important depending upon the objective of the watershed. Ex: For large irrigation project watersheds of $1000^2$ k.m.s. may be considered. On the other hand for a small storage structure in form (farm pond) consideration of only a few hectares of watershed suffices. On an average 5000 Hectares of a milli watershed is an effective unit of watershed management and 500 Hectares of micro watershed is a functional watershed. Watershed is a biological, physical, social and economic factor (Lopez and Hernandez 1972).

**Watershed Characteristics:**

1. Watershed has physical characteristic like size, shape, land, slope, drainage pattern and density. The size of an watershed is an important
determining factor for the peak rate of run-off. The rate and volume of run-off increases with increase in size of the watershed area.

2. The long and narrow watersheds are likely to have longer time of concentration with lower run-off rates than square shaped watershed of the same size. The speed and extend of run-off depends on slope of the land. The velocity of flow of run-off water increases with increase in the land flow. The erosive capacity of run-off is the directly proportion with the slope of land and vegetation cover. The soil erosion increases with increase in land slope.

Drainage pattern is influenced by the slope, lithology, structure and distribution of rock system. High drainage density watershed drains run-off water rapidly. Erosion hazards are very high in dendritic and radial drainage patterns and less in trellis, rectangular and angular drainage patterns.

Soil and geology of the watershed determine the infiltration, circulation and run-off water. The land use effects the rates of run-off, infiltration and types and quality of vegetation. The type, quality and quantity of vegetation cover influences run-off, erosion, sediment removal, rate of evaporation and infiltration. In a good cover of vegetation the soil erosion and run-off are low. The amount frequency and intensity of rainfall determines the behaviour of watershed. Evenly dispersed rainfall is less damaging to the soil and water. Higher precipitation intensity leads to grater run-off, lower evapo-transpiration and circulation. Longer precipitation duration amounts to lower run-off and
grater evapo-transpiration and circulation. Lastly, larger area extent of precipitation leads to grater run-off, evapo-transpiration and circulation.

Socio-economic factors of watershed are demographic profile, sociological stratification, form structure, attitudes and behaviour of the people living in the watershed. In the demographic profile the total population of watershed, location and occupation of population, sex-age-ethnic group stratification, migration, and future demo-graphic trends are important besides the behavioral characteristics in the sociological stratification, caste, family size, political organization, grouping, social status and political role of individual members of the watershed and relations between them modify the watershed characteristics. The area of farms, number of farm workers, division of labour, cropping patterns and land management system, influences the farm structure of watershed. The attitudes and aptitudes, behavior patterns, value systems and religious systems, play an important role in the performance of the watershed. The land holding sizes, dominant classes, land acquisition methods, land rights, land leasing, marketing system of agriculture produce and relationship between land rights and social, political or religious systems effects the watershed functioning.

Uncontrolled, unplanned and unscientific land use leads to destruction of watershed. The main objectives of watershed development projects are to promote socio-economic development of village community which is directly or indirectly dependent on the watershed through optimum utilization of
watershed natural resources. Employment generation and development of human and economic resources encourage restoration and ecological balance in the watershed through a sustained community action for the operation and maintenance of assets and natural resources and to suggest simple, easy and effective technological solutions. To improve the economic and social conditions of the resource poor community in the watershed, equitable distribution of benefits of land and water resources and biomes production are to be carried out to focus on human resource developments.

narrated the importance of Nursery raising in watershed areas. The PRA/RRA techniques in watershed development programmes has been described by Rajora Rajesh (1997). A detailed study on Jhabua Model of integrated watershed development has been carried out by Rajora Rajesh (1997). A field manual for equitable, productive and sustainable development of Integrated Watershed management has been prepared by Rajesh Rajora (1998).


SCOPE OF THE STUDY:

The study would help to understand the pattern of rainfall, rainfall variability, water balance elements and watershed prioritization of the Anantapur district.