CHAPTER XI
SUMMARY AND CONCLUSIONS

1. The Anantapur district covering an area of about 19,125 km$^2$ has been studied with a view to study the pattern of rainfall over a period of 90 years on monthly, seasonal and annual basis. The monthly analysis of rainfall revealed that during the months of January, February, March and December the mean rainfall received is very low and is less than 10 mm. During the month of September the mean rainfall exceeds 100 mm. In August and October months the mean rainfall ranges from 70 mm to 100 mm. The mean rainfall ranges from 50 mm to 70 mm during May and July months. During the April, June and November months the mean rainfall varies from 10 mm to 50 mm. The analysis revealed that the district receives moderate to good rainfall from July to October and this period is climatologically suitable for crop cultivation.

2. Rainfall variability is very high in January, February, March, April, November and December and depict that there is greater instability in occurrence of rainfall. Crop cultivation under rainfed conditions is highly unfavourable during these months.

3. The seasonal analysis of rainfall depicts that during the southwest monsoon period the average rainfall received exceeds 300 mm in majority of the stations and is highly favourable for crop cultivation. The rainfall variability during this season is low and favours for crop cultivation.
4. During northeast monsoon period the mean rainfall is about 150 mm and is favourable for crop cultivation, provided water is supplemented through well, tank or canal irrigation.

5. During the winter and summer periods the crop cultivation is climatologically unfavourable due to very cool conditions, low rainfall, high temperatures and high water losses in the form of evaporation and evapotranspiration during summer period.

6. The monthly analysis of decadal mean rainfall revealed that during January, February, August, September and November there is declining trend. During the months of March, April June and December there is an increase and decrease in the trend of rainfall from 1901-1990.

7. The seasonal analysis of decadal mean rainfall revealed that during winter period there is a declining trend and during summer, southwest and northeast monsoon there is a decrease and increase in the trend of rainfall.

8. The annual analysis of decadal mean rainfall also showed a declining trend of rainfall particularly from 1961-70 to 1981-90.

9. The analysis of monthly droughts in the district revealed that during the months of January, February, March and December the disastrous droughts occurrence is high. In the months of April and November the occurrence of disastrous and severe droughts are moderate. During the May, June, July,
August, September and October the disastrous droughts are very low and the district experienced more of low droughts during these months.

10. The seasonal analysis of droughts revealed that during winter period the occurrence of disastrous droughts are more. During summer, southwest monsoon and northeast monsoon periods the occurrence of low droughts are more.

11. The annual analysis of droughts revealed that the district has experienced more of low droughts followed by moderate droughts.

12. The drought spread is high in Yadiki, Hindupur, Madakasira and Uravakonda stations. The drought spread is found neutral in Anantapur, Gooty, Dharmavaram, Kadiri and Tadipatri stations. The drought spread is low in Bukkapatnam, Rayadurg, Kalyandurg and Penukonda. Overall, there is likely to be an increasing trend in the drought spread in the district.

13. The analysis of monthly water balance elements reveal that the potential evapotranspiration is less than 100 mm in the months of January and December, 100 mm to 150 mm in February, September, October and November and above 150 mm in the months of March, April, May, June, July and August. The actual evapotranspiration is less than 50 mm in the months of January, February, March, April and December. It varies from 50 mm to 75 mm in May, June and July months and 75 mm to 100 mm in November. In August, September and October months
the AE exceeds 100 mm. The water deficit is less than 50 mm in the months of January, September, October, November, and December. It varies from 50 mm to 100 mm in February, July and August months and above 100 mm in the months of March, April, May and June. The water surplus of about 10 mm is noticed in the months of September and October in a few stations. Overall the district experienced more of water deficit.

14. The moisture adequacy is above 75% in the months of September, October and November, 40 to 75% in the months of January, August and December and less than 40% in the months of February, March, April, May, June and July.

15. The Aridity Index of less than 50% is found in the months of September, October and November. It varies from 50 to 75% in January, February, May, June, July, August and December and above 75% in March and April months.

16. The Moisture Index values reveal that the district experiences both dry and wet subhumid climates in September and October, dry subhumid climate in November, dry subhumid and semiarid in January, July and August months and semiarid in February, March, April, May and June months.

17. The analysis of monthly water balance elements revealed that climatologically the crop cultivation is highly favourable in the months of August, September, October and November.
18. The seasonal analysis of water balance elements revealed that during southwest and northeast monsoon period the crop cultivation is favourable.

19. The annual water balance elements reveal that except Dharmavaram station in all other stations the crop cultivation under rainfed conditions is favourable.

20. The monthly analysis of soil moisture availability revealed that during September, October and November the soil moisture storage is high and favours for crop cultivation. It exceeds 100 mm. In January and December, it varies from 50 mm to 100 mm.

21. Soil moisture deficit is very high from February to August in all the stations of the district.

22. Soil moisture adequacy is very low in the months of March, April, May, June, July and August months and soil moisture Aridity during these months is above 75%.

23. The seasonal analysis of soil moisture elements reveal that soil moisture availability is less than 100 mm in winter, summer and southwest monsoon and exceeds 100 mm in northeast monsoon period. Soil moisture deficit is less than 100 mm in northeast monsoon and exceeds 100 mm in other seasons. The soil moisture Aridity is less than 50% in northeast monsoon and more than 50% in other seasons. The seasonal analysis has revealed that northeast monsoon period is highly favourable for crop cultivation.
24. The land-evaluation of Anantapur district based on physical characteristics namely relief, slope, drainage, lithology, land systems, landforms, landuse and hydrogeomorphic units has been classified into 9 classes. They are class I (fluvial plains), class II (terraced plains), class III (irrigated area other than fluvial plains), class IV (colluvial plains), class V (black soil plains), class VI (pediplains), class VII (dissected pediments), class VIII (debris slopes with less than 20° slope) and class IX (hilly terrain with more than 20°).

25. The ground water resources in various geological formations of the district has been discussed and found that the district is comprised of mainly Archean rocks of granitic gneisses, schists and granites. Ground water occurs in semi-confined conditions in weathered, fractured and jointed zones. Ground water in Cuddapah Super Group is formed of Tadipatri shales, Pulivendala quartzites, Vempalle dolomites and Gulcheru Quartzites. Ground water is not found in Quartzites because they stand as ridges. Ground water in Vempalle dolomites is found in weathered, jointed and fissured zones. Ground water in Tadipatri shales also occur in weathered, fractured, jointed and faulted zones. Ground water in Kurnool Group is not prosperous due to location of this group in hilly terrain. Ground water in alluvium confined to river built plains of Pennar, Hagari, Chitravathi, Jayamangala and Chinna Hagari. Ground water occurs in semiconfined conditions at a of about 5 to 9 metres.
26. The average annual recharge of the district is 80.07 mm. The total ground water potential of the district is estimated to be 1054 million m³.

27. The ground water quality analysis of salinity and alkalinity of 54 controlled wells water samples revealed that two wells in Venkatareddipalli and Kadiri Brahmanapalli the ground water quality is excellent. The ground water is permissable and suitable for drinking and cultivation purposes in about 48 wells and in four wells it is doubtful and unsuitable for cultivation purposes.

28. The analysis of land use of the district revealed that in about 10% of the total geographical area the forest cover is noticed, 8 to 10% of land under barren and uncultivable land and land put to nonagricultural use, 6 to 8% of land under other fallows and current fallows and less than 5% under permanent pastures, miscellaneous tree crops, culturable waste lands and area sown more than once. The total net sown area of the district is 1,015,307.69 hectares and account for 53% of the total geographical area in 1989-90.

29. The total gross irrigated area both is Kharif and Rabi crop seasons is about 188,805.26 hectares and accounts for 9.85% of the total geographical area of the district. The area irrigated more than once in the district is about 27,758.30 hectares of land. The net area irrigated in the district during 1989-90 is about 161,046.96 hectares and accounts for
8.40% of the total geographical area of the district. The total irrigated area under canal irrigation both in Kharif and Rabi crop seasons in 1989-90 is 43,576.92 hectares and account for 2.27% of the total geographical area. The total area under tank irrigation is about 36,811.33 hectares both in Kharif and Rabi seasons and account for 1.92%. The total area under tube-well irrigation is about 10,392.70 hectares and account for 0.54%. Other wells is about 93,620.24 hectares (4.88% of the total geographical area), other source of irrigation 7,772.06 hectares and account for 0.40% of the total geographical area.

30. In majority of the mandals, the intensity of irrigation is less than 20% due to geographical location of the district in hard rock terrain, low rainfall, high evapotranspiration and high water deficit.

31. The cropping pattern analysis showed that the total cropped area during 1989-90 is 1,043,564 hectares and accounts for 54.49% of the total geographical area. The major crops cultivated are paddy, bajra, korra, jowar, ragi, cotton and groundnut. Out of these crops groundnut alone accounts for 69.99% of the total gross cropped area with 730,412 hectares of land. The relative increase or decrease in selected crops from 1985-86 to 1989-90 revealed that there is a steep decrease in jowar, bajra, ragi, korra, pulses and cotton. Groundnut alone showed a steep increase in majority of the mandals of the district.
32. The intensity of cropping pattern varies from 100 to 114.54%. In majority of the mandals, the intensity of cropping pattern is less than 105% and in about three mandals it exceeds 110% during 1989-90. The crop diversification index has revealed that low diversification in the district due to predominance of groundnut crop.

33. The first ranking crop in all the mandals is groundnut during 1989-90. The crop combinations by Doi's and Coppock's methods has revealed that in the district groundnut is the mono cropped area.

34. The index of agricultural development during 1989-90 revealed that on northwestern and northeastern mandals where assured water supply through canals is available through Tungabhadra high level stage I and stage II the agricultural development is high. In other mandals, it is low to moderate.

35. The various measures taken under DPAP, IRDP, TRYSEM, PASMA, PRA, NREP and RLEGP programmes have brought short term benefits to the farmers living in the district like ecological balance, soil and moisture conservation, afforestation, restructuring of cropping pattern, changes in agronomic practices, livestock development and development of small marginal farmers and agricultural labour. The construction of percolation ponds and checkdams in various parts of the district has to some extent minimised soil erosion and water conservation in the district. The longterm measures suggested for the development
of land and water resources and mitigation of droughts in the
district are to divert water resource from the Hemavathi
and the Tungabhadra river systems and bring at least, 10% of
the land under canal irrigation for cultivation of crops.