CHAPTER VII

Summary and Conclusions
This Chapter is divided into two sections. The Summary and Conclusions are presented in the first section. The second section, based on the findings of the study, make certain policy recommendations.

7.1 Summary and Conclusions

Agriculture plays an important role in the economic development of the country as it contributes significantly to gross domestic product and employs about 64 per cent of the workforce. Though there was a major breakthrough in Indian agriculture due to green revolution during late sixties. The tempo could not be maintained during eighties. The uneven development due to green revolution has created socio-economic imbalance between small and large farmers and also regional imbalances in the country, as the green revolution is largely confined to assured irrigated area.

About 70 per cent of arable land which contributes about 42 per cent of the total agricultural production is rainfed and dependent on monsoon rains. Erratic and inadequate rainfall adversely affects the agricultural production in drylands. Soil erosion is the serious problem and it is estimated that about 8.4 million tonnes of nutrients goes through soil and water run off. Further the economic efficiency of crop production in drylands has been low on account of the fact that the dryland farmer could not adopt the technologies in full due to various bio physical and socio-economic constraints.
Realising the importance of rainfed farming and restoration of ecological and socio-economic balance, the government of India has strongly advocated the watershed management approach for integrated and comprehensive development of rainfed areas. The watershed approach is expected to benefit the farmer through improved soil health, better drainage and more efficient use of rain water with the possibility of excess water being stored in suitable structures for use during scarcity periods. Accordingly, NWDPRA was initiated with the twin objectives of sustainable production and restoration of ecological balance in the vast tracts of rainfed areas. The watersheds under NWDPRA are to serve as models of comprehensive and integrated development in different agro-climatic regions of the country. An outlay of Rs. 1330.37 crores has been allocated under the programme till the end of eighth plan. During this period, the scheme was modified to provide a single window financing for both arable and non-arable lands with 100 per cent finance.

The Ministry of rural development through it's revised guidelines in 1995 revamped DDP, DPAP and IWD and the focus has been watershed development. Besides, 50 per cent of IJRY and EAS funds were to be utilised for watershed development. By the end of eighth plan through various initiatives under watershed development, 9.6 million hectares of arable land and 6.9 million hectares of non-arable land could be treated leaving an area of 60 million hectares of arable and 1.5 million hectares of non-arable land to be covered by the beginning of ninth plan period.

7.1.1 Review of Literature

The review of previous work done on impact of watershed management was discussed under 6 heads: (1) Cropping pattern and alternative land use.
system, (2) Crop productivity, (3) Income, (4) Employment, (5) Economic viability and (6) people's participation. The review of literature has brought out certain deficiencies and limitations. Though there were many studies on watershed management implemented in India, most of them were limited to Operational Research Project, ICAR implemented Model watersheds and World Bank aided projects. Only a few studies were made on recently implemented Watersheds under NWDPRA. Among the available few studies on NWDPRA, some were restricted only to economic appraisal of the Watershed Project, while others focused on impact of watershed programme on cropping pattern, yield and income. There was no systematic study on peoples participation, knowledge and adoption of watershed technology. Further, while evaluating the impact of watershed management, most of the studies considered farmers as a single entity, which would not bring out the likely differential rates of impact on the farmers in so far as they are not homogeneous in terms of their personal attributes. The present study is a modest attempt to overcome the above limitations of the earlier studies. The objectives of the study are:

1. to assess the physical and financial progress of NWDPRA in India and Andhra Pradesh;

2. to examine the knowledge of the beneficiary farmers on watershed technology;

3. to examine the extent of people's participation in the implementation of NWDPRA watersheds;

4. to find out the level of adoption of recommended watershed management practices by the farmers;
5. to assess the impact of watershed development programme on cropping pattern and cropping intensity and

6. to evaluate the impact of watershed development technology on crop yield, crop income and employment generation.

7.1.2 Methodology

To examine the objectives of the study, relevant data were collected from both primary and secondary sources. The primary data were collected from beneficiaries and non-beneficiaries through a field survey in selected watersheds in Chittoor district of Andhra Pradesh.

The sample beneficiaries were drawn by two stage stratified sampling method. In the first stage, two watersheds were selected on the basis of proportion of dryland area in net cropping area. The farmers of the selected watershed were stratified into three farm size groups viz. small farmers (below 5 acres), medium farmers (5 to 10 acres) and large farmers (above 10 acres). Then 10 per cent of the farmers from each group was selected on the basis of simple random sampling. To assess the net effect of NWDPRA, a group of non-beneficiaries who belonged to the non-watershed area were selected as a control group for the study.

7.1.3 Watershed Management: Theoretical aspects

The theoretical aspects of watershed management were discussed in the second chapter. NWDPRA specifically focus on conservation, upgradation and utilisation of natural endowments, generation of employment, improvement in production environment, restoration of ecological balance and reduction of inequalities between irrigated and rainfed areas. The
programmes approach and strategy are primarily based on the twin concepts of integrated watershed management and sustainable farming systems. Integrated watershed management consists of three physical sectors: (1) Arable land, (2) non-arable land and network of natural drainage lines. The project treats various components of the household farming viz. food, fodder, fuel and income generating components.

The components of the watershed project are land and moisture management works, farm cropping systems, dryland horticulture, farm forestry and fodder production. In the implementation of NWDPRA, due weightage is given to farmers participation and experience. Keeping in view the importance of scientific feedback from farmers, a concept of mitra kisan was proposed, who serves as an important link between scientist and farmers and training is imparted to them. The nodal agencies for farmers training are Krishi-Vigyan Kendras, Farmers Training Centres, and the Regional Research Stations.

7.1.4 Profile of the Study Area

The agro-economic conditions of the study area are presented in Chapter-3. In first section of this chapter, a brief discussion about the agro-economic profile of the Chittoor district is presented. The district is more rural and agriculture is the main occupation of the people. The climate of the district is generally dry and salubrious. There are no perennial rivers in the district and the existing ones generally remains dry for a greater part of the year. The major portion of the district has red soils with portions of alluvial soils. The barren and uncultivable land is more than one third of the net sown area, and cultivable waste accounted for 2.66 per cent of total geographical area, which can be easily brought under cultivation with proper
planning and development. An analysis of cropping pattern revealed that more than 50 per cent of the gross cropped area was under groundnut cultivation followed by paddy cultivation accounting to around 20 per cent of gross cropped area. The share of sugarcane and fruits and vegetables in gross cropped area was 8.8 per cent and 7.1 per cent respectively. The district has fairly adequate infrastructural facilities.

The agro-economic conditions of the sample watersheds are discussed in second section of this chapter. The land utilisation pattern in the selected watersheds revealed significant differences. The share of permanent pastures and grazing land is relatively more in Kalakada watershed while, the share of cultivable wastes and current fallows was more in Udayamanikyam watershed. The average annual rainfall was 891 mm in Udayamanikyam, while the same was 687 mm in Kalakada watershed. The livestock population was relatively high in Kalakada watershed, which might be due to availability of more pastures and grazing land.

The socio-economic conditions of beneficiaries and non-beneficiaries revealed that the beneficiaries and non-beneficiaries were more or less similar with regard to socio-economic characteristics.

7.1.5 Performance of Watershed Management

An analysis of performance of watershed development projects was made in the Fourth Chapter. It was observed that Rs.1,080 crores were allocated for NWDPRA during eighth five year plan and the maximum allocation was for the state of Madhya Pradesh followed by Maharashtra and Andhra Pradesh occupied seventh place. The funds released for DPAP watersheds increased from Rs.118.95 crores in 1995-96 to Rs.189.58 crores in
2000-01 and 13,781 watershed projects were taken up during 1995-96 to 2001-02. The number of watershed projects taken up under DPAP was highest in the state of Andhra Pradesh followed by Maharashtra and Madhya Pradesh. While it was of least in the state of Bihar. The funds revealed for DPAP watersheds amounted to Rs.863 crores during 1995-96 to 2001-02.

Watershed projects under DDP were taken up in seven States. During 1995-96 - 2001-02, 6525 projects were taken up, the highest being in the State of Rajasthan (2914) followed by Gujarat (1298). During the period, Rs.656 crores were released for DDP watershed projects and the State of Rajasthan received more than fifty per cent, Rajasthan being in highly deserted area.

Watersheds were also implemented under IWDP since 1995. These projects were sanctioned in the blocks not covered by DDP and DPAP. Under IWDP, 310 watershed projects were sanctioned to treat a total project area of 29.97 lakh hectares. Among the States, Uttar Pradesh accounted for 12.7 per cent of the area under IWDP watershed projects followed by Andhra Pradesh with 9.9 per cent. An amount of Rs.541 crores were released for implementing watershed projects under IWDP during 1995-96 - 2001-02. In addition to above watershed projects, 50 per cent of the funds released under EAS in the areas under DPAP and DDP and 40 per cent of fund in other areas were spent on watershed works.

An examination of the performance of NWDPRA in Andhra Pradesh revealed that the amount of funds released increased from Rs.3,656 crores during the eighth five year plan to Rs.4,072 crores during ninth plan period. During 1990-91 - 2001-02, Rs.9,290 lakhs were revealed and the actual expenditure during the period was around 7,800 crores covering an area of
2,94,372 hectares out of which, 61 per cent constituted arable land. District-wise analysis revealed that out of 150 watersheds taken up during ninth five year plan, 15 projects were taken up in Mahabubnagar district followed by 13 each in Kurnool and Anantapur districts. In addition to NWDPRA projects, other watershed projects were also taken up in Andhra Pradesh. During 1995-96 - 2003-04 an amount of Rs.447 crores was spent on DPAP watersheds, 401 crores under EAS watersheds, 111 crores under IWDP projects, 126 crores under RIDF and 73 crores under DDP watershed projects and 36.36 lakh hectares of land was covered under watershed management.

In Chittoor district, an amount of Rs.615 crores was spent under NWDPRA during 1991-92 - 2001-02. In this district an amount of Rs.10,620 crores was spent on other watershed projects viz. DPAP, EAS, IWDP, APHM and RIDF. The data on component-wise achievement revealed that construction of water harvesting structure was the major activity taken up under watershed management. The expenditure spent on soil conservation accounted for around 24 per cent of total expenditure and the share of afforestation was about 10 per cent.

7.1.6 People's Participation

People's participation is considered to be an important component for the successful implementation of NWDPRA. People's participation was measured in five stages of the programme viz., pre-project stage, planning, implementation, maintenance and evaluation. The stage-wise participation of farmers in watershed development programme was worked out by adding the scores of individual items of each stage. The study revealed that the participation of farmers was comparatively high at implementation stage and less at evaluation stage. Taking all the stages together, the peoples
participation worked out to be less than 50 per cent. Watershed-wise analysis revealed that farmers participation was comparatively more in Kalakada watershed in all the five stages.

To probe deeper into the extent of people's participation, item analysis was carried out for 30 items, which revealed that around 51 per cent of the beneficiary farmers fully participated while planting forest species in community lands. More than forty per cent of the farmers fully participated in adopting graded, contour bunds, gully checks, etc., supervision of on going activities and adopting crop production and other improved practices recommended by watershed development officials. The participation of beneficiary farmers was least in suggesting suitable modifications for future programme implementation and assisting the officials in collection of feedback. It is observed that more than 40 per cent of the farmers have partially participated in 20 items out of 30. Watershed-wise analysis revealed that full participation of the farmers was high in Kalakada watershed in all the selected thirty items. It is also observed that non-participation of the farmers was high in Kalakada in regard to expressing problems encountered in the programme to officials, discussions for setting of norms for distribution of benefits, adoption of graded, contour bunds, gully checks, etc., and adoption of improved crop production practices.

The problems of the farmers in participating in watershed development programme were analysed. Farmers have expressed that lack of efforts on the part of the implementing agency to educate and convince the farmers, lack of follow up action by implementing officials, lack of resources and lack of technical guidance by scientists were the major problems in their participation.
7.1.7 Knowledge on Watershed Technology

To test the knowledge of the respondents on watershed technology, an inventory of items was prepared under each subject matter like agriculture, horticulture, forestry and alternate land use system. An analysis of the knowledge of the farmers revealed that watershed farmers had around 69 per cent of the knowledge about watershed technology. There were no significant differences in knowledge between the farmers of Udayamanikyam and Kalakada watersheds. With regard to recommended production practices for groundnut crop, around 34 per cent of the farmers were not aware of the dosage of fertiliser use and high yielding variety of seed. The awareness of the farmers about alternative land use was relatively less in comparison with crop production practices. Out of eight practices, highest awareness is recorded in the case of social forestry followed by agro forestry. It is to be noted that around 38 per cent of the watershed farmers did not have any idea about Timber-fibre system and silvipasture system. More or less similar trend is noticed in both the watersheds. However, the awareness of the farmers in Kalakada watershed is observed to be more in the case of five practices viz., social forestry, farm forestry, agro forestry, silvi horti system and alley cropping. An analysis of knowledge of the watershed farmers on land treatment practices indicated that 41 per cent of the farmers were not aware of land reclamation, stone/cement drop structure and earthen embankment. 39 per cent were not aware of strengthening of existing bunds and around 35 per cent were not aware of graded bunds, diversion channels, Ridges and furrows and use of improved implements. High awareness is noticed in case of contour bunds followed by land smoothing/levelling practice. Watershed-
wise analysis revealed that the knowledge on land treatment practices except opening dead furrow and sowing across the slope is high among the farmers of Kalakada watershed in comparison with those in Udayamanikyam watershed. Thus the hypothesis that "the knowledge of the beneficiary farmers on watershed technology is not adequate" is proved in the study.

7.1.8 Adoption of Watershed Technology

Adoption refers to a decision to make full use of an innovation and its continued use. However, the adoption may be partial which means that the practice was applied only in a portion of the cropped area or it might be only adoption of a part of the innovation. An analysis of the level of adoption of watershed technology revealed that only 21 per cent of the watershed farmers had high level of adoption while around 70 per cent had medium level of adoption and 17 per cent had low level of adoption. Watershed-wise analysis revealed that the level of adoption of watershed technology was high in Kalakada watershed.

The recommended practices were broadly divided into three types viz., land treatment practices, crop production practices and alternate land use. Taking all the practices together, the level of adoption was around 45 per cent only. An indepth analysis revealed that the adoption of technology was marginally better in case of land treatment practices. Among the watersheds, the adoption of recommended technology was marginally high in Kalakada watershed in all the three types of practices. Further, it has to be noted that
there was significant gap between knowledge and adoption of the recommended technology.

Among the 20 recommended land treatment practices, only two practices were fully adopted by more than sixty per cent of the farmers and five practices by 40-60 per cent of the farmers, while 10 practices were fully adopted by less than 20 per cent of the farmers. Land treatment practices such as contour bunds, land reclamation, vegetative bunds with khus, contour cultivation, stone/cement drop structures and farm ponds were not adopted by majority of the farmers. With regard to crop production practices, the use of HYV seed was relatively at high level, while the time of sowing was not followed by more than 55 per cent of the farmers. An analysis of adoption of alternate land use practices revealed that not even a single practice was fully adopted by more than twenty per cent of the farmers. Only three practices, namely farm forestry, agro forestry and social forestry were fully adopted by 15 to 18 per cent of the farmers. Hence, the hypothesis "the level of adoption of recommended watershed management practices is not significant" is proved in the study.

7.1.9 Cropping Pattern

An analysis of cropping pattern indicated marginal differences in cropping pattern between watershed and non-watershed areas. The share of irrigated crops namely paddy and sugarcane in gross cropped area was relatively higher in watershed area in comparison with non-watershed area, while the share of vegetables and mango plantation was higher in non-watershed area. The area occupied by groundnut crop accounted for around 62 per cent in watershed area and 66 per cent in non-watershed area. The
relatively high share of paddy and sugarcane cultivation in gross cropped area might be due to increased water table consequent to implementation of soil and moisture conservation works under NWDPR. Farm-size wise analysis revealed that the share of area under paddy, and sugarcane cultivation was marginally high among small, medium and large farmers of watershed area in comparison with their counterparts in non-watershed area. The area under the vegetable cultivation was relatively less in large and medium farms of watershed area, while the same was relatively more in small farms of watershed area in comparison with their counterparts in non-watershed area. Thus, the impact of NWDPR on cropping pattern is marginal and there were no remarkable differences in cropping pattern in watershed area in comparison with non-watershed area.

7.1.10 Cropping Intensity

The implementation of watershed development programme interalia aims at improving the water table and thereby enhancing irrigation facilities due to which the cropping intensity is likely to improve in the watershed area. The information on cropping intensity indicated relatively high cropping intensity in watershed area. The difference in cropping intensity between watershed and non-watershed farms was relatively high in Udayamanikyam watershed than in Kalakada watershed. The computed ‘t’ values indicated significant difference in cropping intensity between watershed farmers and non-watershed farmers in both the watersheds. Among the farm size groups, the cropping intensity of the small farmers was highest followed by medium farmers.
7.1.11 Crop yields

The productivity of the different crops grown by the farmers is the important indicator of watershed management. Groundnut is the major crop grown in the study area. The yield of groundnut crop in watershed area is estimated to be 467 kgs for an acre while the same was 389 kgs in non-watershed area. The higher productivity yields in watershed farms might be due to increased soil moisture consequent to soil conservation works taken up under NWDPRA and adoption of recommended crop technology by the watershed farmers. Further, the yield difference between watershed and non-watershed farmers was high in small farms followed by large and medium farmers. Among the watersheds the yield of groundnut crop is relatively high in Kalakada watershed than in Udayamanikyam watershed. This might be due to relatively higher level of adoption of recommended crop practices in Kalakada watershed and the other agro-climative conditions, which affect the yield.

The yields of paddy also were relatively high in watershed area in comparison with non-watershed area. The difference in paddy yield between watershed and non-watershed area is observed to be high in Udayamanikyam watershed. Further, the yield difference is observed to be the highest in large farms in both the watersheds. With regard to sugarcane crop, the difference in yield between watershed area and non-watershed area was relatively less in comparison with groundnut and paddy.

To test the significance of the yield differences, 't' values were computed for beneficiaries and non-beneficiaries, which revealed that the yield differences were significant in case of groundnut and paddy in both the
watersheds. With regard to sugarcane crop, the yield difference was significant in Kalakada watershed only. To test the variation in crop yield between small, medium and big farms, Anova has been used, which revealed significant variation in groundnut and sugarcane yields in watershed area, while they were non-significant in non-watershed area. The difference in paddy yield among the farm-size groups was non-significant in both watershed and non-watershed area.

7.1.12 Employment

The initiation of watershed development activities in general and land development activity in particular were bound to create additional employment in watershed area. The data on employment furnished in Table 6.12 revealed that the average annual employment per worker was relatively high in watershed area (208 day) in comparison with non-watershed area (179 days). The differences in the level of employment between watershed and non-watershed farms was found to be significant in both the watersheds as indicated by 't' values. The results of Anova revealed significant differences in levels of employment among small, medium and large farmers of watershed area, while they were non-significant in non-watershed area.

7.1.13 Net farm Income

The data with regard to net farm income are given in Table 6.15. It can be seen from the table that the average net farm income of the farmers in watershed area was greater than their counterparts in non-watershed area by 29 per cent. Further, it is observed that the gap in net farm income of farmers between watershed and non-watershed areas was highest in the case
of large farmers followed by small and medium farmers. Watershed-wise analysis revealed no significant differences. The computed 't' values revealed significant difference in net farm income which implies that NWDPRA had significant impact on farm income.

The particulars of distribution of farm holdings according to net farm returns in high income groups is higher in watershed area in comparison with non-watershed area. Similar trend is noticed in case of all the three categories of farmers. The calculated gini ratio indicated marginally higher inequalities in income distribution in non-watershed area.

7.1.14 Net Household Income

The difference in the net household income of the farmers of watershed and non-watershed areas worked out to be 20 per cent. The percentage difference in the net household income was relatively high in Kalakada watershed. Source-wise income analysis revealed that the income from livestock was marginally high in non-watershed area in comparison with watershed area. Same trend is noticed in both the watersheds. However the average household livestock income was found to be marginally high in watershed area in comparison with non-watershed area.

Farm size-wise analysis revealed that large farmers had high net household income than their counterparts in non-watershed area by 32 per cent, while it was 25 per cent and 22 per cent for medium and small farmers respectively.
7.2 Policy Implications

Having presented the findings of the study, an attempt is made to draw some policy implications from these findings.

1. The success of watershed development programme depends more on people's participation. The overview of results of investigation indicated that people's participation at different stages of NWDGRA was moderate or medium. As a result the programme fell below the expected level of income and employment generation. It can therefore be strongly suggested to involve the people more intensively at various stages of the programme. For ensuring effective people's participation in watershed development programme, the following strategy is suggested.

   (a) to provide adequate publicity to the programme, (b) to encourage local leader's participation, (c) to utilise the services of local institutions, (d) to concentrate more on Participatory Rural Appraisal techniques, (e) to select technologies based on farmers needs, (f) to organise farmers skill upgradation trainings, (g) to strengthen the monitoring and evaluation process, (h) to provide incentives for active farmers/institutions and (i) to provide necessary facilities to implementing officials.

2. It was noticed that the Watershed Management technology is observed to be quite expensive and hence it is difficult for the farmers to adopt the same in their fields. Hence, alternatively low-cost or cost effective
technology will have to be evolved by the interaction of scientists, engineers, extension personnel and farmers. This low-cost technology will have to be transferred to the farmers for adoption.

3. An analysis of knowledge of watershed technology revealed that 34 per cent of the farmers were not aware of high yielding variety of groundnut crop in the watershed area. Hence the extension agencies involved in the area have to play an active role in providing input supplies, i.e., better quality seeds. Farmers may also be encouraged to adopt the watershed technology by providing the necessary credit facilities.

4. The knowledge and adoption of land treatment practices, and alternative land use was observed to be low in the selected watersheds. Hence conservation works, crop husbandry, silvi pastoral system and livestock enterprises should be totally integrated to reap the fuller benefits in a sustainable manner.

5. Because of high risk involved in dryland farming, it is necessary to develop a combination of farm plans for each holding size based on varying levels of expected net farm income and risk involved in it. It will provide a good range of choice for the farmers to choose from on the basis of their resource structure, financial position and risk bearing capacity.