

## **Employment Opportunities in Watershed Development Programme in India – A Case Study of Pudukkottai District, Tamilnadu**

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### **Abstract:**

India has about 18 per cent of world's human population and 15 per cent of livestock population to be supported from only 2.45 per cent of world's geographical area and 1.5 per cent of forest and pasture land with the present population growth rate (1.9 percent per year), the population is expected to cross the 1.5 billion mark by 2050. The ever-expanding water demand of the India's growing population and economy, combined with the impacts of climate change, are already making water scarcity a major threat in many parts of the country and with if we are witnessing severe damage to livelihoods, human health and ecosystems. India is one of the world's leading crop producers over the years. There has been an increase in water consumption in the agricultural sector. The volume of water used for irrigation in India is expected to increase by 68.5 million liters between 2000 and 2025. Watershed development has been conceived basically as a strategy for protecting the livelihoods of the people inhabiting the fragile eco-systems experiencing soil erosion and moisture stress. The aim has been to ensure the availability of drinking water, fuel wood and fodder and raise income and employment for farmers and landless labourers through improvements in agricultural production and productivity. The government of India has been implementing watershed development programmes through different ministries the important ongoing watershed development programme DPAP, DDP, IWDP, RVP, NWDPR, DANIDA, NABARD. and others, State – funded watershed development programs, etc. At present watershed development programmes are embarked as IWMP with new mode of implementation. An attempt has been made in this paper to analyse the impact on employment opportunities in watershed development programme. The study also explains the impact watershed development programme on cropping pattern and productivity and find out the employment and income of watershed

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beneficiaries is considerably high. The productivity and cropping pattern have been also positively changed in the watershed area.

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### **Introduction**

Indian agriculture is subject to the vagaries of monsoon. Irrigation facility is one of the significant factors contributing to agricultural development in India. Despite various schemes of the government to extend facilities for irrigation, only around 40 per cent of the net cultivable land has been irrigated so far while the remaining 60 per cent is rain fed. It is therefore imperative for the government to focus on watershed development, particularly in the rain-fed areas. A watershed is a geographical area that drains to a common point, which makes it an attractive unit for technical efforts to conserve soil and maximize the utilization of surface and subsurface water for crop production (ICRISAT, et al., 2009). Anna Hazare's programme of watershed development in Relegan Siddhi of Maharashtra merits attention not only for its environmental impact but also to its ways in which an individual and his organization can play a central role in reshaping rural life. The Ralegan Siddhi is the one among the very successful models of people's participation.

India has about 18 per cent of world's human population and 15 per cent of livestock population to be supported from only 2.47 per cent of world's geographical area and 1.5 per cent of forest and pasture land. The percapita availability of land has declined from 0.89 ha in 1951 to 0.37ha in 1991: and that of agriculture land from 0.48 ha in 1951 to 0.16 ha in 1991. India accounts for 4 per cent of the water resources of the population. India could face a massive 50 per cent water deficit by 2030, the biggest globally, says the recent report of the Water Resources Group (WRG). The study finds that water demand would add up to nearly 1.5 trillion cubic meters, more than double the 740 billion cubic meters today, driven by the demands of the growing domestic population, a large proportion of which is moving towards middle-class lifestyles. According to a study by centre for science and environment's green Rating Project (2009), the fresh water consumption will be more than triple in the next two decades and reach 18,075 million cubic

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meters in 2030-31 (maishnamBobo Singh, 2010). As the water crisis manifests' itself in the form of depleting water tables and water related conflicts between states. It would require integration and adoption of multidimensional approaches that can manage demand by increasing water use efficiency in agriculture. (Archana Gupta, Yojana, 2010).

The ever-expanding water demand of India's growing population and economy, combined with the impacts of climate change, are already making water scarcity a major threat in many parts of the country and with if we are witnessing severe damage to livelihoods, human health and ecosystems.

Watershed development has been conceived basically as a strategy for protecting the livelihoods of the people inhabiting the fmaizele eco-systems experiencing soil erosion and moisture stress. The aim has been to ensure the availability of drinking water, fuel wood and fodder and raise income and employment for farmers and landless labourers through improvements in agricultural production and productivity. The watershed development programme as an official programme is over three decades old in India. The common guidelines for implementing the projects supported by the Ministry of Rural Development (MoRD), the major source of funds for watershed development in the country, require community participation. The district watershed cell, which receive the funds from the ministry. Recently the ministry of agriculture (MoA) has joined with the MoRD in using the common guidelines for watershed development.

Watershed development is attracting considerable attention because it is central to any strategy to develop rainfed agriculture or improve natural resource management. The development of rain fed agriculture is being emphasized as growth in productivity haslagged behind that of irrigated agriculture. More than one half of the increase in agricultural production in the country has come from less than one tenth of the districts, those with substantial access to irrigation (GoI 1992). Rainfed agriculture is considered to have untapped potential (fan and Hazell 1999).

Watershed Development as a multi-purpose programme which increases soIL moisture condition, improves and recharges the ground water, creates economic water ways, enlarges command area, controls soils erosion floods and concomitant recurring losses and also helps co-systems by extending greenery and plantation. Thus watershed development is the key strategy in rain-fed farming. Rain water conservation, improved crop production technologies and income generating options are integrated into the watershed programs. The programme WD is a major

solution for agricultural crisis in India. supply of water is augmented and demand for water is to be managed through participation of the people.

### **Watershed Management**

Watershed management involves management of land, water, energy and greenery integrating all the relevant scientific approaches appropriate to socio-economic background for the development of watershed. The main theme behind the watershed management is to minimize the waste of rain water, which flows into the oceans at the cost of socio – economic and ecological condition of the nations. The approaches are preventive, progressive, maximum benefit from advanced technology. An essential pre-requisite for watershed management is factual assessment of land: soil and ecological regiment of the areas, for which rapid preparation of maps on land use, physiography, land gradient hydrology, watershed nomenclature, geology, soils ground water potential by applying remote sensing techniques using aerial photographs satellite imaginary etc. are required.

In 1994, a technical committee under the Chairmanship of Professor C.H. Hanumantha Rao was appointed by the Government to appraise the impact of DPAP/DDP and suggest measures for improvement. The committee recommended a common set of operational guidelines and expenditure norms for the three programmes of Ministry of Rural Development (MoRD). Accordingly, the Guidelines for watershed development were framed and brought into force from 1<sup>st</sup> April 1995. Since then DPAP, DDP and IWDP are being implemented on watershed basis. The watershed guidelines of 1995 were revised by MoRD in 2001 to make them more focused, transparent and suitable to local requirements. The revised guidelines, 2001 provided for a greater role of Panchayat Raj Institutions Exit protocol and provision for availing the credit facility from financial institutions to ensure higher value addition to the interventions. The guidelines for these programmes were further revised with effect from 1.4.2003 and renamed as Heriyali Guidelines.

### **Need for the study**

The present strategy of watershed development programme in India is prompted by the need to protect the inhabitants of the fmaizele eco-systems vulnerable to different natural shocks. In this sense, it is a strategy of survival, even though in quite a few cases the successful implementation of the watershed development programmes has led to a substantial increase in

income and employment of me people (Rao, 2000). It is necessary to distinguish this strategy for protection or survival from a wider or holistic strategy for the development of agriculture in dryland or rainfed areas. Such a wider strategy would involve issues of agricultural technology suited to rainfed areas, prices, credit policies, infrastructure development for processing, marketing and transportation of agricultural produce and trade policies to afford reasonable protection to dryland farmers and to provide opportunities for export of their products. Some of these supporting measures are present in certain dryland areas, especially, in the watershed areas run by some of the distinguished NGOs, where there is a sustained increase in agricultural production and income (Rao, 2000; Sarkar, 2001; Rajput et. al, 2000; and others).

### **Ongoing Progress of Watershed Development Programmes in India**

Watershed development has emerged as a new paradigm for planning, development and management of land, water and biomass resources following a participatory bottom-up approach. The Government of India has been implementing watershed development programmers through different ministries Viz., Ministry of Agriculture, Ministry of Rural Development, Ministry of Environment and Forests and Ministry of Planning and Programme Implementation. The important ongoing watershed development programmes include, DPAP, DDP, River valley Project (RVP), National Watershed Development Project in Rain-fed Agriculture (NWDPA), international programs of DANIDA,DFID(UK), GTZ, SDC, SIDA and others, State – funded watershed development programs, etc. Based on the experience, the Government of India (GOI) has recently created watershed Development fund (WDF) in collaboration with National Bank for Agricultural and Rural Development.

A technical committee constituted in 2005 by the Department of Land Resources under the chairmanship of Shri S.Parthasarathy analyzed a wide range of statistics to show that even as farming has suffered neglect. The report concludes that the productivity of dry land agriculture needs to be urgently developed if food security demands of the future years are to be met. A greater focus of watershed development programmes to increase productivity.

**Drought Prone Areas Programme (DPAP)**

At present the DPAP is under implementation in 972 blocks of 195 districts in 16 states in India. Since 1995-96 to 2006-07, 27439 DPAP projects covering an area of 13.72 million hectares have been sanctioned in identified DPAP blocks. A total number of 22409 projects covering an area of 11.2045 m ha were completed/closed up to 31.12.2011. (Central funds to the tune of Rs.4,105.46crore have been released up to 31.12.2011.

**Desert Development Programme (DDP)**

The DDP is under implantation in 235 blocks of 40 districts in 7 states. Since 1995-96 to 2006-07. 15,746 DDP projects covering an area of 7.873 million hectares have been sanctioned in identified DDP blocks. A total number of 12,314 projects covering an area of 6.15m ha were completed closed up to 31.12.2011. Central funds to the tune of Rs.3099.13 crore have been released up to 31.12.2011.

**Integrated Wastelands Development Programme (IWDP)**

Under Recent policy modifications, projects under IWDP are sanctioned in the Blocks not covered by DDP and DPAP. The projects under the programme are being implemented in 470 districts in all 28 states of the country. From 1995-96 to 2006-07. 1877 IWDP projects covering an area of 10.722 million hectares have been sanctioned covering all 28 states, except in the identified DDP and DPAP blocks. A total number of 770 projects covering an area of 4895 in ha were completed up to 31.12.2011. Central funds to the tune of Rs.4361.60 crore have been released up to 31.12.2011.

The above three watershed Development Programmes of the Department i.e. IWDP, DPAP and DDP have been consolidated into a single modified programme namely Integrated Watershed Management (IWMP) and launched in 2009-10, with a different cost norm of Rs.12,000/ ha for the plains, Rs.15,000 / ha for the hilly areas.

## Review of Literature

An impact evaluation study in eight drought affected districts of Gujarat (Shah, 2000) reveals that the incidence of drought is much less severe in watershed villages when compared to the adjacent non-watershed or 'control villages'. The study concludes that the "Overall impact is not only positive but also impressive and to a large extent the participatory watershed scheme launched in 1995-96 by Ministry of Rural Development has been found to mitigate the impact of drought". The study observes that the expenditure on drought relief being incurred now can be spent more productively by allocating it for watershed development with very little extra expenditure. Another study in Gujarat (Shah and Menon, 1999) reveals that even though the project had barely completed four years of its implementation in four micro-watershed areas of Rajkot, Surendranagar, Amreli and Bharuch, irrigated area almost doubled since the project intervention that, in turn, has raised the cropping intensity, productivity of all crops taken together. The total returns from all crops increased by 63 per cent.

The economic impact of Rajiv Gandhi Watershed Development Programme in tribal district Jhabua of Madhya Pradesh (Rajput et. al, 2000) reveals that the average yield and cost of production per quintal of various crops were higher in Watershed Development Programme (WDP) areas as compared to non-WDP areas. The average yields per hectare of maize, cotton, wheat and gram were calculated to be 14.00, 10.50, 14.00 and 12.00 quintals, respectively in non-WDP areas.

There is plethora of literature available on watershed management programme covering wide range of issues. However, in this piece of work we have only attempted to review selected literature from the vast sources literature available in the context of understanding major issues, impact and effectiveness of the programme. Studies by Farrington, et al (1999), Deshpande and Narayanamoorthy (1999), Kerr et al (2000), Vaidyanathan (1999, 2006), Reddy and Dev (2006), Biswas, et al (2005), Pascual, et al (2009) and others have discussed several issues in watershed development programmes. They have covered policy related issues, institutional drawbacks, implementation issues, community and participation issues, etc. Despite the fact that there are large numbers of issues already covered, the research scope in the issue of watershed management is tremendous. Over the years, with the attention shifted from more centralized to decentralized system of governance, watershed development programmes have equally emphasized on decentralized approaches such as more community and people's participation and

involvement of PRIs in planning, executing and monitoring of the projects, etc. To ensure good governance, mechanisms like social auditing, periodic review and better documentation processes are taken into account as best practices in some of the WDP regions. There is a good number of studies available on participatory aspects of watershed management. Wani, et al (2001) study in Kothapally in Andhra Pradesh is one of such studies that highlight the effective community participation in watershed management. In fact, their study has developed the model for effective participation in watershed management.

Deshpande and Reddy (1991), Shah (2001), Joshi (2004) and others have reviewed different dimensions of watershed management. These studies while addressing several issues have also focused the positive impact of watershed management on cropping, agricultural productivity, employment generation and increase in income amongst others. The Kothapally study by Wani et al (2001) has shown significant impact of watershed management on crop production, increase in ground water level, reduction in runoff water, increase in income, etc. Similarly, ICRISAT has reported various benefits of the watershed development programmes in the country.

Studies by Deshpande & Narayanamoorthy (1999), Kshirsagar, K.G., M.P. Madhusoodhanan, S. Chavan and R. Rathod (2003) and many others have acknowledged that the watershed development programmes are potential to augment income and reduce poverty among the watershed communities. These studies have focused that there is positive change in crop yielding and productivity, cropping intensity and optimum use of farm implements despite some odds. Deshpande and Narayanamoorthy (1999) have observed several positive impact of National Watershed Development Programme for Rainfed Areas (NWDPR, implemented in 1990) across the four states in the Western and Central Rainfed zones of India viz. Gujarat, Rajasthan, Madhya Pradesh and Maharashtra.

Further, their studies of NWDPR in the southern plateau for the states of Andhra Pradesh, Tamil Nadu and Karnataka show that there was lack of effective beneficiary participation in the meetings and training programmes. Moreover, there was lack of proper local planning in the hilly areas. They have emphasized the need for local planning, peoples"



participation, training, capacity building, etc. Bio-physical aspects of watershed development are studied by large number of researchers from both science and social sciences. Kerr et al (2002) noticed that many studies have revealed that watershed development interventions were successful in controlling soil erosion, runoff reduction, etc.

Most of the studies on watershed management in India have reported significant changes in bio-physical aspects than in social and institutional aspects. Farrington et al. (1999) also noted that the successful watersheds have in fact reduced runoff water and recharged ground and surface water aquifers, improved drinking water supply, increased agricultural intensification and crop productivity. Studies by MYRADA, TERI, ICRISAT and other reputed organizations have focused on bio-physical, social, economic and institutional dimension of watershed development programmes. Kalpataru Foundation (2001) has observed similar changes after implementation of the WDPs under various schemes.

Participatory approaches of watershed management, emphasis on decentralized approach or bottom up approach, etc. are widely discussed by Farrington (1999), Yugandhar, et al (1999) Kerr (2000) D'silva Emmanuel and Sudha Pai (2003) and Vaidyanathan (2006) amongst others. All these studies have stressed importance of proper institutional mechanism both at the ground level and at the top level. Some of the authors have also talked about the issues of equity in distribution and lack of inclusiveness. ICRISAT has reported the lessons learnt from the previous watershed management programme studies in different regions of the country.

Sen (2008) has given significant comment on Indian policies with regard to watershed development programmes and rural development. In a book, *Water First: Issues and Challenges for Nations and Communities in South Asia* edited by Lahiri-Dutt and Wasson (2008), she has extensively discussed some of the significant issues on mainstreaming participatory principles, reorienting the concept of sustainability" in WDPs, reemphasizing equity aspects of watershed programmes, reconsidering scales of operationalisation of watershed programmes, cost-sharing, evaluation and mid-term correction of watershed development programmes amongst others. Despite the fact that the studies are aplenty in the area of watershed management, the documentation and analysis of the evaluation studies and impact assessment studies is essential

to set up a benchmark for the future studies. This can help in further improvement of the programme in the wake of Integrated Watershed Management programme (IWMP) already implemented in the country.

## **Watershed Development in Tamil Nadu**

### **Profile of the State**

Tamilnadu is a pioneer in state in the implementation of Watershed Development Programme. Though the WDP is implemented by several agencies, DPAP and IWDP are the implemented an the state of Tamilnadu.

Agriculture is the major occupation in the state as it provides livelihood support to 56% of the population. Incidentally, about 56% of the total cropped area of the state is under irrigated condition while around 44% of the area is under dryland farming. Land use pattern in the state has witnessed significant changes over the years. The net sown area has declined from 48% of the total geographical area during 1979-80 to 42.8% in 1999-2000 and further to 38.5% in 2005-06. Tamil Nadu agriculture is dominated by marginal and small farmers. The marginal farmers account for 74.3% of the total holdings operated only in about 30% of the total area while the semi-medium, medium and large farmers account for a small proportion of 10% of the holdings operated in a higher proportion of 46.1% of the total area. The number of marginal farmers has been increasing over the years.

Tamil Nadu state which accounts for 7% of the population of the country is endowed with only 3% of water resources in India. The water potential of the state is 46,540 Mm<sup>3</sup>. The groundwater potential available for future development was estimated at 3,142.27 Mm<sup>3</sup> as of January 2003.

Also the development of groundwater has led to increased “drought proofing” of the state’s agricultural economy. An analysis of the variance in growth rates of irrigated and unirrigated agriculture after the advent of new technology in the late 1960s revealed that the degree of instability in irrigated agriculture was less than half of that in unirrigated agriculture (World Bank 1998). Out of 385 blocks in Tamil Nadu, 180 blocks have almost exploited the potential and out of the 1.8 million wells in the state, about 12% are dried up or abandoned due to groundwater overexploitation (GoTN 2002). In some pockets of the state, the average well failure rate is 47%

for open wells and 9% for bore wells (Palanisami et al. 2008). Being a hard-rock region, the externalities of groundwater depletion are felt in most parts of the state.

The overexploitation of groundwater in many areas of the state has resulted in lowering of the water table below the economic pumping level. In this context, the watershed development assumes critical proportions in the state. Watershed Development Programs To increase the overall agricultural production and improve the living conditions of the farmers depending on the rain-fed lands, the watershed development programs are being widely implemented in the state. There are 19,331 micro-watersheds identified in the state of which, approximately 4,000 have already been treated. The details of number of watersheds in the state are given in the Annex. The important programs such as DPAP, National Watershed Development Project for Rain-fed Areas (NWDPR) and Integrated Wasteland Development Programme (IWDP) are implemented through a watershed approach apart from the Comprehensive Watershed Development Projects implemented with assistance from DANIDA.

The DPAP is implemented with the prime objective of promoting the overall economic development of the watershed community through optimum utilization of natural resources, employment generation and restoring ecological balance. The program is implemented in 80 blocks of 16 districts which are Dharmapuri, Thoothukudi, Sivagangai, Ramanathapuram, Virudhunagar, Pudukottai, Tirunelveli, Salem, Namakkal, Coimbatore, Tiruvannamalai, Dindigul, Vellore, Tiruchirappalli, Perambalur and Karur. From 1999-2000 to 2006-07, the Government of India sanctioned 1,222 watersheds in seven batches at a total cost of Rs 3,367 million, for treating a total area of 0.61 Mha (GoTN2009).

The IWDP has been under implementation in Tamil Nadu since 1993-94 to develop non-forest wastelands on the principles of watershed development. This program is being implemented in 96 blocks of 24 districts, which are Coimbatore, Dharmapuri, Dindigul, Karur, Krishnagiri, Namakkal, Perambalur, Pudukkottai, Ramanathapuram, Salem, Sivagangai, Tiruvannamalai, Thoothukudi, Tiruchirappalli, Tirunelveli, Vellore, Erode, Theni, Madurai, Kancheepuram, Villupuram, Tiruvallur, Cuddalore and Virudhunagar. From 1999-2000 to 2006-07 the Government of India has sanctioned 910 watersheds at a total cost of Rs 2,622.039 million, for treating a total area of 0.457 Mha (GoTN 2009).

The other important watershed development program is the NWDPR. It is being implemented in the state from 1990-91. During the period from 2002-03 to 2007-08, a altogether 755 watersheds (0.290 Mha) with a total outlay of Rs 1,306.5 million have been treated.

In addition to these major watershed development programs, watershed programs assisted by the National Bank for Agriculture and Rural Development (NABARD) are being implemented. This covers 100 watersheds at a cost of Rs 600 million in 23 districts of the state.

### **Objectives of the Study**

- To study the impact on Employment in watershed development in the study area.
- To study the inequality of income distribution
- To analyse the impact of productivity of different crops.

The economic impacts are evaluated in terms of changes in income, employment, cropping pattern, production and productivity of different crops. The impact of watershed development on the prevailing state of inequality in income distribution has also been examined.

### **Methodology**

This study is based on primary and secondary sources. A two stage stratified random sampling technique was used for the purpose of the study. Under the Drought Prone Areas Programme (DPAP) watershed project, one treated watershed Pulavankadu (watershed area) and one untreated village Varapur (non- watershed area) of Pudukkottai block of Pudukkottai District of Tamilnadu were selected for this study. In the second stage, a complete enumeration of farmers according to the size of landholding in each sample village was made. The farmers were then stratified into four major groups i.e, Large Farmers (more than two hectares). Small Farmers (1-2 hectare), Marginal Farmers (0-1 hectare) and Landless. Near about 25 per cent of households were selected from the study village comprising 56 farmers from Pulavankadu village and 50 farmers from Varapur village. In total, 106 households were selected for sample study comprising 16 per cent large farmers, 35.8 per cent small farmers 34.9 per cent marginal farmers, and 13.3 per cent landless. The sample households were administered with well-designed semi-structured questionnaires to elicit required information. The data were collected ,it the year 2010-11.

Impacts have been evaluated through 'With-Without Approach' The regression technique has also been employed for the impact evaluation study. The model was fitted with Cobb-Douglas production function as stated below to analyse how size of operational holding, expenditure of improved crop production technology and investment made on soil and water conservation works contributed to increase in farm income in both watershed and non-watershed areas.

Non-watershed village

$$\text{Log } Y_1 = \text{Log } A_1 + a_1 \log H_1 + b_1 \log E_1 + c_1 \log I_1 + U_1 \text{ ----- (1)}$$

Watershed village:

$$\text{Log } Y_2 = \text{Log } A_2 + a_2 \log H_2 + b_2 \log E_2 + c_2 \log I_2 + U_2 \text{ ----- (2)}$$

Where, Y= Farm income (Rs)

H= Size of operational holding

E= Expenditure on improved crop production technology (Rs/ ha)

I= Investment made on soil water conservation works (Rs/ ha)

U= Random disturbance term independently distributed with Zero mean and finite variance.

A = Constant term

The concepts of Lorenz Curve and Gini Coefficient have been suitably used to analyse the extent of inequality in income distribution in the watershed and non-watershed area.

The quantitative measure of Gini Concentration Ratio (GCR) is given as follows:

$$L = 1 - \sum_{i=1}^n p_i(1_i + 1_{i+1})$$

Where ,

L = Gini Concentration Ratio

$p_i$  = Proportion of population of  $i$ th class

$1_i$  = Cumulative proportion of total income at  $i$ th class

$I = 1,2,3 \dots \dots \dots n$

$n$  = Number of classes in the distribution

## Results and Discussion

Impact on Cropping Pattern and Productivity of Crops : The cropping pattern is distinctly better in watershed area compared to non-watershed area as revealed from Table 1. Besides maize,

relative share of area under all other crops is more in watershed area compared to non-watershed area. Specifically more Rabi crops have been cultivated in watershed area that was possible for better availability of irrigation water from different sources including water harvesting structures. In watershed area, greengram, black-gram, Gingili and vegetables have registered higher area coverage to tune of 3.08, 1.38, and 1.2 per cent, respectively compared to non-watershed area. The multiple cropping and mixed cropping systems are widely adopted in the watershed area. As a result, net sown area is larger in the watershed area compared to the non-watershed area.

The improvement in productivity of different crops in the watershed area varied from 36 to 114 per cent in comparison to the non-watershed area. The productivity of paddy and groundnut was higher in the watershed area by 114.6 and 105.6 per cent, respectively. Blackgram and maize also registered 75.6 and 67.2 per cent higher productivity, respectively compared to the non-watershed area. The total production of paddy, Gingili and groundnut in the watershed area was 198, 152 and 173 per cent higher, respectively, compared to the non-beneficiary village. The number of cattle per household in the beneficiary village was 3.5 as against 1.36 in the non-beneficiary village.

### Impact on Cropping Pattern in the Study Area

S. No.	Crop	Watershed area	Non-watershed area	% Increase watershed in the area over non-watershed area
1	Paddy	79.99 (53.8)	56.89 (50.7)	40.60 (+3.11)
2	Greengram	8.06 (5.4)	2.63 (2.3)	206.46 (+3.08)
3	Blackgram	12.98 (8.7)	7.91 (7.1)	64.10 (+1.68)
4	Gingili	7.26 (4.9)	3.93 (3.5)	84.73 (+1.38)
5	Maize	20.83 (14.0)	27.48 (24.5)	-24.20 (-10.48)
6	Groundnut	9.74 (6.6)	7.31 (6.5)	33.24 (+0.04)
7	Vegetables	9.73 (6.5)	6(5.3)	62.17 (+1.20)
Gross Cropped Area		148.59 (100.0)	112.15 (100.0)	32.49 (0.00)

Source: Field survey.

Note: Figures in parentheses indicate percentage to total

### Impact on Productivity of Different Crops (kg/ha)

Crop	Crop Yield		% increase in yield in treated area Over untreated area
	(Watershed Area)	(Non-watershed Area)	
Rice	1320	615	114.6

Blackgram	281	160	75.6
Greengram	320	201	59.2
Gingili	215	157	36.9
Maize	1030	616	67.2
Groundnut	1289	627	105.6

Source: Field Survey

Impact on Household Income and Employment : The watershed programme has significantly increased the farm income and employment of beneficiary households. A significant difference is observed in the distribution of income between the sample households of the watershed areas and the non-watershed area. All categories of farmers registered higher income in the beneficiary village than their counterparts in the non-beneficiary village. The average annual income of sample households in the watershed area is Rs. 25341 compared to Rs. 7813 in non-watershed areas. The large farmers in the watershed area experienced maximum increase (267.7 per cent) compared to all other categories of farmers. The marginal farmers (220 per cent) and small farmers (232.7 per cent) also recorded higher income in the beneficiary village than their counter parts in the non-beneficiary village. The landless group in the beneficiary village could manage to earn Rs. 9684 annually compared to the counter-parts in non-beneficiary village who manage to earn the per annual income of only Rs.3625 which is lowest among different lass of respondents. At the same time, the difference in annual income of landless group of beneficiary and non-beneficiary villages is also found to be lowest compared to all other groups. The pooled income of the beneficiary village is 224.3 per cent higher than that of the non-beneficiary village.

#### **Impact on Annual Household Income (Rs./household/annum)**

<b>Size group</b>	<b>Non Beneficiary</b>	<b>Beneficiary</b>	<b>Difference</b>	<b>% Increase in Beneficiary Village</b>
Landless	3625	9684	6059	167.1
MF	7588	24281	16693	220.0
SF	8332	27721	19389	232.7
LF	9405	34583	25178	267.7
Pooled	7813	25341	17528	224.3

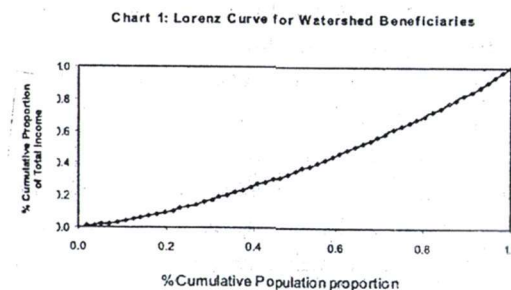
Source: Field survey.

Note: LF: Large Farmers; SF: Small Farmers; MF: Marginal Farmers

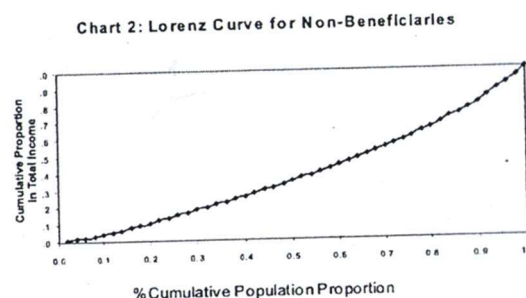
The higher income and assets in the beneficiary village was basically augmented due to the increased productivity of crops and livestock and more employment generation in those areas. It may, be noted that the households of the beneficiary village have possessed 78 per cent higher assets compared to the non-beneficiary households. The farmers have been encouraged to maintain

and to undertake soil and water conservation measures due to benefits accrued from the watershed development programme.

**Nature of Inequality in Income Distribution :** Unlike usual perception that income inequality increases with increase in income and employment in an economy, we observed that inequality in income distribution is lower in the developed watershed area than the non-watershed area under study. It may be noted from Charts-1 & 2 that the value of Gini-coefficient is 0.26 in the non watershed area which is more than the same in watershed area by 0.2



Though the large farmers in the watershed area have been sufficiently benefited through watershed interventions in terms of overall benefits, the small farmers have also been proportionately benefited due to rehabilitation of degraded lands, improvement of soil moisture regime and increase in groundwater table. The small farmers mostly cultivate their lands themselves whereas large farmers rent out. The extent of income inequality is more pronounced in the non-watershed area due to poor productivity of land and non-availability of water to the small farmers. Large farmers could invest in water resources limiting to private use only. Lower class farm categories did not have enough resources to invest in water harvesting and other kind of livelihood generating activities.



### Impacts on Employment Generation

The human labour utilisation in the watershed area is found to be 57.2 per cent higher than the non-watershed area. The employment generation due to agriculture, forest and off-farm activities in the watershed area was 20268 mandays as against 12892 mandays in the non-watershed area. As regards bullock and tractor days generated, about 223 per cent more bullock days and 1933 per cent more tractor days have been generated in the watershed area compared to the non-watershed area. Considering all the income and employment generating activities, 78.3 per cent of higher employment opportunities have been generated in the watershed area over the



non-watershed area. The employment generation is significantly higher in the watershed area basically due to intensive agriculture and forestry activities.

### Impact on Employment Generation

S. No.	Activities	Non-watershed Area	Watershed area	Difference	% Difference
1.	Mandays	12892	20268	7376	57.2
2.	Bullock days	1858	5993	4135	222.6
3.	Tractor days	2	47	44	1932.6
4	Total	14752	26307	11555	78.3

Source: Field survey.

### Conclusion

The study reveals some interesting results. The overall impact of the watershed programme has been positive and significant when compared with non-watershed area. The crop yields have risen and there has been a substantial increase in area under cultivation in the Rabi season, leading to a rise in employment and reduction in migration of labour. The higher productivity in the watershed area was due to bringing of more fallow land into cultivation and employing more bullock and machine labour. Along with the productivity of crops, the productivity of livestock was also higher due to more availability of fodder and development of pastureland. Availability of fodder for animals has also improved leading to a rise in the yield of milch animals. The higher productivity of crops mid livestock and more employment generation helped in augmenting income and assets in the beneficiary village. Though the average annual income of watershed beneficiaries is considerably higher compared to do. non-beneficiaries, the prevailing level of inequality in income distribution is found to be higher in the non-watershed area. The benefits accrued from the watershed project encouraged the farmer to maintain and to undertake soil and water conservation measures which minimised the degradation of the land, which in turn increased the production and productivity of crops. It is suggested to attach more emphasis on integrating biophysical measures with livelihood generation measures and community development programmes so as to make the programme sustainable. People's participation at every stage of the project along with continuous cooperation of the line departments and extension agencies for providing training and demonstration for sustainable use of watershed resources are essentially required for sustainable development of the watershed area.

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