

## **Enhancement of Economic Security via Watershed Intervention Technology in Coimbatore District**

**Parvathi. C<sup>1</sup> and P. Ambigadevi<sup>2</sup>**

**Abstract:** *Watershed Intervention Technology plays a significant role in groundwater recharge. These structures enhance soil moisture regime, enrich soil fertility and thereby promote ecological balance through conservation of eco system. Besides, indirect benefits such as livestock development, improved quality of life in rural area on account of employment generation and income, and increased income, cash flow to the farmers and agricultural labourers also would result from watershed development programmes. Livestock plays an important role in the national economy as well as in the socio economic development. India is emerging as the world's 2<sup>nd</sup> largest poultry market with an annual growth of more than 14 per cent, producing 61 million tones or 3.6 per cent of global egg production (Ministry of Agriculture, 2015). Livestock production plays a major role in the life of farmers in developing countries. It provides food, income, employment and many other contributions to rural development. For the study, two blocks namely Thondamuthur and Periyanaickenpalayam blocks in Coimbatore district in which groundwater was over exploited were selected. The major objective of the study is to assess off-farm impacts of watershed intervention technology. Livestock production and agriculture are intrinsically linked to each other, and both crucial for overall food security. The study concluded that livestock is an important livelihood activity for most of the farmers and also watershed intervention technology plays a vital role in improving the socio-economic conditions of rural masses.*

**Keywords:** Watershed intervention Technology and Socio- Economic Security.

### **Introduction**

Watershed Intervention Technology plays a significant role in groundwater recharge. These structures enhance soil moisture regime, enrich soil fertility and thereby promote ecological balance through conservation of eco system. Rain fed agriculture in India is characterized by low productivity, degraded natural resources and widespread poverty, most of the millions of people living in our country depend on agriculture and natural resource management for their livelihoods watershed has become an acceptable unit for planning soil and water resources conservation. The rain-fed agriculture mainly depends upon receipt of adequate rainfall that should be evenly distributed. Even if normal rainfall is received, rainwater should be conserved most effectively. It also improves microbial activity of the soil (Palanisami, et.al, 2008). It

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<sup>1</sup> Assistant Professor(SG), Department of Economics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.

<sup>2</sup> Dean of Humanities, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.

Corresponding author: Parvathi. C can be contacted at:

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directly leads to improved utilization of the rainfall and crop drainage, stabilization of the area under cultivation and increased production, reducing flooding and water-logging, reducing soil erosion, increased agricultural productivity and augmenting and facilitating dependable water supply for domestic and industrial uses. Besides, indirect benefits such as control of sedimentation of reservoirs, prevention of flooding of downstream areas involving houses, villages, agricultural lands, livestock development, increased availability of food and non-food crops to the society due to enhanced production and productivity, improved quality of life in rural area on account of employment generation and income, prevention of environment degradation and soil erosion, scientific use of water between irrigated crops and rain fed crops, prevention of rural exodus to urban centers, and increased income, cash flow to the farmers and agricultural laborers also would result from watershed development programmes. India ranks first in having the largest livestock population in the world. Livestock plays an important role in the national economy as well as in the socio economic development. India is emerging as the world's 2<sup>nd</sup> largest poultry market with an annual growth of more than 14 per cent, producing 61 million tones or 3.6 per cent of global egg production (Ministry of Agriculture, 2015).

Livestock production plays a major role in the life of farmers in developing countries. It provides food, income, employment and many other contributions to rural development. This region is vast in land, water, and vast amount of livestock and poultry population. With economies in many Asian countries growing at annual rates greater than 5 to 6 per cent and a market potential of 2.8 billion people, the livestock and poultry industry growing faster than ever. Within the agriculture sector, livestock sub sector plays a vital role in economic development. But despite the increasing contribution of the livestock sector, which includes poultry sector, it has not yet achieved the level needed to provide sufficient meat for the growing population. Increasing per capita expenditure on quality food products and growing demand for livestock and poultry products are characteristic and this region is full of surprises and business opportunities.

### **Role of Livestock Sector in Asian Agriculture and Social Life**

Livestock plays a vital role in economic development particularly as societies evolve from subsistence agriculture into cash based economies. In the Asian region, livestock provides major additional contribution to Development of Livestock Sector in Asia agriculture through draft power, manure, fuel and as a fertilizer, animal products such as meat, milk eggs while poultry provide daily cash income and much required nutrition to rural population the importance of different types of livestock in daily life of livestock farmers in this region. Many Asian countries, mixed farming involving crops and livestock integration have been a way of life since the beginning of agriculture. It is widely realized that this is the only method of providing additional income and employment to the small farmers and land less labor families. Countries in many South Asian countries, next to crops, animal husbandry has the largest employment potential in rural areas. Further this sector can make a significant contribution to promote re-distribution effects of income in favor of weaker sections.

Livestock play a vital role in the agricultural and rural economies of the developing world. Not only do they produce food directly, they also provide key inputs to crop agriculture. Most farms in the developing world are too small to justify owning or using a tractor, and the alternatives are animal power or human labour. For many smallholder farmers, livestock are the only ready source of cash to buy inputs for crop production - seeds, fertilizers and pesticides. Livestock income also goes towards buying things the farmers cannot make for themselves. And

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that includes paying for school fees, medicine and taxes. Income from cropping is highly seasonal. In contrast, small stock, with their high rates of reproduction and growth, can provide a regular source of income from sales. So can milk and milk products like butter and cheese. Larger animals such as cattle are a capital reserve, built up in good times to be used when crops are poor or when the family is facing large expenses such as the cost of a wedding or a hospital bill. In the past, farmers could restore the fertility of their land by letting it lie fallow for several years or longer. But as population pressure increases, fallow periods decline or even disappear and different ways of maintaining food production are needed: enter the animal. Animals are a crucial link in nutrient cycles, returning nutrients to the soil in forms that plants can readily use. They can bring nutrients from pasture and rangeland and concentrate them on crop land through their manure and urine. The animal manure and urine that people in the developed world see as pollutants are vital fertilizers in the developing world. Few smallholders can afford enough mineral fertilizers. Animals give farmers a reason to plant legumes as pastures and cover crops that protect the soil and restore its structure and fertility.

### **Live Stock Resources**

Livestock plays a dominant role in Indian economy. It is of great use for the purpose of cultivation as well as transport; and the production of milk is more or less in the nature of by-products to the Indian cultivators. India possesses the largest number of cattle of any country in the world. Its share is 17 per cent of the total livestock population of the world. India has one-fifth of cattle. The buffalo population of India is nearly one-half of the world's. Sheep and goat also constitute nearly one-fifth. China comes second with only 10 percent.

In India, the major livestock products are milk, meat and eggs. Milk production in our country has increased from 17 million tonnes in 1950-51 to 66.1 million tonnes in 1995-96. In the year 2001-2002, the total milk production exceeds 84.5 million tonnes. Out of the total income generated by the livestock resources in India, about 79 per cent is contributed by milk and milk products.

### **Mechanization of agriculture**

Mechanization of agriculture implies replacement of animal and human power of machinery wherever possible in agriculture involving greater investment of capital. It means introduction of tractors, drills, harvesters, threshers, crushers, bulldozers, oil engines and electric pumps in the places of old wooden ploughs, bullocks, sickle and country carts.

### **Advantages of mechanization of Agriculture**

- Increase Productivity
- Increases Agricultural Production
- Reduces the Cost of Production
- Technological Improvement in Agriculture
- Extension of Market
- Increase in National Income

### **Importance and Significance of Livestock in India**

The significance and importance of Animal Husbandry in the Indian economy are manifold. Livestock sector is a prominent sector among agricultural and allied activities in India. The annual rate of growth in GDP from livestock and agriculture had been 7.3 per cent and 3.1 per

cent respectively, during the course of last decade. It is very significant to note that women constitute nearly 70 per cent of the labour force in livestock sector, as against 35 per cent in crop farming.

### **Review of Literature**

Thakur, et.al, (2000) made a study on the “Impact of Irrigation on Farm Production of Sample Farmers in Himachal Pradesh”. It revealed that after the installation of irrigation project the operational holding under cereal crops declined whereas there had been a significant increase in the areas under commercial crops. The resource use pattern had changed; the farmers were still using higher seed rates of crops and following traditional broadcasting method of sowing. However, the use of chemical fertilizers had increased significantly. The overall employment had increased in agriculture sector whereas in Kharif and Rabi vegetables the labour employment had decreased due to economics of scale by introducing more area under vegetables as well as technological improvements. The impact of irrigation was visible in terms of notable increase in the yields of all the crops and that increase was found higher in commercial crops (vegetables). Per farm production and marketable/marketed surplus of food grains after the project was quite higher than before the project installation. Similarly, the production and marketed surplus of vegetables (kharif and rabi) had shown about two to three fold increase after the project. Besides that, the number of livestock owned by sample farms had increased significantly. Sheep rearing followed by drought and milk (milch) animals were the important livestock assets kept by the farmers. Majority of the farmers owned high breed cows instead of local cows and buffaloes as the contribution of high breed cows with respect to milk production were quite high as compared to local cows and buffaloes. Similarly, the cropping system and income had changed which led the improved livestock management for higher milk production, in the study area. About 60 per cent change in household earning was observed after the installation of the project. The contribution of farm sector indicated 154 per cent increase over the pre-project period thereby representing the significant role of irrigation project in the study area. The per capita income too, increased by 60 per cent over the pre-project. This was attributed to the provision of well planned irrigation facilities and agro climatically best suited area provided to the farmers for the production of off-season vegetable crops and high yielding varieties of cereal crops. Also, the farmers in command area of the scheme shifted their cropping pattern and livestock rearing towards cash crops (both kharif and rabi vegetables) and cross-bred cows.

Jain, A.K. (2008) in his study analyzed that the impact of organizational instruments on livestock activities of watershed developments in Andhra Pradesh. The study revealed that livestock population had increased varying from 68 to 83 per cent in cows, 57.5 to 73 per cent in buffaloes and 63 to 149 per cent in sheep and goats across the watersheds. The milk yield improved by 84.5 , 62.7 and 73.2 per cent on number of milking days increased by 20,10 and 20 in NGO , government organization and research organization managed watershed respectively. Across the watersheds, landless have improved their incomes through milk sales by 155 to 168 per cent. Similarly, small and marginal farmers have improved their incomes through milk sales making dairying as a viable alternative for improving their economy. The studies in India by Erappa et.al, (2001), Palanisami (2003), Ramana (2005), Tapan Adikari (2006) and Ajaykumar (2008), analysed the role of watershed programmes on socio-economic development of rainfed and semi-arid rain fed areas.

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### **Methodology**

For the study, two blocks namely Thondamuthur and Periyanaickenpalayam blocks in Coimbatore district in which groundwater was over exploited were selected. From these two blocks, based on multistage and stratified sampling techniques, farm households who satisfy the following criteria were selected; the chosen farm households must be adopting watershed intervention technology since 2008-09. As this is an impact assessment study, impact of watershed intervention technology on these farm households was assessed by making a “before” and “after” study; i.e.; before the adoption of watershed intervention technology in 2007-08 and after the adoption of watershed intervention technology in 2008-09. The major objectives of the study is to assess off-farm impacts of watershed intervention technology. In Thondamuthur block 140 small farmers, 88 medium farmers and 22 large farmers were selected. In the Periyanaickenpalayam block, 148 small farmers, 50 medium farmers and 52 large farmers were selected. Hence from each block 250 farm households making a total of 500 farm households form the sample base of the current study. Data collection was carried out by administering a pretested interview schedule to the sample farm households from July to December 2009.

### **Impacts on Watershed Intervention Technology**

The off-farm impact of watershed intervention technology is assessed in this section in terms of its impacts on input usage, livestock, and income and consumption expenditure.

#### **Impact on Input Usage**

Agricultural sector in India is the largest sector, absorbing lot of employment force and hence all programmes of unemployment alleviation have been made rural-centric. It is evident that, agricultural sector in India is in a dominant position to offer scope for a lot of employment opportunities in the economy, and more than 50 per cent of the employed force is engaged in agriculture or its allied occupations. This section studies the impact of watershed intervention technology in generating employment in farm activities. Bullocks and machines are used in preparatory cultivation, inter-cultivation and in harvesting. Apart from this human labour is used in transplanting and for applying fertilizers and pesticides. The following table 1 gives the usage of bullocks, machines and human labour in farm activities both before and after the watershed intervention technology in the Thondamuthur and the Periyanaickenpalayam blocks.

In the Thondamuthur block during the year 2007-08, bullock labour was used by small farmers for 14.79 pair days per household. The medium and large farmers used bullock labour for about 35 and 50 pair days. On an average bullock labour was used for about 25 pair days. Before the use of watershed intervention technology bullock labour was used only for preparatory cultivation and for harvesting. During 2008-09 it was used in inter cultivation also. The percentage change in the usage of bullock labour was significantly high among the different farmer groups in Thondamuthur block. This was as high as 105.59 per cent for the medium farmers closely followed by the small farmers with 95.47 per cent and by the large farmers with 76.43 per cent. In the Periyanaickenpalayam block, the usage of bullock labour was lower compared to the Thondamuthur block. The bullock labour was used for about 18.58 pair days per household in 2007-08 and for about 27.04 pair days per household in 2008-09. The usage of bullock labour thus has increased in 2008-09 in Periyanaickenpalayam block also.

**Table 1: Usage of Inputs in Farm Activities in the Study Blocks**

Year	2007-08				2008-09				Percentage change			
Farmer Particulars	SF	MF	LF	ALL	SF	MF	LF	ALL	SF	MF	LF	ALL
<b>Thondamuthur</b>												
<b>Bullock Labour (in pair days)</b>												
Preparatory	9.11	21.88	30.45	15.48	13.89	28.95	39.36	21.43	52.47	32.31	29.26	38.44
Inter-cultivation	-	-	-	-	5.97	13.69	19.77	9.90	-	-	-	-
Harvesting	5.68	12.81	19.32	09.39	9.05	28.68	28.68	14.73	59.33	58.31	48.45	56.87
Total	14.79	34.69	49.77	24.87	28.91	71.32	87.81	46.06	95.47	105.59	76.43	85.20
<b>Machine Labour (hours)</b>												
Preparatory	1.8	4.39	7.59	4.83	2.86	6.34	11.36	6.26	58.89	44.42	49.67	29.61
Inter-cultivation	-	-	-	-	3	2.36	3.92	2.70	-	-	-	-
Harvesting	2.43	4.45	8.12	4.85	3.5	6.89	12.6	6.59	44.03	54.83	55.17	35.88
Total	4.23	8.84	15.71	9.68	9.36	15.59	27.88	15.55	121.28	76.36	77.47	60.64
<b>Human Labour (man days)</b>												
Preparatory	12.52	29.66	47.59	21.64	17.24	36.98	53.36	27.36	37.70	24.68	12.12	26.43
Plants & planting	17.82	41.5	59.18	29.81	24.84	50.38	69.05	37.78	39.40	21.39	16.68	26.74
Fertilizer & pesticides	2.07	5.73	9.73	4.04	2.84	8.03	12.45	5.51	37.20	40.14	27.15	36.39
Inter-cultivation	-	-	-	-	11.81	20.99	29.91	16.64	-	-	-	-
Harvesting	27.49	64.51	92.45	46.24	38.59	85.31	120.13	62.21	40.38	32.24	30.14	34.54
Total	59.99	141.4	208.95	101.73	95.32	201.69	284.9	149.5	59.13	42.64	36.35	46.96
Year	2007-08				2008-09				Percentage change			
<b>Periyanaickenpalayam</b>												
<b>Bullock Labour (in pair days)</b>												
Preparatory	9.31	14.88	23.13	13.3	8.66	18.92	21.04	13.3	-6.98	27.15	-9.04	0
Inter-cultivation	-	-	-	-	4.35	7.5	17.33	7.68	-	-	-	-
Harvesting	3.49	4.77	9.86	5.28	3.80	5.56	12.5	6.06	8.88	16.56	26.77	14.77
Total	12.8	19.65	32.99	18.58	16.81	31.98	50.87	27.04	31.33	62.75	54.20	45.53
<b>Machine Labour (hours)</b>												
Preparatory	2.88	3.47	14.4	6.70	4.22	4.95	16.48	7.92	46.53	92.65	14.44	18.21
Inter-cultivation	-	-	-	-	1.95	1.88	2.48	2.16	-	-	-	-
Harvesting	3.11	4.15	7.05	5	3.38	5.65	8.8	5.81	8.68	36.14	24.82	16.2
Total	5.99	7.62	21.45	11.7	9.55	12.48	27.76	15.89	59.43	63.78	29.42	35.81
<b>Human Labour (man days)</b>												
Preparatory	11.51	21.62	44.80	20.42	13.78	28.02	48.48	23.84	19.72	29.60	8.21	16.52
Plants & planting	17.47	24.86	54.5	24.65	21.27	31.58	65.23	32.48	21.75	21.03	19.69	31.76
Fertilizer & pesticides	2.61	5.56	7.81	4.28	3.70	7.88	11.46	6.14	41.76	41.73	46.73	43.46
Inter-cultivation	-	0.8	-	0.8	9.86	26.78	38.31	19.16	-	32.47	-	22.95
Harvesting	27.74	42.62	103.96	46.57	36.22	57.06	123.71	58.59	30.57	33.88	18.99	25.81
Total	59.33	95.46	211.07	96.76	84.83	151.32	287.19	140.21	42.98	58.52	36.06	44.90

Source: Field survey, 2009. SF- Small Farmers, MF – Medium Farmers , LF – Large Farmers

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Next to bullock labour, machine labour (tractor) was used for preparatory cultivation and for harvesting in both blocks before and after watershed intervention technology. After watershed intervention technology this was used in inter cultivation also. On an average in the Thondamuthur block machine labour was used for about 9.68 hours per household during farm activities in 2007-08 and this increased to 15.55 hours in 2008-09. The percentage increase in the usage of machine labour was significantly higher among the small farmers (121.28 per cent). In the Periyanaickenpalayam block also the percentage change in machine labour varied from 29.42 per cent for large farmers to 63.78 per cent for medium farmers and to 59.43 per cent for small farmers. The analysis reveals that after watershed intervention technology in both blocks bullock and machine laboures were used in inter cultivation also. In the Thondamuthur block, during 2007-08 labourers were used by the small farmers for 60 man days, by the medium farmers for 141 man days and by the large farmers for 209 days. On an average each farm house hold used 102 man days in farm activities. This had shown an increase in the year 2008-09. Taking all the farm house holds together in Thondamuthur about 150 man days were used per farm house hold in farm activities. The same trend prevailed in Periyanaickenpalayam block also.

### **The Analysis Thus Reveals**

An increase in the employment generation after the use of watershed intervention technology in both the blocks.

Mahnot et. al, (1992), reported that the human labour utilization in treated watershed area was 96 per cent higher than the non treated area. Employment generation due to agricultural, forest and off farm in water shed area was 20268 man days as against 12892 man days of non watershed area. all category of farmers had higher income. Singh et.al, (2006), Panda (2007) and Palanisami et al., (2009) also reported the same findings in their studies.

### **Impact on Livestock**

Livestock plays a dominant role in Indian economy. It is greatly used for the purpose of cultivation, as well as transportation; and the production of milk is more or less considered as a by-product by the Indian cultivators. India posses the largest number of cattle of any country in the world. It's share is 17 per cent of the total livestock population of the world. India has about one-fifth of cattle. The buffalo population of the India is nearly 50 per cent of the world buffalo population. Sheep and goats also constitute nearly one-fifth of the world's total. China comes second with only ten per cent (Agricultural Statistical at a Glance 2002). In the year 2001-02 the total milk production exceeded 84.5 million tonnes. India is the largest milk producing country in the world. Out of the total income generated by the livestock resources in India, about 79 per cent is contributed by milk and milk products. Livestock sector is a prominent sector among agricultural and allied activities in India. The annual rate of growth in GDP from livestock and agriculture had been 7.3 per cent and 3.1 per cent respectively. The details on the livestock owned by the farm households and the net income earned from the livestock are furnished in the following table 2. Cows, buffaloes, bullocks, sheep and goats are maintained as important sources of income for the livelihood of farmer households. Further they also provide the liquid capital resources. It could be seen from the table 2 that the entire farm households in the selected two blocks have cows and buffaloes. On an average each household has about 3 units of cows and buffaloes in

**Table 2: Impact on Livestock in Selected Study Blocks**

Farmers Particulars	2007 -2008				2008 – 2009				Percentage Change			
	SF	MF	LF	ALL	SF	MF	LF	ALL	SF	MF	LF	ALL
<b>THONDAMUTHUR</b>												
<b>Cows and buffaloes</b>												
Number owning	140	88	22	250	140	88	22	250	-	-	-	-
Average owned	2.98	2.99	2.72	2.88	4.01	3.84	3.72	3.92	34.56	28.43	36.26	36.11
Milk yield (litre)	15.84	15.47	16.45	15.76	22.86	22.73	23.50	22.87	44.32	46.93	42.86	45.11
Average net income (Rs)	36898	35640	37759	36535	72464	70507	73901	71906	96.39	80.21	90.43	96.81
<b>Bullocks</b>												
Number owning	140	88	22	250	140	88	22	250	-	-	-	-
Average owned	4.7	4.64	4.59	4.67	6.00	5.86	5.95	5.95	27.66	26.29	29.63	27.41
<b>Sheep</b>												
Number owning	3	2	3	8	3	2	3	8	-	-	-	-
Average owned	0.08	0.16	0.55	0.15	0.14	0.20	0.68	0.21	7.5	27.5	23.64	31.65
Average net income (Rs)	1483	4013	1800	2788	2750	5825	2750	4288	85.43	45.15	52.78	53.80
<b>Goat</b>												
Number owning	140	88	22	250	140	88	22	250	-	-	-	-
Average owned	13.29	13.76	16.36	13.71	19.06	20.34	22.91	19.85	43.42	667.50	40.04	44.78
Average net income (Rs)	9825	9454	11598	9850	13693	14694	16923	14329	39.37	55.43	45.98	45.47
<b>PERIYANAICKENPALAYAM</b>												
<b>Cows and buffaloes</b>												
Number owning	148	50	52	250	148	50	52	250	-	-	-	-
Average owned	3.54	3.18	4.34	3.64	4.56	4.18	5.34	4.65	28.81	31.45	23.27	27.75
Milk yield (litre)	16.32	15.56	16.04	16.11	23.00	21.64	22.25	22.59	41.11	39.04	38.72	40.22
Average net income (Rs)	39255	37398	31707	37108	71463	70048	63072	69241	82.05	87.30	98.92	86.59
<b>Bullocks</b>												
Number owning	148	50	52	250	148	50	52	250	-	-	-	-
Average owned	3.67	4.54	3.98	3.79	4.86	5.54	4.98	4.88	32.43	22.03	25.13	28.76
<b>Sheep</b>												
Number owning	9	8	7	24	9	8	7	24	-	-	-	-
Average owned	0.74	1.68	1.73	1.14	1.05	2.4	2.12	1.54	41.89	42.86	22.54	35.09
Average net income (Rs)	9639	6394	8657	8271	14783	9306	11150	11898	53.37	45.54	28.80	43.85
<b>Goat</b>												
Number owning	148	50	52	250	148	50	52	250	-	-	-	-
Average owned	16.20	13.77	16.78	15.87	23.55	21.18	23.7	23.14	45.37	53.81	41.24	45.80
Average net income (Rs)	11139	7161	11416	10454	18854	12293	17421	17331	6926	71.67	52.60	65.78

Source: Field survey, 2009., SF- Small Farmers, MF – Medium Farmers , LF – Large Farmers.



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Thondamuthur block and about 4 units in the Periyanaickenpalayam block before the watershed intervention technology were implemented in 2007-08. After the implementation of watershed intervention technology the average number of cows and buffaloes per household in both the blocks have increased substantially. This has increased from 3 to 4 in the Thondamuthur block and from 4 to 5 in the Periyanaickenpalayam block. The farmers group wise analysis reveals that the percentage increase in the number of cows and buffaloes owned by a household ranged from 28.43 per cent for the medium farmers in the Thondamuthur block to 36.26 per cent for the large farmers in the same block. The percentage increase for the small farmers was 34.56.

In the Periyanaickenpalayam block, the percentage change in the number of the cows and buffaloes owned per household was the lowest of 23.27 per cent for the large farmers to the highest of 31.45 per cent for the medium farmers. A substantial increase was seen in the milk yield from cows and buffaloes in the two blocks after the watershed intervention technology. On an average in the Thondamuthur block, the average milk yield was 15.76 litres in 2007-08 and this has increased to 22.87 litres in 2008-09. The corresponding figures for the Periyanaickenpalayam block were 16.11 litres and 22.59 litres respectively. After deducting the cost in maintaining the cows and buffaloes the average net income from these two sources were calculated and are given in the above table. The percentage change in the net income after the watershed intervention technology was significantly high in both blocks exceeding 80 per cent. The average net income earned from cows and buffaloes had increased from Rs. 36,535 in 2007-08 to Rs. 71,906 in 2008-09 in the Thondamuthur block. The corresponding figures for the Periyanaickenpalayam block were Rs. 37,108 and Rs. 69,241 respectively.

All the farmers in both the blocks own bullocks in their farms. This figure increased from about 5 bullocks per household in 2007-08 to 6 in 2008-09 in the Thondamuthur block. In the Periyanaickenpalayam block the increase was from about 4 to 5 bullocks per farm household. It could be seen that only 3.2 per cent in the Thondamuthur block and 9.6 per cent of the farmers in the Periyanaickenpalayam block own sheep. The net income from sheep rearing was high for the medium farmers (Rs. 4,013 and Rs. 5,825) in the Thondamuthur block. In the Periyanaickenpalayam block, the net income from sheep was high among the small farmers (Rs. 9,639 and Rs. 14,783) closely followed by the large farmers (Rs. 8,657 and Rs. 11,150) respectively.

Goat rearing was carried out by all the farmers in both the blocks. On an average each household own about 14 goats in the Thondamuthur block and about 16 goats in Periyanaickenpalayam block before watershed intervention technology was adopted. In 2008-09, this had increased to about 20 goats per farm household in the Thondamuthur block and about 23 goats in the Periyanaickenpalayam block. The average net income had shown an increase in both the blocks in 2008-09. The percentage change in net income from goat in the Thondamuthur block in the year 2008-09 was 45.47 and Periyanaickenpalayam block 65.78. The analysis reveals the positive impact of watershed intervention technology on the farm households to maintain livestock in their farms to derive additional income. It further reveals that the farm households in both the blocks maintain milch animals to derive additional income for their livelihood. Additional income generated from milch animals was also substantially high.

The view of Ramappa et. al, (2008), Shiyani et al. (2002) supported the above findings. They reported that after watershed development programme the number of animals owned increased significantly.

**Table 3: Annual per Household Farm Income in the Study Blocks (in rs)**

Farmers Particulars	Thondamuthur( 2007-08)				Periyanaikenpalayam (2007-08)			
	SF	MF	LF	ALL	SF	MF	LF	ALL
Crop income	50,6 47	1,34, 550	2,06,2 05	93,87 0	69,52 2	1,27,65 9	2,63,138	1,21,422
Livestock income	53,2 86	81,19 6	91,04 8	66,43 3	70,62 9	62,696	70,235	68,960
Total farm income	1,03, 944	2,15, 746	2,92,2 53	1,60,3 03	1,40,1 51	1,90,35 5	3,33,373	1,90,382
Per capita income	43,6 34	77,73 0	63,31 4	57,36 8	64,64 4	68,651	95,803	71,926
<b>Thondamuthur ( 2008-09)</b>					<b>Periyanaikenpalayam (2008-09)</b>			
Crop income	91,3 13	2,22, 390	3,40,4 09	1,59,3 73	1,13,8 50	1,90,72 4	3,31,310	1,74,455
Livestock income	96,4 11	1,31, 359	1,46,2 58	1,13,0 99	1,19,1 32	1,03,85 9	1,14,812	1,15,179
Total farm income	2,02, 872	3,37, 220	4,56,3 98	2,72,4 73	2,32,9 84	2,94,58 3	4,46,112	2,89,634
Per capita income	85,4 26	1,19, 780	95,38 0	98,39 4	1,07,7 52	1,05,78 9	1,26,721	1,11,305
<b>Change in percentage</b>								
Crop income	80.2 9	65.28	65.08	69.78	63.76	49.40	25.90	43.68
Livestock income	80.9 3	61.78	60.64	70.24	68.67	65.65	63.47	67.02
Total farm income	95.1 9	56.30	56.17	69.97	66.24	54.75	33.82	52.13
Per capita income	95.7 8	54.09	50.65	71.51	66.69	54.09	32.27	54.75

**Source:** Field survey, 2009.SF- Small Farmers, MF – Medium Farmers, LF – Large Farmers.

### Impact on income

Irrigation facilities play a dominant role in determining the crop of a region. It can change the pattern of crops. Assured water supply will enable the farmers to have two or three crops in a year. As a result of which, the farm income is high. The farm income derived by the farmers includes income from crop cultivation and income from livestock maintenance as shown in the table 3.

The average annual crop income across the farmers reveals that it was high among the large farmers followed by medium farmers and small farmers. Per house hold crop income was Rs.93,870 in 2007-08 in the Thondamuth ur block. This increased to Rs.1,59,373 in 2008-09, registering an annual income increase of 69.78 per cent. The crop income has significantly increased among the small farmers from Rs.50,647 to Rs.91,313 in 2008-09 with an increase of 80.29 per cent. Income from livestock has increased from Rs.66,433 in 2007-08 to Rs.11,3,099 in 2008-09 with an increase of 70.24 per cent. Here also the small farmers had realized a significant increase in the live stock income from Rs.53,286 in 2007-08 to Rs.96,411 in 2008-

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09. The per household farm income has significantly increased among the small farmers in the Thondamuthur block with the percentage change in per capita income being 95.78.

In the Periyanaickenpalayam block also a similar trend prevailed. The per farm household annual crop income across the farmers reveals that, it was high among the large farmers followed by medium and small farmers. Per farm household crop income has increased from Rs.1, 21, 422 in 2007-08 to Rs.1, 74, 455 in 2008-09, with an increased annual income of 43.68 per cent. The crop income per farm household increased remarkably among the small farmers from Rs.69, 522 in 2007-08 to Rs.1,13,850 in 2008-09 with an increase of 63.76 per cent. Income from livestock has also significantly increased from Rs.68, 960 in 2007-08 to Rs.1, 15,179 in 2008-09; with an increase of 67.02 per cent. The small farmers have shown an increase in the livestock income from Rs.70, 629 in 2007-08 to Rs.1, 19, 132 in 2008-09. Per capita income has increased from Rs. 71,926 in 2007-08 to Rs. 1,11,305 in 2008-09, with an increase of 55 per cent. The analysis reveals the positive impact of watershed intervention technology on the farm household income in both the study blocks. Palanisami et.al, (2005), observed that the watershed intervention was found to help the rural farm households in enhancing their income level.

### **Impact on consumption Expenditure**

The pattern of per farm household consumption expenditure of the selected farm households across the different types of farmers in the two selected blocks is given in the following table 4. In both the blocks the monthly household expenditure had shown an increase after using the watershed intervention technology. In the Thondamuthur block, the monthly household expenditure was Rs.1,347 in 2007-08 and Rs. 1,777 in 2008-09. The data further reveals that the percentage expenditure spent on food items has declined among the small and medium farmers. Before the watershed intervention technology was adopted the percentage of food expenditure was 47.40 for the small farmer and 43.71 for the medium farmers. This has declined to 41.94 per cent and 42.39 per cent respectively in 2008-09. Among the food items, about 20 per cent was spent towards rice. In the case of non-food expenditure the households spent 10 to 12 per cent towards fuel.

In the Periyanaickenpalayam block also a similar expenditure pattern prevailed. On an average the monthly household consumption expenditure was Rs. 1,264 in 2007-08, which increased to Rs.1,607 in 2008-09. The percentage expenditure spent on food items had declined for the small farmers from 51.71 per cent to 49.42 per cent and for medium farmers from 43.52 per cent to 42.46 per cent and for large farmers from 42.19 per cent to 39.58 per cent. The major non-food expenditure was on fuel.

Across the farmer groups it was seen that the household monthly expenditure was high among the large farmers in 2007-08, but in the year 2008-09 there was a perceptual increase in the monthly household consumption expenditure for small farmers from Rs 1059 to Rs. 1850. In the Periyanaickenpalayam block the monthly household consumption expenditure was high among the Large Farmers followed by medium farmers and small farmers both in 2007-08 and 2008-09.

Similar observations were made by Palanisami and Suresh Kumar (2004), in which it was stated that per month per farm household consumption expenditure worked out to Rs. 1620.16 and Rs.1363.20 for watershed treated and control villages respectively.

**Table 4: Monthly Consumption Expenditure in Selected Blocks**

Sl. No	Farmers Particulars	2007-08				2008-09			
		S F	MF	LF	ALL	SF	MF	LF	ALL
<b>Thondamuthur</b>									
<b>FOOD EXPENDITURE (in Rupees)</b>									
<b>1</b>	Rice	217 (20.49)	321 (20.48)	392 (17.04)	269 (19.97)	305 (16.49)	312 (18.92)	331 (18.77)	310 (17.44)
<b>2</b>	Wheat	47 (4.44)	68 (4.34)	81 (3.52)	57 (4.23)	84 (4.54)	76 (4.61)	78 (4.28)	81 (4.56)
<b>3</b>	Cereals	41 (3.87)	43 (2.74)	63 (12.74)	44 (3.27)	63 (3.40)	46 (2.79)	42 (2.31)	55 (3.09)
<b>4</b>	Pulses	37 (3.49)	45 (2.87)	77 (3.35)	43 (3.19)	66 (3.57)	39 (2.37)	32 (1.76)	54 (3.04)
<b>5</b>	Oils & spices	75 (7.08)	94 (6.00)	131 (5.69)	86 (6.38)	112 (6.05)	107 (6.49)	127 (6.97)	111 (6.25)
<b>6</b>	Vegetables	53 (15.00)	72 (4.59)	98 (4.26)	63 (4.68)	88 (4.76)	78 (4.73)	96 (5.27)	85 (4.78)
<b>7</b>	Meat, chicken & Fish	32 (3.02)	43 (12.74)	76 (3.30)	40 (2.97)	58 (3.14)	41 (2.49)	45 (2.47)	51 (2.87)
<b>8</b>	<b>Total food Expenditure (1 to 7)</b>	<b>502 (47.40)</b>	<b>685 (43.71)</b>	<b>919 (39.94)</b>	<b>603 (44.77)</b>	<b>776 (41.94)</b>	<b>699 (42.39)</b>	<b>752 (41.27)</b>	<b>747 (42.04)</b>
<b>NON - FOOD EXPENDITURE (in Rupees)</b>									
<b>9</b>	Fuel	125 (11.80)	191 (12.19)	257 (11.17)	160 (11.88)	214 (11.57)	209 (12.67)	213 (11.69)	212 (11.93)
<b>10</b>	Clothing	57 (5.38)	96 (6.13)	156 (6.78)	80 (15.94)	107 (5.78)	103 (6.25)	115 (6.31)	106 (5.97)
<b>11</b>	Communication	78 (7.36)	126 (8.04)	216 (9.39)	106 (7.89)	141 (7.62)	122 (7.40)	143 (7.85)	135 (7.60)

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Table 4: Continuation..

Sl.No	Farmers Particulars	2007-08				2008-09			
		S F	MF	LF	ALL	SF	MF	LF	ALL
<b>NON- FOOD EXPENDITURE (in Rupees)</b>									
12	Shelter	67 (6.33)	85 (5.42)	92 (4.000)	75 (5.57)	83 (4.49)	100 (6.06)	103 (5.65)	91 (5.12)
13	Electricity	41 (3.87)	74 (4.72)	112 (4.87)	59 (4.38)	69 (3.73)	72 (4.37)	91 (4.99)	72 (4.05)
14	Education	37 (3.49)	71 (4.53)	195 (8.47)	63 (4.68)	86 (4.65)	65 (3.94)	97 (5.32)	80 (4.50)
15	Health	77 (7.27)	122 (7.79)	108 (7.30)	101 (7.50)	155 (8.38)	89 (5.40)	108 (5.93)	128 (7.20)
16	Cosmetics	29 (2.74)	43 (2.74)	86 (3.74)	39 (2.89)	65 (3.51)	46 (2.79)	49 (2.69)	57 (3.21)
17	Social obligation	29 (2.74)	45 (2.87)	38 (2.91)	38 (2.82)	61 (3.30)	50 (3.03)	51 (2.80)	56 (3.15)
18	Festivals	45 (4.25)	73 (14.66)	120 (5.21)	61 (4.53)	92 (4.97)	94 (5.70)	99 (5.43)	93 (5.23)
19	<b>Total non food Expenditure (9 to 18)</b>	<b>557 (52.60)</b>	<b>882 (56.29)</b>	<b>1382 (60.06)</b>	<b>744 (55.23)</b>	<b>1074 (58.05)</b>	<b>950 (57.61)</b>	<b>1070 (58.73)</b>	<b>1030 (57.96)</b>
20	Total household Expenditure (8+19)	1059 (100)	1567 (100)	2301 (100)	1347 (100)	1850 (100)	1649 (100)	1822 (100)	1777 (100)
<b>Periyanaickenpalayam</b>									
<b>FOOD EXPENDITURE (in Rupees)</b>									
1	Rice	267 (26.81)	277 (19.10)	406 (21.93)	298 (23.58)	309 (22.75)	328 (18.38)	443 (19.23)	341 (21.22)
2	Wheat	37 (3.71)	50 (3.45)	61 (3.30)	45 (3.56)	56 (4.30)	69 (3.87)	82 (3.56)	64 (3.98)
3	Cereals	28 (2.81)	46 (3.17)	34 (1.84)	33 (2.61)	36 (2.77)	55 (3.08)	42 (1.82)	41 (2.55)
4	Pulses	27 (2.71)	50 (3.45)	35 (1.89)	34 (2.69)	37 (2.84)	59 (3.30)	46 (1.99)	44 (2.74)
5	Oils & spices	80 (8.03)	100 (6.90)	122 (6.59)	93 (7.36)	104 (7.99)	121 (6.78)	150 (6.51)	116 (7.22)
6	Vegetables	50 (5.02)	67 (4.62)	83 (4.48)	60 (4.75)	67 (5.15)	78 (4.37)	103 (4.47)	77 (4.79)
7	Meat, chicken & Fish	24 (2.41)	40 (2.76)	41 (2.21)	31 (2.45)	33 (2.54)	48 (2.69)	46 (1.99)	39 (2.43)
8	Total food Expenditure (1 to 7)	515 (51.71)	631 (43.52)	781 (42.19)	1593 (46.91)	643 (49.42)	758 (42.46)	912 (39.58)	722 (44.93)

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Sl.No	Farmers Particulars	2007-08				2008-09			
		S F	MF	LF	ALL	SF	MF	LF	ALL
		NON- FOOD EXPENDITURE (in Rupees)							
9	Fuel	105 (10.54)	173 (11.93)	220 (11.89)	142 (11.23)	140 (10.76)	207 (11.60)	288 (12.5)	184 (11.45)
10	Clothing	54 (5.42)	80 (5.52)	104 (5.62)	70 (5.54)	72 (5.53)	100 (5.60)	137 (5.95)	91 (5.66)
11	Communication	62 (6.22)	113 (7.79)	138 (7.45)	88 (6.96)	80 (6.15)	141 (7.90)	174 (7.55)	112 (6.97)
12	Shelter	66 (6.63)	118 (8.14)	144 (7.78)	92 (7.28)	87 (6.69)	139 (7.79)	170 (7.38)	115 (7.16)
13	Electricity	40 (14.02)	75 (5.17)	98 (5.29)	59 (4.67)	51 (3.92)	88 (4.93)	117 (5.08)	72 (4.48)
14	Education	16 (1.61)	67 (4.62)	103 (5.57)	44 (3.48)	23 (1.77)	84 (4.71)	133 (5.77)	58 (3.61)
15	Health	38 (3.81)	54 (3.72)	77 (4.16)	49 (3.88)	60 (4.61)	81 (4.54)	125 (5.43)	78 (4.85)
16	Cosmetics	24 (2.41)	37 (2.55)	44 (2.38)	31 (2.45)	32 (2.46)	48 (2.69)	55 (2.39)	40 (2.49)
17	Social obligation	30 (3.01)	43 (2.97)	54 (2.92)	38 (3.01)	43 (3.30)	57 (3.19)	73 (3.17)	52 (3.23)
18	Festivals	47 (4.72)	59 (4.07)	87 (4.70)	58 (4.59)	70 (5.38)	81 (4.54)	120 (5.21)	83 (5.16)
19	Total non food Expenditure (9 to 18)	481 (48.29)	819 (56.48)	1070 (57.81)	671 (53.09)	658 (50.58)	1027 (57.50)	1392 (60.42)	885 (55.07)
20	Total household Expenditure (8+19)	996 (100)	1450 (100)	1851 (100)	1264 (100)	1301 (100)	1785 (100)	2304 (100)	1607 (100)

Source: Field survey, 2009, SF- Small Farmers, MF – Medium Farmers , LF – Large Farmers, N – number of farmers. Figures in brackets denote percentage to column total.

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### Conclusion

Watershed Intervention Technology plays a significant role in groundwater recharge. These structures enhance soil moisture regime, enrich soil fertility and thereby promote ecological balance through conservation of eco system. Besides, indirect benefits such as livestock development, improved quality of life in rural area on account of employment generation and income, and increased income, cash flow to the farmers and agricultural labourers also would result from watershed development programmes. Livestock plays an important role in the national economy as well as in the socio economic development. Livestock production and agriculture are intrinsically linked to each other, and both crucial for overall food security. Livestock sector is an important livelihood activity for most of the farmers. Livestock plays a dominant role in Indian economy. It is greatly used for the purpose of cultivation, as well as transportation; and the production of milk is more or less considered as a by-product by the Indian cultivators. India posses the largest number of cattle of any country in the world. Watershed intervention technology is plays a vital role in improving the socio-economic conditions of rural masses.

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