TECHNO-SOCIO-ECONOMIC CONSEQUENCES OF NATIONAL WATERSHED DEVELOPMENT PROJECT FOR RAINFED AREAS IN THIRUVANANTHAPURAM DISTRICT

BY
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(98-11-21)

THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN AGRICULTURAL EXTENSION
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM
2000

DECLARATION

I hereby declare that this thesis entitled "TECHNO-SOCIO-ECONOMIC CONSEQUENCES OF NATIONAL WATERSHED DEVELOPMENT PROJECT FOR RAINFED AREAS IN THIRUVANANTHAPURAM DISTRICT" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title, of any other university or society.

Vellayani

Lakshmi. S.

CERTIFICATE

Certified that this thesis entitled "TECHNO-SOCIO-ECONOMIC CONSEQUENCES OF NATIONAL WATERSHED DEVELOPMENT PROJECT FOR RAINFED AREAS IN THIRUVANANTHAPURAM DISTRICT" is a record of research work done independently by Miss. LAKSHMI. S. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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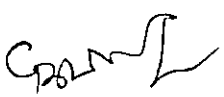

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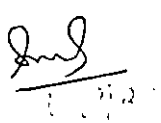

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ACKNOWLEDGEMENT

I, Lakshmi. S., am particularly indebted to Dr. G. Balakrishna Pillai, Professor and Head, Department of Agricultural Extension and chairman of my advisory committee, whose wide reading and experience in and out of the genre and considered critical judgement have influenced several of my choices for inclusion and exclusion herein.

Dr. C. Bhaskaran, Associate Professor, Training Service Scheme, Department of Agricultural Extension and member of my advisory committee, whose enthusiastic support and guidance carried me through a number of rough spots. At every point his creative insights have been provocative and useful.

I am also indebted to Dr. G. Sobhana, Associate Professor, Department of Agricultural Extension and member of my advisory committee for her helpful suggestions and opportune advice.

Dr. Vijayaraghavakumar, Associate Professor, Department of Agricultural Statistics needs special mention for his invaluable help and guidance during the course of my study.

I would also like to express my gratitude to Mr. C. P. Sreekumar, former Assistant Director of Soil Conservation and all the staff of soil conservation department for their invaluable advice and support.

My gratitude extends to Mr.C.E. Ajithkumar, Computer Programmer, Department of Agricultural Statistics, for his timely help especially during the statistical analysis of the data.

Certainly one of the most important acknowledgement would have to be to my friends and colleagues, Parvathy, Sreedaya, Allan, Surendran Sir, Sindhu and Manjjusha not only for discussion, critical commentary and moral support, but also for their patient enthusiasm and companionship, not forgetting the enormous patience and often overlooked contribution of the members of my family.

To all the teaching and non teaching staff, Department of Agricultural Extension, who had been with me during the course of my study, I continue my indebtedness.

I gratefully acknowledge all the respondents for their co-operation, without which my study would perhaps have been incomplete.

I wish to place on record my gratitude to Kerala Agricultural University for awarding me the fellowship for this P.G. Programme.

No acknowledgement would be complete without proper recognition of the role of the person who typesets one's manuscript, in my case Mr. K. Chandrakumar.

Last but not the Least, I thank God for all that He has done for me.

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CHAPTER I

INTRODUCTION

During the early periods of planned development, efforts were by and large directed towards irrigated agriculture in view of serious food shortages and urgent need of self sufficiency in food grains. Development of dryland farming was relegated. The objective of overall food availability in the country has been achieved, but the development process has created and aggravated serious unintended agricultural, socio-economic and ecological imbalances. Indian agriculture mainly depends on stability of crop production in rainfed areas. The rainfed area in the country accounts for 67 per cent of the cropped area contributing 44 per cent of the total food production. The level of crop production in rainfed areas is greatly affected by continuous erosion of soil, low and erratic rainfall, improper cropping pattern and poor crop management practices. The estimated annual target of food production of 240 m.t by 2020 AD would be achievable only if our rainfed croplands develop to their full potential (Dinakar, 1990).

Kerala with undulating topography, heavy and erratic rainfall and the typical agroecological condition is an erosive landscape. The average precipitation of the State is 3125 mm

per year of which 90 per cent is contributed by north-east monsoon and south-west monsoon. Most of the rainwater runs down the hillocks into the major 44 rivers and ultimately to the sea. Eventhough Kerala comes under the high rainfall area, the last few years have witnessed a series of droughts also. This is mainly because of the unscientific water management practices followed.

Out of the total geographic area of 38.86 lakh hectares in Kerala, nearly 50 per cent of the area suffers from the hazards of erosion. Out of this, it is estimated that 9.75 lakh hectares is under serious threat of erosion. To minimise these problems, soil and moisture conservation activities, integrated farming and all other agro-based activities are to be taken up on watershed basis. If a watershed is well managed for surface water, then it is best managed for the other resources.

"For ending the neglect of vast rainfed and dryland areas" the Government of India introduced a programme called National Watershed Development Project for Rainfed Areas (NWDPRA) during the Sixth Plan period. This programme was launched in Kerala during 1991-92 in the Eighth Plan period. The twin objective of the programme includes sustainable production of biomass and restoration of ecological balance in the vast tracts of rainfed areas in the country. It

specifically focus on conservation, upgradation and utilisation of natural endowments in a harmonious and integrated manner, generation of massive employment during the project period and regular employment after the project completion, improvement of production environment and restoration of ecological balance through scientific management of land and rainwater, reduction of inequalities between irrigated and rainfed areas and to enhance cash flow to the rainfed farmers and landless agricultural labourers. This will lead to an efficient management of the land and water resources and thus result in the overall development of the area.

SCOPE OF THE STUDY

In Kerala, 114 watershed areas were selected for implementation of NWDPRA during the Eighth Plan period and these watersheds were completed by the end of the Eighth Plan period. During the Ninth Plan also 114 NWDPRA projects are to be taken up in Kerala for implementation. Twelve watershed areas in Thiruvananthapuram district were selected for the implementation of NWDPRA during the Eighth Plan period (Appendix I) and Ninth Plan period (Appendix II).

There has been enormous criticism on the impact of NWDPRA and problems in implementation. A pilot study conducted by the researcher in Thiruvananthapuram district revealed that there are many problems in the implementation of NWDPRA. No

indepth study on impact of NWDPRA has been conducted in Kerala so far. So a meaningful and indepth study of the treated watersheds under NWDPRA would be very useful to the Department of Agriculture, Soil Conservation Unit, Planning Board and also to the extension agents to review the existing guidelines and make suitable modifications in the operational procedures in NWDPRA. Hence this project proposes to study the technological, social and economic consequences of NWDPRA in selected watershed areas in Thiruvananthapuram district with the following objectives:

1. To find out the relationship and contribution of the selected profile characteristics of farmers of NWDPRA in the adoption of watershed management practices.

2. To study the techno-socio-economic consequences of NWDPRA in Thiruvananthapuram district.

3. To identify the constraints in NWDPRA as perceived by farmers and extension agents.

LIMITATIONS

The study was confined to four watersheds in Thiruvananthapuram district. It was not possible to carryout an indepth study of all watersheds, because it was conducted as a part of the M.Sc. programme of the researcher. In spite of these difficulties, it is expected that the findings of the

study can be of much use for the Department of Agriculture, Soil Conservation Unit, Planning Board and also the extension agents to review the existing guidelines and make suitable modifications in the operational procedures in NWDPRA.

PRESENTATION OF THE STUDY

The study is presented in the following chapters. The first chapter is the "introductory chapter" followed by "Theoretical orientation" presented in the second chapter. The third chapter deals with "research methodology" used in the process of investigation. The fourth chapter is the "results and discussion". The concluding chapter contains "summary and conclusions" and implications of the study.

THEORETICAL ORIENTATION

CHAPTER - II

THEORETICAL ORIENTATION

This chapter provides a proper orientation to the study by associating available research findings with the proposed research problem. The review of previous works attempted in this study may assist in the delineation of new problem areas and may provide a basis for formulating a theoretical framework for the study by which empirical investigation is facilitated. A review of related literature has been organised under the following heads.

2.1 Concept of watershed

2.2 Concept of watershed management

2.3 Contribution and relationship of the selected profile characteristics of the farmers of NWDPRA in the adoption of watershed management practices.

2.4 Techno-socio-economic consequences of watershed management

2.5 Constraints in watershed management.

2.1 Concept of watershed

Kulkarni *et al.* (1980) defined watershed as a drainage area on the earth surface from which runoff resulting from precipitation flows past a single point into a main stream, a river, a lake or an ocean.

Rao (1980) defined watershed as an area which collects the rain water falling on it and allows the water to flow in one or more water courses with a single outlet at the end. It is a geographical separator from adjoining areas.

Sharma and Hooja (1981) referred the farm watershed to an area which has a ridge line on three sides and whose surplus runoff is drained from a drainage point. Watersheds could be as small as 50 hectares in hilly areas and as large as 10,000 hectares or even more. The size of the watershed to be chosen for land development depends upon the objective of land development planning.

Baccongus and Lemit (1982) defined watershed as any sloping surface that sheds water. It implies a body of land bounded by a topographic divide and below by the level at which water drains. Watershed functions by receiving input water from rainfall, storing and releasing it according to the three basic attributes of water namely quality, quantity and timing.

Viswanathan (1982) defined watershed as a body of land, rounded above by ridge and below by the level at which water drains from it. Water enters watershed as precipitation and leaves it as stream flow and flow below ground and through transpiration and evaporation.

Jaiswal *et al* (1985) observed a watershed as an area of land that contributes runoff to a common point. The size of

the watershed can vary from small plot of a farmer to a large river basin. For practical purposes, watersheds of 200 to 500 hectares size have been suggested as units of operation. A watershed is claimed to be the most scientific unit for efficient management of land and water resources as it is basically an agroclimatic unit.

Millette and Sharma (1986) defined a watershed in physical terms, as a hydrological entity and referred to an area above a given drainage point. The total area contributing water flowing into the outlet is the watershed at that outlet.

Nayak (1986) defined watershed as an area having common drainage.

Sivanappan (1991) defined watershed as the area from which the rainwater passes at a particular point. A watershed is synonymous with catchment or basin made up of the natural resources, especially the water, soil and the vegetative factors.

According to Rajan (1998) watershed is an area having land and water draining to a common outlet. It is always bordered with a ridge line.

From the literature it is clear that a watershed is any area above a drainage point. It's area ranges from small plot of a farmer to large areas. Watershed is a hydrological

unit for maximum utilisation of natural resources like soil, water and vegetation whereby the production can be maximised.

2.2. WATERSHED MANAGEMENT

Purushottam (1980) defined watershed management as the development and management of the watershed resources for achieving optimum production.

Russel (1981) defined watershed management as the control of water and transfer from the upper to the lower parts of a river's catchment area, thus it can directly affect all the people living in the whole region.

Perino (1982) stated that watershed management will serve as the umbrella which shall co-ordinate all the disciplines and activities within the watershed. He also emphasized that the areas to be considered will start from the ridge line down to the streams or rivers, then to the arable lands down to the mangrove areas and the coastal waters and estuaries.

Jayakumar (1987) defined watershed management as principally the management of the precipitation in such a way that the maximum use may be made of the water with the minimum loss and the minimum loss to the watershed.

Srivastava (1987) reported that watershed management programme should combine socio-economic as well as ecological

concerns. Interfarm improvements and intra farm measures such as improvement in tillage, cropping systems, fertilizer management etc. should go hand in hand.

Rajan (1998) defined watershed management as the analysis, protection, repair, utilisation and maintenance of the drainage basins for optimum control and conservation of water with due regard to other resources.

It may be observed from the above review that watershed management has a holistic approach for the total development of an area. It has a total approach for the conservation, development and maintenance of the land and water resources in a watershed for the sustained production.

2.3 Contribution and relationship of the selected profile characteristics of the farmers of NWDPRA in the adoption of watershed management practices

2.3.1 Farm size

Senthil (1983) observed that a little over half (51.82 per cent) of the respondents operated big sized farm while 31.82 per cent operated medium sized holdings and 16.36 per cent operated small sized holdings.

Balasubramanian (1985) reported that most of the respondents (41.33 per cent) were owning small sized farms. A little over one-third (35.33 per cent) of respondents were

medium farmers, a little less than one-sixth (15.34 per cent) of respondents were big farmers and about 8.00 per cent of respondents were marginal farmers.

Senniappan (1987) found that majority of the respondents (51.67 per cent) were owning big sized farms followed by medium sized farms (41.67 per cent). Only 6.66 per cent of the respondents were owning small sized farms.

Venugopalan (1989) inferred that positive and significant relationship was found to exist between farm size and adoption of dryland technologies.

Anonymous (1993) reported that majority of the trainees (81.00 per cent) had farm size less than one hectare and 19.00 per cent of the trainees owned land between one and two hectares.

Anusuya (1997) found that majority of the respondents were big farmers (67.50 per cent) followed by small farmers (30.00 per cent). Only 2.50 per cent of the respondents were marginal farmers.

Omprakash *et al* (1998) in their study of constraints in adoption of soil conservation measures by the farmers of Doon valley observed that majority of the farmers were having small sized land holdings.

2.3.2 Technical guidance

Pillai (1978) observed that inadequate technical guidance, non-availability of planting materials and inadequate financial assistance were the important reasons for the non-adoption of Agrostology measures.

Singh (1981) reported that personal guidance on better farming was found to play a crucial role in determining the level of fertilizer use by the farmers and found significant association between personal guidance and adoption.

Desai (1981) had also clearly brought out a positive relationship between extension guidance and adoption of improved cotton practices.

The reasons for non-adoption of recommended practices in the dryland agricultural technology as stated by Baskaram and Praveena (1982) were lack of knowledge, lack of guidance, high cost, risky, lack of time, lack of conviction, no felt need, lack of credit, poor weather, not profitable, requires high skill, work done by government agency, unsatisfactory experience, no experience, less fodder, incidence of pests and diseases and non-availability of inputs.

Waghmare and Pandit (1982) found that lack of knowledge, technical guidance and inputs and small size of holdings were the important constraints in adoption of wheat technology by tribal farmers of Madhya Pradesh.

According to Garforth (1993) and Smith (1994) the extension agent is no longer seen as the expert who has all the useful information and technical solutions. The scale of extension support required is thus often larger than individual farm and extension workers need new skills of negotiation, conflict resolution and the nurturing of emerging community organisations.

Riddell and Robinson (1995) observed that the quality and effectiveness of the management of project staff constitute one of the key factors playing a major role in project effectiveness. The caliber of the staff, their commitment to its philosophy, and overall objectives and their degree of empathy with participants played an important part in meeting objectives.

The above findings reveals that majority of the respondents lack technical guidance.

2.3.3 Availability of low cost watershed technologies

Pillai (1978) reported that the reasons for the non-adoption of engineering measures of soil conservation were lack of credit facilities, high initial cost of the techniques, non-availability of stones in the locality and inadequate technical assistance.

Sripal (1981) reported that the factors responsible for the non-adoption of improved practices in cotton

cultivation were: not in practice, not profitable, high cost, not known and no effect. He stated that the main problem was the high rise in the price of inputs.

It could be seen from the above studies that availability of low cost technologies is an important factor for the adoption of various practices.

2.3.4 Observability of the innovation

Havens and Rogers (1961) observed a positive relationship between the observability of the innovation and its adoption.

Rogers (1983) opined that the characteristics of innovations, as perceived by individuals, helped to explain their different rate of adoption. He also opined that innovations that are perceived by receivers as having greater observability would be adopted more rapidly than other innovations.

It was found that the perception of the farmers about observability of the innovation influence their rate of adoption.

2.3.5 Complexity of the innovation

Singh (1965) reported that complexity of the innovation was not significantly related to adoption of practices.

Danda and Danda (1968) observed no significant relationship between complexity and adoption of the innovation.

Rogers (1983) reported that innovations that are perceived by receivers as having less complexity would be adopted more rapidly than other innovations.

2.3.6 Attitude towards watershed development programmes

Srinivasan (1981) summarised based on the study on dryland technology that the attitude of dryland farmers towards dryland technologies was observed to be on the affirmative side. He reported that 45.00 per cent of the marginal farmers, 43.00 per cent of the small farmers and 50.00 per cent of the big farmers showed most favourable attitude towards dryland technologies.

Menon *et al* (1983) in the study on success or failure of development schemes revealed that in success areas, majority of the beneficiaries were having a favourable attitude towards dryland, soil and water conservation schemes.

Mary (1990) in the study on aspirations and attitude of farm youths towards agriculture concluded that half (50.00 per cent) of the youths belonging to small farm families had more favourable attitude towards agriculture and 30.67 per cent of the youths belonging to big farm families had favourable attitude towards agriculture.

Lakshmi (1992) observed positive and significant association between attitude towards improved dryland agricultural technology and adoption.

Savithri (1992) in her study on attitude of farm women towards dryland technologies reported that little more than half (54.61 per cent) of the farm women were found to have less favourable attitude followed by 35.33 per cent with favourable attitude. Only less percentage of respondents (10.00 per cent) possessed more favourable attitude towards dryland technologies.

Kamaraj (1996) reported that 45.00 per cent of the respondents were found to possess less favourable attitude towards dryland technology, followed by 32.50 per cent in favourable category. More favourable attitude towards dryland technologies was seen among 22.50 per cent of respondents.

Sañkaran (1997) concluded that majority of the men respondents (43.33 per cent) had favourable attitude, whereas majority of women respondents (53.33 per cent) had less favourable attitude towards integrated watershed development programme.

The above findings reveals that majority of the farmers have a favourable attitude towards development programmes.

2.3.7 Extension participation

Reddy (1983) found that extension participation is associated with adoption behaviour of the farmer.

Badagoankar (1983) reported that there existed no relationship between extension participation and adoption behaviour.

Nataraju and Gowda (1986) and Pandurangaiah (1987) reported a positive relationship between extension participation and adoption behaviour.

It could be derived from the above findings that the relationship of extension participation and adoption behaviour varies with different conditions.

2.3.8 Mass media exposure

Rajapandi (1983) reported that mass media exposure was positively and significantly related to the extent of adoption by both wetland and dryland farmers.

Masood (1987) in the study with dryland blackgram growers observed that majority (41.66 per cent) of the farmers were found to have high level of exposure to mass media whereas more than one-third (34.17 per cent) of the farmers had medium level of exposure. Low level of mass media exposure was seen with 24.17 per cent of the respondents.

Sophia (1991) observed that nearly three-fifth (62.22 per cent) of the dryland farmers possessed moderate level of mass media exposure, followed by 20.00 per cent and 17.78 per cent with low and high levels of mass media exposure respectively.

Savithri (1992) concluded that most (62.27 per cent) of the farm women were found to have high level of exposure to mass media followed by medium and low levels with 24.00 per cent and 13.73 per cent respectively.

Sivanandham (1992) while studying the impact analysis of percolation ponds in a semidry farming system revealed that a majority of the farmers (56.50 per cent) had medium level of mass media exposure followed by high (25.50 per cent) and low (18.00 per cent) levels.

Chandran (1993) has stated that 42.00 per cent of sunflower cultivating dryland farmers had low level of exposure to mass media. Medium and high level of mass media exposure were seen among 34.50 per cent and 23.50 per cent respectively.

Kamaraj (1996) observed that majority (54.17 per cent) of the dryland farmers had a moderate level of exposure to mass media sources, followed by 27.50 per cent with low level of media exposure. High level exposure was reported for less than one-fifth (18.33 per cent) of the respondents.

Sankaran (1997) reported in his study on impact of integrated watershed development programme on farmer beneficiaries that majority of the respondents (50.00 per cent and 68.33 per cent men and women respectively) had low level of mass media exposure.

It could be inferred that the extent of mass media exposoure of the respondents varied at different conditions.

2.3.9 Economic motivation

Nanjaiyan (1985) observed that an overwhelming majority of small farmers (63.00 per cent) had medium level of economic motivation and nearly one-fifth of them (19.50 per cent) had low level of economic motivation. Only 17.50 per cent of small farmers were found to have high level of economic motivation.

Masood (1987) found that 40.00 per cent of the total dryland blackgram growers had high level of economic motivation and almost an equal percentage (39.17 per cent) of respondents had low level of economic motivation.

Rathinasabapathi (1987) observed that majority of the respondents had medium level (55.48 per cent) and nearly one-fourth of the respondents had low level (20.31 per cent) of economic motivation.

Juliana (1989) found that 47.50 per cent of big farmers followed by an equal percentage (37.50 per cent) of marginal and small farmers had a high level of economic motivation.

Balavatti and Sundarasamy (1990) in their study on adoption of dryland practices observed that economic motivation has a non-significant association with adoption.

Leemarose (1991) reported that 40.00 per cent of the chilli growers possessed medium level of economic motivation. The high and low levels were seen at equal proportion (30.00 per cent each). Sophia (1991) observed that nearly half (46.67 per cent) of the dryland farmers had medium level of economic motivation, followed by 28.29 per cent and 24.44 per cent with low and high levels respectively.

Chockalingam (1994) stated that nearly half of the dryland farmers (48.33 per cent) had medium level of economic motivation, followed by low (42.50 per cent) and high (9.17 per cent) levels.

Kamaraj (1996) observed that more or less equal percentage of respondents were seen among the three levels of economic motivation. Moderate level of economic motivation category had a slight edge (36.67 per cent) over others (32.50 and 30.83 per cent) in low and high levels respectively.

Sankaran (1997) pointed out that majority of men respondents (43.33 per cent) had medium level of economic motivation whereas majority of women respondents (46.67 per cent) had low level of economic motivation.

2.3.10 Training participation

Rao (1989) found that about 90.00 per cent of IRDP beneficiaries required training and they were not provided with the same.

Lakshmi (1992) revealed through an evaluation of watershed that training had a positive and significant association with adoption.

Ponmani (1993) revealed through her study on rural women's participation in the training programmes that majority of the respondents did not attend any training prior to the participation of studied training programmes.

Uma (1994) found that majority of the respondents (83.33 per cent) did not attend any training before participating in the TRYSEM programme and the training studied by her was the first training attended by them. Among the remaining, majority (14.17 per cent) were found participated in one training.

Sivarevathi (1996) in her study on participation of farm women in development programme concluded that majority of

the farm women (83.33 per cent) did not attend any training. About one tenth (9.17 per cent) were found to have attended one training and only 2.50 per cent attended two trainings. None of them attended more than two trainings.

Sankaran (1997) reported that majority of the respondents in both men and women category did not attend any of the agriculture oriented training (28.33 and 48.33 per cent men and women respectively). Only 1.67 per cent of the men respondents attended four trainings. Since there is no training component under the integrated watershed development programme, the participation in the training programmes was low among the respondents.

It could be concluded from the above findings that majority of the respondents did not attend any training.

2.3.11 Knowledge in watershed planning

Baskaram and Praveena (1982) in their study on adoption of improved dryland agricultural technologies in an integrated dryland development project found that majority of the respondents had high level knowledge on off-season tillage, soil mulching, mid-season correction, correct time of sowing, improved seed, correct seed rate, spacing, weeding and intercultural operations. Medium level of knowledge was observed for the practices like fertilizer use, intercropping and sequence cropping. Low level of knowledge was seen for the

practices like seed treatment, spraying urea, chemical control of weeds, plant protection measures and improved agricultural implements.

Krishnamoorthy (1984) in his study on transfer of dryland technology, acceptance and constraint analysis propounded that 52.50 per cent of the big farmers were found to have high level of knowledge whereas 50.00 per cent and 72.50 per cent of the small and medium farmers were found to possess medium level of knowledge.

Eswarappa (1991) found that majority of land treatment practices were known to the farmers in the watershed and concluded that the farmer's knowledge was fairly high in respect of these land treatment practices. However, few practices which were not common like bench terracing, land reclamation and broad-bed-furrow were not known to majority of the farmers. The knowledge on crop production practices and dryland horticulture practices tend to be low among farmers. There was fairly higher knowledge on forestry practices, improved implements and alternate land use system.

Sophia (1991) in her study with dryland farmers propounded that more than half (58.89 per cent) of the dryland farmers had higher overall knowledge, followed by 27.78 and 13.33 per cent with medium and low levels of knowledge respectively.

Umale *et al.* (1991) in their study on agro-forestry by farmers found that majority of the farmers in the Akola district of Maharashtra had medium level of knowledge about the tree species recommended for agro-forestry programme.

Samuel and Illango (1992) observed in the study on social forestry beneficiary perspective that majority of beneficiaries (67.00 per cent) were having prior knowledge about the types of seedlings suitable for different types of soils.

Savithri (1992) through her study on knowledge of dryland technologies revealed that half (50.67 per cent) of the farm women were found to possess medium level, followed by high (30.00 per cent) and low (19.33 per cent) knowledge levels respectively.

Chandran (1993) in his study on spread and acceptance of sunflower among dryland farmers concluded that 36.00 per cent of the dry land farmers found to possess high knowledge level and more or less equal (33.00 and 31.00 per cent) percentage were observed in medium and low level categories.

Reddy and Ratnakar (1993) in the study on knowledge about improved mango cultivation practices reported that majority of the respondents (67.50 per cent) possessed medium level of knowledge, followed by high (23.83 per cent) and low

(9.17 per cent) knowledge levels on improved mango cultivation practices.

Tharaneetharan (1993) in his study on knowledge and adoption of agroforestry practices revealed that more than one third of the farmers (36.13 per cent) were seen in high knowledge category, followed by low (33.10 per cent) and medium (30.77 per cent) categories.

Lakshmi and Manoharan (1994) in their study on knowledge on dryland technology reported that 80.00 per cent of the big farmers, 63.38 per cent of the medium farmers, 43.33 per cent of the small farmers and 36.67 per cent of marginal farmers had high knowledge on soil and moisture conservation practices.

Rathakrishnan *et al.* (1994) found that 46.67 per cent of the rainfed groundnut growers had knowledge on recommended seed rate and 41.67 per cent of respondents had knowledge on gypsum application and 40.00 per cent on fertilizer application.

Kamaraj (1996) in his study on knowledge of technologies for rainfed crops concluded that there was an equal distribution of respondents in low and moderate levels (39.17 per cent), followed by 21.66 per cent in high knowledge level.

Manjunath *et al.* (1996) in a study on knowledge of farmers on dry farming practices concluded that 53.00 per cent of the respondents belonged to medium knowledge category, while 24.00 and 23.00 per cent of dryland farmers belonged to high and low knowledge categories respectively.

Sankaran (1997) observed that knowledge level on Integrated watershed development programme technologies had a positive and significant association with adoption level of respondents.

2.3.12 Innovativeness

Pillai (1987) revealed that 50.30 per cent of rice farmers had medium level of innovativeness while 45.00 per cent had high innovativeness.

Rathinasabapathi (1987) observed that majority of the respondents had high level of innovativeness (58.38 per cent) followed by medium level (35.16 per cent) and low level (5.46 per cent).

Bose (1988) observed that majority of small (80.00 per cent) and big (59.00 per cent) farmers had medium level of innovativeness.

Juliana (1989) reported that the big farmers had a high (42.50 per cent) level of innovation proneness followed by

small and marginal farmers which was contributed by 17.50 per cent and 10.00 per cent respectively.

Chandran (1993) pointed out that half (50.00 per cent) of the dryland farmers in general were highly innovative followed by medium level (30.50 per cent) and low (19.50 per cent) levels.

Velusamy (1996) observed that 70.00 per cent of the farmers had medium level of innovativeness followed by high (16.67 per cent) and low (13.33 per cent) levels.

Anusuya (1997) revealed that majority (59.17 per cent) of the respondents had medium level of innovativeness followed by high level (21.66 per cent) and low levels (19.17 per cent).

Thomas (1998) reported positive and significant relationship between innovation proneness and participation in watershed development programmes.

2.3.13 Indebtedness

Salunke and Thorat (1975) reported that indebtedness of small farmers had a significant relationship with adoption behaviour.

According to Mathur (1975) tribal indebtedness is both a cause and effect of poverty and is related to bonded labour and alienation of tribal land.

Sadamate (1978) found that indebtedness was positively and non-significantly related to the technological gap in the tribal farming system.

Prakash (1980) reported a positive and significant relationship between indebtedness and adoption of improved agricultural practices in the medium developed tribal areas of Wyanad, while this relationship was not significant in less developed area.

Marla (1981) observed that the wages fixed and actually paid have been so low that the bonded labourer never gets the opportunity of repaying the debt completely to free himself from bondage.

Viju (1985) reported that indebtedness had no significant correlation with the extent of adoption of improved agricultural practices by tribal farmers.

Punekar *et al* (1988) informed that of the total 60 workers, only two had no debts at all. Ten of them had debts here and there which could not be accounted for. Fourty eight of them (80%) borrowed up to Rs.4000/=. Some of them had borrowed over and above this amount. The average debt of the industrial workers surveyed was found to be Rs.2264.00 which was around five and a half times their average monthly wages.

Sabapathi (1988) from his study among the 'Irulas' of 'Attappady' stated that indebtedness was a common phenomenon

among the Irulas of Attappady. A person who has more indebtedness may find it difficult to pull on. Many such people work in their neighbour's farms as labourers.

2.3.14 Incentives to beneficiaries

Gowda and Jayaramaiah (1996) in their study on 'Impact of watershed development programme' reported that incentives to beneficiaries had played a vital role in influencing the variation in technological components of watershed development programme on participants.

Kerr *et al.* (1996) pointed out that subsidised watershed development programme has been used for employment generation, to convince farmers to try new methods, and to compensate for externalities.

Kareem and Jayaramaiah (1998) found significant relationship between subsidy amount received and extent of participation.

Sutherland *et al.* (1998) opined that material incentives should be reduced to a minimum for participation, so that the desire for new knowledge become the main motivator.

According to Turton *et al.* (1998) an incentive is something that motivate a person to act and they observed that subsidy undermined the objectives of watershed programme.

2.3.15 Cropping intensity

Shankaraiah (1965) and Kolte (1967) reported that adopters of improved agricultural practices had higher intensity of cropping than nonadopters.

Singh and Singh (1970) had indicated that there was no association between cropping intensity and adoption of improved agricultural practices.

Pathak and Mazumdar (1976) and Shukla (1980) reported that cropping intensity is one of the most important variables which influenced the adoption behaviour of farmers.

It could be inferred that the cropping intensity of the respondents influence their adoption behaviour.

2.4 Techno-socio-economic consequences

2.4.1 Adoption of integrated watershed management practices

Dhanakumar (1981) while studying "integrated dryland agricultural development project" concluded that majority of the respondents (more than 75.00 per cent) adopted two practices of jowar viz., seed rate and seed treatment, whereas half of the respondents (52.50 per cent) adopted nitrogen application fully as recommended and roughly one third (31.67 per cent) did not adopt any practice at all.

Srinivasan (1981) in his study on adoption of dryland technologies found that majority of the marginal and small farmers in dryland tract belonged to medium level adoption category (65.00 per cent and 70.00 per cent respectively).

Baskaram and Praveena (1982) in a study on adoption of improved dryland technology in an integrated dryland development project reported that over two third of dryland farmers adopted off-season tillage, soil mulching and mid-term correction only. Less than 5.00 per cent of the farmers adopted irrigation technologies.

Krishnamoorthy (1984) reported that adoption of dryland technologies by farmers was found to be medium in nature. Adoption level among different categories of farmers were not uniform. The adoption among big farmers was high. It was medium and low among marginal and small farmers respectively.

Reddy (1987) in his study on attitude and adoption behaviour of farmers observed higher levels of adoption of recommended practices in ragi and wheat crops respectively in the watershed area.

Balasubramanian (1988) reported that majority of the farmers (72.50 per cent) were medium in their levels of adoption of dryland practices, followed by high (17.50 per cent) and low adoption levels (10.00 per cent).

Lallanrai *et al.* (1989) observed higher levels of adoption of recommended practices in ragi and wheat crops respectively in the watershed area.

Balavatti and Sundarasamy (1990) in a study on adoption of dryland practices observed that crop rotation was adopted by 95.00 per cent of the farmers, followed by application of farm yard manure (85.00 per cent), ploughing (83.00 per cent) and furrow cultivation (57.00 per cent).

Padaria and Singh (1990) observed that the traditionally followed practices like plot to plot bunding (97.00 per cent), ploughing the field in March-April (91.00 per cent) and ploughing the field after each shower (94.00 per cent) were adopted largely by the respondents.

Ramachandran and Sripal (1990) in the study on constraints in adoption of dryland technique for rainfed crops observed higher adoption level for the technologies like premonsoon sowing (92.50 per cent), improved varieties (91.67 per cent), plant protection (89.17 per cent), seed treatment (75.00 per cent), broadcasting (45.00 per cent) and fertilizer application (30.00 per cent). Lower adoption was reported for the technologies like dibbling of seed (8.33 per cent), weedicide application (8.33 per cent) and pheromone trap utilisation (4.17 per cent).

Vijayaraghavan *et al.* (1990) found that the adoption level for individual dryland practices were 90.00 per cent for varietal selection, 12.50 per cent for seed treatment, 7.50 per cent for azospirillum application, 87.50 per cent for plant protection and 2.50 per cent for weedicide application.

Lakshmi (1992) in her study on the impact of improved dryland agricultural technologies concluded that 38.33 per cent of dryland farmers of watershed had high level of adoption of improved dryland agricultural practices, followed by 37.50 per cent with low level and 24.17 per cent with medium level of adoption.

Subramanian (1994) stated that majority of the farmers (69.48 per cent) had medium to high level of overall adoption of wasteland development practices. Timely life irrigation (88.31 per cent), bush clearance (84.42 per cent) recommended dose of filling material (84.42 per cent), deep disc ploughing (81.22 per cent) and stipulated number of seedlings (81.66 per cent) were found to be adopted by most of the wasteland development programme beneficiaries.

Ranganathan (1995) in the study on adoption of technologies of rainfed sorghum observed cent per cent adoption for summer ploughing, followed by azospirillum application (60.00 per cent), intercropping (23.30 per cent), plant protection and seed treatment (10.00 per cent each). Enriched farm

yard manure (7.50 per cent), top dressing (6.60 per cent) and seed hardening (1.60 per cent) were the less adopted practices.

Kamaraj (1996) in the study on knowledge and adoption of technologies for rainfed crops reported that majority (76.67 per cent) of the dry land farmers were found to possess low (43.44 per cent) to medium (33.33 per cent) levels of adoption. Higher adoption group constituted relatively low percentage (23.33 per cent) of respondents.

Gowda and Jayaramaiah (1996) reported that with respect to adoption of recommended practices of groundnut, the participants scored significantly higher levels of adoption of soil and moisture conservation practices, recommended variety, sowing across the slope and recommended fertilizers as compared to non-participants.

Sankaran (1997) observed that cultivation of intercrop, summer ploughing, vegetative hedging on contour bund and recommended sorghum variety were adopted by majority of men and women beneficiaries.

Khatik and Singh (1998) observed that majority of the respondents in the Navamota watershed were medium level adopters of soil and water conservation practices. Maximum of 46 per cent of respondents were having medium level of adoption and 34 per cent and 20 per cent of respondents were having low

level of adoption and high level of adoption respectively towards soil and water conservation technologies.

The findings on the adoption of watershed management practices were found to differ with the respondents.

2.4.2 Increase in social status

Charayula *et al.* (1985) stated that the beneficiaries of IRDP reported change in their occupation, more days of self employment, wage employment and additional income.

Joseph (1987) observed that the impact of lab to land programme on farm size, type of house and possession of farm implements was very low with 10.11, 19.76 and 3.86 per cent respectively and 98.33 per cent have reported an increasing rice consumption.

Narayana *et al.* (1988) pointed out that the rural works programmes in India have served as a very effective instrument for alleviating rural poverty.

Behari (1989) revealed that IRDP has made a significant impact on alleviating poverty of the bulk of the rural poor.

Ravindra and Veerabhadraiah (1991) concluded that 47 per cent of the sample beneficiaries had crossed the poverty line as a result of their participation in development programmes.

Satapathy (1991) observed that 71 per cent of beneficiaries had retained the assets and 48 per cent of them had crossed the poverty line.

Giriappa (1992) reported that about 15 per cent of beneficiaries had crossed the poverty line.

Mahnot *et al.* (1992) in their study on socio-economic evaluation of watershed management observed shift in occupational status of the farm families of Thakarda, Dungarpur, Rajasthan after introduction of watershed management project. The percentage of farm families in agriculture was increased to 38.00 per cent from 30.00 per cent. The percentage of farm families engaged in service and daily wages has been reduced to 30.00 per cent from 53.00 per cent after the introduction of watershed management project. They also observed that the employment in agriculture sector increased by 22.05 per cent and daily sector by 9.15 per cent consequent on implementation of the watershed management with the imposition of soil and water conservation measures and availability of irrigation water.

Todesse (1996) revealed that beneficiary households covered under the programme attained probabilities ranging from a minimum of 3.41 per cent to a maximum of 97.57 per cent to cross the poverty line.

Thejaswini and Veerabhadraiah (1997) observed that the economic status of beneficiaries, nutritional status of their children and amount of benefit received by each of the groups had increased.

It could be derived from the above findings that the social status of the beneficiaries had increased due to the implementation of various development programmes.

2.4.3 Employment generation

Mencher (1980) observed that eventhough wage rates are high in Kerala, number of days for which employment available for agricultural labourers are less.

Padmanabhan (1981) found that the average period of unemployment in a year for men labourers was 138.87 days.

Santhanam *et al.* (1982) inferred in their study that about 30 per cent of the respondents in Kerala were employed for more than 181 days. Those employed for less than 120 days in a year in Kerala was 18 per cent.

Shenoy and Rao (1983) in a study on new philosophy of rural development revealed that drought relief measures for the drought prone Niagaon village in Pune district of Maharashtra emphasised the formation of percolation ponds in drought prone areas as the primary drought relief measure. They further stated that it would not only provide employment in that period

but would also provide a permanent solution of alleviating the farming community from the hazards of recurring droughts.

Chauchan and Sharma (1990) observed that dairy farming by the landless and poor farmers also substantially contributed to their family income and it provided gainful employment to large proportion of work force, most significantly in rural areas.

Nema *et al.* (1991) reported that the employment opportunities to human labour and bullock labour were found in increasing trend (28.00 per cent and 14.00 per cent respectively) in watershed development project area, Barkhela-Hat in Guna district of Madhya Pradesh.

Senthilnathan (1991) opined that seasonal unemployment and under employment were the biggest problems faced by the agricultural labourers.

Lakshmi (1992) stated in her study on impact of dryland technologies in the watershed programme that majority (57.50 per cent) of farmers had low level of additional employment and only 14.17 per cent had medium level of employment. An over view of the results revealed that there was increase in the additional employment due to the introduction of improved dryland technologies under the watershed system with all category of farmers.

Prasad and Krishna (1995) revealed that the direct employment generation programme was more suitable for creating additional employment opportunities than the assets creation programme.

Sharma and Shubhraparashar (1998) reported that out of 394 sample beneficiaries only 94 (23.86 per cent) established in self-employment in trades in which they got training and 45 (11.42 per cent) got employment on salary basis.

2.4.4 Increase in resource use efficiecny

Mathivanan (1985) in his study on impact of percolation ponds stated that 84.44 per cent of farmers owned and operated wells in the influence zone of percolation ponds at Thirumangalam block of Madurai district. He also found that the percolation ponds had increased the water yield of wells through additional recharge of ground water. However, only 64.14 per cent of beneficiaries accepted that the percolation ponds have helped to increase their farm income.

Singh (1993) while studying the dryland agricultural and technological options has explained that watershed concept was quite helpful in improving soil moisture and reducing soil erosion. These projects have also helped in increasing income and employment opportunities. Major shift in cropping systems in favour of superior high value crops and overall ecological improvement have been observed.

Singh *et al.* (1995) reported that the various land treatment measures implemented for moisture conservation and runoff control have helped in the improvement of ground water table which has risen by an extent of 0.90 m over the base year.

2.4.5 Increase in income

Surendran (1981) reported that 78 per cent got increased income, 11 per cent purchased new utensils, 5 per cent improved the existing house, 5 per cent changed their dressing pattern and 22 per cent invested in savings as a result of their participation in Toda welfare scheme.

Singh and Singh (1989) observed that there is an increase in the income of all recipients including farmers and agricultural labourers. The initial improvement has led to a considerable increase in the level of education and consequently the socio-economic status of local people.

Balishter and Chandraumesh (1990) reported that the overall increase in income of sample beneficiary families was worked out to about 38 per cent. The higher increase was recorded for landless labourers in both scheduled caste (49 per cent) and non-scheduled caste families (48 per cent).

Gowda and Jayaramaiah (1990) from their study on impact of watershed development, found that the extent of

increase in annual gross income of farmers was due to the implementation of watershed development programme. The increase was significant with small farmers but not significant with regard to marginal farmers. The average annual gross income of small farmers was Rs.11,970 over four years of implementation of watershed programme.

Reddy (1990) stated that in the case of youth trained in poultry there was considerable rise in their annual income from Rs.940/- to Rs.9,100/- from the pre-training assistance period to post-training assistance period.

Premkumar and Mehtarahul (1992) reported that all the beneficiaries had crossed the poverty line with an additional income ranging from Rs.280/- to Rs.395/-.

Sankaran (1997) concluded that increased income was the directly perceived impact of Integrated Watershed Development Programmes. The income of 68.33 per cent of men respondents and 56.66 per cent of women respondents were found to be increased due to their involvement in IWDP.

2.4.6 Increase in productivity

Saini (1971) found that there was inverse relationship between farm size and productivity and concluded that this inverse relationship was a confirmed phenomenon in Indian Agriculture.

Pochaiah (1975) observed that dryland agricultural pilot project has contributed significantly towards the increased farm productivity (in terms of gross and net farm income) from pre-project to post-project period in the adopted villages, though it was not of the same order in the non-adopted villages.

Reddy (1983) reported that the return for every rupee invested towards variable cost in jowar was highest in lab to land programme group of villages and lowest in Hayathnagar block group of villages. In case of castor, it was highest in Krishivignan kendra group of villages and lowest in Hayathnagar block group of villages.

Reddy and Rastogi (1985) reported that there was an increase of 102.00 per cent in the yield of sorghum + redgram intercrop at Anantapur and 175.00 per cent increase in Hyderabad by adopting improved dryland technologies. There would be ample scope to augment the yield and returns through adoption of recommended technologies in dryland tract.

Singh *et al* (1995) reported that the productivity of maize, paddy, jowar, blackgram and wheat have increased by about 2.15, 2.16, 1.79, 3.62 and 2.07 times respectively over the base year.

Jeya (1999) observed that majority of the respondents (83.20 per cent) had medium level of productivity followed by

9.60 per cent with high and 7.20 per cent had low productivity in her study on women in agriculture.

2.5 Constraints in watershed management

Pandey (1980) found that the extension personnel had no regular contact or link with researchers in the command area.

Purushottam (1980) identified the constraints in watershed management as over exploitation of forests, excessive grazing and sedimentation of reservoirs.

Arokya (1982) reported that lack of credit and labour, non availability of inputs, lack of sufficient information and lack of knowledge were the main reasons for the non adoption of paddy technology.

Jaiswal *et al.* (1982) identified the following constraints in watershed planning:

* The concept of management of intersectoral linkages for development was not clear to many sectoral officers.
* People in watershed were not aware of the long term benefits from soil and water conservation activities and hence their participation at various stages was not forthcoming.
* The role of local institutions was totally absent at planning and implementation of watershed activities and maintenances of community assets.

* None of the district level officers received any special training in watershed management.

* Sectoral officers were unaware of the rationale behind the integration of activities of watershed.

Bhakari and Vijayakumar (1985) observed that high cost of inputs was the chief reason expressed by the respondents, while other important constraints were hill topography, lack of timely supply of inputs, lack of knowledge, non-availability of inputs, lack of finance, lack of timely guidance, unfavourable weather conditions and lack of skills in dryland agricultural technologies.

Reddy *et al.* (1986) identified the constraints in adopting the improved technologies in dryland as high cost of input, shortage of capital, lack of knowledge about improved practices, fear of loss due to failure of rains and non-availability of inputs at appropriate time.

Sheela (1989) found out the constraints in watershed planning as non-availability of demonstration plots to see the benefits of watershed management, anticipated protest from land owners to treat the watershed as a whole for development and inadequate training of the officers in watershed planning and management.

Eswarappa (1991) reported that high cost of inputs, lack of knowledge, lack of finance, lack of credit facilities,

non availability of inputs at the appropriate time, lack of technical guidance, conviction, skills and unfavourable weather condition were the important constraints in the adoption of the recommended dry land agricultural technologies by the farmers in watershed development programme.

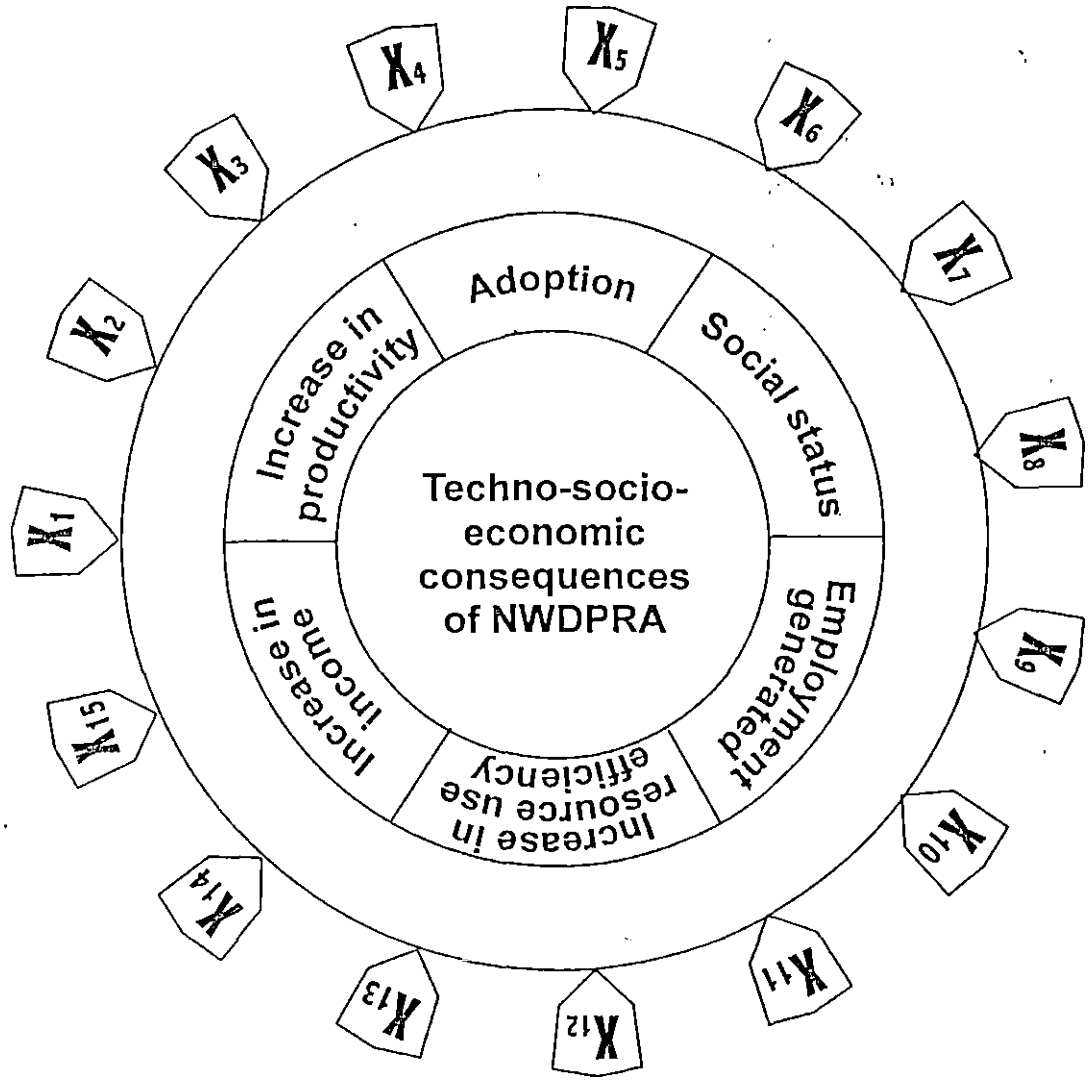
Lakshmi (1992) reported that poor knowledge was the major constraint felt by the beneficiaries in the implementation of watershed programme.

Savithri (1992) revealed that frequent failure of monsoon was the main constraint in the adoption of dryland technologies followed by risk and uncertainity of returns, high cost involved, lack of awareness and nonavailability of labourers as expressed by farm women in adopting dryland technologies.

Ranganathan (1995) in his study on adoption of technologies of rainfed sorghum pointed out the constraints as lack of suitable technology, erratic rainfall, shortage of labour, nonavailability of required inputs and inadequate information.

Kamaraj (1996) identified the constraints expressed by dryland beneficiaries as erratic monsoon, nonavailability of labour, poor infrastructure facilities, insufficient marketing facilities, high cost of inputs, lack of knowledge, complex nature of technologies and lack of technical support.

.Sankaran (1997) concluded that the predominant problems faced by majority of IWDP beneficiaries were extension constraints followed by programme constraints, technological constraints, subsidy and finance constraints and marketing constraints.



X_1 - Farm size
X_2 - Technical guidance
X_3 - Availability of low cost watershed technologies
X_4 - Observability of innovation
X_5 - Complexity of innovation
X_6 - Attitude towards watershed development programmes
X_7 - Extension participation
X_8 - Mass media exposure
X_9 - Economic motivation
X_{10} - Training participation
X_{11} - Knowledge in watershed planning
X_{12} - Innovativeness
X_{13} - Indebtedness
X_{14} - Orientation towards incentives
X_{15} - Cropping intensity

Fig. 1. Conceptual model of the study

METHODOLOGY

CHAPTER III

METHODOLOGY

This chapter deals with the research methods and procedures used in the study and are presented under the following sub headings.

3.1 Locale of research

The study was conducted in Thiruvananthapuram district.

Thiruvananthapuram district lies between latitude 8°17' and 8°47' north and longitudes 76°41' and 77°16' east. It is the southern most district of Kerala with Kollam district bordering the north. The topography of Thiruvananthapuram district is identical with that of the State of Kerala as it lies between the Arabian sea on the west and the mountain strips of western ghats on the east. Undulating terrain called midlands fill the space between coastal plains and high lands.

In the South, it borders Kanyakumari district of Tamil Nadu. The district has a 78 km. long coastal line. The rainfall varies from 215 cm to 420 cm. The climate is humid tropical and the temperature varies from 10° to 35°C (Meterological centre, Thiruvananthapuram). The important crops cultivated in the district are coconut, tapioca, paddy, arecanut, pepper and vegetables.

The National Watershed Development Project for Rainfed Areas (NWDPRA) was initiated as a centrally sponsored scheme during the Eighth Plan period. One hundred and fourteen projects under NWDPRA were taken up during the Eighth Plan in Kerala, out of which 12 projects were in Thiruvananthapuram district. All these projects were reported to be completed by the end of the Eighth Plan period. No scientific investigation has been so far conducted to study the techno-socio-economic consequences of NWDPRA in Kerala.

Thiruvananthapuram district was selected purposively as the location for the study, considering the facilities for conducting the research work.

3.2 Sampling procedure

3.2.1 Selection of Project areas

Thiruvananthapuram district is administratively divided into four taluks viz. Chirayinkil, Nedumangad, Neyyattinkara and Thiruvananthapuram. One watershed project area each from every taluk of Thiruvananthapuram district was

selected at random. Accordingly, Ottur watershed from Chirayinkil taluk, Anad watershed from Nedumangad taluk, Kurumkutty watershed from Neyyattinkara taluk and Thettiyar watershed from Thiruvananthapuram taluk were selected for the study. NWDPRA activities were completed in all these watersheds. The location of the selected watersheds are given in Fig. 2.

3.2.2 Selection of respondents

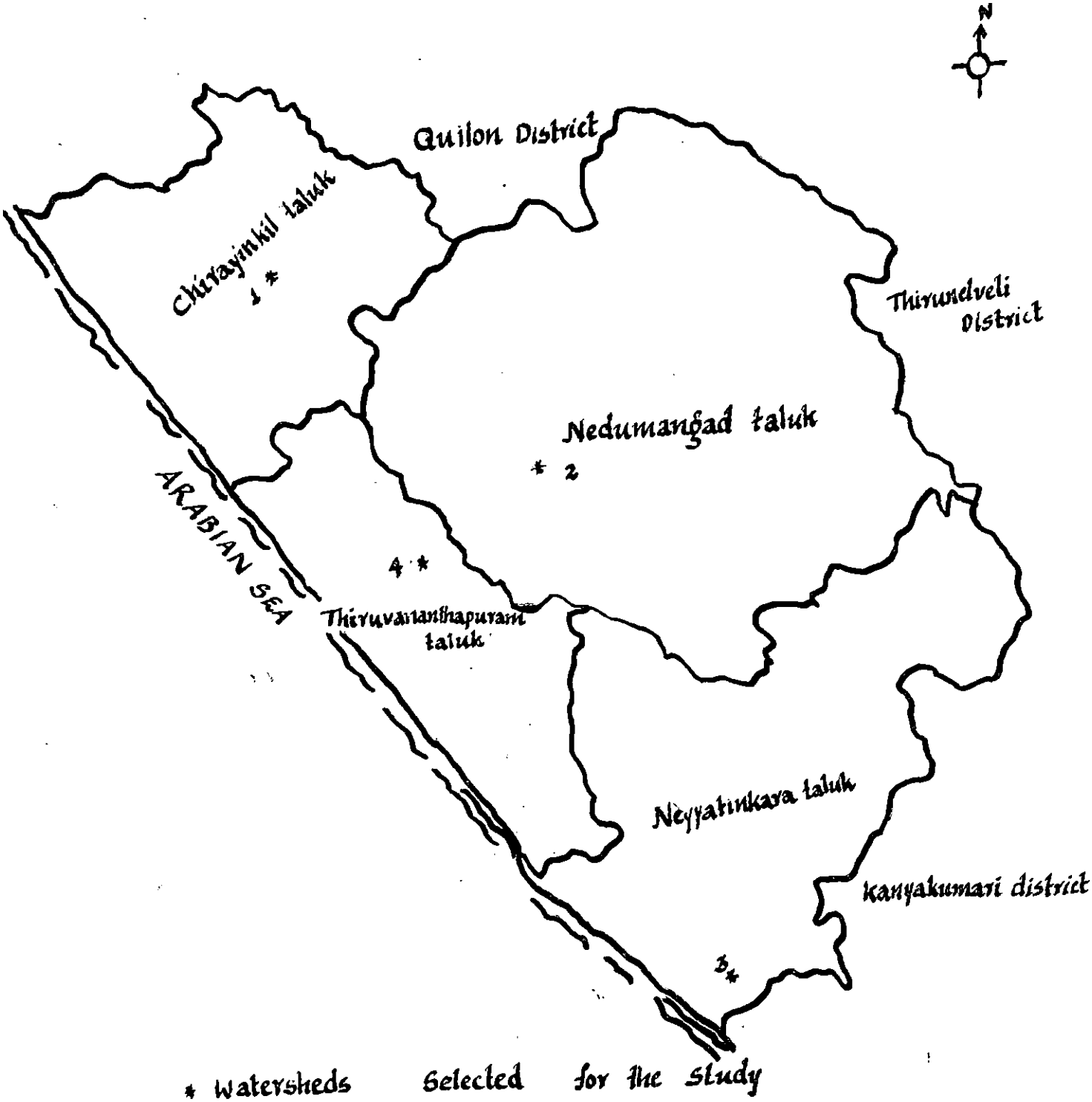
The total number of beneficiaries of each completed NWDPRA area in Thiruvananthapuram district is given in Table 1.

Table 1 Completed NWDPRA areas and number of beneficiaries in Thiruvananthapuram district

Sl. No.	Taluk		Completed Watershed (NWDPRA)	Area in (hectare)	Number of beneficiaries	Respondents selected for study
1.	Chirayinkil	i)	Illamba	355.00	981	
		ii)	Ottur*	769.20	1450	16
		iii)	Manjappara	616.00	1998	
2.	Nedumangad	i)	Kaithumoola	504.00	1450	
		ii)	Anad*	509.00	1860	20
		iii)	Kuthirakulam	815.00	1562	
3.	Neyyattinkara	i)	Kollamkonam	710.00	3002	
		ii)	Kurumkutty*	643.00	3000	33
		iii)	Anavur	742.00	2820	
		iv)	Kottukal	1585.00	7230	
		v)	Nettayam	580.00	915	
4.	Thiruvananthapuram	i)	Thettiyar*	682.00	2906	31
	Total					100

* Watersheds selected for the study

Fig-2 Map Showing Locale of Study



The list of beneficiaries of each project area made available from the Directorate of Soil conservation was made use of in selecting the respondents at random. Sixteen respondents from Ottur watershed, 20 respondents from Anad watershed, 33 respondents from Kurumkutty watershed and 31 respondents from Thettiyar watershed were selected for the study, according to probability proportional to size of beneficiaries. Thus, a total number of one hundred respondents were selected as the sample.

For identifying the constraints, 30 extension agents who worked in NWDPRA or now working in NWDPRA of Thiruvananthapuram district belonging to the different departments were selected as the respondents.

3.3 Selection, operationalisation and measurement of variables

As adoption of watershed development programme has already occurred either partially or fully and the proposed activities envisaged in the watersheds were completed in the study areas, an expost - facto design was used in the study.

3.3.1 Selection of variables

Detailed review of literature and discussions with experts and scientists in agricultural extension as well as watershed management were made use of in selecting the variables that could possibly influence the dependent

variables. Moreover, a pilot study conducted by the researcher in two watershed project areas revealed the importance of the selected variables. Judge's rating was relied upon for the final selection of the variables.

The list of variables selected along with the methods used to measure them are given below.

Variables	Measurements
Independent variables	
1. Farm size	scoring procedure developed for the study
2. Technical guidance	scoring procedure developed for the study
3. Availability of low cost watershed technologies	scoring procedure developed for the study
4. Observability of the innovation	scoring procedure developed for the study
5. Complexity of the innovation	scoring procedure developed for the study
6. Attitude towards watershed development programmes	used the attitude scale followed by Lakshmi (1992).
7. Extension participation	procedure developed for the study
8. Mass media exposure	scoring procedure developed for the study

9. Economic motivation	followed the scale developed by Supe (1969) and adopted by Gangadharan (1993)
10. Training participation	using the scoring procedure developed by Ponmani (1993) with slight modification.
11. Knowledge in watershed planning	knowledge test developed by Sheela (1989)
12. Innovativeness	used the scoring procedure followed by Sajeevchandran (1989) with slight modification
13. Indebtedness	scoring procedure developed for the study
14. Orientation towards incentives	used the schedule developed by Surendran (2000)
15. Cropping intensity	procedure adopted by Pillai(1983)
Dependent variables	
1. Adoption of watershed management practices	scoring procedure developed for the study
2. Social status	first dimension 'health care' was measured using the scoring procedure developed by Selvin (1998). Second dimension 'education to children' was measured using the

		scoring procedure developed by Velusamy (1999). Third dimension 'occupation' was measured by using the procedure developed by Mansingh (1993).
3.	Employment generation	Scoring procedure developed for the study
4.	Increase in resource use efficiency	Scoring procedure developed for the study
5.	Increase in income	Scoring procedure developed for the study
6.	Increase in productivity	Followed the scoring procedure developed by Surendran (2000)

3.3.2 Operationalisation and measurement of independent variables

The operationalisation and measurement procedure followed for the selected 15 independent variables are given below.

3.3.2.1 Farm size

Farm size refers to the total land owned by the farmer at the time of conducting the survey. This variable was measured by asking the respondent about the total land possessed by them. Scores were assigned to each respondent based on the area possessed as given below.

Farm size (hectare)	Score
< 0.1	1
0.1 - 0.2	2
0.2 - 0.3	3
0.3 - 0.4	4
> 0.4	5

3.3.2.2 Technical guidance

Technical guidance is operationally defined as the degree to which a particular farmer has received technical advice, guidance and assistance from the extension personnel on watershed management aspects. The responses from farmers were obtained for the four statements on a three point continuum.

Category	Score
Always	2
Sometimes	1
Never	0

The scores obtained on each statement by an individual respondent were summed up to obtain his total score for technical guidance. The score ranges between zero and eight.

3.3.2.3 Availability of lowcost watershed technologies

The recommended low cost watershed technologies were listed out in consultation with the experts in various

development departments. The respondents were asked to respond to the statements of important low cost technologies to study their availability to the farmers for adopting the watershed management practices. A score of 1 was given to the favourable answer. The total score of an individual respondent on this variable was worked out by summing up the scores obtained on all the items. The score ranges between zero and 13.

The low cost technologies identified are:

- Biological fencing on contour, using grass species such as vettiver
- Intercropping in coconut garden
- Drainage line treatment with vegetative measures
- Planting agro-forestry species of subabul, mahagony, tamarind etc.
- Construction of live check dams using agave, vettiver, etc.
- Construction of brush wood check dams
- Making loose boulder checkdams with vegetative support
- Making water harvesting structures
- Fodder cultivation on contour bunds, boundaries and centripetal terraces
- Organic farming
- Application of bio-fertilizers
- Use of high yielding varieties of paddy/coconut/banana for cultivation
- Construction of small dug out ponds of size 3x3x1 m (pits)

3.3.2.4 Observability of the innovation

It is operationalised as the farmers' perception of the visibility of the results of the watershed management practices. To measure the observability of the innovation, a scoring procedure was developed. The responses as to how the farmers perceived about the observability of the results of the innovation were obtained against all the low cost watershed technologies on a five point continuum viz. 'most observable', 'more observable', 'somewhat observable', 'less observable' and 'least observable' with scores 5, 4, 3, 2 and 1 respectively. The total score of an individual respondent was worked out by summing up the scores obtained on all the items. The score ranges between 65 and 13.

3.3.2.5 Complexity of the innovation

Complexity of the innovation is operationally defined as the farmers' perception of the difficulty in undertaking the watershed management practices. A scoring procedure was developed to measure this variable. The responses as to how the farmers perceived about the complexity of the innovations were obtained against all the low-cost watershed technologies on a five point continuum viz. 'very simple to practice', 'simple to practice', 'neither simple nor difficult to practice', 'complex to practice' and 'very complex to practice' with scores 5, 4, 3, 2 and 1 respectively.

3.3.2.6 Attitude towards watershed development programmes

Attitude in this study is operationally defined as the degree of positive or negative disposition associated with watershed development programmes. The scale developed by Lakshmi (1992) was used in this study. The scale consisted of 15 statements of which 11 statements were positive and rest of the statements negative. Responses were collected in a five point continuum as follows. The scoring procedure is also given below.

	Response				
Statements	Strongly agree	Agree	Unde-cided	Dis-agree	Strongly disagree
Positive statements	7	5	4	3	1
Negative statements	1	3	4	5	7

The maximum score an individual could obtain on this scale is 105 and minimum score is 15. The scores obtained on each statement by an individual respondent were summed up to obtain his total score for attitude towards watershed development programme. High score referred to more favourable attitude.

3.3.2.7 Extension participation

The following activities are included in the schedule to measure the extension participation of the respondents.

Group meetings

Seminars

Exhibitions

Farm-film shows

Farmer's day

Demonstrations

Organized farm visits

The respondents' participation in the above extension activities for the past five years was considered to arrive at extension participation scores as given below.

Frequency of participation	Scores
Whenever conducted	4
Often	3
Occasionally	2
Rare	1
Never	0

The scores obtained on all the items by each respondent were summed up to get the extension participation score of the individual respondent. The score ranges between 28 and zero.

3.3.2.8 Mass media exposure

It refers to the degree to which the different mass media viz. radio, television, newspaper, magazines, bulletins, books and films were utilised by the farmers for getting information about different watershed management practices.

The frequency of exposure to mass media was measured as shown below.

Media	Frequency of exposure				
	Always (4)	Regularly (3)	Occasionally (2)	Rarely (1)	Never (0)
1. Radio					
2. Television					
3. Newspaper					
4. Magazines					
5. Bulletins					
6. Books					
7. Films					

The possible score ranges between 28 and zero.

3.3.2.9 Economic motivation

Economic motivation is operationally defined as the degree of willingness for investment of available potential resources in adopting watershed technologies for increasing income.

In this study, economic motivation was measured with the help of the economic motivation scale developed by Supe (1969) and adopted by Gangadharan (1993). The scale consisted of six statements. The responses were collected on a five point continuum as follows.

Responses	Score
Strongly agree	5
Agree	4
Undecided	3
Disagree	2
Strongly disagree	1

The scores obtained on each statement were summed up to arrive at the individual score on economic motivation. The possible scores range from 6 to 30.

3.3.2.10 Training participation

It is operationally defined as the number of trainings in watershed management undergone by the respondent during the last five years.

The scoring procedure followed by Ponmani (1993) was used with slight modifications. The possible scores range from zero to three.

Trainings undergone in watershed management	Score
No training	0
One training	1
Two trainings	2
Three and more trainings	3

3.3.2.11 Knowledge in watershed planning

Knowledge is defined as the behaviour and test indications which emphasised the remembering either by recognition or recall of ideas, material or phenomenon (Bloom *et al.*, 1955).

English and English (1961) defined knowledge as a body of information possessed by an individual which is in accordance with the established fact.

In the present study, knowledge in watershed planning indicates the farmer's understanding of the concept, practices, procedures and benefits of watershed planning and development.

The knowledge test developed by Sheela (1989) is used in this study.

Scoring:

In the knowledge test used in the present study, the summation of scores for the correct answers over all the items for a particular respondent indicated his level of knowledge.

The total knowledge score was worked out for individual respondents. The maximum score that could be obtained by a respondent is 19 and minimum score is zero.

3.3.2.12 Innovativeness

It is operationally defined as the characteristic of the farmer to accept new ideas in farming.

Innovativeness was measured by using the procedure followed by Sajeevchandran (1989) with slight modifications. The scale consisted of five statements and the responses were collected on a two-point continuum of agree or disagree. The scoring given was 1 for 'agree' and 0 for 'disagree'. The total score for the five statements was taken as the score for innovativeness. The possible score ranges between five and zero.

3.3.2.13 Indebtedness

Indebtedness in this study refers to the total debt in terms of money, a farmer owes to various money lending sources such as private money lenders, relatives, co-operatives, merchants, traders, banks, etc.

On the basis of the total debt a farmer had during the last five years his status on indebtedness was scored as follows. The score ranges between zero and five.

Item	Score
No debt	0
Upto Rs.1000/-	1
Between 1001/- and Rs.2000/-	2
Between 2001/- and Rs.3000/-	3
Between 3001/- and Rs.4000/-	4
Above Rs.4000/-	5

3.3.2.14 Orientation towards incentives

It is operationally defined as the orientation of farmers towards subsidies and assistance provided by the Government and other sponsoring agencies to motivate farmers to follow watershed management practices. The variable was measured by using the schedule developed by Surendran (2000). The schedule consisted of four statements of which one statement was in negative form. Responses to these statements were obtained in a five point continuum viz. 'strongly agree', 'agree', 'undecided', 'disagree', 'strongly disagree'. The scoring pattern was 5, 4, 3, 2 and 1 respectively and this was reversed in the case of the negative statement. Summation of the scores on all the four statements formed the score of orientation towards incentives.

The maximum score that could be obtained by a respondent is 20 and minimum score is five.

3.3.2.15 Cropping intensity

It refers to the proportion of total annual cropped area to the size of holding expressed in percentage. The cropping intensity was calculated by the formula

$$\text{Cropping intensity} = \frac{\text{Total annual cropped area in ha}}{\text{Size of holding in ha}} \times 100$$

This procedure was adopted by Pillai (1983) and followed in this study.

3.3.3 Operationalisation and measurement of dependent variables

The study of the techno-socio-economic consequences is a major area in this research work. They are the changes that had occurred as a result of implementing the watershed management practices under NWDPRA.

Techno-socio-economic consequences in the completed watershed areas under NWDPRA were studied with respect to adoption of the watershed management practices, increase in social status, employment generation, increase in income, increase in productivity and increase in resource use efficiency.

3.3.3.1 Adoption of watershed management practices

Rogers and Shoemaker (1971) defined adoption as a decision to make full use of the new idea as the best course of action available.

In this study, adoption is operationalised as the acceptance and use of the watershed management technology/practices by the farmer, if recommended for his farm.

Wilkening (1952) used an index for measuring the adoption of improved farm practices. The index of adoption used was the percentage of practices adopted in relation to the total number of practices applicable for adoption.

Chathopadhyay (1963) used adoption quotient for measuring adoption behaviour. This was a ratio scale that measures a farmer's behaviour on dimensions of applicability, potentiality, extent, time, consistency and differential nature of innovation.

All the important low cost technologies of watershed management which are judged by the experts in watershed management were included in the schedule (Appendix-IV). To know the potentiality of each technology for adoption, the farmers were asked to state whether this technology was recommended for his farm. If the answer is 'yes' the farmer is asked to state whether they adopted the practice 'fully', 'partially' or 'not adopted'. A score of 2 was given if fully adopted, score of 1 for partial adoption and score of 0 for non-adoption. For all the 13 recommended practices, the same continuum was used.

The responses were scored as detailed above and the index score of each respondent was worked out as follows.

$$\text{Adoption Index} = \frac{\text{Score obtained for recommended practice}}{\text{Maximum possible score for the recommended practices}} \times 100$$

The respondents were grouped as low, medium and high level adopters based on mean and standard deviation of the adoption index obtained by the respondents as a whole. The maximum score one can obtain was 100.

3.3.3.2 Social status

Difference in social status of the farmer is an indicator of the impact of watershed management practices.

The various dimensions selected to measure the social status as an indicator of change are health care, education to children and occupation. Scoring procedures followed to measure social status are given below. Summation of the scores for all the three dimensions gives the score for social status. The possible score ranges between three and 15.

Health care refers to the nature of medical treatment of the respondents. The scoring procedure developed by Selvin (1998) was adopted to measure health care with slight modification.

Item	Score
a) Self medication	1
b) Local treatment	
Unqualified persons	2
Qualified persons	3
c) Outside treatment	
Government hospital	4
Private hospital	5

Education to children refers to the pattern of education given by the respondents to their children in local school/outside school/college. The scoring procedure developed by Velusamy (1999) was used in this study to measure education to children.

Item	Score
a) Children sent to local school	1
b) Children sent to school outside the village	2
c) Children sent to college	3

Occupation refers to any activity in which a person was regularly engaged to achieve a standardised utilization award. The occupation status of the respondents were measured using the procedure developed by Mansingh (1993). The scoring procedure was as follows.

Item	Score
a) Wage earners	1
b) Farming and wage earners	2
c) Farming	3
d) Business	4
e) Services	5
f) Farming and Business	6
g) Farming and services	7

3.3.3.3 Employment generation

It refers to the extent to which the activities of NWDPRA generated additional employment opportunities.

In this study, employment generation was measured by considering the number of mandays of employment generated per year as responded by farmer. A scoring procedure was developed to measure this impact.

Sl. No.	Employment generated in terms of Number of mandays/year	Score
1.	Nil	0
2.	Upto 30 days	1
3.	30 - 60 days	2
4.	More than 60 days	3

3.3.3.4 Increase in resource use efficiency

It refers to the perception of increased efficiency in using the local and natural resources in the watershed area.

A scoring procedure was developed for this study to measure the increase in resource use efficiency with respect to soil, rock, moisture, ground water and vegetation. The respondents were asked to rate their efficiency in resource use with respect to the five statements on a five point continuum viz. 'very much increased', 'increased', 'undecided', 'decreased', and 'very much decreased' with scores of 4, 3, 2, 1 and 0 respectively. The scores obtained on each statement was summed up to arrive at the individual score on increase in resource use efficiency. The possible score ranges from 20 to zero.

3.3.3.5 Increase in income

Increase in income refers to the increase in total earnings of the family, including income from agriculture, allied sectors and sources, self employment and agri-based enterprises as a result of implementation of NWDPRA.

The measurement of increase in income was done by asking the respondents to state the increase in total income after the implementation of NWDPRA. The scoring procedure developed to measure this is given below.

Sl.No.	Increase in total income/year	Score
1.	Upto Rs.1000/-	1
2.	Rs.1000/- to Rs.2000/-	2
3.	Rs.2000/- to Rs.3000/-	3
4.	Above Rs.3000/-	4

The scores obtained on each statement was summed up to arrive at the individual score on increase in income. The possible score ranges between 16 and four.

3.3.3.6 Increase in productivity

It refers to the increase in yield from the unit area cultivated by the beneficiaries of NWDPRA.

In this study, the scoring procedure developed by Surendran (2000) was followed to measure the perception of increase in productivity.

Increase in yield	Score
No increase	0
Increase upto 25%	1
25% - 50%	2
51% - 75%	3
76% - 100%	4
Increase above 100%	5

3.4 Constraints in NWDPRA

Constraint analysis is one of the important areas of research in extension. Before arriving at any strategy for transfer of technology, the constraints if any are to be identified for finding solutions.

Shamitha and Karuppai (1995) considered constraints as obstacles encountered by the beneficiaries in the course of action. In the study, constraints mean difficulties or problems experienced by farmers and also by extension agents in adopting watershed management practices.

In order to identify the constraints encountered, the following procedure was adopted.

A list of possible constraints in watershed management was prepared after discussion with officers implementing NWDPRA and social scientists. More number of constraints were added after detailed review of literature and information available from the pilot study conducted. These constraints were included in the interview schedule as simple and clear statements. The two categories of respondents (farmers and extension agents) were asked to respond to the items of constraints on a five point continuum as 'very important', 'important', 'neither important nor unimportant', 'less important' and 'least important' with scores 4, 3, 2, 1 and 0 respectively. The over all mean score for each constraint was worked out for the two categories of respondents separately and ranking was done.

3.5 Techniques of data collection

Based on the methodology described above, an interview schedule was prepared for the purpose of data

collection. The interview schedule prepared in English was translated into Malayalam before administering to the farmer - respondents.

The interview schedule was pre-tested in a non-sample area having similar conditions. Based on the pre-testing, certain modifications were made in the statements of the schedule to avoid ambiguous and irrelevant items.

The interview schedule duly revised is given in Appendix-IV. The data collection was carried out during April 2000. The respondents were individually contacted by the researcher.

3.6 Categorisation of respondents

For most of the variables except a few, viz. farm size, training participation, indebtedness, increase in income, employment generation and increase in productivity, the respondents were classified into low, medium and high group taking mean and SD as criteria. For the variable farm size, training participation, indebtedness, increase in income, employment generation and increase in productivity the respondents were categorised into low, medium and high group on the basis of the observed range of scores.

Low group - < Mean - 1 SD

Medium group - Between Mean $\pm$ 1 SD

High group - > Mean + 1 SD

3.7 Statistical methods used

The following statistical tools were used for the analysis and interpretation of data.

Arithmetic mean

Arithmetic mean is the quotient that results when all items in the series is divided by the number of items.

Correlation analysis

Simple correlation coefficients were computed to find out the relationship between the dependent variables and each of the independent variables.

Stepwise multiple regression

This was done to know the relative effect of the independent variables in predicting the dependent variable and for elimination of unimportant variables. The best fitting regression equation of dependent variable on independent variables was predicted by applying step wise regression.

Spearman's rank order correlation coefficient

Spearman's rank order correlation was used in the present study to measure the degree of agreement among the farmers and extension agents in their ranking of constraints.

RESULTS AND DISCUSSION

CHAPTER - IV

RESULTS AND DISCUSSION

The results of the study are presented and discussed in this chapter under the following subheadings.

4.1 Profile of NWDPRA beneficiaries

4.2 Techno-socio-economic consequences of NWDPRA

4.3 Association of the characteristics of the farmers with techno-socio-economic consequences

4.4 Relative importance of the selected profile characteristics and their contribution in explaining the dependent variables

4.5 Constraints in NWDPRA as perceived by the farmers and extension agents

4.1 Profile of NWDPRA beneficiaries

4.1.1 Farm size

The data obtained with regard to the farm size of the NWDPRA beneficiaries is depicted in Table 2.

Table 2 Distribution of farmers according to their farm size

(n=100)

Farm size (hectare)	Category	Frequency
> 0.4	High	13
0.2 - 0.4	Medium	20
< 0.2	Low	67

It is evident from the above table that a higher proportion of the respondents (67 per cent) belonged to the low group having below 0.2 hectare and only 20 per cent of farmers belonged to medium and 13 per cent belonged to high group having more than 0.4 hectare of farm size.

This is in confirmity with the findings of Varma (1996) and Thomas (1998).

A sizeable proportion of the respondents have only marginal farm size of less than 0.2 hectare. This supports the fact that the average size of holding in Kerala is very low. Also our State is characterised by high fragmentation of holdings, which may be another reason for the small holdings of the farmers.

4.1.2 Technical guidance

The data pertaining to the technical guidance received by the farmers is given in Table 3.

Table 3 Distribution of farmers according to the technical guidance received

(n=100)

Score	Category	Frequency
> 4	High	0
2-4	Medium	95
< 2	Low	5

Mean = 2.91
SD = 0.92

Table 3 reveals that majority of the respondents (95 per cent) got medium level of technical guidance and five per cent of the respondents received only low level of technical guidance. No farmer received high level of technical guidance.

Due to the democratic decentralisation, the work load of the different officials in the departments concerned with watershed management might have increased. Thus they may not have sufficient time to give regular guidance to the farmers. This may be the reason for the middle level of technical guidance received by the farmers.

4.1.3 Availability of low cost watershed technologies

The perception of the farmers about the availability of low cost watershed technologies is given in Table 4.

Table 4 Distribution of farmers according to their perception about the availability of low cost watershed technologies

(n=100)

Score	Category	Frequency
> 7	High	12
3-7	Medium	68
< 3	Low	20

Mean = 4.69
SD = 2.07

It is clear from Table 4 that majority of the farmers (68 per cent) belonged to medium level of perception about the availability of low cost watershed technologies and 20 per cent and 12 per cent of farmers belonged to low and high level of perception respectively about the availability of low cost watershed technologies. Only the needed technology for the particular farm used to be discussed with the farmers by the extension agents so that other low cost technologies might not have been brought to the attention of the farmers. This is a possible reason for the majority being in the medium category.

4.1.4 Observability of the innovation

The results presented in Table 5 reveal the perception of farmers about the observability of the innovation.

Table 5 Distribution of farmers according to their perception about the observability of the innovation

(n=100)

Score	Category	Frequency
>26	High	7
12-26	Medium	72
<12	Low	21

Mean = 18.78
SD = 6.78

The Table 5 depicted that majority of the respondents (72 per cent) were in medium category considering their

perception about the observability of the innovation and 21 per cent and 7 per cent of farmers were in low and high category respectively.

The results of most of the low cost watershed technologies are not immediately and directly visible. This may be the reason for the medium level of perception about the observability of the innovation by the majority of the farmers.

4.1.5 Complexity of the innovation

The results indicating the complexity of the innovation as perceived by the farmers are furnished in Table 6.

Table 6 Distribution of the farmers according to their perception about the complexity of the innovation

(n=100)

Score	Category	Frequency
>29	High	10
16-29	Medium	72
<16	Low	18

Mean = 22.52
SD = 6.78

It can be seen from Table 6 that 72 per cent of the respondents perceived the watershed technologies as moderately complex, while 18 per cent perceived them as simple and 10 per cent considered them as complex.

Most of the watershed technologies required technical skills such as marking contour lines using the dumpy level. This might have resulted in the middle level of perception about the complexity of the innovation by majority of the farmers.

4.1.6 Attitude towards watershed development programmes

The distribution of the farmers based on their attitude towards watershed development programmes is shown in Table 7.

Table 7 Distribution of farmers according to their attitude towards watershed development programmes

(n=100)

Score	Category	Frequency
>65	High	13
59-65	Medium	79
<59	Low	8

Mean = 62.46
SD = 3.03

It could be seen from the above table that majority of the respondents (79 per cent) possessed favourable attitude followed by 13 per cent with more favourable attitude and 8 per cent with less favourable attitude towards development programmes.

The above finding derives support from the findings of Savithri (1992), Kamaraj (1996) and Sankaran (1997).

Favourable attitude of the farmers towards watershed development programmes may be due to their awareness about the watershed management practices and its importance.

4.1.7 Extension participation

Table 8 depicts the distribution of farmers on the basis of their extension participation.

Table 8 Distribution of farmers according to their extension participation

(n=100)

Score	Category	Frequency
> 6	High	15
2-6	Medium	82
< 2	Low	3

Mean = 3.97
SD = 1.8

The table reveals that majority of the respondents (82 per cent) had medium level of extension participation, while 15 per cent of the respondents were in high group and the remaining 3 per cent in the low group of extension participation.

The result is in line with the findings of Anusuya (1997).

Most of the farmers were taking up farming only as a subsidiary occupation. Their involvement in other avenues

might have taken much of their time and hence they may not have enough time to participate in all extension activities. This, coupled with increased work load of extension agents might have resulted in middle level of extension participation by majority of the farmers.

4.1.8 Mass media exposure

The data regarding the mass media exposure of the farmers are presented in Table 9.

Table 9 Distribution of farmers according to mass media exposure

(n=100)

Score	Category	Frequency
>17	High	11
12-17	Medium	84
<12	Low	5

Mean = 14.62
SD = 2.54

Regarding the mass media exposure, a good portion of the respondents were in the medium group (84 per cent) and 11 per cent of the respondents were in high group and 5 per cent in low group.

The above finding derives support from the findings of Senthil (1983), Jeyaseelan (1992) and Anusuya (1997).

Medium level of exposure to mass media may be due to the fact that most of the farmers are engaged in various

activities and the time factor may have restricted them from listening to different mass media sources regularly.

4.1.9 Economic motivation

The results pertaining to the economic motivation of the farmers are presented in Table 10.

Table 10 Distribution of farmers according to economic motivation

(n=100)

Score	Category	Frequency
>24	High	1
21-24	Medium	84
< 21	Low	15

Mean = 22.13
SD = 1.53

It could be seen from Table 10 that majority of the respondents (84 per cent) had medium level of economic motivation followed by low level (15 per cent) and high level (1 per cent) of economic motivation.

The result agrees with that of Velusamy (1996) and Anusuya (1997).

People in the villages are generally interested in immediate profits from agriculture. Watershed management provides economic returns in the long term only. This could be a possible reason for the big majority of farmers coming in the medium level of economic motivation.

4.1.10 Training participation

The distribution of farmers based on the training participation are given in Table 11.

Table 11 Distribution of farmers according to their training participation

(n=100)

Number of trainings	Frequency
No training	57
One training	39
Two trainings	4
Three and more trainings	0

It is evident from Table 11 that more than half of the respondents did not attend any training programme related to watershed management.

The result is in confirmity with that of Sankaran (1997).

This may be due to the lack of trainings conducted by the various departments related to watershed management.

4.1.11 Knowledge in watershed planning

Knowledge of farmers in watershed planning is presented in Table 12.

Table 12 Distribution of farmers according to their knowledge in watershed planning

(n=100)

Score	Category	Frequency
> 6	High	13
3 - 6	Medium	64
< 3	Low	23

Mean = 4.67
SD = 1.46

Perusal of the Table 12 revealed that more than half of the respondents (64 per cent) were seen in medium knowledge category followed by low (23 per cent) and high (13 per cent) categories.

The finding is in alignment with that of Jayakrishnan (1984), and Manjunath *et al* (1996) and Jeya (1999).

Mass media exposure of the farmers and the technical guidance received by the farmers were only medium. These reasons combined with inadequate participation in trainings might have resulted in the medium level of knowledge possessed by the farmers in watershed planning.

4.1.12 Innovativeness

Innovativeness of the farmers is presented in Table 13.

Table 13 Distribution of farmers according to the innovativeness

(n=100)

Score	Category	Frequency
>4	High	0
3-4	Medium	88
< 3	Low	12

Mean = 3.18
SD = 0.65

Table 13 elucidates that more than three fourth (88 per cent) of the respondents had only medium level of innovativeness and no farmer possessed high level of innovativeness.

This result agrees with those of Velusamy (1996), Anusuya (1997) and Jeya (1999).

Majority of the farmers in the scheme areas were above middle age. They tend to be more conservative than the young. The respondents might have viewed the technologies in NWDPRA with some scepticism.

4.1.13 Indebtedness

The data regarding the indebtedness of the farmers are presented in Table 14.

Table 14 Distribution of respondents according to the indebtedness

(n=100)

Amount	Category	Frequency
Rs.3001/- and above	High	8
Rs.1001/- to 3000/-	Medium	52
Upto Rs.1000/-	Low	40

A glance at the above table revealed that 52 per cent of respondents comes under medium level of indebtedness followed by low and high level with 40 per cent and 8 per cent respectively.

Majority of the farmers have small land holdings. So the income from the farm is very low and to carryout various practices they may depend on different money lending agencies. This might be the reason for middle level of indebtedness.

4.1.14 Orientation towards incentives

The distribution of farmers according to their orientation towards incentives is presented in Table 15.

Table 15 Distribution of farmers according to orientation towards incentives

(n=100)

Score	Category	Frequency
>17	High	1
14-17	Medium	95
<14	Low	4

Mean = 15.58
SD = 1.2

It could be seen from Table 15 that more than three fourths of the respondents had medium level of orientation towards incentives and 4 per cent of the respondents had low level and 1 per cent had high level of orientation towards incentives.

The farmers in the village areas look for some incentives such as free planting materials from the implementing agency. In this study also, majority of the respondents had an orientation towards incentives, eventhough at medium level.

4.1.15 Cropping intensity

The data regarding the cropping intensity of the farmers are furnished in Table 16.

Table 16 Distribution of farmers according to the cropping intensity

(n=100)

Score	Category	Frequency
>88	High	15
61-88	Medium	68
< 61	Low	17

Mean = 74.72
SD = 13.74

The results of Table 16 indicates that 68 per cent of farmers were in medium group followed by low and high group with 17 per cent and 15 per cent respectively, regarding their

cropping intensity.

Similar result was obtained by Singh *et al* (1995).

Medium level of cropping intensity followed by most of the farmers may be due to the small size of their land holdings.

4.2 Techno-socio-economic consequences of NWDPRA

4.2.1 Adoption of watershed management practices

The results regarding the adoption level of farmers are presented in Table 17.

Table 17 Distribution of farmers according to the adoption of watershed management practices

(n=100)

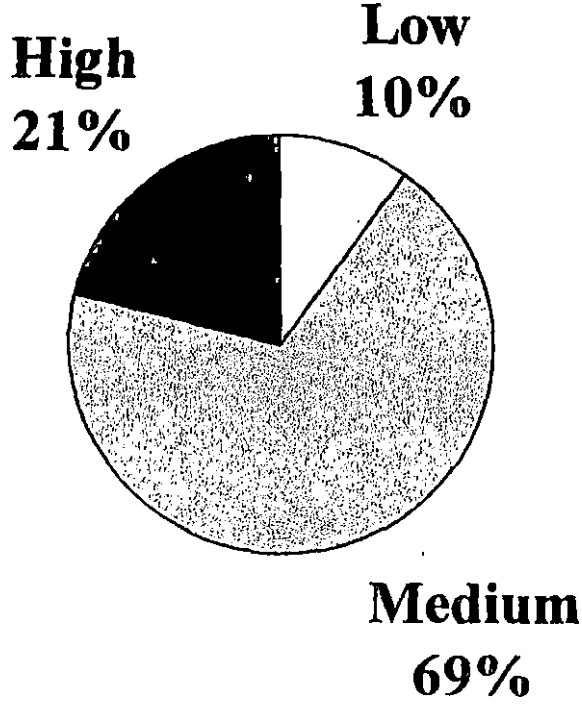
Score	Category	Frequency
> 98.52	High	21
58.72-98.52	Medium	69
< 58.72	Low	10

Mean = 78.62
SD = 19.90

From the above table and Fig. 3 it is clear that majority of the farmers had medium level of adoption (69 per cent) followed by high level (21 per cent) and low level (10 per cent) of adoption.

This finding derived support from Sakunthalai (1992), Sundarambal (1994) and Sujatha and Annamalai (1998).

Fig3: Distribution of farmers based on adoption of watershed management practices



Only less than 25 per cent of the respondents have adopted most of the recommended practices on their farm. Out of this group only 20 farmers have fully adopted the required and recommended watershed management practices. The various constraints such as inadequacy of funds for implementing NWDPRA, inadequate technical guidance etc. might have contributed to the medium level of adoption of majority of the respondents.

4.2.2 Social status

The results indicating the social status of the farmers are presented in Table 18.

Table 18 Distribution of farmers according to the social status

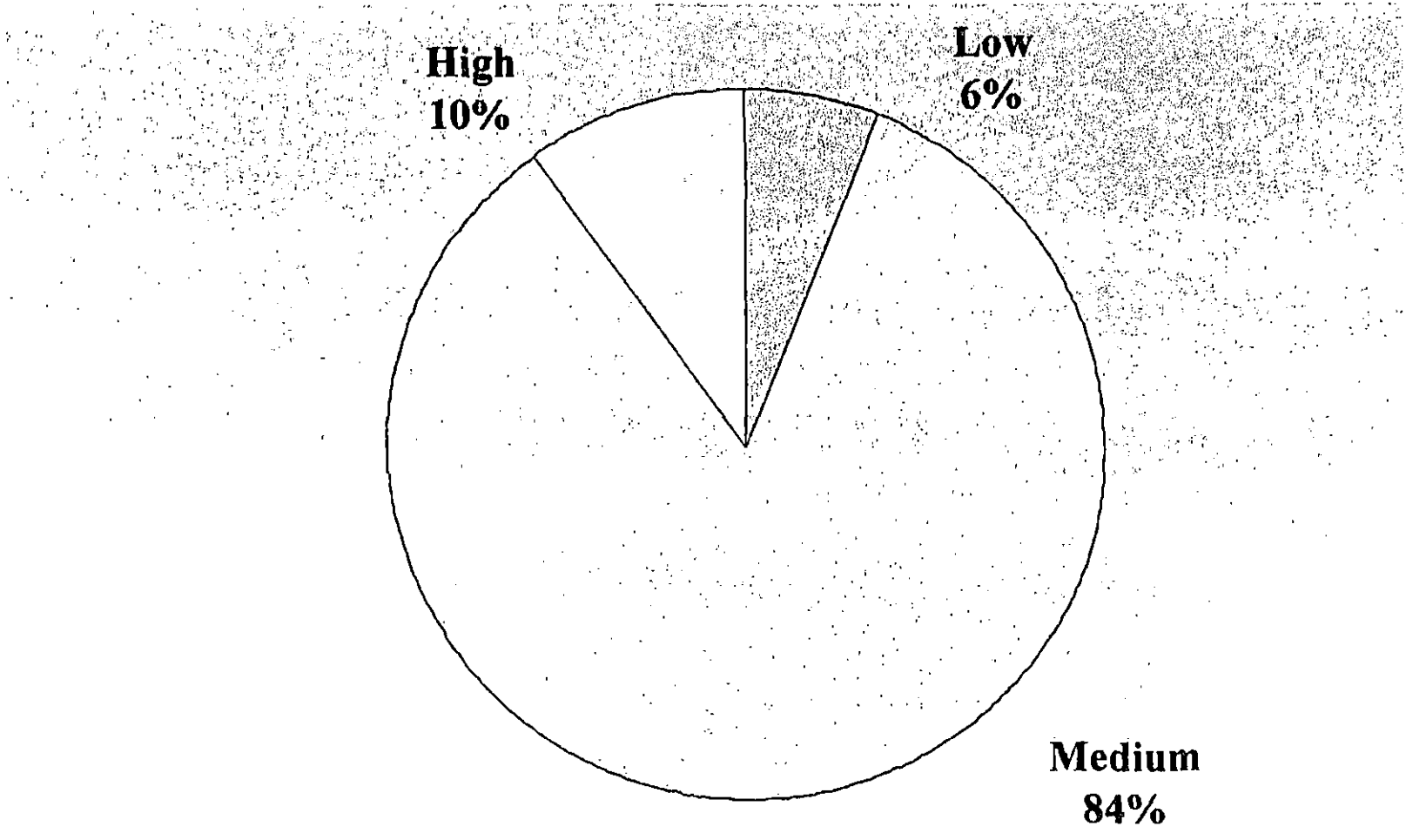
(n=100)

Score	Category	Frequency
>10	High	10
6-10	Medium	84
< 6	Low	6

Mean = 7.92
SD = 2.12

It could be observed from the table and Fig. 4 that majority of the farmers (84 per cent) belonged to medium level of social status followed by high level (10 per cent) of social status. Only 6 per cent of the farmers had low level of social status.

Fig 4: Distribution of farmers based on their social status



This is in line with the findings of Kushwah and Bajpai (1998) and Dharmalingam (1990).

4.2.3 Employment generation

The results presented in Table 19 reveal the perception of farmers about the employment generated.

Table 19 Distribution of farmers according to their perception about the employment generated

(n=100)

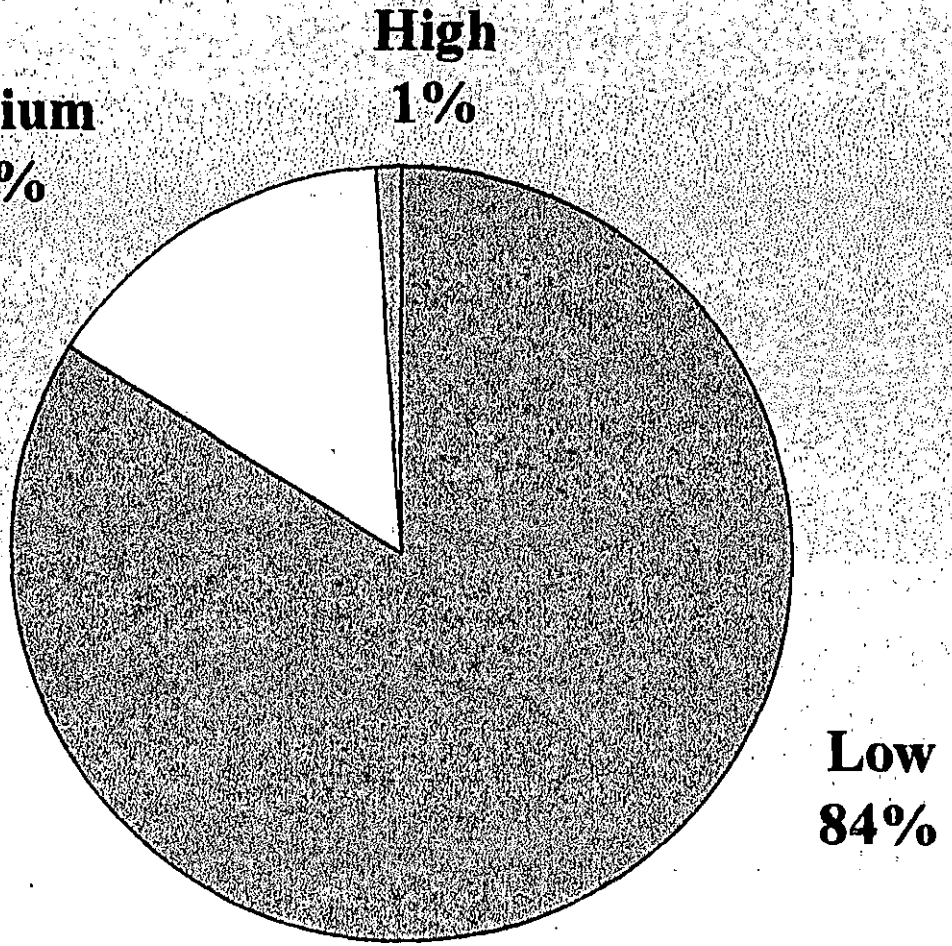
Mandays/year	Category	Frequency
> 60 days	High	1
30 - 60 days	Medium	15
< 30 days	Low	84

It is clear from Table 19 and Fig. 5 that 84 per cent of the respondents perceived that their number of employment days increased upto 30 days and 15 per cent of the respondents perceived that the employment days increased between 30 to 60 days. Only one farmer perceived that the employment days increased more than 60 days.

The result supports the finding of Lakshmi (1992).

Majority of the farmers perceived that employment generated was low. This may be due to the fact that majority of the farmers had small land holdings and they required only very small labourforce from outside the family.

Fig 5: Distribution of farmers based on the perception about the employment generated



4.2.4 Increase in resource use efficiency

The results presented in Table 20 revealed the perception of farmers about the increase in resource use efficiency.

Table 20 Distribution of farmers according to their perception about increase in resource use efficiency

(n=100)

Score	Category	Frequency
>15	High	7
12-15	Medium	88
<12	Low	5

Mean = 13.57
SD = 1.29

Table 20 and Fig. 6 reveals that more than three fourths of the farmers (88 per cent) perceived that the resource use efficiency increased upto medium level.

This result is in tune with the findings of Singh *et al* (1995).

The medium level of adoption of watershed management practices may be the reason behind their perception that resource use efficiency had increased upto medium level.

4.2.5 Increase in income

The results pertaining to the increase in income of the farmers are presented in Table 21.

Fig 6: Distribution of farmers based on their perception about increase in resource use efficiency and increase in productivity

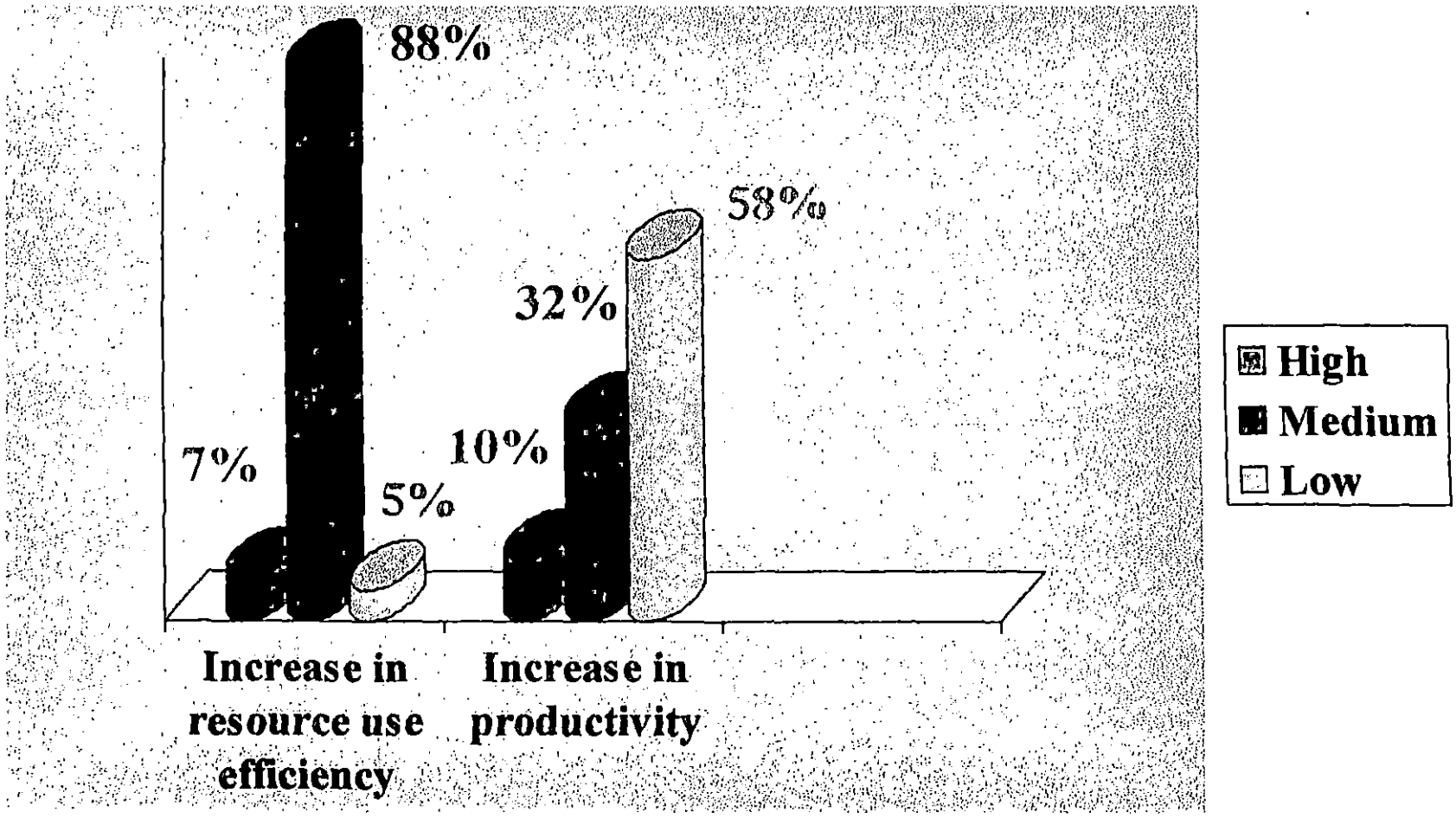


Table 21 Distribution of farmers according to the increase in income

(n=100)

Rupees/annum	Category	Frequency
> 2000/-	High	24
1000/- to 2000/-	Medium	31
< 1000/-	Low	45

It was seen from Table 21 and Fig. 7 that 45 per cent, 31 per cent and 24 per cent of the respondents were in the low, medium and high income group respectively.

Gowda and Jayaramaiah (1990) and Eswarappa (1991) had also reached the same conclusion.

The adoption level of the majority of the farmers were medium and this may be the reason for medium level of increase in income as a result of implementing NWDPRA.

4.2.6 Increase in productivity

The perception of the farmers about the increase in productivity is given in Table 22.

Table 22 Distribution of farmers according to their perception about the increase in productivity

(n=100)

Productivity	Category	Frequency
>50%	High	10
26-50%	Medium	32
<26%	Low	58

Fig 7: Distribution of farmers based on increase in income

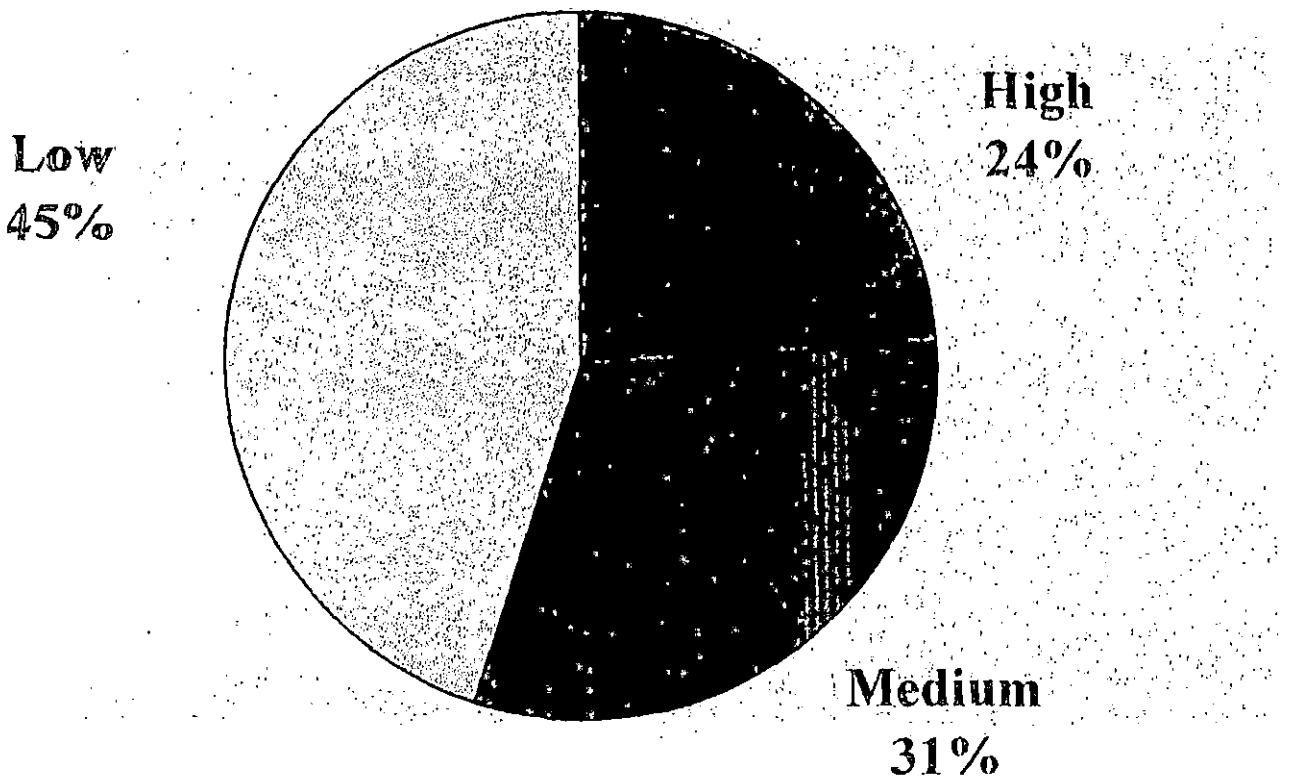


Table 22 and Fig. 6 revealed that the distribution of respondents in the low, medium and high level of productivity were 58 per cent, 32 per cent and 10 per cent respectively. Majority of the farmers perceived that increase in productivity as a result of implementing NWDPRA was low.

The result is in accordance with the findings of Mencher (1980) and Singh *et al* (1995).

Watershed management is to be practiced on a multidisciplinary, holistic and integrated way for deriving the benefits. Non-adoption and partial adoption of the watershed management practices will adversely affect the effectiveness of the programme. Defective implementation of NWDPRA might have influenced the farmers to perceive a low level of increase in productivity.

4.3 Association of the characteristics of the farmers with techno-socio-economic consequences

Correlation analysis was done to find out the intensity of the association between the independent variables and each of the dependent variable.

The results of the simple correlation between the dependent variables and the independent variables is given in Table 23.

Table 23 Correlation between the dependent variables and the independent variables

(n=100)

Variable number	Name of the variable	Adoption of watershed management practices	Social status	Employment generation	Increases in resource use efficiency	Increases in income	Increase in productivity
X_1	Farm size	0.7784**	0.5415**	0.1631	0.2980**	0.7226**	0.6054**
X_2	Technical guidance	0.1389	0.3783**	0.0892	0.2515*	0.1856	0.1412
X_3	Availability of low cost watershed technologies	0.8581**	0.5191**	0.1518	0.3204**	0.5327**	0.4908**
X_4	Observability of innovation	0.5765**	0.3645**	0.1737	0.2992**	0.4925**	0.4015**
X_5	Complexity of innovation	-0.4314**	0.1975	0.1773	-0.0282	0.1044	0.1206
X_6	Attitude towards watershed programmes	0.5628**	0.4981**	0.0687	0.2599**	0.5006**	0.4527**
X_7	Extension participation	0.4730**	0.3519**	0.1331	0.2144*	0.4247**	0.3293**
X_8	Mass media exposure	0.2694**	-0.0187	0.0437	-0.0621	0.3663**	0.3657**
X_9	Economic motivation	0.1398	0.1327	0.0927	-0.0475	0.2331*	0.1459
X_{10}	Training participation	0.3319**	0.3936**	0.0146	0.3541**	0.1007	0.5879**
X_{11}	Knowledge in watershed planning	0.4047**	0.3469**	0.1122	0.3962**	0.4604**	0.3196**
X_{12}	Innovativeness	0.1129	0.2852**	0.0556	0.1273	0.5126**	0.1571
X_{13}	Indebtedness	-0.2129*	-0.2342*	0.2043*	0.0451	-0.2341*	-0.3782**
X_{14}	Orientation towards incentives	0.1592	0.3803**	0.3257**	0.0577	0.1545	0.0315
X_{15}	Cropping intensity	0.4439**	0.1732	0.0845	0.1344	0.3202**	0.2714**

** Significant at 1% level of probability
* Significant at 5% level of probability

4.3.1 Correlation between the extent of adoption of watershed management practices and the independent variables

From Table 23 it is observed that the variables farm size, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, mass media exposure, knowledge about watershed planning, training participation and cropping intensity were positively and significantly correlated with the adoption of watershed management practices at one per cent level of probability. Complexity of the innovation and the indebtedness were found to be negatively significant with the adoption of watershed management practices.

The positive and significant correlation between farm size and adoption of watershed management practices may be attributed to the fact that farmers with large holdings may be able to adopt most of the watershed management practices which are land based due to their large farm size. Further, the income from the farm might have motivated the farmers to develop a favourable attitude towards watershed management practices.

This result is in confirmity with the findings of Venugopalan (1989), Balavatti and Sundarasamy (1990).

Various factors are involved in the adoption of watershed management practices. The perception of the farmers about the availability of various low cost watershed technologies might have created a favourable attitude towards watershed development programmes. This might have resulted in the positive and significant relationship between the availability of low cost watershed technologies and adoption of watershed management practices.

This is in tune with the findings of Choudhary (1967), Ray (1967) and Pillai (1978).

Observability of an innovation is the degree to which the results of an innovation are visible to others. Some of the watershed management practies such as construction of check dams, water harvesting structures and drainage line treatments are very much observable. Farmers were more likely to adopt watershed management practices when they perceive the results of the innovation as observable. This might be the reason for the positive and significant association between observability of the innovation and adoption of watershed management practices in this study.

This result is in confirmity with the findings of Havens and Rogers (1961).

Majority of the farmers had favourable attitude towards watershed development programmes. More over attitude

is inter related with the knowledge in watershed planning, mass media exposure and observability of the innovation. This serves as a favourable condition resulting in higher adoption of watershed management practices, leading to a positive and significant relationship between attitude and adoption in the present study.

Similar result was obtained by Lakshmi (1992) who reported significant relationship between attitude and adoption.

Participation of an individual in various extension activities might have increased their awareness and knowledge about watershed based farming, which results in adoption of watershed management technologies. This may be the reason behind positive and significant relationship between extension participation and adoption. Nataraju and Gowda (1986) and Pandurangaiah (1987) also reported that extension participation had a positive relationship with adoption.

Mass media exposure was found to have a significant and positive relationship with adoption. Exposure to different mass media would have helped the farmers to get familiarise with the various watershed management practices. This might have resulted in an increase in their knowledge and change of attitude, there by resulting in the adoption of different watershed management practices.

The significant and positive relationship of mass media exposure with adoption was also reported by Masood (1987), Chandran (1993) and Kamaraj (1996).

Training makes a man proficient in doing some work. In the present study training was found to have a positive and significant relationship with adoption of watershed management practices. Training might have helped the farmers to gain more knowledge about the various watershed management practices and it might have given them an opportunity to change their attitude. This might have led to the adoption of various watershed management practices.

This result is in confirmity with the findings of Lakshmi (1992).

Knowledge is of utmost importance while adopting new practices. If the farmer has proper knowledge, he can evaluate the practices and adopt it. This might have resulted in a significant and positive relationship between knowledge and adoption.

Sophia (1991) and Tharaneetharan (1993) had also reported that knowledge is significantly related to adoption.

Cropping intensity was found to have a positive and significant relationship with adoption. The desire to get increased returns might have led the farmers to intensify the

cropping intensity which inturn might have resulted in the increased adoption of watershed management practices. Moreover the observability of the various practices and availability of low cost watershed technologies might also have prompted them to adopt various practices.

This result is in contrast with the findings of Singh and Singh (1970) and in accordance with the findings of Pathak and Mazumdar (1976) and Shukla (1980).

Complexity is the degree to which an innovation is relatively difficult to understand and use. Hence it is quite natural to assume that complexity of an innovation as perceived by the farmers affects its rate of adoption, resulting in a negatively significant association between complexity of an innovation and its adoption.

Rogers (1983) also reported that innovations that are perceived by the receivers as having less complexity would be adopted more rapidly than other innovations.

For the adoption of new practices money is an important factor. Thus it becomes difficult for an indebted farmer to adopt new practices. This may be the reason for the negatively significant correlation between indebtedness and adoption.

This is in confirmity with the findings of Sajeevchandran (1989).

4.3.2 Correlation between the social status of the farmers and the independent variables

It could be clearly noted from the Table 23 that out of 15 variables, 10 variables viz. Farm size, technical guidance, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, training participation, knowledge in watershed planning, innovativeness and orientation towards incentives have positive and significant association at one per cent level with the social status of the farmers. Indebtedness was found to be negatively significant at five per cent level.

Farm size was found to have a significant and positive relationship with the social status of the farmers. It is quite logical to assume that a farmer with big holding is likely to adopt more number of practices. This results in an increased income from the farm which leads to a higher social status of the farmer in the society.

A farmer who receives technical guidance may use appropriate practices in the proper way. This might lead to an increase in the income which inturn may increase the social status of the farmer. This accounts for the positive and significant association observed between technical guidance and social status of the farmers in this study.

The significant and positive association between availability of low cost watershed technologies and social status might be due to the fact that the easy availability of various technologies for watershed management might have motivated the farmers to adopt various practices. This could have increased their profit from the farm resulting in an increased social status.

The correlation coefficients computed and tested for significance showed that observability of the innovation was positively and significantly related to social status. The farmers may adopt the practices whose results are observable. This might have increased their income from the farm and also their social status.

Attitude of the farmers towards watershed development programmes was found to be having positive correlation with the social status. It is reasonable to believe that a farmer who had realised the importance of watershed development programmes may more efficiently involve in various programmes. As the involvement of farmers in various development programmes increased, there was corresponding increase in social status also.

This result is in confirmity with the findings of Singh and Singh (1968) and Reddy and Reddy (1977).

Extension participation might have increased the knowledge about watershed planning, which play a prime role in the adoption of various practices. This might have enabled them to gain more profit which inturn might have increased their social status. This may lead to a positive and significant relationship between the independent variables extension participation and knowledge in watershed planning with the dependent variable social status.

Trainings attended by the farmers might have helped them to gain more skill and knowledge about the various scientific practices to be followed for watershed management. This perception about training might have influenced their adoption level of various practices leading to an increased social status. This accounts for the positive and significant relationship between training participation and social status.

The results of the study indicated that innovativeness was positively related with social status of the farmers. Interest and desire of farmers to seek changes in various practices and to introduce such changes might have influenced their perception of social status.

Indebtedness was found to be negatively correlated with social status of the farmers. An indebted farmer is not able to adopt most of the practices. Indebted farmers are likely to develop a negative self concept and perceive a relatively low social status.

Orientation towards incentives was found to be having positive correlation with social status. Orientation towards incentives might have encouraged the farmers to adopt more number of practices. As a result of adopting more practices, the productivity from the farm also might have increased, leading to increased social status.

4.3.3 Correlation between employment generated and the independent variables

From the results given in Table 23 it was found that only indebtedness of the farmers and orientation towards incentives were positively and significantly correlated with employment generated.

It is evident from Table 23 that indebtedness was positively and significantly related to employment generation. An indebted farmer may have low social status and income. In order to increase his social status and income he may try out new employment opportunities.

It could be inferred that the significant and positive relation between orientation towards incentives and employment generation may be due to the adoption of technologies having relatively high cost. Once the farmers are given incentives to adopt such technologies, they are motivated

to adopt all the recommended practices which need a large labour force which results in employment generation.

The result is in confirmity with the findings of Gowda (1988) and Gowda and Jayaramaiah (1996).

4.3.4 Correlation between increase in resource use efficiency and the independent variables

It is evident from the Table 23, that farm size, technical guidance, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, training participation and knowledge about watershed planning are positively and significantly related to increase in resource use efficiency.

Farm size was found to have significant and positive relationship with increase in resource use efficiency. A farmer with large farm size may have more income and adoption of watershed management practices. This might have resulted in the increase in resource use efficiency.

The significant and positive relationship between the technical guidance and increase in resource use efficiency might be due to the fact that when a farmer receives technical guidance, he is more likely to be aware about the various

resources in his farm and its uses. This might have increased their resource use efficiency.

Availability of low cost watershed technologies was positively and significantly related with increase in resource use efficiency. The availability of low cost watershed technologies might have increased the adoption of various watershed management practices which inturn might have increased their resource use efficiency.

Similar results have also been reported by Khatik *et al.* (1997).

The farmers perception about the observability of the innovation will affect the adoption level of farmers. The increase in the adoption of various practices with technical guidance might have increased the resource use efficiency. This may be the fact behind the significant and positive association of observability of the innovation with the increase in resource use efficiency.

Attitude towards watershed development programmes had a positive and significant association with resource use efficiency. The favourable attitude of the farmers about watershed development programmes might have increased the adoption of watershed technologies. The increased adoption

along with increased knowledge about watershed planning and the importance of the conservation of various resources could result in an increased resource use efficiency.

Considering the significant and positive correlation of extension participation with the increase in resource use efficiency it can be concluded that farmers with greater degree of involvement in extension activities would have gathered more scientific information from reliable sources and have changed their awareness about various resources. This might have increased their resource use efficiency.

Trainings undergone may help the farmers to acquire knowledge about the use and importance of various resources in their farm. This might have increased the resource use efficiency, resulting in a positive and significant association between training participation and increased resource use efficiency.

Favourable attitude and trainings undergone by the farmers might have contributed to an increased knowledge and practical skill in using various resources effectively, which is an essential component of watershed planning. This would have contributed to the significant relationship between knowledge and resource use efficiency.

4.3.5 Correlation between increase in income and the independent variables

As seen from Table 23, the variables farm size, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, mass media exposure, economic motivation, training participation, knowledge about watershed planning, innovativeness and cropping intensity were found to have a positive and significant relationship with increase in income. Indebtedness was negatively correlated with increase in income.

Farm size was found to have a positive and significant relationship with the increase in income. It is quite reasonable to assume that a large farm size would contribute to more income.

This result is in confirmity with the findings of Lakshmi (1992).

Availability of low cost watershed technologies may have encouraged the farmers to adopt more number of practices in their farm which play an important role in increasing their income. This might have resulted in the significant association between availability of low cost watershed technologies and increase in income.

The observability of the results of various technologies might have prompted the farmers to adopt them which might have resulted in the increased economic status. This might be the reason for the significant association between observability and increase in income.

The significant and positive correlation of attitude and increase in income might be due to the fact that favourable attitude might have motivated them to attain more awareness about various practices and adopt them, which resulted in the increased income from the farm.

This result is in confirmity with the findings of Lakshmi (1992).

Extension participation might have helped the farmers to know more about the various watershed management practices. Having gathered more scientific information they would be able to adopt the necessary practices which inturn increase their income. This could be the reason for the significant and positive relationship between extension participation and increase in income.

Mass media exposure might have helped the farmers to gain more knowledge and favourable attitude towards watershed development programmes and that would have motivated the farmers to adopt different practices. This might have facilitated greater income. This explains the significant and

positive relationship observed between mass media exposure and increase in income.

Economically motivated farmers are more receptive to different watershed management practices which ensured higher yields and income. This accounts for the positive and significant relationship between economic motivation and increase in income.

Knowledge was found to have a positive and significant relationship with increase in income. Farmers with good knowledge about watershed planning tend to adopt the watershed management practices and this might have resulted in increase in income.

It was found that innovativeness was positively and significantly related to increase in income. Innovative farmers are progressive in their outlook and seek changes in their practices. This factor coupled with greater knowledge might have ensured greater adoption which resulted in increase in income.

The adoption of watershed management practices by an indebted farmer would be low and this might be the reason for the negative association between indebtedness and increase in income.

It is quite logical to assume that if the cropping intensity is high, the yield from the area would be more and

this might lead to an increased income. This explains the positive and significant association observed between cropping intensity and increase in income.

4.3.6 Correlation between increase in productivity and the independent variables

From Table 23, it could be seen that out of the 15 variables, ten variables namely farm size, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, mass media exposure, training participation, knowledge about watershed planning and cropping intensity showed positive and significant relationship with the increase in productivity. Indebtedness was found to be negatively significant with the increase in productivity.

Farm size had a positive and significant relationship with increase in productivity. If the farm size is more, the area under crops and quantity of management inputs would be more. This might be the reason for the increase in productivity.

This result is in contrast with the findings of Saini (1971).

Availability of low cost watershed technologies may have increased the adoption level of farmers and this inturn

would have increased the productivity from the farm. This accounts for the positive and significant correlation between availability of low cost watershed technologies and increase in productivity.

This observation is in confirmity with the findings of Munishkumar and Warsi (1998).

Observability of the results of various technologies might have prompted the farmers to follow those practices. This might have resulted in the perception of increased productivity. This may be the reason for the positive and significant association between observability of the innovation and increase in productivity.

Attitude towards watershed development programmes was found to have a positive and significant relationship with increase in productivity. Favourable attitude of the farmers towards the watershed development programmes would have helped them to know more about the programmes and this would have encouraged them to adopt various practices in their farm. This might have resulted in the perception of increase in productivity.

Extension participation might have helped the farmers to interact with many sources and this helped them to gain more awareness and knowledge about various practices, which could lead to increase in productivity. This accounts for the

significant and positive relationship between extension participation and increase in productivity.

When farmers are exposed to different mass media, they are sure of knowing more about the watershed management practices. This might have increased the adoption rate of various practices, which resulted in an increase in productivity. This may be the fact behind the positive and significant association observed between mass media exposure and increase in productivity.

Training participation was found to have a positive and significant relationship with the increase in productivity. This may be due to the fact that by participating in trainings, the farmer might have gained more awareness and knowledge about various watershed based practices. This might have resulted in increase in productivity.

Knowledge about watershed planning would have enabled the farmers to follow various watershed technologies and might have helped to increase the productivity. This may be the reason for the significant and positive correlation observed between knowledge and increase in productivity.

This is in line with the findings of Shilaja (1990) who found that knowledge of crops of farm women in progressive village was positively and significantly related with mixed farming productivity.

Considering the positive and significant relationship of cropping intensity with increase in productivity, it is quite logical to assume that if the cropping intensity is more, naturally the productivity will be high, provided the farmer had the knowledge and motivation to adopt the necessary practices at the right time.

Indebtedness was found to have a negative and significant relationship with the increase in productivity. An indebted farmer may find difficult to invest money on scientific watershed management practices. The financial assistance rendered by NWDPRA is very low. This might have resulted in partial adoption of the required watershed technologies. As a result of poor management of the farm, productivity decreases.

4.4 Relative importance of the selected profile characteristics and their contribution in explaining the dependent variables

The technique of stepwise multiple regression analysis was useful to know the relative effect of the 15 independent variables in predicting the three dependent variables and to identify the independent variables which are having maximum influence on these dependent variables.

4.4.1 Stepwise multiple regression analysis of the adoption of watershed management practices with the independent variables

The results of the step wise multiple regression analysis showing all the significant steps of adoption of watershed management practices with the independent variables are presented in Table 24.

Table 24 Step wise regression analysis showing the final significant steps with all significant variables included in the study of the adoption of watershed management practices

Variable No.	Name of the variable	Regression coefficient (b)	S.E.of b	t value
X_3	Availability of low cost watershed technologies	0.817	0.102	7.981**
X_1	Farm size	0.508	0.152	3.341**

** Significant at 1% level
R^2 = 0.76

It is evident from Table 24 that 76 per cent of the variation in adoption of watershed management practices by the farmers was attributed to the two characteristics included as indicated by the coefficient of determination (R^2).

The regression equation is

$$y = 0.960 + 0.508\ X_1 + 0.816\ X_3$$

The variables availability of low cost watershed technologies and farm size were found to have significant influence on adoption behaviour of the farmers.

The results showed that a unit increase in the farmer's perception about the availability of low cost watershed technologies resulted in an increase of 0.82 units of their adoption of the recommended practices, other factors being kept constant. With a unit increase in farm size, their adoption was increased by 0.51 units.

4.4.2 Step wise multiple regression analysis of social status of the farmers with the independent variables

The results of the regression analysis are presented in Table 25

Table 25 Step wise regression analysis of independent variables on social status of farmers

Variable number	Name of the variable	Regression coefficient (b)	SE of b	t value
X_1	Farm size	0.564	0.187	3.018**
X_8	Mass media exposure	-0.287	0.078	-3.690**
X_{14}	Orientation towards incentives	0.409	0.132	3.092**
X_2	Technical guidance	0.280	0.184	1.526
X_4	Observability of the innovation	5.057	0.028	1.991
X_{12}	Innovativeness	0.491	0.273	1.795
X_6	Attitude towards watershed development programmes	0.120	0.070	1.710

R^2 = 0.54
** - Significant at 1% level

Table 25 reveals that 54 per cent of the variation in the social status of farmers was attributed to the seven characteristics included as indicated by the coefficient of determination (R^2).

The regression equation is

$$Y = -6.54 + 0.120 X_6 + 0.491 X_{12} + 5.665 \times 10^{-2} X_4 + 0.280 X_2 + 0.409 X_{14} + -0.287 X_8 + 0.564 X_1$$

The variables farm size, orientation towards incentives and mass media exposure were found to have significant influence on social status of farmers.

4.4.3 Step wise multiple regression analysis of the increase in productivity with the independent variables

The results of the step wise multiple regression analysis showing all the significant steps of increase in productivity with the independent variables is presented in Table 26.

Table 26 Step wise regression analysis of independent variables on increase in productivity

Variable Number	Name of the variables	Regression coefficient (b)	SE of b	t value
X_1	Farm size	0.199	0.050	4.00**
X_{10}	Training participation	0.457	0.119	3.83**
X_{13}	Indebtedness	-0.108	0.050	-2.15*

R^2 = 0.49
** - Significant at 1% level
* - Significant at 5% level

It could be seen from Table 26 that out of 15 independent variables, 3 variables namely farm size, training participation and indebtedness were significant in contributing increase in productivity.

The regression equation is

$$Y = 0.977 + {}^{-}0.108\ X_{13} + 0.457\ X_{10} + 0.199\ X_1$$

From the prediction table, it could be seen that an increase in farm size would lead to an increase in productivity by 0.2 units, other factors being kept constant. Among the three variables, the 't' value of farm size is highly significant.

4.5 Constraints in NWDPRA as perceived by farmers and extension agents

The constraints experienced by the farmers and extension agents in NWDPRA are presented in Table 27. These constraints are ranked on the importance with which they were felt.

Table 27 Constraints in NWDPRA as perceived by farmers and extension agents

Sl. No.	Name of constraints	Farmers		Extension agents	
		Mean score	Rank	Mean score	Rank
1.	Inadequacy of funds provided to land owners in NWDPRA	2.4	1	2.8	4.5
2.	Inadequate co-ordination among the implementing agencies of NWDPRA	1.83	6	2.97	1
3.	Allocation of funds for different sectors of NWDPRA is not need based	2.06	3	2.9	2
4.	Low cost technologies such as vegetative measures are not suitable for steep slopes	1.45	11	2.37	7
5.	Dearth of technical staff for implementation of NWDPRA	1.99	4	1.87	16
6.	Rigorous guidelines and procedures of NWDPRA create problems	1.11	16	1.97	14
7.	Want of clear and practical objectives in NWDPRA	1.00	20.5	1.5	19
8.	Lack of understanding of the concept of watershed development	1.33	14	2.6	5
9.	Inadequate technical guidance	1.86	5	2.33	8.5
10.	Non availability of model watershed plans for reference	0.83	23	2.4	6
11.	Non availability of demonstration plots to see the benefits of watershed management	0.86	22	1.67	18
12.	Inadequate knowledge about the procedure and benefits in watershed management	1.36	13	2.13	11
13.	Protest from the land owners to treat the watershed as a whole for development	0.79	24	1.03	22

(Contd...2)

Table 27 Continued

Sl. No.	Name of constraints	Farmers		Extension agents	
		Mean score	Rank	Mean score	Rank
14.	Inadequate training in watershed management	1.75	8	1.90	15
15.	Want of experienced persons in the implementing agency to transfer the watershed technology	1.53	10	2.8	4.5
16.	Inadequate involvement of local institutions and voluntary agencies in watershed planning and management	1.00	20.5	2.87	3.5
17.	Negative attitude of field staff towards NWDPRA	1.43	12	2.87	3.5
18.	NWDPRA is not based on local needs of the farmers	2.14	2	2.27	10
19.	Non availability of farm literature on watershed development	1.15	15	1.23	21.5
20.	Non availability of quality planting materials of high yielding varieties	0.99	21	1.23	21.5
21.	Inadequate credit facilities for watershed development	1.67	9.5	2.00	13
22.	Inadequate marketing facilities	1.06	18	1.70	17
23.	Political bias in providing incentives to beneficiaries	1.80	7	2.30	9
24.	Inadequate linkage between Micrakisans and other beneficiaries in the watershed	1.67	9.5	2.07	12
25.	Non availability of quality fodder seeds	1.09	17	1.40	20
26.	Lethargic nature of watershed development team	1.04	19	2.23	8.5

4.5.1 Constraints in NWDPRA as perceived by the farmers

Perusal of the data revealed that inadequacy of funds provided to land owners in NWDPRA was perceived as the most important constraint (Mean score (MS) = 2.40). Next in rank was NWDPRA is not based on local needs of farmers (MS = 2.14). Allocation of funds for different sectors of NWDPRA is not need based (MS = 2.06) was perceived to be next in importance.

4.5.2 Constraints in NWDPRA as perceived by the extension agents

It is evident from Table 27 that inadequate co-ordination among the implementing agencies of NWDPRA was perceived as the most important constraint (MS - 2.97). This is followed by allocation of funds for different sectors of NWDPRA is not need based (MS - 2.9). Next in rank was inadequate involvement of local institutions and voluntary agencies in watershed planning and the negative attitude of field staff towards NWDPRA (MS - 1.00).

Inadequacy of funds provided to land owners in NWDPRA was perceived as the most important constraint by the farmers. The financial assistance provided to the farmers in NWDPRA is meagre. The farmers had difficulty in getting the financial assistance in time. This indicates that there are some lacunae in the proper functioning of NWDPRA scheme. This can be

overcome by proper monitoring and evaluation besides increasing the subsidy for soil and water management practices.

NWDPRA is not based on the local needs of the farmers is identified as the next important constraint by the farmers. Watershed programmes should be location specific. The slope of the land, soil type and availability of the resources may vary from place to place, so the works recommended for one area may not be suitable for another area. So importance should be given to develop schemes based on the needs of the farmers in a location.

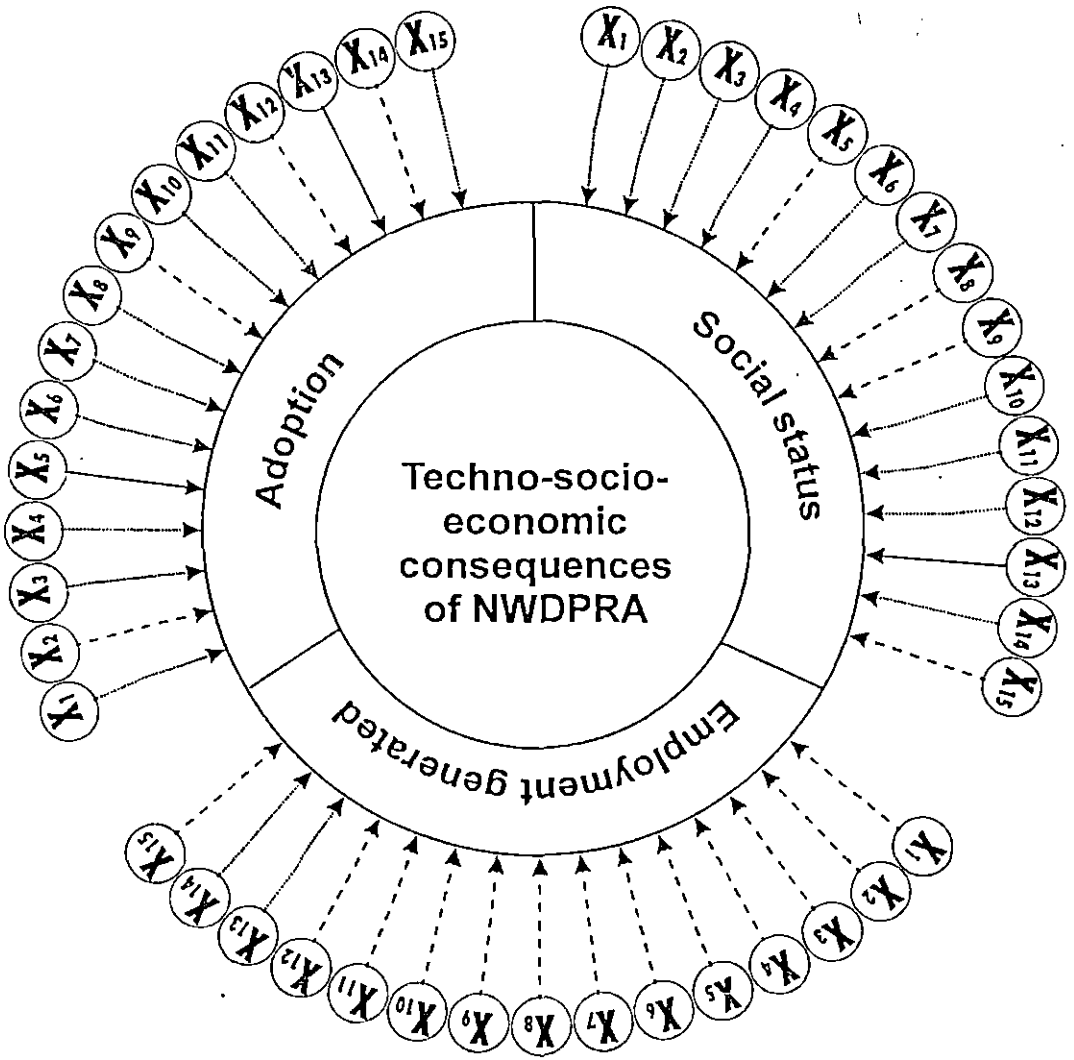
The next important constraint perceived by the farmers is allocation of funds for different sectors of NWDPRA is not need based. While formulating different schemes, funds should be allocated based on the relative importance of the components in the programmes. Extension agents also perceived this as an important constraint.

Inadequate co-ordination among the implementing agencies of NWDPRA was perceived as the most important constraint by the extension agents. Since there are several departments involved in implementing the programme, effective co-ordination has to be ensured. The problems in co-ordination can be overcome by forming a single Department or Board for Watershed Development to take up watershed management activities in Kerala.

Inadequate involvement of local institutions and voluntary agencies in watershed planning and negative attitude of field staff towards NWDPRA are perceived as the third constraint by extension agents. The negative attitude of the extension agents might be due to their heavy work load and inadequate financial assistance envisaged in the NWDPRA to beneficiaries.

4.5.3 Rank correlation between farmers and extension agents with respect to the constraints in NWDPRA

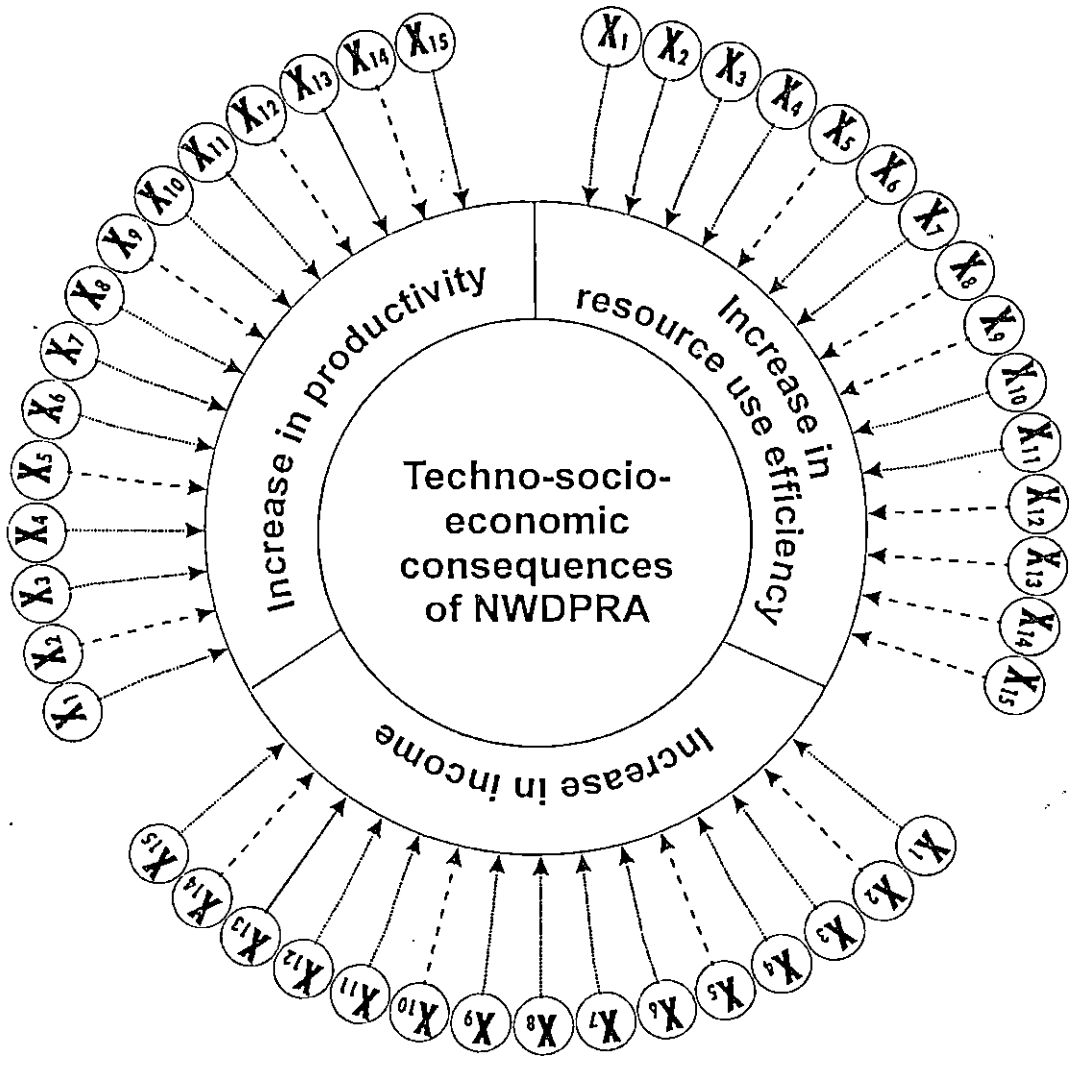
Rank correlation coefficients of 26 constraints between farmers and extension agents was 0.443 which was significant at 0.05 level. So there was agreement between farmers and extension agents with respect to the constraints in NWDPRA.



X_1 - Farm size
X_2 - Technical guidance
X_3 - Availability of low cost watershed technologies
X_4 - Observability of innovation
X_5 - Complexity of innovation
X_6 - Attitude towards watershed development programmes
X_7 - Extension participation
X_8 - Mass media exposure
X_9 - Economic motivation
X_{10} - Training participation
X_{11} - Knowledge in watershed planning
X_{12} - Innovativeness
X_{13} - Indebtedness
X_{14} - Orientation towards incentives
X_{15} - Cropping intensity

→ Positive and significant
→ Negative and significant
--→ Non-significant

Fig. 8a. Empirical model of the study



X_1 - Farm size
X_2 - Technical guidance
X_3 - Availability of low cost watershed technologies
X_4 - Observability of innovation
X_5 - Complexity of innovation
X_6 - Attitude towards watershed development programmes
X_7 - Extension participation
X_8 - Mass media exposure
X_9 - Economic motivation
X_{10} - Training participation
X_{11} - Knowledge in watershed planning
X_{12} - Innovativeness
X_{13} - Indebtedness
X_{14} - Orientation towards incentives
X_{15} - Cropping intensity

→ Positive and significant
→ Negative and significant
⇢ Non-significant

Fig. 8b. Empirical model of the study

SUMMARY AND CONCLUSION

CHAPTER - V

SUMMARY AND CONCLUSION

We claim to have achieved considerable success in providing safe drinking water to about 85 per cent of its rural population. But on the other hand, statistics revealed that out of the total annual fresh water available in India, two-thirds get lost. In a State like Kerala, although the average rainfall is high, the run-off is very fast with only 20 per cent retention due to undulating topography. This leads to acute scarcity during the summer months (Varadan, 2000).

India does not have the luxury of new land and fresh water resources. The current resources too face serious threat of depletion due to indiscriminate utilisation and ever increasing population demands. As a solution, Government of India launched a programme called National Watershed Development Project for Rainfed areas (NWDPRA) and it was started in Kerala during the Eighth Plan period. The objective of the programme includes sustainable production of biomass and restoration of ecological balance in rainfed areas.

The present study was an attempt to understand the techno-socio-economic consequences of NWDPRA in Thiruvananthapuram district and the perceived constraints by the farmers and extension agents.

The specific objectives of the study were:

1. To findout the relationship and contribution of the selected profile characteristics of farmers of NWDPRA in the adoption of watershed management practices.

2. To study the techno-socio-economic consequences of NWDPRA in Thiruvananthapuram district.

3. To identify the constraints in NWDPRA as perceived by farmers and extension agents.

The investigation was carried out in Thiruvananthapuram district, which comprises of four taluks. From each taluk one watershed area was randomly selected. Selection of respondents from each watershed area was made according to probability proportional to size of beneficiaries. Thus a total of one hundred respondents were selected as the sample size. For the identification of constraints, thirty extension agents who worked in NWDPRA or now working in NWDPRA of Thiruvananthapuram district belonging to the different departments were identified.

Adoption of watershed management practices, social status of farmers, employment generation, increase in resource use efficiency, increase in income and increase in productivity were the variables selected for identifying the techno-socio-economic consequences. The independent variables selected were

farm size, technical guidance, availability of low cost watershed technologies, observability of the innovation, complexity of the innovation, attitude towards watershed development programmes, extension participation, mass media exposure, economic motivation, training participation, knowledge in watershed planning, innovativeness, indebtedness, orientation towards incentives and cropping intensity.

A well structured and pretested interview schedule was used for data collection. The data collected were statistically analysed using arithmetic mean, correlation, step-wise multiple regression and Spearman's rank order correlation.

The salient findings of the study are summarised below:

1. The frequency distribution of the profile characteristics of the farmers revealed that 67 per cent of the farmers had less than 0.2 hectare, supporting the fact that average size of holding in Kerala is very low. Ninety five per cent of the farmers perceived that they received only medium level of technical guidance. Majority of the farmers (68 per cent) perceived that the availability of low cost watershed technologies was medium. About the observability and complexity of the innovation, majority of the respondents (72 per cent) were

in medium category. Seventy nine per cent of the respondents had a favourable attitude towards watershed development programmes and more than three fourths of the farmers had medium level of extension participation (82 per cent), mass media exposure (84 per cent) and economic motivation (84 per cent). Regarding the training participation, 57 per cent of the farmers had not attended any training related to watershed management. Majority of the farmers had medium level of knowledge in watershed planning (64 per cent), innovativeness (88 per cent), indebtedness (52 per cent) and orientation towards incentives (95 per cent). Cropping intensity of majority of farmers (68 per cent) was found to be medium.

2. Study of the techno-socio-economic consequences of NWDPRA disclosed that 69 per cent of the farmers had only medium level of adoption of watershed management practices and 84 per cent of the farmers belonged to medium level of social status. More than three fourths (84 per cent) perceived that their number of employment days increased upto 30 days. Eighty eight per cent of the respondents perceived that the resource use efficiency increased upto medium level and 45 per cent of farmers were of perception that the income increased upto Rs.1000/-. More than half of the farmers (58 per cent) were of the perception that productivity was increased upto 25 per cent.

3. Correlation studies revealed that farm size, availability of low cost watershed technologies, observability of innovation, attitude towards watershed development programmes, extension participation, mass media exposure, training participation, knowledge in watershed planning and cropping intensity had positive and significant relationship with the adoption of watershed management practices, while complexity of the innovation and indebtedness had negative and significant correlation with adoption. Technical guidance, economic motivation, innovativeness and orientation towards incentives was found to have no correlation with the adoption of watershed management practices.

4. In the case of social status of the farmers, farmsize, technical guidance, availability of low cost watershed technologies, observability of innovation, attitude towards watershed development programmes, extension participation, training participation, knowledge in watershed planning, innovativeness and orientation towards incentives had positive and significant relationship. Indebtedness had negative and significant relationship with social status of farmers. Complexity of the innovation, mass media exposure, economic motivation and cropping intensity were not related with social status of farmers.

5. With respect to employment generation, studies revealed that indebtedness and orientation towards incentives had a positive and significant relationship and the variables farmsize, technical guidance, availability of low cost watershed technologies, observability and complexity of innovation, attitude towards watershed development programmes, extension participation, mass media exposure, economic motivation, training participation, knowledge in watershed planning, innovativeness and cropping intensity were found to have no relationship with employment generation.

6. The studies revealed that farmsize, technical guidance, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, training participation, and knowledge in watershed planning had positive and significant association with increase in resource use efficiency. Complexity of the innovation, mass media exposure, economic motivation, innovativeness, indebtedness, orientation towards incentives and cropping intensity were observed to have no relationship with increase in resource use efficiency.

7. Results of the correlation studies revealed that farmsize, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed

development programmes, extension participation, mass media exposure, economic motivation, knowledge in watershed planning, innovativeness and cropping intensity had a positive and significant relationship with increase in income of the farmers. Indebtedness had a negative and significant correlation with increase in income. Technical guidance, complexity of the innovation, training participation and orientation towards incentives had no relationship with increase in income.

8. The variables farmsize, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, mass media exposure, training participation, knowledge in watershed planning and cropping intensity were found to have a positive and significant relationship with increase in productivity and indebtedness showed a negative and significant relationship with increase in productivity. Technical guidance, complexity of innovation, economic motivation, innovativeness and orientation towards incentives were found to have no relationship with increase in productivity.

9. Stepwise regression analysis revealed that two variables viz, availability of low cost watershed technologies and farmsize contributed to 76 per cent of

the variation in adoption of watershed management practices.

10. The variables farmsize, mass media exposure, orientation towards incentives, technical guidance, observability of innovation, innovativeness and attitude towards watershed development programmes were fitted in the regression equation resulting in 54 per cent of variation in the social status of NWDPRA beneficiaries.

11. Stepwise regression analysis indicated that the variables farmsize, training participation, and indebtedness contributed 49 per cent variation in increase in productivity of the farmers.

12. The important constraints perceived by the farmers were inadequacy of funds provided to land owners in NWDPRA, NWDPRA is not based on local needs of farmers, and allocation of funds for different sectors of NWDPRA is not need based. The important constraints perceived by the extension agents in NWDPRA were inadequate co-ordination among the implementing agencies of NWDPRA, allocation of funds for different sectors of NWDPRA is not need based, inadequate involvement of local institutions and voluntary agencies in watershed planning and negative attitude of field staff towards NWDPRA.

13. The results of Spearman's rank order correlation of constraints revealed that there was agreement between farmers and extension agents with respect to constraints in NWDPRA.

Implications of the study

The management of watersheds are now gaining attention in recent days due to the occurance of severe droughts and degradation of natural resources. Hence the results of this study entitled "Techno-socio-economic consequences of NWDPRA in Thiruvananthapuram district" will be of use to the researchers and extension agents to review the existing guidelines and make suitable modifications in NWDPRA.

Suggestions for future research

1. Suitability of the watershed technologies recommended for Kerala can be studied.

2. An indepth study can be conducted on the organizational constraints on watershed management.

3. Role of Kerala Agricultural University in watershed development of Kerala can be studied.

4. A training need analysis of watershed management can be conducted.

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5. An action research can be conducted on "Sloping Agricultural Land Technology" (SALT) in some of the selected locations to test the low cost technologies of watershed management.

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APPENDICES

APPENDIX - I

Details of NWDPRA schemes completed in Thiruvananthapuram district during the Eighth Plan period

Taluk	Name of watershed	Area in hectare	Number of beneficiaries
Chirayinkil	Illamba	355.00	981
	Ottur	769.20	1450
	Manjappara	616.00	1998
Nedumangad	Kaithumoola	504.00	1450
	Anad	509.00	1860
	Kuthirakulam	815.00	1562
Neyyattinkara	Kollamkonam	710.00	3002
	Kurumkutty	643.00	3000
	Anavur	742.00	2820
	Kottukal	1585.00	7230
	Nettayam	580.00	915
Thiruvananthapuram	Thettiyar	682.00	2906

APPENDIX - II

Details of NWDPRA schemes selected in Thiruvananthapuram district during the Ninth Plan period

Taluk	Name of watershed	Area in hectare	Total number of beneficiaries
Chirayinkil	Edaikode	285.00	1301
	Chemaruthy	339.00	1239
	Mevarakkal	697.64	3130
Nedumangad	Eliyavoor	242.00	838
	Panayam	501.00	895
	Irukunnam	340.00	761
	Vellanickal	256.00	594
Neyyattinkara	Ayria	1975.00	10771
	Chittar	845.65	3592
	Venganoor	1142.60	8581
	Pallichal	800.00	6200
Thiruvananthapuram	Anathazhchira	496.00	1868

APPENDIX - III

KERALA AGRICULTURAL UNIVERSITY

Dr.G.Balakrishna Pillai
Professor and Head

Dept. of Agricultural Extension
College of Agriculture
Vellayani
Thiruvananthapuram - 695522

Dear Sir/Madam,

This is in connection with the research study undertaken by one of my students Ms. Lakshmi. S., who is doing M.Sc. in Agricultural Extension in this department. She has taken up a research study entitled "Techno-socio-economic consequences of National Watershed Development Project for Rainfed areas in Thiruvananthapuram District".

The main objectives of the study are to find out the relationship and contribution of the selected profile characteristics of farmers of NWDPRA in the adoption of watershed management practices, to study the techno-socio-economic consequences of NWDPRA in Thiruvananthapuram district and to identify the constraints in NWDPRA as perceived by farmers and extension agents.

The independent variables related to the study have been identified based on review of literature and discussion with experts. These are listed in the Annexure along with their operational definition.

Considering your expertise and vast experience, you have been identified as a judge to rate the relevancy of the variables on a three point continuum ranging from "most relevant" to "least relevant". Please put a tick mark (✓) against each of the variables to indicate your judgement on the degree of relevance of the variables. You are free to add more number of variables.

Kindly return the judgement sheet to the researcher.

Thanking you,
Yours sincerely

(Dr. G.B.Pillai)

Following are the list of Independent variables identified for the study. The operational definition is given for each variable. You are requested to indicate the relevancy of the variables by putting (✓) in the space provided

Sl. No.	List of variables	Most Relevant	Relevant	Least Relevant
1.	Age:-, refers to the number of completed years of the respondent since birth			
2.	Caste: the caste hierarchy of respondents whether belongs to upper/backward/scheduled caste			
3.	Education: defined as the formal schooling attended by the respondent			
4.	Income: refers to earnings of the family from all sources			
5.	Farm size: the total area of the land possessed by the farmer at the time of conducting the survey			
6.	Farming experience: Number of completed years in farming			
7.	Family size: the specific number of members in the family living together			
8.	Technical guidance: refers as the degree to which a particular farmers has received technical advice, guidance and assistance from the extension personnel on watershed management aspects			
9.	Observability of the innovation:- refers to the farmer's perception about the visibility of the results of the watershed management practice			

Sl. No.	List of variables	Most Relevant	Relevant	Least Relevant
10.	Complexity of the innovation: refers to the farmer's perception about the difficulty in undertaking the watershed management practices			
11.	Attitude: refers to the degree of positive or negative disposition associated with watershed development programmes			
12.	Knowledge:- refers to the farmer's understanding of the concept, practices, procedures and benefits of watershed planning and development			
13.	Extension contact:- refers to the degree to which one has contact with different extension agencies			
14.	Extension participation:refers to the frequency of participation in various extension activities			
15.	Social participation:- refers to degree of the respondent's participation in formal and informal social organizations either as member or as office bearer which also include their extent of participation in organizational activities			
16.	Economic motivation: refers to the degree of willingness for investment of available potential resources in adopting watershed technologies for increasing income			
17.	Achievement motivation: refers to the striving of the respondent to do good work and attain a sense of accomplishment			

Sl. No.	List of variables	Most Relevant	Relevant	Least Relevant
18.	Scientific orientation: degree to which the respondent is oriented to the use of scientific methods in decision making			
19.	Mass media exposure: refers to the degree to which the different mass media are utilised by the farmers for getting information about different watershed management practices			
20.	Training participation: refers to the number of trainings in watershed management undergone by the respondents during the last five years			
21.	Innovativeness: refers to the characteristic of the farmer to accept new ideas in farming			
22.	Indebtedness: refers to the total debt in terms of money a farmer owes to various money lending sources such as private money leaders, relatives, co-operatives etc.			
23.	Orientation towards incentives refers to the orientation of farmers towards subsidies and assistance provided by Government and other sponsoring agencies to motivate farmers to follow watershed management practices			
24.	Cropping intensity: refers to the proportion of total annual cropped area to the size of holding expressed in percentage			

APPENDIX - IV

INTERVIEW SCHEDULE

Techno-socio-economic consequences of National Watershed Development Project for Rainfed Areas in Thiruvananthapuram district

Respondent No.
Date:

Taluk :

Name of Watershed :

Name of the respondent :

Address :

Age :

No. of members in the family :

Occupation :

1. Farm size: Area in hectares:

2. Technical guidance

Sl. No.	Statements	Always (2)	Sometimes (1)	Never (0)
1.	Whether the local extension agent regularly visits your farm and provides necessary technical advise on watershed management			
2.	Whether higher level officers of the various departments involved in watershed management visits your farm and give necessary advice for the watershed management practices			
3.	Whether the extension agents help the farmers to identify and solve the problems related to watershed management.			
4.	Whether the members of the watershed management committees meet you and provide technical help in watershed management			

3. Availability of low cost watershed technologies. Are the following low cost technologies available to you for adopting watershed management?

Sl. No.	Low cost watershed technologies	Available (1)	Not available (0)
1.	Biological fencing on contour using grass species such as vettiver.		
2.	Intercropping in coconut garden.		
3.	Drainage line treatment with vegetative measures.		
4.	Planting agro-forestry species of subabul, mahagony, tamarind etc.		
5.	Construction of live check dams using agave, shrubs, vettiver etc.		
6.	Construction of brush wood check dams.		
7.	Making loose boulder check dams with vegetative support.		
8.	Making water harvesting structures		
9.	Fodder cultivation on contour bunds, boundaries and centripetal terraces.		
10.	Organic farming		
11.	Application of biofertilizers.		
12.	Use of high yielding varieties of paddy/coconut/banana for cultivation.		
13.	Construction of small dug out ponds of size 3x3x1m (pits)		

4. Observability of the innovation

Sl. No.	Item	Most observable (5)	More observable (4)	Somewhat observable (3)	Less observable (2)	Least observable (1)
1.	Biological fencing on contour using grass species such as vettiver					
2.	Intercropping in coconut garden					
3.	Drainage line treatment with vegetative measures					
4.	Planting agro-forestry species of subabul, mahagony, tamarind etc.					
5.	Construction of live-check dams using agave, shrubs, vettiver etc.					
6.	Construction of brush wood check dams.					
7.	Making loose boulder check dams with vegetative support					
8.	Making water harvesting structures					
9.	Fodder cultivation on contour bunds, boundaries and centripetal terraces					
10.	Organic farming					
11.	Application of biofertilizers					
12.	Use of high yielding varieties of paddy/ banana / coconut for cultivation					
13.	Construction of small dugout ponds of size 3x1x1m (pits)					

5. Complexity of the innovation

Sl. No.	Practices	Very simple to practice (5)	simple to practice (4)	Neither simple nor difficult to practice (3)	Complex to practice (2)	Very complex to practice (1)
1.	Biological fencing on contour using grass species such as vettiver.					
2.	Intercropping in coconut garden					
3.	Drainage line treatment with vegetative measures					
4.	Planting agro-forestry species of subabul, mahagony, tamarind etc.					
5.	Construction of live check dams using agava, shrubs, vettiver etc.					
6.	Construction of brush wood check dams					
7.	Making loose boulder check dams with vegetative support					
8.	Making water harvesting structures					
9.	Fodder cultivation on contour bunds, boundaries and centripetal terraces.					
10.	Organic farming					
11.	Application of biofertilisers					

Sl. No.	Practices	Very simple to practice (5)	simple to practice (4)	Neither simple nor difficult to practice (3)	Complex to practice (2)	Very complex to practice (1)
12.	Use of high yielding varieties of paddy/ coconut / banana for cultivation.					
13.	Construction of small dug out ponds of size 3x3x1m (pit)					

6. Attitude towards development programmes

Sl. No.	Statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1.	Integrated watershed development programme is a boon to dryland farmers.					
2.	Integrated watershed development programme is risky for small farmers.					
3.	Soil and water conservation can be achieved through integrated watershed development programme.					
4.	Integrated watershed development programme and agriculture are complementary to each other.					
5.	Integrated watershed development programme require low financial input.					

Sl. No.	Statements	Strongly agree	Agree	Unde-cided	Dis-agree	Strongly disagree
6.	Improved dry farming technology on watershed basis has helped in increasing crop yield and there by stepping up the standard of living.					
7.	Integrated watershed development programme does not provide employment to the people.					
8.	Improved dry land technology developed on watershed basis are specific.					
9.	Tree / fruit species suitable to different soil types are proposed for integrated watershed development programme.					
10.	Improved implements recommended for your area have suited to your conditions and helpful for efficient management of crops and reduced cost on labour and draft.					
11.	Farmers adopting NWDPRA are not free to choose tree/fruit species to plant in their integrated watershed development programme.					
12.	Integrated watershed development programme decreases the fertile land available for cultivation of crops.					

Sl. No.	Statements	Strongly agree	Agree	Unde-cided	Dis-agree	Strongly disagree
13.	Integrated watershed development programme is suitable only to big farmers.					
14.	The new cropping system / technology for crops recommended for your areas has really suited to your agro climatical conditions and in giving substantial income.					
15.	Integrated watershed development programme is based on the need of the farmers.					

7. Extension participation

Sl. No.	Item	Frequency of participation				
		Whenever conducted (4)	Often (3)	Ocass-ionally (2)	Rare (1)	Never (0)
1.	Group meeting					
2.	Seminars					
3.	Exhibitions					
4.	Farm film shows					
5.	Farmer's day					
6.	Demonstrations					
7.	Organised farm visits					

8. Mass media exposure

Sl. No.	Item	Frequency of exposure				
		Always (4)	Regularly (3)	Occasionally (2)	Rarely (1)	Never (0)
1.	Radio					
2.	Television					
3.	Newspaper					
4.	Magazines					
5.	Bulletins					
6.	Books					
7.	Films					

9. Economic motivation

Sl. No.	Statements	Strongly agree (5)	Agree (4)	Undecided (3)	Disagree (2)	Strongly disagree (1)
1.	A farmer should work towards higher yields and economic profit.					
2.	The most successful farmer is one who makes more profit.					
3.	A farmer should try any new farming idea which may help him to earn more money.					
4.	A farmer should grow more food crops for home consumption and to increase monetary profits.					

Sl. No.	Statements	Strongly agree (5)	Agree (4)	Unde-cided (3)	Dis-agree (2)	Strongly disagree (1)
5.	It is difficult for the farmers' children to make good start unless he provides them with economic assistance.					
6.	A farmer must earn his living but the most important thing in life cannot be identified in economic terms.					

10. Training participation

Sl. No.	No training (0)	One training (1)	Two trainings (2)	Three and more trainings (3)

11. Knowledge in watershed planning

Sl.No.	Items	True (1)	False (0)
1.	Watershed is bounded by panchayat boundaries		
2.	The operational size of a microwatershed is 1000 ha		
3.	The use of code number for each category of watershed is for identification of the mini watersheds.		
4.	The objective of contour survey is to gather useful information about soil and land.		

Sl.No.	Items	True (1)	False (0)
5.	The important details you can gather from the contour map are different vertical intervals to be followed for contour bunding.		
6.	The method to be adopted for preparing the resource inventory is the detailed bench mark survey.		
7.	The use of land capability classification is to study the slope of ranges only.		
8.	To prevent soil erosion in very steep slopes, the recommended mechanical measure is to construct contour bunding.		
9.	For preventing soil erosion through gullies, contour bunds are constructed.		
10.	A grass species found to be most suited for planting on contours to prevent soil and waterloss in *Cynodon daitylon*.		
11.	Stone-pitched contour bunds are also called bench terraces.		
12.	One climatological parameter to be considered in watershed planning is the intensity of rainfall.		
13.	It is necessary to collect data on socio economic aspects of land owners in the watershed for watershed planning.		
14.	Cultivation of tapioca on hill slopes will decrease erosion hazards.		
15.	One grass species you can use for planting on the top of bunds is *Congosignal*.		
16.	The water harvesting structures constructed on appropriate locations of the watershed will lower the ground water level.		
17.	A horticultural species used for reclammation of waste lands is cashew.		
18.	For minimising the havocs of floods and droughts in the State, watershed planning has to be substituted by panchayat level planning.		

Sl.No.	Items	True (1)	False (0)
19.	The best extension approach for effective watershed development is individual contact only.		

12. Innovativeness:
Please indicate your responses for the following statements

Sl.No.	Statements	Agree (1)	Disagree (0)
1.	A good farmer experiments with new ideas in farming		
2.	Though it takes time for a farmer to learn new methodologies it is worth taking the efforts		
3.	As soon as you get information regarding a new agricultural practice, you take immediate decision to put it into practice		
4.	If the Government would help you to establish a farm elsewhere, you would accept.		
5.	A farmer experimenting with his own new ideas but maintaining his farm enterprise without loss could be called innovative.		

13. Indebtedness

Sl. No.	Source	Purpose of borrowing	Amount borrowed (Rs.)	Score
			No debt	(0)
			Upto Rs.1000/-	(1)
			Between Rs.1001/- Rs. 2000/-	(2)
			Between Rs.2001/- Rs. 3000/-	(3)
			Between Rs.3001/- Rs. 4000/-	(4)
			Above Rs.4000/-	(5)

14. Orientation towards incentives:

Please indicate your extent of agreement or disagreement to the following statements

Sl. No.	Statements	Strongly Agree (5)	Agree (4)	Unde-cided (3)	Dis agree (2)	Strongly Disagree (1)
1.	Subsidies/assistance provided by sponsoring agency motivated farmers to follow watershed management practices.					
2.	Subsidies/assistance provided by the sponsoring agency are not adequate when compared to the expenditure in watershed management.					
3.	Subsidised supply of inputs like seeds, seed lings, fertilizers PPC reduced the hardship faced by farmers following watershed management practices.					
4.	Free electricity provided by Government for farming is a boon for farmers to reduce cost of cultivation.					

15. Cropping intensity

Sl. No.	Size of the holding in ha.	Area under annual crops (ha)	
		Name of the crop	Area

16. Adoption of watershed management practices. Please give your response with regard to your adoption of watershed management practices

Sl. No.	Practices	Potentiality for adoption: Was it recommended for your farms		Adoption: If recommended did you adopt?		
		Yes (1)	No (0)	Fully (2)	Partially (1)	Not adopted (0)
1.	Biological fencing on contour using grass species such as vettiver					
2.	Intercropping in coconut garden					
3.	Drainage line treatment with vegetative measures					
4.	Planting agro-forestry species of subabul, mahagony, tamarind etc.					
5.	Construction of live check dams using agave, shrubs, vettiver etc.					
6.	Construction of brush wood check dams.					
7.	Making loose boulder check dams with vegetative support.					
8.	Making waters harvesting structures.					

Sl. No.	Practices	Potentiality for adoption: Was it recommended for your farms: Yes (1)	Potentiality for adoption: Was it recommended for your farms: No (0)	Adoption: If recommended did you adopt? Fully (2)	Adoption: If recommended did you adopt? Partially (1)	Adoption: If recommended did you adopt? Not adopted (0)
9.	Fodder cultivation on contour bunds, boundaries and cetripetal terraces.					
10.	Organic farming.					
11.	Application of bio-fertilizers.					
12.	Use of high yielding varieties of paddy/ coconut / banana for cultivation.					
13.	Construction of small dug out ponds of size 3x3x1m (pits)					

17. Social status

1. Health Care

Sl. No.	Item	Score
a.	Self medication	(1)
b.	Local treatment:	
	Unqualified persons	(2)
	Qualified persons	(3)
c.	Outside treatment	
	Government hospital	(4)
	Private hospital	(5)

2. Education to Children

Sl. No.	Item	Score
a.	Children sent to local school	(1)
b.	Children sent to school outside the village	(2)
c.	Children sent to college	(3)

3. Occupation

Sl. No.	Item	Score
a.	Wage earners	(1)
b.	Farming and wage earners	(2)
c.	Farming	(3)
d.	Business	(4)
e.	Services	(5)
f.	Farming and business	(6)
g.	Farming and services	(7)

18. Employment generation:
(Please indicate how much employmen tis generated)

Sl. No.	Employment generated in terms of Number of mandays/year	Score
1.	Nil	(0)
2.	30 days	(1)
3.	30 - 60 days	(2)
4.	More than 60 days	(3)

19. Increase in resource use efficiency

Sl. No.	Item	Verymuch increased (4)	Increased (3)	Undecided (2)	Decreased (1)	Verymuch decreased (0)
1.	Conservation of fertile surface soil					
2.	Utility of rocks and stones available on the land					
3.	Moisture retention and conservation					
4.	Water table of wells and ponds increased					
5.	More bio-mass available for fodder and organic manure					

20. Increase in income

Sl. No.	Item	Upto Rs.1000/- (1)	1000/- to 2000/- (2)	2000/- to 3000/- (3)	Above 3000/- (4)
1.	Income from Agriculture				
2.	Income from allied sectors (Dairying, poultry keeping etc.)				
3.	Income from self employment				
4.	Income from agri-based enterprises				

21. Increase in productivity

Sl. No.	Item (Increase in yield)	Score
1.	No increase	(0)
2.	Increase upto 25%	(1)
3.	25 - 50%	(2)
4.	51 - 75%	(3)
5.	76 - 100%	(4)
6.	Increase above 100%	(5)

22. Constraints in NWDPRA

Sl. No.	Constraints in NWDPRA	Most important (5)	Important (4)	Neither important nor unimportant (3)	Less important (2)	Least important (1)
1.	Inadequacy of funds provided to land owners in NWDPRA.					
2.	Inadequate co-ordination among the implementing agencies of NWDPRA.					
3.	Allocation of funds for different sectors of NWDPRA is not need based.					
4.	Low cost technologies such as vegetative measures are not suitable for steep slopes					

Sl. No.	Constraints in NWDPRA	Most important	Important	Neither important nor unimportant	Less important	Least important
		(5)	(4)	(3)	(2)	(1)
5.	Dearth of technical staff for implementation of NWDPRA.					
6.	Rigorous guidelines and procedures of NWDPRA create problems.					
7.	Want of clear and practical objectives in NWDPRA.					
8.	Lack of understanding of the concept of watershed development					
9.	Inadequate technical guidance.					
10.	Non-availability of model watershed plans for reference.					
11.	Non-availability of demonstration plots to see the benefits of watershed management.					
12.	Inadequate knowledge about the procedure and benefits in watershed management.					
13.	Protest from the land owners to treat the watershed as a whole for development.					
14.	Inadequate training in watershed management.					

Sl. No.	Constraints in NWDPRA	Most important (5)	Important (4)	Neither important nor unimportant (3)	Less important (2)	Least important (1)
15.	Want of experienced persons in the implementing agency to transfer the watershed technology.					
16.	Inadequate involvement of local institutions and voluntary agencies in watershed planning and management.					
17.	Negative attitude of field staff towards NWDPRA.					
18.	NWDPRA is not based on local needs of the farmers.					
19.	Non-availability of farm literature on watershed development					
20.	Non-availability of quality planting materials of high yielding varieties.					
21.	Inadequate credit facilities for watershed development.					
22.	Inadequate marketing facilities.					
23.	Political bias in providing incentives to beneficiaries.					

Sl. No.	Constraints in NWDPRA	Most important (5)	Important (4)	Neither important nor unimportant (3)	Less important (2)	Least important (1)
24.	Inadequate linkage between 'Mitrakisans' and other beneficiaries in the watershed.					
25.	Non-availability of quality fodder seeds.					
26.	Lethargic nature of watershed development team.					
	Other items if any					

TECHNO-SOCIO-ECONOMIC CONSEQUENCES OF NATIONAL WATERSHED DEVELOPMENT PROJECT FOR RAINFED AREAS IN THIRUVANANTHAPURAM DISTRICT

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(98-11-21)

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN AGRICULTURAL EXTENSION
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM
2000

ABSTRACT

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The study entitled "Techno-socio-economic consequences of NWDPRA in Thiruvananthapuram district" was undertaken to assess the techno-socio-economic consequences on beneficiaries due to the implementation of NWDPRA. An attempt was also made to identify the constraints perceived by the farmers and extension agents.

The study was conducted in the four watersheds, one from each taluk of Thiruvananthapuram district which was selected randomly. A sample of hundred beneficiaries was selected according to the probability proportional to size of the beneficiaries in the selected watershed areas. Data were collected through well structured and pretested interview schedule.

The study revealed the following:

Majority of the farmers had small land holdings. Most of the farmers received only medium level of technical guidance.

The perceptions of the majority of respondents about the availability of low cost watershed technologies, observability of the innovation and complexity of the innovation were medium.

About three-fourths of the farmers had a favourable attitude towards watershed development programmes. Most of the farmers had medium level of extension participation, mass media exposure and economic motivation.

More than half of the respondents did not attend any training programme related to watershed management.

More than half of the respondents had only medium level of knowledge in watershed planning, innovativeness, indebtedness and orientation towards incentives.

Majority of the farmers followed medium level of cropping intensity.

The adoption of the watershed management practices by the farmers was only at medium level. Social status of the farmers was on average level.

The perception of the farmers about the employment generated was low and the perception about the increase in resource use efficiency was medium.

About half of the respondents were of the perception that the increase in income and productivity was low on account of NWDPRA.

Farm size, availability of low cost watershed technologies, observability of the innovation, attitude towards

watershed development programmes, extension participation, mass media exposure, training participation, knowledge in watershed planning and cropping intensity had positive and significant association with adoption of watershed management practices. Complexity of innovation and indebtedness had negative association with adoption.

Social status of farmers had positive association with farm size, technical guidance, availability of low cost watershed technologies, observability of innovation, attitude towards watershed development programmes, extension participation, training participation, knowledge in watershed planning, innovativeness and orientation towards incentives. Indebtedness had negative association with social status of farmers.

Employment generation had positive and significant relationship with indebtedness and orientation towards incentives.

Farm size, technical guidance, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, training participation and knowledge in watershed planning had positive and significant relationship with increase in resource use efficiency.

The variables farm size, availability of low cost watershed technologies, observability of the innovation, attitude towards watershed development programmes, extension participation, mass media exposure, economic motivation, knowledge in watershed planning, innovativeness and cropping intensity were found to have positive and significant relationship with increase in income. Indebtedness had a negative relationship with increase in income.

Increase in productivity had a positive and significant relationship with farm size, availability of low cost watershed technologies, observability of innovation, attitude towards watershed development programmes, extension participation, mass media exposure, training participation, knowledge in watershed planning and cropping intensity. Indebtedness had a negative relationship with increase in productivity.

Stepwise regression analysis revealed that availability of low cost watershed technologies and farm size contributed to 76 per cent of variation in adoption of watershed management practices.

The results of stepwise regression analysis revealed that the variables farm size, mass media exposure, orientation towards incentives, technical guidance, observability of innovation, innovativeness and attitude towards watershed

development programmes contributed to 54 per cent of variation in social status of farmers.

The important constraint perceived by the farmers was inadequacy of funds provided to land owners in NWDPRA and the important constraint perceived by the extension agent was inadequate co-ordination among the implementing agencies of NWDPRA.

The results of Spearman's rank order correlation of constraints revealed that there was agreement between farmers and extension agents with respect to the constraints in NWDPRA.