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Iduhatti Model Watershed
Nilgiris District
Tamil Nadu

ICAR-Indian Institute of Soil & Water Conservation (IISWC)
Ree's Corner, P.O. Fernhill, Udhagamandalam
The Nilgiris-643 004, Tamil Nadu

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Project Implementation Team

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FOREWORD

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The ICAR-IISWC, Research Centre, Udhagamandalam, Chennai took up Iduhatti watershed in Udhagamandalam Tehsil, District Nilgiris, Tamil Nadu during 2008 to 2013 for developmental activities in response to agricultural related problems under Hill Area Development Programme (HADP). The watershed lies in the sub-temperate zone with 800-1000mm average rainfall. Major area of the watershed was under rainfed agriculture without any prominent agroforestry systems. The farmers were practicing conventional agriculture, neither applying recommended doses of fertilizers nor micronutrients or biofertilizers. Livestock population in the watershed was poor. A large chunk of population was landless laborers who need employment or any other income generating activities. A number of interventions were introduced to improve the livelihood status of the people residing in the watershed. Tea plantation with an improved variety of vegetatively propagated clones(B-6/16) was taken up on large scale on properly designed contour staggered trenches. Inward sloping bench terraces were recommended for cultivation of annual crops in steeply sloping lands of Nilgiris for soil and water conservation. Demonstration of Integrated Nutrient Management practices improved 18.6, 19.3,12.0,20.3 and 17.0 per cent higher average yield in potato, carrot, vatex beans, cabbage and beet root respectively over farmer practice providing additional benefit of Rs 16628/- to Rs 47056/- per hectare to the farmer. A total of sixteen collection wells installed in the watershed increased the water availability during lean season by harvesting sub-surface flow. Construction of new check dams and renovation of existing check dams provided water for irrigation during summer season. Ten units of sprinkler irrigation system were introduced in watershed through project and contribution of farmers. One community hall in Trichigadi village and one gabion retaining wall in Doddanni village were constructed through convergence approach. With the concurrence of Executive committee, 19 self-help groups were formed in the project period for taking up income generating activities among resource poor section of watershed. Animal health camps in collaboration with Animal Husbandry Department were organized for improvement of livestock in the watershed. In Trichigadi village of Iduhatti watershed, five acres of community wasteland has been developed as a community resource for tribal village by establishing tea plantation along the contour staggered trenches as soil and water conservation. The activities carried out in the watershed resulted an increase in yield of crops, diversified agriculture against crop failure , improved live stock , water availability for irrigation during lean period and over all improvement in livelihood status of people.

Dr M.Madhu
Director
ICAR-IISWC, Dehradun

CONTENTS

1.0 Watershed Details

1.1 Name: Iduhatti watershed

Villages covered: Doddanni, Thiruchigudi, Iduhatti, Periyar nagar, Ganganagar and Murakutty

1.2 Location: Latitude: 11° 26'42.7" to11° 29'10.7" N,

Longitude:76° 45' 58.5" to 76° 47'42.5" E

1.3 State: TamilNadu, District: Nilgiris, Block/Tehsil: Udhagamandalam

1.4 Area (ha): 716.4 Average Annual Rainfall (mm):800-1000

Elevation range (m amsl): 1710-2150

1.5 Average slope (%): 1.5 to 50

1.6 Implementation Period: 2008-2013

1.7 Sponsored by: Hill Area Development Programme (HADP)

1.8 Total Budget (Rs in lakh): Rs. 71.65

1.9 Problems identified for interventions: Landless laborers were a significant part of population and needed employment or other income generation activities the livestock population in the watershed was very less. Major area of this watershed was under rainfed agriculture and prominent agro-forestry systems were found in the watershed, The farmers were commonly using the fertilizer mixtures and not following the recommended dose of fertilizer application. The soils were acidic in nature which required periodical lime application

2.0 Demographic Details

2.1 Total Population (number): 2796

SC/ST (%): All the households of Muthusamynagar, Ganganagar, Bharathinagar, Periyarnagar and Doddani belonged to SC community. In Trichigadi, all the house holds belonged to *Kotha* tribe (ST).

Total number of families: 761

Agricultural labour accounted for 47 per cent of the population followed by only agriculture (29%) and agriculture + agricultural labour (22%).

2.2 General Socio-Economic Status: (Average landholding size, Major occupations,Outmigration, *etc*.)

- Average land holding in the watershed was 0.3 ha which fell under marginal category. Landless laborers formed a significant part of population and needed employment or other income generation activities.

- Agricultural labour accounted for 47 per cent of the population followed by only agriculture (29%) and agriculture + agricultural labour (22%). The population in business and service category was negligible.
- The livestock population in the watershed was very less with only 128 goats, 71 cows and 10 horses. Horses were used for transportation of agricultural inputs/ produce.

2.3 General Agricultural Status: (Total cultivable area, Rainfed area, Irrigated area, Forest land, Other land uses)

Table 1: Major land uses in Iduhatti watershed

S.No	Land use	Area (ha)	Per cent
1	Agriculture	363.1	50.7
i	Annual vegetable crops	143.7	20.1
ii	Tea	219.5	30.7
2	Forest	315.0	44.0
i	Revenue forest	309.0	43.2
ii	Shola	6.0	0.8
3	Swamps & Grass land	4.6	0.6
4	Habitation	33.0	4.6
	Total	715.7	100.0

Agriculture: Major area of watershed was under rainfed agriculture. Annual vegetable crop and tea cultivation were the major agricultural activities in the watershed. The most commonly grown annual vegetables were potato, cabbage, carrot, peas, beans, beetroot, cauliflower, radish *etc*. Cropping intensity was 198.77 per cent and annual crops land utilization Index was 0.64 and total agricultural crops land utilization index was 0.86. Beans and double beans were grown as inter crop with potato and carrot. On flat lands where water source was available, carrot, beans and peas were grown during summer under irrigated conditions. Potato, beans, cabbage and carrot were grown during monsoon season both under rainfed and irrigated conditions. No prominent agro-forestry systems were found in the watershed.

The farmers were commonly using the fertilizer mixtures and did not follow the recommended doses of fertilizer application. They were not using micro nutrient mixture or biofertlizers. The soils were acidic in nature which required periodical lime application. But the farmers hardly used to apply lime.

Tea occupied an area of 219.46 ha in the watershed. Double hedge staggered planting of tea was most common with silver oak as shade tree. Maintenance level was poor to good. About 50 per cent plantation area needed infilling and replanting of tea with improved tea clones. Most of the farmers were using sickles for harvesting tea leaves.

Soil and water conservation measures: The following measures were being practiced by farmers in the watershed for soil erosion control. Maximum area of annual crops was under outward sloping terraces (72.46 ha), followed by level terraces (52.66 ha) and sloping land (18.54 ha).

Table 2: Area under agricultural land use in Iduhatti watershed

S.No.	Land use	Sloping	LBT (ha)	OBT (ha)	Total (ha)
1	Annual crops				
	a. Fallow	7.61	0.91	16.48	25.00
	b. Single crop	3.64	9.51	5.00	18.16
	c. Double crop	6.88	9.23	17.98	34.09
	d. Triple crop	0.40	33.00	33.00	66.40
	Sub-total	18.54	52.66	72.46	143.65
	Irrigated area	0.00	49.83	36.17	86.00
	Rainfed area	18.54	2.82	36.29	57.65
2	Tea plantation				219.46
Total agricultural area					363.11

LBT: Level Bench Terraces, OBT: Outward sloping terraces

Forest, grass land and swamps: An area of 309.03 ha was present under revenue forest, 5.96 ha under shola forest and 4.60 ha under swamps and grassland. The entire revenue forest was degraded and at places encroached for tea cultivation.

Only shola forest was under protection since it served as a perennial source of drinking water to Iduhatti hamlet. Swamps and grassland were in degraded condition.

3.0 Technological Interventions (NRM and Livelihood Activities)

(a) Introduction of improved tea clones

Tea plantation covering an area of about 12.0 ha was taken up with improved variety of vegetatively propagated tea clones (B-6/61) in Iduhatti watershed during the project period (Photo 15).Gap filling had also been carried out in the tea planted as a project intervention. A total number of 2500 silver oak seedlings were distributed to the farmers for planting as shade trees in new tea plantations.

(b) Trenching in new tea plantation

It had been earlier observed that farmers did not follow scientific manner of taking up trenches and planting tea on contour in new tea plantations of Iduhatti watershed. As a result, the very purpose of soil and water conservation for which the trenches have been taken up was not served.

Therefore, properly designed contour staggered trenches (2 m X 0.3 m X 0.45 m) with 2 m spacing between a pair of trenches in a row were taken up in the 12 ha of new tea plantation in Iduhatti watershed as a project intervention (Photo 18). Farmers were trained to maintain correct spacing (0.65m between two paired rows and 0.75 m between the plants) using a triangular frame (measuring 0.75 m on all three sides) devised for that purpose.

(c) Bench terracing

Inward sloping bench terraces are the recommended soil and water conservation measures for cultivation of annual crops in steeply sloping lands of the Nilgiris. This measure was demonstrated in 0.6 ha of sloping land in Trichigadi village of Iduhatti watershed (Photo 19). The terraces were constructed with an inward slope of 2.5 % and longitudinal gradient of 1 %. Toe drains were installed in all the terraces and the riser portion was shaped with a slope of 1:1. Tea was planted in the riser portion of the first two terraces. The water from the toe drains was led through a vertical drain into a surface pond created in the valley portion

(d) Crop demonstrations

Farmers in Iduhatti watershed, in general, did not follow Integrated Nutrient Management (INM) practices for vegetable crop cultivation which was highly market oriented. As a result, decline in crop productivity and deterioration in soil health was witnessed in the long run. Farmers generally applied low analysis fertilizer mixtures *viz*., (6:12:6::N:P:K) in case of potato and (9:9:9::N:P:K) for other vegetable crops. In order

to facilitate farmers to tide over this problem, INM practice was demonstrated by conducting 37 demonstrations for different vegetable crops (potato, carrot, vatex beans, cabbage and beet root) on farmers' fields in Iduhatti watershed during 2009-2012. Under INM, use of straight fertilizers (DAP, MOP and Urea) along with bio-fertilizers (Phosphobacteria and *Azospirillium*, *Rhizobium* in vatex beans), liming material (dolomite) and $MgSO_4$ in potato and $ZnSO_4$ in carrot was demonstrated.

Results of the crop demonstrations conducted on INM practices in different crops showed 18.6, 19.3, 12.0, 20.3 and 17.0 per cent higher average yield in potato, carrot, vatex beans, cabbage and beet root, respectively compared to the farmers' practice of using low analysis fertilizer mixture. Because of increase in yield and savings on fertilizer cost, farmers could realize additional benefits in the range of Rs 16628/- to 47056/- per ha from the different vegetable crops.

Table3: Performance of vegetable crops under INM demonstrations in Iduhatti watershed (2009-2012)

S. No.	Crop	No. of farmers	Area (ha)	Yield with farmers' practice(t/ha)	Yield with INM (t/ha)	% increase in yield	Additional benefits (Rs/ha)
1.	Potato	17	4.0	16.2	19.9	18.6	47056
2.	Carrot	6	2.2	15.9	19.7	19.3	40868
3.	Vatex beans	10	2.1	10.8	12.3	12.0	27184
4.	Cabbage	3	1.0	26.3	33.0	20.3	16628
5.	Beet root	1	0.4	22.0	26.5	17.0	21328
Total		37	9.7				

(e) Introduction of fruit plants in Iduhatti watershed

Lime, pear, pomegranate, plum, peach and orange fruit trees were introduced in homestead gardens in Iduhatti watershed. A total of 946 fruit saplings were planted in the watershed under this intervention

(f) Sub-surface water harvesting

A total of sixteen collection wells were installed in Iduhatti watershed - four in Iduhatti village, five in Doddanni village and seven in Trichigadi village for harvesting sub-surface flow and increasing the water availability during lean season.

(g) Stream widening

Steam alignment, widening and deepening had been done for a total length of 1013.5 m in Iduhatti watershed to increase its carrying capacity

(h) Surface water harvesting

One new check dam was constructed near the out let point of sub-watershed W1 (Iduhatti) in the main stream which is perennial in nature and provides water for irrigation during summer season. One check dam at outlet of sub-watershed W2 (Morakutti) was renovated which was constructed by the forest department way back in 1996.

Two new check dams and one surface storage pond with pipe outlet and were constructed in the stream passing through Trichigadi village of Iduhatti watershed. The harvested surface flow is being utilized by the farmers whose fields are adjoining the check dams for irrigation purpose

(I) Introduction of sprinkler irrigation

Ten units of sprinkler irrigation systems had been introduced in the watershed during the project period with a total cost of Rs. 2.40 lakh out of which Rs.1.60 lakh was met from the project side and Rs.0.80 lakh from the farmers' side as contribution

Meteorological Observations in Iduhatti watershed

Three ordinary rain gauges were established in Bharathinagar, Ganganagar and Morakutti hamlets in Iduhatti watershed. In addition to these gauges, one automatic rain gauge and open pan evaporimeter were installed in Ganganagar.

Runoff measurement in Iduhatti watershed

Runoff monitoring is being carried out through gauging station constructed at the outlet of W1sub-watershed, where agriculture is the major land use. The total runoff from this sub-watershed during Jan – Dec, 2009 was 222.61 mm (18.31 % of rainfall) while during the period from July to Dec, 2010 it was 178.2 mm which works out to 17.5 per cent of rainfall received during this period.

The total runoff from W1 sub-watershed during 2011 was 95.2 mm which works out to 8.8 per cent of rainfall received during this period. The total runoff from W1 sub-watershed during the year 2012 was 74.9 mm which works out to 9.5 per cent of rainfall received during this period.

Interventions through convergence approach.

One community hall in Trichigadi village and one gabion retaining wall in Doddanni village were constructed through convergence approach wherein proposals were submitted to HADP.

Community organization activities

In the initial stage, during 2008, eight Village Resource Management Committees (VRMCs) were formed at hamlet/village level and Iduhatti Watershed Association and its

Executive Committee at watershed level. Watershed Association was registered (Photo 3) and Watershed Development Fund account was opened in State Bank of India at Agalar, Nilgiris district.

On completion of the first term of these committees in June 2010, the VRMCs were once again formed and from the members of VRMCs of the eight hamlets, members of Watershed Executive Committee were selected in the General Body meeting held in May, 2010 and its office bearers were elected.

User groups

One user group – Small Tea Grower Society (Photo 5) which had been formed with 240 members during 2008 and linked with Tea Board, Coonoor, The Nilgiris, is successfully functioning. With the support from Tea Board, the Nilgiris had bought two small pickup vehicles for transporting tea leaves directly to the tea factory. Other benefits incurred by this society are listed below:

- Better price for quality tea leaves
- No cheating in weighing of tea leaves
- Loans to members for purchase of inputs

Two more user groups had been formed for spraying of insecticides and pesticides in the watershed

Livelihood support activities

With the concurrence of the Executive Committee, 19 Self Help Groups (SHGs) were formed in the project period for taking up income generating activities among the resource poor sections of the watershed community. Among these groups, 13 SHGs were initially formed with a revolving fund of Rs 3.15 lakh and six more SHGs were formed from the amount paid pack by the initial groups.

A total amount of Rs 1.92 lakh had been paid back by these nineteen SHGs till date, out of which Rs 1.10 lakh had been payed back to form the new groups. The overall repayment is 45.4 per cent. Through these SHG activities, 5108 man days of employment and a net income of Rs. 13. 82 lakh have been generated

Capacity building activities

As part of capacity building activities for the watershed community, nine training programmes had been organized during the project period. A total of 280 stakeholders have been trained through these training programmes.

Table 4: Details of SHGs formed in Iduhatti watershed (2009-13)

S. No.	SHG activities	No. of groups	No. of members	Seed money (Rs in lakh)	Amount paid back (Rs in lakh)
SHG initially formed from project fund					
1.	Sheep rearing	1	8	0.25	0.25
2.	Cow/heifer rearing	5	17	1.15	0.44
3.	Vegetable cultivation by leasing the land	5	25	1.25	0.82
4.	Black smithy	1	5	0.25	0.09
5.	Coffee seed grinding	1	4	0.25	-
Total		13	60	3.15	1.61
SHG formed from paid back amount					
6.	Cow/heifer rearing	3	3	0.62	0.09
7.	Vegetable cultivation by leasing in the land	1	5	0.25	0.14
8.	Tailoring	2	2	0.23	0.08
Total		6	10	1.10	0.31

Table 5: Impact of SHG Activities in Iduhatti watershed (2009-13)

S.No.	Name of the activity	No. of groups	Employment generated (man days)	Net income till date (Rs in lakh)
1.	Sheep rearing	1	180	0.14
2.	Cow/ heifer rearing	6	3789	4.54
3.	Tailoring	2	343	0.65
4.	Black smithy	1	104	0.34
5.	Vegetable cultivation on leased land	8	942	8.41
6.	Coffee grinding (formed last)	1	34	-
	Total	19	5108	13.82

Table 6: Details of trainings conducted for stake holders from Iduhatti watershed

S. No.	Topic of the training	No. of training	No. of participants
1	One day exposure visit to CSWCRTI, RC, Ooty	1	20
2	Three days exposure visit to Brahmagiri Development Society, Wayanad, Kerala	1	20
3	One day exposure visit to UPASI, KVK, Coonoor	1	25
4	Training on Soil and Water Conservation Measures for Young Tea Plantation	2	50
5	Training on Improved Practices of Vegetable Cultivation in the Nilgiris	1	20
6	Training on Improved Livestock Management in the Nilgiris	1	20
7	Training cum exposure visit on Potato cultivation in the Nilgiris	1	25
8	Farmers -Scientists interaction meet	1	100
Total		9	280

Livestock improvement

Two animal health camps were organized in collaboration with Animal Husbandry department, The Nilgiris in Iduhatti watershed. Around 170 farmers participated in this programme and 177 animals (cows, calves and goats) were treated by veterinarians for various ailments and disorders.

During both the camps, vaccination was given for foot and mouth diseases, pregnancy diagnosis was carried out and, de-worming was done for animals. Mineral mixtures were distributed to weak as well as high yielding animals in Iduhatti watershed.

Development of community resources

In Trichigadi village of Iduhatti watershed, five acres of community waste land was developed into a new tea plantation by planting tea seedlings along with contour staggered trenches as soil and water conservation measure.Villagers were trained for taking up this soil and water conservation measure and the area has been developed as a

community resource for this tribal village.A convergence approach was adopted and link was established with UPASI Krishi Vigyan Kendra to provide irrigation to the young tea clones.

4.0 Impacts

4.1 Productivity indicators

S. No	Indicators	Unit	Before (Year)	After (Year)	Change (%)
1	**Change in land use**				
i	Net sown area	ha			
a.	Rainfed	ha	57.65		
b.	Irrigated	ha	86.00		
ii	Area sown more than once	ha			
iii	Gross cropped area	ha			
iv	Current fallow	ha	25		
v	Culturable waste land	ha	2	0	-100
vi	Area covered under plantation (non arable Land)	ha	219.5		
vii	Area put under agroforestry (arable land)	ha			
viii	Number of tube-wells	No			
ix	Number of functional dug/open wells	No	60		
2	**Area under crops**				
i	Kharif	ha			
ii	Rabi	ha			
iii	Change in area under major crops				
a.	Annual vegetables	ha	143.7	144.3	0.42
b.	Tea	ha	219.5	231.5	5.47
c.	Lime, pear, pomegranate, plum, peach and orange	ha	Nil	Newly introduced	
3	**Impact on Yield of Major Crops**				
i	Potato	q/ha	162	199	18.6
ii	Carrot	q/ha	159	197	19.3
iii	Vatex beans	q/ha	108	123	12.0
iv	Cabbage	q/ha	263	330	20.3
v	Beet root	q/ha	220	265	17.0

4	**Productivity indices**				
i	Crop Diversification Index (CDI) Or Crops/Cropping systems before & after				
ii	Water productivity	Rs./cum	321.0	430.9	34.24
iii	Change in area under cultivation	ha			
iv	Cropping Intensity	%	198.77		
v	Change in Milk Production	litres/yr	88370.15		

During the year 2012, one community cattle shed in Trichigadi village which was in a dilapidated condition was renovated at a cost of Rs. 1.24 lakh. Around 35 cattle belonging to this hamlet are currently being housed in this renovated shed. One multipurpose water tank had also been constructed for the cattle at a cost of Rs 0.48 lakh near the renovated cattle shed with a capacity of 8.4 m^3.

4.2 Environmental impact indicators

S.No	Indicators	Unit	Before (Year)	After (Year)	Change (%)
1	**Hydrology and water resources**				
i	Surface Runoff	%	18.31	9.5	-48.12
ii	Surface water storage	cu-m	Nil	270	
iii	Surface Water resources (Number of water bodies)				
iv	Perenniality of streams	%			
v	Water Table Depth In Well	m	3-4		
vi	Increase In Ground Water Contribution	% or ha-m			
vii	Reduction In Soil Loss	tons/ha/year			
2	**Soil fertility improvement in the watershed**				
i	Organic Carbon	%	High		
ii	Nitrogen	kg/ha	Medium		
iii	Phosphorus	kg/ha	Medium to high		
iv	Potash	kg/ha	Medium to high		

4.3 Socio-economic impact indicators

S. No.	Indicators	Unit	Before (Year)	After (Year)	Change
1	**Overall People's Participation Index**	%		63.0	
	Total contribution (Rs) or percent of total budget expenditure (%)	Rs or %			
2	**Av. Family Income**	(Rs/yr)			
i	Large		96000		
ii	Medium		62125		
iii	Small		34899		
iv	Marginal		13806		
3	**Av. Family Expenditure**	(Rs/yr)			
i	Large				
ii	Medium				
iii	Small				
iv	Marginal				
4	**Employment Generation**	Man days			
5	**IGAs (**Annual income per SHG)				
6	**Amount in WDF Account after financial withdrawal**	Rs.			
7	**Economic Viability of the Project**				
i	BCR at Discount Rate ____% for period of analysis years				
ii	IRR (%)				

5.0 Award/ Appreciation/ Recognition

6.0 Project Implementation Team

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7.0 Photographs

Introduction of improved tea clones

Contour staggered trenches in new tea plantation

Newly formed bench terraces with surface pond for surface and subsurface water harvesting

Vatex beans and potato crops under INM demonstration

Carrot and cabbage crops under INM demonstration

Introduction of fruit plants in home stead gardens




Installation of collection wells


Stream widening work




Construction and renovation of check dams


Introduction of sprinkler irrigation

Meteorological observatory installed in Iduhatti watershed

Runoff gauging station

Interventions carried out through convergence approach

Formation of VRMCs and executive committee for Iduhatti watershed association

User groups formed

Tribal SHGs for blacksmith and cow rearing

Women SHGs for sheep and cow rearing

Women SHGs for tailoring and vegetable cultivation

SHG for coffee grinding and vegetable cultivation in Iduhatti watershed capacity building

Exposure visit for stakeholders

Training programme for stakeholders

Scientists-farmers interaction meet

Animal health camp

Trenching activity taken up by village community for new tea plantation developed as community resource

Renovation of cattle shed and construction of water tank

For further details, please contact

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