

# WTCER

Research Bulletin (NATP-WTMM)

Publication No. - 10

## PARTICIPATORY RESOURCE APPRAISAL FOR PREPARING WATERSHED ACTION PLAN



K. KANNAN      R.C. SRIVASTAVA  
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H.C. VERMA      N. SAHOO  
P. NANDA      S. MOHANTY



**Water Technology Centre for Eastern Region**

*(Indian Council of Agricultural Research)*

Bhubaneswar, Orissa - 751023, India



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***Cover Photo :***

Left photograph depicts the critical eroded area in the watershed. Centre photograph shows the PRA exercise while right photograph depicts a water harvesting structure in the watershed.

## MESSAGE



*Participatory approaches are bottom-up, people-centred and demand-driven compared with the top-down government centred and supply-driven development of the past. Analyzing location-specific problems through participatory rural appraisal and working out appropriate remedies by harmonizing indigenous technical knowledge with exogenously developed innovations under diverse micro-situations are the major considerations of the current research and development programme.*

*I congratulate the authors for bringing out this bulletin on "Participatory Rural Appraisal of the Watershed" under National Agricultural Technology Project (Watershed Management Technology- Mission Mode) comprising all the aspects of participatory resource appraisal. I sincerely hope that this bulletin will be helpful for all those engaged in watershed management in the eastern region of the country.*



Krishi Bhavan  
New Delhi

(J. S. SAMRA)  
Deputy Director General (NRM), ICAR

## FOREWORD



Management of natural resources Viz., land and water is acquiring added importance in new millennium. However these resources being community resource can best be managed in participatory mode. Thus, any resource management plan should have a participatory element from very beginning. The resource appraisal is first step in a planning process and therefore participatory resource appraisal has gained importance in watershed management planning. In view of this, the research team of NATP project on Watershed Management Technology Mission Mode has done an exercise in the selected Watershed. The exercise has helped them in identifying problems and constraints. I hope that these will be helpful in formulation watershed development plan.

I congratulate Dr. R.C.Srivastava, CCPI of the project and his team for carrying out this exercise and putting it in a proper shape. The report will be useful for other Watersheds also in preparing developmental plan.

A handwritten signature in black ink, appearing to read 'H.N. Verma'.

**H.N.Verma**  
Director



## PREFACE

Participatory development process has variable perceptions among different stakeholders, actors or partners depending on community composition, nature of resources, tenure/ownership system, gender and other social factors. There are three major outcomes of people's participation: learning, empowerment and organization building. For ensuring active participation in watershed management programme, it is essential to have knowledge of resource base of the people. Participatory Resource appraisal is such a technique which enables the planners to identify problems, constraints and solutions of problems.

To develop watershed management plan for Jonai nala watershed under watershed Management Technology Mission Mode project funded by NATP, a PRA exercise was undertaken by scientists of the institute along with officer trainees undergoing training in watershed management. This report is an outcome of that exercise. We hope this report will form a model for developing watershed management plans for the central table land agro climatic sub region of Orissa.

Authors are grateful to Dr. J.S. Samra, DDG (NRM), ICAR, New Delhi and Ex Mission Director of this project for providing guidance in this project. The authors are thankful to Dr. H.N.Verma, Director, WTCER, Bhubaneswar for his encouragement. The authors will also like to thank all their colleagues who provided direct and indirect inputs and suggestions to prepare this report.

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## **INTRODUCTION**

People's participation has been enshrined in the guidelines of watershed management for harmonizing complementarities of different sectors of livelihood gathering in India. Several policy initiatives have been undertaken for realizing productive employment, poverty alleviation, environmental securities and empowerment of local people.

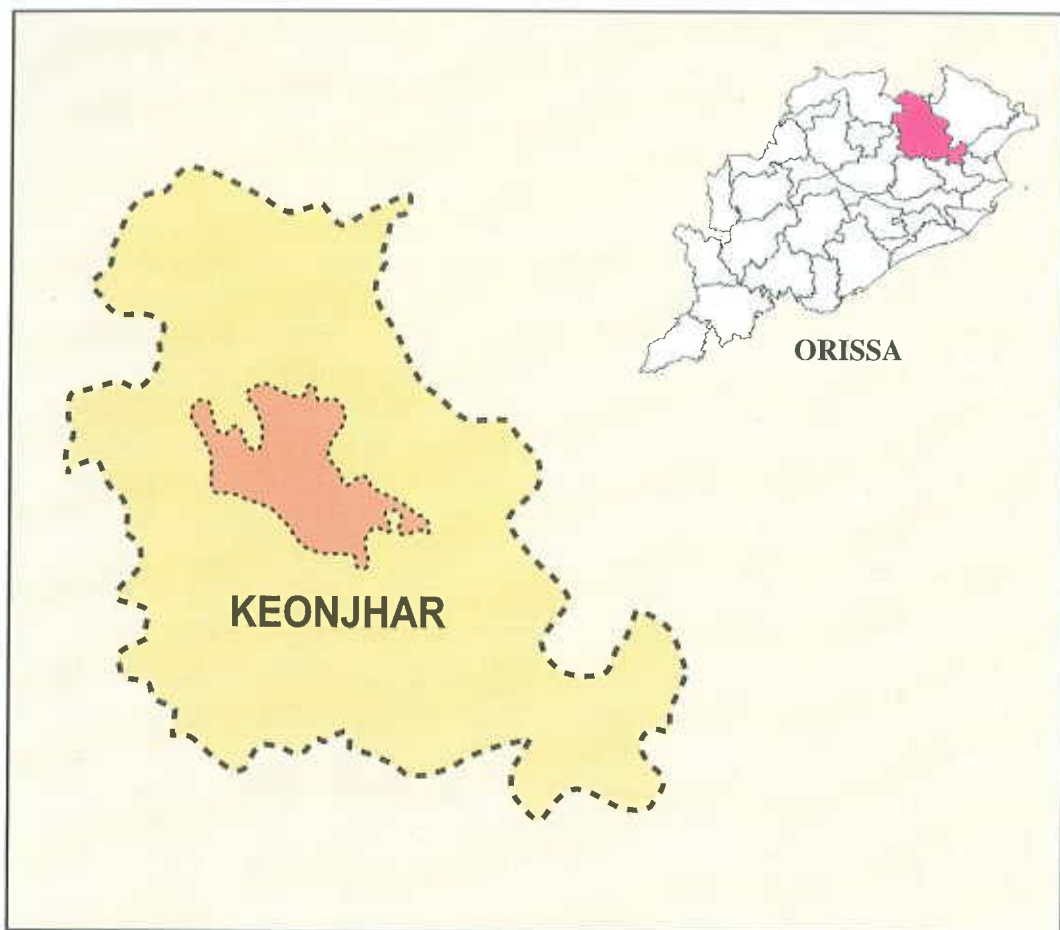
This participation development process is a bottom-up people-centered voluntary process where in government or non-government functionaries are the facilitators, and this should start from the very beginning. Appraisal of the resources, strengths and weaknesses of a society is first step of development process and for ensuring people's participation, this appraisal should also be rapid process as the time is short and heavy expenditure cannot be afforded. Thus, emphasis of rapidity has to be more to reduce the time taken for data collection, its analysis and dissemination to community members and development workers. Participatory Rural Appraisal (PRA) is one such tool which is being widely used for resource appraisal in participatory mode.

Under NATP project on Watershed Technology (Mission Mode), a watershed comprising Dabarchuaon, Kheritangri and Naugaon village was selected for study. A PRA exercise was undertaken by research team of the project in close coordination from other scientists of the institute and officer trainees under training at this institute. The results of this exercise has been compiled to help the research team in watershed planning. This will also serve as model for PRA exercise in other watersheds of the region.

## **BASIC INFORMATION**

Jonai nala watershed is selected under NATP, under Watershed Technology Mission Mode considering the standard watershed selection criteria. Any integrated watershed management plan deals with resource management and conservation. Therefore, a detailed benchmark survey of the watersheds villages viz., Kheritangri, Dabarchuaon and Naugaon which falls under this watershed were carried out covering more than 550 households with respect to their land use pattern, cropping system, basic resources, information about existing management practices, productivity and marketable surplus etc. The results in (Table 1.) indicates that 46.5%, 41.90% and 16.35% of land is cultivable in Kheritangri, Debarchuaon and Naugaon respectively. Among all three villages, Naugaon has maximum percentage area under forest. The agriculture is mostly rainfed with 90 %, 79.20 % and 100% area being rainfed in Kheritangri, Dabarchuaon and Naugaon respectively

(Table 2). The major crop in kharif is rice occupying about 90 % of area followed by fallow with vegetables being cultivated in patches where water is available.



**Table 1: Land distribution pattern in Jonai nala watershed in Hectare**

Items	Kheritangri	Dabarchuan	Naugaon
<i>Cultivable land</i>	388.97 (46.50 %)	137.61 (41.90 %)	28.04 (16.35 %)
<i>Cultivable waste</i>	51.63 (6.16 %)	19.97 (6.07 %)	16.75 (9.77 %)
<i>Pasture land</i>	30.53 (3.64 %)	5.91 (1.80 %)	8.488 (4.95 %)
<i>Forest land</i>	82.56 (9.85 %)	55.07 (16.75 %)	35.38 (20.63 %)
<i>Others</i>	283.79 (33.88 %)	110.16 (33.13%)	82.80 (48.29 %)
<i>Total</i>	837.41 (100%)	328.72 (100.00)	171.47 (100.00 %)

**Table 2: Land uses pattern in Jonai nala Watershed, Keonjhar in hectares**

Items	Kheritangri	Denarchunn	Naugaon
Holdings	333	146	117
Irrigated land	41.20	28.63	-
Dry land	347.77	108.99	28.04
Total	388.97	137.61	28.04

In forest area of the watershed species like *Kendu*, *Jamun*, *Sisso* and *Sal* dominate and grasses like *Digitaria* is the major species of the area (68%). About 60% of the population of the villages are tribal population (Table 3.)

**Table 3: Distribution of Population according to Caste (No).**

Item	SC	ST	Others	Total
Kheritangri	141	1032	589	1761
Debarchunn	49	450	21	520
Naugaon	43	346	8	397

## SOCIAL MAP

The village Dabarchua has 132 families with a total population of about 520 and mostly belongs to scheduled tribe (60%) and Hindu religion. Most of the families are engaged in farming. Most of the cultivated lands are owned by the marginal and medium category farmers.

Thatched mud houses are predominant in the village. Houses are built along the village kutchra road. Except a primary school, there are no other infrastructure facilities such as, primary health centre, veterinary hospital, marketing



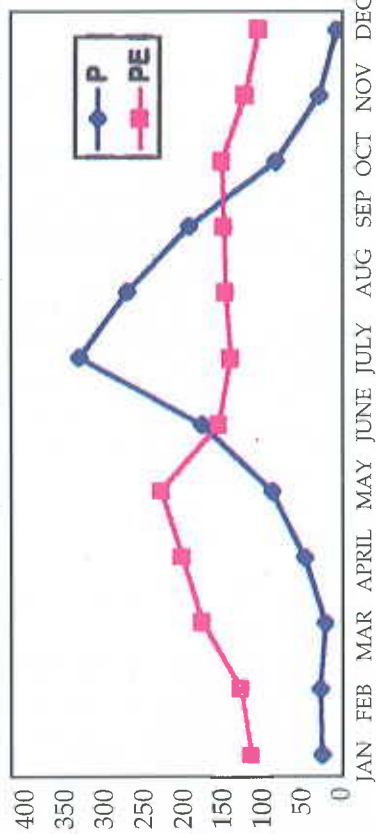
*Resource mapping by the villagers*





Table - 4 Monthwise climatic water balance of Keonjhargarh (Orissa)

	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
P	23	26	19	48	95	195	367	300	213	91	30	5	1412
PE	124	139	194	222	252	171	154	161	164	167	134	116	1998
P-PE	-101	-113	-175	-174	-157	24	213	139	49	-76	-104	-111	-586
APWL	-392	-505	-680	-854	-1011	0	0	0	0	-76	-180	-291	-3989
STOR	10.99	5.18	1.61	0.51	0.18	24	150	150	150	90.38	45.18	21.56	649.59
S	-10.57	-5.81	-3.57	-1.10	-0.33	23.82	126	0	0	-59.62	-45.2	-23.62	0
AE	33.57	31.81	22.57	49.10	95.33	171	154	161	164	150.62	75.2	28.62	1136.82
WD	90.43	107.19	171.43	172.9	156.67	0	0	0	0	16.38	58.80	87.38	861.18
WS	0	0	0	0	0	0.18	87	139	49	0	0	0	275.18





## TRANSECT MAP

Three transects have been done from east to west to get the first hand information about the village. In this exercise a team of scientists walks across the village transectionally and observe all the characteristics of the village. The aim of the transect is to explore and study the major land use zones and to compare main features, resources utilization patterns, problems and potentialities.

Three types of land viz., low, medium and upland were found and the soil type ranges from red laterite to red loam. Houses are concentrated along the main roadside.

The crop grown in the fields is mostly paddy. Onions, Greens and potato are grown in the kitchen garden. *Sal*, *Kendu*, *Sisso*, *Jamun*, *Eucalyptus* and *bamboo* are the common tree species found in the village. Banana, mango, guava and jamun are the fruit trees grown in the village around the residential areas. Small water harvesting structures and open wells are the irrigation source in some areas.



*Transect Walk*

## RESOURCE MAP

The village is mainly an agricultural based. The village is surrounded by low mounts and forest, which feed the water harvesting structures located in the village. There is no tube well in the village. Many households have shallow open well for domestic use and to irrigate kitchen garden.



*Natural Resource (pond)*

## TRANCECT MAP



Items	Transect I	Transect II	Transect III
Land use	Crop cultivation	Houses, kitchen garden	Plantation
Soil	Red laterite, loamy	Red loamy	Red laterite,
Irrigation	Water harvesting structures, rainfed	Open well	Rainfed
Crops	Paddy	Onion, chillies, potato	Jamun
Trees	Arjuna, sal, jamun	Bamboo, mango,	Kendu, sal, Eucalyptus, sisso, Jamun
Animals	Desi cattles	Desi cattles	Desi cattles
Problems	Water scarcity during rabi Low productivity	Un employment in lean season	Soil erosion
Opportunities	Constructing more water harvesting structures, introduction of high yielding short duration varieties, agro forestry and introduction of cross bred cattle.	Sericulture using forest trees, introduced of cross bred cattle	Gully control, afforestation

*Sal and kendu* are the major forest trees. The forest department has taken up plantation of Arjuna trees (for sericulture) and Eucalyptus. Rice is the main crop in the kharif season. More than 70 per cent of kharif crop is rainfed. Double crop is not common in the village, as there is an acute water scarcity during the rabi season. Elephant menace is also a problem, which discourage farmers to go for the second crop. Small water harvesting structures created by the soil conservation department is serving as a supplementary irrigation source for kharif rice during the dry spell.



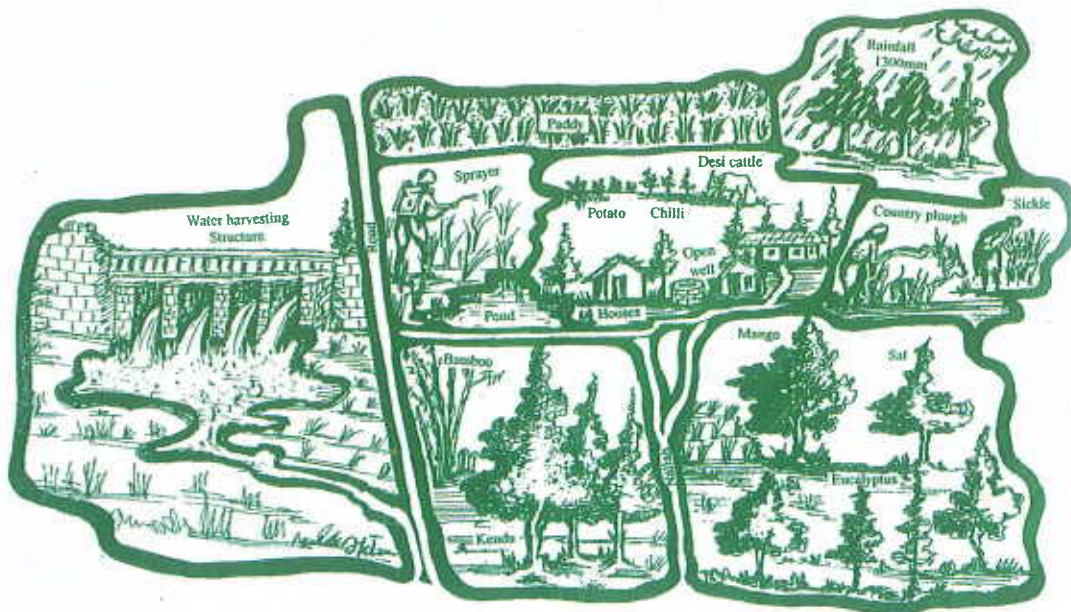


*Scientists and villagers participation in PRA activities*

Bullock cart and country plough is used for transport and ploughing. Apart from sickle, spade, equipment like sprayer, motor pumps are also being used in the village. Cattle are mostly desi type. Agricultural inputs like seeds, fertilizers and pesticides are available either in cash or in loan from various markets at Keonjhar. Farmers can get

loan from Co-operative Bank located at Khiritengari village. There is no telephone in the village.

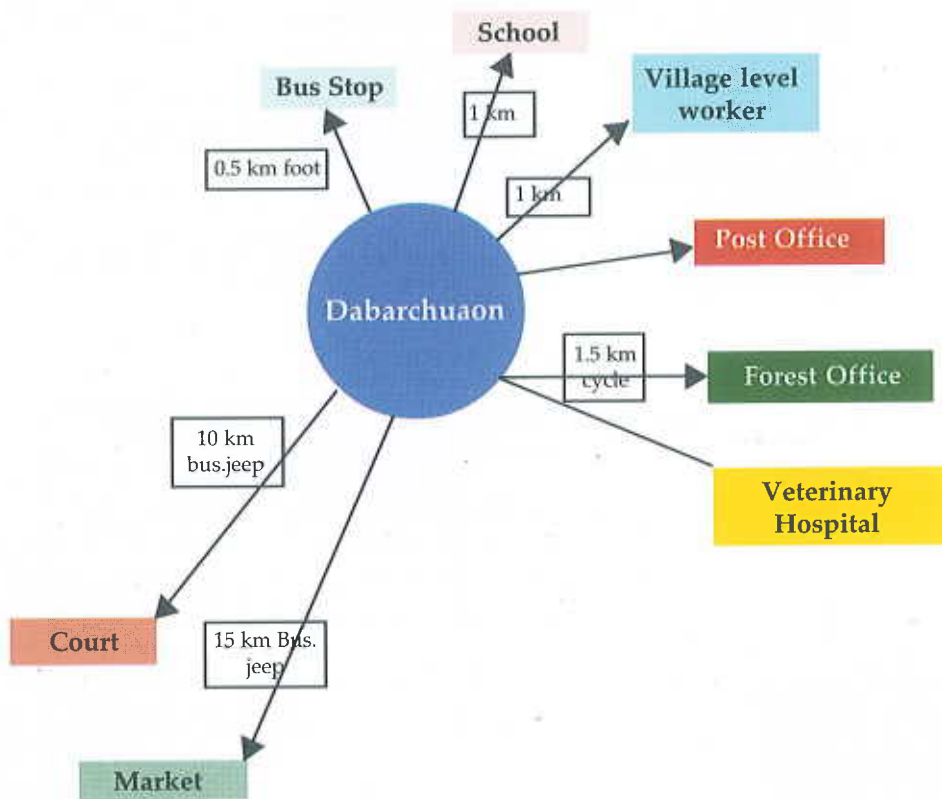
## RESOURCE MAP



## MOBILITY MAP

The mobility map shows the pattern of social mobility for different sections of a community with regard to different activities. As the village is very small, it depends on the near by town Keonjhar for marketing of produce and purchase of inputs. The distance between the village and Keonjhar town is 13 km. The village is connected to the national highway, which is 0.5 km away from the village, by kuchha road. The mode of travel is hired jeeps and bus.

Farmers are going to Kenojhar for meeting block development officer. Farmers are also going to nearby village Khiritengari for veterinary hospital, to meet village level worker and post office, forest office and revenue office which is 2 km away from the village. The mode of travel is mostly the bi-cycle. The frequency of travel to khiritengari is weekly to occasional depending on the purpose.



## TIME TREND

Time trend is a technique, which represents easily the quantitative fluctuation or changes over time in different aspects that influence life of rural community. These aspects may be yields, price of commodities, population of livestock, area under

different crops and fertilizer consumption. Paddy yield and fertilizer use was taken for time trend. Farmers were asked to place paddy grains in different quantity against each year according to difference in paddy yield and fertilizer use for easy understanding.

There was a quantum jump in the yield of paddy in the year 1995 due to introduction of HYV of paddy and it was almost static up to 2000. The villagers used to apply only FYM during the 70's. From 1980 onwards, they started applying chemical fertilizers.

### TIME TREND

#### Change in paddy yield

Year	Paddy yield
1970	•
1980	• • •
1988	• • • •
1995	• • • • •
2000	• • • • • •







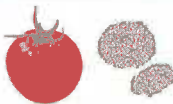




Year	Fertiliser use
1970	•
1980	• •
1986	• • • •
1990	• • • • •
1995	• • • • • •

### TIME LINE

The villagers have been using radio and bi-cyle since 1970 as an audio aid and transportation respectively. In 1971, they started using bio-pesticides(Karong leaf). They started applying chemical fertilizer from 1980. Diesel pumpset was introduced



in the year 1985. The village was electrified in the year of 1986. In the year 1990, villagers started pici-culture. Use of tractor for ploughing and transportation started in the year of 1994.

Year	Events related to agriculture	
1970	Radio	
1970	Bi-cycle	
1971	Use of bio-pesticide(Karang leaf)	
1980	Use of chemical fertilizer	
1985	Diesel pump	
1986	Electricity	
1990	Tomato and potato cultivation	
1990	Fishery	
1991	Improved breed of goat and pig	
1994	Tractor	
1995	HYV of paddy	

## TECHNOLOGY MAP

Technology map for crops and animals gives a detailed account of the various technologies which are available in the village and its treatment by the farmers. Depending upon the weather condition, soil type, financial condition, social structure and other factors various technologies can be adopted, rejected, discontinued, over-adopted or reinvented in farming community.



*Involvement of Women in PRA exercise*



*Scientist team participated in the PRA Exercise*

Adoption of technology is the final decision to use a technology to the recommended level. Active rejection is the decision not to use a technology after observing its performance in trial stage of the adoption process while discontinuance is the decision not to use a technology after considerable period of

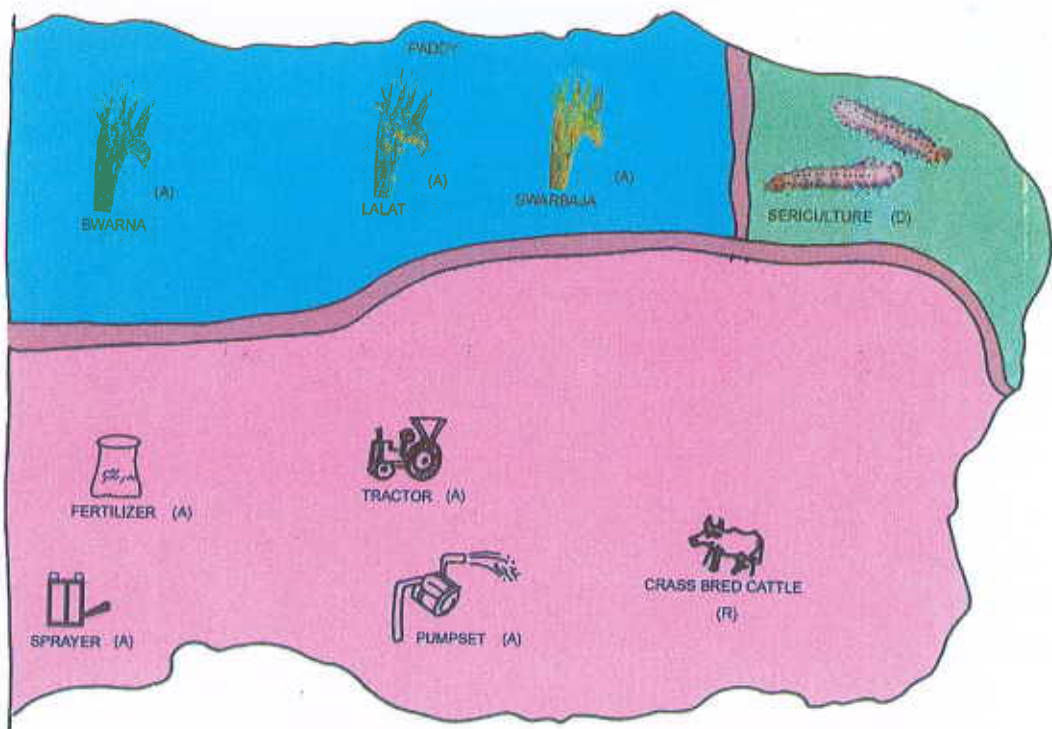
adoption either due to dissatisfied performance or due to the availability of alternative superior technology. Over adoption is the continued use of a technology by the farmers, when the extension agencies desire that, it should be discontinued due to ill effects or availability of superior technology.

Technology map for crops and animals has been prepared by discussing with key informants of Dabarchua village for adoption, active rejection and discontinuance. Pictorial presentation of the identified technologies has been shown on the technology map. Reasons for various technologies behavior are given in table 4.

**Table 5. Details about status of various technologies**

Sl.No.	Technology	Technology behaviour	Reasons
1	Rice varieties Swarna Lalat Swarbaja	Adoption	High yield High yield
2	Tractor Sprayer Pump	Adoption	Superior quality Easy operation and labour saving
3	Chemical fertilizer	Adoption	High yield
4	Sericulture	Discontinued	Lack of market and co- ordination with the government agencies.
5	Cross bred cattles	Rejection	Lack of purchasing power and interest

### TECHNOLOGY MAP



## SESONAL ANALYSIS

PROBLEM	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Rice stem borer			■									
High labour demand	■											
Input availability	■							■				
Shortage of cash	■											
Unemployment									■			
Elephant attack								■				
Rice ear head bug attack					■							
Flood		■										
Diseases in cattle										■		
Water secarcity								■				

## MATRIX RANKING

Matrix ranking means placing the technologies in order of preference given by farmers based on certain common criteria. It facilitates us to understand the common reasons for local preferences for particular technology to adopt or reject. Matrix ranking was done for adoption of rice varieties *lalat*, *swarna*, *malatho*, *annapurna* and *swarbaja*.

It was found that cultivation of rice variety *swarna* ranked first in adoption behavior which was followed by the rice variety *lalat*, *arnapurna swarbaja* and *malatho*. High market price ranked first in reasons for adopting various high yielding varieties, which is followed by high yield.

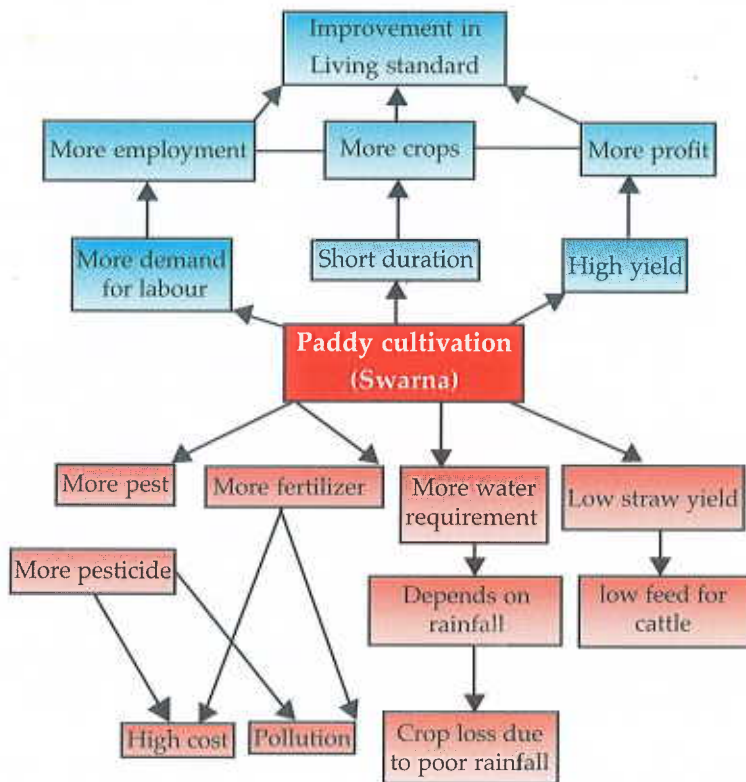


**Table 6. Matrix ranking - Adoption**

Criteria	Lalat	Swarna	Malatho	Annapurna	Swarbaja	Total marks	Rank
Less water requirement	14	18	13	15	12	72	V
Saving in labour	14	13	18	14	17	76	II
Pest and disease resistance	14	14	16	15	15	74	IV
Drought resistance	15	14	15	14	16	74	IV
Grain yield	19	20	10	14	13	76	II
Market price	19	20	12	15	13	79	I
Total marks	95	99	84	87	86		
Rank	II	I	V	III	IV		

**IMPACT DIAGRAM**

It indicates the positive and negative impact of a technology adopted by the farmers with respect to crop and animal sciences. It also projects the valid reasons why





that particular technology was adopted to a considerable degree.

Impact analysis was done for the most adopted technology by the village i.e., cultivation of high yielding rice variety "Swarna".

#### Positive consequences:

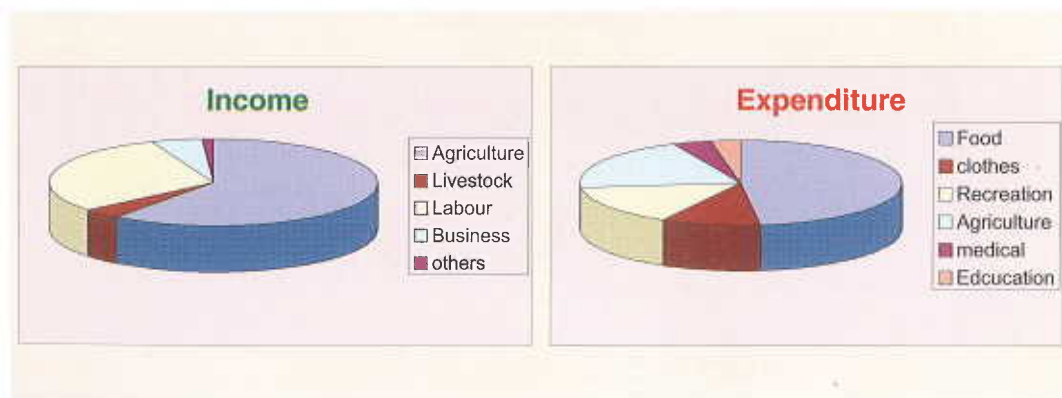
- Higher yield of produce led to marketable surplus and hence higher economic return, More profit and improvement in living standards of the villagers.
- More labour demand creates more employment for labourers.
- Provides daily needs

#### Negative consequences:

- Less straw yield led to lesser amount of feed for cattle.
- More water requirement and failure of crops if rain fails.
- More fertilizer requirement and poor soil health.
- More pest and disease attack
- Created wedge between resource rich and resource poor farmers.

### LIVELIHOOD ANALYSIS

Livelihood analysis is the study of income and expenditure. The various sources of income are given in the map. Income from agriculture occupies 60 per cent out of total income, followed by wage earning (30 per cent). Though the village is agricultural based one, it is interesting to note that the income from the livestock is only 4 per cent. This is due to the absence of crossbred cattle. More than 50 per cent of their income is spent towards food. The expenditure on education and health care is meager.



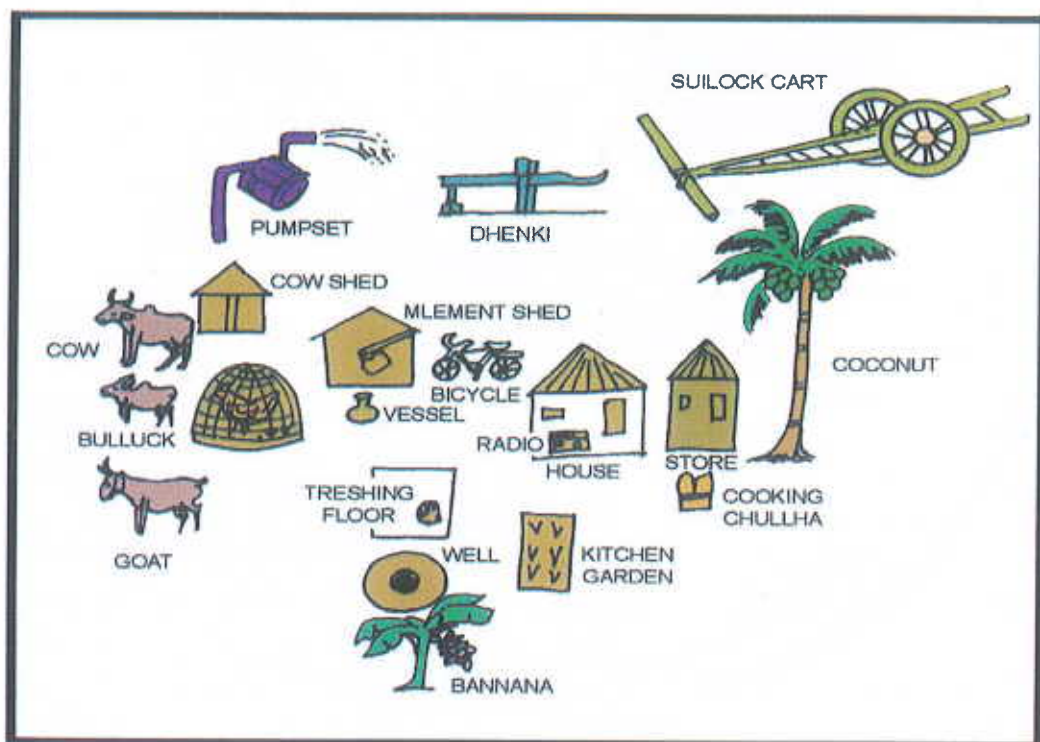
## FARM HOUSEHOLD MAP

In the village Daburchua, maximum number of farm household are built up with mud/stone wall and thatched roof. Houses are situated on the both the sides of the village kutchra road. Cattle shed is situated at the front side of the house. A separate provision has been made for storing the produce adjacent to the house.

Kitchen garden is practiced in the most of the houses with onion, potato and chilly. Banana and coconut are also grown in the back and front side of the house. Earthen chulla is used for cooking. At the side of village road compost pit is present where waste material collected from kitchen, cattle shed and cow dung are dumped and later on used as organic manure.

There is no permanent drainage system through which foul water or waste materials generated by the households can be drained out to a safer place. Absence of sanitary latrine forces villagers to go to forest or fallow field for nature calls.

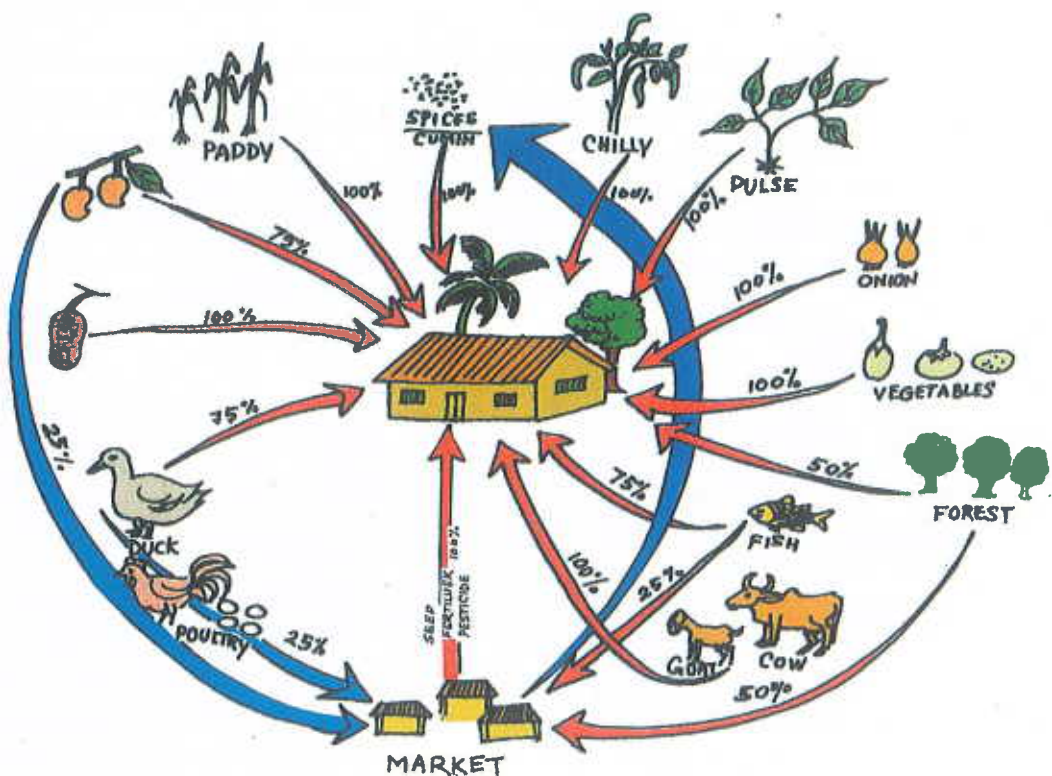
### FARM HOUSEHOLD MAP OF VILLAGE - DABARCHUA



## BIO-RESOURCE FLOW DIAGRAM

Bio-resource flow diagram indicates the flow of inputs and outputs in a farm household related to agriculture and livestock from market to farm and vice-versa. For this exercise we selected one representative farmer. A little more than 50 per cent of paddy, produced is consumed by the family and rest goes to the market. Besides paddy field, he is having kitchen garden, mango tree and cattle. The family consumes seventy five per cent of mango and 100 per cent of produce from kitchen garden. Fifty per cent of milk, twenty five per cent of fish and 25 per cent of poultry produce goes to the market. Straw collected after harvesting of paddy is used for thatching the house roofs and feeding the cattle.

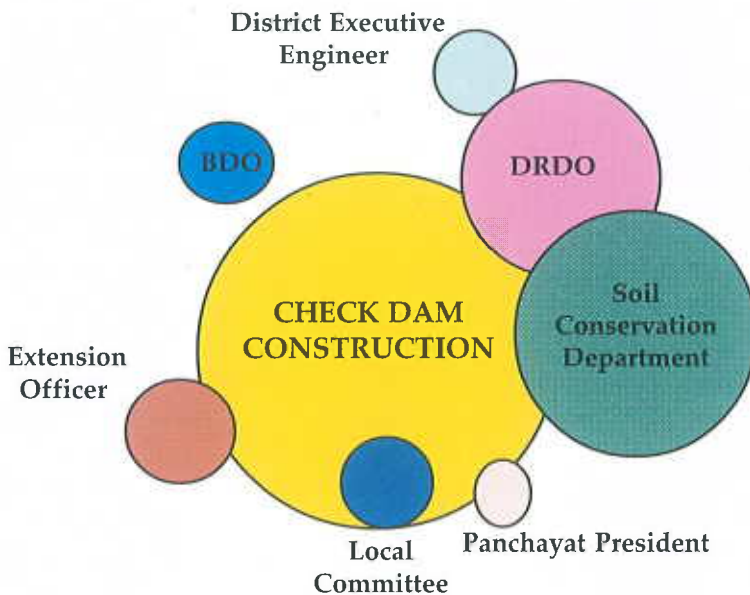
### BIO-RESOURCE FLOW MAP VILLAGE- DABARCHUAN



## VENN DIAGRAM

It is a diagram that shows key organizations and individual members inside or outside the village community, their relationships and importance in bringing any spectacular development/ infrastructure in the village.

Check Dam and water harvesting structures are the most important development in the Daburchuaon village. People who contributed from within the village are panchayat president and local committee. Soil conservation office and District rural development authority are the agencies from out side contributing directly and closely. Block development officer; District executive engineer and extension officer contributed indirectly.

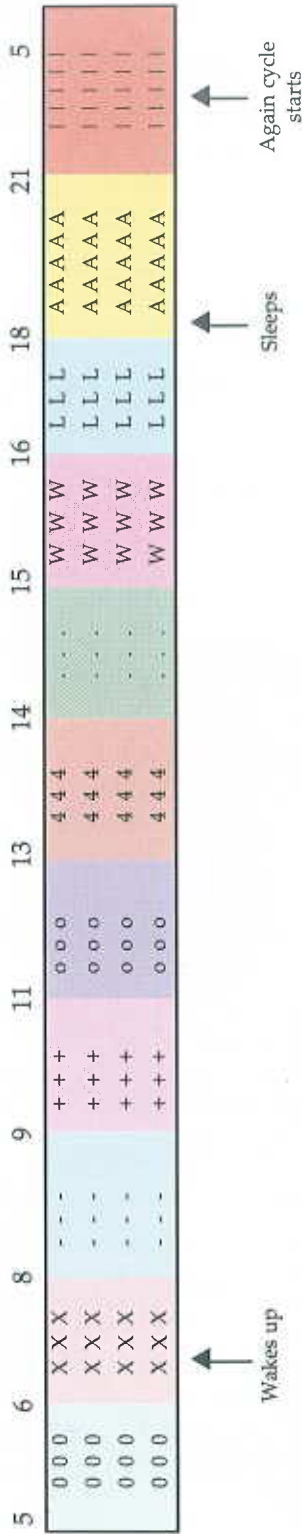


## DAILY ROUTINE DIAGRAM

Daily routine diagram was carried out with the help of villagers for both male and female to get first hand information about their activities, time of various operation. This technique helps in fixing the best time and place to meet the farmers for interaction.

## DAILY ROUTINE DIAGRAM

A. House wife (Age : 35 years)

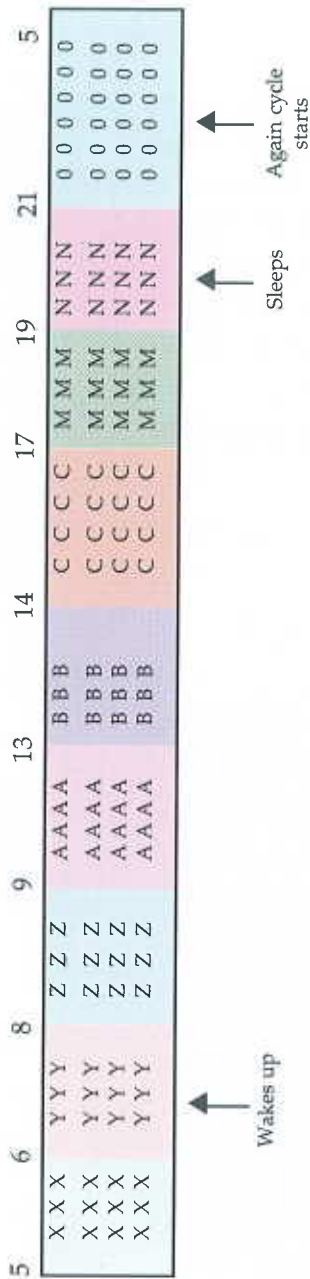


- Waking up, Freshening
- House cleaning, utensil cleaning, bath
- Watering of Potato and Onion
- Preparation of food, Serving food to children
- Washing of clothes, Looking after livestock
- Serving and taking Lunch, cleaning of utensils
- Collection of wood
- Taking rest
- Preparation of dinner and serving food to family members
- Watering of vegetable crops
- Sleeping



## DAILY ROUTINE DIAGRAM

B. Farmer (Male, Age : 35)



X X X	C C C
X X X	C C C
Y Y Y	M M M
Y Y Y	M M M
Z Z Z	N N N
Z Z Z	N N N
A A A	O O O
A A A	O O O
B B B	
B B B	

- Waking up, Freshening
- Collection of wood, Feeding and milking of animals
- Processing of FYM
- Field work (Transplanting, Irrigation, Weeding, Harvesting etc.)
- Taking Lunch and rest
- Field work
- Collection of wood, watering and feeding of animals
- Passing time with family members
- Sleeping

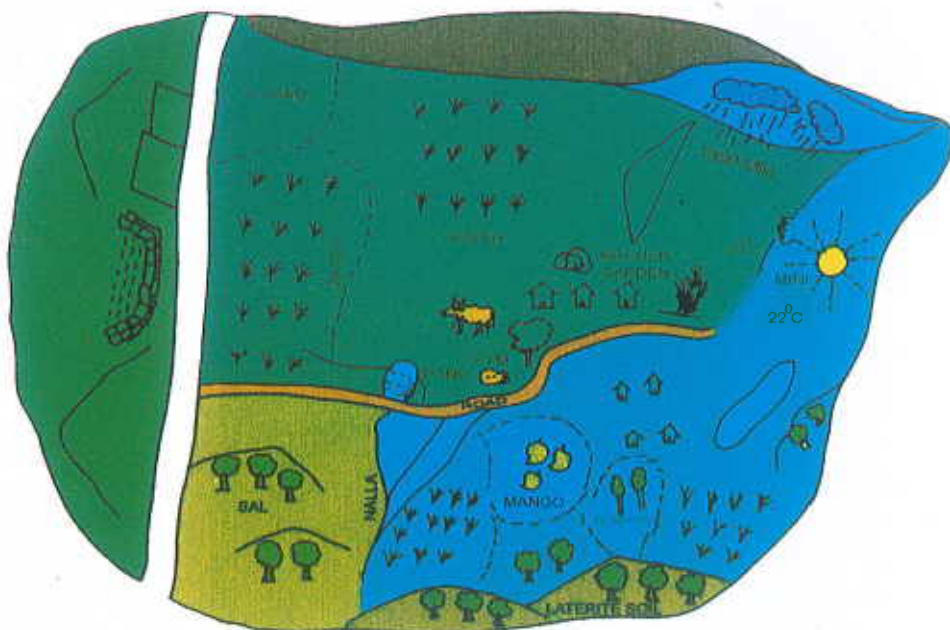
Male farmers start their day with collection of wood, processing of FYM, feeding and milking of animals in the morning. They spend time in the field after the breakfast till evening. They are pass time with their family and friends between 6.00 pm and 7.30 pm. Housewife spend most of her time in preparation of food, watering kitchen garden and washing cloth in the morning. They also collect woods in the afternoon hours.

### AGRO-ECOLOGICAL MAP

The Daburchuaon village is surrounded by the Keonjhar range. The average rainfall is 1412 mm which is mainly due to southwest monsoon and confined to only five months (June to October). The daily mean annual temperature is around 30°C. The daily mean monthly temperature is lowest in the month on December and highest in the month of May. Water table fluctuates between 1 to 5 meter, but due to hard rocks, tube well is not feasible. There are few open dug wells used for irrigation. The soil is red laterite to red loamy in nature devoid of organic matter and phosphorous.

Paddy is the main crop in kharif season and mostly single cropping is norm rather than exception. Though use of FYM is common, villagers are not doing any green manuring. Many households are practicing kitchen garden with onion, potato and

### AGRO-ECOLOGICAL MAP



greens. Agro forestry, growing fodder trees/crops are not common as there is no improved breeds and are allowed to graze in the forest. *Cyprus sp.*, *Ageratum*, *Panicum repens*, *Lantana camara* and *Argemone* are the main weeds.

## INDIGENOUS TECHNICAL KNOWLEDGE (ITKs)

In village Daburchua, villagers follow some ITKs which are as follows:

- They use paddy straw for the preparation of storage bins (for storing paddy grain).
- The natural extracts from the leaves of neem and *karanj* are applied for wound healing.
- Powdered leaf of neem is mixed with paddy grains to prevent pest attack during grain storage.
- They keep wood and bamboo immersed inside water for quite a long period of time before use to prevent insect attack and to increase the life of wood.
- Turmeric powder in combination with mustard oil is applied in wound portion for quick healing effect.
- The bamboo produced in the village is mainly used for house making and basket making.
- Application of *karoda* (forest tree) leaves in paddy field water for prevention of insect pest control may be considered as unique ITK of this village.

## PROBLEM IDENTIFICATION

Farmers were contacted using snowball-sampling technique and they were asked to test problems, rank them and give extent of damage caused by the problems. RBQ values were calculated using the formula:

$$RBQ = \{ [ Fi(N+1)-i] / N \times n \} \times 100$$

Where, F= frequency of the problem of the i<sup>th</sup> rank

N= Number of farmers who have given the ith rank

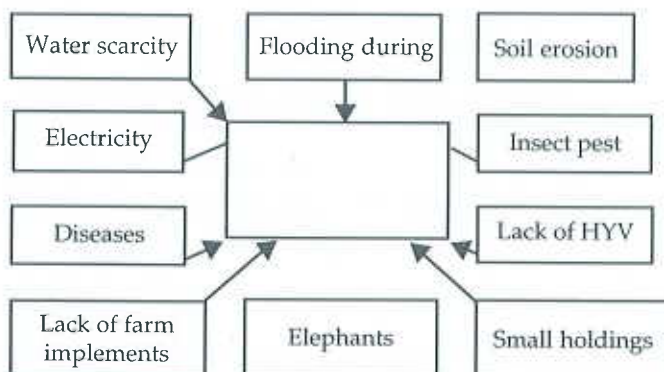
n= number of problems

The RBQ value, rank and average yield is given in the table. On the basis of RBQ values, it was found that water scarcity in rabi and therefore single cropping is the top most problem faced by the farmers of the watershed with the average yield loss of 75% Lack of electricity ranked as the second most problem. Elephant attack during rabi, soil erosion, non availability of HYV, flood during monsoon, lack of farm implements, small holding and pest attack are other problems pointed out by the farmers.

## AGRICULTURAL PROBLEMS VILLAGE-DABURCHUAON

### PARTICIPANTS

Gadadhar Nayak	Prabakar Nayak	Sharat chandra
Gangadhar Nayak	Nartan Nayak	Laxman Nayak
Dinabandhu Nayak	Narayan Patra	Kanakalata Nayak
Kartik Nayak		



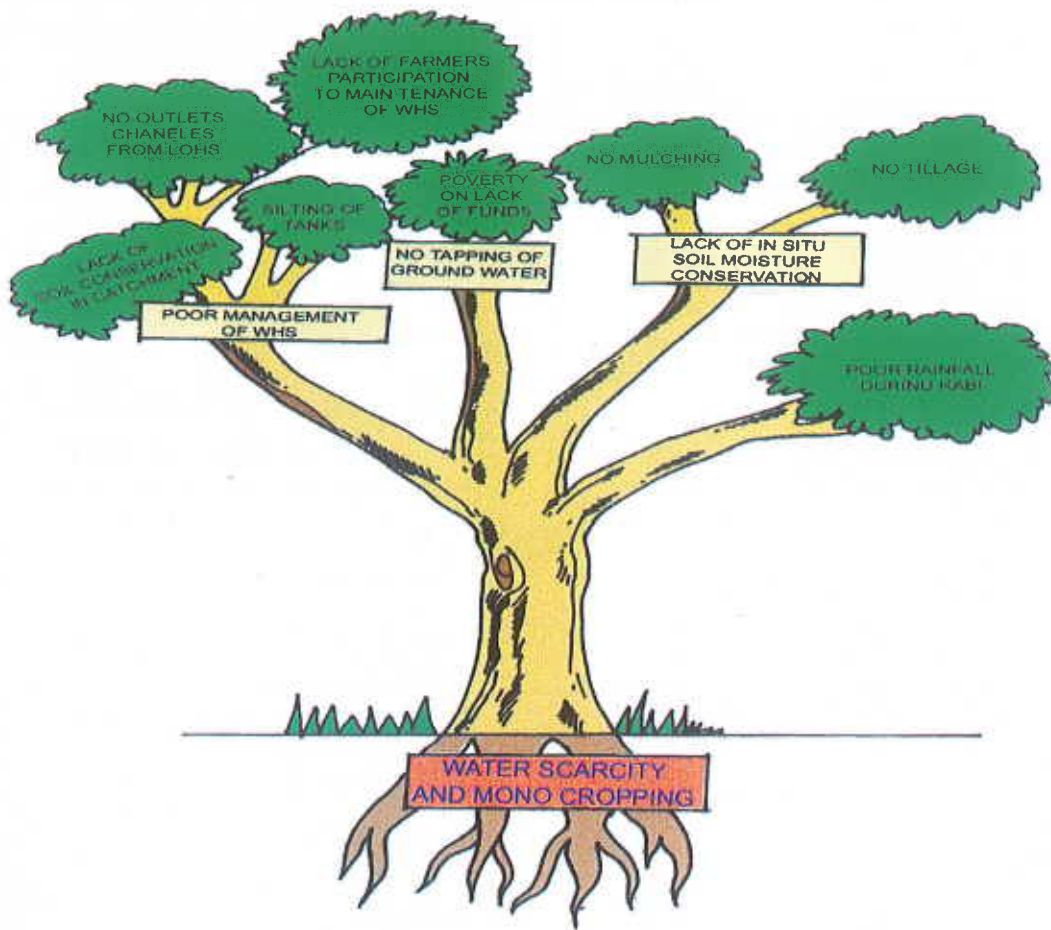
Problems	1	2	3	4	5	6	7	8	9	10	RBQ	Rank	Average% of yield loss
1. Water scarcity and mono-cropping	7	2	1	-	-	-	-	-	-	-	96	I	75
2. Flood during monsoon	1	1	1	-	1	2	-	3	-	-	53	V	36
3. Soil erosion	1	2	1	1	1	-	4	-	-	-	65	III	30
4. Lack of electricity	1	2	4	2	-	-	-	1	-	-	77	II	15
5. Insect attack	-	-	-	-	4	2	-	-	-	-	40	VIII	40
6. Diseases	-	-	-	1	1	4	-	-	2	2	39	IX	30
7. Lack of HYV	-	2	2	2	-	1	-	2	1	-	61	IV	46
8. Lack of farm implements	-	-	1	2	2	1	1	2	1	-	51	VI	26
9. Elephant menace	-	1	-	2	1	-	3	1	1	1	47	III	40
10. Small holding	-	-	-	-	-	-	2	1	2	4	21	X	



## PROBLEM TREE

The cause for the top most problem of water scarcity and single cropping was analysed using problem tree. The primary causes for these problems are negligible rainfall during rabi, lack of insitu soil moisture conservation, no tapping of ground water and poor management of water harvesting structures. No summer ploughing and mulching, poverty, lack of funds for ground water utilization, lack of soil conservation in catchment area, absence of outlets and channels from water harvesting structures, very level of farmer's participation in the maintenance of water harvesting structures and silting of tanks are the secondary reasons that contributed to the primary causes. It is given in the flow chart under problem tree.

### PROBLEM TREE



## ACTION PLAN

Problems	Solution
1. Water scarcity and mono cropping	<ol style="list-style-type: none"> <li>1. Proper maintenance of existing Water Harvesting Structures(WHS).</li> <li>2. Constructions of more number of WHS</li> <li>3. Soil conservation measures in the catchment's area.</li> <li>4. Providing outlets and channels from WHS</li> <li>5. <i>In situ</i> moisture conservation.</li> <li>6. Introduction of drought resistant crop and varieties</li> <li>7. Tapping of ground water</li> </ol>
2. Lack of Electricity	<ol style="list-style-type: none"> <li>1. Efforts to bring electricity to village</li> <li>2. Use of diesel and other indigenous water lifting devices from WHS.</li> </ol>
3. Soil erosion	<ol style="list-style-type: none"> <li>1. Soil conservation structures</li> <li>2. Aforestation in the upper ridges.</li> <li>3. Vegetative barriers across the slope</li> </ol>
4. Lack of High Yielding Variety	<ol style="list-style-type: none"> <li>1. On farm demonstration of HYV</li> <li>2. Regular supply of HYV seeds</li> </ol>
5. Flood during monsoon	<ol style="list-style-type: none"> <li>1. More water harvesting structures</li> <li>2. Safe disposal of excess water</li> <li>3. De silting of existing WHS</li> </ol>
6. Lack of Farm Implements	<ol style="list-style-type: none"> <li>1. Demonstration of improved farm implements.</li> <li>2. Establishment of farmer's cooperative for purchasing tractors and farm implements</li> </ol>
7. Elephant menace	<ol style="list-style-type: none"> <li>1. Trenching in the pathway of elephants</li> <li>2. Afforestation in the upper region</li> <li>3. Weir fencing</li> </ol>
8. Pest and Diseases	<ol style="list-style-type: none"> <li>1. Integrated pest management</li> <li>2. Use of <i>neem</i> based product</li> <li>3. Use of light trap</li> </ol>
9. Small holding and Poverty	<ol style="list-style-type: none"> <li>1. Co-operative and collective farming</li> <li>2. Encourage to take up other allied agricultural enterprise.               <ol style="list-style-type: none"> <li>a. Use of existing <i>Terminalia arjuna</i> for sericulture</li> <li>b. Introduction of improved cattle breed</li> </ol> </li> </ol>

## INSTITUTES / AGENCIES INVOLVED IN THE WATERSHED

The following agencies are involved in the development of the watershed:

1. District Rural Development Agency
2. Department of Soil Conservation
3. Block development office

District Rural Development Agency is the nodal office for financing and monitoring of all developmental works under employment assurance scheme, Integrated wasteland development programme and National watershed development programme for the rainfed area(NWDPRA). District soil conservation officer at district level looking after the overall development watersheds under the district. He is assisted by assistant soil conservation and junior soil conservation officer at field level. Apart from these agencies, Department of Forest under the state government is also taking up plantation forest like *eucalyptus* and *Arjuna* trees for sericulture.

