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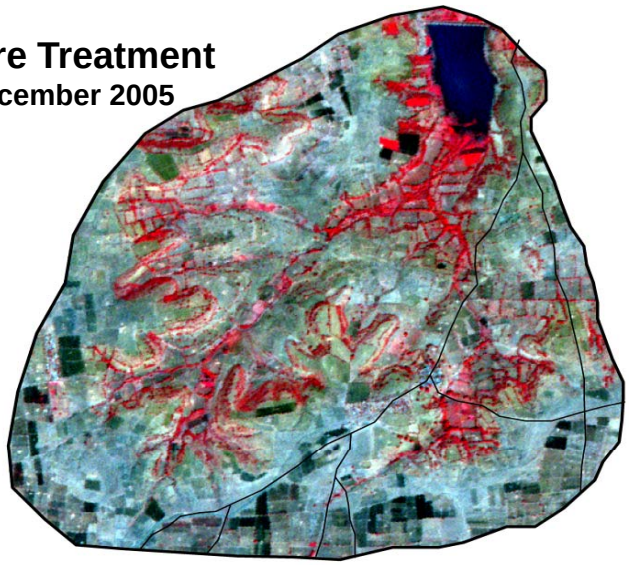
Evaluation Report

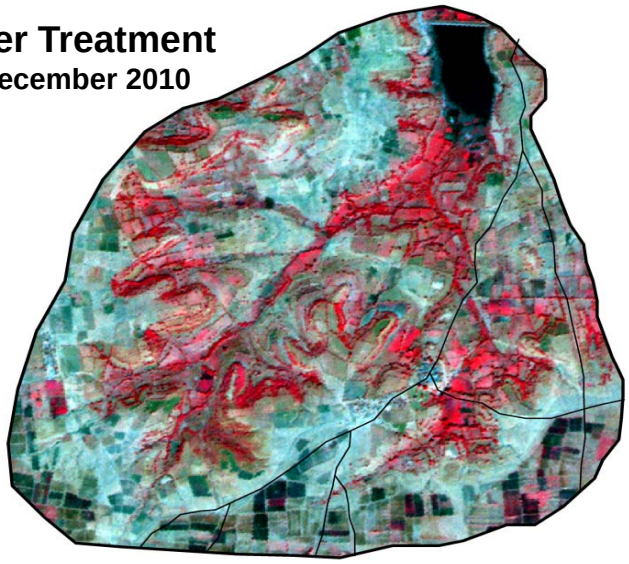
Impact Evaluation of Jonnikere Watershed,

Aurad Taluk, Bidar District, Karnataka

Before Treatment
December 2005



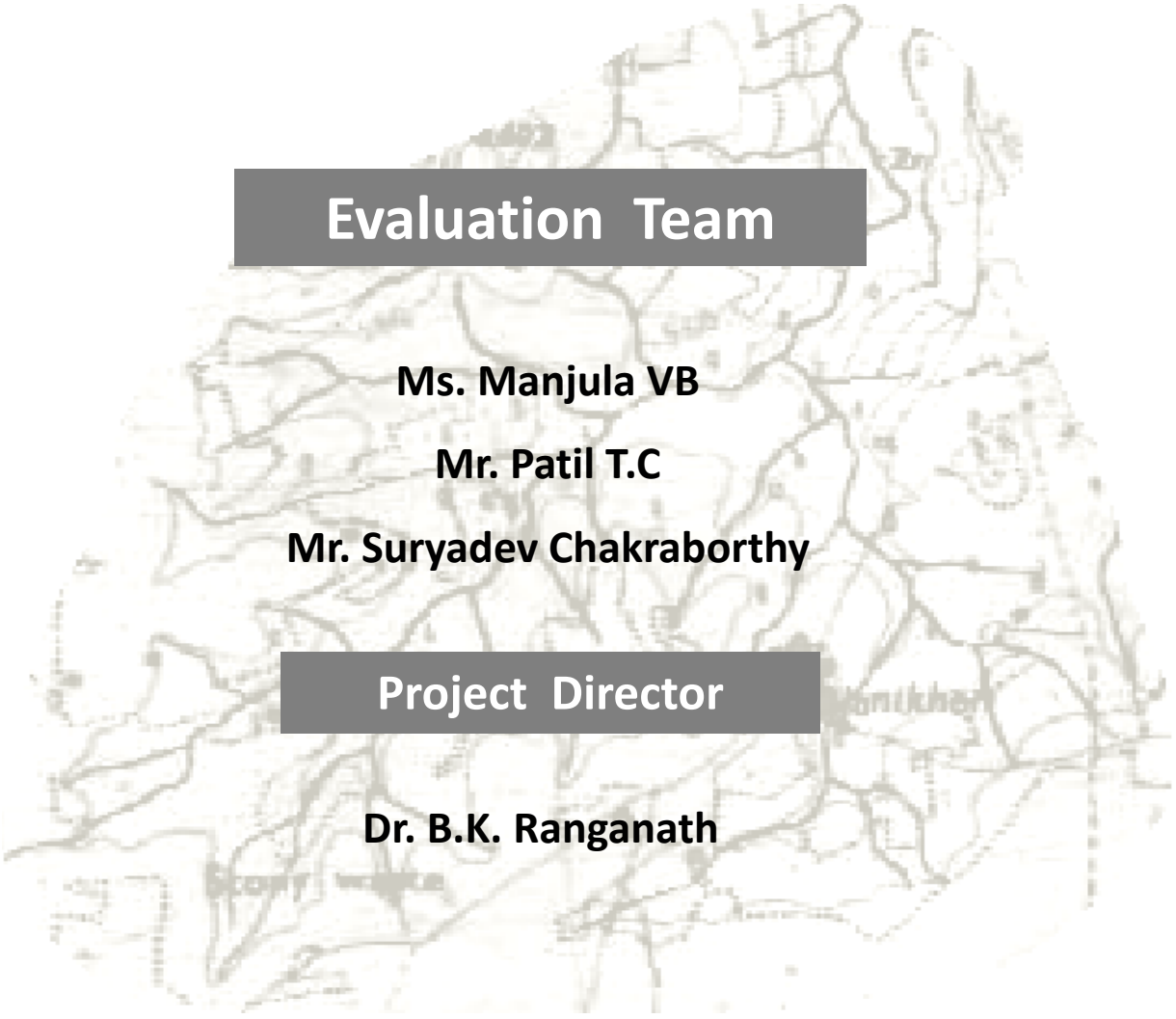
After Treatment
December 2010



Monitoring Evaluation Learning & Documentation
Antrix Corpn. (ISRO), Bangalore

Impact Evaluation of Jonnikeri Watershed,

Aurad Taluk, Bidar District, Karnataka



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Executive Summary

Watershed development has become the flagship programme of land management in the country for holistic and sustainable development of rainfed areas. Integrated Watershed development essentially relates to development of land and water resources; improve livelihoods through a set of biophysical, technological and social interventions. National Bank for Agriculture and Rural Development (NABARD) has been actively promoting the watershed development in the country involving village level Institutions and NGO's. Investment of considerable money, manpower and efforts for watershed development, calls for understanding land use /land cover transformation in the watershed, socio-economic changes of the rural livelihoods and lessons to be drawn for further implementation.

In this context, Antrix corporation, ISRO undertook an evaluation of a Jonnikeri Nala watershed lying in Aurad taluk, Bidar district *in 2011, at the instance of Watershed Development Department (WDD), Govt. of Karnataka in order to study the activities implemented and their resultant socio-economic and environmental impacts in the watershed area, identify deficiencies if any and to adopt corrective measures in the future course of projects.*

This report highlights the findings of the evaluation study of Jonnikeri Nala watershed *lying in Aurad taluk, Bidar district*, *Karnataka, which was treated under NABARD WDF scheme during March 2002 to 2009. This watershed development was facilitated by an NGO called OUTREACH and implemented through community based organizations. The geographical area of the watershed was about 800 ha encompassing four villages. An amount of Rs 41.78 lakhs has been invested for the development of this watershed in two phases namely Capacity building phase (CBP) and Full Implementation Phase (FIP).*

A combination of satellite remote sensing images and ground based data collection with feedback / observations from stake holders were adopted for the evaluation. A questioner schedule covering all identified indicators to reflect the impact of watershed development was administered for collecting the information. Household level information was collected by visiting the beneficiaries using random sampling method with probability proportional to size (PPS). The Household data collected through beneficiary survey was tabulated and analysed.

The satellite data of Jonnikeri watershed pertaining to pre treatment (2005) and post treatment period (2011) were procured and subjected to interpretation / analysis to derive land use / land cover classes and also transformation, incorporating ground truth information / GPS coordinates. In addition, vegetation index images were also generated to study the changes/improvement in biomass in the watershed.

The satellite as well as ground data analysis indicates a positive improvement in the watershed with respect to environmental, social and economical aspects. In general it is understood that the interventions were carried out as per the programme procedures and specifications. The Sensitization and awareness of the program, Community based organization (CBO) formation, their capacity building and exposure visits have helped the community to participate in the project and implement the activities satisfactorily.

The land based activities encompassing Soil & Water conservation measures, horticulture, agro-horticulture, forestry, demonstrations have been implemented and its impacts are visible on the ground. Increase in agriculture crop yield, Changes in the cropping pattern, change over to crops like soya bean, sunflower, and maize etc., are the resultant outcomes of various interventions. The use of organic fertilizer, improved package of practices and crop varieties, is considered as a major driver affecting the changes. Although enhancement of the yields of all the crops grown in the watershed are observed, significant improvement in soyabean, jowar and redgram has been recorded.

The improvement in ground water level in the open wells and perennial flow of water in nalas has influenced the cropping intensity as well as cropping pattern. The extent of horticulture and forestry interventions has not been given much emphasis thus lacking an integrated approach.

An analysis of Satellite images pertaining to pre and post treatment period has not indicated significant transformation in the land use / land cover as well as improvement of biomass in the watershed, since more than 60% of the budget has been spent on soil and moisture conservation activities which has more impact on the agriculture sector particularly crop yield and cropping pattern rather than building up of biomass.

The non-land based activities involving livestock development and Income Generating Activities have been instrumental in improving the livelihoods with alternate source of income. The animal health camps and IGA involving livestock has contributed to the

increase in its number as well as milk yield. EDP training including computer training, tailoring and embroidery has helped them to a greater extent to start as IGA.

Feedback indicates that the fodder requirement gap has been met due to cultivation of maize crop and improved fodder varieties thus making self sufficient. The migration has been significantly reduced by 50% due to employment opportunities created and improvement in their agricultural produce.

The convergence of other programs like vermi composte, Human health camp, animal health camps, other capacity building programs in the watershed, was facilitated by OUTREACH which resulted in greater awareness creation and induced overall development.

To summarise, the biophysical and social interventions had positive changes on the environment as well as socio-economic aspects of Jonnikeri watershed. Considering the performance, the overall evaluation rating falls into "Moderate" category. .

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CHAPTER-I

INTRODUCTION

Integrated Watershed development has become the flagship program for land management in the country for holistic and sustainable development of rainfed areas and to alleviate poverty. A watershed is a geo-hydrological unit that drains to a common outlet, which makes an ideal planning unit for development. Watershed development essentially relates to development of land and water resources through a set of biophysical, technological and social interventions. An Integrated Watershed Management approaches is being adopted in order to conserve rain water, minimize land degradation, arrest soil erosion, improve ground water recharge, increase crop intensity and productivity, meet the demands of fuel wood and fodder and improve the socio-economic conditions of the people.

Participatory watershed development programs are being recognized as the ideal approach for integrated natural resource management in rain fed areas and improve the rural livelihoods. An integrated approach to natural resource management at the watershed level would ideally address the complex system dynamics in watersheds, and achieve environmental benefits where ever it is feasible.

National Bank for Agriculture and Rural Development (NABARD) has been actively promoting the watershed development through involvement of village level Institutions and NGO's. Watershed Development Fund has been created for such activity by NABARD and Government of India, with a broad objective of unification of multiplicity of watershed development programs into a single national initiative.

1.1 Watershed Development activities in Karnataka:

Karnataka is predominantly agriculture based State having more than 70% of its population depending on agriculture and allied activities. Karnataka has two thirds of the geographical area under arid to semi-arid conditions. The State ranks

second next to Rajasthan in terms of drought prone with an annual normal rainfall of 750 mm. The, Rain fed agriculture in Karnataka is characterized by low productivity, degraded natural resources and widespread poverty. Most of the people living in arid to semi-arid zones of Karnataka depend on dry land agriculture for their livelihoods. The dry land farming in Karnataka is riddled not only by natural/physical constraints like unfavourable soil, moisture and climatic conditions, but also by the socio-economic conditions of the farmers such as poverty, fragmented land holdings, urbanization etc.

Realizing the importance of watershed approach for rainfed farming, Govt. of Karnataka has been implementing watershed development programmes under various schemes with different approaches and technology inputs, cost and subsidies, and Institutional arrangements. NABARD also has promoted watershed development in different districts of Karnataka state with support from watershed development fund from 2002 onwards.

1.2 NABARD – Watershed Development Programmes:

NABARD which is called as the banker's bank has played a significant role in rural development. Over the period it has introduced several important schemes and innovative ideas to enhance the flow of rural and agricultural credit. NABARD provides policy support for various farm sector initiatives aimed at accelerating ground level credit flow by rural credit agencies for various farm related activities under investment credit with a view to increase agricultural production and productivity, generating rural employment, managing natural resources and alleviating rural poverty through credit and grant support.

In addition, with the objective of facilitating development and ensuring prosperity in the rural sector, NABARD supports initiatives in Natural Resource Management through watershed development and has developed unique models in the process which have become bench marks. Many of the watersheds implemented by NABARD in Karnataka have been completed in all respects.

1.2 Need for Evaluation:

It is always pertinent to analyse the impacts of these developmental efforts on social, economic, Institutional and environmental parameters after the intervention. Having invested considerable budget, manpower and efforts, the land use /land cover transformation and socio-economic changes of the rural livelihoods needs to be understood and lessons to be drawn. It is in this context, the evaluation of Jonnikeri Nala watershed lying in Aurad taluk, Bidar district was undertaken by Antrix Corporation, Indian Space Research Organisation (ISRO), at the instance of Watershed Development Department, Govt. of Karnataka.

The evaluation involved systematic study of all activities implemented and their resultant implications in the watershed area and on the community. Attempts were also made to identify deficiencies if any and to adopt corrective measures in the future course of projects.

1.3 Objectives of the present Study

The major objectives of the present study are:

- Study and analyse various activities/ interventions carried out in the watershed under the project.
- Assess and document the visible impacts of the project on the socio-economic conditions and natural resources
- Analysis of biophysical changes like land use / land cover transformation
- Impact analysis on social aspects like capacity building, Income generating activities and sustainability aspects

With these objectives in mind, Antrix Corporation, ISRO carried out the evaluation in 2011 by visiting the watershed, interacting with the stakeholders, referring the documents / registers and also anlaysing the satellite images of pre and post treatment period.

CHAPTER-II

JONNIKERI NALA WATERSHED

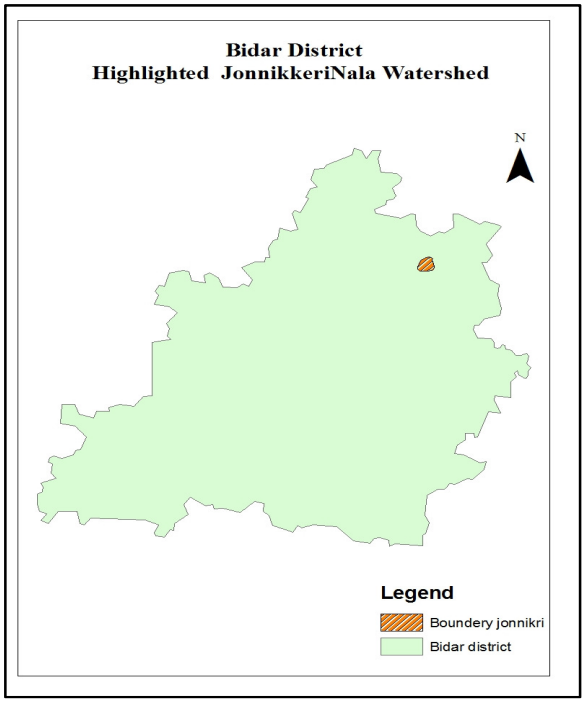
Jonnikkeri Nala Watershed Development Project was implemented from January 7, 2002 to April 30, 2009. The watershed activities were implemented by OUTREACH BIDAR, an NGO with the participation of Community Based Organizations (CBOs) and facilitated by Watershed Development Department (WDD), Government of Karnataka(GoK). An amount of Rs 41,77,521 has been spent for the project which includes the cost of CBP, PPM trainings, FSR preparation and FIP.

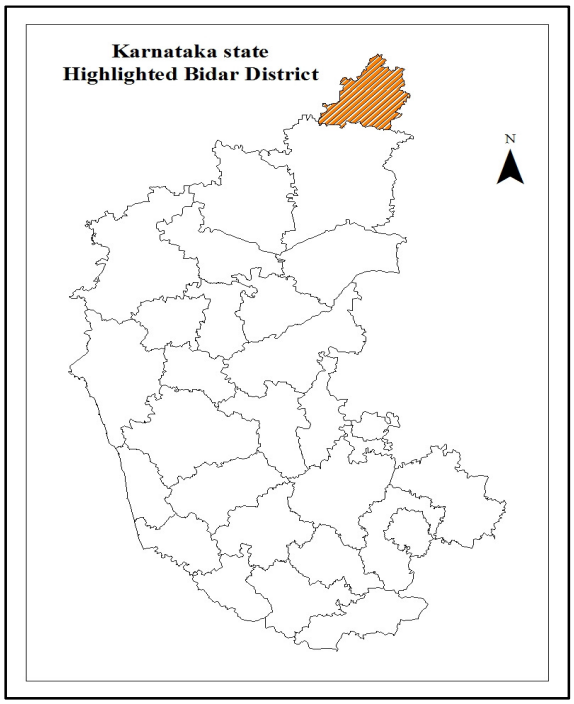
2.1 Study Area/ Watershed:

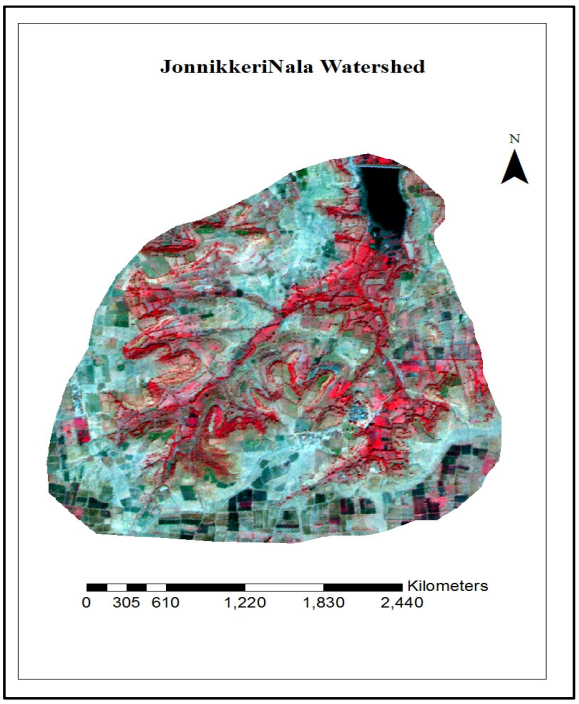
Jonnikkeri Nala Watershed lies in Aurad Taluk of Bidar District, Karnataka. It is located between 18°10′ and 18° 22′ North Latitudes and 77° 25′ and 77° 30′ East Longitudes falling in the Survey of India topo sheet number 56/F/9. The watershed has geographical area of 800 Hectares, of which 792.8 ha has been treated. There are 247 families covering 4 villages viz., Jonnikeri, Santhpur, Eklara and Kollur.

2.2 Project Details: The Jonnikkeri Nala Watershed Development Project was funded by NABARD under its Watershed Development Fund (WDF). The project facilitating agency (PFA) was an NGO – OUTREACH, whose project office is located in Bidar.

OUTREACH, the NGO was responsible for carrying out the activities like, social mobilization, formation and effective functioning of community based organizations, participatory action plan preparation and implementation. Capacity building and senistive The community got the awareness and importance of Maintenance fund and social fencing aspects after the project withdrawal. The technical support was extended by Watershed Development Department (WDD).







Location Map of Jonnikeri Nala Watershed
Aurad Taluk, Bidar District

2.3 Project Implementation: The project was implemented in two phases namely Capacity Building Phase (CBP) and Full Implementation Phase (FIP) (Table 2.1).The spatial extent of the watershed is 800 hectares, out of which the total treatable area is 792.8 hectares. The area covered was 84 ha and 708.8 ha under CBP and FIP phases respectively. There are 247 families covering 4 village, Jonnikeri, santhpur, Eklara, and Kollur.

Table 2.1 Area treated under project,Jonnikeri WS

Sl. No	Particulars	Area (ha)		
		Public Land	Private Land	Total
1	Area of WS	7.2	792.8	800
2	Treatable area in the watershed	0	792.8	792.8
2	Area treated under CBP	0	84	84
3	Area proposed under FIP	0	708.8	708.8
4	Total area treated (CBP+FIP)	0	792.8	792.8
	Total area benefited	**--**	**792.8**	**792.8**

- ***Community Based Organizations (CBOs):***

In the initial stage, social mobilization was carried out to form community based organizations (i.e. CBOs) and were promoted with an objective of ensuring a platform for planning and decision making with active involvement of the target group. Various awareness and training programs on different aspects were carried out to ensure community participation, implementation and management of the assets created under the project. Self-help groups and village watershed committees were the key CBOs established under this project.

- ***Self Help Groups (SHGs):***

For enhancing the social mobilization, under community organization activities, the village community was organized into Self Help Groups. 14 SHGs were formed consisting of 12 women SHG's and 1 Men SHG's and 1 other group (physical handicap) covering 108 families in the project area.

Village Watershed Committee (VWC): Vasundhare village watershed development committee was formed in Jonnikeri. Each SHG in VWC were eligible to share views and problems regarding watershed developmental activities. The VWC was responsible for planning, work execution, making payments, work inspection, certification, maintenance of records, and monitoring of physical and financial aspects. In addition to this, VWC was involved in selection of participants for trainings, exposure visits, beneficiary selection and collection of contributions from SHGs.

Capacity Building Phase (CBP):The Capacity Building Phase (CBP) which was sanctioned on 7 January 2002 and administered by NGO, wherein village communities were facilitated to prepare action plan and execute implementation. Watershed Development Department supported NGO for effective implementation. About 84 ha area of Jonnikeri village was treated under CBP spending Rs.265920.

2.4 Full Implementation Phase (FIP): After successful completion of CBP, the project enters FIP which is the main phase administered by OUTREACH BIDAR NGO in association with WDD. FIP started in January 2005, this phase mainly focused on implementation of the proposed activities in the entire watershed area. FIP covered 708 ha by implementing various developmental activities such as SHG strengthening through trainings, demonstrations and establishment of financial linkages through banks; Drainage line treatment for Soil & Water Conservation, horticulture, forestry, livestock and IGA initiatives.

i)Financial Outlay: Totally an amount of 45,12,393 was sanctioned for the project(CBP and FIP) out of which Rs 40,54,071 has been utilized. Totally including CBP, PPM trainings and FSR preparation and FIP an amount of Rs 41, 77,521 was utilized for the project.

From the table 2.3, it can be seen that 40.45 % amount has been invested in the area/drainage line treatment. The funds utilized for other activities are physical

interventions (40.45%), demonstration (0.78%), Training (1.34%), livelihood support (4.74%), supervision cost (1.60), Project management (6.72%) and Community organization (3.93%).

Table 2.3: Financial outlay of Jonnikeri Watershed Development Project – Full Implementation Phase

Sl.No	Particulars	Amount Sanctioned (Rs)	Amount Released	Amount Utilized	
			Rs	Rs	%
1	Area treatment	22,84,200	23,44,200	2224248.8	34.97
2	Drainage line Treatment	2,93,300	3,50,000	348493.66	5.48
3	Physical interventions	25,77,500	26,94,200	25,72,742	40.45
4	Training	85,000	85,000	85,000	1.34
5	Demonstration	85,000	85,000	49,353	0.78
6	Livelihood support	3,18,700	3,18,700	301420	4.74
7	supervision	1,98,500	1,98,500	1,01,989	1.60
8	Maintenance	1,98,500	0	0	0.00
9	Community Organisation	3,18,700	3,18,700	2,49,970	3.93
10	Project management	4,24,900	4,24,900	4,27,677	6.72
	Total	**67,84,300**	**68,19,200**	**63,60,893**	100.00

ii) Capacity Building - Trainings: To increase the knowledge of the participants (SHGs, VWC and farmers), training programmes regarding watershed development were given by the experienced and specialized resource persons of OUTREACH BIDAR. In addition to trainings, to improve knowledge and skills, "computer training programme" was taken up 10 youths for 10 months. 29 women's effectively taken tailoring and embroider for 6 months. 45 participants took EDP training also.

Table 2.4 : Details of trainings conducted in the FIP programme

Sl No	Name of traningprograme	No of participent	Expenditure	%
1	Crop production training	20	8150	9.63
2	Livestock training	78	9238	10.91
3	Horticulture/forestry	48	14550	17.19
4	Soil & water conservation	87	26370	31.16
5	KrishiMelabangalore	10	16000	18.90
6	Krishimela sedum	15	2532	2.99
7	Integrated forming system	24	7800	9.22
	Total	282	84640	100.00

Here from the table above we can see that maximum expenditure was incurred for soil and water conservation (31.16%) and followed by Horticulture/forestry

(17.19%), Livestock training (10.91%), Crop production training (9.63%), KrishiMela, Bangalore (18.90%).

The details of demonstrations conducted in FIP programme are given in the following table.

Demonstrations conducted in FIP programme				
SL.No	Name of demostration	No of farmer	Expendeture	%
1	Crop demostration	15	11406	23.11
2	Improve varieties	15	14580	29.54
2	Contour Cultivation	5	2500	5.07
3	Vermi Compost	10	20867	42.28
	Total	45	49353	100.00

As many as 45 farmers participated in the demonstrations on different aspects like crop demonstration, improved varieties, contour cultivation, and vermin compost.

iii) Soil and Moisture conservation : Formation of trench cum bund, boulder bund, gully plug, farm ponds and waist weirs are the major activities implemented under soil and water conservation activities with a sanction of Rs. 2777732.95 (Table 2.5) but Rs. 2674722.55are utilized with in this total financial outlay of S&WC, about Rs. 1391396 was spent on formation of boulder bands; Rs. 13469.15 utilized for waist weirs; about Rs. 209895.8 for water harvesting and for diversion channel spending Rs. 62070.11and Rs. 32098.56 for farm pond, Rs. 27434.67 for contour staggered trench respectively. These are the major expenditures and details are given in table below (Table 2.5).

Table 2.5 - Soil and water conservation activities in FIP						
Sl No	Treatment	Units	Amount sanctioned	Amount Utilized	% of achievement	
					Physically	Financially
1	Boulder bunds	Cmt	1352457	1391396	102.99	110.76
2	Boulder bund Existing	Cmt	5184.33	0	0	0
3	Diversion channel	Cmt	44956.93	62070.11	96.2	138.08
4	Water harvesting	Cmt	170246.5	209895.8	85.74	123.28
5	Earthen Bund	Cmt	275718.2	362475.6	104.37	131.46
6	waste weir	Cmt	10408.66	13469.15	150.09	165.64
7	Bund plantation	No	56457	14145	35.75	25.04
8	F seed dibling on bund	Kg	0	13243	0	0
9	Farm pond	No	105742.2	32098.56	43.75	30.78
10	Contour staggered trench	Cmt	37114.75	27434.67	50.33	73.91
11	Forest plantation	No	43065	10375	33.32	24.09
12	Forestry seed	No	1050	0	0	0
13	Agave Plantation	No	7200	10310	128.13	143.19
14	Fodder development	Ha	20000	830	10	4.15

15	Horticulture Plants	No	156024	76497	58.7	49.02
16	Boulders checks (0.60m)	No	80953.87	66276.29	82.23	82.23
17	Boulders checks (0.75m)	No	28015.78	31520.37	112.51	112.5
18	R.R.S-3	No	125649.9	163347	100	129.51
19	Vented C.D	No	58988.83	87350	100	148.14
20	Supervision cost		198500	101989		
	Total		**2777732.95**	**2674722.55**		

The major financial expenditures are on waste weir followed by Vented C.D, agave plantation, diversion channel, earthen Bund, R.R.S, water harvesting boulders checks and boulder bunds.

v) ***Forestry Plantation:*** In all the villages, about 43,065 seedlings were sanctioned. Planting was carried out along the parcel boundaries and fence of each land holding.

Table 2.6 : Financial outlay of Forestry activity in JonnikkeriNala WS

Sl No	Tretments	Units	Amount sanctioned	Amount Utilized	%	% of achievement	
						Physically	Financially
1	F seed dibling on bund	Kg	0	13243	11.99	0	0
2	Forest plantation	No	43065	10375	9.40	33.32	24.09
3	Forestry seed	No	1050	0	0.00	0	0
4	Agave Plantation	No	7200	10310	9.34	128.13	143.19
5	Horticulture Plants	No	156024	76497	69.28	58.7	49.02
	Total		**207339**	**110425**	**100.00**		

Of the total financial outlay, about Rs. 76497 (69.28%) was spent on horticulture plants; about Rs. 13243 (11.99%) was utilized for F seed dibbling on bund; Nearly Rs. 10375 (9.40%) for Forestry Planting and Rs.10310 was utilized for agave plantation.

vi) ***Horticulture:*** Horticulture grafts were distributed by NGO and planted by beneficiaries. Major species opted are mango trees with varieties of dasheri, mallika, keshar, benishan and neelam. After the plants were distributed to beneficiaries, NGO had monitored all the activities such as basin preparation,

mulching, planting, stalking, fencing and watering or provision of critical irrigation, which was carried out by the respective beneficiary. An amount of Rs.156024 was sanctioned, within that Rs.76497amount were utilized. Financially 49.02% and physically 58.7% progress was achieved.

vii) Fodder Development: Due to the fodder development and intercrop management, animal rearing has increased. The farmers gained knowledge on stall feeding, fodder production. Purchase of fodder from outside has reduced. Pre development stage total fodder availability was 399 Tonnes but after implementation, fodder availability was surplus with 347 Tonnes

viii) Livelihood Activity: In livelihood activities preference was given to landless and marginal categories in Watershed area. Members from landless and marginal farmer class were motivated to join SHGs; special entity was given for the widows, women headed families, physically handicapped persons. The labour required for watershed activities like soil conservation measures, construction of water harvesting structures etc. In addition to this provision was made for promotion of alternate livelihood options which includes both livestock and non-livestock related income generating activities. Rs. 247420 was sanctioned for livelihood activity within that 76.79% was used for milch Animal, 19.56% was used for skill training, tailoring and embroidery training and 3.63 % was used for computer training which mainly covered maximum amount.

Table 2.7:Details of activities under Livelihood support

Activity carred out	No of beneficiary	Total expenditures	%
Milch Animal	20	190000	76.79
Skill Training tailoring training and embroiderytraining	29	48420	19.56
Computer training	10	9000	3.63
	59	247420	100

ix) Community organization activities: Community participation was very important and also programme success depends upon active community participation. The training and awareness activities taken up by community organization are given in Table 2.8.

Table 2.8 : Activities taken up by community organizations

Sl. No	Name of the activity	Quantity	NO of Participants attended	Total expenditure	%
1	SHG Concept training	4	119	10000	1.49
2	SHG book keeping Training	2	32	5000	0.74
3	Training on EDP programme	2	37	5000	0.74
4	leadership training to SHG member	2	43	4376	0.65
5	Training on gender issues	2	64	5000	0.74
6	Training on Conflict resolution	2	45	500	0.07
7	Training on legal issue	1	25	2500	0.37
8	Training on basic health	2	52	5000	0.74
9	Children camp	1	88	13228	1.97
10	street play	2	0	9895	1.47
11	Animal health camp	2	450	12633	1.88
12	Human health camp	3	750	21071	3.13
13	celebration women day & environment day	1	2500	28314	4.21
14	Field publicity awareness	2		14953	2.22
15	Community organization salary			108000	16.04
16	Project management total			427677	63.53
		28	4205	673147	100.00

Capacity Building : Trainings were conducted in all villages for SHG members on concept of SHGs and their formation, capacity building trainings on structural analysis of society, local resources of finance, vision building, gender, network and linkage, book keeping and auditing, leadership, community organizing and financial management, importance of document maintenance, common fund management, herbal production, concept of resource centre, role and responsibilities etc. EDP trainings were also conducted on food processing, computer training, tailoring and embroidery

The members of Watershed groups were trained on agriculture practices, soil and water conservation , linkages, livestock, fodder, horticulture promotion in dry land, animal husbandry, fodder seeds promotion, dry land agriculture practices and organic farming systems, integrated farm development, Ayurveda plants, role and responsibility, implementation of FIP programme. The farmer were exposed to krushi Mela and understood various agriculture technology and practices.

Integrated farming demonstration on contour cultivation, vermi compost production and package of practices for Bengal gram was conducted.

CHAPTER - III

IMPACT EVALUATION – DATA COLLECTION & ANALYSIS

The evaluation involved systematic study of all the activities implemented and their resultant implications on the watershed and the community. The major indicators used for the assessment are:

- Peoples participation and community involvement
- Land use / Land cover transformation, biomass
- Soil and moisture conservation measures
- Rain Water harvesting measures
- Forestry
- Horticulture & Agro-horticulture
- Animal husbandry & fodder development
- CPR treatment
- Water availability status (hydrology; both surface and sub-surface)
- Income Generating Activities
- O & M of completed activities.
- Post project maintenance and sustainability.

3.1 Methodology:

A combination of satellite remote sensing images and ground based data collection with feedback / observations from stake holders were adopted. A questioner schedule covering all identified indicators to reflect the impact of watershed development was administered for collecting the information.

Household level information and feedback was collected by visiting the beneficiaries of the villages of Jonnikkeri Nala Watershed through field visit and surveys. Transect walk was carried out to selected locations to have a first-hand information on various interventions implemented, quality of implementation and its impact, biomass improvement etc. Secondary data was collected from the office of NGO (OUTREACH BIDAR), SHGs and VWC with respect to activities carried out.

3.2 Sampling Strategy:

3.2.1 Sampling frame: Initially to get an overall status about the project implementation, a list of caste wise actual benefited households was prepared, covering all villages under the project area. This served as a 'Sampling Frame'. This frame provided the total number of families benefited under the project. This information was collected using a simple format as a preliminary exercise. The information served as a starting point for the sampling. Based on this sampling frame, it was decided to sample (overall) 15 percent of the beneficiaries by considering their caste or community. So, 40 households were considered for sampling in this study.

3.3 Data Analysis: All the 40 (sampled) households were interviewed using a structured questionnaire. Aspects regarding watershed implementation in Jonnikkeri Nala Watershed like membership status, their participation in capacity building, project planning, implementation, operation and maintenance, impacts etc., were recorded. The household level data was analysed and consolidated at the village level and then generalized to watershed level.

For the field survey of natural resources, Global positioning System (GPS) and satellite images were used to ground truth the various land based activities such as soil and moisture conservation structures, horticulture plantations, forestry plantations, crop related, demonstration plots, etc. In general the overall land use / land cover pattern was observed to relate it to satellite images for further analysis.

Satellite images of pre and post treatment periods were analysed to spatially map and determine the extent different land use / land cover categories and also generate vegetation index images to study the changes / improvement in biomass.

CHAPTER – IV

4.0 RESULTS & DISCUSSION

***4.1 Capacity Building & Community Participation*:** NGO – OUTREACH, BIDAR has created awareness about the project and succeeded in formation of 14 SHGs (12 women SHG's, one men SHG and one physically handicapped) and VWCs with effective functioning. MEL&D interviewed the beneficiaries of SHG and VWC members about their group's functional status, financial flow and book keeping, leadership, documentation, etc along with participation in trainings, exposure visits, and level of involvement in project planning and implementation, which was found to be sound.

4.1.1 Village Level Trainings: A series of *Village Level Trainings (VLTs)* were conducted on various aspects of agriculture practices, horticulture, Nursery raising, livestock organic farming, IPM/INM etc to the members of different groups, which has helped the farming community.

4.1.2 Capacity building

Various training programs and exposure visits to the community conducted by Outreach NGO, enabled their participation in the project. The NGO has made sincere efforts in improving the knowledge and skill of the stakeholders. EDP training on food processing and enterprise training and also the computer training, tailoring and embroidery has helped the community to undertake various IGA activities. IGA activities has improved their economic status and life style. All the responded beneficiaries have appreciated the exposure visits and the learning's were successfully incorporated in the project activities especially in Soil & Moisture Conservation, horticulture, organic farming and livestock management.

4.2 Impacts – Natural Resources & Household Income: Based on the activities taken-up under CBP/FIP of Jonnikkeri Nala Watershed, impact on natural resources and annual income of the beneficiaries have been assessed through interaction with farmers/beneficiaries and the details are as follows:

4.2.1: Surface & Ground Water: The structures constructed/developed under soil and water conservation sector has been assessed from both private and common lands. The feedback revealed that there is an improvement in the water availability at the end of the project (EOP) as compared to the baseline situation. Due to effective soil and water conservation activities like boulder bund, diversion channel, waste weir, water harvesting trench, farm ponds, earthern bund were constructed with peoples' participation in the project area had an impact on the ground water level and yield to a greater extent.

In the watershed area, there were 5 open wells. Out of which water levels of two wells were found to be 4.48 meter bgl in December 2005 and now the average is 1.12 meters in December 2009. The other 2 wells were not used.

Ground water status difference base line and EOP		
	Pre -development	**post development**
Project impact	**Average water level in Meter (2005)**	**Average water level in Meter (2009)**
Water table depth bgl	4.48	1.12

Earlier rain water used flow to nala immediately and low lying lands ware used to flood and resulting in crop losses. Now due to treatments immediate flow of rain water during the rainy season reduced and it is seen subsurface flow and raise in water in open well in upper reaches also. These facts indicate the impact of effective implementation of S&WC interventions in these areas.

4.2.2. Agriculture Production: The agriculture productions of major crop in the water shed area were found to be improved after implementation of this project. After interventions, the agricultural land area has increased which help to improve the agricultural production as well as income level of the farmer in this watershed. Below the table shows the change of area, grain yield and income level which show the difference between base line status to End of program (EOP). There has been considerable improvement in the yield of agricultural crops. The Soybean crop has shown maximum increase in area as well as production, whereas the red gram has shown considerable increase in the yield. The following table provides the details of the three important crops.

Agriculture Status in Jonnekahari WS						
SL	Crop	Period	Area(ha)	Grain Yield(MT/ha)	Income	Overall
1	Red gram	Base Line	280	3.0	4950	1930.50
		EOP	335	6 -7	17000	6002.37
		Change (%)	19.64	40.00	243.43	140.79
2	Jowar	Base Line	295	4	3400	1429.53
		EOP	388	6	3800	1762.67
		Change (%)	31.53	15.00	11.76	
3	Soybean	Base Line	15	10	8000	2691.67
		EOP	285	17	19000	6635.33
		Change (%)	1800.00	70.00	137.50	1915.83

Comparison of pre and post project information with respect to agriculture indicates the following. The fallow land area is reduced in watershed due to reclamation. At the beginning it was 90 ha, now it has reduced to 48ha. Net sown crop area is increased from 682.80ha to 742ha. Major crops in the beginning were red gram, jowar, green gram, sun flower and avare, now green gram crop reduced which is replaced by soya bean. In case of red gram the area of cultivation increased by 55 ha and. the production increases from 3 quintal per ha to 6-7 quintal per ha. Overall net income increases from 4950 per ha to 15100 per ha. Which is mainly due to increase in grain cost (Rs 3200 per quintal this year) and increase in yield. The area of jowar cultivation is increased by 60 ha and also marginal increase in the production from 4 quintal per ha to 6 quintal per ha. Overall net income increases from 3400 per ha to 3800 per ha which is mainly due to increase in grain cost (Rs 3200 per quintal this year) and increases in yield. Some new crops like maize, soya bean, sun flower and avare are cultivated in the water shed which are not cultivated earlier. Cultivation of fodder for animals increased with varieties like CO1, stylo Hameta and maize are cultivated.

4.2.3. Afforestation and Horticulture: Out of 40 sampled households, 23 have taken horticulture activity. Major species opted are mango with varieties like dashahari, mallika, keshar, benishan and neelam. After the plants were distributed to beneficiaries, NGO had monitored all the activities such as basin preparation, mulching, planting, staking, fencing and watering or provision of critical irrigation, which was carried out by the respective beneficiary.

4.2.4. Livestock: Livestock's activity was an integral part of project. The impact was found after implementation of project in livestock population. The milk yield and number of livestock both have increased. The milk production has increased substantially.

Livestock population	Pre Development			Post development		
	Population	Milk yield	Net income	Population	Milk yield	Net income
C.B Cow	5	3600	28000	20	15000	150000
Buffalo	350	82000	4,92,000	485	232800	2328000
Goat	0	0	0	150	0	270000
Sheep	500	0	0	650	0	975000
Local Cow	310	23250	162750	408	367200	367200
Others	398	0	0	442	0	0

Cross breed cows increased in number from 5 to 20 and milk production in the area is increased. Daily 355 liters milk produced and marketed. KMF installed bulk cooler in the area. A private dairy run by men group successfully. Goat population is increase considerable from (500 to 650) because of employment opportunities through watershed works to labours. Further continuous training and financial support under live hood to landless labours and women also help to purchases goats.

4.2.5 Fodder Availability: In order to strengthen the trench-cum-bunds under soil and water conservation activities, grass seeds and other plants were dibbled. The farmers have provided the grass seeds. Due to this fodder availability has been increased in the watershed area. Fuel and fodder status and its utilities are given in Table 4.11.

Project Impact on fodder developement			
	Pre development	Post development	%
Total fodder requirements	3190	4065	27.42
Total fodder availability	2791	4412	58.07

Fodder gap in the pre development was 399 tonnes per year. The fodder requirements were met as envisaged and there was surplus fodder of 347 tonnes per

year. This is mainly due to cultivation of maize crop and improved fodder varieties and other crops. .

4.2.6 Household Income: Annual household income has been enhanced by the activities taken up under NABARD-WDF Scheme. The improvements in agriculture productivity, enhanced agriculture labour man days, additional horticulture income, livestock improvements, etc has proven positive impacts on income level. Pre development activities were confined to only labour work whereas presently diverse activities like rearing of livestock, petty business, tailoring and season wise fruit business.

4.2.7 Migration : 78 persons from 46 families used to migrate for 6 to 8 months before the project in search of employment and livelihood.. After the project implementation, migration has considerably reduced to 34 persons from 24 families and the period has reduced to 4 months.

CHAPTER - V

USE OF REMOTE SENSING & GIS TECHNIQUES

The satellite data of the study area pertaining to pretreatment period (2005) and post treatment period (2010) were procured from NRSC, Hyderabad and subjected to analysis. The analysis of satellite data involved geometric correction with respect to map to start with, digitization of Jonnikeri watershed boundary (obtained from NGO), extraction of the study area and discrimination of land use/land cover types.

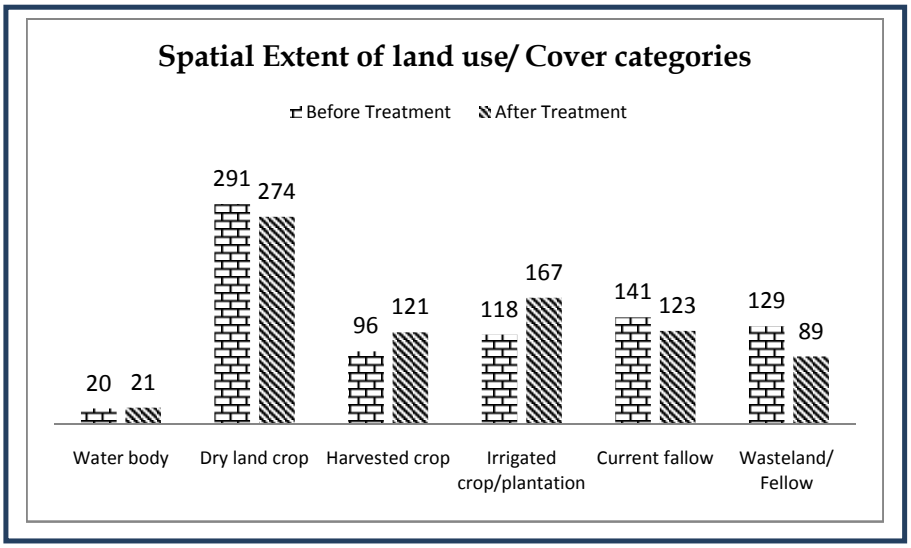
Image to image registration of two period satellite data (pre & post treatment) was also carried out by identifying Ground control Points (GCPs) on common image locations with an accuracy of less than a pixel. This was essential to compare and derive the change information.

5.1 Land use / land cover Classification*:*

A combination of unsupervised and supervised classification techniques was adopted using Maximum likelihood algorithm criteria in order to classify different land use / land cover categories. The major classes delineated are Water body, Dry land crop, Harvested crop, Irrigated crop/plantation, Current fallow and wasteland under arable lands. Classification was done on the satellite data of pretreatment period (2005) and post treatment period (2010) separately and the statistics derived with respect to spatial extent were compared. The land use / land cover categories statistics during the Pre and post treatment periods are given in table 5.1.

Table 5.1: Spatial Extent of land use/ Cover categories

SL No	Land Use/ Land cover	Before Treatment	After Treatment	Change (ha)	Change %(with in category)	Change %(overall watershed)
1	Water body	20	21	+01	+5	+ 0.12
2	Dry land crop	291	274	-17	- 5.8	- 2.1
3	Harvested crop	96	121	+25	+ 26	+3.15
4	Irrigated crop/plantation	118	167	+49	+ 41.5	+6.16
5	Current fallow	141	123	-18	- 12.7	- 2.36
6	Wasteland/ Fallow	129	89	-40	- 68.9	- 5.0
	Total	**759**	**759**			



5.11 Change statistics:

Comparative analysis of the pre and post treatment spatial statistics of land use / land cover indicates that about 5.8 % (with in category) and 2.1 %(overall watershed) of the area under dry land crop has been decreased in post project period. Whereas 26 %(with in category) and 3.15 %(overall watershed) area under harvested crop,is noticed. About 41.5 %(with in category) and 6.16%(overall watershed)area has been brought under Irrigated crop/plantation. About 68.9%(with in category) and 5% (overall watershed) area under wastelands have been reclaimed for cultivation. About 12.7 %(with in category) and 2.36 %(overall watershed) of lands which were fallow have been brought under cultivation.

The spatial distribution of different land use / land cover categories and satellite images of pre and post treatment periods are given in the figures.

5.2 Generation of Normalized Difference Vegetation Index (NDVI):

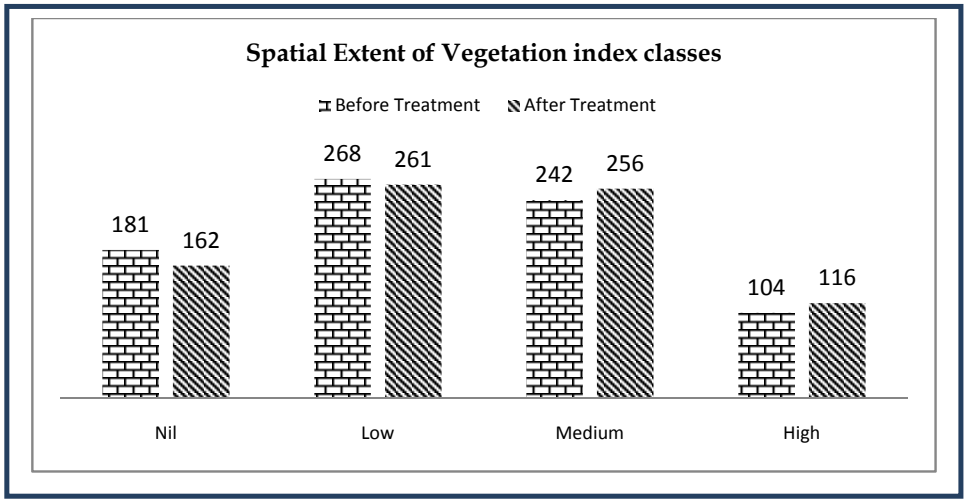
The spectral response of green and healthy vegetation is characterized by a strong absorption in the red region together with a high reflection in the near Infrared (IR) region of the electromagnetic spectrum. The NDVI is highly correlated with vegetation parameters such as green leaf biomass, leaf area and is an indicator of photosynthetic activity and hence is of considerable value for vegetation discrimination and seasonal monitoring. NDVI has been used to describe vegetation discrimination and seasonal monitoring. Water, snow and clouds have negative values because they reflect more red than IR radiation. Rocks and bare soils have NDVI values around 0 since they have similar reflectance in both the bands and represent areas without any vegetation cover. Only green vegetation has positive NDVI values and high values being associated with higher densities / vigour of any given healthy phytomass.

In the present study, in order to assess the biomass qualitatively, NDVI has been computed using the infrared and red bands of the satellite data as NDVI **= (IR –R) / (IR+R).** This ratioining helps in removing temporally or spatially varying gain and bias factors, suppressing radiance variations arising from topographic slope and aspect and enhances radiance differences between soils and vegetation. The vegetation index in the image has been depicted as nil, low, medium and high categories

Table 5.2: Spatial Extent of Vegetation index classes

SL No	Analysis	Before Treatment	After Treatment	Change(ha)	Change % Individual Class	Change% Over watershed
1	Nil	181	162	-19	- 10.5	- 2.3
2	Low	268	261	-7	- 2.6	- 0.9
3	Medium	242	256	+14	+ 5.8	+ 1.8
4	High	104	116	+12	+ 11.5	+ 1.5
	Total	795	795			

The above table indicates that there is reduction in the Nil and low categories of biomass and slight increase in the category of medium and high categories. The increase is due to biomass build up due to horticulture/ forestry activities.



The interpretation indicates that, there is an increase in NDVI values for post project scenario. About 11.5%(Individual Class) and 1.5 %(overall watershed) has shown increased NDVI in high biomass category compared to baseline. About 5.8% (Individual Class) and 1.8 %(overall watershed) land has shown increased NDVI in medium biomass categories compared to baseline. The reduction of NDVI values in the nil and low categories was found to be about 10.5% and 2.6 % (Individual Class) and 2.3% and 0.9% (overall watershed) land respectively, is observed indicating transformation with biomass. It implies that there is an increase in vegetation densities with biomass in post project scenario compared to base line period. The increase is not that significant since most of the interventions was on the soil and moisture conservation when compared to forestry and horticulture sectors.

The spatial distribution of different biomass categories and satellite images of pre and post treatment periods are given in the figures.

CHAPTER - VI

SUSTAINABILITY ASSESSMENT

The sustainability assessment involved systematic study of all activities/structures implemented and their present status (i.e. post project scenario) in the watershed area. The major indicators used for the assessment are:

- Functional status of SHGs and VWCs
- Financial status and linkages of SHGs and VWCs
- Status of Income Generating Activity (IGAs): Livestock and Non-livestock
- Quality of soil and water conservation structures
- Maintenance of Forestry and Horticulture plantations
- O & M of completed activities.

6.1 Methodology:

All the villages of Jonnikkeri Nala watershed was covered through field visit and surveys. Transect walk was carried out in selected locations of structures to have a first-hand information on quality of structure and their maintenance, growth and survival of forestry and horticulture plantations. In case of "Community Based Organizations (CBOs)" all the SHGs and VWC was visited and collected the information with respect to functional status, frequency of meetings, status of loan/revolving fund dispersion, loan re-payment status & savings, and also examined the book maintenance of respective SHGs and VWC in Jonnikkeri Nala watershed area.

6.2 Sustainability of assets created under project: In addition to CBOs sustainability, structures implemented under soil and water conservation, drainage line treatment activities, horticulture and forestry plantations were assessed for their sustainability.

The maintenance fund of Rs 50,673 has been mobilised and social fencing guidelines like ban on free grazing and additional bore wells are being followed.

CHAPTER - VII

PROJECT PERFORMANCE RATING

Considering the progress made in the project, its impacts and sustainability, the overall development of Jonnikere watershed falls under **"Moderate"** category. While the social engineering part involving social mobilization and capacity building were good, integrated and holistic approach on land development was weak, with more focus on soil and moisture conservation sector. The SHG's and livestock are quite moderate in their activities. The horticulture and forestry sector interventions should have got more emphasis to improve the overall biomass and reduce soil erosion / runoff.

Table 6.1: Performance rating – Jonnikeri watershed

Sl. No	Activity	Project Cycle					
		Planning	Implementation	Impacts	O & M Post Project	Sustainability	Overall
1	Awareness & Capacity Building	Good	Good	Good	Good	Good	Good
2	S&WC/Agri	Good	Good	Good	Good	Moderate	Good
3	Horticulture	Moderate	Moderate	Poor	Poor	Poor	Poor
4	Forestry	Moderate	Moderate	Poor	Poor	Poor	Poor
5	Animal Husbandry	Good	Good	Good	Good	Good	Good
6	SHGs	Good	Good	Good	Moderate	Moderate	Good
	Overall	Good	Good	Good	Moderate	Moderate	**Moderate**

Ratings scale : 1. Very Good. 2. Good 3. Moderate 4. Satisfactory 5.Poor

CHAPTER – VIII

CONCLUSION

About 800 ha of Jonnikeri watershed area encompassing four villages has been treated under two phases viz., CBP and FIP phases by investing a total amount of Rs. 41.78 Lakhs from Jan 2002 to April 2009. At the overall level both technical as well as procedural specifications have been followed. It was also noted that not only NGO staff, but also community at large is quite well aware of these guidelines and specifications.

Fourteen Self Help Groups (SHGs) and a Village Watershed Committee (VWC) was formed successfully. The NGO – OUTREACH, Bidar, did the social engineering and facilitated the execution of work. Relatively good involvement of SHGs and VWC in the implementation of project was observed. In the land treatment, more emphasis has been given to soil and moisture conservation measures indicating sectoral approach rather than integrated approach.

Household income enhancement has been recorded due to the outputs from the agriculture sector, IGA and employment opportunities. Animal husbandry has been successful in terms of increase in the number of livestock, reduced mortality and increase in the milk yield due to animal health camps and surplus fodder availability.

Effective soil and moisture conservation measures like Trench cum bunding, waste weirs, farm ponds, boulder bunds, gully plugs, etc have not only reduced the soil erosion and runoff, but improved the in situ soil moisture, ground water level and perenniality of water flow in nalas. Due to the improvement in the retention of soil moisture, cropping pattern has been changed and farmers have undertaken crops like soyabean, sunflower and Maize. Net sown cropped area has also increased while reducing the extent of fallow and wastelands. Horticulture / forestry activities are found to be limited. EDP trainings have been innovative in providing capacity in the field of food processing, computers and tailoring/embroidery.

The following are the salient transformations observed in the watershed.

- Overall improvement in the agriculture sector with respect to yield, cropping Pattern and cropping intensity.
- Increase in the Net sown area
- Reduction in the spatial extent of fallow / wastelands
- Employment opportunities generated during the project period
- Overall increase in the household income
- Limited extent of land cover transformation & biomass increase
- Gained knowledge on usage of agriculture waste, organic farming, improved package of practices, INM/IPM etc
- Usage of chemical fertilizers has decreased
- Livestock improvement with increase in milk yield.
- Surplus fodder availability in the watershed
- Migration reduced
- SHG's undertaking IGA- cattle and sheep rearing , tailoring/embroidery
- Maintenance fund and social fencing adopted for sustainability

The biophysical and social interventions have brought in positive changes in the watershed. Its impacts are seen on the ground as well as livelihoods. Horticulture and forestry sector interventions also should have got more emphasis to improve the overall biomass and reduce soil erosion/runoff. Considering the overall performance, the evaluation rating of Jonnikeri watershed falls into **"Moderate**" category.

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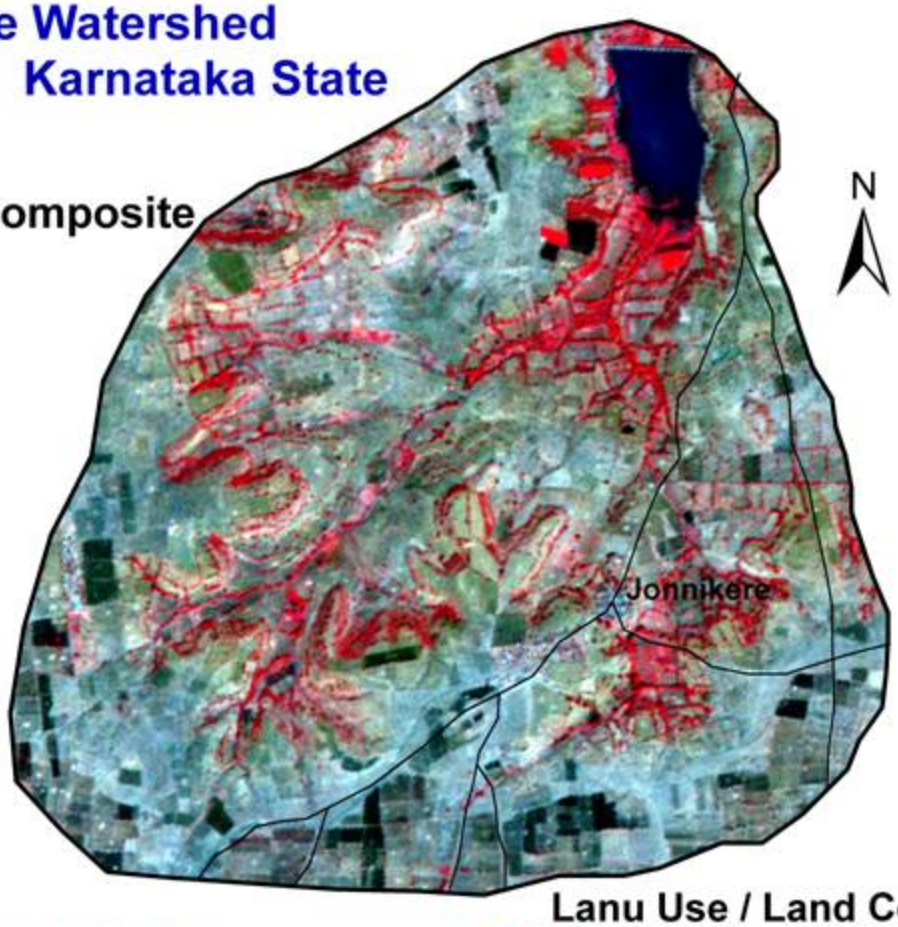
Jonnikere Watershed
Bidar District Karnataka State

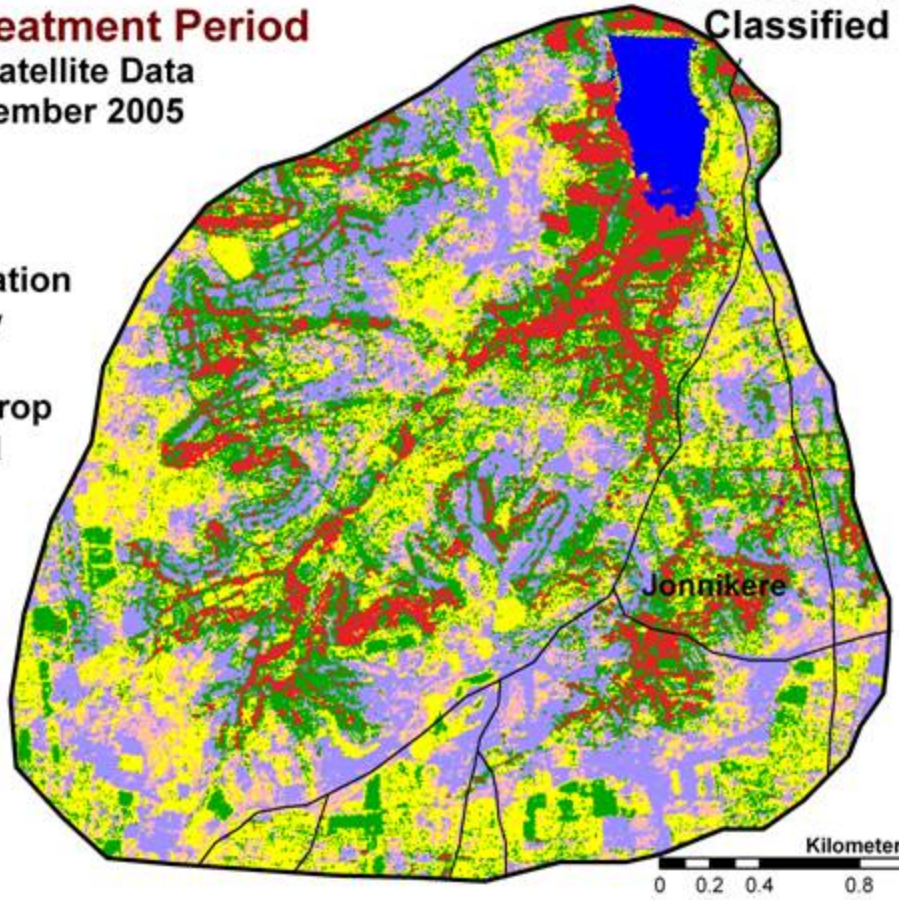
False Colour Composite



Lanu Use / Land Cover Classified Image

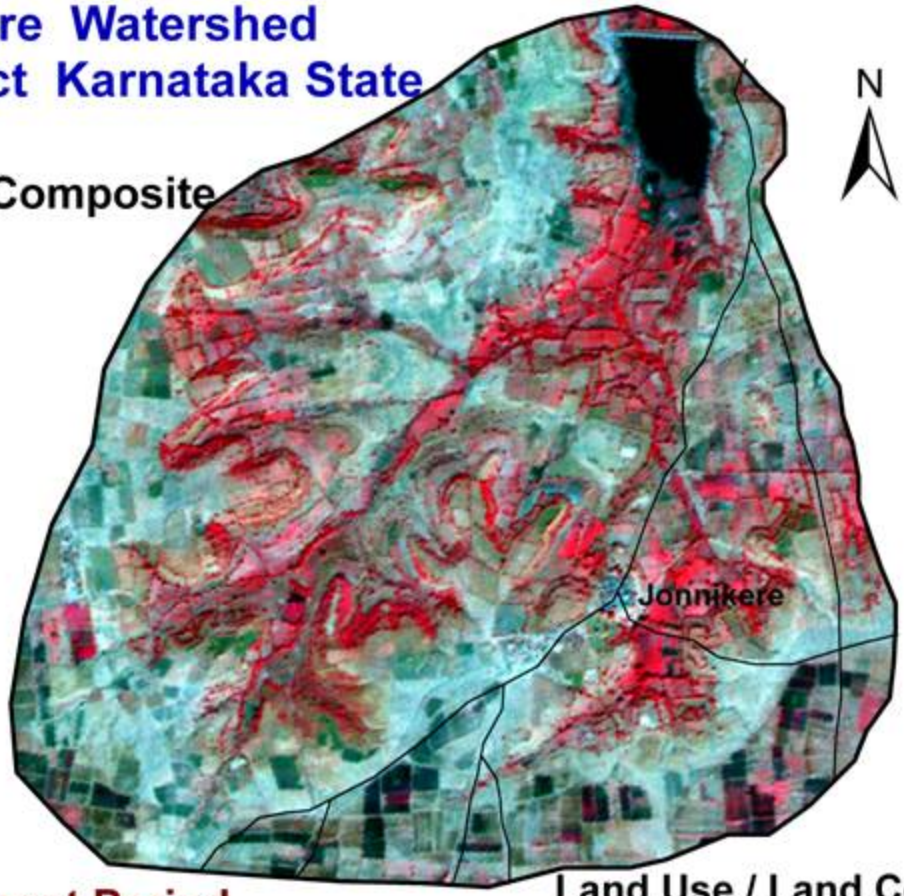
Pre - Treatment Period

IRS Satellite Data
December 2005



Jonnikere Watershed
Bidar District Karnataka State

False Colour Composite



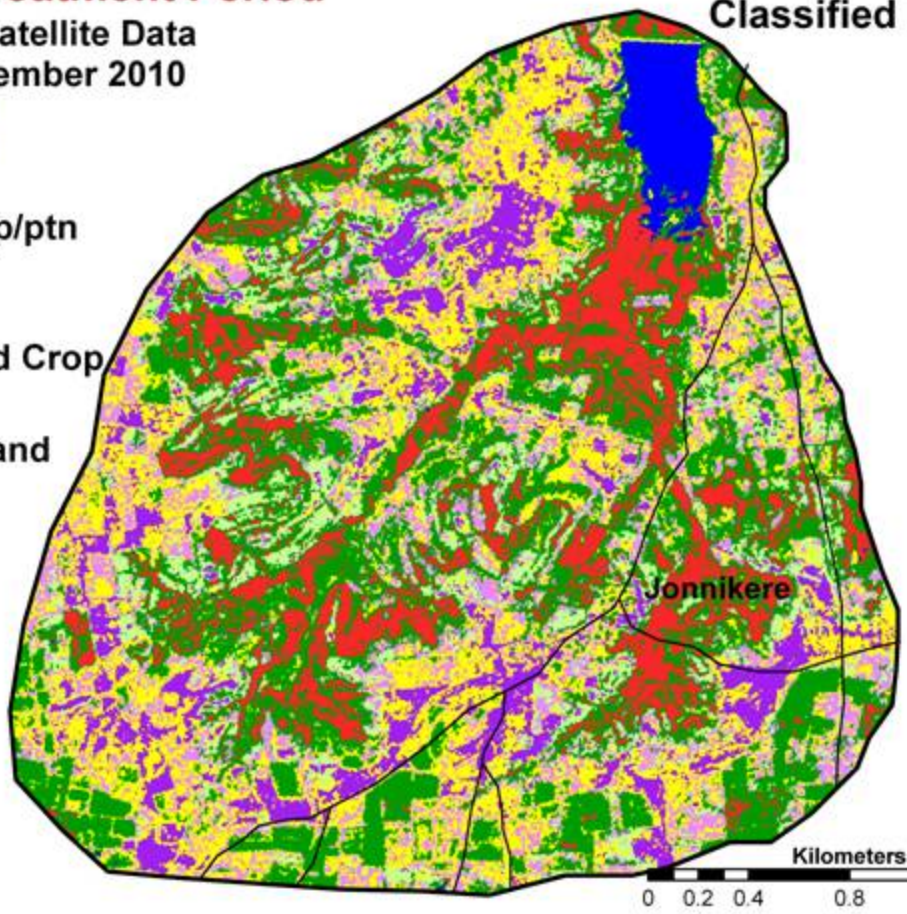
Post - Treatment Period

IRS Satellite Data
December 2010

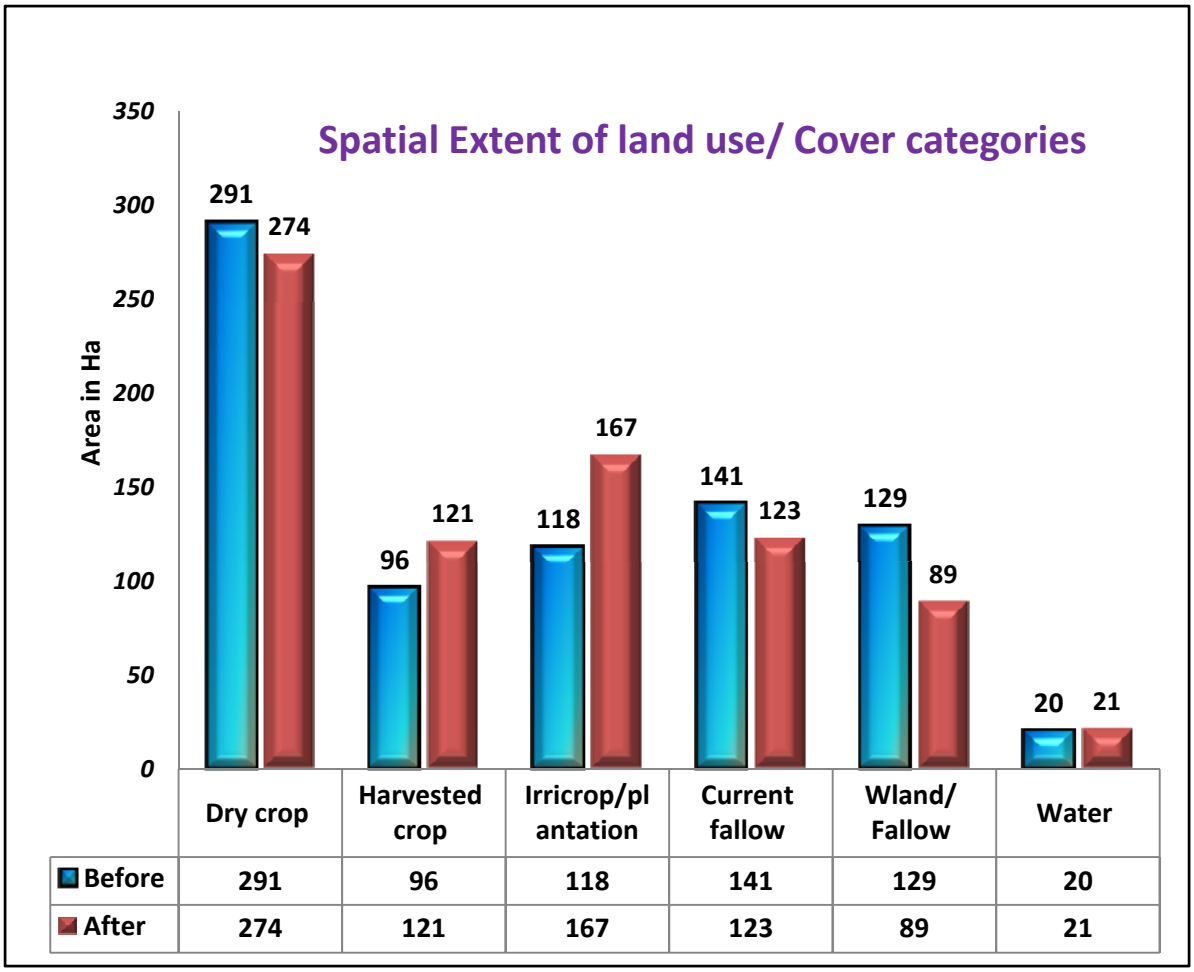
Land Use / Land Cover Classified Image

Legend

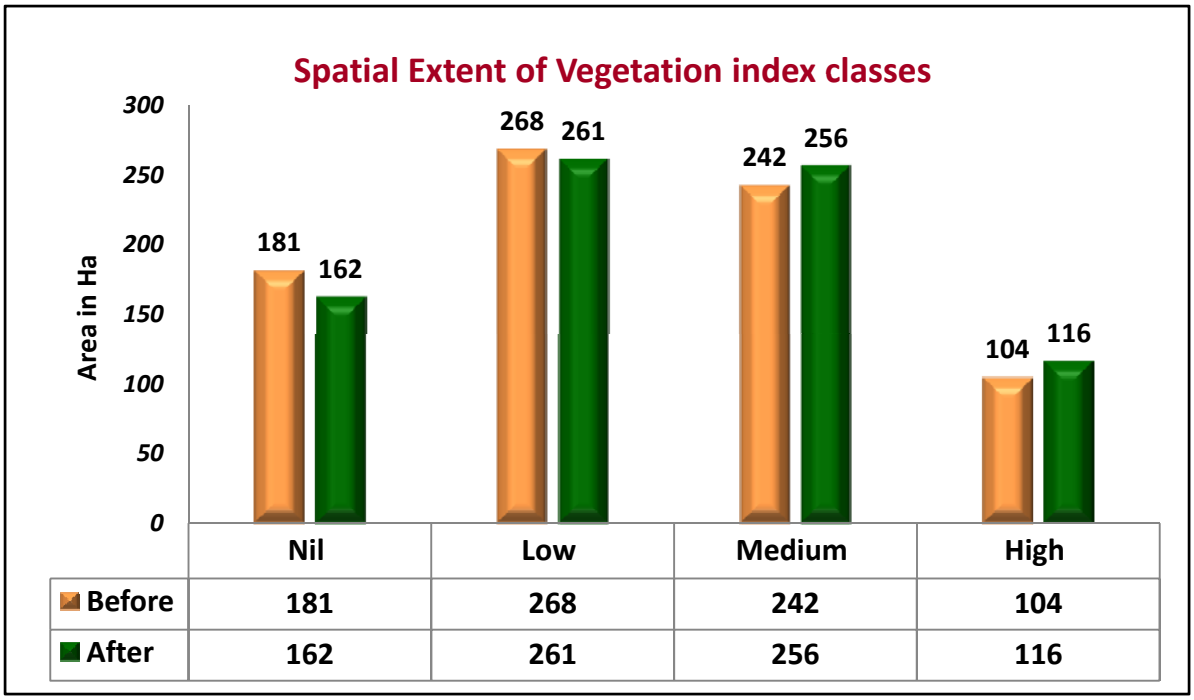
- water
- irri.crop/ptn
- crop
- fallow
- Dryland Crop
- agh
- wasteland



Jonnikere Watershed, Aurad, Bidar District



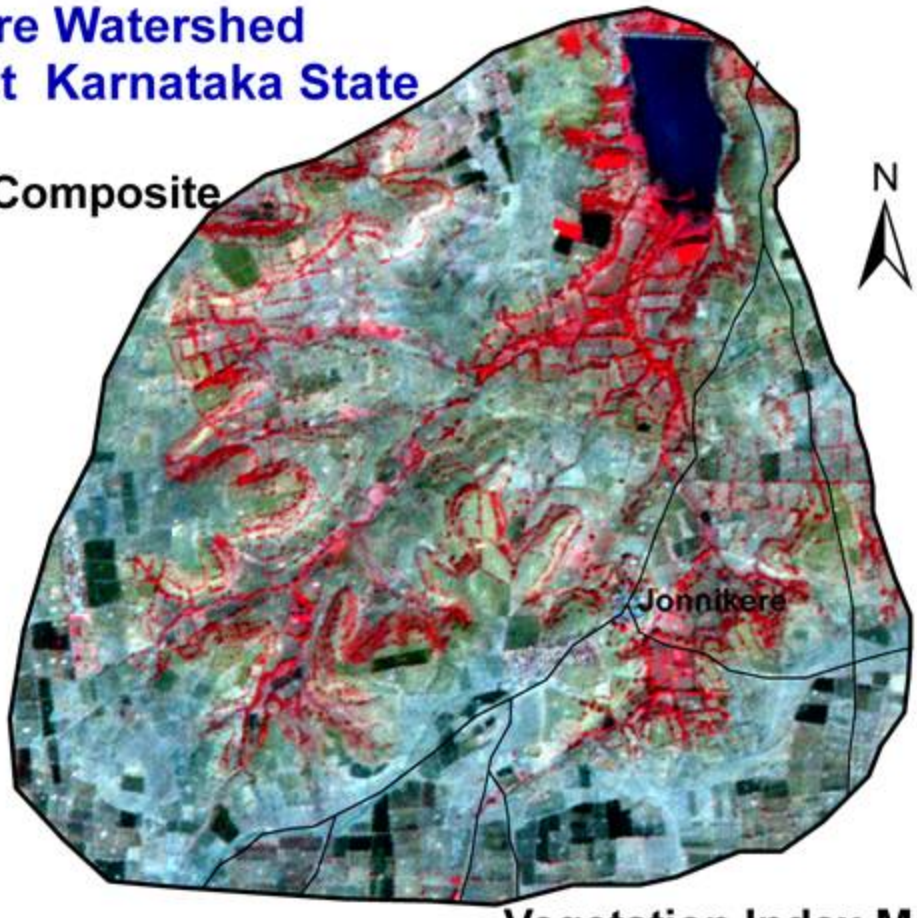
	Dry crop	Harvested crop	Irricrop/plantation	Current fallow	Wland/ Fallow	Water
Before	291	96	118	141	129	20
After	274	121	167	123	89	21



	Nil	Low	Medium	High
Before	181	268	242	104
After	162	261	256	116

Jonnikere Watershed
Bidar District Karnataka State

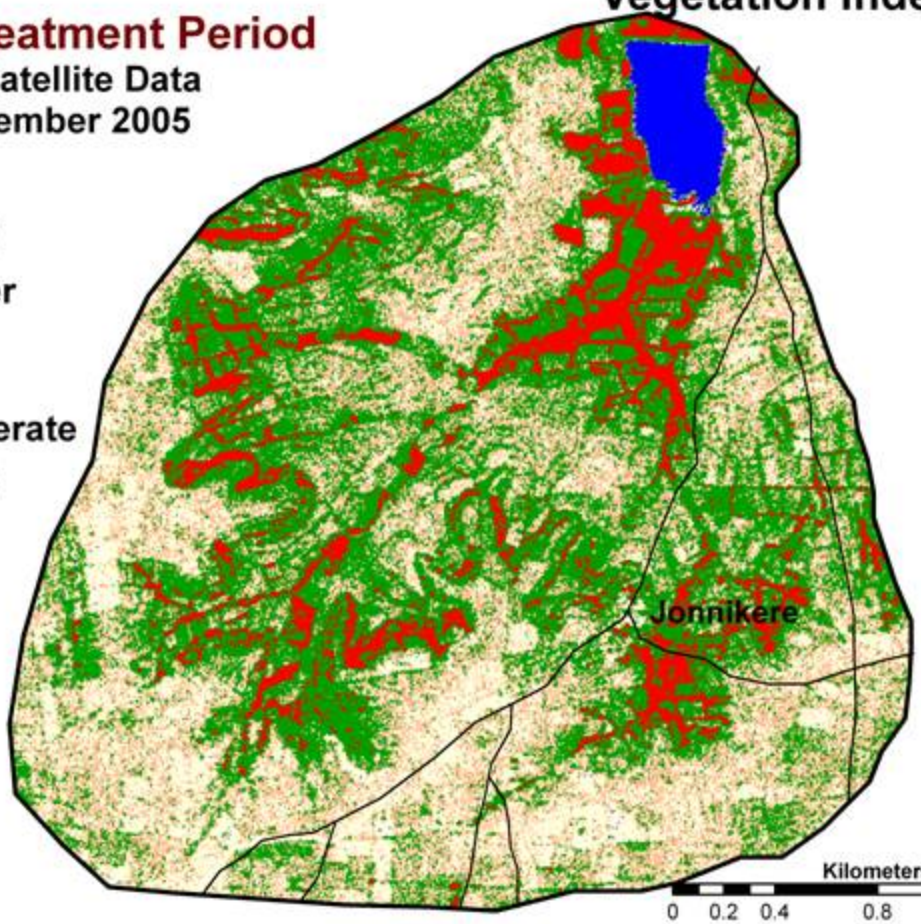
False Colour Composite



Vegetation Index Map

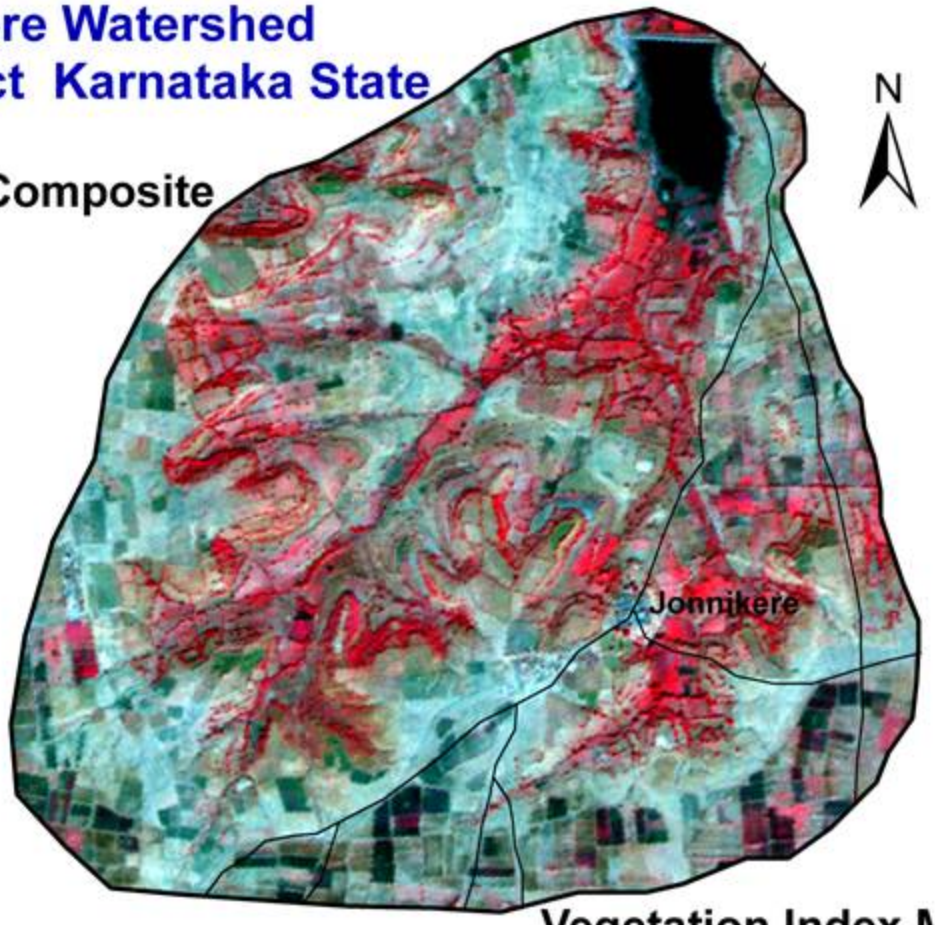
Pre - Treatment Period

IRS Satellite Data
December 2005



Jonnikere Watershed
Bidar District Karnataka State

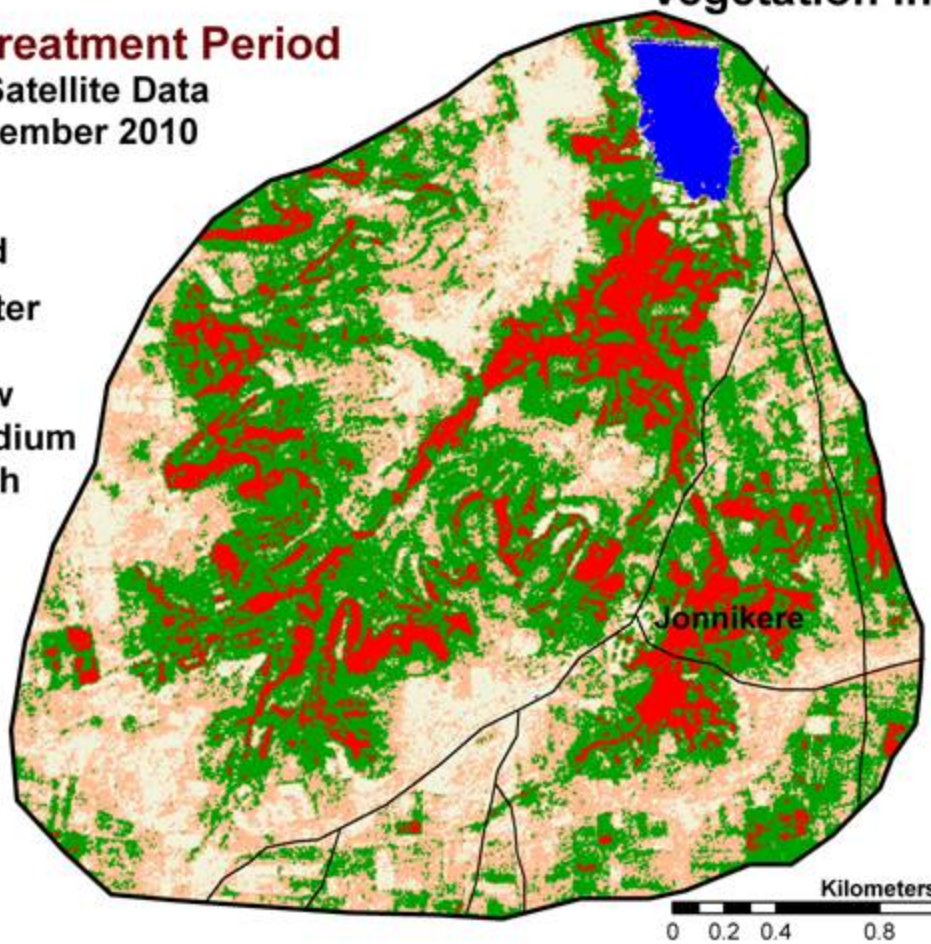
False Colour Composite



Vegetation Index Map

Post - Treatment Period

IRS Satellite Data
December 2010



Field Photographs









SMC, Agriculture & Agro-horticulture Activities

Jonnikere Watershed, Bidar District

Field Photographs






SMC, IGA, Livestock & Village Committees

Jonnikere Watershed, Bidar District