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Impact Assessment of Watershed Development Programme: A Meta Analysis of Chenani Watershed Programme of J&K (India)

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Abstract

The present study was undertaken for estimating the impact of Chenani watershed development programme (WDP) in terms of resource condition and availability, on the project area during 2005-08. A multilateral approach using combination of both the quantitative and qualitative parameters was adopted for overall impact assessment of WDP. Although the economic analysis using benefit cost approach showed positive impact of WDP as the B: C ratio was greater than 1 and net present value was positive at 10 and 15 % discount rates, but the other indicators like change in land use/cover pattern, soil erosion level and carrying capacity of the natural resources showed no significant improvement from the base year (i.e. 1991) and non project area respectively. Similarly, poor people's participation was observed in all activities of WDP, resulting in severely restricting the benefits of this approach. Thus, it was proved from the study that economic viability of WDP cannot ensure its ecological viability.

Keywords: Watershed, carrying capacity, quantitative approach, qualitative approach, discount rate

Watershed development has been conceived as a strategy for conservation and protection of fragile eco-systems worldwide, experiencing soil erosion and moisture stress. The basic objective is to increase production and availability of food, fodder and fuel wood, restore ecological balance, improve economic status of the farmers and rural communities and generate sustainable rural employment. Thus, in watershed development programme (WDP) all aspects are considered, addressed and improved upon for overall development of an area (Shankar, 1999)[1].

Since early 1950's India has invested more than Rs. 170 billions (US $ 4 billions) on WDP's covering more than 45 million ha, and in the recent years the annual expenditure on these programmes have exceeded Rs. 10 billion which reflects the priority and faith of Indian Government on WDP's for improvement of natural resources (Reddy *et al.,* 2007)[2] . Although these WDP's have resulted in increasing cropping intensity, changing cropping patterns, increasing productivity of crops, augmenting underground recharge of water and increasing family incomes and employment opportunities in some areas but these improvements were short lived and WDP's failed to generate sustainability of these improvements. Further more, despite the long history of WDP's, there are no systematic and large scale impact assessment studies on their performance as there is lack of proper indicators and evaluation methods to assess the overall impact of these programmes (Government of India, 2001)[3].

However, the National Wasteland Development Board (NWDB) in collaboration with National Remote Sensing Agency, Hyderabad (NRSA) identified 147 different districts spread over different agro-climatic zones of the country, having more than 17 per cent area under wastelands. Such wastelands possess great potential of mitigating the biomass requirement of the people living in these areas, if put to optimal and judicious use. The Udhampur district of J&K was one of such district and therefore a WDP for Chenani watershed (Udhampur district) was formulated by Forest Department, Government of Jammu and Kashmir during the year 1990 and was started as a centrally sponsored scheme with the help of NWDB, in 1992. The Chenani WDP was executed in 3300 ha, with financial implication of Rs. 22.95 millions from the year 1992 to 1997. The WDP was claimed to be quite successful by the project implementing agency, as it has helped in improving the condition and availability of natural resources considerably in the study area (Forest Department, 1997)[4] .

The present study was undertaken for assessing the impact of this particular WDP in terms of resource conditions and availability. As some other WDP's are ongoing in Udhampur district, therefore lessons learnt from previous (WDP) experiences could be very helpful in making future WDP's more effective, efficient, economical and sustainable. The present study with following specific objectives was undertaken during the year 2005-08 with following specific objectives:

1. To evaluate the economic impact of watershed development programme in the study area.
2. To develop indicators for estimation of overall impact of WDP on resource condition and availability in the study area.

Data and Methodology

In the present study multilateral approach using both quantitative and qualitative parameters were used for estimating the impact of WDP on the project area. In quantitative analysis of WDP, land use pattern and benefit cost analysis were undertaken whereas for qualitative analysis of WDP indicators like carrying capacity of the natural resources, soil erosion level, people's participation in WDP were used

for overall impact assessment of WDP in the present study. The 'with and without' approach was used to estimate the change/difference in terms of these indicators, so as to compare the extent of difference WDP has made in the area regarding resources condition and availability in Project Area (PA) where WDP was implemented as compared to area where no WDP was implemented i.e. Non Project Areas (NPA).

In the beginning, information about the study area was collected from the offices of Revenue Department, Forest Department, District Statistical Department, Department of Water Resources, Department of Animal Husbandry and Directorate of Soil Conservation, Government of Jammu and Kashmir. The secondary data includes information regarding area, number of villages, land use pattern, land holdings, number of households, human and animal population, availability of fuel wood, fodder and other by products of natural resources in the study area (PA and NPA separately), pasture development and wastelands in the area. Information regarding WDP's activities undertaken like details of plantations, formation of enclosures, fencing erected, grasses and legumes sown, soil and water conservation methods adopted, assets created and costs incurred on these activities were also collected from forest department. Primary data was collected by using conventional method i.e. personal questionnaire method, where information was collected from 300 households i.e. 150 from PA and NPA respectively, regarding their participation in project activities and benefits derived due to WDP. Information regarding economic variables like education level, employment pattern, income level, production and consumption patterns of fuelwood, fodder and foodgrains were also collected from respondents. Along with these conventional data, advanced data using the satellite images of 1:50,000 scale of the study area for the year 1991 (before implementation of WDP) and year 2001 (after the implementation of WDP) were procured from National Remote Sensing Agency (NRSA) Hyderabad. Geographical Information System (GIS) was used for extracting information from images like land use/cover pattern, types and conditions of natural resources, categorization of land resources on the basis of their condition and level of soil erosion were also estimated. These images were also used for verification of the data, which was collected from various other sources.

Analytical tools used

In the initial stages of analysis, simple averages, frequencies and percentages were used and in the advanced stages of analysis benefit-cost technique was used with benefit cost ratio (B:C ratio), net present value (NPV) so as to work out economic viability of WDP. In the present study only tangible benefits due to WDP were taken into consideration as non tangible benefits like amount of ground water recharge, air purified etc. were beyond the scope of the study. The cost incurred and benefits derived from the WDP were aggregated and net benefits were discounted at 10, 15, 20 per cent rate. The NPV analysis was done using following formula:

$$PV = B_0\text{-}C_0 + \frac{B_1 - C_1}{(1+v)} + \frac{B_2 - C_2}{(1+v)^2} - - - \frac{B_n - C_n}{(1+v)^m}$$

Where

PV = Present value of net benefits occurring from the project for 10 years

B = Indicates benefits

C = Indicates costs

n = The projects life in years

v = The rate of time preference or discount rate

Land Use Pattern:

In the land use pattern, the land resources were categorised into forest lands agricultural lands, scrublands and drainage areas. Each category was further subdivided into various groups i.e. :-

Forest lands – These lands were categorised on the basis of Crown Density (CD) of trees into Dense forests (with CD>40 per cent), Moderate forests (CD between 10 to 40 per cent) and open/degraded forests (CD<10 per cent)

Agricultural lands- These lands were categorised into cultivable and uncultivable lands.

Scrub lands- Areas under wasteland, pasture lands, open lands etc. come under scrub lands. It was categorised into three sub classes on the basis of Green Biomass Density (GBD) i.e. dense scrub (with GBD>40 per cent), thin scrub (with GBD between 10 to 40 per cent) and degraded scrub (GBD<10 per cent)

Carrying Capacity:

An environment's carrying capacity is its maximum persistently supportable load (Catton 1986) [5]. In simple words carrying capacity is the maximum population of a given species that can be supported indefinitely in a defined habitat without permanently impairing the productivity of that habitat. Carrying Capacity estimation was done in terms of fuelwood, fodder and foodgrains, in two phases. In the first phase production level of various categories of forest land , agricultural lands and scrub lands were estimated by using sampling techniques. Sample plots measuring 20 mtrs x 20 mtrs were laid on different categories of forest and scrub lands so as to estimate the annual production/productivity of fuelwood and fodder from these land resources. Similarly, the amount of foodgrains produced from the agricultural lands was estimated by multiplying the productivity of crops (evaluated from sample households) with the cropping pattern in the study area. In the second step number of persons/animals/households that can be supported with the production capacity were estimated by dividing the total production capacity with per household per year requirement in case of fuelwood, per cow head per year requirement for fodder and per person per year requirement in case of foodgrains.

Level of Soil Erosion:

In the present study extent and magnitude of soil erosion was estimated according to

the methodology adopted by the Directorate of Soil Conservation, Govt of J&K, based on parameters like:- a) Loss of top soil, b) Slope of the area, c) Gully Erosion, d) Land slides and landslips, e) Stream bank Erosion, f) Land use etc. On these parameters soil erosion was measured in terms of six erosion intensity classes (E.I), from E.I class I to E.I – VI indicating intensity of erosion problem in ascending order

People's Participation Level in WDP's

People's participation in WDP's is a crucial factor for their success and sustainability (Singh 1991 [6] ; Sreedevi. *et al.*, 2006 [7] ; German *et al.*, 2006 [8]). As WDP's are people targeted and therefore people should be sensitised, empowered and involved in the programme activities for making them effective, efficient and sustainable. Therefore, in the present study people's participation in the WDP activities were estimated on the basis of information collected from respondents in the project area. The people's participation level was estimated by using following formula:

$$PPL = \sum_{i=1}^{N} \frac{Ei}{Pi} x100$$

Where

PPL = People's Participation level

$\sum$ = Summation of N respondents

1 = One is i^{th} respondent

Ei = Extent of people participation

Pi = Potential of people's participation

People's participation in various WDP activities was estimated for different stages right from planning stage to implementation stage and subsequently during maintenance stage. Participation in all forms was recorded i.e. labour, cash and time etc, during the WDP. Each stage was further categorized in to different sub stages on the basis of activities performed under them (As per records of the implementing agency). The participation in the respective stages were evaluated by averaging the total number of persons, who have participated with number of sub stages in the respective stages. Overall participation (in per cent) was evaluated by considering participation at each stage of WDP by the respective section of society.

Results and Discussion

The results and discussion is discussed under five sections given below:

Change in Land Use Pattern due to WDP

The land use/land cover pattern in the study area as analyzed from satellite images (Fig. 1) showed significant change in current year (2001) than the base year (1991). This 'before and after' approach showed decrease in total forest area by 135 ha i.e., 4.3 per cent from the base year especially dense and moderate forests by 65 ha and

133 ha respectively. Whereas, area under degraded forests increased by 63 ha from the base year indicating conversion of area under dense and moderate forests into degraded forests. The significant increase in area under degraded forests from the base year highlights limited or no impact of WDP on land use pattern.

Table 1 - Change in Land Use/ Land Cover in the Project Area

Particulars	1991	2001	Change
1) Forest Area	3155	3020	-135 (4.3)
a) Dense forests	1027	962	-65 (6.3)
b) Moderate/open forests	1412	1279	-133 (9.4)
c) Degraded forests	716	779	63 (8.8)
2) Agricultural Area	2658	2824	166 (6.2)
a) Cultivated area	2189	2454	265 (12.1)
b) Uncultivated area	69	370	- 99 (21.1)
3) Scrub Area	2460	2508	- 48 (2.0)
a) Dense scrub	1385	1223	- 162 (11.7)
b) Moderate scrub	948	853	- 95 (10.0)
c) Thin scrub	357	432	75 (21.0)
4) Drainage System	489	390	- 99 (20.2)
5)Residential/commercial areas / other areas	136	155	19 (13.9)
G. Total (1+2+3+4+5)	8898	8898	-

Source: Satellite Images NRSA ; Figures in parentheses () show percentage change from the base year.

Economic Analysis of WDP

On the basis of the official records the different works/activities performed during WDP by implementing agency can be broadly classified into five components on the basis of nature of work performed :

1. Afforestation in forest areas
2. Horticultural plantations
3. Soil and moisture conservation measures
4. Pasture land development
5. Promoting fuel saving devices

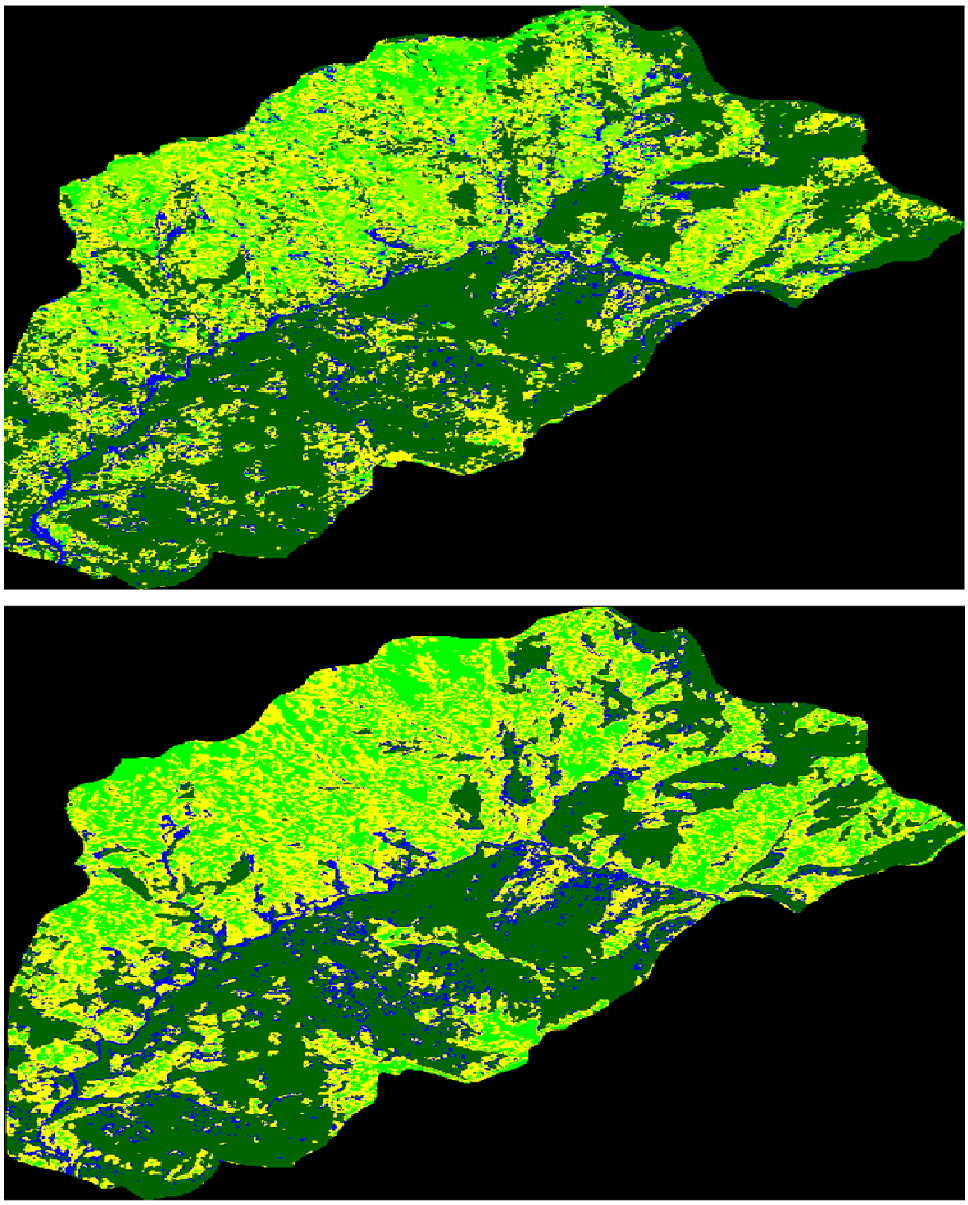

Fig: 1 - Satellite Image of Chenani Watershed Year 1991 and 2001

The economic viability using benefit cost analysis was estimated for all components of WDP separately. As benefits/returns from certain components of WDP like trees planted, mechanical structures etc, start coming after a time gap and continue for number of years, therefore B - C analysis was done for a period of ten years i.e. from 1992 to 2002 using discount rates of 10, 15 and 20 per cent for each component of WDP and given in table 2 below.

TABLE 2 - Benefits Cost Analysis of Components of WDP at Different Discount Rates

S. No.	Particulars	Benefits	Cost	NPV	B/C
1)	Afforestation				
	a) 10 %	349.13	199.26	149.96	1.75
	b) 15%	390.63	284.78	105.84	1.37
	c) 20%	436.27	402.18	34.09	1.09
2)	Horticultural plantations				
	a) 10%	10.43	28.12	17.69	0.37
	b) 15%	12.57	40.62	28.05	0.31
	c) 20%	15.13	57.97	42.83	0.26
3)	Soil & moisture conservation				
	a) 10%	18.51	35.40	16.89	0.52
	b) 15%	23.32	51.86	28.54	0.45
	c) 20%	29.38	74.93	45.55	0.39
4)	Pasture land development				
	a) 10%	56.33	113.13	56.79	0.50
	b) 15%	72.79	162.30	89.50	0.45
	c) 20%	93.92	230.11	136.19	0.41
5)	Fuel saving devices				
	a) 10%	92.45	4.32	88.13	21.4
	b) 15%	119.65	6.28	113.38	19.05
	c) 20%	154.97	9.01	145.96	17.20
	Overall				
	a) 10%	526.85	380.23	146.62	1.39
	b) 15%	618.96	545.84	73.12	1.13
	c) 20%	729.67	774.2	-44.53	0.94

The overall B: C ratio for WDP was estimated greater than 1 with significant NPV at 10 and 15 per cent discount rates which signifies economic viability of the WDP as any project with B:C ratio greater than one is considered to be economically viable (Linsley and Franzini, 1979 [9]; Tung, 1992 [10] ; Tiwari and Goyal, 1998 [11]). But at 20 per cent discount rate NPV was negative and B: C ratio less than 1, signifies non viability of WDP at this discount rate. Only two components i.e. afforestation and fuel saving devices were economically viable with B: C ratio greater than 1 and positive NPV at all the discount rates. Whereas, the other three components i.e. horticultural plantations, soil and moisture conservation measures and pasture land development were economically non viable. The promotion of fuel saving devices component was the only component having highest benefit cost ratio of 21.4, 19.05 and 17.2 at 10, 15 and 20 per cent discount rate respectively and significantly high NPV. It could be interpreted that even a small component of WDP like this (with only 1 per cent expenditure of total fund) could provide more benefits than other large components (which used up major portion of total funds) which failed to generate sufficient

economic viability. The IRR which signifies discount rate at which benefits and costs are equal and if subtracted becomes zero, was not estimated as already three components of WDP were having NPV less than zero even at 10 per cent discount rate (Table 2)..

Moreover, the authenticity of official records of implementing agency was doubtful, as they were not in accordance with the situation on ground. According to official records of forest department, J&K government, On critically analyzing the official records of the project implementing agency for details regarding activities undertaken during WDP, serious discrepancies were observed in the records briefly discussed below:-

1. The comparison of physical and financial targets and their subsequent achievements were made (Table 3) and it was established that except one component of WDP (horticultural plantations) rest all components fell short of the approved targets. The afforestation in forest area fell short by 160 ha and pasture land development by 32 ha. Moreover, as against the sanctioned amount of Rs. 22.95 millions for WDP, a sum of Rs. 20.63 millions could be procured by the implementing agency from the state government, which reflects inefficiency on their part. This has resulted in non fulfilment of many approved targets of the WDP by implementing agency.
2. The number of trees (i.e. 12, 42, 188) claimed to be planted under aforestation by the implementing agencies during the project, would have required nearly 1100 ha of area at 3m x 3m spacing (and not 1840 ha of area as shown in records) resulting in significant change in land use pattern of the area. But in reality no such drastic change were observed in the land use pattern of the forest area as analysed from satellite images procured from NRSA, Hyderabad. Moreover conversion of dense and moderate forests into degraded forests areas was observed in this study.
3. Furthermore as against target of 3000 m^3 area for treatment under soil and moisture conservation, 16,521 m^3 areas was treated at much lower cost (i.e. Rs. 1.57 millions) than approved target of Rs 1.95 millions. Therefore, significantly more area (i.e. 13,521 m^3) was treated at low cost which is quite surprising.
4. Some of the major objectives like to encourage scientific agriculture, horticulture, pesiculture etc. for bringing area under intensive productivity campaign, were completely ignored as none of the works carried out during the project were aimed for fulfilment of these objective.
5. The overhead expenses incurred were Rs 2.91 millions i.e. 14.1 per cent of the total sanctioned amount which is quite significant. It includes expenses incurred on purchase of vehicles (one jeep and two pickup vans), construction of residential quarters for forest officials, construction of stores, purchase of implements etc. (Table 3).

TABLE 3- Comparison of Physical and Financial (in Rs. million) Approved and Achieved Targets of WDP

	Components of work	Approved Targets of WDP		Achievements of WDP		Difference	
		Phy.	Fin.	Phy.	Fin.	Phy.	Fin.
1)	Afforestation in forest area	2000 ha	10.20	1840 ha	9.35	160ha	0.85
2)	Horticultural plantations.	200	1.45	200 ha	1.29	0	0.16
3)	Pasture land development	1100	5.70	1068 ha	5.29	32 ha	0.41
4)	Soil and moisture conservation	3000 m^3	1.95	16521m^3	1.58	13521m^3	0.37
5)	Promoting fuel saving devices	1000	0.25	800	0.20	200 unit	0.05
6)	Overhead expenses	0	3.40	-	2.91	-	0.49
	G. Total	3300 ha + 3000 m^3 + 1000	22.95	3108 ha+ 16521 + 800 units	20.63	192ha+ 13521+ 200units	2.32

However, in order to assess the impact of WDP various qualitative parameters were also estimated like carrying capacity of resources, soil erosion level, people's participation level in WDP.

Carrying Capacity

In the present study carrying capacity of the study area (PA & NPA) was used as an indicator for estimating resource availability and quality. The overall comparison of carrying capacities in terms of fuelwood, fodder and foodgrains between PA and NPA, revealed overall better situation in terms of availability of resources (fuelwood, fodder and foodgrains) in the NPA than PA. Table 4 shows the difference in production capacities, carrying capacities and burden on carrying capacities of PA and NPA respectively. In case of fuelwood the production capacity of PA was 279.7 M t/yr, less than NPA's production capacity. The carrying capacity of PA in terms of fuelwood was less than NPA by 554 families per year and the burden on natural resources for fuelwood was exerted by 639 more families in PA than NPA every year.

In case of fodder the production capacity of PA fell short by 1780.1 M t/yr from that of NPA thereby resulting into low carrying capacity of 446 cowheads per year in PA than NPA respectively. Human carrying capacity (HCC) in terms of energy was computed on the basis of areas under cereals and pulses, yield per hectare and population during that period. Total production of cereals and pulses were converted into their calorific values (in K cal/M t) by multiplying the total production of cereals and pulses with their respective calorie contents. Then per capita availability of calories were estimated by using the formula :-

$$\text{Human Carrying Capacity} = \frac{\text{Total production in calorie}}{\text{Per capita calorie requirement (in Kcal/yr)}}$$

From the consumption pattern of the foodgrains in the study area it was clearly established that nearly 75 per cent of the total energy requirements of the people were fulfilled from cereals and pulses. The recommended value of calories was 6.57×10^5 K cal/per person/year which was obtained by multiplying per person per day energy requirement with number of days in an year as 2400 x 365 x 0.75, where 2400 Kcal is recommended energy requirement for a person per day (Desai and Subramanian, 1996)[12]. The total energy produced (in K cal/yr) was estimated to be 122907.76×10^5 K cal per year in PA and $1,23,203.28 \times 10^5$ K cal per year for NPA. The human carrying capacity (persons/yr) was estimated to be 18,707 persons per year in PA and 18,752 persons per year in NPA, which is quite less than total population of 29,870 and 24,361 persons in the respective areas. The carrying capacity in terms of calories falls short by 11,163 persons in PA and 5609 in NPA every year. Therefore it was clearly established that even in terms of TFP, the area falls short of the requirement of foodgrains both quantitatively as well as qualitatively. One of the reason for this situation was low productivity of agricultural lands in the area due to poor resource condition (quality) and lack of irrigation facilities which leads to foodgrains deficit in the area.

TABLE 4 - Comparison of Production and Carrying Capacities of PA and NPA

PARTICULARS	PA	NPA	Difference
A) Fuelwood			
1) Production capacity (M t/yr)	6198.55	6478.25	-279.7
2) Carrying capacity (households/yr)	1878	1963	-85
3) Total no. of households	3798	3244	554
4) Burden (families/yr)	1920	1281	639
B) Fodder			
1) Production capacity (M t/yr)	33279.65	35059.75	-1780.1
2) Carrying capacity (cowheads/yr)	8319	8765	-446
3) Total cowheads	16396	16529	-133
4) Burden (cowheads/yr)	8077	7764	313
C) Foodgrains			
1) Production capacity (M t/yr)	3752.3	3782.1	-29.8
2) Carrying capacity quantitatively (households/yr)	25701	25905	-204
3) Total no. of persons (excluding minors)	29870	24361	5509
4) Burden (persons/yr)	4169	1544	2625
1a) Production capacity ($Kcal x 10^5$/yr)	122907.76	123203.28	-295.52
1b) Carrying capacity qualitatively (person/yr)	18707	18752	-45
1c) Burden	11163	5609	5554

Soil Erosion

The various measures undertaken during WDP were aimed at reducing erosion level in the PA. As soil erosion was widely prevalent due to steep slope of the area, faulty methods of cultivation (agricultural lands), deforestation, overgrazing on scrub lands and poor vegetative cover etc. Therefore the extent and magnitude of soil erosion in the PA and NPA were estimated so as to compare the improvement in the PA (if any) due to WDP. The land under E.I class VI was considered to be beyond conservation and regeneration, whereas soils under III, IV, V required immediate attention for redemption of soil, so that it could be saved from future deterioration and ultimate loss. The soil under E.I classes I and II were having erosion at minimum levels. Nearly 3.8 per cent of the total area in PA and 2.5 per cent in NPA were under E.I category VI. The maximum area in both PA as well as NPA were under E.I category III, IV and V, with 36.2, 25.3 and 14 per cent area in PA and 39, 28.2 and 11.4 per cent in NPA respectively (Table 5). From comparison of areas of PA and NPA facing various levels of soil erosion problem small difference was observed within the same E.I level of the respective areas. This signifies limited or no significant improvement in soil erosion status of PA due to WDP, as due to high level of siltation in river tawi (because of soil erosion), the Chenani hydel project still faces many problems resulting in reduction in its production capacity. Moreover regular landslides and landslips were reported during monsoon seasons especially in Samroli area of PA, resulting in closure of NH-1A, which highlights the ineffectiveness of measures undertaken during WDP for controlling erosion problem in the area.

TABLE 5 - Soil Erosion Level

E.I class	PA	NPA
I	658 (7.4)	761 (9.3)*
II	975 (11)	630 (7.7)
III	3222 (36.2)	3192 (39)
IV	2252 (25.3)	2309 (28.2)
V	1246 (14)	933 (11.4)
VI	338 (3.8)	204 (2.5)
Nallahs	207 (2.3)	158 (1.9)
Total	8898 (100)	8187 (100)

***** *figures in parentheses ( ) represents in per cent*

People's Participation Level in WDP

The overall people's participation during all stages of WDP i.e. right from planning stage to implementation stage and thereafter maintenance stage, was analysed. The overall people's participation in the planning stage was maximum from local leaders i.e. 16 per cent, followed by farmers i.e. 9.6 per cent, whereas the women's participation was only 2.8 per cent i.e. quite minimal. In the implementation stage maximum participation was from labourers i.e. 14 per cent, as they were engaged for WDP activities like construction of structures, plantations, grass cultivation and entry

point activities etc. Local leaders and farmers followed by landless labourers with 11.5 per cent and 9 per cent participation respectively during implementation stage. In the maintenance stage maximum participation was from local leaders i.e. 7 per cent, and it was 6 per cent from farmers and 4 per cent from non farmers, 3 per cent from landless labourers and only 2 per cent from women's of the area.

The overall low people's participation in WDP activities especially during maintenance stage was mainly responsible for poor condition of assets created i.e. closures, soil and moisture conservation structures etc. as observed during field visits in the area. Moreover most of the closures were used for grazing cattle's and collecting fuelwood, and mechanical structures need immediate repairs. The overall extent of people's participation in per cent was analysed for different sections of the society in the PA, the local leaders participation level was highest i.e. 11.5 per cent followed by farmers with 8.2 per cent, landless labourer with 7 per cent, non-forming communities with 4.2 per cent and women with only 2.3 per cent participation The overall participation of women's were found to be minimum i.e. only 2 per cent in all the stages of WDP. The overall mean people's participation was estimated to be 6.6 per cent which is quite low (Table 6).

TABLE 6 - People's Participation in WDP (in per cent)

Stages of Participation		Land Less Labourer	Farmers	Non-Farming Community	Women	Local Leaders
A.	Planning stage					
	1. Mapping of the area	00	00	00	00	10
	2. Need assessment	12	08	08	02	20
	3. Group discussion	08	13	07	04	17
	4. Meetings	00	12	07	05	15
	5. Training/lectures	00	15	03	05	18
	Total	4.0	9.6	5.0	2.8	16
B.	Implementation stage					
	1. Construction of structures	23	09	07	02	13
	2. Closure formation	16	00	00	00	00
	3. Plantation of trees	20	00	00	00	00
	4. Patches grown	18	00	00	00	00
	5. Entry point activities	13	15	08	00	23
	6. Sharamdan (volunteer service)	04	12	00	00	20
	7. Kulhad bandi (ban on tree felling)	08	16	08	06	19
	8. Charai bandi (ban on grazing)	10	20	05	08	17
	Total	14	09	3.5	2.0	11.5

C.	Maintenance stage					
	1. Cleaning and maintenance of assets	00	00	00	00	00
	2. Correcting minor problems	00	00	00	00	00
	3. Ensuring ban on tree felling and grazing in forest area	09	18	12	06	21
	Total	03	06	04	2.0	7.0
D.	Overall Participation in WDP	7.0	8.2	4.2	2.3	11.5
E.	Mean People's Participation in WDP	6.6				

Mean Participation < 33 per cent → Low people's participation
Mean Participation between 33-66 per cent → Medium people's participation Mean Participation > 66 per cent → High people's participation

Conclusions and Policy Implications

The following conclusions could safely be drawn from the study:

1. The WDP implemented in Chenani area of Udhampur district, had limited/no significant impact on natural resource condition and their availability in view of the exorbitant cost of Rs. 20.63 millions incurred.
2. No comparative improvement in production capacity and subsequently the carrying capacity of resources was observed (in terms of fuelwood, fodder and food grains) in PA than NPA. In fact the production capacities of resources was better in NPA than PA and hence the overall burden on carrying capacity was found to be more severe in PA than NPA which highlights limited or no impact of WDP on resource availability.
3. The soil erosion problem was quite serious in the PA as significant PA still comes under danger zone i.e. E.I. IV to VI (i.e. nearly 42 %). Moreover, problems such as regular closure of NH-IA due to landslides after rainfalls specially in Samroli area and siltation problems in Chenani hydel power station clearly highlights the ineffectiveness of WDP activities in controlling soil erosion of PA.
4. The major reason for limited impact of WDP was poor implementation of the project in the area by the implementing agency were:
    a. The project with multidisplinary objectives (like improving the production and productivity of agricultural lands, controlling soil erosion, improving water situation through conservation etc.) was implemented by a single department i.e. Forest Department. The non-involvement of other concerned departments, like Agriculture, Animal Husbandry, Soil Conservation, Water Resources etc. had clearly

affected the efficiency and ability of WDP to deliver. The project which was and should have been an 'Integrated' WDP thus remained compartmentalized, 'Departmental' WDP thereby severely restricting the benefits of this approach.

b. The project implementing agency could not procure the total sanctioned amount for WDP from state exchequer which clearly highlights the inefficiency on their part. Moreover, the data collected from satellite images (procured for NRSA) and field visits were contrary to the official records of forest department, J&K government, thereby making authenticity of official records of implementing agency doubtful.
c. The study highlighted decrease in area and tree density in forests, conversion of dense forests into degraded forests, increase in agricultural area and aggravated soil erosion problem in the area which means WDP has been ineffective in fulfilling its objective.
d. As typical government department approach of 'working on it own' was followed for project implementation resulting in poor people's participation. Hence, the assets created during the project period were in bad condition due to lack of maintenance.

5. Although the economic analysis showed positive impact of WDP, but still WDP failed to have any impact on natural resource condition and availability, carrying capacity, erosion problem and vegetative cover of PA. Thus, it was proved from the study that economic viability of WDP cannot ensure its ecological viability.

On the basis of above conclusions following policy implications for future WDP's in the hill areas could be given :

1. Launching need based watershed development programmes in ecologically fragile areas facing acute moisture stress and where tribals and other weaker sections of the society live.
2. People's participation should be generated by involving them in WDP activities right from planning to implementation stage and subsequently maintenance stage.
3. As WDP's are multilateral objective programmes hence involvement of all concerned specialized departments should be ensured for effective and efficient implementation of these programmes.
4. Training of WDP implementing officials, right from top to bottom, as officials at higher level should be sensitized to plan according to local area needs and lower officials (who actually implement the project) should be trained for implementing project activities for fulfilling the project objectives.
5. Improving efficiency and accountability of WDP by ensuring timely and sufficient funding, regular monitoring & evaluating different components of WDP.
6. Strict legislative measures for restricting people's greed to save natural

resources from exploitations & subsequent losses.

7. Moreover certain other measures for decreasing level of people's dependence on natural resources should be undertaken like sensitizing people towards importance of natural resources, improving education and awareness level, popularizing alternative sources of energy like gobar–gas plants, solar lights, solar cookers, etc

References:

[1] Vinay Shankar (1999) Some thoughts on watershed management, *Journal of Rural Development.* **18**(3): 359-380.

[2] V.R. Reddy, B. Shiferaw, MCS Bantilan, S.P. Wani and T.K. Sreedevi (2007) Collective action for integrated watershed management in semi arid India : Strategic policy and institutional options, *policy brief no. 11, ICRISAT*, Hyderabad.

[3] Government of India (2001) *Mid term appraisal of Nineth Five Year Plan*, Planning Commission, New Delhi.

[4] Forest Department (1997) *Annual report on integrated wasteland development project Chenani Watershed Udhampur*, Government of Jammu and Kashmir.

[5] W. Catton (1986) Carrying capacity and the limits to freedom, paper prepared for *Social Ecology Session 1, XI World Congress of Sociology*, New Delhi, India.

[6] A.J. Singh, A.S. Joshi, R.P. Singh and Ravi Gupta (1991) An economic appraisal of Kandi watershed and area development in Punjab, *Indian Journal of Agricultural Economics.* **46**(3): 287-293.

[7] T. Sreedevi (2006) Livelihood analysis in Powerguda and Kistapur microwatersheds in southern India, *report presented to ICRISAT*, Hyderabad, Andhra Pradesh.

[8] Laura German, Mansoor Hussein, Gatachew Alemu, Waga Mazengia, Tilahun Amede and Anne Stroud (2006) Participatory Integrated Watershed Management: Evaluation of Concepts and Methods, *working paper 11, African Highlands Initiatives*, Uganda.

[9] R.K. Linsley and J.B. Franzini (1979) *Water Resources Engineering*, McGraw Hills, New York.

[10] Y.K. Tung (1992) Probability distribution for benefit cost ratio and net benefits, *Journal of Water Resources and Planning Management*, **118** (2): 113-150.

[11] G.N. Tiwari and R.K. Goyal (1998) *Green house technology : Fundamentals, designs, modeling and applications*, Narosa Publishing House, New Delhi, pp. 503.

[12] Desai, Anjana P. and Chandra Subramanian (1996) Human carrying capacity in terms of calories and proteins in the backward region of Gujarat, *Journal of Rural Development*, **15(**4): 563-569.