Watershed Development Programmes in India: A Review

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Abstract: Watershed Development Programmes (WDPs), which emphasise land and water management assume significance in the context of pursuing environmentally-sound development strategies. In view of their benefits, WDPs are being implemented in several parts of India. This paper assesses the impact of WDPs on crop yields and income, and on soil and moisture conservation. The paper notes that WDPs have led to an increase in crop yields and income, improved moisture availability, etc. Small farmers too have shared in the gains of growth. The paper concludes that WDPs are beneficial in improving the economic and natural resource base of the disadvantaged regions of India.

Keywords: watershed development programmes, crop yields,Income,soil and moisture conservation

1 Introduction

Watershed development Programmes (WDPs) which emphasise land and water management assume significance in the context of pursuing environmentally-sound development strategies. WDPs seek to make productive and optimum use of fragile and degraded lands, and also promote soil and moisture conservation. They also aim to meet community needs for fuel, food, fodder and small timber. In view of their economic and environmental benefits, WDPs have been accorded importance in the development plans of India.

This paper focuses on WDPs implemented in the drylands of India which house a large number of India's poor and also contribute more than 40 per cent of the country's total foodgrain output.

The specific objectives of the paper are as follows:

(1) To analyse the impact of WDPs on crop yields, and income.

(2) To analyse the impact of WDPs on the relative economics of alternate land-use systems.

(3) To assess the impact of WDPs on soil and water conservation.

Paper presented at the **International Conference on Sustainable Utilisation of Global Soil and Water Resources,** organized by International Soil Conservation Organisation and Ministry of Water Resources, People's Republic of China, and held at Beijing, China from May 26—31, 2002.

The paper draws upon earlier works of the author (Ninan 1992; 1994; 1998; Ninan and Lakshmikanthamma, 1994; 2001) and covers a cross-section of WDPs implemented in India during the eighties and nineties. Descriptive-cum-tabular statistics, averages, ratios, and proportions and project viability measures such as IRR have been used in the analysis.

2 Benefits from WDPs

WDPs seek to improve crop yields and income by popularizing better production and conservation technologies. Crop varieties that are tolerant of droughts and other environmental stresses, better crop and land use practices, use of modern inputs, etc., are envisaged under WDPs. Table 1 sheds light on the impact of WDPs on crop yields and income for a cross section of watersheds in India using a with and without watershed approach. As evident, WDPs have had a positive impact resulting in increased crop yields and income.

Table 1 Impact of Watershed Development Programmes on crop yields and income

Items	Variables			
	With watershed		Without watershed	
	Mittemari	Gonur	Mittemari	Gonur
Crop yields (quintals per ha)				
CROPS				
Finger millet	12.3	—	9.6	—
Groundnut	13.2	—	9.6	—
Sorghum	—	8.5	—	6.0
Groundnut + redgram	—	5.5 + 2.1	—	2.8 + 0.5
Pearl millet + horsegram	—	2.9 + 1.6	—	1.8 + 0.4
Minor millet + horsegram	—	2.6 + 0.8	—	0.2 + 0.2
Finger millet + horsegram	—	5.3 + 1.1	—	2.5 + 0.5
Sunflower + redgram	—	2.5 + 1.0	—	Not grown
Sorghum + redgram	—	3.7 + 3.2	—	Not grown
Maize + redgram	—	6.4 + 1.4	—	Not grown
Net returns (in Rupees per ha of net cropped area) (Achalu micro-watershed)	1986-87 (Bench mark)(Rs/ha)-46		1989-90 (Rs/ha) 2,575	
(Jaladarashi watershed)	With watershed		Without watershed	
CROPS	(Rs/ha)		(Rs/ha)	
Sorghum	1003		642	
Coriander + safflower	1042		902	
Safflower (local)	403		309	

Source: Ninan, 1994; Ninan and Lakshmikanthamma, 1994.

Table 2 which provides information on the returns from crop farming in Mittemari Watershed area reveals that the returns from crop farming are not only higher in the watershed area as compared to the non-watershed area but also these returns continued to be positive, as against negative in the non-watershed area, even after accounting for all costs. Taking all farms together, these returns over all costs were positive and high (Rs.752 per ha) in the watershed, and negative (-Rs.73 per ha) in the non-watershed area. It is significant that small farmers have also shared in the gains of growth following implementation of WDPs.

Table 2 Income from crop farming with and without watershed development in Mittemari, India (1989—1990)

Category of farms (in hectares)	Returns over all paid costs[1] (Rs/ha)		Returns over all costs[2] (Rs/ha)	
	With watershed	Without watershed	With watershed	Without watershed
Total dry (non-irrigated) crops				
<2	56	–21	–608	–665
2— 4	–502	39	–1,094	–305
>4	12	606	–404	263
All	–51	332	–613	–78
Total irrigated crops				
<2	5,501	4,588	2,897	2,467

Continued

Category of farms (in hectares)	Returns over all paid costs[1] (Rs/ha)		Returns over all costs[2] (Rs/ha)	
	With watershed	Without watershed	With watershed	Without watershed
2— 4	5,685	2,958	3,235	1,267
>4	7,412	6,050	5,061	4,490
All	6,396	5,161	3,977	3,500
All crops				
<2	1,010	915	24	–30
2— 4	1,662	703	510	51
>4	3,146	588	1,910	–148
All	1,870	675	752	–73

[1] 'all paid costs' includes all actually paid - for costs plus the imputed value of owned seeds, organic manures and animal labour;

[2] 'all costs' includes all paid costs plus the imputed value of owned inputs including owned land and family labour.

Source: Lakshmikanthamma (1994)

WDPs also endeavour to motivate farmers to shift to crops and land use systems that are more suited to the dry regions such as horticultural crops and forest species, etc., as against growing annual crops. To assess the relative economics of alternative crops and land use systems implemented under WDPs, we may look at Table 3 which presents information on the economics of annual versus horticultural or fuel species. As evident, the benefit-cost ratios or gross returns for horticultural crops and fuel fodder crops are much higher than for annual crops.

Table 3 Benefits from alternate land-use systems after watershed development programmes

Items	Variables			
Economics of annual vs horticultural crops	Annual		Horticultural	
	Sorghum	Groundnut	Mango	Acid lime
	1.2	1.5	6.9	4.9
			Sweet lime	Cashew
			2.9	1.3
Watersheds		Adgaon	Ralegaon Shindi	Makhada
RATIO OF GROSS RETURNS FROM:				
Fruit trees vis-à-vis nnu l crops				
Ber (Ziziphus M urit ni)		2.3	4.9	0.9
M ngo (M ngifer indic)		3.0	2.4	4.3
Mos mbi (Citrus sineesis)		3.1	—	—
Chikoo (T m rindus indic)		2.6	4.3	2.5
FUEL/FODDER CROPS VIS-À-VIS ANNUAL CROPS:				Sadalli
Subabul (Leucaena Leucocephala)		2.3	0.8	0.8
Nilgiri (Euc lyptus)		3.7	5.5	2.3
Neem (Az din cht indic)		1.6	2.0	—
B bul (Ac ci nilotic)		4.0	2.1	—

Source: Refer Table 1.

Investments in soil and water conservation under WDPs are expected to improve moisture availability in watershed areas. An improvement in moisture availability will be reflected in terms of an

increase in cropping intensity, a shift from low to high value crops or from mono to mixed crops, an increase in the irrigated area and water table, etc. Table 4 shows that WDPs have led to an increase in cropping intensity (8 to 53 per cent increase), a shift from low value to high value crops or from mono to mixed cropping, and an increase in the irrigated and well command area.

Table 4 Indicators of improved moisture availability after watershed development programmes

State/watershed	Indicators		
Increase in cropping intensity	Before WDP	After WDP	% Increase
MAHARASHTRA			
Western part	—	—	53
Gunj	105	134	28
Manoli	104	115	11
WEST BENGAL			
Bankura	109	118	8
Shift from low to high value crops/mono to mixed/inter-cropping	Yes/No	Observations	
KARNATAKA			
Mittemari	Yes	Area under groundnut + pigeon-peg increased; area under finger millet declined.	
Hirehalla	Yes	New crops: banana, grapes, rice	
MAHARASHTRA			
Kolhewadi	Yes	Area under cash crops, pulses, oilseed and horticultural crops increased.	
Gunj	Yes	—	
TAMIL NADU			
Anakkati	Yes	New crops raised, namely, cotton, cowpea.	
UTTAR PRADESH			
Jhansi	Yes	Autumn season: shift from cereals, oilseeds to pulses. Winter season: shift from pulses, oilseeds to cereals.	
WEST BENGAL			
Bankura	Yes	Area under horticultural crops increased; that under rice decreased	

Increase in irrigated area/well command area and groundwater-table	Increase in water-table in metres (monthly average for January to June)		Area irrigated out of the wells % (in ha)		
	1985-86 (base year)	1989-90 / 1990-91	Before	After	% Increase
KARNATAKA					
Seethanadi	5.5	33.7	316	371	17
Chandakavathe	—	13.2	31	35	13
Mugalikatte	—	37.8	95	122	28
Hirehalla	2.3	1.3	225	379	68
Mandagod Tallihalla	—	4.9	2	14	600
Humabad	—	—	42	67	60
Asundinala	—	15.6	177	213	20

Source: Refer Table 1.

Soil conservation programmes implemented under WDPs are also found to be beneficial. Table 5 shows that the benefit-cost ratios from contour bunding are high and greater than unity using rigorous tests and sensitivity analysis. Crop yields and income registered a significant increase after soil reclamation or adoption of contour bunding under WDPs.

Table 5 Benefits from soil conservation programmes after watershed development programmes

State/watershed	Variable		
Tamil Nadu	Benefit-cost ratios from SWC		
Avanashi	(assuming lifespan of contour bunding 10 years)		
	----------discounted at 12%----------		
Four scenarios			
a) benefits at current level over 10 years	All high and greater than 1		
b) if at 50% of this			
c) if investment by government alone			
d) if both by government and farmers			
Maharashtra	Reduction in soil and nutrient losses		
Daate	6.7 to 82.8%	and	17.2% to 32.6%
Gunj	Per ha gross returns from soil reclamation		
	Before WDP (1985—1986)		After WDP (1989—1990)
	Rs. 1,778		Rs. 3,344
	Crop yields (in quintals)		
	Without contour cultivation		With contour cultivation
Groundnut + Redgram (ICRISAT study)	15.9		19.9

Source: Refer Table 1.

Ultimately the success of WDPs depends upon how far it is economically viable.

In order to examine this we have assessed the economic viability of a watershed, i.e., Mittermari watershed in Karnataka. Internal Rates of Return (IRR) have been computed and these reveal (see Table 6) that at full expected benefits net of costs excluding or including the opportunity cost of grazing benefits foregone, the IRRs of Mittermari watershed ranged from 19 to 96 per cent. At reduced benefits net of costs excluding or including the grazing benefits foregone these IRRs ranged between 3.8 to 17 per cent. Thus, it is only at reduced benefits net of all costs that the watershed reports low returns.

Table 6 Internal rates of return for mittemari watershed development project, India (Cash Flows at 1989-90 prices and summed up over 25 years)

Items	(a)	(b)
Full benefits, net of costs, excluding the opportunity cost of grazing benefits foregone	96.0	21.5
Full benefits, net of costs, including the opportunity cost of grazing benefits foregone	75.0	19.0
Benefits reduced by 25%, net of costs, excluding the opportunity cost of grazing benefits foregone	17.0	4.5
Benefits reduced by 25%, net of costs, including the opportunity cost of grazing benefits foregone	15.5	3.8

Note: (a) Crop production costs includes all paid-out costs, plus the imputed value of farm-produced inputs and owned animal labour.

(b) Crop production costs includes all paid-out costs as above, plus rental value of owned land, interest on owned fixed capital, and imputed value of family labour.

Source: Ninan and Lakshmikanthamma, 2001.

3 Conclusions

Investment in soil and water conservation and other activities under WDPs in India have proved to be beneficial. These have led to increased crop yields and income, an increase in cropping intensity, better returns from alternate land use systems, improved moisture availability, etc. WDPs thus hold promise of reducing poverty levels and improving the natural resource base of the disadvantaged regions of India.

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