WATERSHED DEVELOPMENT IN KARNATAKA:

A LARGE-SCALE ASSESSMENT OF PROCESSES, SUSTAINABILITY AND IMPACTS

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1. BACKGROUND

From the margins of rural development practice and a limited focus on soil and water conservation, the concept of integrated and participatory watershed development and management has today emerged as the cornerstone of rural development in the dry and semi-arid regions of India. What began as a set of diverse and isolated experiments in Sukhomajri, Ralegaon Siddhi and the Operations Research Project of the Indian Council for Agricultural Research (ICAR) got institutionalised initially in the form of the National Watershed Development Programme for Rainfed Areas (NWDPRA) in 1990. Following the Hanumantha Rao Committee's review in 1994 and the formulation of Common Guidelines, the period 1995-2001 saw the implementation of the first generation projects under these guidelines on a very wide scale. More importantly, it is now acknowledged that integrated watershed development must be the core strategy for stabilising rural livelihoods in dry and semi-arid regions. The country is poised to make a major leap in this direction in the next 20-25 years, with the setting of a target of treating 63 million hectares.

The country has made very significant investments in this approach. By the end of the 8th five-year Plan an area of 4.23 million ha in about 2554 watersheds had been treated and developed at an expenditure of Rs. 968 crores (Anonymous, 2001). In the 9th Plan period, an outlay of Rs. 1020 crores was provided to treat 2.25 million ha. Overall, including funds from bilateral, multi-lateral and private foreign donors as well as national funds, it is estimated that Rs.2400 crores (about 500 million US$) have been spent annually since the mid-1990s on watershed development in the country (Farrington *et al.*, 1999). And the government has set a target of Rs. 76,000 crores for the next 25 years, i.e., Rs. 3,000 crores per year. It issued a revised set of guidelines in the form of the Hariyali Guidelines of 2003, and then set up the Parthasarathy Committee in 2005 to carry out a comprehensive review of the watershed development programmes under the Ministry of Rural Development.

Note that these investment figures pale in comparison with the ongoing and proposed investments in major irrigation projects. But the potential benefits from watershed development can be much higher and more sustainable. Hence, as the country enters this second generation of watershed-based development programmes with such heightened targets and expectations, it is important to ensure that the experiences from the first generation of widely implemented watershed development are fully understood and internalised.

Karnataka state has been one of the pioneering states in the implementation of watershed development programmes, particularly since the 1980s. Programmes include both centrally funded ones and special bilaterally funded ones. There have been a number of studies that have examined the 'successes/failures' and the constraints encountered (a comprehensive review of these studies is given in Joy *et al.*, 2004). However, the review by Joy *et al.* and subsequent discussions in various workshops have, however, revealed some limitations in our understanding of the sustainability and impacts of watershed development programmes in Karnataka in particular and south-central India in general. First, most studies focus only on specific programmes, e.g., KAWAD (Iyengar *et al.*, 2001; Deshpande *et al.*, 2003),

NWDPRA (Deshpande and Thimmaiah, 1999) or Sujala (Silori *et al.*, 2008).[1] One does not get an overall picture of the differences across all programmes.[2] Second, virtually all studies have been conducted immediately after the completion of the projects, and hence we know very little about the longevity of the benefits of watershed development (Vaidyanathan, 2001). Third, a methodological limitation of most studies is the limited sample size, and therefore the difficulty in generalizing across regions and socio-economic situations. As a result of these limitations, policy-makers continue to believe that watershed development programmes as implemented provide substantial and long-lasting benefits to rural communities, whereas in fact there may a need for a substantial reworking of the programmes or implementation strategies to make the public investments more effective.

2. STUDY OBJECTIVES: WATERSHED DEVELOPMENT SUSTAINABILITY AND IMPACTS

In order to fill this gap, we carried out an appraisal of watershed development sustainability across a large number of micro-watersheds (MWSs) in Karnataka that have been treated under different programmes at different points in time, ranging from 1 year to 16 years post-completion. This was part of a three-state study that covered Karnataka, Maharashtra and Madhya Pradesh.

The main questions we posed in this study were:

1. How well did the key processes follow the design laid down for respective watershed development programmes?

2. What is the status of the physical structures and institutions created under the watershed development intervention and what variables appear to explain the variations in these status indicators across villages?

3. What were the perceptions of the villagers about the impacts of watershed development, and what variables appear to explain the variations in these perceived impacts? [3]

In order to cover a large sample of micro-watersheds, we adopted a 'rapid appraisal' strategy in which data on a small set of key variables were gathered through group discussions and field verifications. It should also be noted that this appraisal is not a benefit-cost evaluation, nor even a full-fledged examination of the cost-effectiveness of public investments in different programmes. The focus is on trying to understand the pattern of current status and perceived impact across a large region, and across different watershed programmes.

The conceptual framework for this study is outlined in section 3. The study region, sampling strategy and data collection methodology are described in section 4. The results are presented in section 5, followed by a discussion of their implications in the concluding section.

[1] Many other studies exist on the heavily funded programmes such as KAWAD (Wilkin, 2002; Batchelor *et al.*, 2000) but they were carried out as part of the programme itself and cannot probably be called truly independent.

[2] In fact, there is not even a single comprehensive list of villages/watersheds treated so far under various programmes—a lacunae addressed by ForWaRD through its "Taluka-level GIS Database on Watershed Development Programmes" (http://www.forward.org.in/giscd.htm).

[3] The data collected may enable us to answer a few more questions, such as whether the strategy for selection of villages for treatment is appropriate or not, and to what extent the actual implementation followed the guidelines specified for those programmes. However, these questions are not taken up here.

3. CONCEPTUAL FRAMEWORK FOR THE STUDY

Broadly speaking, the impact of watershed development relates to the long-term changes in physical and socio-economic variables or relevance, while the sustainability of watershed programmes would be defined in terms of the longevity of interventions, i.e., whether the physical and social structures created by the project still exist and function. These outcomes and impacts would in turn be the related to several implementational and contextual variables.

Any assessment of the current status and possible impacts of watershed development projects, however, also needs to be based on an understanding of what the programmes were attempting to achieve and how. It would, for instance, be inappropriate to expect gains for the landless if a programme in its very conceptualisation is meant only for the landed. We therefore begin with an overview of the nature of watershed development programmes implemented in Karnataka, thereby identifying which programmes are relevant to our exercise and which questions can be meaningfully asked of them. We then provide a conceptual framework that identifies the relevant variables and indicates the links between them.

3.1 Nature of watershed development programmes in Karnataka

According to some calculations, Karnataka has the highest proportion (79%) of drought-prone area in a state's total geographical area in India. Accordingly, Karnataka state has been one of the leading states in adopting the watershed development approach. Several experiments were initiated in the 1980s, including the Operational Research Programme (ORP) of ICAR, and the government set up a Dry Land Development Board (DLDB) in early 1980s (which has now metamorphosed into the Watershed Development Department). Over 3.5 million hectares (of a total treatable area of ~12 million ha) have been treated between 1984 and 2007.

Over the past 23 years since the watershed development strategy was adopted officially, watershed development in Karnataka has been carried out under a large variety of programmes and projects (see Table 1). The major activity has been under centrally sponsored programmes of the Ministry of Rural Development (MoRD) such as Desert Development Programme (DDP), Drought Prone Areas Programme (DPAP), Integrated Wasteland Development Program (IWDP) and Ministry of Agriculture (MoA) sponsored River Valley Projects (RVP) (adding up to more than 25% of the total area treated), and of the central Ministry of Agriculture's National Watershed Development Project for Rainfed Areas (NWDPRA) (17% of area treated). The area treated under individual bilaterally or multi-laterally funded special projects, such as the Swiss funded PIDOW and Indo-Swiss Participative Watershed Development-Karnataka (ISPWD-K), the Danish funded programme (DANIDA), the British Department for International Development's (DfID's) Karnataka Watershed Development Project (KAWAD) or the World Bank's SUJALA is much smaller, although these programmes are generally considered as more interesting (higher quality).

Table 1. Area treated under different watershed development programmes[4] in Karnataka during 1984-2007, sorted in ascending order of area treated (those covered in this study are marked in red).

Programme	Programme Type	Area treated (ha)	% of total treated area in Karnataka
WLDP	GoK	100	0%
RAJIV	MoRD	185	0%
DRY_D	MoRD	2,250	0%
PMGRY	MoRD	2,854	0%
SALINE	MoA	3,019	0%
WDF	Bilat/Multilat	4,375	0%
ISPWDK2	Bilat/Multilat	9,860	0%
PIDOW	Bilat/Multilat	19,633	1%
TSP	GoK	21,269	1%
KAWAD	Bilat/Multilat	23,626	1%
IRWS	GoK-other	26,105	1%
JRY	MoRD	27,763	1%
ISPWDK1	Bilat/Multilat	30,000	1%
DANIDA	Bilat/Multilat	32,556	1%
RLEGP	GoK-employ	34,700	1%
DROUGHT	GoK-other	37,377	1%
MWS	GoK-other	42,798	1%
SCP	GoK-employ	51,497	1%
SGRY	GoK-employ	61,963	2%
SUJALA	Bilat/Multilat	73,655	2%
DLDB	GoK	76,587	2%
WGDP	GoI	111,886	3%
DDP	MoRD	144,330	4%
IWDP	MoRD	212,184	6%
EAS	GoK-employ	430,238	12%
RVP	Irrigation Dept	432,662	12%
OTHER		483,570	13%
DPAP	MoRD	541,302	15%
NWDPRA	MoA	613,956	17%
Total Area treated in Karnataka		**3,602,295**	**100%**

Source: GIS database on spread of watershed development compiled by CISED (see footnote 2).

[4] MoRD=Ministry of Rural Development of Govt of India (GoI); GoK=Govt. of Karnataka; MoA=Ministry of Agriculture of GoI; EAS=Employment Assurance Scheme, DLDB=Dryland Development Board of GoK; WLDP=, Waste Land Development Program, RAJIV= Rajiv Gandhi drinking water mission, DRY_D= Dry Area Development Program, PMGRY=Prime Minister's Grameen Rozgar Yojana, SALINE=Reclamation of Saline & Alkaline Water logged Area, WDF= Watershed Development Fund, ISPWDK1 and ISPWDK2=Indo-Swiss Participative Watershed Development Karnataka (First and second phase), PIDOW=Participatory Integrated Development of Watersheds Project, TSP= Tribal Sub Plan, KAWAD= Karnataka Watershed Development Project, IRWS=Integrated Rural Water supply Scheme, JRY=Jawahar Rozgar Yojana, DANIDA= DANIDA funded Watershed Development Project, RLEGP=Rural Landless Employment Generating Program, DROUGHT= Drought area development programme, MWS= Million Well Scheme, SCP= Special Component Plan, SGRY= Sampoorna Grameen Rojgar Yojana, DLDB= Dry Land Development Board, WGDP= Western Ghats Development Program, DDP= Desert Development Program, IWDP=Integrated Wasteland Development Program, EAS=Employment Assurance Scheme, RVP= River Valley Project, DPAP=Drought Prone Areas Program, NWDPRA= National Watershed Development Project for Rainfed Areas.

Notwithstanding the use of the common label of 'watershed development' and recent attempts to bring about convergence of guidelines, there continue to be major differences in the approaches adopted—both technical and social—under different programmes. To begin with, the River Valley Programme (RVP) is really quite distinct from all other programmes, as its purpose and approach are quite different from the rest of the programmes. RVP's aim is to reduce siltation in reservoirs and is implemented across entire catchments of major reservoirs, without any major involvement of local communities. Similarly, watershed development activities carried out under the Employment Assurance Scheme (EAS) in Karnataka and other such employment schemes (e.g., PMGRY) are in most cases simply conducted like an employment programme where treatments are taken up piecemeal as and when funds and labour are available and little attention is devoted to community involvement or the ridge-to-valley approach or other attributes of integrated watershed development programmes. The category called "Other" also includes many programmes (such as Million Wells Scheme and Command Area Development programme) which do not really follow the integrated and participatory watershed development approach. Finally, the context in which some programmes such as the Western Ghats Development Programme (WGDP) are implemented is quite different, where the question of water conservation or increasing recharge is not a significant one for local residents, as water availability in this high rainfall region is generally adequate. In light of the above, we have excluded the RVP, EAS (and other employment programmes), most of the "other" programmes, and WGDP programmes from our assessment. The programmes that were sampled are indicated in red in Table 1.

3.2 Conceptual framework for process, status and impact

Having limited our focus to those programmes that qualify as integrated and participatory watershed development interventions in the dry and semi-arid rainfed regions of Karnataka, the nature of questions we could ask of this set of programmes depended upon both the nature of the programme and the limitations imposed by our rapid assessment methodology. Fundamentally, across programmes, we assume that "integrated and participatory watershed development" will manifest itself on the ground in the form of:

a) some soil and water conservation structures: check dams, nala bunds, gully plugs, field bunds, farm ponds, etc. on drainage lines, private farmlands and/or common lands, and

b) some institutions set up initially to facilitate the planning and implementation of the watershed programme (including the location of structures, but also other activities such as credit and marketing) and subsequently to maintain the structures created as well as the flow of the other developmental benefits.

There are of course variations across programmes, and the guidelines for individual programmes have also changed over the years. Generally speaking, the MoRD and bilateral programmes are somewhat more focused on broad-based rural development whereas the NWDPRA programme is focused more on increasing farm productivity. The main elements of the prominent programmes are summarised in Table 2. This has implications for how we assess the status. E.g., if a programme does not build check dams, there is no question of check dams being present when we assess the structures today. The same is true of institutions: while formation of watershed development committees (WDCs or WCs) or equivalent institutions was a requirement of almost all programmes, some programmes did not have creation of self -help groups in their design itself. These variations also have implications for the eventual impact. A more compact grouping of the programmes is suggested later in section 3.3.

Given this variation in the approaches adopted even within the so-called "integrated and participatory" programmes, we felt it was necessary to understand what interventions had

actually been carried out, before understanding the status and impact of the interventions. In the process, we could also examine to what extent the processes and components of intervention followed or deviated from the official designs of the individual programmes. For this purpose, we focused on a few variables each related to process, structures and institutions.

Table 2. Comparison of guidelines across major programmes and phases[5]

Watershed Programme/ Epoch	Soil & Water Conservation Treatments	Common lands	Livestock develop-ment	Drinking water provision/ protection	Institutional design	Entry point activities (EPA)	Funding level
MoRD -1994	Drainage line treatment with a combination of vegetative and engineering structures. Development of small water harvesting structures such as low-cost farm ponds, nala bunds, check-dams and percolation tanks.	Afforestation, pasture development, Nursery development for fodder, timber, fuel wood and horticultural species.	no explicit attempt	No explicit attempt.	WDC, SHGs and UGs.	Can use 5% of the works component placed with them for EPA (the village temple, community hall. or drinking water)	Rs. **4,000**/ha
MoRD - 2001	Land development including in situ conservation, afforestation, small water harvesting structures, crop demonstration, etc	Afforestation, pasture development, Development of CPR	no explicit attempt	Renovation and augmentation of water resources, desiltation of tanks for drinking water/irrigation.	WDC, SHGs, UGs.	As a part of confidence building exercise, some community benefiting EPA can be taken up.	Rs. **6,000**/ha
NWDPRA - 1990	1. **Arable land treatment** (not less than 40% of the cost)-(i) vegetative hedges, inter-bund treatment, measures for gully control, organic farming, Diversified production systems including mixed cropping, inter-cropping… 2. **Non arable lands**	On common lands work may be done through the village panchayat or a group or association of beneficiaries. One tenth of the common area	10% of which 2% for castration of scrub bulls and other means and 8 % for production of fodder on cultivated	No attempt	No WDC. Instead, 2 contact farmers (Mitra-Kisan) to concentrate on cultivated lands and one landless labourer (Gopal) to focus on	--	**Rs. 3,500/ha** (where 72 % of total areas has < 8% slope) **Rs.5,000/ha** (for Hilly, rocky and undulation areas –WS

[5] The MoRD guidelines changed significantly again in 2003 with the promulgation of the "Hariyali" guidelines. However, we did not come across any MWSs implemented under the Hariyali guidelines that had been *completed* at the time of our assessment.

Watershed Programme/ Epoch	Soil & Water Conservation Treatments	Common lands	Livestock develop-ment	Drinking water provision/ protection	Institutional design	Entry point activities (EPA)	Funding level
	including Drainage lines (not less than50% of the cost)- clearing of drainage congestions, stabilization of nala banks with vegetative measures, construction of check dams, loose boulder dams, earthen dugout bunds	should be enclosed in the first year and every year thereafter.	lands.		common lands management on behalf of the village community.		with 75% of total areas having more than 8% slope)
NWDPRA – 2000	**Private land resource**: This involves 4 types of land resources namely cultivated land (with engineering, fallow land, drainage lines and special problem soils.	Mixed Plantation of multipurpose species, staggered trenching, contour furrows, separated furrows across the slope.	Not mentioned in the guidelines	Not mentioned in the guidelines	WDC, SHGs and UGs	A maximum of 3.0 % fund is allocated for EPA	**Rs. 4,500/ha** (for areas with <8% slope) **Rs.6,000/ha** (for areas with > 8% slope)
KAWAD	Treatment on private land – such as field bunds, land levelling, boulder checks etc.	Treatment on Common land is envisaged in the project	no explicit attempt	no explicit attempt	MWDC, SHGs, Area groups/ User groups	Very strong component	**Rs. 16,000/ha.**
SUJALA	Stone masonry structures (check dam. drop structure waste weir), SWC measures such as field bunds, boulder bunds, Nala revetment, farm ponds., horticulture	Development and management of common lands, pasture development.	no explicit attempt	Based on request of the farmers different animal husbandry programmes, will be taken up	Executive Committee (EC), SHGs, AGs	Budget of Rs. 1 lakh for EPA.	**Rs. 10,500/ha.**

Note: WDC=Watershed Development Committee or Watershed Committee, SHG=self-help group, UG=user group, AG=area group

- whether entry-point activities had been carried out and broadly whether villagers were consulted in decision-making,

- which kinds of treatments had been carried out (including soil and water conservation structures created), and

- which institutions had been set up (including watershed development committees and self-help groups).

It then follows that if one visits a treated micro-watershed or village today, one should find the above physical structures and institutions at some level of functionality, if the benefits of watershed development are to be flowing to the villagers. That these expectations are not unrealistic is borne out by the "criteria for post-project sustainability" laid down by the Ministry of Agriculture (http://agricoop.nic.in/guideline.htm), which state that "at least 70% of the SHGs should be functioning" and "at least 80% of the assets created should be properly maintained".[6] Essentially similar criteria are used by other programmes and assessments. We believe that it is possible to assess these basic 'sustainability indicators' even in a single rapid visit to the village with a high level of reliability, because they are the most tangible features, even if programmes have been implemented one or several years ago. What was the condition (in qualitative terms) of the physical structures, plantations and institutions created at the time of implementation was therefore the focus of our assessment of project status.

Estimating impact of watershed development in any kind of independent and quantitative manner is much more difficult in a rapid assessment mode. What can be assessed is people's perceptions of the impact, in terms of whether they perceive positive or negative changes in agricultural production or income, groundwater recharge, or availability of fodder, fuel, drinking water and wage income. While this certainly increases the uncertainty, across a large sample we believe it would still be possible to generate a broad picture of the impacts.

3.3 Explaining status and impact

What are the likely variables that might influence the observed status, which reflects the sustainability of structures and institutions? Broadly speaking, sustainability would be expected to be influenced by design, implementation, and contextual factors. We examined the differences in design (some of which are given in Table 2) and found that there are similarities across some programmes and perhaps more differences between phases of the same programme than amongst some recently implemented programmes. We therefore grouped the programmes into eight categories or 'modes'. These are summarized in Table

[6] The full set of criteria is:

- Functioning of the new SHG / UG even beyond the project period (at least upto the extent of 70 percent) organized by MoA, GOI.
- Functioning of the WC even beyond the project period as reflected in the following specific achievements: proper maintenance of at least 80 percent assets created under the project through operation of WDF; proper management of revolving fund with at least 50 percent of the SHG & UG; starting of at least two community oriented activities which require group action (as a result of organization of community into SHG / UG).
- Convergence of on-going schemes from each of the relevant development departments in the area for the benefit of SHG / UG members.
- Linkage with a nearby credit and input institution.
- Linkages with KVK, ZRS or SAU nearby for addressing the local technical requirements of the community.

3. (Note that the year in the mode label refers to the guidelines, not the year or period of implementation.)

Table 3. Major 'modes' of implementation and their key features

MODE	Programmes included	Key features
DLDB	GoK supported Dry Land Development Board programme	DT+AT, no WDC, GO
MoRD pre-1994	DDP, DPAP & IWDP implemented under pre-1994 guidelines	DT, no WDC, GO
MoRD 1994	DDP, DPAP & IWDP implemented under 1994 guidelines	DT+AT, WDC, GO/NGO
MoRD 2001	DDP, DPAP & IWDP implemented under 2001 guidelines	DT+AT, WDC, GO/NGO, DW
MoA 1990	NWDPRA implemented under 1990 guidelines	AT+some DT, no WDC, GO, LV
MoA 2000	NWDPRA implemented under 2000 guidelines	AT+some DT, WDC, GO, LV
Bilateral	KAWAD, ISPDWK, DANIDA, ICEF	AT+DT(+LR in KAWAD), WDC, NGO, higher funding
SUJALA	World Bank funded Sujala phase I and II	AT+some DT, WDC, NGO, higher funding

Note: DT=drainage line treatments, AT=area treatments, WDC=WDC is formed, GO=implemented only through govt. organizations, GO/NGO=mixed PIAs, DW=special attention to drinking water, LV=special attention to livestock development, LR=land reclamation activities (levelling, clearing, boulder removal)

Within a given design, a second factor that would be expected to affect the status would be the quality of implementation. But this factor is harder to assess. We chose to focus on a few variables that capture the extent to which participatory processes were attempted, viz., whether villagers said they were consulted for site selection or not and whether villagers felt they were involved in the overall planning or not. Another proxy variable for implementation quality could be the type of project implementing agency (PIA)—with the hypothesis that NGOs might do a better job of implementation than government organisations. A third factor would actually be the functioning of the institutions such as WDCs that may have been set up to carry out the maintenance of the structures and plantations.

In terms of the context, the level of interest, motivation and mobilisation amongst the villagers that existed independent of the programme, which was sought to be assessed by asking whether they had approached the PIA to initiate the programme. But the broader socio-economic context cannot be understood in a rapid assessment approach. At best, what can be obtained is some basic information on caste composition, extent of landlessness, presence of other cooperative institutions, and perhaps some information from the Census 2001 datasets, if one can easily correlate the village with its census code number.

Cutting across all these variables, the status of structures and institutions would be expected to be affected simply by the number of years post-implementation. This is particularly important because we are assessing programme implemented at very different times—

ranging from those completed 20 years ago to those completed a few months before our field visits.

When it comes to impact, one would broadly expect the design or the mode, the quality of implementation, the current status of structures and institutions (which also captures the role of age) and the agro-climatic context to be major factors. It should also be noted that the programmes are not randomly applied across villages. Selection criteria for choosing villages for watershed development vary from programme to programme, and at least the MoRD's programmes (DDP, DPAP and IWDP) are consciously designed to be applicable in different agro-climatic zones. This interaction between context and programme design needs to be kept in mind during the analysis. The overall conceptual framework is depicted in Figure 1.

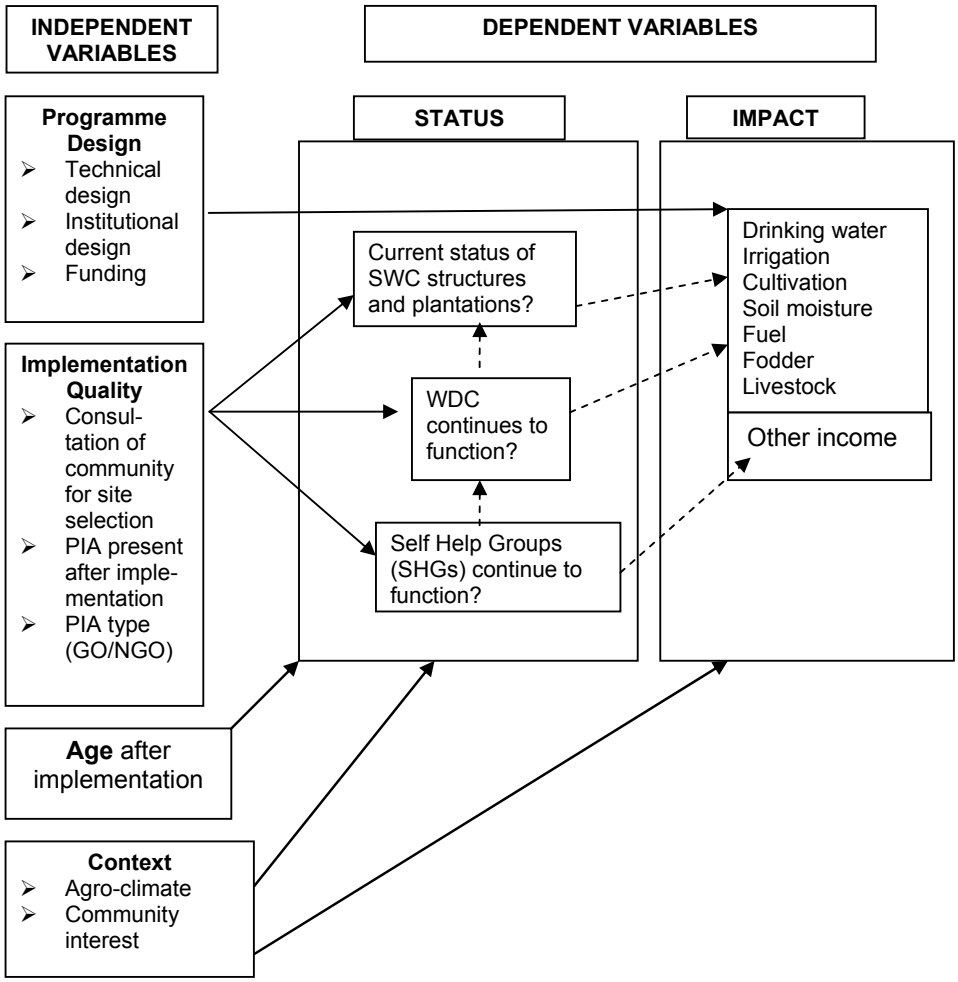

Figure 1. Independent and dependent variables and their relationships. (The dotted line denotes a weak relationship.)

4. STUDY REGION, SAMPLING STRATEGY AND FIELD METHODS

4.1 Study region and distribution of watershed development programmes

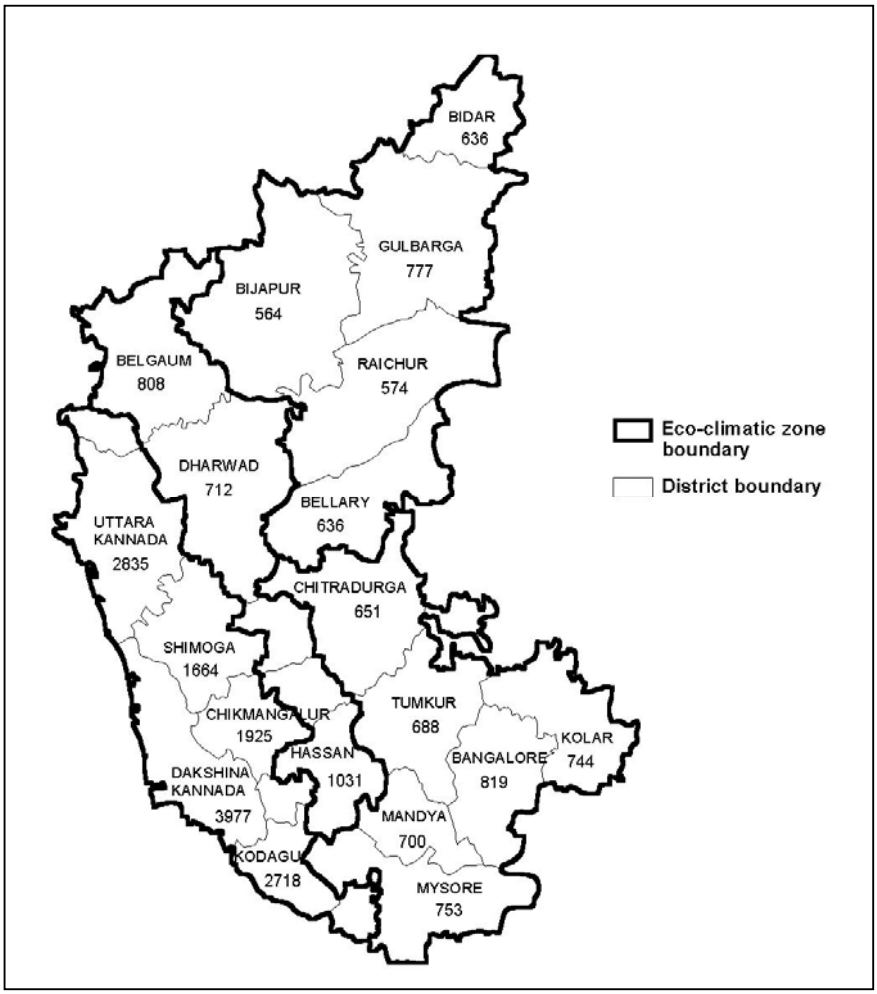

Figure 2. Agro-climatic zones of Karnataka: simplified

The state of Karnataka encompasses significant agro-climatic diversity. One major determinant of this variation is the variation in rainfall, which is high along the western coast and increases in the Ghats that parallel the coast, and then declines rapidly eastwards across the Deccan plateau. The northern parts of the plateau are drier than the southern parts. Thus, a broad classification that focuses on the extent of rainfall would divide the state into 4 zones, viz., high rainfall zone (coastal plus Ghats region) along the western side, the narrow 'transition' region, the dry southern *maidan* (plains) region and the semi-arid northern maidan region. This broad classification is depicted in Figure 2. A more detailed 11-fold classification based on finer distinctions in rainfall and topography is often made (e.g., GoK, 2008), in which the northern and southern maidan zones are further divided and the classification is done at the taluka-level rather than district-level. We used the district-level 4-fold classification for simplicity, and restricted the study to the transition, northern maidan and southern maidan zones. But we avoided sampling in those talukas of a district that fall in a different climatic zone from that to which the district is assigned.[7]

[7] For instance, some talukas of Belgaum district are considered to belong to the 'coastal & hill zone', and hence were not considered part of the population.

The total number of MWSs treated or under treatment in these three zones of Karnataka in 2006 were 4,274. Of these, more than half were being treated under ongoing projects and so could not be included in the population of treated watersheds. In a few cases, although treatment was over, the MWS was not being classified as 'completed' for some bureaucratic reasons. We therefore chose all those MWSs where treatment had been initiated on or before 2001, with the assumption that treatment must be complete at least in 5 years, as our population. There were 1,901 such MWSs. This population was distributed over more than 19 districts, but rather than spread our sampling to all districts, we chose about 4 districts in each zone that had the highest densities of MWSs (highest treated area to total area available for treatment). We therefore focused on 13 districts in all, containing 1,516 MWSs, which is the bulk of the population. The list of districts we focused on and the total number of completed MWSs in that district are given in Table 4.

Table 4. Distribution of population and sample MWSs in chosen districts

Sampled Districts	Total population of treated MWSs in the district	No. of MWSs where treatment started on or before 2001	Total MWSs sampled in district	ZONE		
				Northern Zone	Southern Zone	Transition Zone
Bijapur	356	207	38	38		
Gulbarga	356	233	45	45		
Bidar	184	173	21	21		
Koppal	180	45	9	9		
Bellary	291	183	18	18		
Chitradurga	418	213	37		37	
Tumkur	280	90	23		23	
Kolar	486	133	20		20	
Bangalore Rural	173	42	6		6	
Belgaum*	162	118	25			25
Gadag	109	25	3			3
Haveri	242	24	8			8
Hassan	163	30	8		1	7
TOTAL	3400	1516	261	131	87	43

* Only eastern part of Belgaum district.

4.2 Sampling strategy and sample characteristics

Our attempt was to sample 15% of this population of 1516 MWSs, in proportion to the numbers in each heavily treated district. However, to ensure that the programmes that covered small numbers of MWSs but were known to be more innovative or more intensive in their approach (such as some of the bilaterally funded programmes—PIDOW, KAWAD, ISPWDK, DANIDA) were represented in our sample, we added another 30-odd MWSs from these programmes through a purposive sampling approach, ending with a total sample of 261.

Table 5 Distribution of micro-watersheds population and sample across agro-climatic zones

WDP coverage	Transition zone	Northern maidan	Southern maidan	Total
No. of MWS initiated before 2001	197	841	478	1516
MWSs sampled	44	131	86	261

Corresponding to the higher attention given to the drought-prone northern maidan region of Karnataka, the population of MWSs and hence the sample is highest in this region, followed by the southern maidan region.

As mentioned above, this sample covered the major integrated watershed development programmes implemented under the central Ministry of Rural Development's (MoRD's) schemes (DPAP, DDP, IWDP) and the central Ministry of Agriculture's (MoA's) scheme (NWDPRA), the major state-supported initiative that preceded these programmes (DLDB), and the bilateral and multilaterally funded programmes (PIDOW, DANIDA, ISPWDK, ICEF, KAWAD and SUJALA). The distribution of the sample across these programmes is given in Table 6.

Table 6. Distribution of sample across specific watershed programmes

Programme	No. of MWSs sampled	% in total sample
DPAP	116	44
DDP	37	14
IWDP	21	08
NWDPRA	15	06
KAWAD	25	10
SUJALA	19	07
Others*	28	11
TOTAL	261	100

Note: Others= DLDB (7), DANIDA (5), PIDOW (8), CEC (1), ISPWDK (5), ICEF (2).

It should be noted that although the NWDPRA programme constituted the largest fraction of the treated area in the state as reported in Table 1, it forms a rather small fraction of our sample. This has happened for two reasons. First, many of the NWDPRA treated areas are in the coastal and hilly zones, which have been excluded from our study (whereas the DPAP and DDP-type programmes are specifically targeted at dry regions and therefore entirely within our sampling frame). Second, and more important, even though there are many dry and semi-arid districts where NWDPRA was implemented, in most talukas, we were told by the officials that the NWDPRA programmes were still incomplete. It appears that the bulk of NWDPRA programmes in the state have begun late (post-2000) and their implementation has also lagged or remained incomplete due to inadequate release of funds. As a result, when sampling 15% of the completed MWSs, we ended up with not a very big sample from the NWDPRA programme.

If one categorizes the sample by the major eight modes identified in section 3.3, then the frequencies are given in Table 7. One can see that the only modes in which the sample size is significant are MoRD-1994 guidelines (166), bilaterally funded projects (47), and possibly MoA (14) and multi-laterally funded projects (19). A two-level categorization by mode and zone (see Table 8) shows that there is a certain bias in the distribution of modes: bilateral

programmes (especially KAWAD) have concentrated heavily in the northern maidan, whereas Sujala has concentrated heavily in the southern maidan. These biases need to be kept in mind when carrying out the analyses.

Table 7. Distribution of sample in terms of major modes

Mode	Frequency	Percent
MORD Pre 1994	7	2.7
MORD 1994	166	63.6
MOA (NWDPRA)1990	14	5.4
MOA (NWDPRA) 2000	1	.4
Bilateral	47	18.0
SUJALA	19	7.3
DLDB	7	2.7
Total	261	100.0

Table 8. Distribution of sample MWSs by mode and zone

MODE	ZONE			Total
	Northern Zone	Southern Zone	Transition Zone	
MoRD pre-1994	7	0	0	7
	100%	%	%	100%
MORD 1994	72	54	40	166
	43%	32.5%	24%	100%
MOA (NWDPRA)-1990	7	7	0	14
	50%	50%	%	100%
MOA (NWDPRA) 2000	0	0	1	1
	%	%	100%	100%
Bilateral	38	9	0	47
	80.9%	19%	%	100%
Sujala	0	17	2	19
	%	89.5%	10.5%	100%
DLDB	7	0	0	7
	100%	%	%	100%
TOTAL	131	87	43	261
	50%	33%	16.5%	100%

There is also some correlation between the mode and the nature of implementing agency ("PIA type" in Figure 1). As Table 9 indicates, whereas NGOs were the PIAs in 82 of the total 261 cases (31%), this percentage is only 13% for MWSs implemented under MoRD1995, whereas it is 77% for bilateral programmes and 10)% for Sujala. This means that to test the influence of NGOs as PIAs independently of the programme mode, we would have to limit the analysis to only MoRD1994 cases.

Table 9. Cross tabulation of modes with PIA type

Mode	PIA Type		Total
	GO	NGO	
MoRD Pre 1994	2	5	7
MORD 1994	144	22	166
MOA (NWDPRA)-1990	14	0	14
MOA (NWDPRA) 2000	1	0	1
Bilateral	11	36	47
Sujala	0	19	19
DLDB	7	0	7
All modes	179	82	261

Finally, it should be noted that the bulk of the sample consists of watersheds completed 1 to 6 years before the assessment (see Table 10). This is indicative of the fact that the implementation of watershed development programmes in Karnataka expanded since 2000. This has implications for the statistical analysis, since there are inadequate samples for the earlier years.

Table 10. Distribution of sample in terms of years since completion

Year of completion	No. of years since completion*	No. of MWS	% of total sample
1989	17	5	1.9
1990	16	1	0.4
1991	15	1	0.4
1995	11	6	2.3
1996	10	8	3.1
1998	8	2	0.8
1999	7	6	2.3
2000	6	36	13.8
2001	5	31	11.9
2002	4	12	4.6
2003	3	22	8.4
2004	2	43	16.5
2005	1	87	33.3
2007**	-1*	1	0.4
Total	Total	261	100

* At the time of the assessment (2006)
**Mostly completed, but officially extended till 2007.

4.3 Field methods

The rapid assessment exercise was carried out by a seven member team (five men and two women) who have had their basic training in a social science discipline. The actual amount of time spent in the field was 54 days (excluding travel). Training in the physical verification of check dams and other structures was provided separately to the team.

A structured questionnaire was designed for data collection which was administered at the village level and the data was collected through a group discussion.[8] The group mainly consisted of president and vice-president, members of Watershed Development Committee (WDC), member of Self Help Groups (SHGs) which formed under WDC, Gram Panchayat members and beneficiaries of watershed activities. In addition to these people, group also included other village citizens. If committees were not formed under the watershed program (in case of some first phase of DPAP, DDP, IWDP etc), discussion was held with the individuals and Gram Panchayat members who were involved in the watershed activities.

The information collected include the process of project implementation, land treatment activities, functioning of community based organisations (WDCs, SHGs, area groups, etc.), impact on ground water sources, livestock, fuel, fodder, cropping pattern and also overall perception of the villagers about the project and activities carried out. In addition to the group discussion, data collection involved physical verification of the structures created under watershed program. Along with some members, the team visited some of the randomly selected structures. This exercise was to get qualitative information about the soil and water conservation (SWC) structures. A separate checklist was prepared to ensure that maximum information is collected about the quality of the SWC structures. We then verified the extent to which the perceptions of the villagers about the condition of the structures matched with our own field verification of a subset of these structures. We found that

a) in general, the villagers' perceptions correlated well with the results of field verification: the percentage of check dams in good condition had a correlation coefficient of more than 0.8 ($p<0.0001$), and

b) where there were deviations, the villagers often tended to over-estimate the quality of the structures.

We have therefore used the villagers' perception data in our analysis.

We shall now briefly examine whether the implementation of watershed development in the sample villages broadly followed the guidelines prescribed for that programme. We then analyse the status of physical structures and institutions, and the correlates of these status indicators. We then present results for the impact perceptions and their correlates. Finally, we present some case studies from which additional insights can be gleaned.

5. FINDINGS: IMPLEMENTATION VIS-À-VIS GUIDELINES

We examined the correspondence between the guidelines and the actual implementation on three dimensions: processes followed, physical treatments carried out, and institutions created. Along each dimension, we only focused on the variables that one could assess in the rapid assessment approach and that seemed most important.

5.1 Processes

The major assumption in a participatory watershed development approach is the quality of implementation and its impact will improve significantly if the processes are participatory, i.e., if the community is consulted and involved in decision-making about how to implement the programme, where to locate the check dams, etc. One of the ways of generating community interest in participation has been the use of "entry-point activities". As Table 2 shows, most programmes now require and budget for such activities. We therefore examined to what extent the programmes actually implemented this budgeted activity. The

[8] Before the main survey, a pilot study was conducted in three districts Village was considered as a base to collect the information. So, if there are different programs in the village, questionnaires were administered separately for all the programs and if the watershed spans several villages, then the information were collected for the surveyed village only.

results are given in Table 11. They show that while most of the programmes implemented under bilateral and multi-lateral projects did carry out entry-point activities, almost 47% of the MoRD programmes did not carry out such activities.[9]

Table 11. Implementation of entry-point activities

Was entry-point programme a part of the design of the project?	Programme category or "Mode"	Were entry-point activities carried out?		Total
		Yes	No	
No	MoRD Pre-1994 (DPAP, DDP, IWDP)	6	1	7
		85.7%	14%	100%
	MOA (NWDPRA) 1990	2	12	14
		14%	85.7%	100%
	DLDB	2	5	7
		28.6%	71%	100%
	All "no"	10	18	28
		35.7%	64%	100%
yes	MoRD 1994 (DPAP, DDP, IWDP)	88	78	166
		53%	47%	100%
	MOA (NWDPRA) 2000	0	1	1
		%	100%	100%
	Bilateral	42	5	47
		89%	10.6%	100%
	SUJALA	18	1	19
		94.7%	5%	100%
	All "yes"	148	85	233
		63.5%	36.5%	100%

The second dimension of process is of course whether the community was involved in the decision-making regarding the watershed development programme. In this case, there is no question of whether guidelines require such involvement or not—notionally, all programmes prescribe community involvement as key. The results presented in Table 12 show that in fact this part of the guidelines was reasonably adhered to. Except for DLDB and MoA programmes, where it is a matter of record that there is limited emphasis on community participation, we find that the proportion of MWSs reporting some level of involvement is quite high. It is noteworthy, however, that even here 13%-14% of MoRD programmes are reporting non-consultation, suggesting that the process quality is somewhat uneven.

[9] It is also interesting to note that in a few cases where the guidelines did not prescribe such activities, they were nevertheless carried out.

Table 12. Community involvement in watershed development decision-making

Mode	How were watershed development decisions taken?			Total
	No community participation	Community participation	Only WDC was consulted for decisions	
MORD (DPAP, DDP, IWDP) – Pre-1994	1	6	0	7
	14%	85.7%	%	100%
MORD (DPAP, DDP, IWDP) 1994	21	141	4	166
	12.7%	84.9%	2%	100%
MOA (NWDPRA)-1990	6	8	0	14
	42.9%	57%	%	100%
MOA (NWDPRA)-2000	0	1	0	1
	%	100%	%	100%
Bilateral	2	45	0	47
	4%	95.7%	%	100%
SUJALA	0	19	0	19
	%	100%	%	100%
DLDB	5	2	0	7
	71%	28.6%	%	100%
All programmes combined	35	222	4	261
	13%	85%	1.5%	100%

The roots of this unevenness can be traced by looking at the role of NGOs in community mobilisation (the 'software' part, as it is known in the watershed programme jargon). The tendency to not consult communities in the implementation was higher (20% as compared to 2%) in those MWSs where NGOs were not involved in the 'software' part of the programme as compared to the tendency in those where NGOs were involved. This is an important finding in light of several criticisms of NGO involvement. As mentioned earlier, there is a bias towards involving NGOs in the bilateral and multilateral programmes, but even if one focuses on MoRD1994 alone, the NGO effect on community involvement was still present.

Table 13. Effect of NGO involvement on community mobilisation

NGO involvement in 'software'	Community involvement in decision-making			Total
	No community participation	Community participation	Only WDC was consulted for decisions	
NGO **not** involved significantly	34	139	3	176
	19%	79%	1.7%	100%
NGO significantly involved	2	82	1	85
	2%	96.5%	1%	100%
All	36	221	4	261
	13.8%	84.7%	1.5%	100%

5.2 Treatments

Over the years, the technical design and institutional design of different programmes has been converging. Indeed, a diverse set of treatments are now being used in the field, as can be seen from Table 14 below.

Table 14. Different soil and water conservation treatments and their frequency in the sample

Structures/ Treatments	Number of MWSs in which found	Number of Structures or Area treated (ha)	Structures/ Treatments	Number of MWSs in which found	Number of Structures or Area treated (ha)
Check dams	216	1723	Borewell recharge pit	4	118
Nala bunds	90	266	Compost pit	6	364
Farm pond	93	1626	Tank desiltation	20	18
Village tank construction	4	7	Silt application	7	Not avail.
Gully plugs	7	340	Storage tanks	6	44
Field bund	191	27534*	Waste land development	2	140*
Boulder bund	12	6004*	Jungle clearance	1	40*
Boulder check	19	1304	Drip irrigation	1	40*
Loose boulder check	2	51	Diversion drain	3	700**
Rubble check	9	382	Land reclamation	3	260*
Rock-filled dam	3	65	Nala deepening	1	400**
Ravine reclamation structure	3	34	Nala revetment	5	3440**
Land levelling	37	1904*	Shallow well digging	1	5
Percolation pond	9	153	Open well desiltation	1	13
Percolation pit	6	32			

Notes:
1. Treatments marked in blue are "area treatments"; others are "drainage-line treatments".
2. Some treatments differ in name only (e.g., jungle clearance and wasteland development).
3. * Unit is ha, ** units in meters.

At a broad level, these diverse treatments are classified into 'drainage-line treatments' and 'area treatments'. The most important ones in the first category are check dams, nala bunds, and boulder bunds/checks, whereas the important ones in the second category are field

bunds and land levelling measures. Note that second category can refer to both on-farm and off-farm treatments (the latter being treatments in common lands) and also vegetative treatments (not mentioned in Table 14).

How does the use of these treatments vary across programmes or modes? At the design level, as Table 3 showed, there is only limited variation in the recommended treatments. Most programmes, except MoRD pre-1994, recommend area treatments. Similarly, most programmes give importance to some drainage-line treatments, although the emphasis is lower in MoA and Sujala modes. These differences are, however, somewhat magnified at the field level, as the next two tables show.

At the level of implementation, the pattern differs from the guidelines (see Table 15). Drainage line treatments are missing in many cases in the MoA (NWDPRA) 1990 mode, which follows from the lack of emphasis on drainage line treatments in that mode. On the other hand, the Sujala mode has drainage line treatments even though these were not supposed to be emphasized, suggesting that they have adapted their treatments to site conditions. In contrast, a significant fraction (25%) of the MoRD 1994 MWSs did not implement drainage line treatments.

Table 15. Whether drainage line treatments were adopted at all

Whether Drainage Line Treatment was part of the Technical design of the project?	Mode	Drainage line treatment of any kind done (yes/no)		Total
		No	Yes	
Not Emphasized	MOA (NWDPRA)-1990	2	12	14
		14%	86	100%
	MOA (NWDPRA)-2000	0	1	1
		0%	100%	100%
		0%	100%	100%
	Sujala	3	16	19
		16%	84%	100%
Emphasized	MORD - Pre(1994) - DPAP, DDP, IWDP	0	7	7
		0%	100%	100%
	MORD 1994	12	154	166
		7%	93%	100%
	Bilateral	3	44	47
		6%	94%	100%
	DLDB	0	7	7
		0%	100%	100%
Total		20	241	261
		8%	92%	100%

But there is clearly difference in emphasis across modes. The average number of check dams per MWS was 13 in DLDB sites whereas it was 5 in MoA1990 sites (and the difference is statistically significant), indicating the much greater intensity of drainage line treatment under the DLDB mode. At the same time, there is also a lot of variation in terms of intensity of drainage line treatment within each mode, as the number of major structures per MWS varies from 1 to more than 10.

In the case of area treatments, there is slightly greater variation (see Table 16). As expected, the MoRD programmes somewhat de-emphasize the use of area treatments. But what is surprising is that the MoA programmes also seem to have not always implemented area (on-

farm) treatments, when they are actually known for focusing on farm lands rather than drainage lines. While the MoA sample is rather small and therefore risky to extrapolate from, one wonders whether the bias towards 'recharge' (even if it benefits only well-owning farmers) has spread to the MoA programme also.

Table 16. Whether area treatments of any kind were adopted at all

Mode	AT in design	Whether area treatment of any kind has been done (yes/no)		
		No	Yes	Total
MORD Pre 1994	No	1	6	7
		14 %	86%	100%
MORD 1994	Yes	42	124	166
		25%	75%	100%
MOA (NWDPRA) 1990	Yes	7	7	14
		50%	50%	100%
MOA (NWDPRA)- Post 2000	Yes	0	1	1
		0%	100%	100%
Bilateral	Yes	2	45	47
		4%	96%	100%
Sujala	Yes	0	19	19
		0%	100%	100%
DLDB	Yes	0	7	7
		0%	100%	100%
Total		52	209	261
		20%	80%	100%

Again, there is a lot of variation within a mode in terms of intensity of area treatments. The area treated with field bunds varies from few tens of hectares to hundreds of hectares, and the number of farm ponds per MWS varies from 0 in 68% cases, 1-3 in 10% of cases to more than 10 in 10% of cases. Thus, in many cases, the treatments are nominal, not really covering substantial portions of the watersheds. Moreover, in the case of farm ponds, the real issue seems to be the limited penetration: the median number of farm ponds per MWS was 4, indicating how few farmers are benefiting from this potentially important on-farm treatment. The reason, as revealed in several sites, was the difficulty smaller farmers had in accepting farm ponds because they require a large land area.

When it comes to the regeneration of common lands, however, the picture is rather different. Only 43% of the MWSs had plantations on common lands (see Table 17). Even after removing those that did not have common lands to begin with (59 MWSs), the number of cases where common land existed but were not planted is very high. Again, some of these may be explained by the fact that villagers preferred to leave them as grazing lands and not plant them up, but it is unlikely that the numbers are so large (90 MWSs). It shows that the watershed development programmes tend to de-emphasize common lands, and de-emphasize the question of fuel or fodder scarcity. This is reflected later on in the impact assessment, where only a minority of villages report improvements in fuel and fodder availability because of watershed development.

In terms of sector-specific interventions, only 7% cases reported that any specific efforts had been made to improve drinking water availability. Most of these were under the MoRD 1994 programmes or bilateral programmes.

Table 17. Whether plantations were taken up in common lands

Mode	Whether plantations were taken up on public lands		
	No	Yes	Total
MoRD Pre 1994	1	6	7
	14%	86%	100%
MORD 1994	113	53	166
	68%	32%	100%
MOA (NWDPRA)-1990	7	7	14
	50%	50%	100%
MOA (NWDPRA) 2000	1		1
	100%		100%
Bilateral	19	28	47
	40%	59.6%	100%
Sujala	5	14	19
	26%	73.7%	100%
DLDB	4	3	7
	57%	43%	100%
Total	150	111	261
	58%	42%	100%

5.3 Institutions

The earlier programmes (such as DLDB and pre-1994 MoRD) did not require the formation of village-level institutions such as watershed committees that would facilitate democratic decision-making about the watershed development programme. This requirement came in at different points in time depending upon which ministry's guidelines one looks at. And this difference is reflected in the fact that the majority of the MWSs (~80%) treated under the MoA's 1990 guidelines did not have WDCs formed in them (see Table 18). But what is surprising is that even when WDCs were mandated in the guidelines, they have not been formed in 22% of the post-1994 MoRD implementation cases (see row highlighted in red). On the other hand, the bilateral and multi-lateral programmes have been much more meticulous at least about formation of the WDCs. This shows up the MoRD programmes as being much less committed to institution building and democratic decision-making.

A further analysis of the post-1994 MoRD programmes alone reveals that the tendency to form WDCs is much higher where NGOs have been involved in the 'software' component (100%) as compared to where they were not involved (76%). This confirms the trend noticed above of process quality being higher with NGO participation.

Table 18. Formation of watershed development committees

Were they expected to form the WDC as a part of the project guidelines	Mode	Were watershed committees formed at all		
		Yes	No	Total
NO	MORD - Pre(1994) - DPAP, DDP, IWDP	5	2	7
		71%	28.6%	100%
	MOA (NWDPRA)- 1990	3	11	14
		21%	78.6%	100%
	Subtotal	8	13	21
		38%	61.9%	100%
YES	MORD 1994	130	36	166
		78%	21.7%	100%
	MOA (NWDPRA) 2000	0	1	1
		%	100%	100%
	Bilateral	43	4	47
		91.5%	8.5%	100%
	Sujala	19	0	19
		100%	%	100%
	DLDB	0	7	7
		%	100%	100%
	Subtotal	192	48	240
		80%	20%	100%

Table 19. Formation of SHGs

Were they expected to form SHGs as a part of programme design?	Mode	Formation of SHGs		
		Yes	No	Total
NO	MoRD Pre 1994	6	1	7
		86%	14%	100%
	MORD 1994	0	1	1
		0%	100%	100%
	MOA (NWDPRA)- 1990	4	10	14
		29%	71%	100%
	DLDB	0	7	7
		0%	100%	100%
	Subtotal	10	19	29
		35%	65%	100%
YES	MORD 1994	71	94	165
		43%	57%	100%
	MOA (NWDPRA) 2000	0	1	1
		0%	100%	100%
	Bilateral	39	8	47
		83%	17%	100%
	Sujala	19	0	19
		100%	0%	100%
	Subtotal	129	103	232
		56%	44%	100%

The formation of SHGs as part of the watershed development programme is a more recent trend—as Table 19 shows, in several programmes this was not part of the design itself. (It is a bit puzzling as to how then SHGs are reported to have been formed in some of these programmes—this may be mis-reporting of SHGs formed under some other programmes later on.) But even when SHG formation was made mandatory, we again find that in 57% of

MoRD (post-1994) projects, SHGs were reportedly not formed, as also in 100% of the MoA projects. Again, SHG formation is more meticulously followed in bilateral and multilateral programmes. Also, when one examines the MoRD post-1994 programmes alone, one finds that again NGO involvement in the software component makes a difference to SHG formation: the fraction of cases reporting SHG formation was much higher (88%) when NGOs were involved than when they were not involved (37%).[10]

Formation of area groups or user groups (organizations of a few farmers typically having lands around a particular structure like a check dam) was part of the design in only a few programmes: KAWAD, Sujala and MoA2000, and also in some of the other bilateral programmes such as ISPWDK. But it appears that in most cases such groups were not formed even when they were part of the guidelines (or the villagers consulted did not know about the formation of these groups). Such groups had been formed in only 27 cases, whereas the total cases of KAWAD, Sujala and MoA2000 in the sample are 45 and the total including all bilateral programmes is 67. This suggests that these particular organisations have not become a key component of watershed development even among those programmes that profess to use them.

5.4 Overall

It appears that, while in a majority of the cases the guidelines are largely followed, there are a substantial number of cases where there are deviations, particularly in community involvement and institution building. While the quality of the process and institutions built cannot be assessed, the fact that in so many cases the process did not even take place is worrisome. It is also noteworthy that, contrary to claims of NGO presence making no difference (Deshpande, 2008), the participation of NGOs in implementation seems to lead to greater attention to processes, at least at the level that we were able to assess, even in programmes which are not well-endowed with funds.

6. FINDINGS: STATUS OF STRUCTURES AND INSTITUTIONS AND CORRELATES

6.1 Soil and water conservation (SWC) structures

As was indicated in Table 14, the most common treatments or structures are check dams, nala bunds and field bunds, and farm ponds are one other treatment used in more recent programmes (Sujala, KAWAD, but also DDP). The overall status of check dams, nala bunds and farm ponds as reported by the villagers is given in Table 20.

Table 20. Overall status of major structures

Structures	No. of MWSs	No. of structures	Current status					
			Good		Average		Poor	
Check dams	216	1723	794	46%	435	25%	494	29%
Nala bunds	90	267	188	70%	57	21%	22	8%
Farm ponds	93	1641	1176	72%	361	22%	104	6%

As can be seen, the overall status of check dams is quite mixed, with only about 46% being in good condition.[11] Whereas the status of nala bunds and farm ponds is somewhat better, with about 70% being reported in good condition.[12]

[10] Chi-square test is significant.

[11] In our field verification, the label 'bad' was given to the CDs which are completely or 50% broken, water leakage, where stones in the apron are misplaced, there is heavy silt deposition, water flows through side walls, or there are major cracks in the main wall of the check dam.

[12] The results do not vary significantly whether one looks at reported data or data from physical verification.

Figure 3. An example of check dam in poor condition–in Maddihalli of Hiriyur taluk under NWDPRA programme

Figure 4. Example of breached check dam (Dongargaon village, Gulbarga district, DPAP programme)

Table 21. Percentage of check dams in good condition: by age

No. of years since the project has been completed	Mean percentage of check dams in good condition	Std. Deviation	N
-1	100	--	1
0	85	25	6
1	60	40	63
2	51	41	30
3	67	37	19
4	46	42	9
5	44	40	30
6	31	40	32
7	56	39	6
8	50	71	2
10	26	24	7
11	15	34	5
15	15	.	1
16	50	.	1
17	21	25	4
Total	50	41	216

Note: -1 refers to an ongoing project.

The variation in check dam condition was examined within our conceptual framework and found to correlate with age and possibly also influenced by the programme type. Firstly, it is clear that check dam condition deteriorates with age. A simple tabulation as in Table 21 indicates this trend, which is also plotted in Figure 6. This is verified by estimating the correlation coefficient, which is negative and significant at $p<0.001$.

Figure 5. Check dam in 'good' condition: Kalliguddi village, Belgaum district, DPAP programme

We then investigated whether there was also variation by programmes or modes, after allowing for age. Splitting the sample by programme type (MoRD versus foreign-funded programmes, which are the two largest sub-samples) and plotting the trend in check dam status over time suggests that there might be some effect of programme type: visually, it appears that MoRD check dams deteriorate somewhat more quickly (compare Figure 7 with Figure 8), but it is difficult to verify this result in statistical terms. Limiting the sample to a particular age group of say 2 years (2000 and 2001) resulted in a major reduction in sample size per mode, and then the modes made no significant difference to check dam condition. However, when we limited the sample to just those where implementation had been completed 1 year ago (in 2005), and compared the modes that had significant sample sizes, we get the result that is shown graphically in Figure 9—check dams in MoRD programmes show significant deterioration while those constructed in other programmes show less so, and this observation is supported by statistical tests at 0.05 level of significance for the two extremes (MoRD versus Sujala). Of course, the presence of NGOs could be an alternative potential explanatory variable (NGO presence leading to better implementation and therefore better check dam longevity) and it does turn out that 1-year old check dams built where NGO are PIAs are more robust than those built where GOs are PIAs. Further, the difference in check dam longevity between GO and NGO PIAs is apparent even for the entire sample, after factoring out the effect of age, although the significance is low and the effect of age is stronger than the effect of PIA.

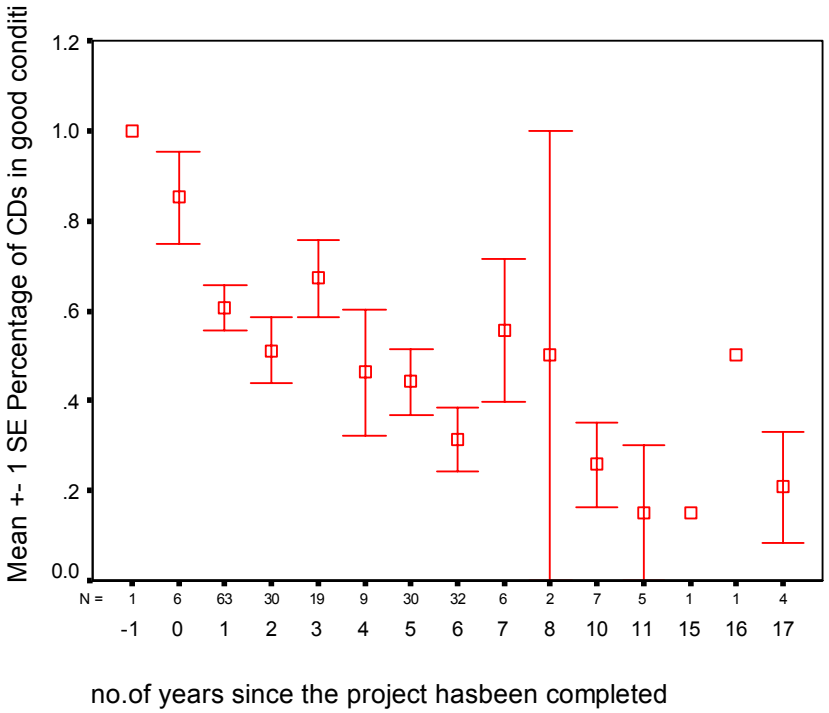

Figure 6. Trend in check dam condition w.r.t. years after completion -- all programmes

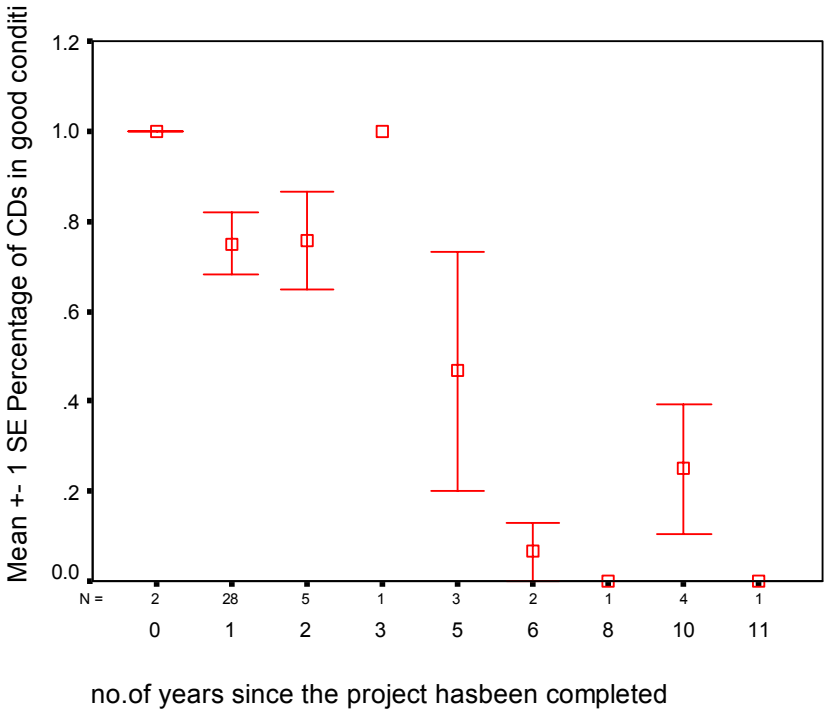

Figure 7. Trend: Foreign funded programmes

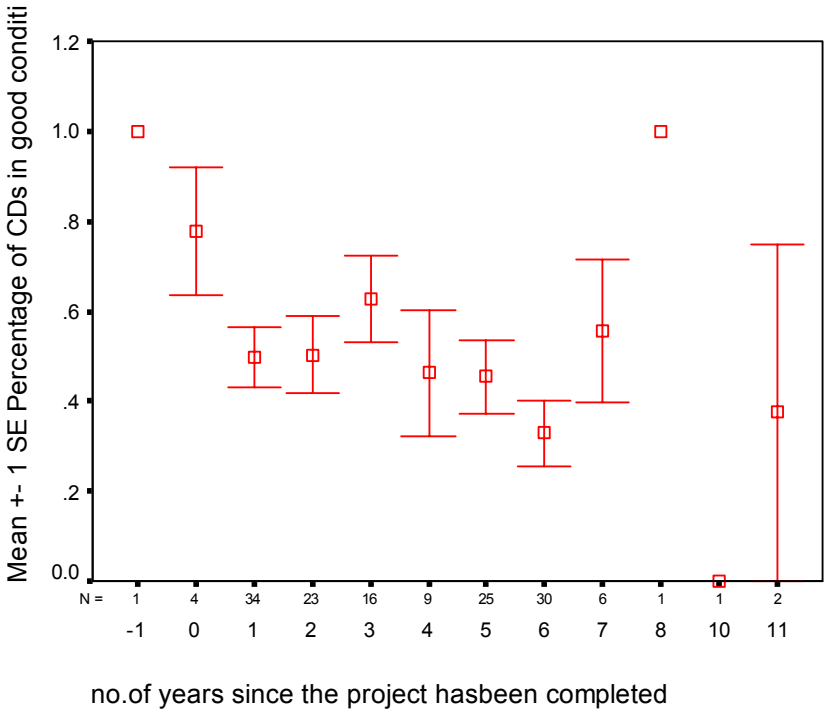

Figure 8. Trend: MoRD programmes

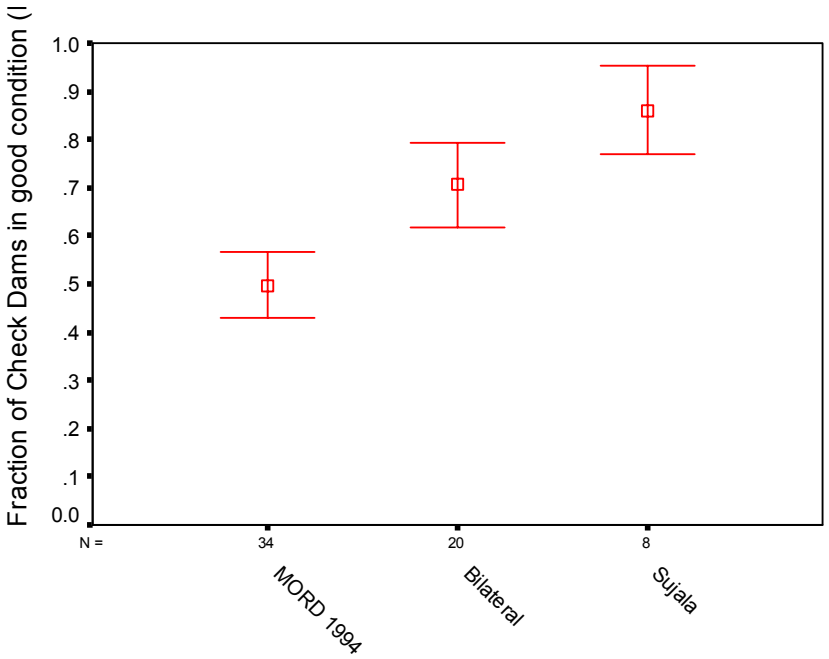

Figure 9. Check dam condition in one-year old MWSs only

For nala bunds, although the overall statistics show that around 30% are not in good condition, there is no correlation with age or PIA type or mode.

In the case of field bunds, since the bunds cover large areas, we sought to estimate current condition using a range variable (percentage of field bunds that are in good condition, i.e., not breached or washed away). The results are given in Table 22. While the samples are too small in some of the modes, the data suggest that the status of field bunds in MoRD is generally poorer in MoRD 1994 sites and also bilateral sites compared to Sujala sites. An age effect was ruled out by comparing sites of the same vintage as the Sujala sites, and still the Sujala sites performed better on this variable. Clearly, Sujala has invested more in the construction of better quality check dams. This was generally borne out by field observations.

Figure 10. Example of field bund in good condition (Alsoor village, Tumkur District, SUJALA programme)

Table 22. Status of field bunds in different modes

Mode	Current Status of Field Bunds				Total numbers of MWSs
	<25% are in good condition	25-50% are in good condition	50-75% are in good condition	>75% are in good condition	
MORD - Pre 1994	0 0%	0 0%	1 20%	4 80%	5 100%
MORD 1994	7 8%	28 31%	36 40%	19 21%	90 100%
MOA (NWDPRA) 1990	1 14%	2 29%	4 57%	0 0%	7 100%
Bilateral Agencies	1 3%	8 20%	11 27%	20 50%	40 100%
SUJALA	0 0%	1 6%	4 25%	11 69%	16 100%
DLDB	2 40%	2 40%	1 20%	0 0%	5 100%
Total	11 7%	41 25%	57 35%	54 33%	163 100%

In the case of farm ponds, which is the second major farm-level treatment, the fraction that is reported to be in good condition is around 64%. There seems to be some difference

between modes: the percentage in Sujala is higher at ~75% whereas that in MoRD 1994 is ~56% (the difference being statistically significant at $p<0.10$).

Figure 11. Example of farm pond in good condition (Virupakshapura village, Tumkur district, IWDP programme)

Figure 12. Example of farm pond in poor condition (Guttala village, Haveri district, SUJALA programme)

6.2 Plantations on public lands

The condition of common land plantations is much poorer than that of most structures. Mean survival of plantations on public lands is only around 25%. There is no statistically significant variation in this indicator by age, PIA type or mode. Note that this is on top of the fact that there is very poor coverage of common lands under the plantations in the first place.

Figure 13. Rare example of good survival of plantation on common land: Dyapenahalli village, Tumkur District, IWDP programme

Our analysis showed that the survival is related to the arrangements made for protection: those that had some protection arrangements averaged 51% survival whereas those that had no protection averaged 17% survival. And unfortunately, MWSs in the latter category (with no protection) were the majority in the sample (77 against 34). In the few cases where protection is taking place, it is being done either by the WDC or the forest department. There is a distinct correlation between cases where WDCs are functioning and where public land plantations are getting taken care of by the WDC.

6.3 Watershed Committees

The WDCs formed during the implementation of watershed development programmes are supposed to continue to function as the main village-level body that will oversee the various activities that continue after the project period, including maintenance of structures, regulation of common lands, support for SHGs, and so on, and also initiate new activities for village development if necessary. What is the current status of WDCs formed during the implementation of various programmes (where they were formed at all—see section 5.3 above)?

Overall, for the set of 200 MWSs where WDCs were formed initially, only 23% were functioning at the time of the assessment Table 23. And, as one would expect, the older WDCs are less likely to survive than recently formed ones: notwithstanding the scatter seen in Figure 14, one finds the regression with starting year weak but significant at $p<0.1$. But it is also interesting to note that some WDCs in 1994 or 1996 are still functioning today at some level.

Table 23. Status of watershed committees: overall

WDC functioning today?	N	Percent	Valid Percent
No	154	59%	77%
Yes	46	18%	23%
Total	200	77%	100%
Not formed at all	61	23%	
Total	261	100%	

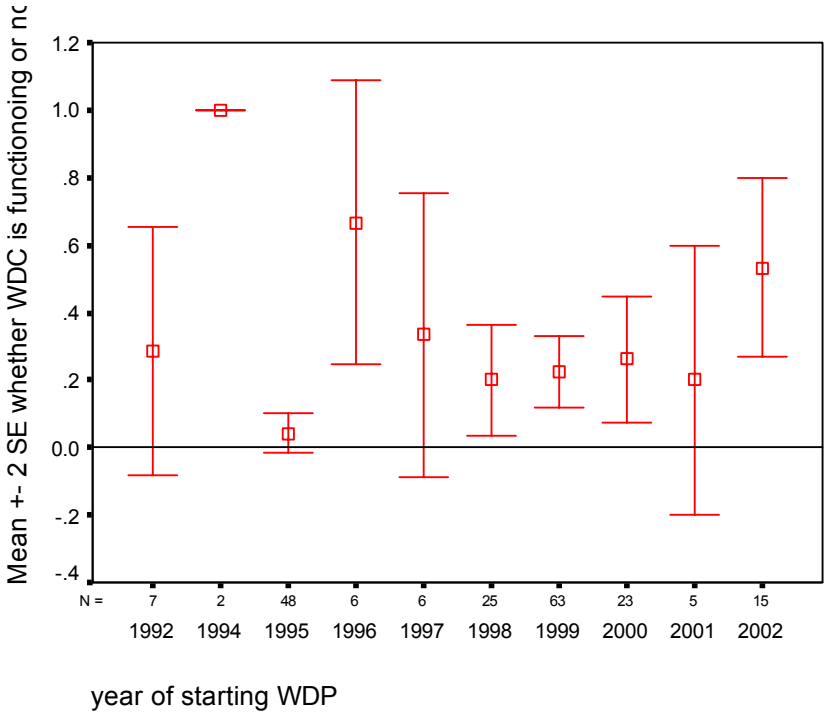

Figure 14. Status of WDCs with age

The tendency to decline over time becomes more sharply visible when one restricts oneself to the 3 modes that contribute the maximum number of cases, viz., MoRD-1994, bilateral and multilateral programmes.[13]

At the same time, over and above the effect of age, one sees an effect of mode: the survival of WDCs created under the MoRD-1994 mode is much poorer (9%) than that of WDCs created under bilateral and multi-lateral programmes (46%-47%), and this effect is significant even after allowing for age.[14] Alternatively, if one uses "whether NGO did software component or not" as the independent variable (in addition to starting year), one finds this variable also significant. Similarly, one finds that if entry-point activities were conducted, the chances of WDC surviving are much higher than if these activities were not carried out. However, Since carrying out of entry-point activities, PIA type, and the modes are correlated (bilateral and multi-lateral agencies used NGOs much more than MoRD1994 did on the whole, and NGOs as PIAs are more likely to carry out entry-point activities), it is not clear whether it is NGO involvement as such or some other attributes of the bilateral/multi-lateral

[13] The r-square increases, the regression coefficient increases, and p-value becomes more significant ($p<0.001$).

[14] In a multiple regression analysis, where starting year and mode are both given as independent variables, both coefficients come highly significant.

programmes that make the WDCs last somewhat longer. Note, however, that even in bilateral/multilateral cases, the survival rate of WDCs is still less than 50%.

The activities carried out by surviving WDCs are varied. Only 30% of the surviving WDCs were reported as carrying out maintenance of check dams constructed under the watershed development programme. A similar fraction of WDCs were involved in some activities related to helping the SHGs. Very few of them were involved in protection of public plantations.

6.4 Status of Self-Help Groups and Area Groups

As can be seen from Table 24, the majority (73%) of the villages where SHGs were formed still have some SHG functioning. The proportion is similar if one simply takes aggregate numbers of SHGs functioning in aggregate of SHGs formed. This is a healthier proportion than that of functioning WDCs. There is no significant correlation with age—older SHGs are as likely to be functioning as newer ones. But there is a significant difference across modes: SHGs formed in MoRD1994 programmes are less likely to be functioning than those formed under bilateral and multilateral programmes.

Table 24. Status of SHGs formed

Mode	Whether any of the formed SHGs are functioning in the village		Total
	Yes	No	
MORD Pre-1994	6	0	6
	100%	0%	100%
MORD 1994	42	29	71
	59%	41%	100%
MOA 1990	4	0	4
	100%	0%	100%
Bilateral	33	6	39
	84.6%	15%	100%
Sujala	17	2	19
	90%	10%	100%
Total	102	37	139
	73%	26.6%	100%

As mentioned above, this could be because of NGO involvement or because of other features of the bilateral/multilateral modes. An examination of the percentage of villages reporting some SHG functioning by PIA type and by whether NGO was involved in software component indicates that there is some positive influence of NGO as PIA type, and even more clearly of NGO involvement in software component, but the effect of the bilateral/multi-lateral modes is stronger than just that of NGO involvement,[15] suggesting that perhaps there is an influence of some design factors other than just NGO involvement on SHG longevity.

It should be noted that many SHGs were involved in more than just savings and credit. A number of SHGs reported being involved in a variety of activities related to marketing, petty trade, tailoring and other livelihood activities, etc. But there is no link between the SHG functioning and the functioning of the WDCs or the maintenance of structures/regulation of common lands.

Given the small number of area groups formed (see section 5.3), we have not analysed their status in this report.

[15] Chi-square test is significant in both cases.

7. FINDINGS: PERCEIVED IMPACTS

The expected impacts of watershed development can be classified: improvements in agriculture, improvements in resources for subsistence (fuelwood, fodder and drinking water) and improvements in other livelihood activities (wage employment and credit). We present these analyses for these broad categories of impact, as perceived by the villagers, in this section, to the extent that the data permit us to do so.

7.1 Perceived Impact on agriculture

The major aim of watershed development (as currently implemented) is clearly to increase the returns from agriculture to the farmers in the watershed. This can happen through increases in productivity of existing rainfed crops, expansion in cultivated area (as uncultivable land is treated and becomes cultivable) and expansion in irrigated area as increased groundwater recharge leads to greater water availability. The analysis of the villagers' perceptions about such impacts is presented in this section.

In the rapid assessment methodology, we were unable to collect data on whether farmers perceived increased productivity of the same rainfed crop. So we focused the analysis on perceptions about increases in cultivated area and in irrigated area, and soil moisture.

Table 25. Perception of change in total cultivated area

Mode	Whether there is any change in cultivated area		Total
	No change	Increased	
MORD Pre-1994	3	4	7
	42.9%	57%	100%
MORD 1994	131	35	166
	78.9%	21%	100%
MOA 1990	9	5	14
	64%	35.7%	100%
MOA 2000	1	0	1
	100%	%	100%
Bilateral	17	30	47
	36%	63.8%	100%
Sujala	14	5	19
	73.7%	26%	100%
DLDB	5	2	7
	71%	28.6%	100%
Total	180	81	261
	69%	31%	100%

The overall percentage of villages reporting an increase in cultivated area is 31%, but the percentage is much higher in bilateral programmes than in any other mode that has significant numbers in the sample. This is explained by the fact that the bilateral mode is dominated by cases from the KAWAD programme, and this programme had an explicit component on land levelling, boulder removal and other land reclamation activities.

Table 26. Perception of increase in irrigated area

MODE	Perceived change in Irrigated Area		Total
	No change	Increased	
MoRD Pre 1994	2	5	7
	28.6%	71%	100%
MORD 1994	120	46	166
	72%	27.7%	100%
MOA (NWDPRA)-1990	9	5	14
	64%	35.7%	100%
MOA (NWDPRA) 2000	1	0	1
	100%	%	100%
Bilateral	26	21	47
	55%	44.7%	100%
SUJALA	8	11	19
	42%	57.9%	100%
DLDB	4	3	7
	57%	42.9%	100%
TOTAL	170	91	261
	65%	34.9%	100%

In the case of expansion in irrigated area, 35% of the villages reported some expansion. There is no significant variation in this perception across the agro-climatic zones, but there is variation across modes. The percentage is higher for bilateral, Sujala, and also MoA1990 cases, as compared to MoRD1994, where it is only 28%. This correlates well with earlier observations about MoRD1994 programmes having lower longevity of structures and poorer performance on other process and status variables.

It is interesting that the perception of an increase in cultivated area is correlated significantly ($r=0.4$, $p<0.001$) with the perception of an increase in irrigated area. This suggests that while there may be programmatic differences, the successfully implemented watershed projects generate gains on both fronts.

A comparison of households benefited from soil moisture increase as against irrigation increase (based on villager perceptions) is quite revealing. As a fraction of total households in the village, the median value for soil moisture beneficiaries is 15% whereas that for irrigated area beneficiaries is 1% (across all modes). This highlights the relatively widespread of benefits from on-farm treatments versus the narrowly distributed benefits from irrigation increases. Thus, modes that focus on on-farm treatments and successfully carry them out have a broader distribution of benefits: the fraction of soil moisture beneficiaries is higher for Sujala, bilateral and (surprisingly) MoRD pre-1994 sites (median ~42%-55%) as compared to MoRD 1994 or MoA 1990 sites (median 3% to 10%).

7.2 Perceived impacts on fuelwood, fodder and drinking water

The villages reporting increases in fuelwood availability were very few: only 10% overall. This is not surprising, given the failure of public land plantations reported in the previous section. Even where increases in fuel availability are reported, in many cases these are due to the spread of *Prosopis* (locally called *Bellary jaali*) rather than any explicit efforts from the watershed development programme. This is reconfirmed by the fact that there is no correlation between survival of public plantations and the perception of increase in fuelwood availability.

Villages reporting increases in fodder availability were more, about 33%. Where such an increase was reported, the respondents identified two main reasons for how this increased had taken place: general increases in soil moisture resulting in greater grass growth in fields and on field bunds, and specific grass seed and sod distribution by the implementing agency. It also appears that the overall increases in irrigated agriculture and cultivated areas play a role: villages reporting increases in fodder availability are correlated with those reporting increases in cultivated or irrigated area (correlations are weak but significant at $p<0.01$ in both cases).

Interestingly, although not many sites had reported specific efforts being made for drinking water enhancement, 21% of the cases report a perception of improvement in drinking water availability. And this perception is significantly higher in the bilateral programme sites (40%). The reasons for this higher percentage of perception are not clear.

8. SUMMARY AND CONCLUDING REMARKS

This large-scale rapid assessment of watershed development programmes implemented in Karnataka has generated some clear cut overall findings. First, the implementation of the programmes themselves often deviates from the guidelines laid out for them. The deviations in the physical interventions are somewhat random—some sites get due attention while others don't. But the non-implementation or limited area implementation of public land revegetation in a large number of sites is striking. And the biggest failure in the implementation process is on the community mobilisation, consultation and institution-building front: consultation is often inadequate, mandatory committees are not created or created only perfunctorily.

Second, the interventions generally don't last or sustain. On the physical side, a significant fraction of check dams crack within the first year after the project is completed, and more than 50% are no longer in 'good' condition within 3 years after completion. The plantations on public lands almost invariably fail. And the institutional interventions vary quite a bit in their longevity. Those that are less related to watershed development per se (SHGs in particular) have continued to function, but those meant to maintain structures or regulate common land management do not survive and therefore do not perform these functions in the long run.

Third, the perceived impacts of watershed development are on the lower side. A majority of villages apparently do not perceive even limited agricultural gains that have been the focus of most of the interventions. Where there is a perception of gains, it is also clear that the substantial gains (from increased irrigation) are limited to a very small fraction of the village community, while only those programmes that provide for widespread area treatments are perceived as benefiting a large fraction (albeit less than 50%) of the population. Impacts on other fronts are even less common, although the potential to alleviate certain resource shortages (such as fodder) is apparent.

Within this overall picture, there are also significant variations across modes, programmes and programme implementing agencies on several counts. Overall, the attention to process has been better in NGO-implemented programmes, regardless of the guidelines. But certain programmes also clearly ensure more attention to process, viz., the bilaterally and multi-laterally funded programmes. Entry-point activities are more systematically implemented in NGO-implemented and donor driven programmes, and this has some influence on the longevity of Watershed Development Committees. However, all of this does not necessarily translate into better quality structures. While 1-year old check dams in these (bilateral/multilateral) programmes are on an average in better condition than those in MoRD programmes, check dams that are a few years older seem to have deteriorated to similar levels. However, some specific measures, such as the land reclamation measures in

KAWAD, appear to have achieved their objectives. Similarly, the attention to area treatments in these programmes (especially Sujala and KAWAD) has resulted in structures such as field bunds and farm ponds that have a lower failure rate as well as wider reach than big structures such as check dams.

And overall, bilateral and multi-lateral programmes do perform better in terms of perceived agricultural impacts, although the perception of improvement is still only in around 50% cases. On the other hand, there are hardly any improvements in fuel availability across programmes, and only 30% cases report some improvement in the fodder situation, largely as a side-effect of agricultural change (and therefore likely to be limited to the farmers only, not benefiting the pastoralists).

What does this imply for watershed development policy in the state and in general? Clearly, much greater attention to process as well as to the quality and maintenance of structures is required. If the better-funded programmes are generating better results, it may be necessary to invest greater funds into the mainstream (MoRD and MoA) programmes. But without the attention to process, quality and broad-based interventions, the benefits will be limited in their magnitude, distribution and sustainability.

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