COMMUNITY WATERSHEDS FOR IMPROVED LIVELIHOODS THROUGH CONSORTIUM APPROACH IN DROUGHT PRONE RAINFED AREAS

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ABSTRACT *Rainfed agriculture is important globally (80%)) with varying regional importance (95% in sub-saharan Africa and 60% of the farmed land in South Asia) and is also the hotspot of poverty, hunger, and water stress. Occurrence of droughts is a common feature and the frequency of droughts is expected to increase due to prevailing climate change. Watershed development is adopted as a drought proofing strategy for improving livelihoods. Watershed development approach has evolved from a compartmental approach of conserving soil and water to a holistic and participatory livelihoods approach. The new approach calls for inputs from various institutions and actors for greater impact. ICRISAT-led Consortium has developed an innovative community watershed management model involving participatory research and development. This approach developed in Adarsha Watershed, Kothapally in India and further scaled out in 368 watersheds in India, China, Philippines, Thailand and Vietnam has showed multiple impacts by increasing crop productivity by 2 to 4 folds, doubling the family incomes, enhancing biodiversity, enhancing community resilience to cope with changes including due to climate change, reducing run-off and soil losses, building institutions and developing local capacity. ICRISAT's experiences and learnings about community scale watershed management through Consortium are discussed.*

***Key words*:** Rainfed agriculture, drought, community watershed, consortium approach

INTRODUCTION

Management of natural resources in dry land areas is very important not only because livelihoods of millions of rural poor (>500 million) are directly connected to these areas but also due to the fact that these areas will continue to play a crucial role in determining food security for growing population and reducing poverty in the coming decades (Rockström et al., 2007). Enhancing efficiency and

sustainability of natural resource management (NRM) projects in these areas has been the challenge faced by all the concerned stakeholders.

In the beginning watershed development in rainfed areas had become synonymous to soil and water conservation by putting up field bunds and structures to harvest runoff (Singh, 1998 Wani et al, 2002). The approach was target oriented, top down, techno-centric, compartmental and involved one or two government departments without much coordination and involvement of stakeholders. Hence, such efforts did not make headway in impacting livelihoods of the rural poor in the rainfed areas (Farrington and Lobo, 1997; Kerr, 2001; Dixit et al, 2001; Wani, 2002; Kerr and Chung, 2005; Shah, 2007. Learning from such experiences, in the later stages watershed management in rainfed areas has been attempted by various watershed development programs implemented through different agencies such as Government departments, non governmental organizations (NGOs), and research institutions.

Watersheds are not only hydrological units but provide life support to rural people making people and animals integral parts of watersheds. Activities of people/animals affect the productive status of watersheds and *vice versa*. Currently there is a vicious cycle of 'poverty – poor management of land (soil and water) and crop – poor soils and crop productivity – poverty' in operation in most of the watersheds in rainfed areas. This results in a strong nexus between drought, land degradation and poverty. Appreciating this fact, the new generation of watershed development program is implemented with a larger aim to address problems such as food security, equity, poverty, gender, severe land degradation and water scarcity in dry land areas. Hence in the new approach, watershed, a land unit to manage water resources has been adopted as a planning unit to manage total natural resources of the area been looking beyond soil and water conservation into a range of activities from productivity enhancement through interventions in agriculture, horticulture, animal husbandry to livelihoods, community organization and gender equity (Wani et al, 2002; APRLP, 2007; NRAA, 2008). This holistic approach required optimal contribution from different disciplinary backgrounds creating a demand for multi-stakeholder situation in watershed development programs.

During 1990's there has been a paradigm shift in the thinking of policy makers based on the learning's of earlier programs. In India, watershed programs are silently revolutionizing rainfed areas (Joshi et al., 2005; Wani et al., 2006, 2008). Till 2006, up to 10^{th} five year plan, about US $ 6 billion have been invested by Government of India and other donor agencies treating 38 million ha in the country (Wani et al., 2008). During detailed evaluation of on-farm watershed programs implemented in the country, ICRISAT team observed that once the project team withdrew from the villages the farmers reverted back to their earlier practices and very few components of the improved soil, water and nutrient management options were adopted and continued. Although, economic benefits of improved technologies were observed in on-farm experiments, adoption rates were quite low. The farmers continued individual component technologies such as summer ploughing, improved crop varieties and intercropping. However, soil and water conservation technologies were not much favored (Wani et al., 2002).

Importance of making local communities to participate in watershed programs to enhance efficiency and sustainability has been widely acknowledged (Samra et al., 2000; Kerr et al., 2000; Wani et al., 2002; Joshi et al., 2004). As a result, through a series of policies and guidelines, responsibilities have been shifted more towards local communities. Detailed meta-analysis of 311 watershed case studies from different agro-eco regions in India (Joshi et al., 2005) and subsequent meta-analysis of 656 watershed case studies across different agro-ecoregions including the North-eastern India revealed that watershed programs benefited farmers through enhanced irrigated areas by 52%, increased cropping intensity by 35.5%, reducing soil loss to 1.1 t ha^{-1} and runoff to 45.7%, of rainfall and improved groundwater availability. Economically, the watershed programs were beneficial and viable with a benefit – cost ratio of 1: 2.01 with the internal rate of return of 27.4% (Joshi et al., 2008). However, about 65% of the case studies showed below average performance (Figure 1). Based on the learning from the meta-analysis of 311 case studies and earlier on-farm watersheds study the authors developed and evaluated an innovative farmers participatory integrated watershed consortium model (Wani et al., 2003). True to their words, villagers showed the benefits in terms of doubling their crop productivity (Table 1). But achieving participation of primary stakeholders has not been easy. One of the major learning's over a period of time has been that, unless there is some tangible economic benefit for the community, people's participation does not come forth (Olson, 1971; Wani et al., 2002). To achieve enhanced community participation through tangible benefits and impact, it is necessary that different agencies such as research centers, Government line departments, training institutions, community-based organizations (CBOs), and NGOs come together and share their expertise in a complementary way through convergence of approaches, actors and actions (Figure 2).

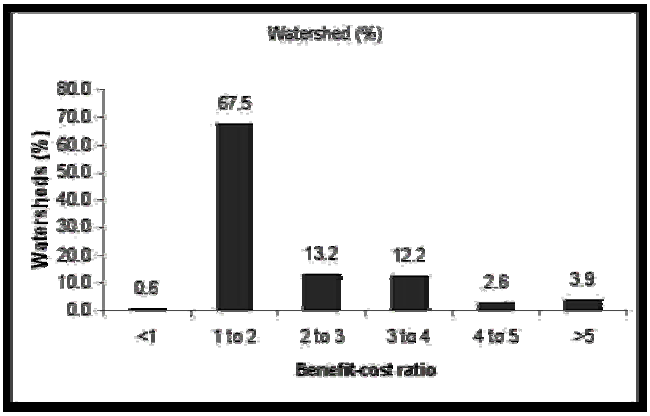

Fig. 1 Performance of different watersheds analyzed during meta analysis, with regards to BC ratio

Table 1 Benefits of watersheds-summary of meta-analysis of 636 case studies in India.

Indicator	Particulars	Unit	No. of studies	Mean	Minimum	Maximum	t-value
Efficiency	B:C ratio	Ratio	311	2.01	0.82	7.30	35.09
	IRR	%	162	27.43	2.03	102.70	21.75
Equity	Employment	Person days ha-1 yr-1	99	154.53	0.05	900.00	8.13
Sustainability	Increase in irrigated area	%	93	51.55	1.28	204.00	10.94
	Increase in cropping intensity	%	339	35.51	3.00	283.00	14.96
	Runoff reduced	%	83	45.72	0.38	96.00	9.36
	Soil loss saved	t ha-1 yr-1	72	1.12	0.11	2.05	47.21

Source: Joshi et al. 2008

Fig. 2 A pictorial representation of different partners in the Adarsha Watershed Consortium

These different watershed implementing agencies had varied degrees of success due to their strengths and weaknesses in different areas. For example, the NGOs are generally action oriented field level agencies with their inbuilt strengths in community organization but in majority of the cases, lack technical competencies in

development and management of natural resources. They depend heavily on technical resource agencies that have their compartmental specializations in specific areas for building capacities of their own staff and community members involved in NRM affecting their performance in implementing watershed programs due to lack of holistic approach in technical support. On the other hand, research organizations usually work at the individual farm level, with narrow disciplinary focus and biophysical scientists often have limited experience in the dynamics of forming the collective action groups that is essential for water-based activities. However, with the approach of ultra disciplinary specialization (reductionist approach), lack of professional reward mechanisms in the research institutions for interdisciplinary work, and disciplinary hierarchy, scientists are more comfortable to work in their own area of specialization rather than working in multidisciplinary teams. In projects that have been led by research centers, researchers seem to document results and findings mainly for the biophysical sector overlooking social aspects (Gündel et al., 2001). Government departments have their strengths in specific technical competencies and wider reach but lack convergence skills in social organization and interdepartmental cooperation. Traditionally, the Central and State governments adopted supply driven, target based top down watershed development approach that did not match the needs of stakeholders in the watershed (Kerr et al., 2000; Joshi et al., 2004). The programs implemented by these departments failed to achieve desired results due to compartmental approach in implementation and lack of community participation (Farrington and Lobo, 1997; Kerr and Chung, 2001; Wani et al., 2002; Joshi et al., 2004). This situation has strongly supported the idea of different agencies coming together to support watershed programs.

But bringing together organisations with different strengths, weaknesses and styles of functioning on a common platform to work together for a common cause is challenging. ICRISAT accepted the challenge and successfully evolved an up-scalable model termed 'the Consortium Approach' in the Asian Development Bank (ADB) supported watershed development programme at Kothapally in Rangareddy district of Andhra Pradesh (Wani et al., 2003). The success has been scaled up to many areas henceforth. The authors elucidate the process of evolution and associated learning's in this paper.

EVOLUTION OF THE CONSORTIUM APPROACH

ICRISAT was one of the earliest CG centres to give formal recognition in its mandate to supplement research on individual crops with research into farming systems. Watershed-based research was an example of interdisciplinary research even before the term assumed significance (Shambu Prasad et al., 2005, 2006). This interdisciplinary research, over the years, has shaped up into an Integrated Genetic Natural Resources Management (IGNRM) approach within ICRISAT (Twomlow et al., 2006). But in the beginning, ICRISAT also faced the problems of hierarchy of disciplines among scientists who were working together. After realising the importance and potential of combining disciplinary expertises in a complimentary way such issues were sorted out which gave rise to the idea of the Consortium

Approach based on the success of multi-disciplinary approach at the research station.

The Consortium is a convergence of agencies/actors/stakeholders that have a significant role to play in watershed development project. Facilitated by a leader/leading organization, member-organizations prepare common plans and work towards achieving the agreed common objectives. ICRISAT has been involved in an intensive on-station watershed development work for about 25 years before the new approach was adopted. After witnessing the quality work and its results, many agencies have approached ICRISAT for sharing of knowledge/ technology in their areas. After a series of deliberations within the Institute, decision was taken to support Bhartiya Agro-Industries Foundation (BAIF), a prominent NGO, through technical advice in their watershed programmes in Madhya Pradesh during the year 1997. Though it was restricted, in the beginning, to on-farm demonstrations, this experience of working with a voluntary organisation helped significantly in strengthening the idea of the Consortium Approach. ICRISAT is a premier research institution holding the implicit responsibility to give guidance in the right direction to other national and regional agencies. There has been a strong feeling within its scientific communities after years of deliberations in various forums that the target of IGNRM research is not just the farmers or the NARSs researchers but changing the thinking of actors in the system. This gave motivation to try to this challenging approach.

During the year 1999, ADB came forward to support ICRISAT's idea of testing the consortium model in a watershed in Kothapally village of Rangareddy district in Andhra Pradesh, called Adarsha (meaning model) watershed to minimize the gap between research findings and on-farm development. Secondly, the purpose was also to adopt the learning loop in planning of strategic research based on the participatory research and development (PR&D). There was also a request from the Government of Andhra Pradesh to demonstrate the benefits of increasing crop productivity substantially through watershed approach in the rainfed areas under farmer's situation.

For this model, relevant organizations viz; ICRISAT, M Venkatarangiah Foundation (MVF), an NGO, Central Research Institute for Dryland Agriculture (CRIDA), National Remote Sensing Agency (NRSA), Drought Prone Areas Program (DPAP) which is now called as District Water Management Agency (DWMA), Rangareddy district administration of government of Andhra Pradesh along with farmers of the watershed formed the consortium (Figure 2, Wani et al., 2003).

The first success of the new approach was evident when more number of farmers came forward in second season to undertake participatory evaluation of technologies as except knowledge farmers had to pay for the inputs in cash or kind. The tangible economic benefits due to increase in crop yields two to three folds attracted the farmers (Table 2). During second year, people from surrounding four villages of Kothapally came to ICRISAT and asked for the technical help promising that they will show similar/ better results than Kothapally in shorter period indicating self replication of the approach due to tangible benefits. ICRISAT and

DWMA of Rangareddy district decided to provide technical support and necessary inputs on cost basis to these four villages. The farmers recorded increased crop yields by 1.5 to three folds (Table 3). The model has become a success story and henceforth the model has been suitably adapted and scaled-up in many locations.

Table 2 Crop yields in Adarsha watershed Kothapally during 1999-2006.

Crop	1998 base-line yield	Yield (kg ha^{-1})									
		1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	Average yields	SE±
Sole maize	1500	3250	3750	3300	3480	3921	3420	3918	3635	3644	283.3
Inter cropped maize with pigeonpea	-	2700	2790	2800	3083	3129	2950	3362	3180	3029	263.0
(Traditional)	-	700	1600	1600	1800	1950	2025	2275	2150	1785	115.6
Inter cropped pigeonpea	190	640	940	800	720	949	680	925	970	861	120.3
(Traditional)		200	180	-	-	-	-	-	-	190	-
Sole Sorghum	-	3050	3170	2600	2425	2288	2325	2250	2085	2530	164.0
(Traditional)	1070	1070	1011	938	910	952	1025	1083	995	996	120.7
Inter crop Sorghum	-	1770	1940	2200	-	2109	1980	1958	1850	1971	206.0

Table 3 Results from evaluation of yields of 98 farmers' from four villages around Kothapally during the year 2001

Cropping system	Farmers' practice (kg ha^{-1})	Improved practice (improved seed + management) (kg ha^{-1})
Maize/ pigeon pea		
Maize	1900	4365
Pigeonpea	350	1130
Sorghum/pigeon pea		
Sorghum	1200	2725
Pigeonpea	330	1185
Maize/chick pea		
Maize	2200	4800
Chickpea	650	1085

Knowledge-Based Entry Point Activity (EPA)

During the process of scaling-out of the consortium model for Andhra Pradesh Rural Livelihoods Program (APRLP) of Government of Andhra Pradesh (A.P) supported by the Department of International Development (DFID, U.K), in the states of Rajasthan, Madhya Pradesh, Gujarat and Karnataka, supported by Sir Dorabji Tata Trust, Mumbai, the Asian Development Bank (ADB) Manila, Philippines, Sujala Watershed (Program of Government of Karnataka supported by World Bank) baseline characterization of soils was used in watersheds as a knowledge-based entry point activity. Analysis of 15600 soil samples from the farmers fields in different states of India revealed that soils in the tropics were not only thirsty but hungry also particularly for micronutrients like zinc, boron and secondary nutrients like sulphur along with macronutrients like N and P (Table 4). Eighty and 100% farmers' fields in several states of India were found critically deficient in Zn, and B.

Table 4 Percentage of farmers' fields deficient in soil nutrients in different states of India.

State	No. of farmers' fields	Org.C %	Av.P	K	S	B	Zn
			Mg kg^{-1} soil				
Andhra Pradesh	1927	84	39	12	87	88	81
Karnataka	1260	58	49	18	85	76	72
Madhya Pradesh	73	9	86	1	96	65	93
Rajasthan	179	22	40	9	64	43	24
Gujarat	82	12	60	10	46	100	82
Tamilnadu	119	57	51	24	71	89	61
Kerala	28	11	21	7	96	100	18

Participatory Research and Development (PR&D)

Subsequent trials in 50 micro watersheds in Andhra Pradesh with amendments of Zn, B and S showed increased yields by 30-174% for maize, 35-270% for sorghum, 28–179% for groundnut, 72–242% for pearl millet and 97-204% for pigeon pea, (Table 5 and 6), (Rego et al., 2007). Farmer's participatory selection of improved crop cultivars in 150 micro watersheds of APRLP in five districts resulted in identification of improved cultivars of sorghum, pearl millet, maize, castor, green gram, groundnut, pigeon pea and chickpea.

Best-Bet Options for Productivity Enhancement

For vulnerable group members such as landless, small farmers, women and other IGAs such as nursery raising, biopesticide production, vermicomposting, poultry and sheep rearing, etc., were undertaken through SHGs. During 2004, 255 farmers' participatory evaluation trials with improved cultivars of castor, maize,

groundnut, sorghum and chickpea along with improved nutrient management showed 41-70 percent increased crop yields over the farmers management practice (Table 7).

Table 5 Micronutrient amendments increased crop productivity in 50 watersheds in three districts of Andhra Pradesh, 2002.

Crop	Average grain yield (kg ha^{-1}) control	Average grain yield (kg ha^{-1}) MN treatment*	% increase over control grain
Maize	2800	4560	79
Greengram	770	1110	51
Castor	470	760	61
Groundnut pod	1430	1825	28

* Micronutrients applied: Boron (0.5 kg ha^{-1}), Sulphur (30 kg ha^{-1}) and Zinc (10 kg ha^{-1})

Table 6 Micronutrient amendments along with recommended macro-nutrients doses increased crop productivity in 50 nucleus watersheds in Andhra Pradesh, 2003.

	Treatment					
	Yield (kg ha^{-1})					
Crop	Control (C)	Sulphur (S)	Boron (B)	Zinc (Zn)	C+SBZn	C+NP+ SBZn
Maize	2790	3510 (26)*	3710 (33)	3710 (33)	4140 (49)	4890 (75)
Groundnut	830	930 (12)	1000 (20)	1060 (27)	1230 (48)	1490 (78)
Mungbean	900	1210 (33)	1130 (24)	1320 (46)	1390 (54)	1540 (70)
Sorghum	900	1190 (32)	1160 (29)	1330 (47)	1460 (62)	1970 (119)

* % increase over control

Table 7 Farmers' participatory evaluations for productivity enhancements in watersheds of 5 districts of Andhra Pradesh under APRLP during 2002-2004.

District	Watershed villages	Crop	No. of Trials	Cultivars	Yield (kg ha^{-1}) FM	Best bet	Yield gain (%)
Kurnool, Nalgonda Mahabubnagar	17	Castor	41	Kranthi	780	1240	59
Mahabubnagar Nalgonda	22	Maize	40	Ratna 2232	2770	4510	63
Kurnool	13	Groundnut/ Pigeonpea	53	ICGS 76 ICGV 86590	775	1320	70
Kurnool	19	Sole groundnut	52	ICGS 76 ICGV 86590	1075	1605	49
Kurnool	2	Chickpea	34	ICCV 37	1370	1930	41
Anantapur	19	Sole groundnut	35	ICGS 76 ICGV 86590	770	1100	43

In 208 watersheds in Asia, yields of several crops increased by 30 to 242% over baseline yields varying from 500 to 1500 kg ha^{-1}. Recently under the World Bank aided Sujala-ICRISAT initiative in 22 villages in five districts of Karnataka, 232 on-farm PR&D trials showed increased crop productivity by 56–148% with groundnut, maize, finger millet, sunflower etc. (Table 8).

In northern Vietnam watersheds, from maize-based systems farmers diversified their systems with groundnut and vegetables resulting in increased productivity as well as income (Table 9). Inclusion of groundnut and legumes reduced chemical N fertilizer for maize and also increased yield by 18%.

In Tad Fa and Wang Chai watersheds of Thailand, farm incomes increased by 45% within three years. Average net income is now $1,195 per cropping season. Lucheba watershed in Guizhou, China, transformed its economy through crop-livestock integration with buckwheat as an alley crop that controlled soil erosion, provided fodder and increased per capita income from $200 to $325 in two years. Improved soil, water, nutrient and crop management options reduced runoff and soil loss in the nucleus micro watersheds in the four countries (Table 10).

Table 8 Farmers' participatory evaluations for productivity enhancements in watersheds of

District	Watershed villages	Crop	No. of trials	Cultivars	Yield (kg/ha) FM[(a)]	Best bet
Kolar & Tumkur	7	Groundnut	63	JL 24, ICGV 91114, K1375, K6	915	2260
Kolar & Tumkur	9	Finger Millet	62	MR 1, L 5, GPU 28	1154	1934
Chitradurga	2	Sunflower	30	KBSH-41, KBSH-44, GK 2002	760	2265
Chitradurga & Haveri	4	Maize	49	PA 4642, GK 3014	3450	5870
Haveri	4	Sole groundnut	16	ICGV 91114	1100	1720
Dharwad	4	Soybean	12	JS 335, JS 9305	1350	2470

5 districts of Karnataka under ICRISAT-Sujala project during 2005-2006.

Table 9 Details of crops grown in Thanh Ha commune, Ho Binh Province, Vietnam.

Crop	% area	Yield (t ha^{-1})		Income (US$)	B:C ratio
		Average	Range		
Maize	83	3.4	0.9-7.0	421	1.41
Watermelon	6	17.8	10.0-36.0	2015	1.73
Sugarcane	8	58.3	20.0-83.0	1270	1.06

Table 10 Seasonal rainfall, runoff and soil loss from different benchmark watersheds in

Watershed	Seasonal rainfall (mm)	Runoff (mm)		Soil loss (t ha^{-1})	
		Treated	Untreated	Treated	Untreated
Tad Fa, Khon Kaen, NE Thailand	1284	169	364	4.21	31.2
Kothapally, Andhra Pradesh, India	743	44	67	0.82	1.90
Ringnodia, Madhya Pradesh, India	764	21	66	0.75	2.2
Lalatora, Madhya Pradesh, India	1046	70	273	0.63	3.2

India and Thailand.

Income Generating Activities (IGA) for Enhancing Incomes

Further, to ensure availability of seeds of improved cultivars of varieties, self-help groups (SHGs) in the villages were trained to handle village seed banks (Dixit et al., 2005; Reddy et al., 2007). Trained farmers under took seed production using breeders' seed for sowing and with the help of consortium partner farmers maintained purity. The village seed banks were very effective in overcoming the bottleneck problem of good quality seed availability in villages particularly of improved varieties of low-value nutritive cereals like pearl millet, sorghum and legumes such as groundnut, chickpea and pigeon pea, which private seed companies do not like to handle. The Government of Andhra Pradesh in India has scaled-up this initiative by providing Rs. 100,000 (US$ 2500) as a revolving fund to each SHG and organizing breeder or foundation seeds for the SHG. In all 200-village seed banks are operating in the state (Shanti Kumari, 2007).

Increased Incomes through Rainwater Conservation and Harvesting

Soil and water conservation measures such as staggered contour trenching, planting of *Glyricidia*, or pine apple vegetative border, rainwater harvesting pits and loose boulder gully control structures on slopping lands improved water availability (Figure 3) in open wells and enabled the farmers to grow high-value water melon crop with the highest B:C ratio amongst the cropping systems (Table 9).

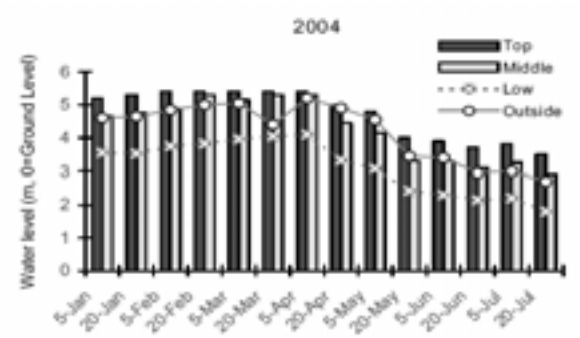

Fig. 3 Groundwater levels in the open wells in the Thanh Ha watershed during 2004

Targeting Poor Families

The consortium approach has vastly improved livelihoods of 250,000 poor people in watersheds of 368 villages across Asia. Vulnerable groups, such as women and the landless, are empowered to undertake livelihood activities, including the rehabilitation of degraded common lands with bio-diesel plantations (Box 1).

Box 1: Model to Benefit Landless People Collectively through rehabilitation of CPRs with Biodiesel Plantation:

As part of National Oilseeds and Vegetable Oils Development Board (NOVOD) – ICRISAT project, during the year 2005 – '06 an innovative community participatory model for development of wastelands was successfully implemented through a ICRISAT-led consortium of District Collector and District Magistrate of Rangareddy district, District Watershed Management Agency (DWMA), NGOs – Rural Education and Agriculture Development (READ) and HELP, Village Panchayats of Kothlapur and Velchal, and SHGs of agriculture labourers in these two villages of Rangareddy district of Andhra Pradesh, India.

In the model, 300 ha of Jatropha Curcas mixed with Pongamia Pinnata plantation was established in Velchal and Kothlapur villages with suitable soil and water conservation measures. Landless labourers in these two villages were organized into 15 groups of 10-12 members in each group. All the 300 ha was geo-referenced and divided into 15 pieces for each group using GIS. These labour groups were made responsible for planting, gap-filling, fertilization and maintenance of plantations. Usufruct rights were awarded by the District Collector, Rangareddy district, for these groups to reap benefits from their respective areas. Soil and water conservation measures were initiated in these plantations. Wherever soils are suitable, groups were encouraged to grow intercrops during rainy season to enhance benefits from the plantation. Thrift and credit activity was initiated in those groups. Groups have opened separate bank accounts and each member saves Rs.5 per day during working days. That amount is used as revolving. Local NGOs (READ and HELP) were involved in the social organization.

Now with three year biodiesel plantation in 300 ha, GTZ is sponsoring a PPP model with ICRISAT, Kirloskar Oil Engines Limited, Government of Andhra Pradesh and the CBOs a decentralized oil extraction and renewable energy generation model.

Through this model a win-win situation was ensured with multiple benefits such as rehabilitation of degraded lands, provide livelihood opportunities for land-less villagers, increased availability of seeds for bio-diesel, reduced degradation of natural resources, enhanced greenery cover in the villages and most importantly build the capacity of rural poor for sustainable management of natural resources.

Detailed household survey in Adarsha Watershed, Kothapally revealed that 59.4% landholders belonged to backward, scheduled casts, scheduled tribes and minority communities. The dominant land-owning group was at the middle and not at the top of the cast hierarchy (Hughes et al., 2005). The consortium adopted IGNRM approach for community watershed management and most interventions were for enhancing productivity and generating additional income for the small, marginal farmers and other vulnerable groups including landless and women to ensure tangible economic benefits. In all the community watersheds, equity issues are addressed through productivity enhancement and income-generating activities in addition to the normal soil and water conservation measures. The results showed that only 36.6 per cent of the 1962 direct beneficiaries in Sujala-ICRISAT watershed initiative belonged to other categories and 67.4 per cent beneficiaries

belonged to SCs, STs, OBCs categories. Similar distribution of beneficiaries was there in other watersheds also.

Institutional Arrangements

Institutional arrangements have been different to suit the needs of different projects. For instance for the project funded by the Sir Dorabji Tata Trust, Mumbai in Madhya Pradesh and Rajasthan, a national level Project Steering Committee also called Project Advisory Committee (PAC) was constituted with representatives from the Ministry of Agriculture of Government of India, state governments of Madhya Pradesh and Rajasthan where the project is being implemented, partner NGO representative and Indian Council of Agriculture Research (ICAR) are part of the committee.

Dr. M.S. Swaminathan, a widely respected person in the Indian and International Agriculture establishments acts as the Chairperson of the Committee. The Director General represents ICRISAT on the committee while Project Manager from ICRISAT is the member secretary. This committee meets once a year to review the progress and gives necessary direction to the project team on future course of action. In addition to the national level PAC, separate state level committees were formed for Madhya Pradesh and Rajasthan comprising of partners in each of the state. In this project a district level coordination committee for effective convergence of government line departments and other partners was also formed, Chaired by the District Collector. These committees bring to the notice of the national level committee their experiences and issues while the latter gives necessary guidance. This is because the project was prepared with focus on policy advocacy.

In addition to the external arrangements, ICRISAT has evolved internal arrangements. This internal arrangement has evolved over time and it is a three-tier functional structure consisting of a project manager assisted by a team of scientists and scientific officers. Site coordinators and activity coordinators report to the project manager and assist him in planning and execution of the project activities. For day-to-day support in the project areas, Visiting Scientists have been put in place. They offer technical support to the NGO partners. Along with staff located that they are also instrumental in data collection and communication with multidisciplinary team of scientists supporting project activities. In a way they act as link between ICRISAT and Project Implementing Agency (PIA).

ICRISAT-led the consortium in ten nucleus watersheds and 40 satellite watersheds in Mahabubnagar, Kurnool and Nalgonda districts and later extended to 150 villages in five districts. Through a program with funding support from the Sir Dorabji Tata Trust (SDTT), the approach is scaled up in Madhya Pradesh and Rajasthan. Through ADB supported projects, the approach is adapted and facilitated in India, China, Vietnam and Thailand. The Bureau of Agriculture, Government of Philippines has established four community watershed sites as sites of learning in four provinces with the technical support from ICRISAT (Figure 4). There has been spill over of the learning's concerning the approach in Africa, particularly in

Eastern Africa through ICRISAT association with Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA).

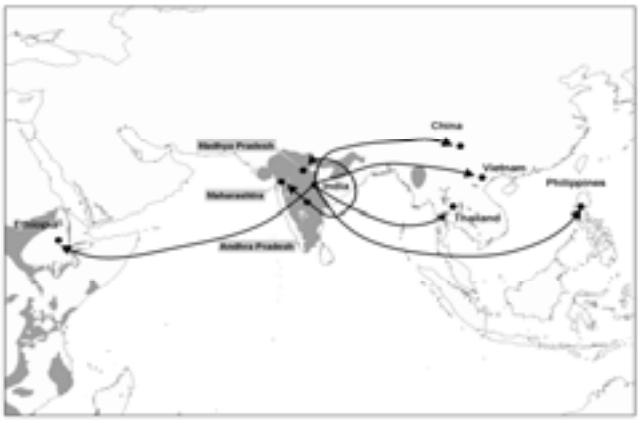

Fig. 4 Flow of the Consortium Approach

KEY FEATURES OF FACILITATING THE CONSORTIUM APPROACH

Need for a Common Goal – Team Building Workshops

For the Consortium Approach ICRISAT tried to identify common goal by identifying important institutions whose objective is to enhance agriculture productivity, incomes and reduce rural poverty, and are working in the area of watersheds. A series of team building workshops were conducted to internalize the goal and objectives among consortium members and to build rapport and trust among the partners. Team building workshops addressed the objectives of:

- A common vision of the watershed development program among consortium partners
- Inculcate a team spirit among the members to achieve the goal of sustainable NRM for improved rural livelihoods,
- Develop an understanding of and appreciation for the efforts and initiatives taken up by various teams
- Discuss and develop action plans for desired impact
- Develop a combined strategy to up scale the impact to the neighboring watersheds.

The series of team building exercises started with the core team in the first round and spiraled up further to include the entire network of consortium partners in the fourth round using the cascade approach. This was helpful in reinforcing the project objectives at all levels and across all the partner organizations of the consortium. These exercises helped partners to discuss the objectives, know their roles and

responsibilities and develop a sense of belonging with their fellow partners and most importantly to build tolerance amongst the members for divergent views.

Building on the Strengths

The consortium's principle was to harness the strengths of the partners and overcome the weaknesses. This principle was ingrained amongst all the partners and strengths of each of the partner was highlighted to ensure the feeling of importance and each member's valuable inputs.

Institutionalization of Partnerships

The process of institutionalization started with identification of suitable institutions and people for the project. Efforts were made to identify partners with common goals and willingness to collaborate. Once such people were identified, their parent organizations were contacted for collaboration. This approach was found to be more effective than identifying organizations first and then trying to find people within those organizations who can get represented in the consortium. While being part of the consortium, participating organizations appreciated strengths of each other and rapport was built. This collaborative spirit has been shared in many other projects that took shape later.

Internal and External Institutional Arrangements

For facilitating the Consortium there was a need to put in place an institutional mechanism both internal and external – to review the progress of the project from time to time and to take necessary action.

Dynamic and Evolving

Consortium Approach is not a static model but should be adapted based on field situation and requirements. It provides the philosophy and framework while specific components need to be added to make it a relevant one as per the situation. In addition to the critical stakeholders such as NGOs, NARSs, State and Central Government line departments and farmers' organizations; based on the need, relevant private industries can also be brought into the consortium. For example, initial consortium for Adarsha watershed consisted of CRIDA, NGO and DPAP and subsequently NRSA and BAIF were included. In other watersheds, private industrial partners and credit institutions were also brought in to ensure market linkages and credit sources.

Scaling-up of the Approach

Following the success of the model, the Consortium Approach has been scaled up to many locations. In Andhra Pradesh, it facilitated scaling up in Andhra Pradesh

Rural Livelihoods Programme of Government of Andhra Pradesh funded DFID. The South – South collaboration between Indian Council of Agriculture Research (ICAR) and ASARECA in the area of integrated watershed management is facilitated by ICRISAT and IWMI. From all the places there has been positive feedback about the approach. In all, there are more than 368 watersheds, which are supported by the Consortium.

ADVANTAGES OF THE CONSORTIUM APPROACH

Synergy and Creativeness

Quite often in NRM challenges are thrown for which answers hardly remain with one discipline, for example livestock – fodder, fisheries – water, different crops, (breeding, pest management, soil fertility etc.,) credit-markets etc. In the Consortium Approach where multidisciplinary team is addressing the problem situation, there is a possibility for creative thinking and new ideas, which benefit the farmers as well as researchers and development workers.

Sustainability

The Consortium Approach facilitates members of the network to have ownership of the objectives of the program. This leads to optimal contribution from diverse disciplinary backgrounds providing a holistic systems approach. As a result solutions for problems are effective. Since activities are planned on demand driven basis, implemented in a participatory manner, and solutions offered are effective ones, there is a good chance for the long-term sustainability of project initiatives.

Cost Effectiveness

At the time of project implementation, working linkages are established among actors in the consortium. This ensures quick access to relevant people when primary stakeholders encounter a situation and timely solutions. (Box 1 & 2). One of the main issues in NRM work is involvement of different departments independently and in many cases resulting in duplication of work. In the Consortium Approach, each of the actor knows what other departments are doing. So there is less chance for duplication of the work.

Win-win Solution through Empowerment of Partners

The Consortium Approach allows members to learn from each other. It spreads interdisciplinary knowledge among partners. Strengths of each of the partners are harnessed and partners to get over their weaknesses provide help mutually. When there is an effort to build upon strengths of each of the partners, weaknesses get covered with strengths of other partners. In the team not only biophysical scientists started offering solutions for issues related with other disciplines but also got

sensitized with socioeconomic, gender and institutional issues. One team became more cohesive overcoming conventional disciplinary hegemony.

Box 2: Faster formation of new functional alliances:

Due to the rapport built while being part of the ICRISAT-led Consortium, CRIDA approached ICRISAT for their NRSP-DFID Project along with BAIF, the existing consortium partner, a new consortium for the project was formed with CRIDA's leadership. Similarly, with the emerging biodiesel field, Government of Andhra Pradesh, India wanted to initiate research on *Jatropha* and *Pongamia* in 2005. The State Agricultural University took the lead. ANGRAU felt ICRISAT and CRIDA as natural partners for a bio-diesel consortium. Time taken for forging these functionally active partnerships was quite less. This was possible only due to the confidence built amongst the consortium partners during the earlier work in the watershed consortium. In addition, other relevant partners like National Bureau of Plan Genetic Resources (NBPGR), Directorate of Oil Seeds Research (DOR) and Indian Institute of Chemical Technology (IICT) were also brought into the Biodiesel Consortium led by ANGRAU. In 2005-06, Ministry of Agriculture and Ministry of Rural Development, Government of India asked ICRISAT to undertake comprehensive Assessment (CA) of the watershed programs in the country. ICRISAT consulted its existing watershed consortium partners and brought together 23 institutions within one month. The consortium completed the CA in two years and number of recommendations and learnings are documented (Wani et al., 2008).

The transaction costs (time and financial) are very less to form new alliances needed for new projects.

Faster Scaling-up

The Consortium Approach ensures intensity and closeness in which communication and collaboration takes place among partners, which contributes for effective scaling up. Impact could be further enhanced through new innovative partnerships. Since different partners are involved, necessary enabling institutions and policies are put in place in a short time. For example, while working on a model to benefit landless people through bio-diesel plantations in CPRs (Box 1), we could get the usufruct rights for landless people from the administration in six months. In addition, this example would enable the administration to develop CPRs to benefit the vulnerable groups without giving land rights. Now GTZ and Kirloskar Oil Engines Ltd., a private company joined the consortium to pilot use of straight vegetable oil (SVO) for energy generation at village level.

Change in Organizational Behavior

General tendency of a researcher is to develop technology in the laboratory/research station and transfer it to the field through extension agencies. This tendency got re-engineered into working closely with primary stakeholders and developing technology in a participatory way. Governmental and NGOs also find it

worthwhile to play a role in developing the technology by listening to farmers carefully and contributing through feedback and sharing indigenous knowledge options with researchers. Different researchers within ICRISAT and other partner institutions also got sensitized about social, gender, equity, and other disciplines and overcame disciplinary biases. Good research and management practices got internalized amongst the partners.

Public-private Partnerships are Facilitated (Multiplier Effect)

For enhancing incomes and agricultural production in rural areas, backward and forward linkages are important. Private entrepreneurs came forward to join the consortium for harnessing the opportunity. For example, during baseline characterization, wide spread deficiency of boron, zinc and sulphur in addition to nitrogen and phosphorus was observed in 80–100% of the farmers' fields (Sahrawat et al., 2007). Farmers' participatory trials with amendments of deficient nutrients showed substantial yield increases and enhanced incomes (Rego et al., 2007). However, availability of boron and other micronutrients in remote villages was a problem. The Borax Morarji Ltd. producers of boron fertilizers in India came forward to join the consortium to ensure availability of boron fertilizers in villages through SHGs. Similarly for handling market produce and processing, different industries came forward to join the consortium, for example – in case of biodiesel initiative a PPP amongst GTZ-Southern Online Bio-Technology (SBT) – and ICRISAT is ongoing under which SBT is operating 40 Kl d^{-1} biodiesel plant in Nalgonda district, Andhra Pradesh with German technology provided by Lurgi and ICRISAT is providing technical support to the farmers for cultivating biodiesel plantations and facilitating buy-back arrangements between the farmers and the SBT (Kashyap, 2007). There are number of other examples of PPP through consortium in the area of biodiesel and medicinal and aromatic plants also. In addition to fulfill their corporate social responsibilities different industries [For example; SDTT, Mumbai; Sir Ratan Tata Trust (SRTT), Mumbai; TVS Foundation. Chennai; Coca Cola Foundation, USA) and their formal associations such as Confederation of Indian Industries (CII) and Federation of Indian Chambers and Commerce Industries (FICCI) are collaborating with the Consortium.

LEARNING'S FROM THE EXPERIENCE AND TRIGGERS FOR SUCCESS

The most crucial issue that determines success of a Consortium is the capable leading/ facilitating partner. Partnerships need to be nurtured by the lead partner. As mentioned earlier, Consortium Approach is not a static model. Following the framework and philosophy, lead partner should be innovative enough to facilitate adaptation and evolution of the model to suit the local needs. Quite often there would be conflicting values of working among partners. Consortium leader needs to understand this fact and ensure flexibility and transparency among partners to accommodate opinions of certain members without causing damage to the overall objectives.

Each member of the team should know that he/she could influence the team agenda. There should be a feeling of trust and equal influence among team members that facilitates open and honest communication. This allows each member to provide their technical knowledge and skills in helping to solve the problem, complete the project, and develop new programs.

The Consortium leader, where possible, should help select or influence the composition of consortium members. Selection of members should be based on their willingness to work in a team approach and share their resources, both technical skills and financial that they are able to bring in to the consortium. Selection of right set of partners determines success to a major extent. Learning behavior among partners is essential for the Consortium Approach. More importantly there should be pre-disposition to work collectively for community development.

It is essential to achieve shared understanding of objectives by the members. They should be able to identify themselves with the common objectives. The lead organization should facilitate this process. Once objectives are evolved, it is again the responsibility of the lead partner to always bring members' attention to the objectives and help in ensuring focused work in the correct direction. There is a need to develop, understand and accept a set of principles by the members, which include norms for operating with in the team. Team building measures go a long way in for stronger partnerships and internalizing operating guidelines. Sharing of credit for the impact, publications, and policy guidelines amongst the partners is very critical. The leader has to ensure that in all communications about the consortium activities all partners are recognized, acknowledged, and rewarded. Such measures go a long way to build trust amongst the consortium partners. Similarly open communication and conflict resolution mechanisms must be in place.

Tangible economic benefits to individual primary stakeholders are must for community participation. Integration of new science tools such as GIS and remote sensing enhanced the efficiency of recommendations and resulted in higher benefits to the community. Knowledge-based entry point activity is another reason for enhanced sustainable community participation. Their motivation was sustained due to the fact that there is continuous learning, which is directly relevant to their fields. Capacity building of partners and sensitization of policy makers helped in building partnerships. Transaction costs (time and money) are higher for partnership building but higher benefits call for partnerships.

CONCLUSIONS

Rainfed agriculture is not only widespread worldwide but is also the hot spot of poverty, hunger and water scarcity. Watershed development has been adopted as strategy to combat drought and enhance agricultural productivity in rainfed areas. As evident from the recently completed comprehensive assessment of watershed impacts in India undertaken by the ICRISAT-led consortium, watershed programs

are silently revolutionalising dryland areas. However, watershed programs could become growth engine for sustainable development of drylands by enhancing the impact of 66% of watershed projects which performed below average in terms of various parameters of economic efficiency, equity and sustainability. The consortium approach developed and evaluated by ICRISAT-led consortium in Asia demonstrated that agricultural productivity could be increased by two to four folds, incomes could be doubled, employment opportunities could be enhanced through increased cropping intensity, diversification of farming systems, income generating activities, improving water availability and reducing soil run-off and nutrient losses in community watersheds by adopting holistic participatory approach. Transaction costs of consortium approach are higher than the compartmental top down target driven approach, however, the benefits in terms of enhanced adoption, impact, sustainability and improving livelihoods by addressing issues of equity, efficiency, economic and environment are more by several folds. The consortium approach is up-scalable and promoted inter disciplinary and is integration of various actors and their actions to tackle drought and water scarcity in rainfed areas.

Acknowledgements The authers acknowledge the help of all the consortium members for their contributions in the Consortium and financial support from Asian Development Bank (ADB), Andhra Pradesh Rural Livelihoods Programme (APRLP), Sir Dorabji Tata Trust (SDTT), Sir Ratan Tata Trust (SRTT), Coca Cola Foundation, USA; TVS Foundation., Chennai; Sujala-World Bank Project, Bangalore; Bureau of Agricultural Research (BAR), The Philippines; and State Government of Andhra Pradesh, Rajasthan, Madhya Pradesh, and Karnataka for undertaking Consortium approach.

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