

Progress Report

March 2014–February 2015

Improving Rural Livelihoods through Farmer-centric Integrated Watershed Management: Kurnool Watershed, Andhra Pradesh

Submitted to

**POWERGRID Corporation of India Ltd
Gurgaon, India**



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Executive summary

POWERGRID Corporation of India, Gurgaon, India, supported the ICRISAT-led consortium to improve rural livelihoods through farmer-centric integrated watershed management in Kurnool district of Andhra Pradesh. During 2014, sites of action were identified in Bethamcherla mandal in Andhra Pradesh considering the representativeness in terms of soils, landscape, rainfall, crops, socio-economic conditions and other parameters like willingness of farmers and potential to develop. Through a series of awareness and capacity building meetings, community mobilization was undertaken for participation in watershed management. Watershed committees, with bank accounts in their name, are formed and registered with mandal/district level administration. Participatory Rural Appraisal (PRA) was conducted to identify demand-driven priority activities to be undertaken which comprised activities like soil and water conservation through nala plugs, rock-filled dams, sunken pits, farm ponds, masonry check dams, well recharge pits. Productivity enhancements through crop demonstrations and livelihood improvement activities like vermicomposting, avenue plantation were prioritized. In order to identify soil fertility related constraints and bring on board the farmers for participatory research for development through demonstrating the benefits of science-led interventions, soil sampling and soil test-based fertilizer management was undertaken as an entry point activity. Soil samples (220 no.) were collected from the farmers' fields in 10 villages and analyzed for macro and micro nutrient deficiencies. The results demonstrated the deficiencies of sulfur (S), zinc (Zn), calcium (Ca) along with nitrogen (N) in 50 to 80% of the farmers' fields. Phosphorus (P) and potassium (K) were adequate in most farmers' fields (15% deficient fields in P, 8% deficient fields in K). Based on soil analysis results fertilizer recommendations were developed to target optimum yields by adopting the principle to recommend full dose of a nutrient in case of >50% farmers' fields are found deficient and half dose if <50% farmers' fields are found deficient. Participatory trials (64 no.) were conducted to evaluate soil test-based recommendations. The results showed productivity improvement by 19-24% in maize, 27% in pigeonpea, 8% in groundnut and 9% in paddy. Regarding other activities, five farm ponds, two check dams, three rock filled dams, three loose boulder structures, well recharge pits, one cattle-trough construction and stony land development (1 ha) has been done.

In order to make the initiative sustainable over the long run, capacity building is a focused activity in the watershed. During 2014, six formal capacity development programs were conducted in which capacity of around 220 farmers was strengthened.

Background

The first major activity taken up was the selection of appropriate sites for the watershed project. Following major criteria were considered in the selection of sites for the model watersheds.

- Representativeness in terms of soils, landscape (slope and terrain), rainfall, crops, socio-economic conditions
- Cooperative farmers who are willing to take active part in the watershed program.
- Good potential for increasing agricultural productivity, income and conservation of natural resources

- Strong need for watershed program
- Major area under rainfed conditions
- Good accessibility even during rainy season

Considering the above key criteria, two potential sites for watershed project were identified in Kurnool district in Andhra Pradesh. ICRISAT team and Watershed Development department officials visited the proposed sites. At each site, farmers' meetings were conducted and interactions were held with local institutions and community members. Based on these discussions and the observation collected followed by a transact walk, the final selection of sites for the watershed project was made.

Bethamcherla watershed, Kurnool, Andhra Pradesh

The overall goal of this initiative is to increase agricultural productivity and improve the livelihoods of rural poor in fragile dryland areas on a sustainable basis by enhancing the impact of integrated watershed management programs in the country through capacity-building initiatives using the 'site of learning' model in low-rainfall agro-ecoregions. The specific goal of this initiative is to increase agricultural productivity and improve rural livelihoods sustainable in selected villages. The specific objectives of the project are:

1. To establish "Model Sites of Learning" in Karnataka for harnessing the potential of rainfed areas by adopting the integrated water resource management approach;
2. To enhance water availability and its (green and blue water) use efficiency for diversifying the livelihood systems in the target villages by adopting integrated water resource management approach; and
3. To build capacity of the farmers in the region for improving rural livelihoods through knowledge sharing and dissemination strategy

Site selection

The site selection for watershed development project in Kurnool district was done in coordination with the District Water Management Agency (DWMA). Mr Harnath Reddy, Project Director (PD), and Mr Khadar Basha, Asst. Project Director coordinated in this activity (Figure 1).



DWMA staff showing the boundary of watershed; Pigeonpea is a predominant crop after harvest



Mango orchard in Pendekal village; Groundnut crop is grown with well irrigation



Farmer ploughing after a shower

General view of Muddavaram village

Two potential locations were proposed for the project. They are: 1. Bethamcherla Mandal and 2. Adoni mandal. Villages in these two mandals were visited. The proposed locations in Bethamcherla mandal were found to be quite appropriate compared to Adoni (Figure 2). The general consensus was that the Bethamcherla site was more suitable for the watershed project.

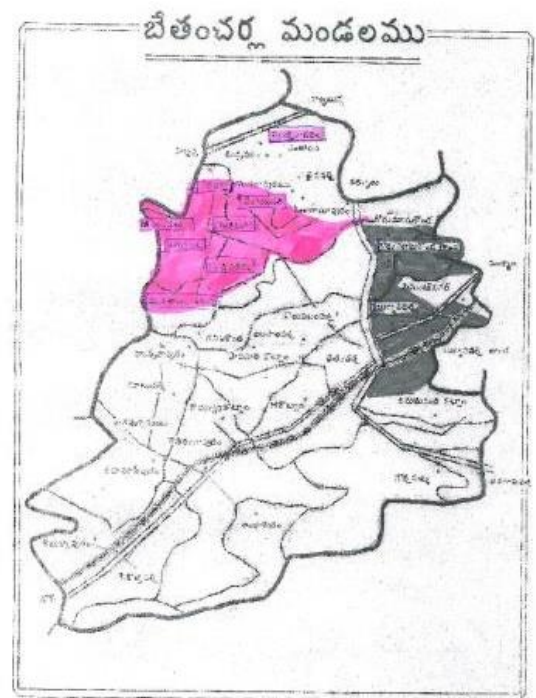


Figure 2. Bethamcherla Mandal map with watershed villages.

Table 1. Proposed locations for watershed project in Kurnool district with the scorings based on priorities.							
Watershed location	Hydro-geology (20)	Need based (20)	Less irrigation area (20)	Socio-economic status (20)	Access-ibility (10)	Potential for development (10)	Total Score (100)
Bethamcherla mandal	18	16	16	14	9	7	80
Adoni mandal	10	13	10	13	2	3	51

Due to local body elections, other planned activities like participatory soil sampling, formation of committees, farmers' awareness and capacity building activities were postponed/delayed.

Details of the watershed villages in Bethamcherla are given in Table 2 and land use information is given in Table 3.

Table 2. Villages covered in proposed watershed project in Bethamcherla mandal, Kurnool.	
Villages and hamlets coming under revenue villages	Revenue villages
Pendekal, Marrikunta, Venkatagiri and Repalli	Pendekal
Muddavaram, Musalayacherue, Veraiahpalli	Muddavaram
Mandalavaripalli	Emboy
Bugganipalli, G Tanda	Bugganipalli

Table 3. Land-use information of proposed watershed location, Bethamcherla mandal, Kurnool.							
Revenue village	Geogra- phical Area (ha)	Forest (ha)	Un cultivable (ha)	Land under non-agri uses (ha)	Other fallow (ha)	Current fallow (ha)	Net used (ha)
Pendekallu	1264	39	207	63	44	475	436
Muddavaram	2599	147	635	74	178	60	1505
Emboy (Mandlavari- palli)	589	-	130	60	-	54	345
Bugganipalli, G Tanda	3259	455	314	516	45	676	1624
Total	7711	641	1286	713	267	1265	3910

Of the Emboy revenue villages only Mandlavaripalli is covered in the watershed project; the other two villages, Emboy and Rudravaram have been replaced due to unsuitable conditions with Bugganipalli and G Tanda of Bugganapalli revenue village.

Watershed committee formation

One watershed committee has been formed, consisting seven members that includes the members from all the eight villages. The watershed committee comprises of all sections of the community viz. 50% of women representatives, proportionately small, medium, big and landless farmers and representing all communities. A bank account has been opened in the name of watershed committee. A meeting was conducted with the WC members to brief the project activities and its benefit. Table 4 shows the watershed committee members list.

Sl. No.	Name and father name	Village	Age	Education	Designation
1	K Venkataramudu/K Venganna	Rudravaram	45	7 th	President
2	Y Rangaswamy/Y Thimmaiah	Pendekallu	40	9 th	Secretary
3	H Padmavathi/H Veeranna	Muddavaram	38	10 th	Treasurer
4	K Rajeswarappa/K Veerabhadrapa	Emboy	34	9 th	Member
5	Ayyaswamy/Chinna Somanna	Marrikunta	38	5 th	Member
6	CV Nagashekhar/Subbaiah	Muddavaram	32	BA	Member
7	CM Vijay/CM Subbaiah	Dhone	40	MA	Member; NGO representative

Table 5. Soil health status in Bethamcherla watershed, Kurnool.														
Villages	pH	EC dS/m	OC %	Av P ppm	Av K ppm	Av S ppm	Av Zn ppm	Av B ppm	Avail- Fe ppm	Avail- Cu ppm	Avail- Mn ppm	Ca ppm	Mg ppm	Na ppm
Emboy	8.1	0.31	0.84	27.5	314	15.0	1.37	1.47	7.61	1.31	7.70	1289	802	102
M. Pendekal	7.3	0.16	0.75	11.3	174	6.5	0.57	0.62	7.55	1.93	10.00	706	300	39
Mandlavari Pally	7.9	0.11	0.28	31.5	110	4.3	0.50	0.61	9.61	0.91	7.88	312	234	32
Marrikunta	6.6	0.11	0.41	7.2	70	5.4	0.40	0.42	10.46	0.62	16.86	171	117	28
Muddavaram	7.7	0.25	0.51	16.8	174	10.9	0.95	1.22	8.04	1.02	8.56	854	538	112
Musalai Cheruvu	7.0	0.19	0.77	17.3	130	7.2	0.64	0.83	8.02	1.12	16.59	408	237	33
Pendekal	7.5	0.18	0.53	11.1	205	11.3	0.90	0.80	4.84	1.92	6.11	1120	492	61
Rudravaram	8.0	0.14	0.43	28.5	111	6.3	0.43	0.77	4.89	0.88	7.91	496	300	49
Veeraiah Pally	7.0	0.18	0.71	10.5	132	5.7	0.48	0.61	7.09	0.88	13.21	422	176	31
Venkatagiri	7.1	0.11	0.60	8.0	172	5.9	0.37	0.63	9.14	2.11	13.18	666	296	30
Mean	7.5	0.19	0.57	17.0	159	8.3	0.71	0.85	7.45	1.21	10.11	680	374	61

Stratified soil sampling and soil test-based fertilizer recommendation

To assess the soil fertility status and develop a soil health based fertilizer recommendation, 220 referenced soil samples were collected and analyzed (Figure 2; Table 5). The soils in 10 villages reveal that the severe deficiency was found for organic carbon (50-85% deficiency), sulphur (65-100%) and boron also (Table 6). Based on the soil test results, crop-wise fertilizer recommendations were provided to farmers (Table 7). Trainings were conducted to demonstrate soil sampling method and the results were shared with farmers.



Figure 2. Hands-on training to farmers for participatory soil sampling in Muddavaram, Kurnool.

Table 6. Percent of farmers' fields deficient in nutrients, Bethamcherla watershed, Kurnool.											
Villages	OC	Av P	Av K	Av S	Av Zn	Av B	Avail-Fe	Avail-Cu	Avail-Mn	Ca	Mg
	% deficient										
Emboy	18	0	0	36	73	0	0	0	0	18	0
M. Pendekal	17	6	0	94	78	39	0	0	0	78	0
Mandlavari Pally	85	0	15	100	85	54	0	31	0	100	0
Marrikunta	75	33	33	92	92	75	0	33	0	100	0
Muddavaram	50	23	3	65	58	18	15	0	0	70	0
Musalai Cheruvu	46	8	0	77	77	23	0	15	0	100	0
Pendekal	50	20	5	55	60	30	5	0	0	70	0
Rudravaram	67	0	17	83	100	44	0	17	0	94	0
Veeraiah Pally	45	30	10	95	80	50	0	35	0	100	0
Venkatagiri	50	25	0	75	100	50	0	0	0	50	0
Mean	50	15	8	76	75	35	4	12	0	80	0

Table 7. Soil-test-based fertilizer recommendation, Bethamcherla watershed, Kurnool.

Bethamcherla watershed Kurnool											
Soil test based fertilizer recommendations								When SSP used only Urea,DAP, Gypsum change others same			
SI No	Crop	Urea	DAP	MOP	Gypsum kg ha-1)	ZnSO ₄ 7H ₂ O	Agribor	Borax	Urea	SSP	Gypsum
1	Maize (kharif)	88	54	33	200	50	1.25	2.5	109	179	3
2	Maize (Rabi)	105	65	42	200	50	1.25	2.5	130	214	0
3	Paddy (Kharif)	74	60	33	200	50	1.25	2.5	98	196	0
4	Paddy (Rabi)	105	65	33	200	50	1.25	2.5	130	214	0
7	Sorghum (Rainfed)	65	43	25	200	50	1.25	2.5	82	143	32
8	Sorghum (Irrigated)	72	65	33	200	50	1.25	2.5	98	214	0
9	Sunflower (Rainfed)	40	65	25	200	50	1.25	2.5	65	214	0
10	Sunflower (Irrigated)	43	98	25	200	50	1.25	2.5	82	321	0
12	Cotton (Hybrids)	105	65	50	200	50	1.25	2.5	130	214	0
13	Soybean	7	65	33	200	50	1.25	2.5	33	214	0
14	Castor	65	43	25	200	50	1.25	2.5	82	143	32
17	Sesame(Kharif)	18	65	33	200	50	1.25	2.5	43	214	0
18	Chillies (Irrigated)	301	65	100	200	50	1.25	2.5	326	214	0
19	Chillies (Rainfed)	48	43	42	200	50	1.25	2.5	65	143	32
20	Groundnut (Rainfed)	5	43	42	500	50	1.25	2.5	22	143	332
21	Groundnut (Irrigated)	16	43	42	500	50	1.25	2.5	33	143	332
22	Pigeonpea (Kharif)	1	54	0	200	50	1.25	2.5	22	179	3
23	Greengram,Blackgram, Chickpea	1	54	0	200	50	1.25	2.5	22	179	3

Participatory action plan preparation

The action plan has been prepared by a team comprising ICRISAT scientists, farmers and NGO officials with a participatory approach. A transect walk was taken up to prepare the action plan. Suitable sites were selected based on technical feasibility taking into account farmers' opinions.

The proposed action plan in Bethamcherla Watershed, Kurnool, includes soil and water conservation activities (nala plugs/ rock-filled dams, sunken pits, farm ponds, masonry check dam, well recharge pits); productivity enhancement (crop demonstration); income generating activities (vermicompost); and afforestation/avenue plantation.

Soil and water conservation: Various SWC structures constructed included four farm ponds, two check dams, three rock-filled dams, three loose boulder structures and one cattle trough. Other structures like farm ponds, well recharge pits and stony land development are under construction.



Figure 3. Check dam on Gorla vagu drain at Mandlavanipalli village; RFD and LBS in Emboiy; and cattle trough construction at Mandlavani Kunta of Mandlavanipalli village, Bethamcherla watershed, Kurnool.

Crop demonstration: As a productivity enhancement initiative, 56 demonstration plots were established with improved technologies such as improved cultivar seeds, seed treatment, soil test based fertilizer application that included micro and secondary nutrient application

and integrated pest management practices (Figure 4). Three crops (groundnut, pigeonpea and maize) were taken up as test crop in the demonstration fields. Inputs such as improved cultivar seeds, micro and secondary nutrients such as boron (agribor), zinc (zinc sulphate) and sulphur (gypsum) were provided to demo farmers. Although the rainfall in this region was poor, the crop stands in the demonstration fields are quite good compared to the crops in farmers' practice.

Crop	No. of demonstration fields	Remarks
Pigeonpea	14	Soil-test based nutrient and pest management
Groundnut	16	Soil-test based nutrient and pest management
Maize	34	Soil-test based nutrient and pest management
Total	64	

Table 9. Crop yields (t/ha) in improved practice, PowerGrid-ICRISAT watershed, Kurnool, 2014-15.

Crop	Improved practice (IP)	Farmers' Practice (FP)	% increase in IP
Maize (rainfed)	2.91	2.33	25
Maize (irrigated)	4.13	6.00	19
Pigeonpea	1.35	1.1.07	27
Groundnut	1.25	1.16	8
Paddy	2.95	2.70	9

The crop response to improved management that included seed treatment, improved cultivar and balanced nutrient management has shown quite encouraging in terms of increased yield (Table 9) despite poor rainfall during the year.

An initiative was taken up to plant pigeonpea on field bunds as an additional income for farmers and also to strengthen field bunds (Figure 5).



Bhagyamma shows the micro nutrients used.



Improved ptice in maize



Figure 4. Demonstration fields in Emboiy, Muddavaram and Pendekal field trials, Kurnool.



Figure 5. Pigeonpea on field bund Muddavaram and Pendekal villages.

Capacity building/awareness creating activities: Several capacity building programs were conducted to create awareness about the watershed project on various aspects such as

community formation, participatory soil sampling, soil health and action plan preparation, use and application of improved crop productivity initiatives and integrated pest management (Figure 6).

Table 9. Capacity building activities in Bethamcherla watershed, Kurnool.		
Date	Topics discussed	Participants attended
1-3 April 2014	Participatory watershed objectives and activities in all the villages	20-45 in each of the villages
9-11 June 2014	Hands-on training on soil sampling, importance of soil sampling in all the villages, demonstration field trials details	18-35
5-7 August 2014	Participatory action plan preparation, transect walk	20-25
9 August 2014	Watershed committee formation in each village	40-45
3 Sep 2014	Integrated pest management in Mandlavaripalli on groundnut, crop	40
	Integrated pest management in Emboy on groundnut, pigeonpea and maize crops	30



Awareness building, interaction and meeting with farmers.



IPM training to farmers in Bethamcherla watershed.



Mr Ashok Rai and Mr M R Sarkar of PowerGrid visited on 13 December 2014; and members from other watershed projects visit Bethamcherla.

Figure 6. Various capacity building activities conducted in Bethamcherla watershed, Kurnool.

Four rain gauges have been installed for rainfall measurement in the project area. These rain gauges have data loggers which can measure and store rainfall data (Figure 7). Also the field staff and watershed committee secretary have been trained to collect and record the rainfall data manually.



Figure 7. Rain gauges have been installed in the project area.

Annexure 1

PowerGrid – ICRISAT watershed activities in Kurnool, Andhra Pradesh, 2014-15

Sl. No.	Line items	Achieved	Remarks
1	Knowledge-based entry point activity and establishing community-based organizations	Accomplished	Improved cultivars of pigeonpea, groundnut and maize were provided and demonstrations were established; Watershed committee has been formed, bank account opened, capacity/ awareness building programs conducted.
2	Rain water harvesting and waste water reuse	Check dam 2 nos. , Farm pond 4 nos, RFD 3 nos., LBS 3 nos., and one water trough for cattle constructed	This activity was initiated after the harvest of rabi crops and completed during Jan-Mar 2015.
3	Productivity Enhancement, INM, IPM and crop diversification	220 soil samples were collected, analyzed and results were shared with farmers; 64 field demonstrations with improved practices were conducted. IPM demos with various measures to control pests were established.	Crop specific (soil test based recommendation was provided to farmers. To establish demonstrations, required inputs such as seeds, micronutrient fertilizers were provided. Eco-friendly, cost-effective measures in pigeonpea and groundnut were demonstrated.
4	Equipments	Improved farm implement “Tropicultor” provided	Tropicultor is a multi-purpose farm implement; training of farmers was organized.
5	Training and capacity building	Several capacity building of topics covering watershed interventions, improved crop management and community participation to watershed committee, farmers and NGO staff were imparted.	Awareness, community mobilization and capacity building is an important activity for successful implementation of project. In the initial stage of project, bringing awareness and community participation needs considerable efforts.
6	Field days & workshops	Two field days were conducted.	Field day in Emboy village conducted on 8 November 2014 in maize field where 35 farmers attended.
7	Income generation activities	Self-help groups were formed and activities will be initiated.	Vermicomposting, kitchen gardening and dairying will be done before March 2015.