



# Improving livelihoods through sustainable natural resource management in micro-watersheds

## TATA-ICRISAT-ICAR-BAIF Project

Sir Dorabji  
Tata Trust

### TATA-ICRISAT-ICAR Project

Rainfed areas of the dry agro-ecosystem of Madhya Pradesh (M.P) and Eastern Rajasthan are characterised by erratic and low rainfall (600-1100 mm), frequent droughts, soils with moisture storage capacity (100-200mm). The Sir Dorabji Tata trust supported a distinctive project to Develop strategies to arrest Land Degradation and improve Agricultural production in Madhya Pradesh and Eastern Rajasthan (Bundi). We have adopted the approach of representative benchmark watersheds and districts representing the target ecoregion. The over all objectives of the project are

- Enhance agricultural productivity and crop-livestock management systems to alleviate poverty
- Minimise land degradation and improve livelihoods through sustainable management of natural resources
- Understand the linkages between socio-economic factors, productivity, and land degradation

### Project launching

This novel initiative of improving livelihoods of the poor residing in the target regions through sustainable management of natural resources in the watersheds, while minimizing land degradation was launched in Jaipur by Honourable Chief Minister of Rajasthan Shri. Ashok Gehlot on 26th July 2002. The project launching workshop was attended by

Honourable Minister of Agriculture Shri. Govind Singh Gurjar, Dr. M.S. Swaminathan, eminent Agril.scientist and chairman M.S. Swaminathan Research Foundation, Dr. Panjab Singh, Director General, Indian Council of Agricultural Research (ICAR), Dr. A.S. Faroda, Vice Chancellor, Maharana Pratap University of Agriculture and Technology (MPUAT), Mr. Mukund Gorashkar, Project Officer, Sir Dorabji Tata Trust, Dr. N.G. Hegde, President Bhartiya Agri Industries Foundation (BAIF), Pune and other distinguished govt. officials and scientists participated in the project launching and planning workshop.

### Project area

Thana, Govardhanpura and Gokulpura benchmark watersheds in Hindoli tehsil, Bundi district of Rajasthan are selected for study in this project. The soils are shallow to medium deep clay loams and silt loams. The total geographical area is 1356 ha land, out of which forest area is 195 ha (11.10%) and 95 ha common grazing area for cattle. Thana watershed has a population of 1300 with 285 households having 22.16% literacy. A multidisciplinary team of ICRISAT, ICAR scientists and BAIF staff have jointly conducted reconnaissance survey in the potential watershed villages, interacted with the community, conducted Grama-Sabhas, surveyed the site physically and collected baseline data through Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA). The baseline information is



Inauguration of the project



View of degraded land in Bundi district



Grama sabha at Bundi



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analysed. The constraints identified are

- Low rainfall use efficiency
- Temporal and spatial variability in amount and distribution of rainfall
- Reduced productivity, low incomes and increased land degradation
- Stubborn poverty
- Drought is a constant threat and water scarcity
- Low natural fertility of tropical soils

## The strategy

- The consortium approach developed and evaluated by ICRISAT and NARS partners at Adarsha watershed, Kothapally, RR District in A.P. is adopted. Important strategy and components are
- Farmer participatory consortium approach of institutions for technical backstopping
- New science tools for developing and management of watersheds
- Holistic system approach
- Continuous monitoring and evaluation by partners
- Watershed activities are used as entry point and project becomes livelihood project

## Improved natural resource management options

### Farmers are evaluating improved SWNM options

In-situ moisture conservation

Landform treatments

- Broadbed and furrow (BBF)
- Ridge and furrow
- Reduced tillage
- Bunding, vegetative bunding
- Planting on contour
- Contour trenching



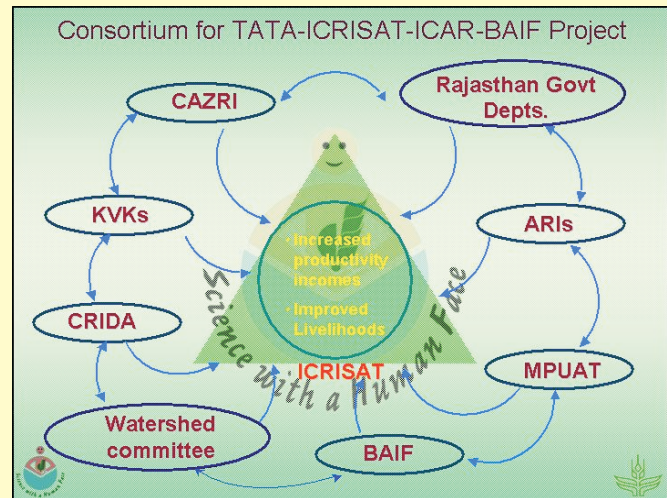
Vermicompost preparation



Contour trenches made at Govardhanpura watershed



Tropicultor operation for ridges



Ex-situ moisture conservation

- Gully control measure
- Water tanks
- Grassed water ways

## Improved machinery for agricultural operations

Bullock drawn tropicultor which is referred as “poor man’s” tractor undertakes all agricultural operations

- Tropicultor is a animal drawn multipurpose equipment
- Flexible, easy to attach all implements
- Economical, efficient and faster operation
- Sowing and apply fertilizers at proper depth
- It covers 2 ha per day for cultivation, planting, fertilizer application and blade harrowing thus saving the labour cost by 40%

## Integrated nutrient management

As a part of baseline characterisation, soil samples from the micro-watershed revealed that in Govardhanpura 44-83% fields were deficient in nitrogen, sulphur, zinc, boron and organic carbon, where as in Thana 50-83% fields were deficient in these nutrients.



## Soil analysis results

Watershed	No.of Farmers	Sulphur ppm		Zinc ppm		Boron ppm		Organic Carbon %		Av.P (Olsen) ppm	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Govardhanpura % fields Deficient	18	7.4	3.3-25.7 83	0.8	0.2-1.8 56	0.5	0.1-0.9 61	0.65	0.3-1.2 44	6.5	0.9-20.1 56
Thana % fields Deficient	18	11.1	3.6-51.0 61	0.5	0.2-1.3 83	0.4	0.1-1.0 83	0.54	0.2-1.1 50	5.9	1.5-13.2 61

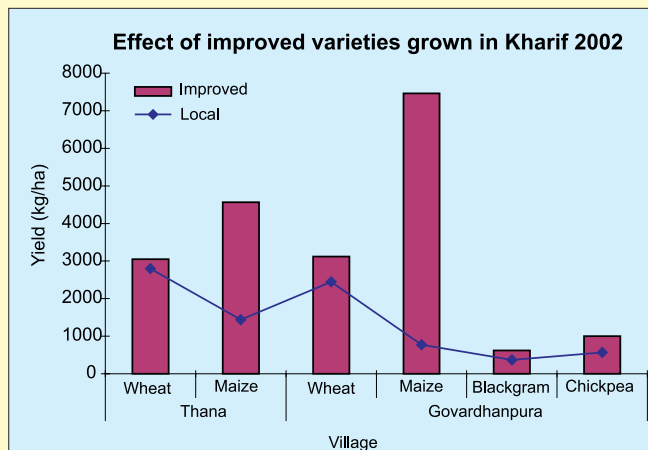
## Effect of micro-nutrients on crop yield in Rabi 2002-2003

Watershed	Crop	Grain yield kg ha <sup>-1</sup>			% increase over control
		Sulphur	Boron	Control	
Thana	Wheat	2320	NA	1700	36
	Chickpea	1600	1200	1000	60

- The significance of soil analysis was discussed and explained to the farmers in Grama-Sabhas
- Biofertilizers – Rhizobia and phosphate solubilisers
- *Gliricidia* on bunds for green manuring
- Organics – Vermicomposting and NADEP composting
- Micro-nutrient amendments (B, S and Zn)
- Nutrient budget studies
- Best-bet options

## Improved crop varieties and system's diversification

Improved varieties seed of different crops like wheat, maize, chickpea, blackgram and short duration



pigeonpea and safflower were evaluated by the farmers for improved crop production.

- Improved varieties of crops gave 9-217% higher production over local varieties
- Application of micro-nutrients like sulphur, boron increased yield of chickpea and wheat by 36-60%
- Nutrients increased number of nodules and VAM colonization from 45-182%
- Improved varieties and micro-nutrient application gave additional income of Rs.5000 per ha in case of wheat



Farmer showing improved variety of wheat at Govardhanpura



Farmers observing improved variety of chickpea at Thana

## Village-based Seed Bank

With the aim of providing improved varieties to the farmers, breeders seed of improved cultivars of different crops were introduced in the watersheds through community groups and established a seed bank.

The seed bank is operational as follows

- Farmers returned seeds produced to kisan vikas samitis' as a seed capital at a ratio of 1:1.25
- Farmers participatory seed production mechanism ensures the availability of true-to-type varieties and quality seeds to whole watershed community.
- Ten quintals of improved variety chickpea seed was procured from the farmers for redistribution in Rabi season, 2003.

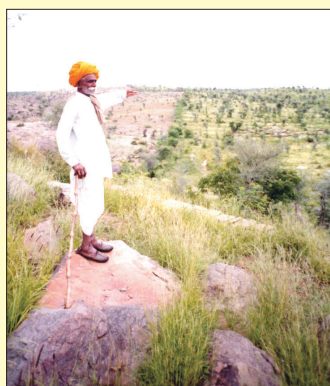
### Rehabilitation of degraded lands and participatory biodiversity management

The Bhimsagar dam in Thana is subjected to silting due to soil erosion during monsoon season. A major piece of 23 ha in upper dam area was developed through physical and biological treatment to reduce soil erosion and improve fertility, greenery, fodder production etc.

- The area is surrounded by physical (stone wall of 2,105 running meters) under food for work program and social (villagers responsibility) fencing
- Physical treatment consisting of staggered trenches (200), CPTs (293), gully plugs (6) have been completed
- Villagers planted useful grasses, Gliricidia, Accacia, Neem as a biological treatment



Farmers and scientists tame blue bull calf in developed common lands of the watershed



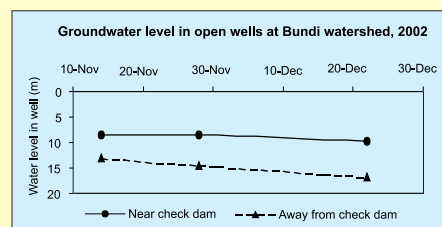
A farmer showing clear-cut distinction of area cordoned by physical and social fencing at Thana

- Plantation of 25,000 *Jatropha curcas* seedlings (Bio-diesel) to minimize land degradation
- Planting grasses and useful trees also developed shelter for animal population such as blue bull and fodder availability following cut and carry system is improved

### Monitoring and impact assessment of runoff, groundwater levels and soil loss

The micro-watersheds are equipped with automatic weather station hydrological gauging stations and continuous monitoring for increased productivity, income and greenery. The seasonal runoff was 12.8 mm occurred in 3 runoff events which is 3.7% of seasonal rainfall in 2002. The major event of 11.2 mm with a

peak runoff rate of  $0.108 \text{ m}^3 \text{ s}^{-1} \text{ ha}^{-1}$  was on 10 August and remaining events were negligible. The seasonal soil loss was  $0.453 \text{ t ha}^{-1}$ .



- Significant improvement in water level were found in the wells which are located near the check dam as compared to the wells away from check dam.
- Through this innovative approach, in participation with the farmers and scientific research institutions, production in rainfed areas of Bundi district, increased substantially while minimizing land degradation. It is a win-win proposition for all the stakeholders to manage the natural resources sustainably and improve the livelihoods.



Automatic weather station at Thana



Automatic water level recorder and sediment sampler at Govardhanpura

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Global Theme 3

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