Integrated Watershed Management – A Food Security Approach for SAT Rainfed Areas



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Importance of Rainfed Agriculture

- Contributes 60% of world's food from 80% of cultivated land
- Home of world's poor and malnourished people
- Yields from rain-fed agriculture are low in semi-arid tropical agroecosystems
- Green revolution drove away food shortage of 1960's but at a cost





Common Challenge: *Eliminating rural poverty and sustainable development*











Who are the hungry?



22% Landless Rural Poor



50% Small Farmers



20% Urban Poor



8% Pastoralists, Fishers, Forest dwellers

Climate Change & Increased Variability

- On 23 June 2007 Kurnool received 420 mm rainfall (monthly average of 77 mm, > 60% of the normal annual rainfall)
- On 13 Feb 2008 Tirunalvelli received 125 mm in three hrs

Projected Water Scarcity in 2025

A Water-Short World

- ☆ Vital, finite and scarce
- ☆ Essence that makes GREY - GREEN
- ☆ By 2025 1/3rd population will face water scarcity



Emerging Issues

- Food security
- Fodder security
- Water security
- Energy security
- Human health



All are interlinked and we need to have holistic and long-term vision







Water for Food – A Daunting Challenge

- Irrigation cannot do it alone
- Irrigated agriculture accounts >70% of water withdrawals
- Competing demands for water
- Rainfed agriculture depends on rainfall infiltrated in the soil
- Green water consumption is almost 3-fold more than blue water consumed for food production (5000 vs 1800 $km^3\ yr^{-1}$)



Water Alone Can't Do it

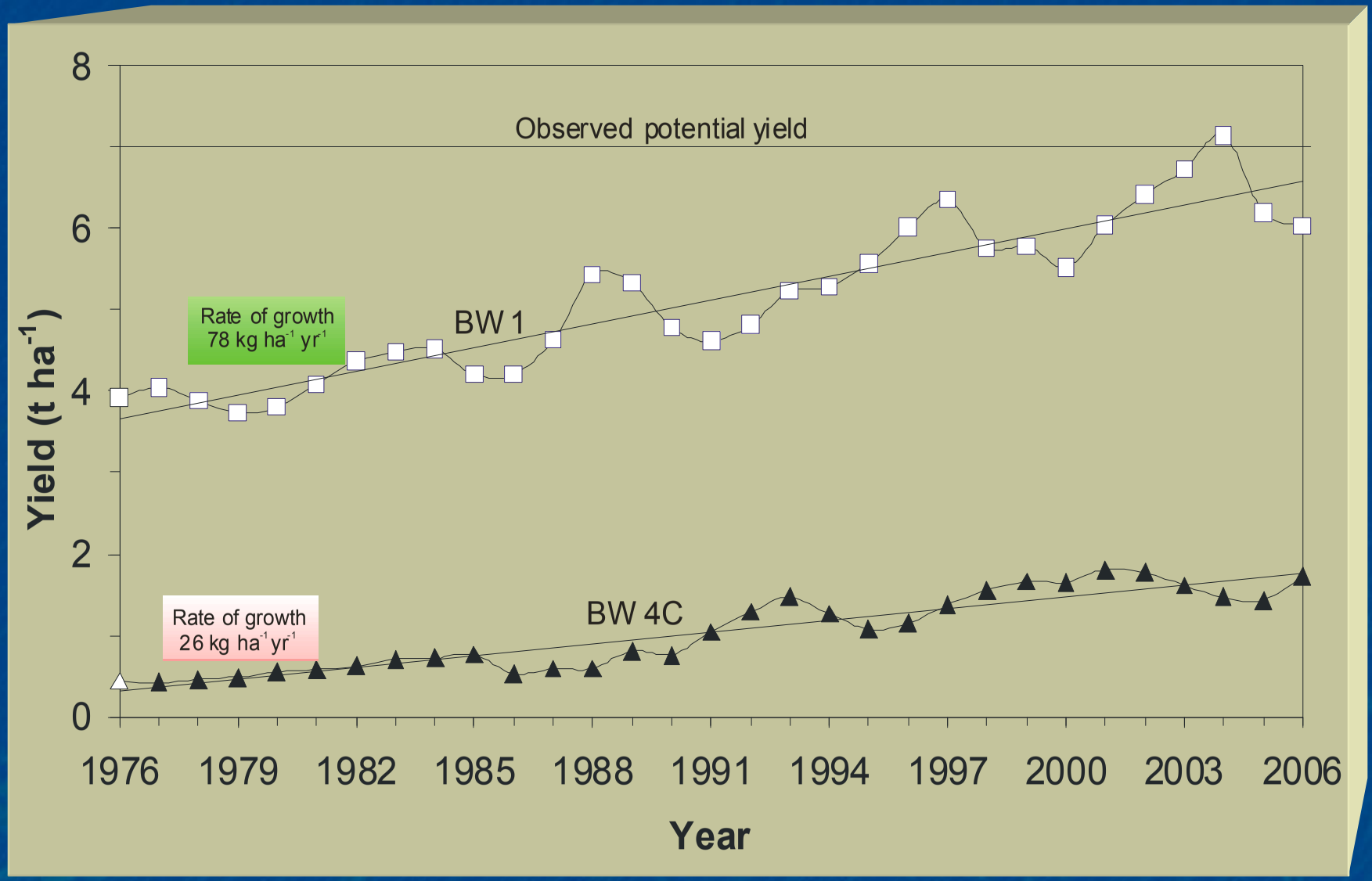




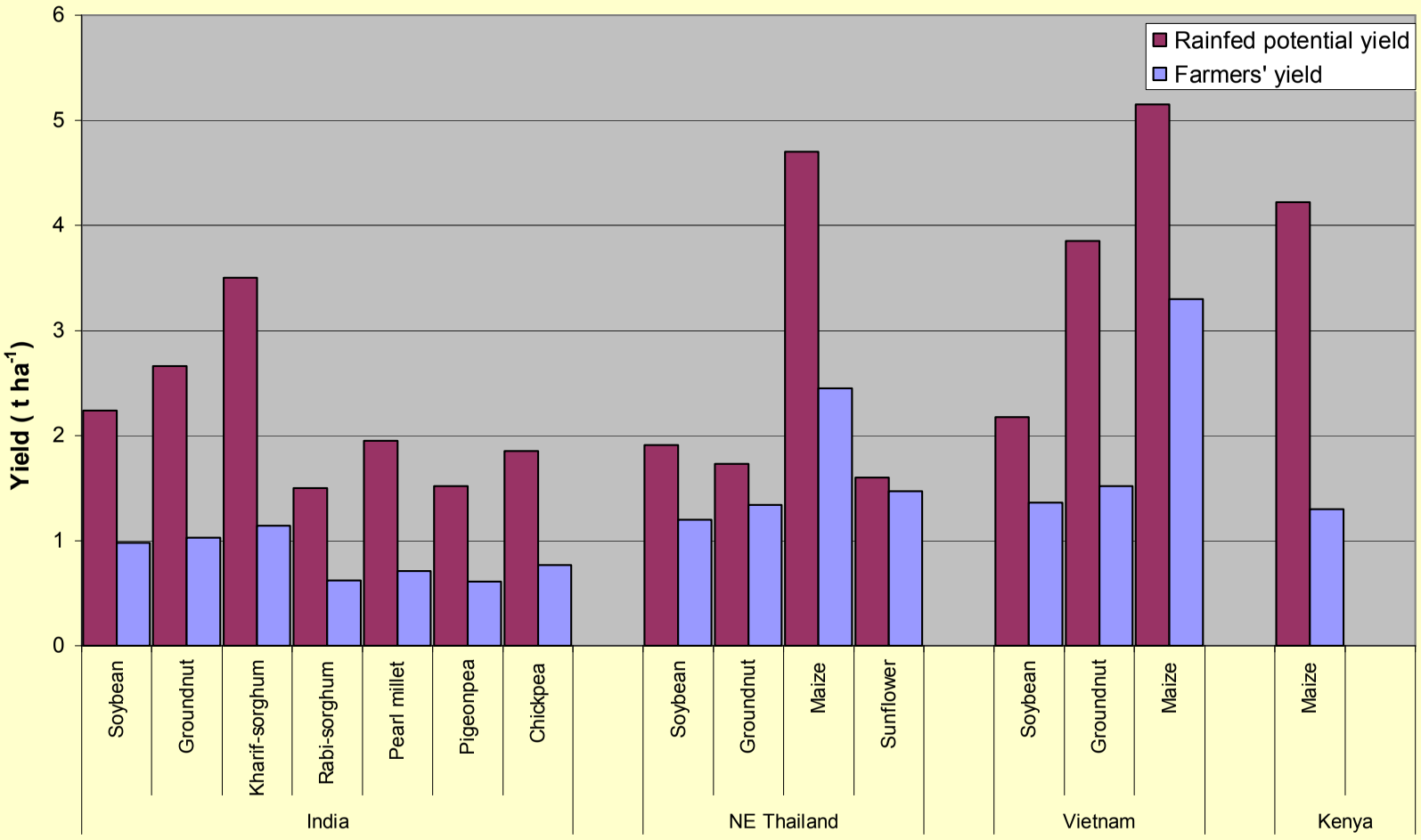


- Increased water use efficiency along with water augmentation
- IGNRM
  (balanced nutrient management, improved cultivars, capacity building, enhancing policies and institutions)
- Livelihood approach – Diversification of systems and crops
- Empowering stakeholders

Large opportunities to increase greenwater use efficiency to reduce the consumptive water use in rainfed agriculture



Large Potential of Rainfed Crops to be Harnessed



Global Problem—Needs Local Solution

- Holistic systems approach
- Collective efforts of all the stakeholders
- Knowledge driven management systems

New Paradigm in Community Watersheds : Engine of agricultural growth in rainfed areas



Watershed as entry point for:

- Increasing productivity
- Improving livelihoods
- Protecting environment
- Building resilience of human and natural resources to cope with future challenges including climate change

Need for Paradigm Shift in Water Management

- Discard artificial divide between irrigated and rain-fed systems
- Change from supply augmentation to demand management
- Consider water use efficiency than water availability
- More Crop and Income per Drop of Water





A New Watershed Paradigm: What it Involves

- Water management as an entry point only to improve livelihoods using science-led development adopting
- Holistic system's approach and not an end in it self as was the case with the conventional approach
- Guidelines need to be evolved and harmonized to suit the needs and interventions
- Emphasis on productivity enhancement and value addition

A New Watershed Paradigm: What it Involves (Cont..)

- Targeted activities for women and vulnerable groups
- Empowerment and knowledge sharing
- Innovative extension methods
- Diversification with high-value crops
- Rehabilitation of degraded lands
- Promoting partnerships and private investments

New Paradigm

- The new paradigm for watershed management needs to be evolved to address the issues faced and the learnings from the past studies
- It has to be evolutionary and a tool box approach highlighting the principles rather than prescribing the technologies
- It can not be either or for example we can not say only bottom-up or top down approach, it will depend on the context and existing situation
- It should be science-led at the same time indigenous knowledge also need to be put together, etc.

Enhanced Rainwater and Irrigation Water Use Efficiency

- Conserve in soil
- Harvest and store rainwater
- Increase groundwater recharge
- Reduce losses and use efficiently
- Discard artificial divide between irrigated and rainfed systems







Field-based Soil and Water Conservation



Vegetative bunds with fruit trees and annual crop at Tad Fa Watershed, Thailand

This system gave 35% higher profit and reduced soil loss to 1/8th (3.2 t ha^{-1}) that of sole annual crop of maize.

Plastic mulch system at Lucheba watershed, China

Plastic mulch to conserve moisture and improve soil temperature gave 31% higher yield (20.5 t ha^{-1}) over no mulch in China cabbage.



Small Water Harvesting Structures

- Better equity
- Easy to construct and maintained by local community

Water harvesting structure in northeast Thailand



Low-cost mini percolation tank at Kothapally, A.P.



SAT Soils are not only thirsty but hungry also

- Documented widespread deficiency of micronutrients

Percentage of farmers' fields deficient in soil nutrients in different states of India							
State	No. of farmers' fields	Org.C %	Av.P ppm	K Ppm	S ppm	B ppm	Zn ppm
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

Benefits of watersheds: Summary of meta-analysis

Indicator	Particulars	Unit	No. of studies	Mean	Min	Max	t- value
Efficiency	B/C ratio	Ratio	128	2.14	0.82	7.06	21.25
	IRR	Per cent	40	22.04	1.68	94.00	6.54
Equity	Employment	Person days/ha/yr	39	181.50	11.00	900.00	6.74
Sustainability	Irrigated area	Per cent	97	33.56	1.37	156.03	11.77
	Cropping intensity	Per cent	115	63.51	10.00	200.00	12.65
	Rate of runoff	Per cent	36	-13.00	-1.30	-50.00	6.78
	Soil loss	Tons/ha/yr	51	-0.82	-0.11	-0.99	39.29

Improved Soil Health

- Conserve Soil
- Diversify systems with legumes
- Organic matter
- Balanced nutrition – Emerging wide spread micronutrient deficiencies

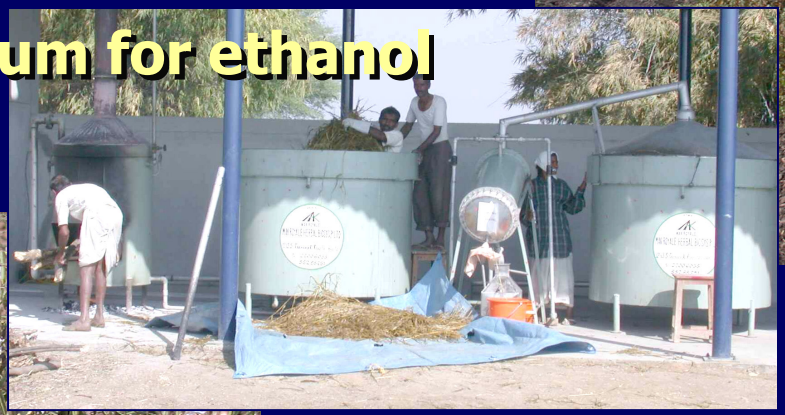




Diversification of Systems for Sustainable Development

- Legumes in systems
- Grow water efficient crops
- Medicinal and aromatic plants
- Vegetable and fruit trees
- Sweet sorghum for ethanol









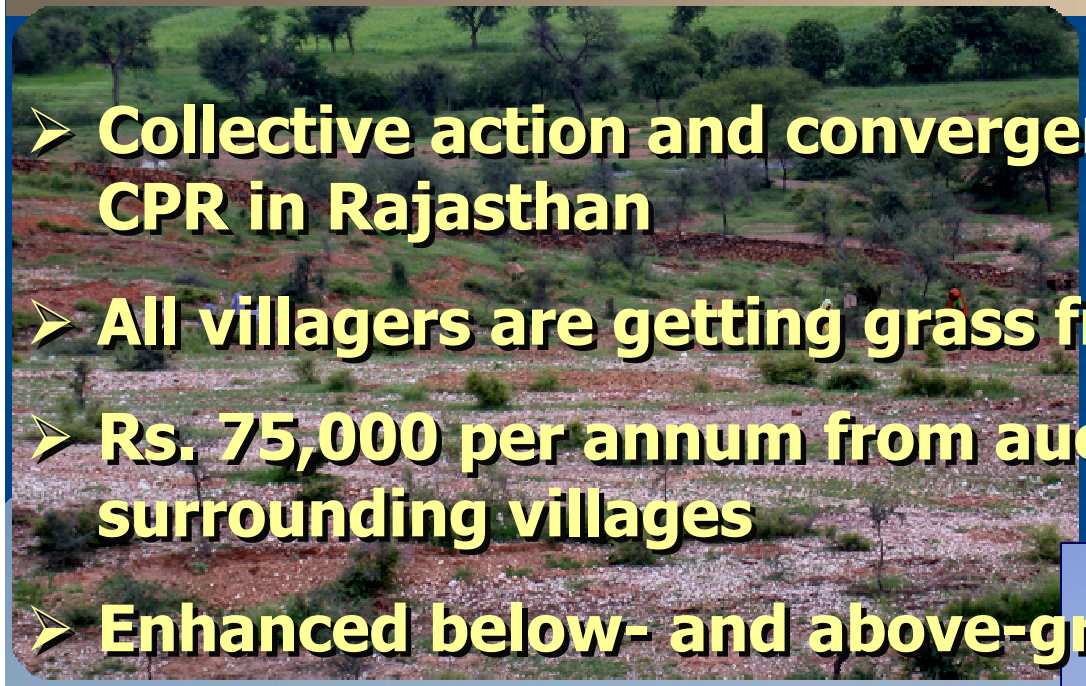
Rehabilitation of CPRs with Biodiesel Plantation



- Collective action for minimizing land degradation
- CPRs are rehabilitated thru biodiesel plantations with SWM
- SHGs are formed and would benefit not only from the wages but will have usufruct rights
- Within six months usufruct rights awarded to SHGs

Community-based Initiatives Rehabilitated Degraded Lands and Conserved Biodiversity

- Collective action and convergence developed CPR in Rajasthan
- All villagers are getting grass free of cost
- Rs. 75,000 per annum from auction of grass to surrounding villages
- Enhanced below- and above-ground biodiversity









Micro-enterprises: Improved Livelihoods in Benchmark Watershed

- Vermicomposting
- Value addition: *Daal* mills installed
- Village-based seed bank
- Nursery raising by SHGs













Capacity Building, Close Interactions with Community Enhanced Benefits



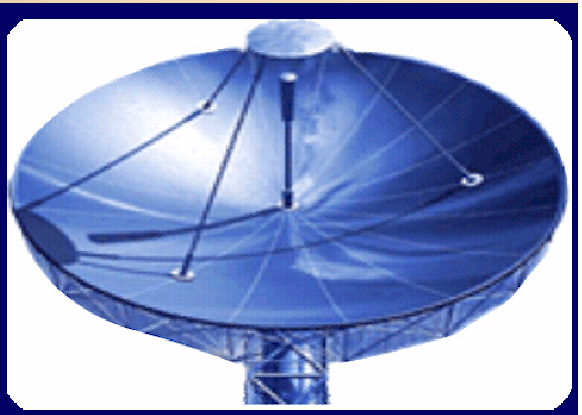


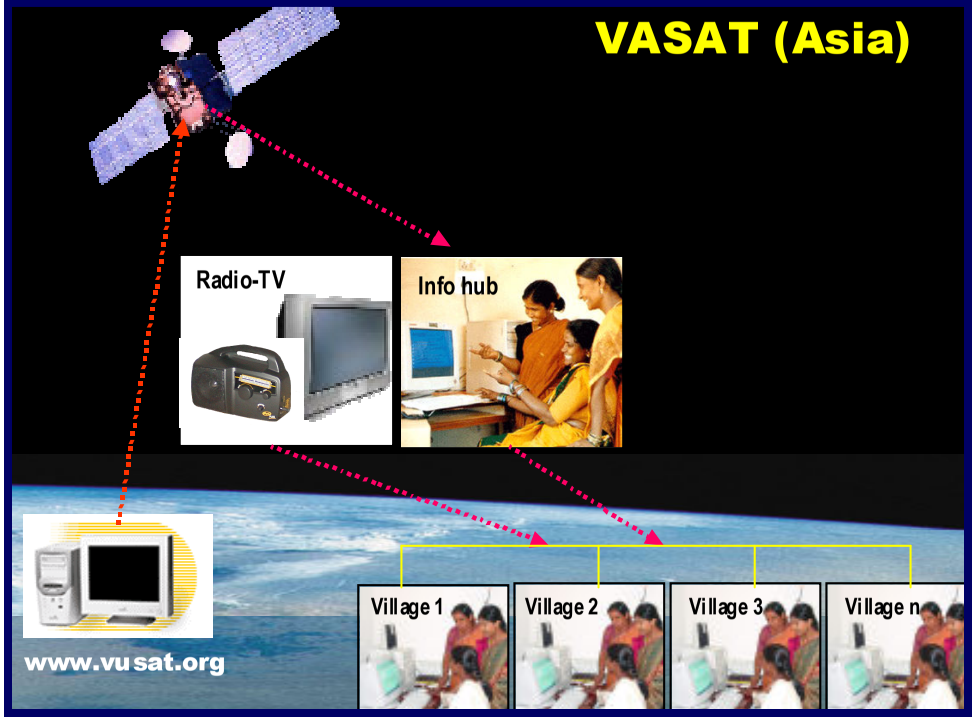


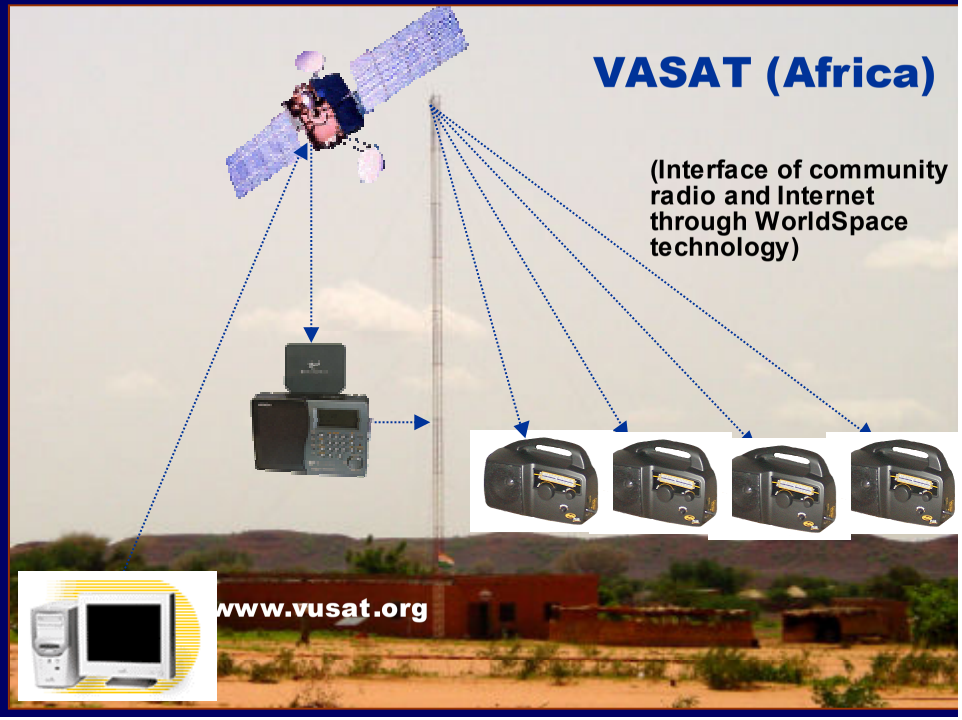


ICT has Important Role in Sharing Knowledge and Empowering Community

- Seeing is believing
- Community information hub
- Audio video training material
- VASAT

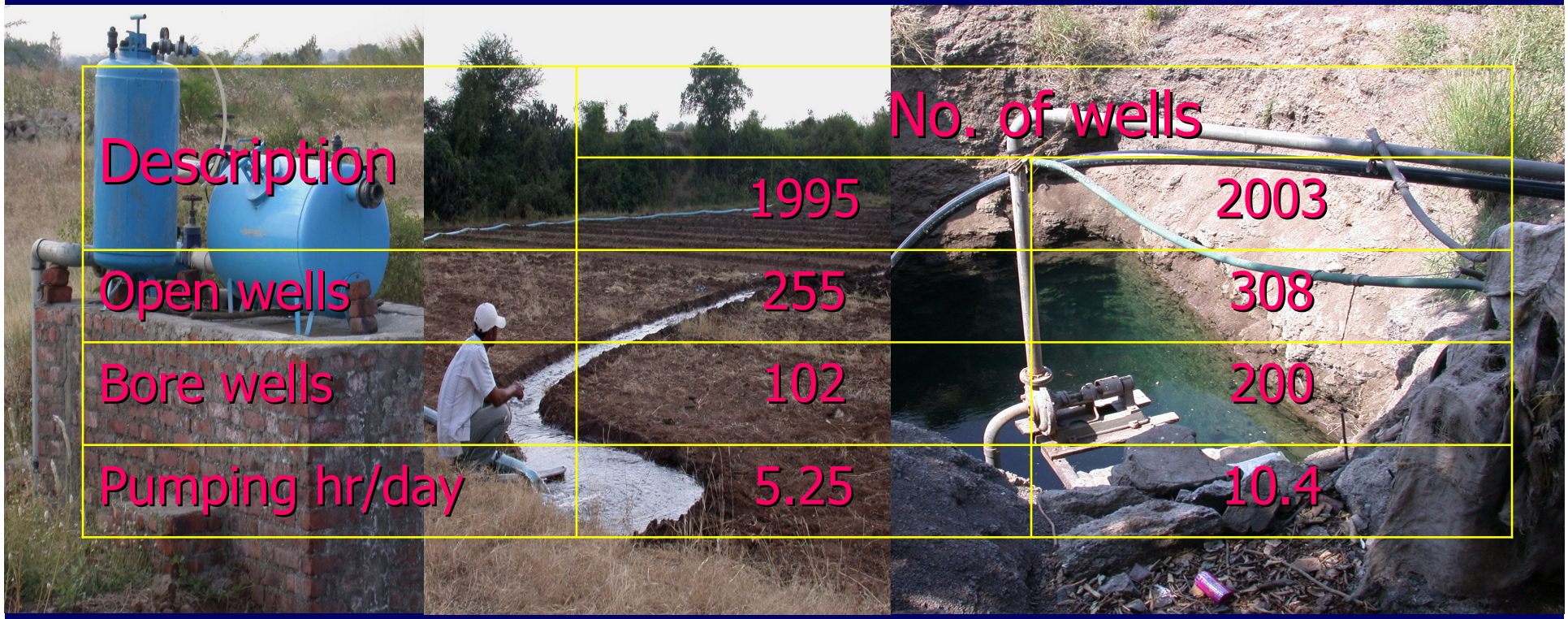






Sustainable Groundwater Use Policies are Must in Rainfed Areas

Rajasamadhiyala watershed



Description	No. of wells	
	1995	2003
Open wells	255	308
Bore wells	102	200
Pumping hr/day	5.25	10.4

Innovative Institutions

- Innovative institutional mechanisms such as consortium approach for technical backstopping
- Strengthening of area groups as is the case in Sujala Watershed program
- Strengthening of SHGs in APRLP, women's village organization (VO) in APRLP or Village organization like in Sujala watershed
- Concurrent monitoring and evaluation by an independent body as evaluated in Sujala Watershed program

Innovative Institutions (Contd..)

- Participatory M&E involving community and other stakeholders
- Transparency at village level
- Farm-based planning (net planning) (Indo-German Program)
- Trained farmers as master trainers are found effective institutional mechanisms. There is an urgent need to identify such effective institutional mechanisms

Convergence

- Convergence of actors and their actions at watershed level to harness the synergies and to maximize the benefits
- We have missed out large benefits of watershed programs due to compartmental approach
- There is an urgent need to bring in convergence as the benefits are many folds and its win-win for all the stakeholders including number of line departments involved in improving rural livelihoods

Coordination

- New institutional mechanisms are also needed at district, state, and national level to converge various watershed programs
- Establishment National Authority for Rainfed Areas
- Welcome developments, however, it is just a beginning and lot more still need to be done to provide institutional and policy support for development of rainfed areas

Monitoring and Evaluation

- Align M&E processes as per the objectives and use quantitative and qualitative indicators judiciously for assessing the effectiveness of the programs
- Select suitable impact assessment methods at different levels
- Use new science (social as well as biophysical) tools to assess the impact collecting quality data selectively rather than collecting voluminous reports out of the mill approach
- Independent agency to monitor

Watersheds as Business Model

- Watersheds to be developed as business model
- Public private partnership (PPP)
- Market-led diversification using high-value crops
- Value chain approach
- Livelihood approach rather than only soil and water conservation approach

Caution

- Watersheds are only management units for sustainable development of NRs
- Watersheds need to be used as planning units for inclusive growth
- Water management as an entry point activity
- Watershed management is just a beginning for holistic area development and improving livelihoods and not an end in itself
- The watershed plans can be converged to make district and state plan

India to be Global Leader in IWM for Inclusive Growth

- It will be a role model not only for India it self but also for all the developing countries in Asia and Africa
- These countries are plagued with the same dilemma of achieving inclusive sustainable growth including small and marginal farmers from rainfed areas
- The challenge faced in the country can be converted in to an opportunity

Farmers' participatory evaluations for productivity enhancements in watersheds of 7 districts of Karnataka under ICRISAT-Sujala project during 2005-2006

District/Crop	Watershed villages	No. of trials	Cultivars	Yield (kg ha^{-1})		% Income over FP
				FM	Best- bet	
Kolar & Tumkur (Groundnut)	7	63	JL 24, ICGV 91114, K1375, K6	920	2260	146
Kolar & Tumkur (Ragi)	9	62	MR 1, L 5, GPU 28	1150	1930	68
Chitradurga (Sunflower)	2	30	KBSH-41, KBSH-44, GK 2002	760	2260	197
Chitradurga & Haveri (Maize)	4	49	PA 4642, GK 3014	3450	5870	70
Haveri (Sole groundnut)	4	16	ICGV 91114	1100	1720	56
Dharwad (Soybean)	4	12	JS335, JS 9305	1350	2470	83

Watershed Improvement thru a Consortium Approach: Impact



- Lives of 2,50,000 poor people are changed for better in 4 countries in South & SE Asia in 218 villages

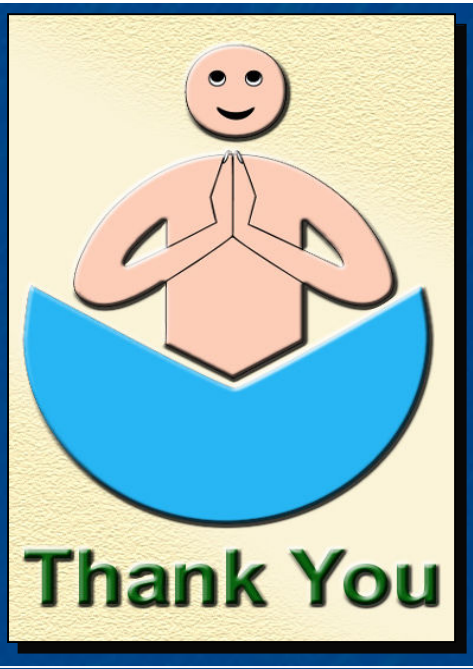
Partners: NARES, ICRISAT, NGOs and CBOs



















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