Data for Drinking Water

Centre for Technology Alternatives for Rural Areas
GISE Lab, CSE
IIT-Bombay

www.ctara.iitb.ac.in

www.gise.cse.iitb.ac.in

Centre for Technology Alternatives for Rural Areas

- An academic center of IIT-Bombay, started in 1985
- Development as an intellectual pursuit-challenges, solutions.

Academic Initiatives

- 2007: M.Tech./Ph.D. program in Technology and Development.
- 2010: TDSL- with other departments and UGs.

Recent focus:

- Energy –household, domestic and rural
- Agriculture/Livelihoods –post-harvest, foods
- Water sector –drinking water, policy.
- Environmental planning –development plans, urban and rural appraisal
- and others...

The T&D core values

- Concrete beneficiary/stake-holder-the bottom 80%, households, hamlets, gram-panchayats, villages, towns and cities
- Basic areas-soil, water, energy, livelihoods, public health
  - end-user defined or demand-driven
- **Towards change**- as close to implementation as possible
  - deliver solutions -technology, policy
  - deliver knowledge -consultancy, capacity-building, debate.

Objectives of the M.Tech. program

To produce the developmentalist/development practioner

- Analyse "development" situations and design solutions
- Work with implementation agencies and see them to completion
- Rising demand for such professionals

Drinking water for Boriwali

or for that matter, a savings and micro-lending analysis for Boriwali.

Or saving drudgery for women

Our students (and our faculty) in the field

Typology!

- Data Gathering : fidelity and intensity-expensive
- Use and Cost/Benefit : Other than research, smaller loops of delivery.
- actionable–even at the *taluka and GP* level

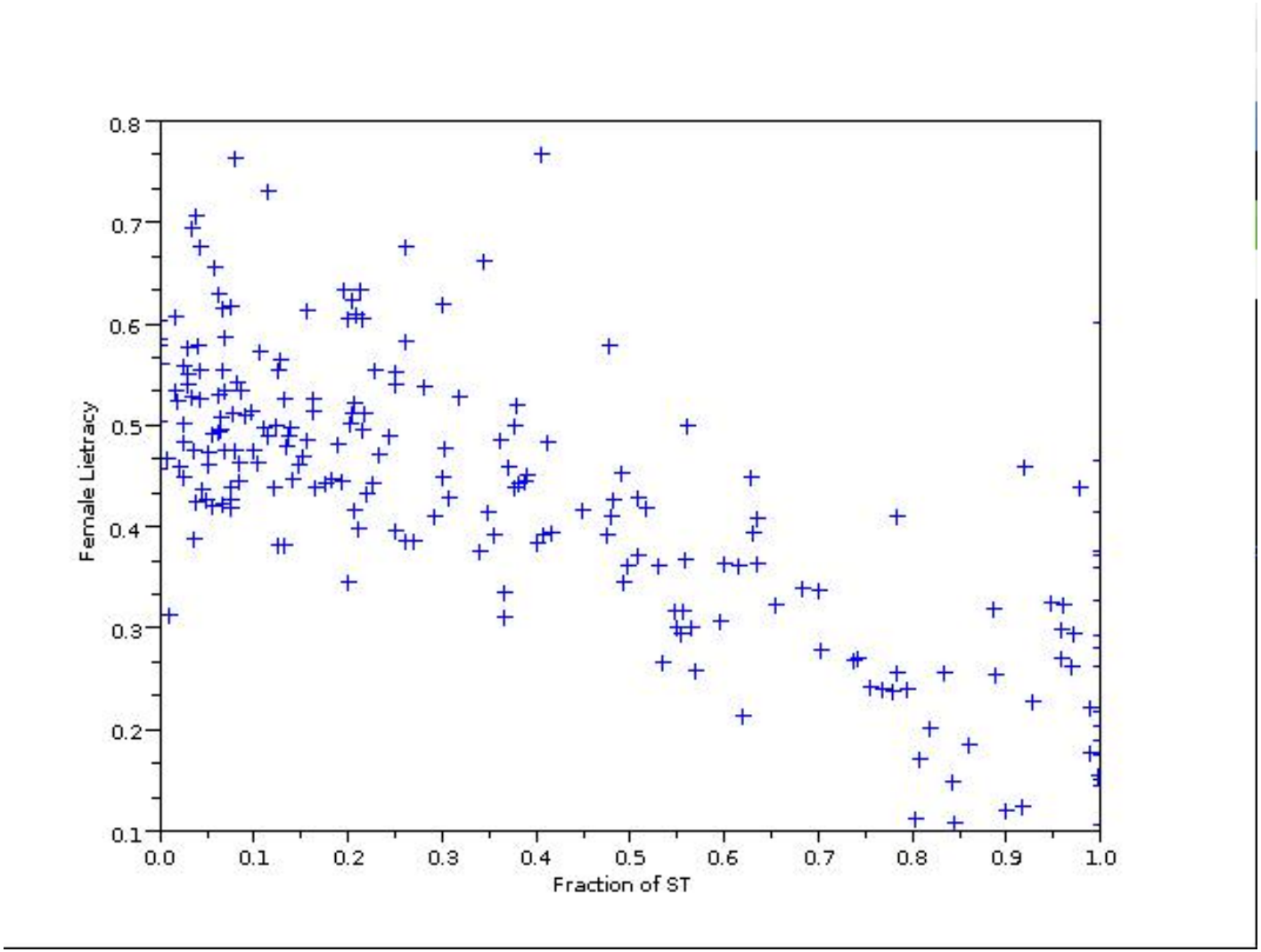
Use	Stake-holders
Research	University, Policy-Makers, CSO
Pedagogy	University
Action-Research	University, Local Administration, NGO
Monitoring	University, Local Administration, NGO
Planning	University, Local Administration

Our Datasets

- Census Part I and II : basic socio-economic back-grounder, land-use
- MRSAC : Remote sensing, planning, roads, watersheds, drainage, District Resource Maps
- DDWS, PWS habaitation-wise (believed) coverage, sources and schemes
- Groundwater Data: Observation wells, watershed labelling, prediction and modelling of GW.
- Local Administrative Data : tanker-fed lists, scheme case-files, yield tests
- IMD, bhuvan : station-wise daily rainfall and other parameters, 90m DEM
- Our concoctions: contours from DEMs, GP atlas, scheme simulation models, planning GIS and so on

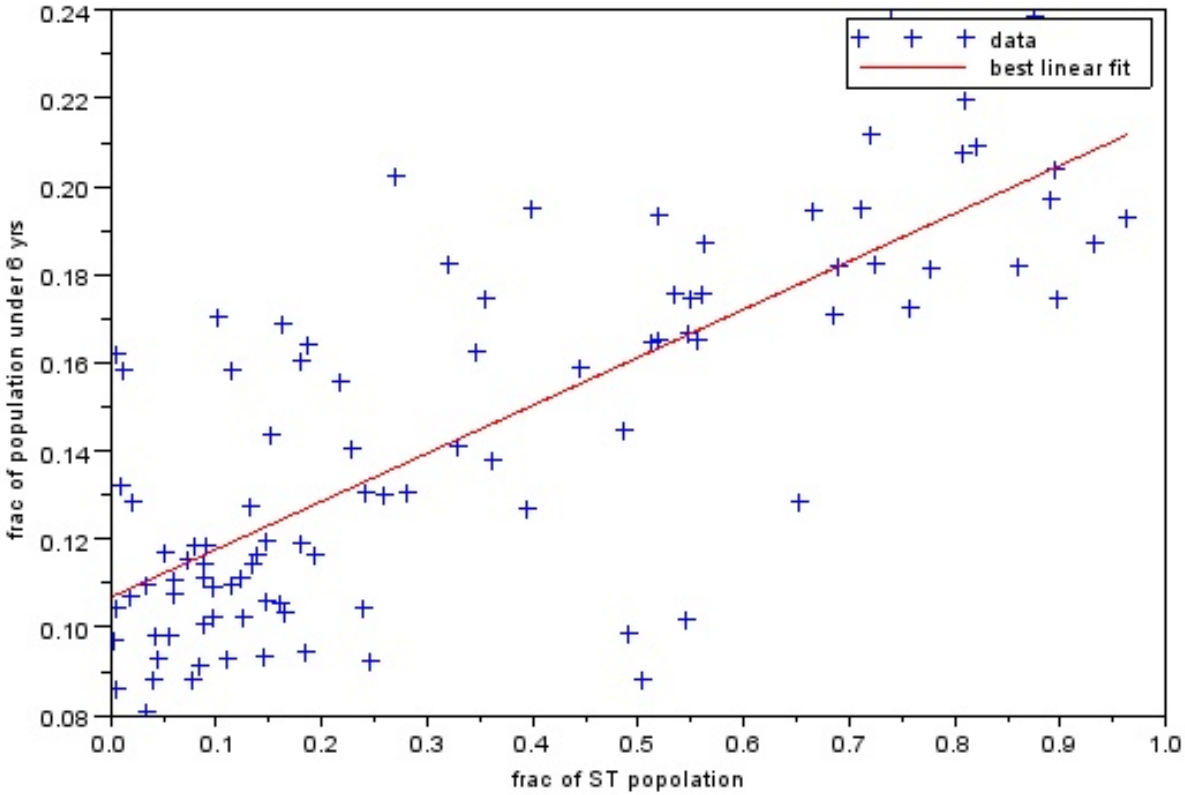
Pedagogy

Village statistics-ST fraction vs. female literacy



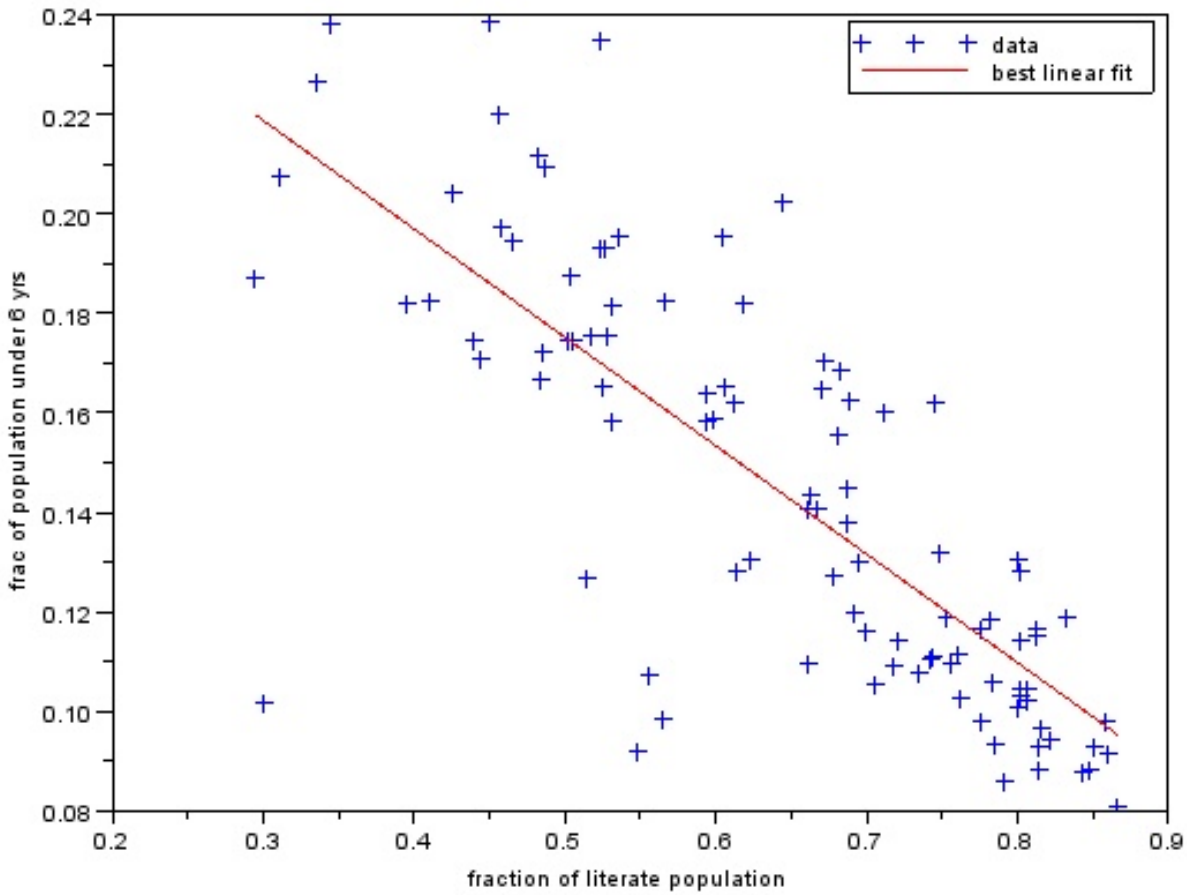
Pedagogy

ST fraction vs. population under 6

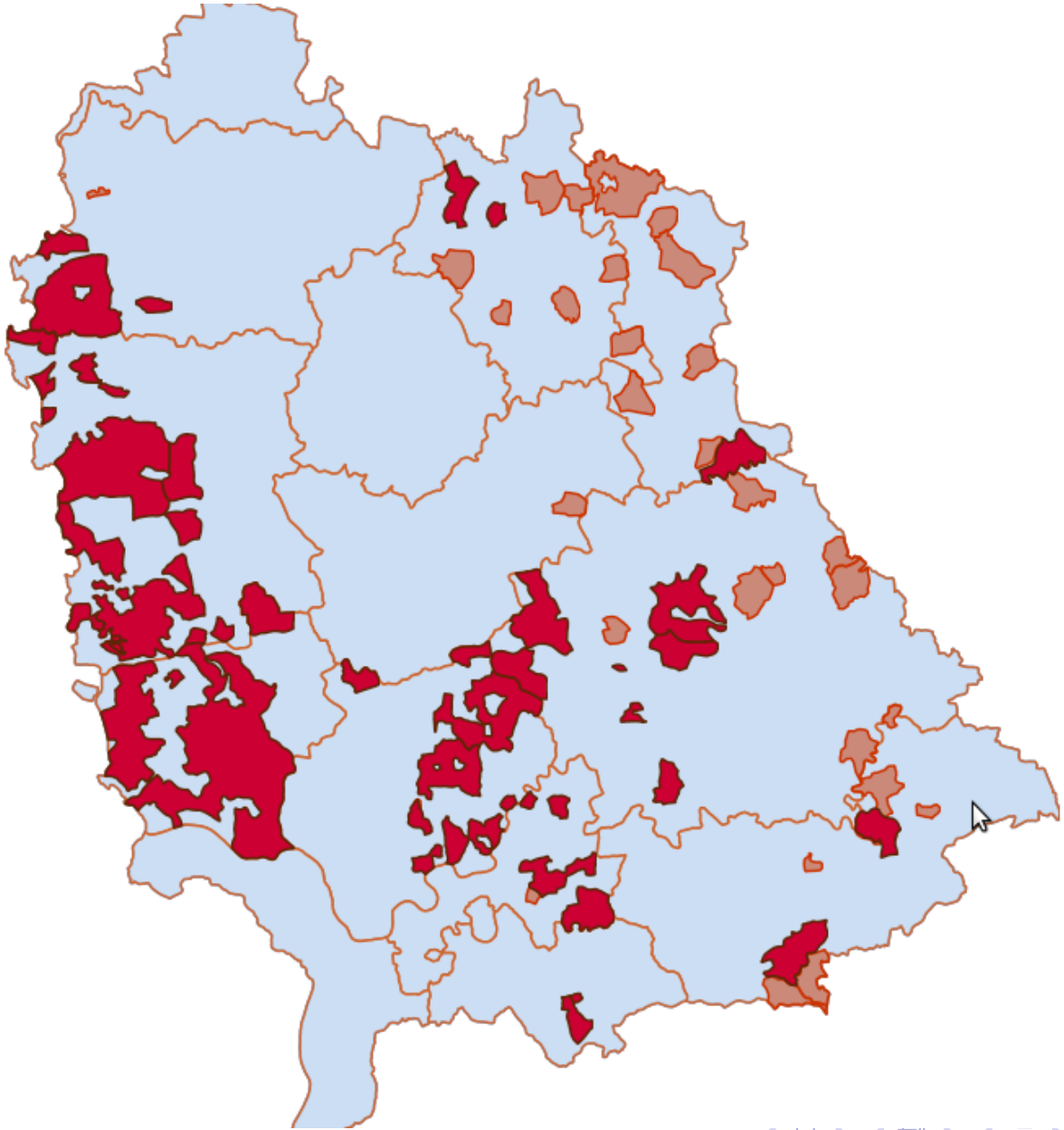


Pedagogy

more decisive-female literacy vs. population under 6



Analysis of tanker-fed wadis in Thane/Raigad



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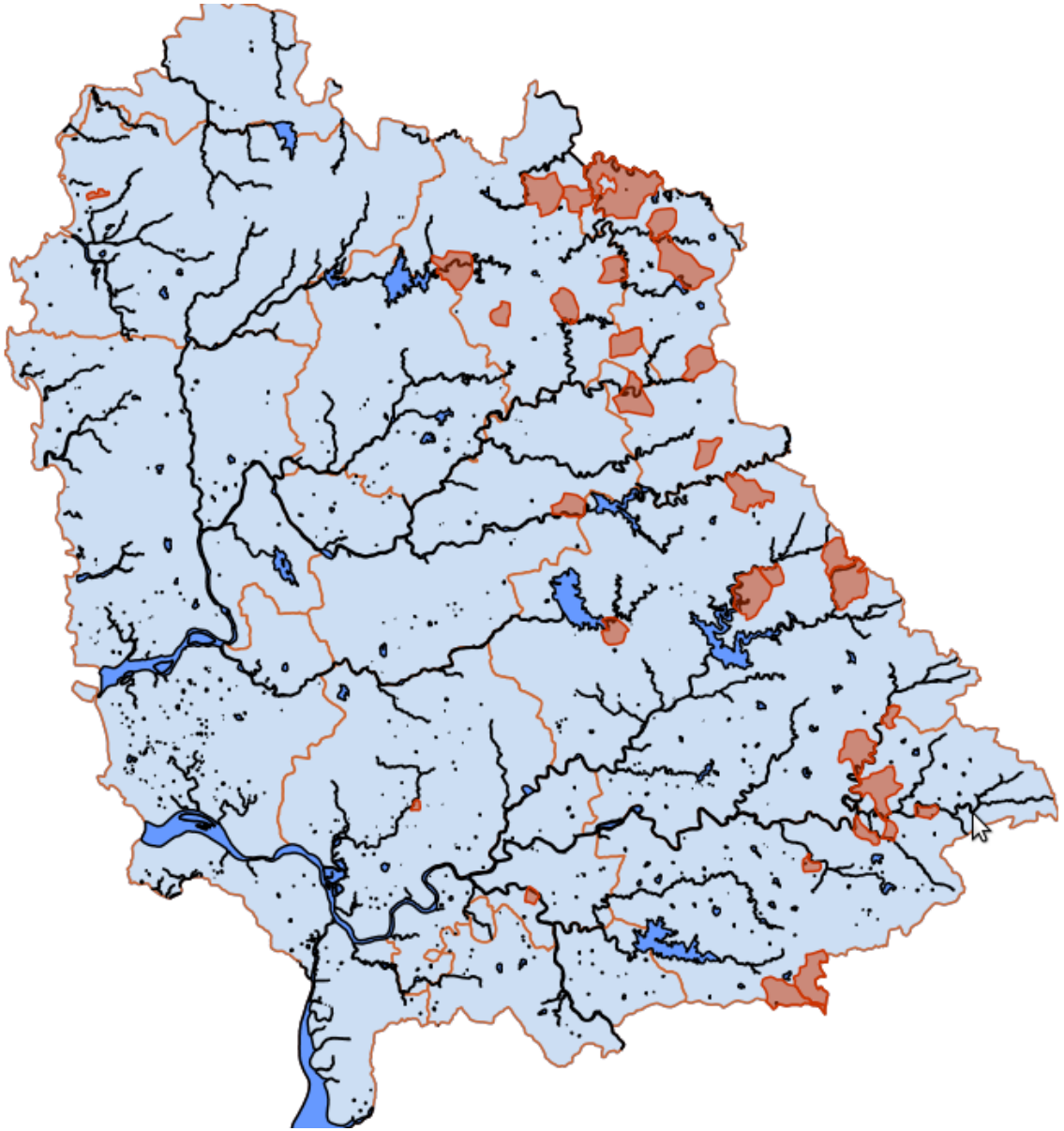
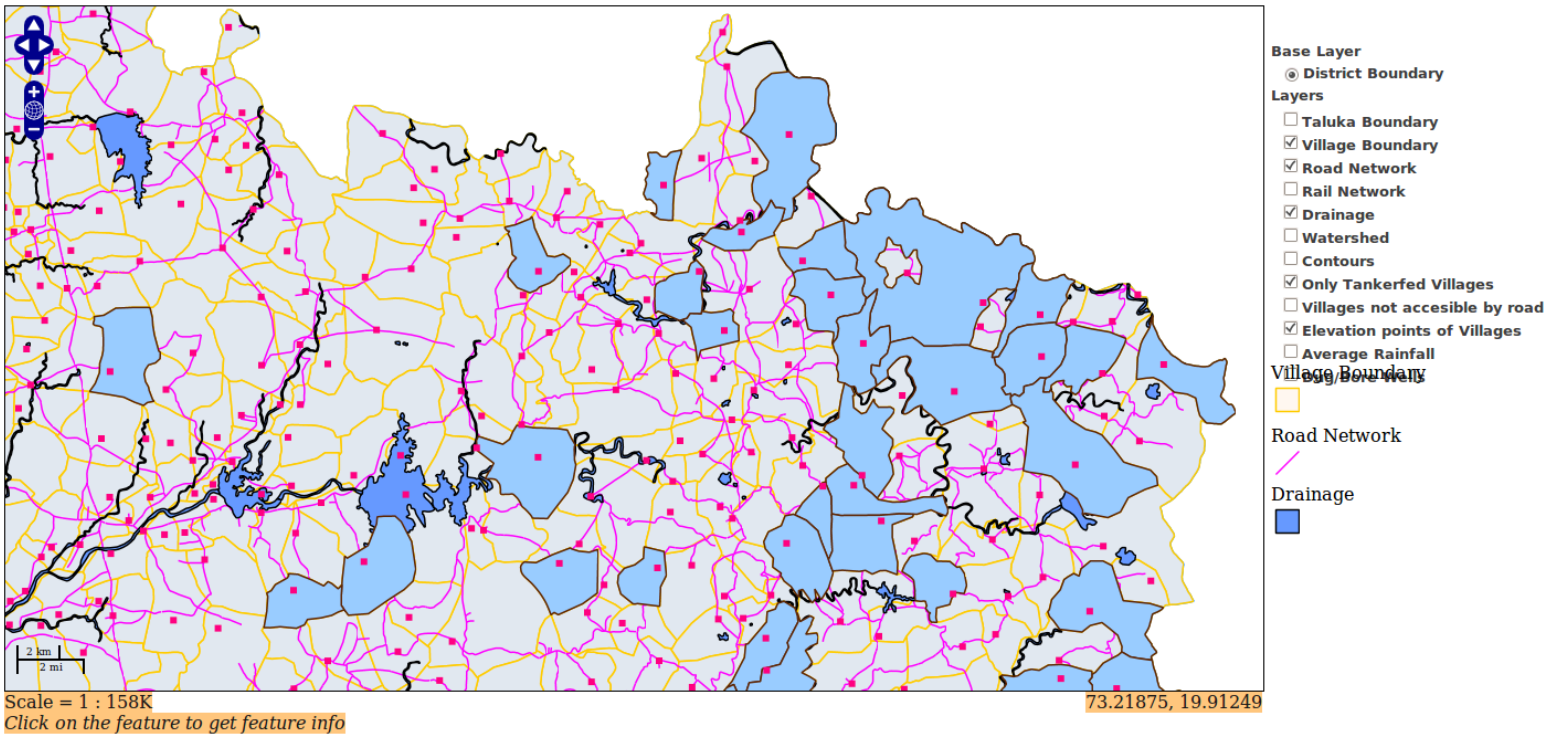
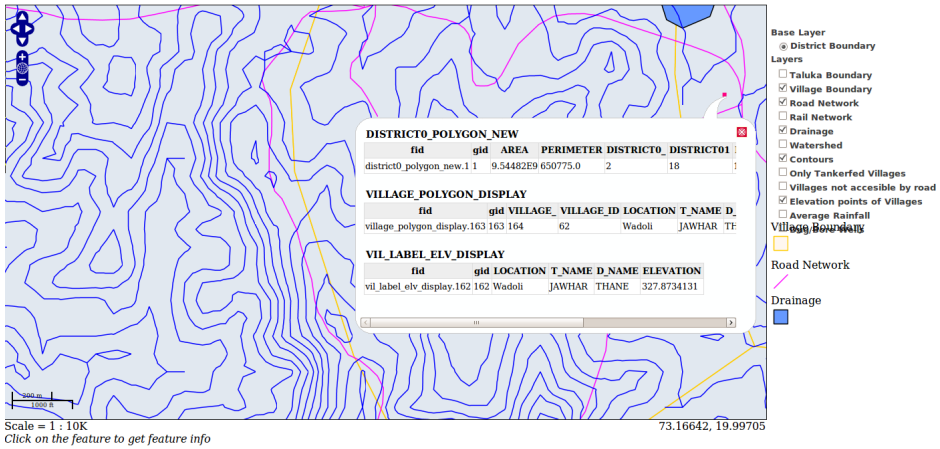


What have we done-I

Construct a planning and representation tool

- data from MRSAC, CGWB, our own analysis, local admin.
- enable visualization, analysis and planning





Fraction of ST population.

	Jawhar	Mokhada	Murbad	Shahpur
Tankerfed	0.97	0.93	0.74	0.62
Neighbors	0.99	0.97	0.32	0.42
Taluka	0.97	0.91	0.24	0.35

Mean elevation:

	Jawhar	Mokhada	Murbad	Shahpur
Tankerfed	344	361	123	197
Taluka	320	350	126	132

What have we done-II

Visited tens of GPs to understand problem

- Dhamni, Dalkhan, Vihigaon, Washala, Dhakne, Mograj
- certain observations about schemes, terrain, surface vs. ground

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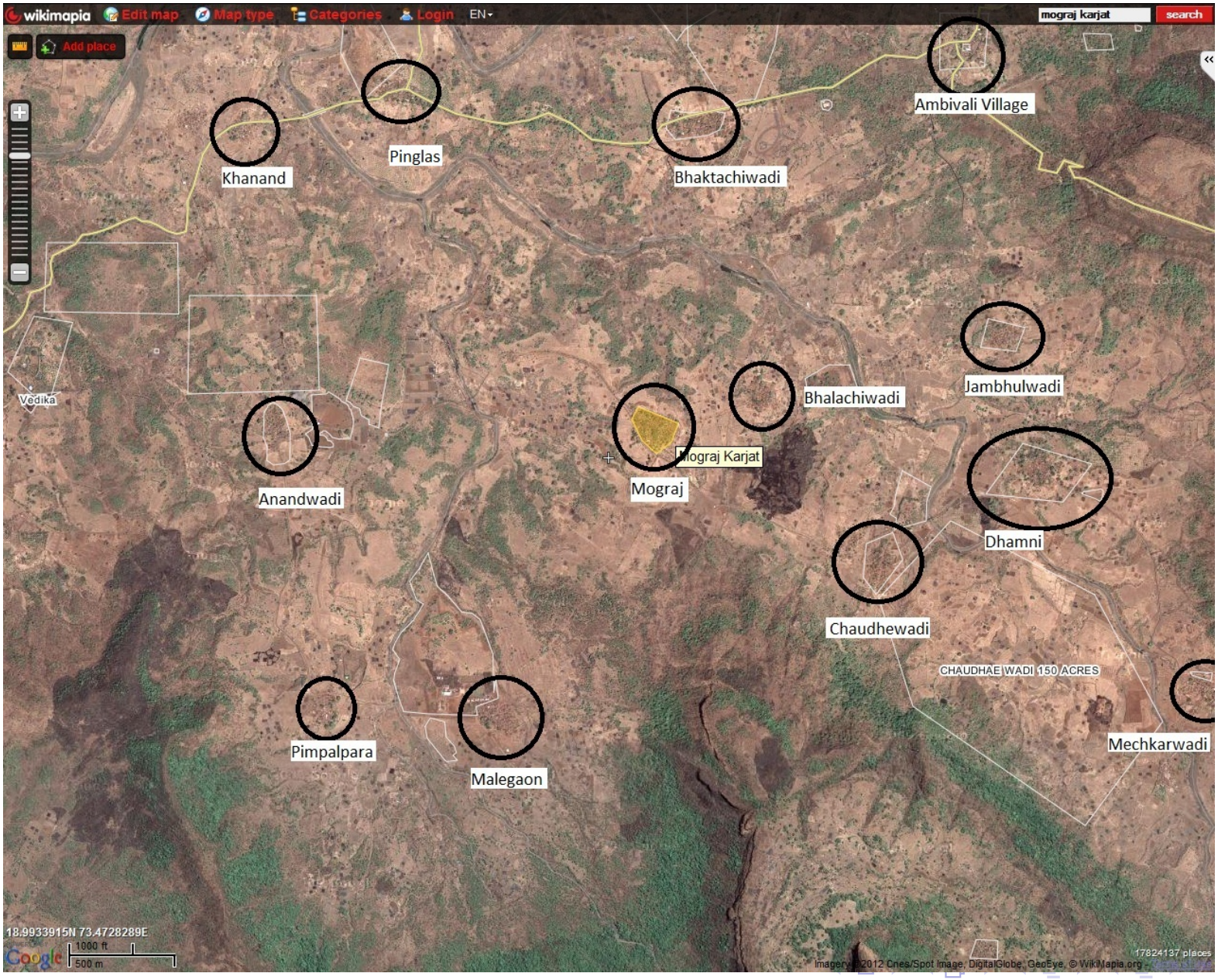
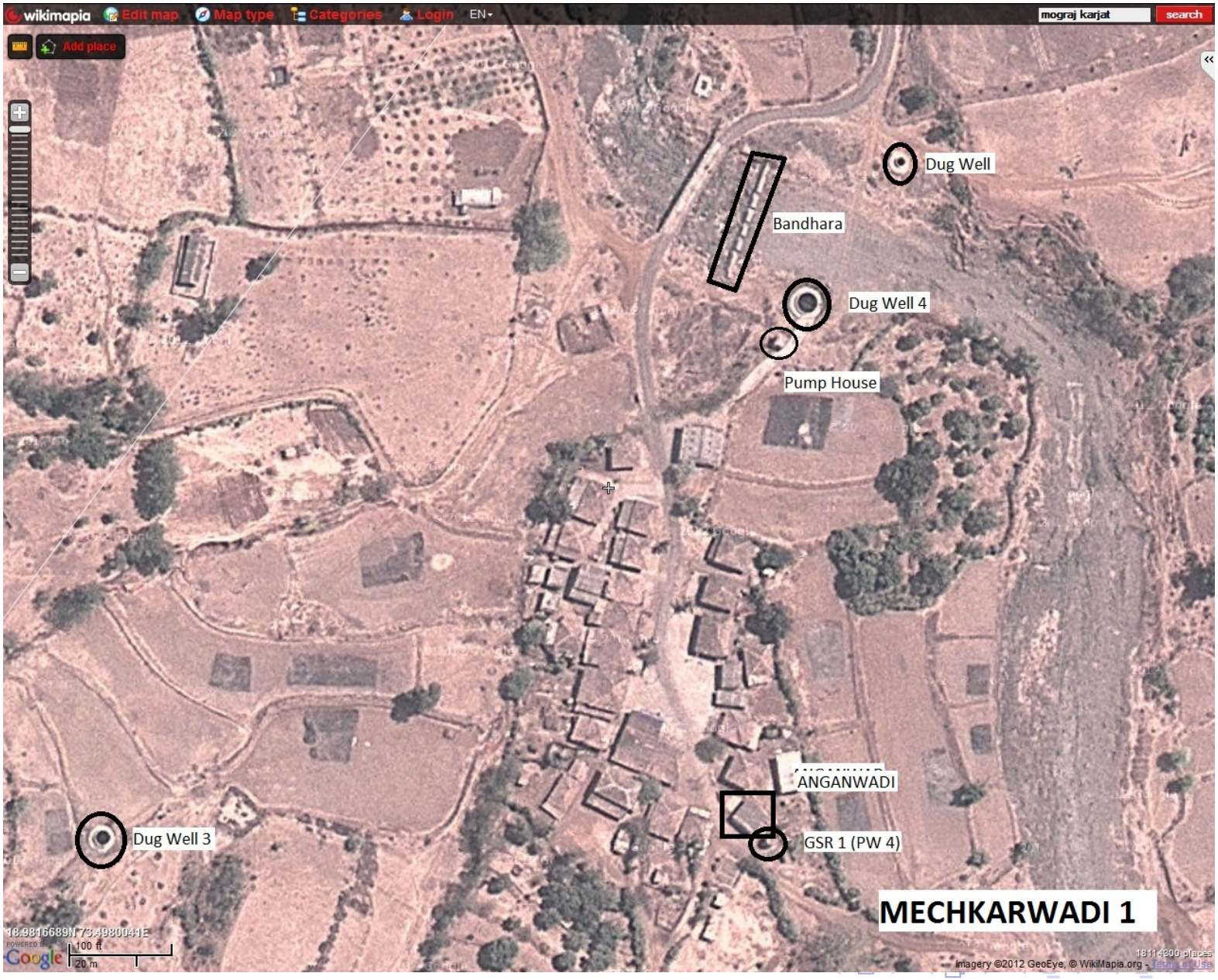
Mograj GP -according to DDWS and actual!

	VillageName	HabitationName	SchemeNameDP	SanctionYear	SchemeType	Estimated Cost	DateOfCommencement	sourceTypeCategory	TypeOf Source	locationWater Source	Satus as per CTARA survey as of March 2012
2	AMBIWADI T.	AMBIWADI T. KOTHAL KHALATI	PWSS AMBIVALI	2008-2009	Piped Water Supply Scheme	25.00000	31/03/2009	Surface Water	River		Functional
3		AMBIWALI	PWSS AMBIVALI	2008-2009	Piped Water Supply Scheme	25.00000	31/03/2009	Ground Water	Openwell	near village	Repeated
4	DHAMNI	CHOUDHARWADI	Chowdhariwadi handpump	2000-2001	Hand Pump	0.35000	14/01/2000	Ground Water	Deep Tubewell	near field	Functional
5		DHAMNI	DHAMANI DUGWELL	2005-2006	DUG WELL	0.35000	01/09/2005	Ground Water	Openwell	in village	Functional
6		MECHKARWADI	MECHKARWADI PWSS	2002-2003	Piped Water Supply Scheme	13.32000	30/05/2003	Ground Water	Openwell	NEAR VILLAGE	Functional
7		MECHKARWADI	MECHKARWADI PWSS	2002-2003	Piped Water Supply Scheme	13.32000	30/05/2003	Ground Water	Openwell	near village	Failed for one wadi
8		PACHKHADAKWADI	DHAMANI DUGWELL	2005-2006	DUG WELL	0.35000	01/09/2005	Ground Water	Openwell	near village	No data
9	KHANAND	BHALAYACHIWADI	BHALYACHIIWADI DUGWELL	2005-2006	DUG WELL	2.21000	20/04/2005	Ground Water	Openwell	in wadi	Functional
10		KHANAND	khanand pwss	2008-2009	Piped Water Supply Scheme	12.61000	12/06/2008	Surface Water	Pond		Not working
11		KHANAND	KHANAND VILLAGE TANK	2008-2009	DUG WELL	11.57000	07/12/2008	Ground Water	Openwell	Near village	Seasonal
12	MALEGAON T.	JAMBHULWADI	JAMBHULWADI HANDPUMP	2005-2006	Hand Pump	0.35000	20/04/2005	Ground Water	Deep Tubewell	in village	Functional
13		MALEGAON	malegaon pwss	2007-2008	Piped Water Supply Scheme	4.06000	30/03/2008	Ground Water	Openwell		Failed
14	MOGRAJ	ANANDWADI	MOGRAJ ANANDWADI PWSS	2003-2004	Combined Water Supply	8.27000	25/05/2003	Ground Water	Openwell	NEAR FIELD	Failed
15		BHAKTACHIWADI	BHAKTACHIWADI PWSS	2002-2003	Piped Water Supply Scheme	8.26000	30/05/2003	Ground Water	Deep Tubewell	NEAR VILLAGE	Failed
16		MOGRAJ	Mograj	2008-2009	Piped Water Supply Scheme	4.08000	30/03/2009	Ground Water	Openwell	near village	Failed
17		MOGRAJ	MOGRAJ WELL	2008-2009	DUG WELL	4.08000	07/12/2008	Ground Water	Openwell	Near village	Seasonal
18	PIMPALPADA	PIMPALPADA	pimpalpada pwss scheme	2008-2009	Piped Water Supply Scheme	4.44793	31/03/2008	Surface Water	Treated Surface Water		Failed
19		PIMPALPADA	PIMPALPADA WELL	2007-2008	DUG WELL	4.44000	31/03/2008	Ground Water	Openwell		No data
20	PINGLAS	PINGLAS	Pinglas WSS	1998-1999	Piped Water Supply Scheme	43.00000	26/04/2000	Surface Water	River		Failed
21											
22			Source: http://indiawater.gov.in								

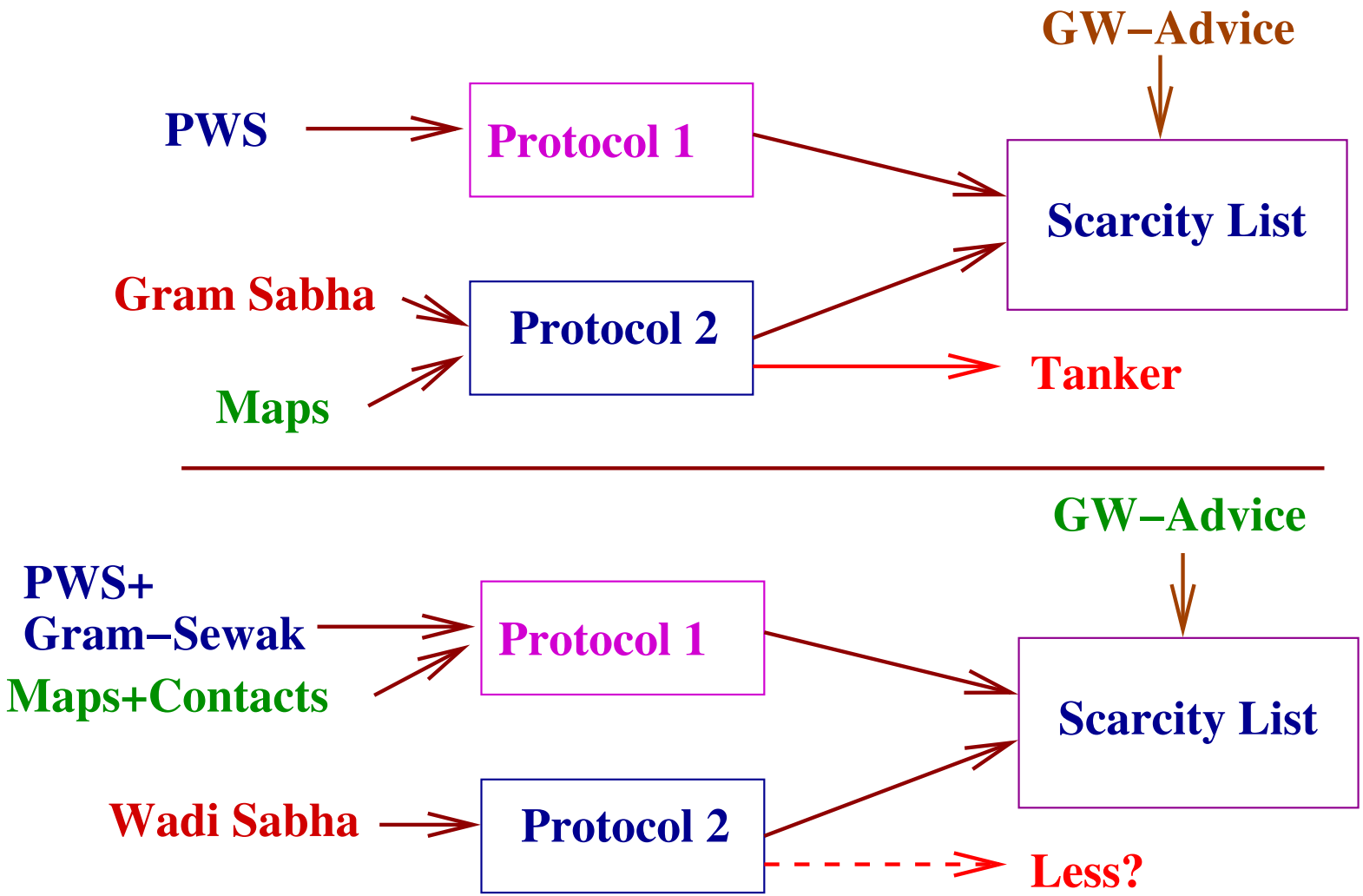
Mograj GP and habitations



GP and sub-GP GIS



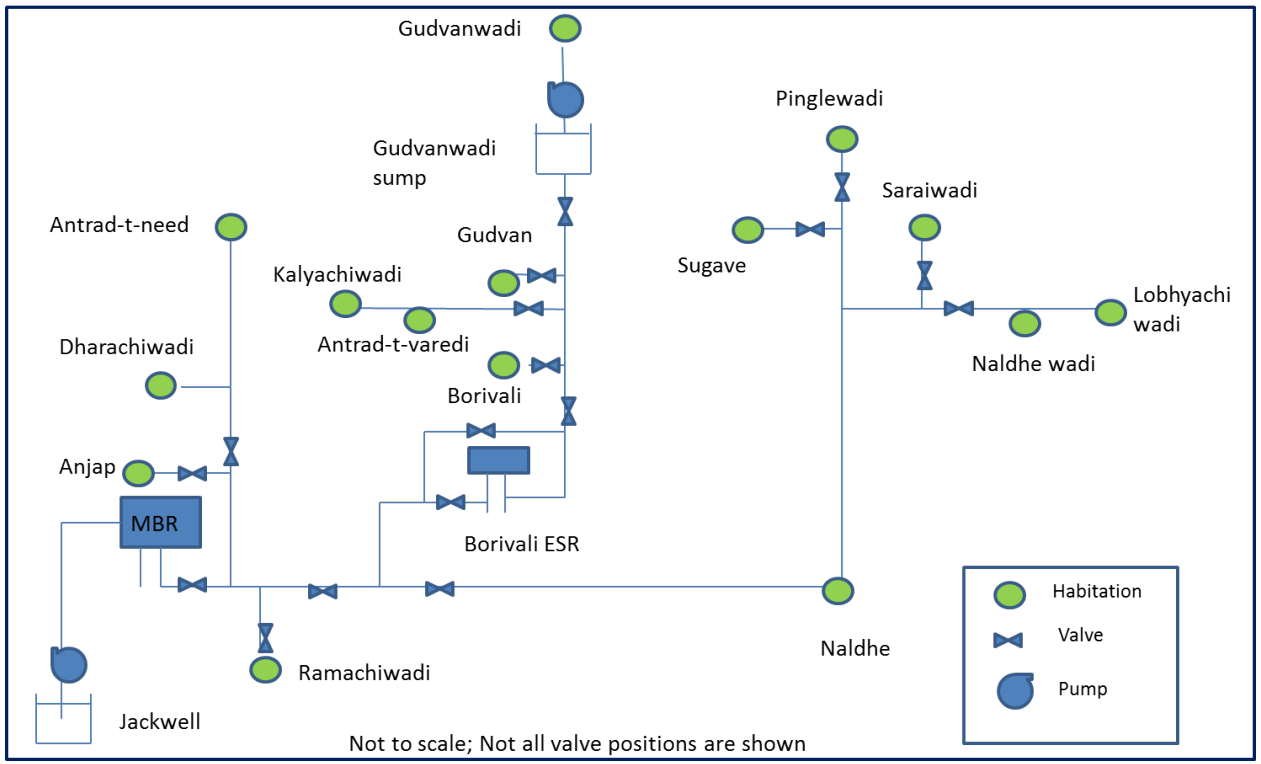
The policy change



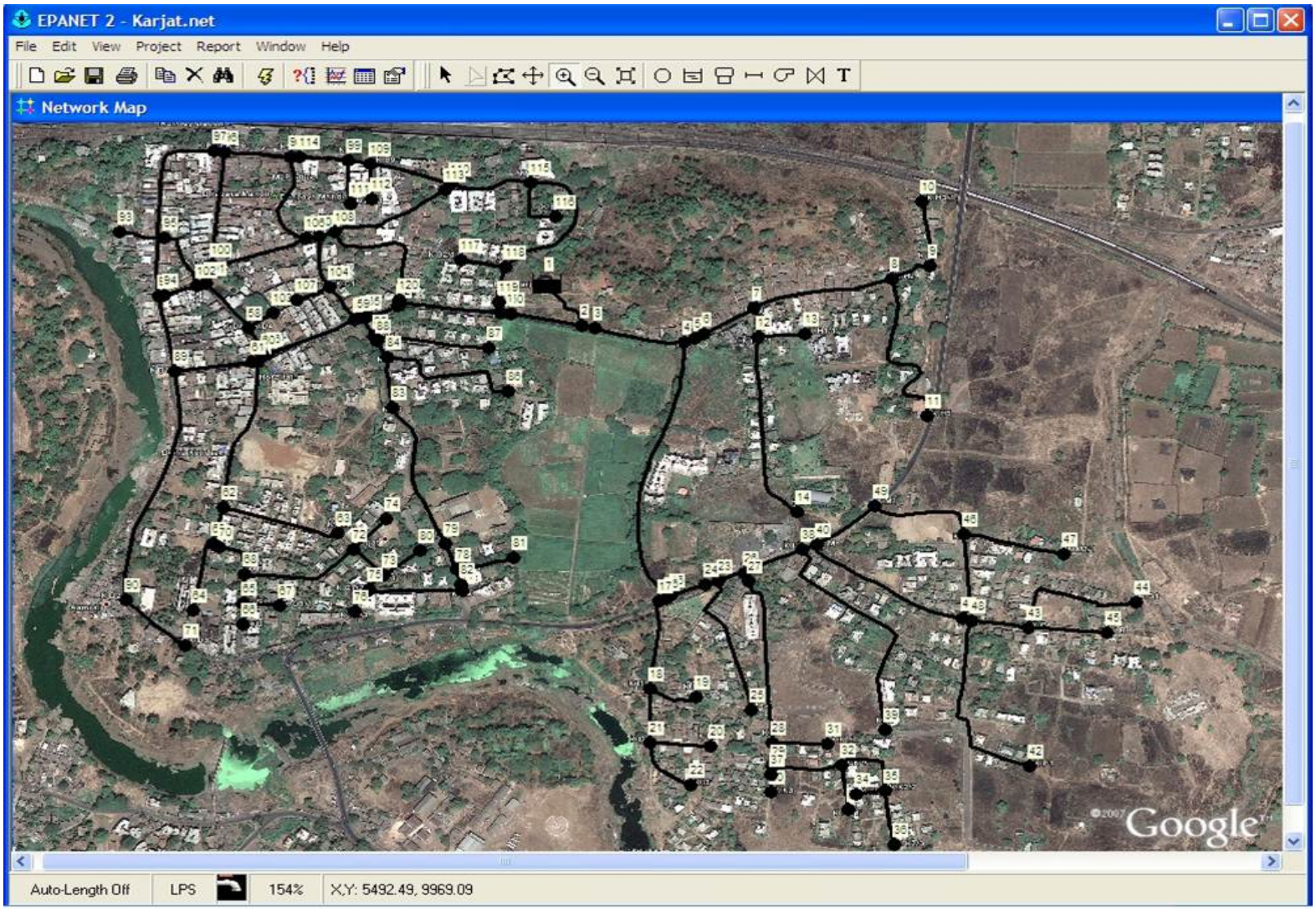
Multi-village and regional schemes

Simulation : of existing poorly performing rural DWS

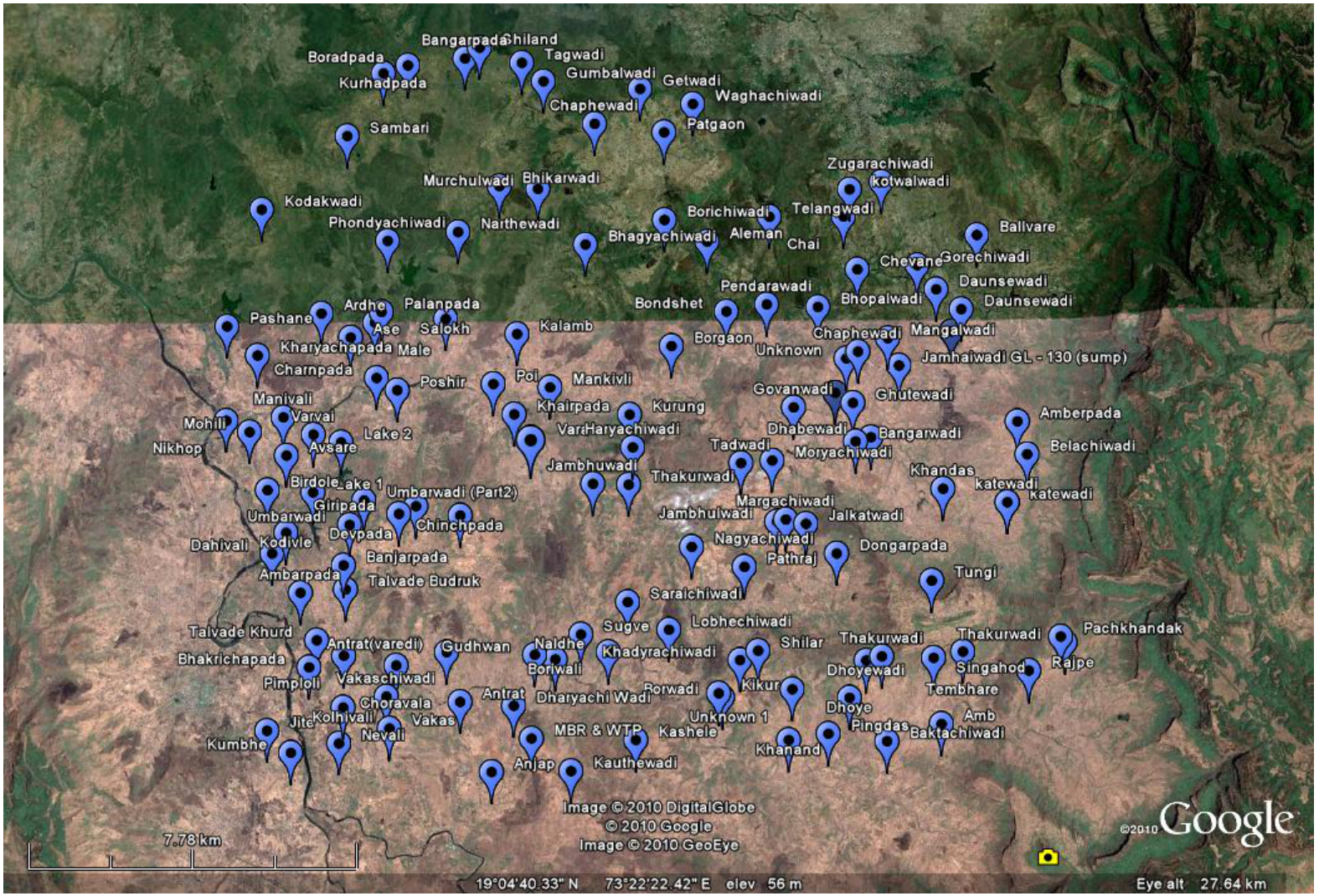
Schematic of infrastructure currently used for seasonal supply



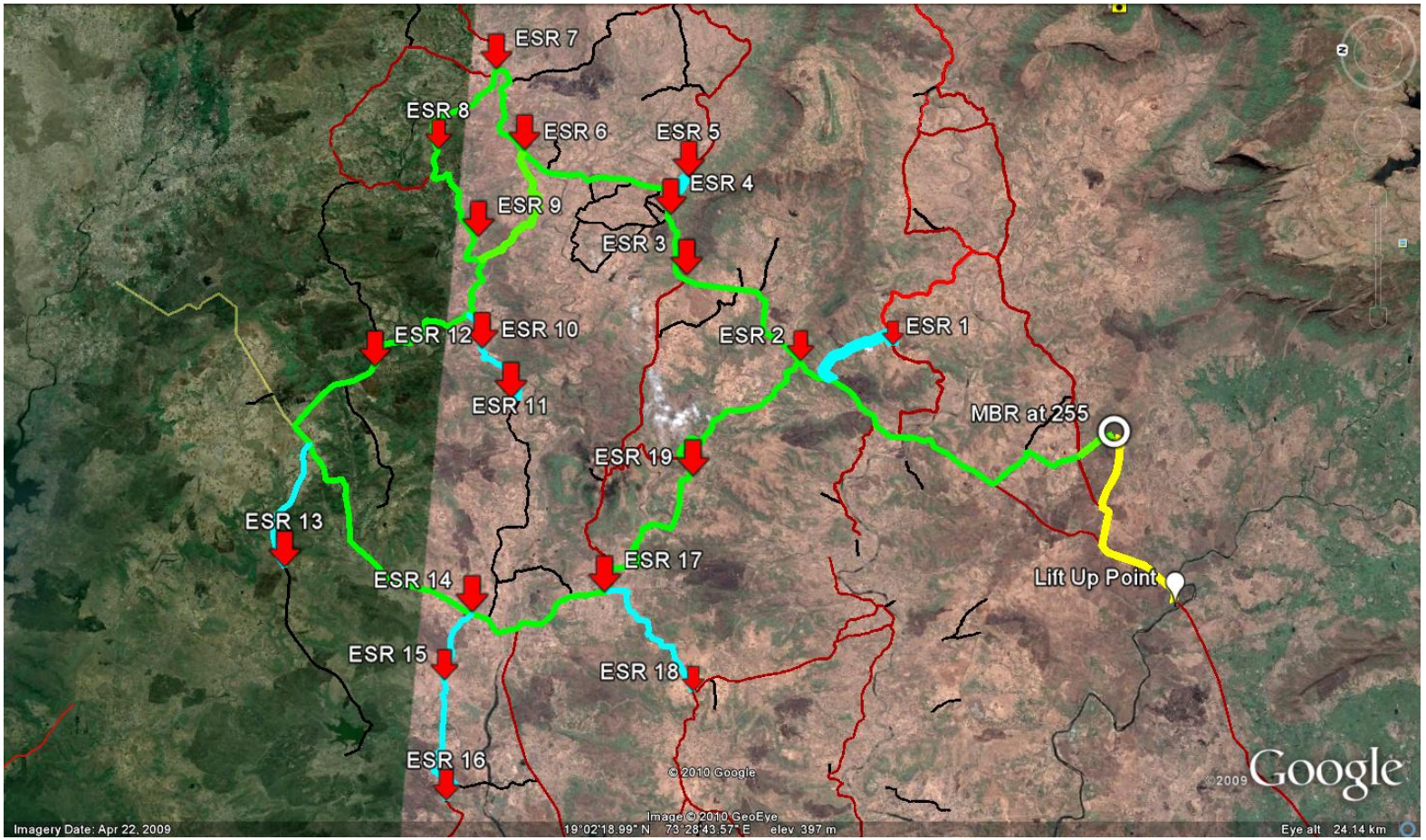
Also Karjat town (pop. 29,000)



And a feasibility study-70 hamlet

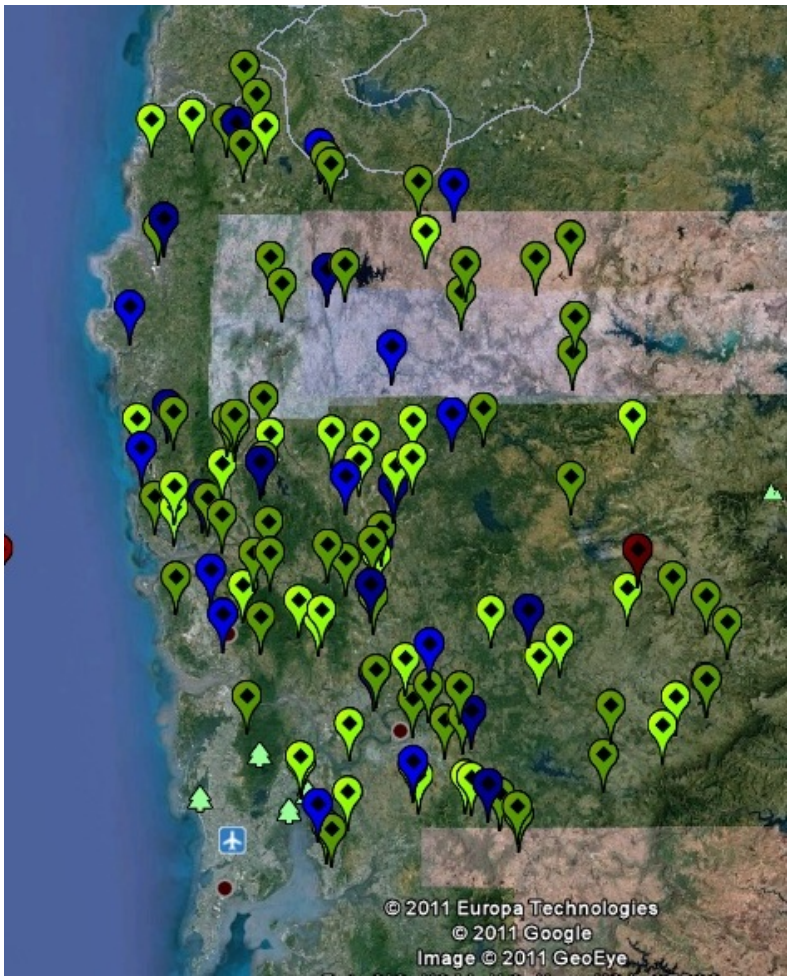


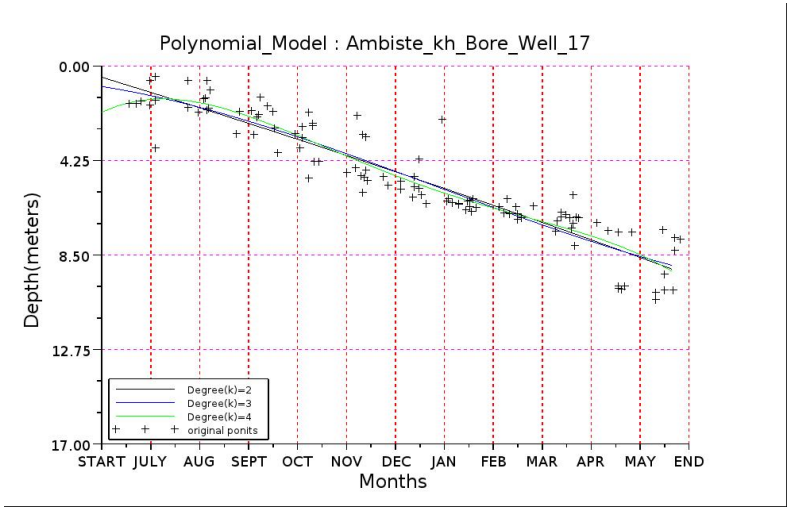
Feasibile! 40 lpcd at Rs. 2100 capital costs.



Groundwater

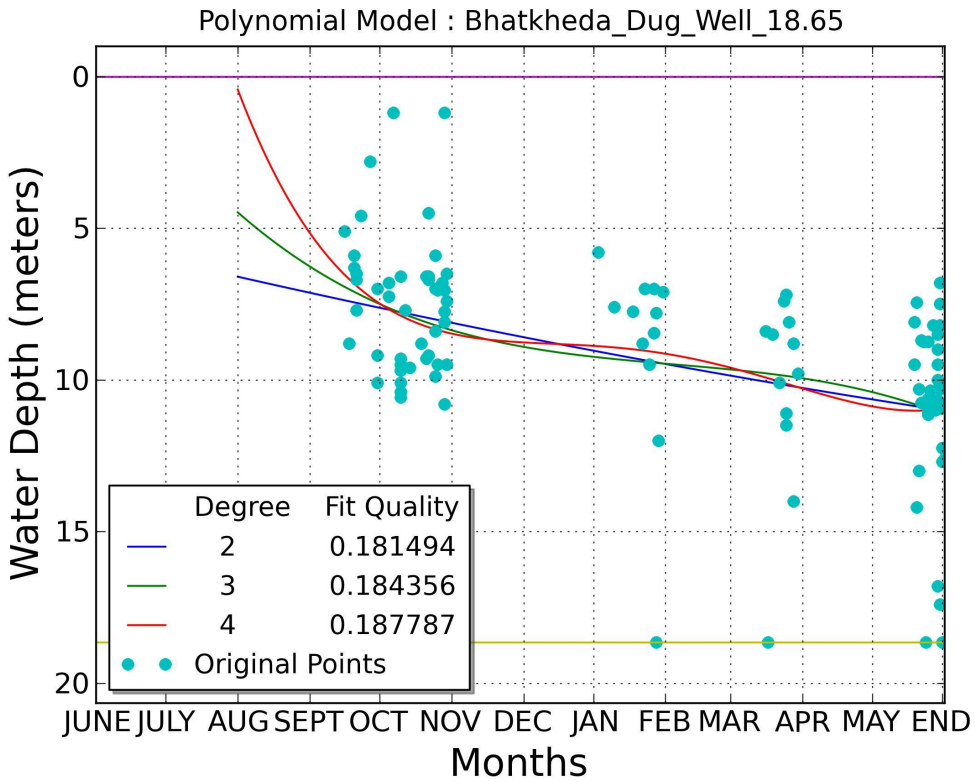
Question : What would be the ground-water at position x at time t?
Useful to predict scarcity (GSDA), its use for drinking water security.



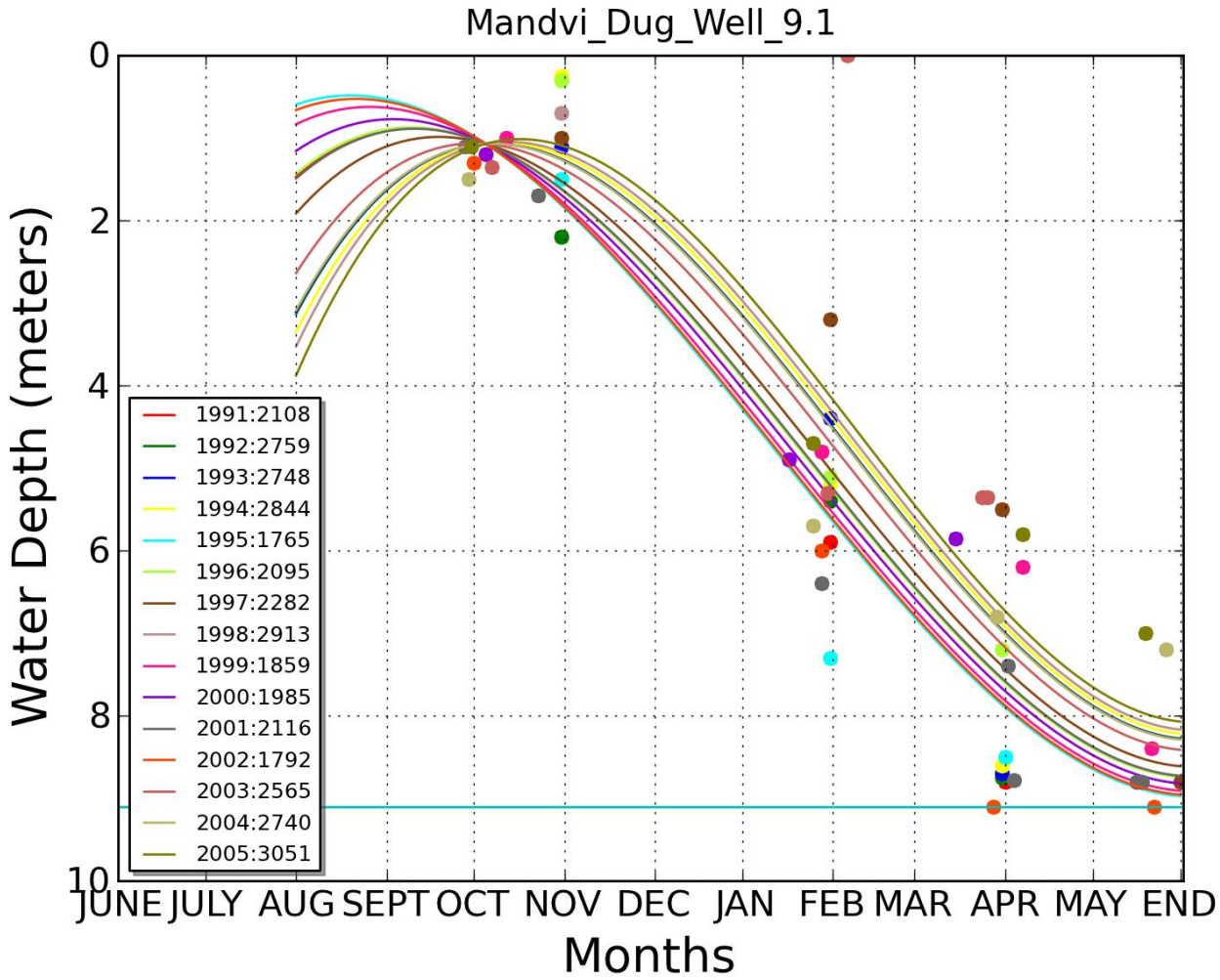


- Towards regional groundwater advise, budgets
- Location specific advise

Stationary models



Rainfall models-Thane



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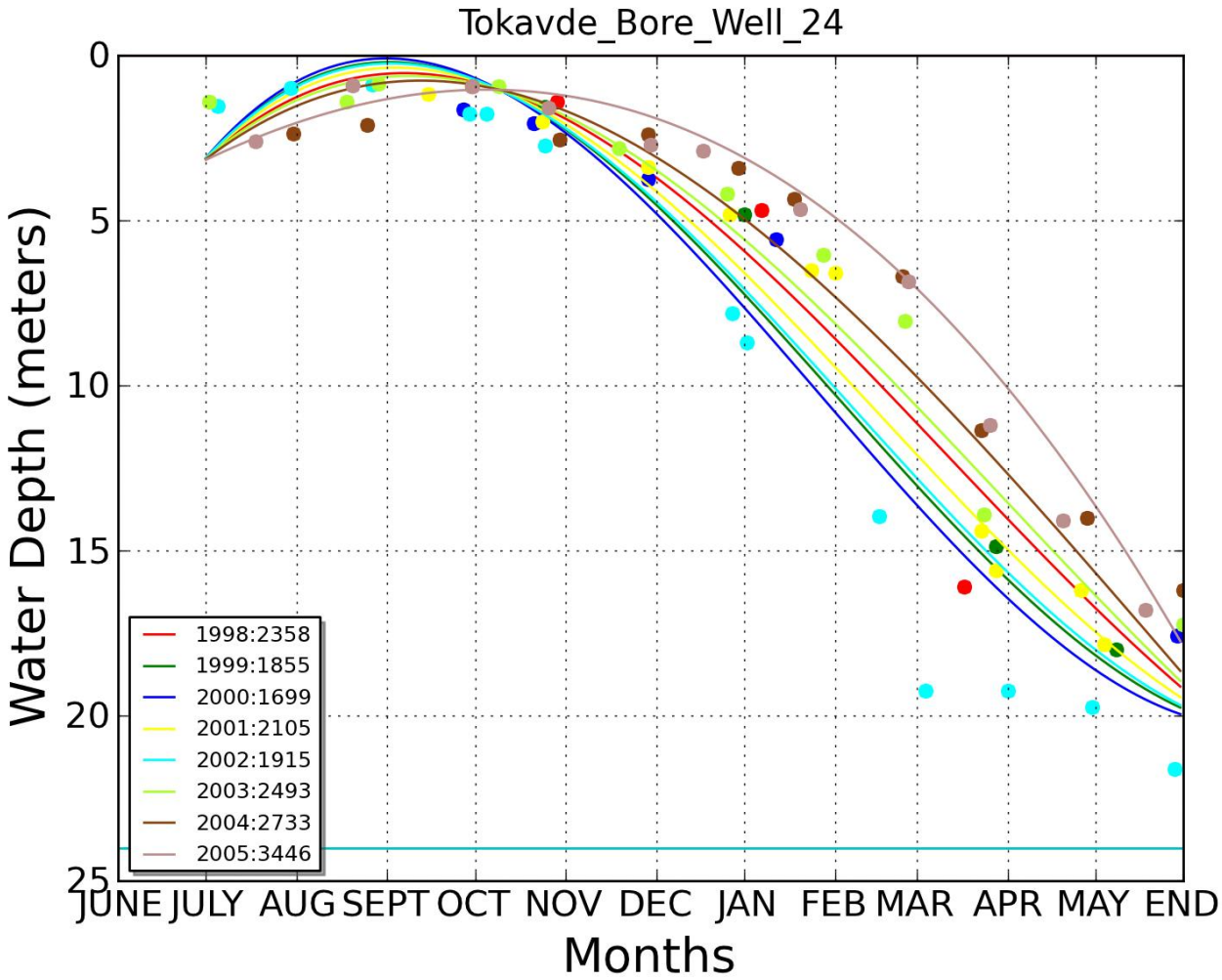
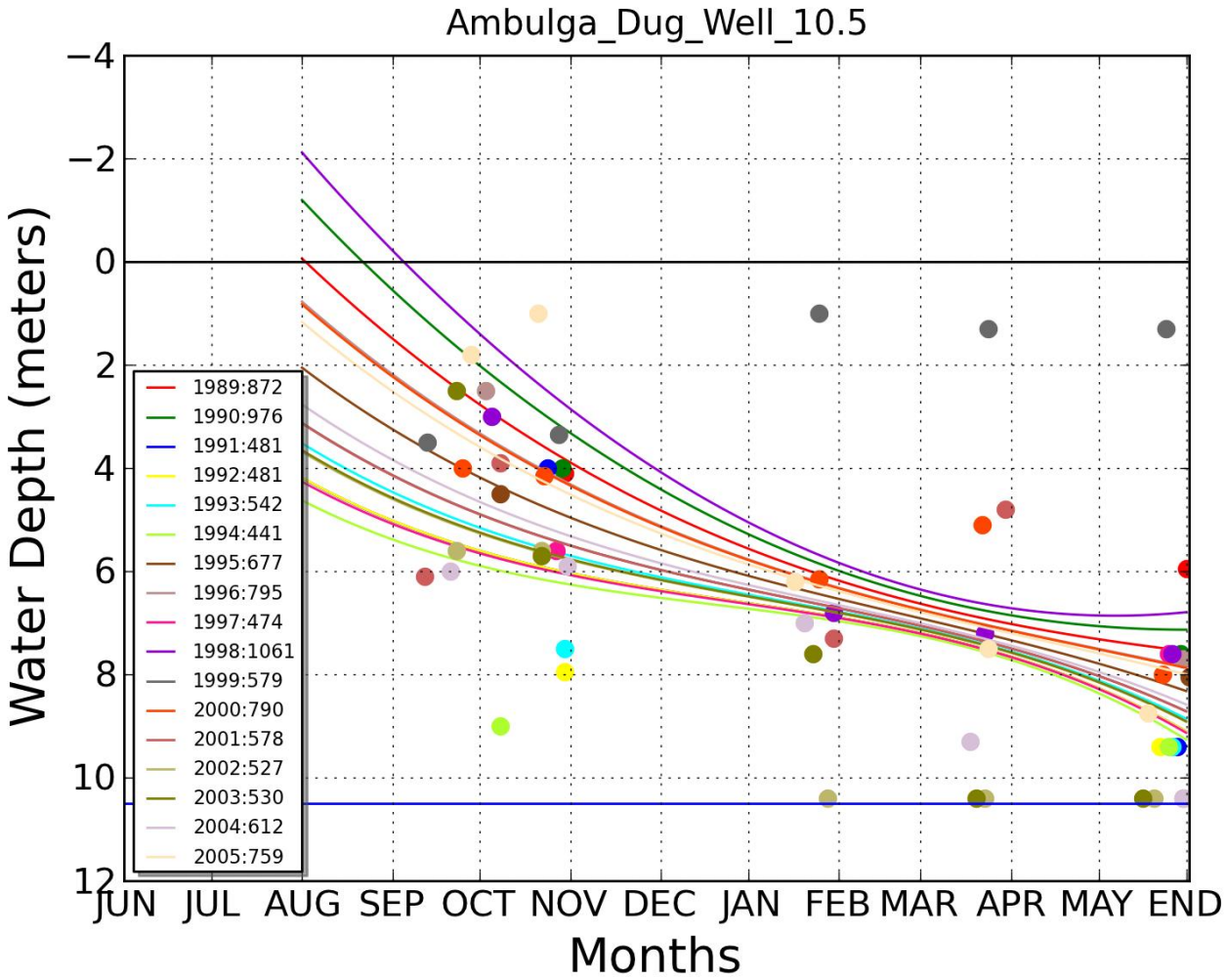
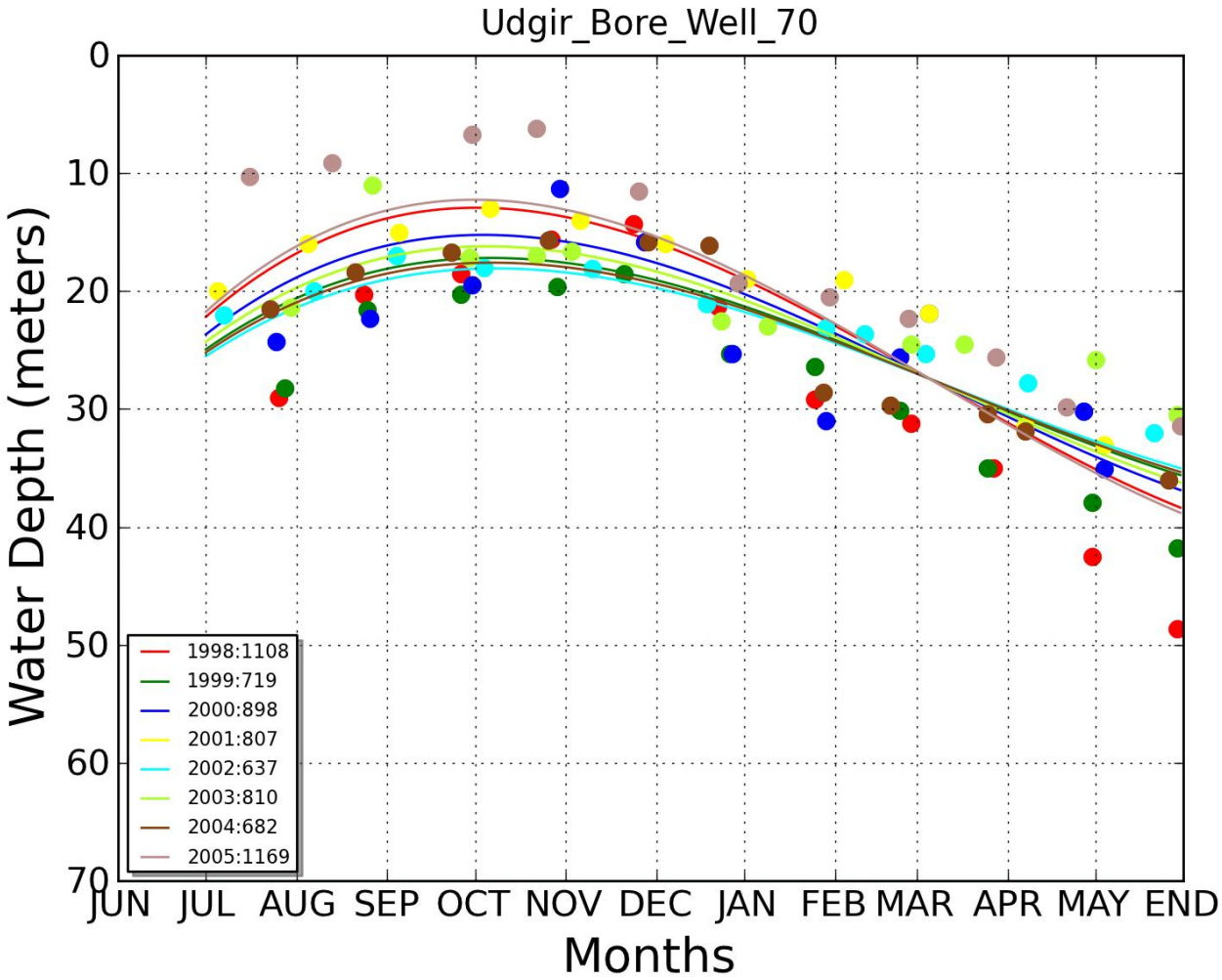


Rainfall models-Latur



Rainfall models-Latur



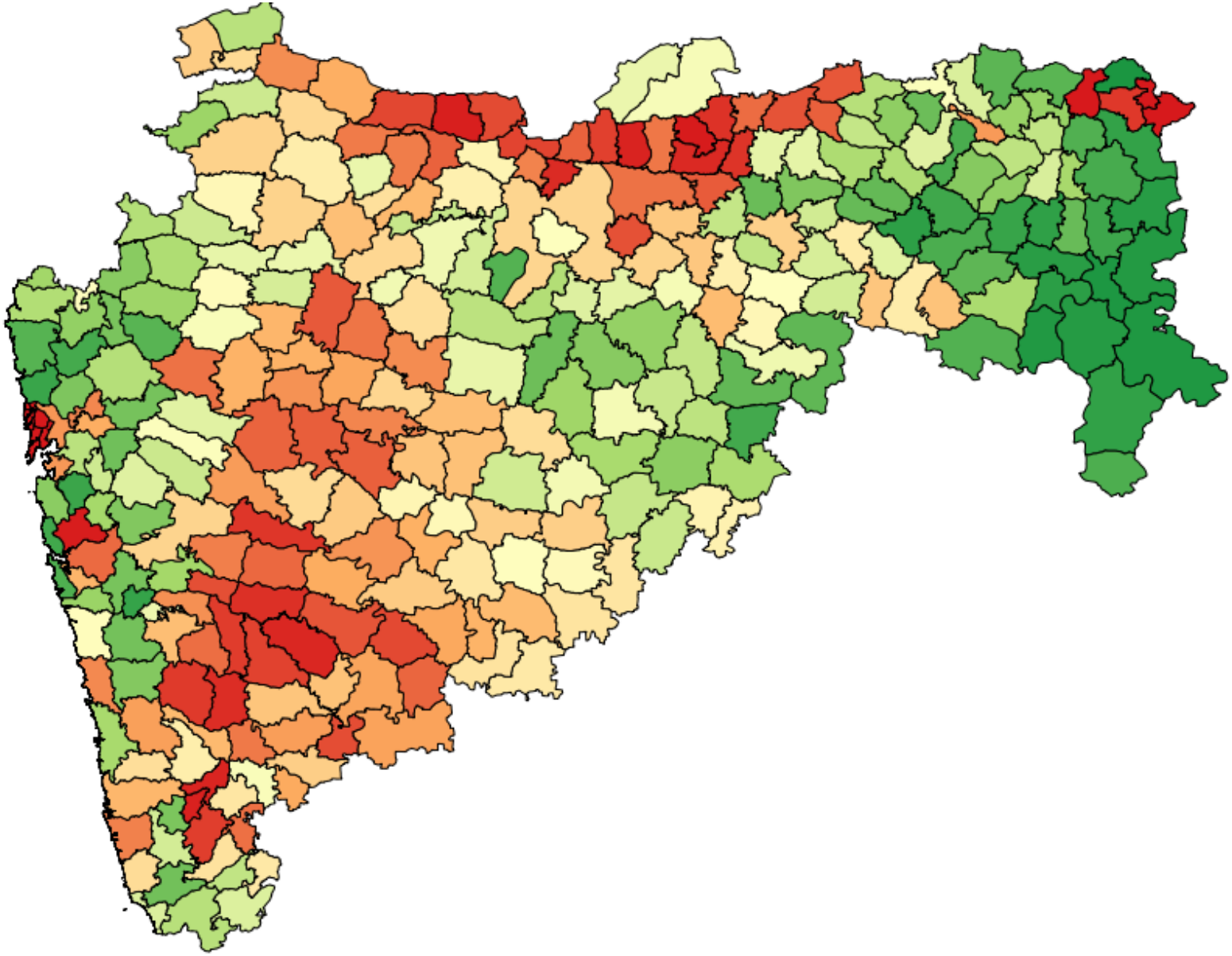
Summary

R^2-values

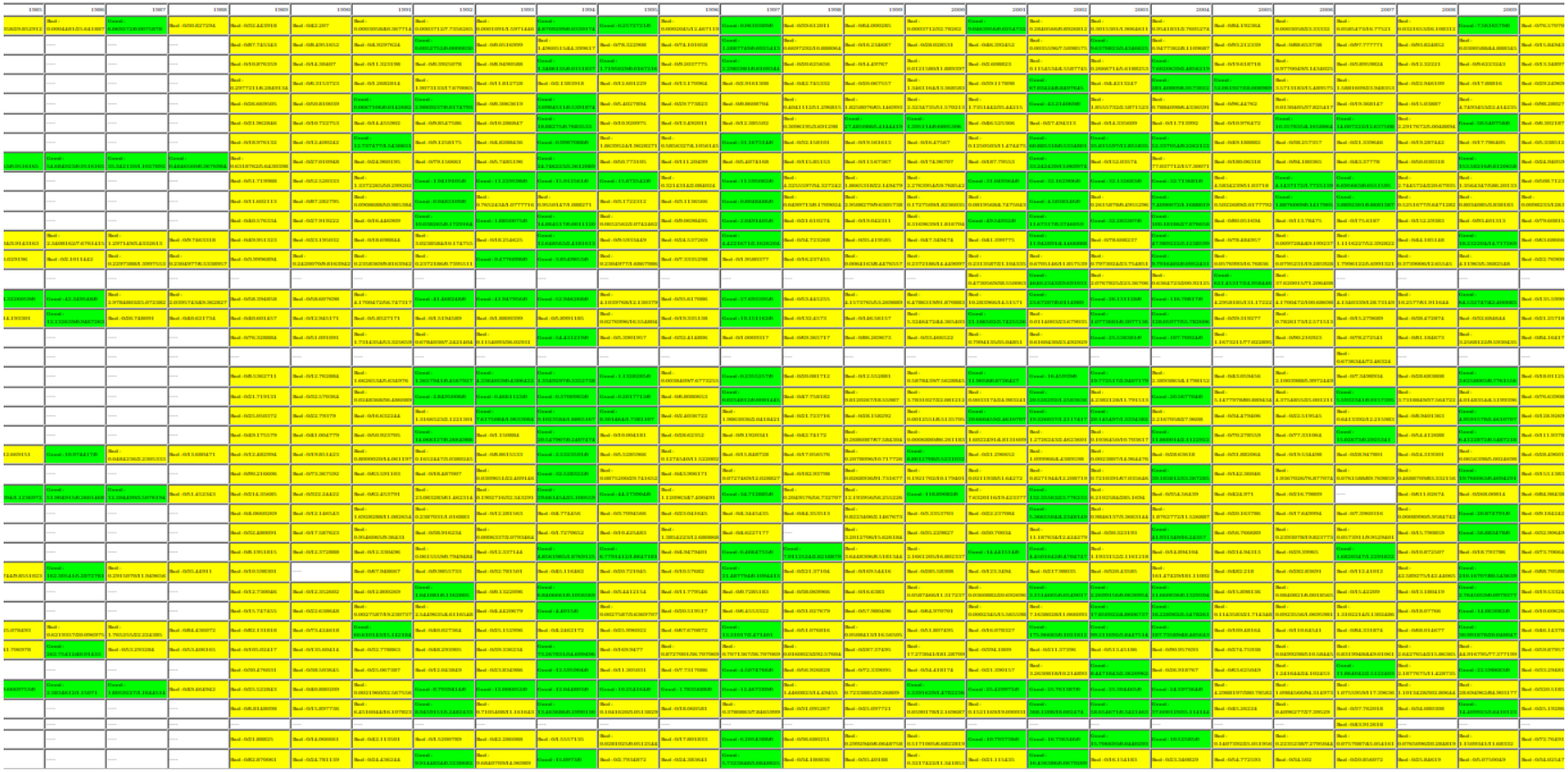
District	No Rain (1991-2005)	0.5 Grid Rain (1991-2005)
Latur	0.4508	0.5610
Thane	0.6730	0.6988

- Nearby extraction, long-term effects, shallow/deep aquifers make a difference
- Great predictability from first reading of the year
- For Thane, scarcity more episodic.

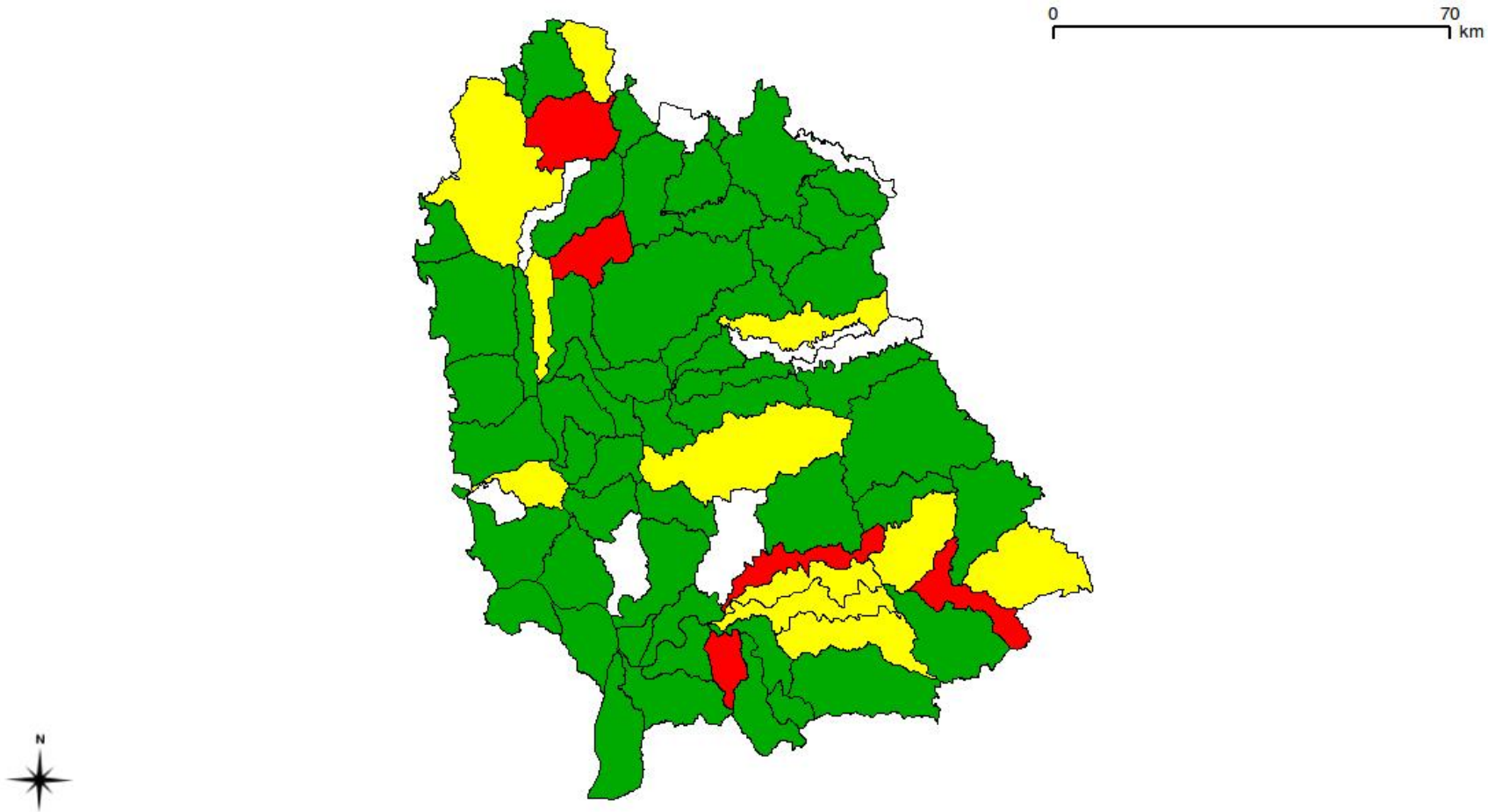
How good are our predictions?



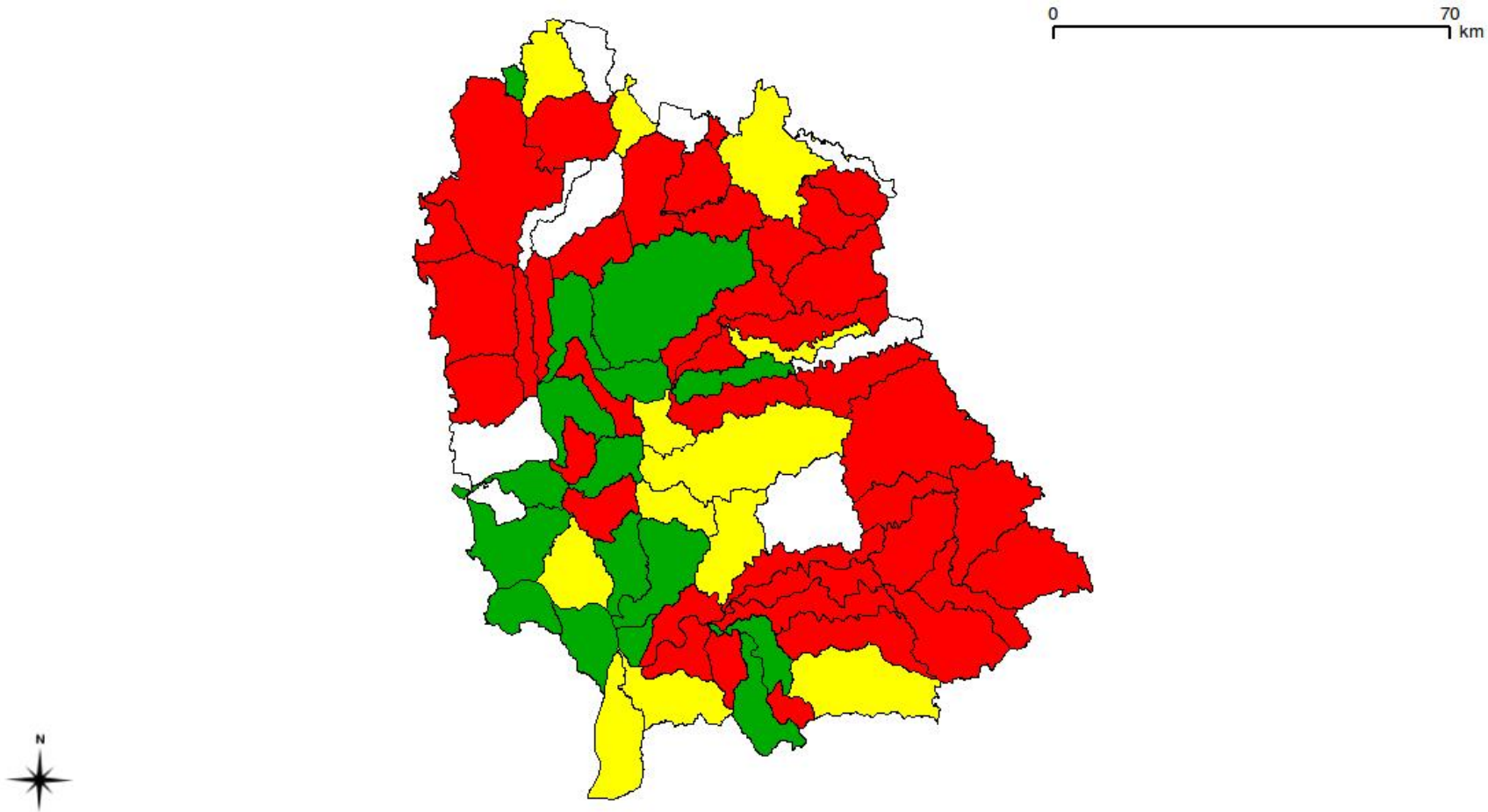
Good-Year/Bad-Year-Latur



1998-Thane watersheds



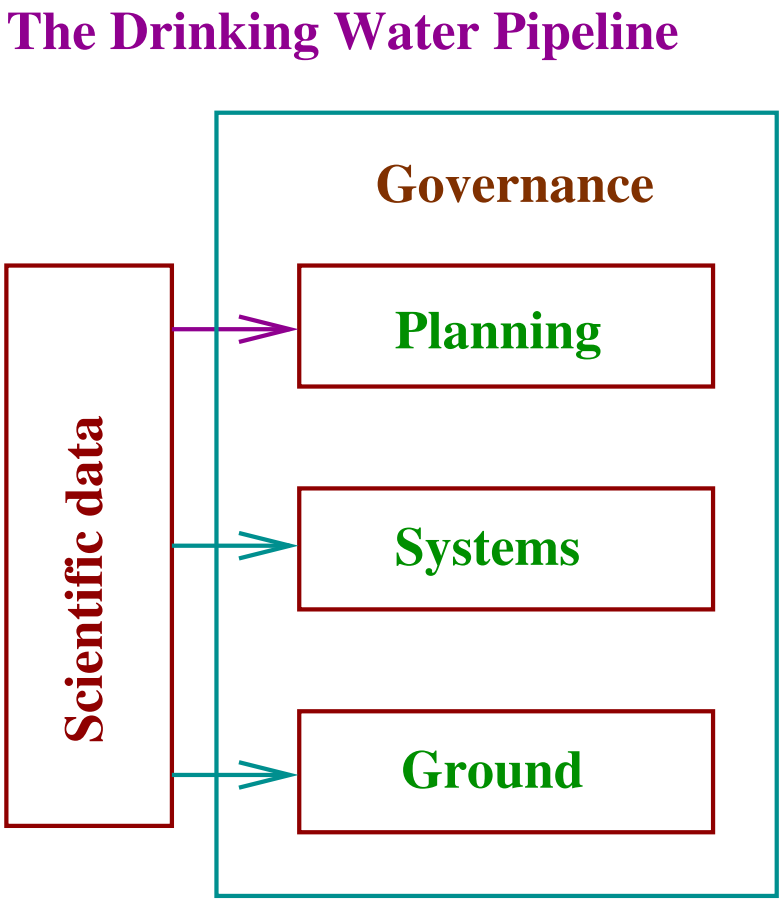
2002-Thane watersheds



The Future

- Watershed Improvement Program -data-centric approach
  - Maybe, the only solution to expensive bulk water transfer
  - Must improve predictability
- Better geological modelling
  - District resource maps, better models for ground water
- District Planning tools
  - get CEO/collector on board
  - monitoring other resources (roads etc.)
- Taluka-level atlas for drinking water
  - already indicated in DDWS
  - needs OK from collector and needs local implementation agency
- A valuable local capacity-The Taluka College

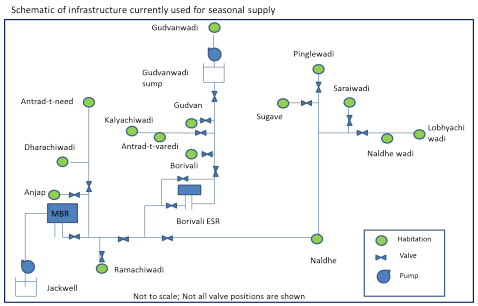
Whats the point

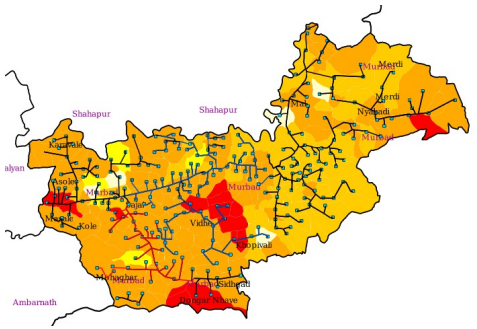


Highlight the Analysis and its use in Decision-making !

- local-stake holders, local knowledge loops-easier to justify
- capacity-building-BDOs, engineering, GPs, colleges and IITs
- enhances transparency, participation and accountability

Thanks





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[1] Joint work with Vikram, Om, Puru, Pooja, Abhishek, Lalit, Ravi, Rahul, Anuja, Janhvi, hemant, Vishal, and about 10 others