Water and Development

Finally

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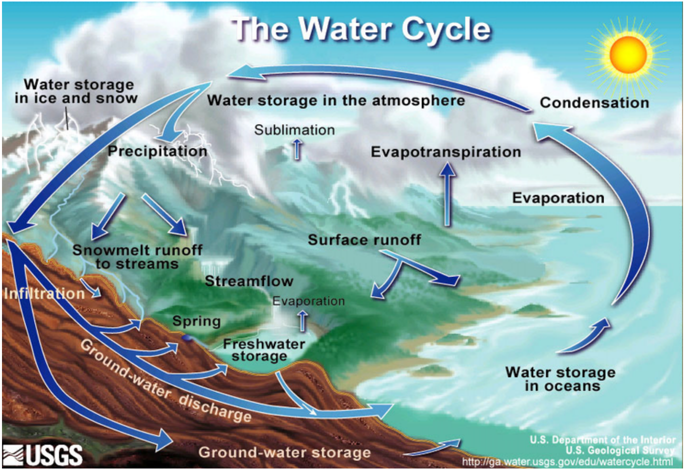
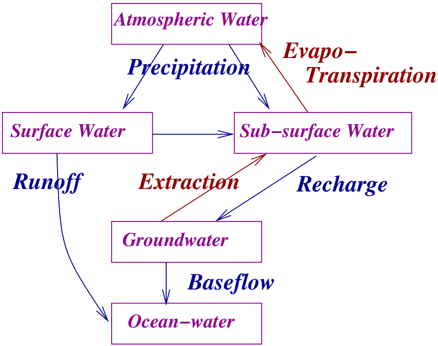
The basic movement of water



source: USGS.

The basic stocks and flows



- Air Moisture: Clouds end in the Troposphere (about 35,000 ft).
- Surface: Rivers, streams and glaciers. Man-made reservoirs.
  - Subsurface: Soil Moisture.
- Groundwater: under the *water table*.

Measuring Stream-flows

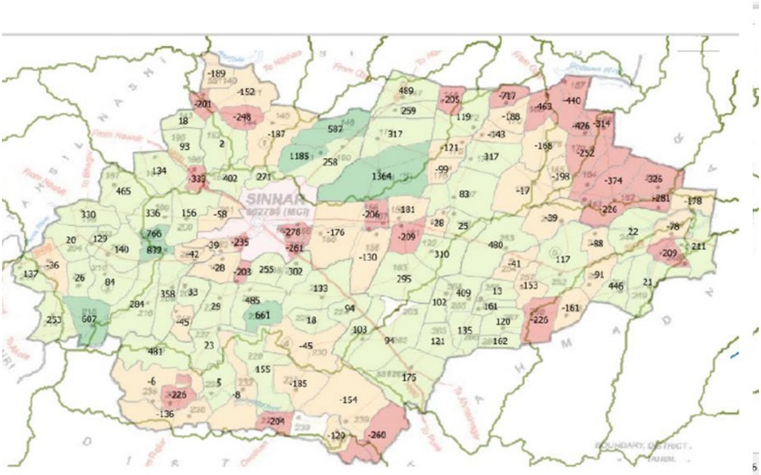
For larger streams

- Use a stick-mounted flow-meter.
- Select a stream cross-section.
- Follow a schedule of measurements at various depths and points on the cross-section.
- Use formula to compute flow.

Deficit

mm water use beyond rain in cultivable area

(rain*cultivable area – water use*cropped area)/cropped area



The regional water system

Attributes of Water

Users: households for domestic consumption, farmers for agriculture, industries as a raw material for their processes.
By nature: geographic resource, utilization depends on regional, scientific and technological issues.

- **Quality and Quantity**. Two largely scientific attributes of water.
- **Source, Transmission and Destination**. Devices of extraction, transmission and delivery to points of use. Treatment of "used" water and preparing it for discharge.
- **Demand and Supply**. Socio-economic attributes of actual quantity and quality of water demanded, Seasonality, economic and technical efficiency of use, regulations on pollution. The supply side: ownership of resources, planning and regulation.

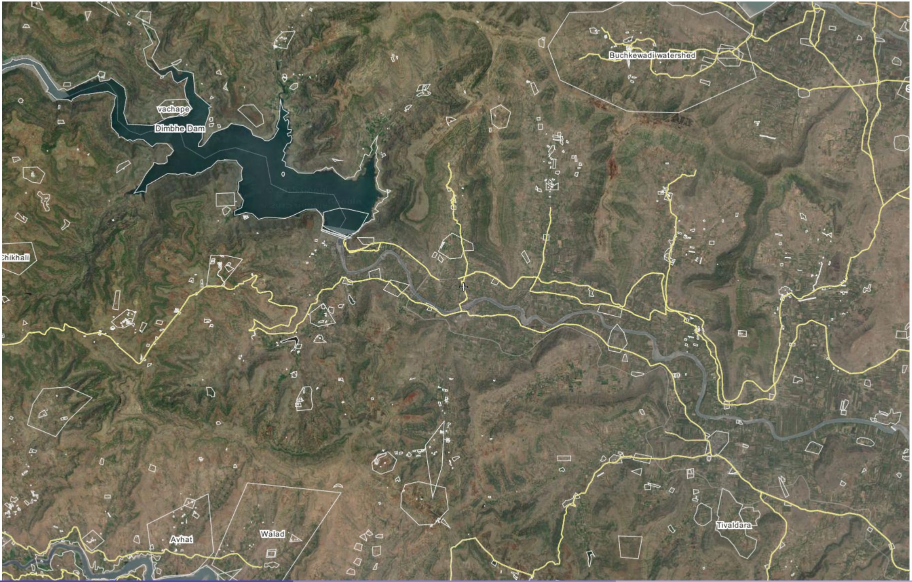
A Region as an example

Details

Dimbhe: Pune district, nestled between two high ridges on its north as well as the south.

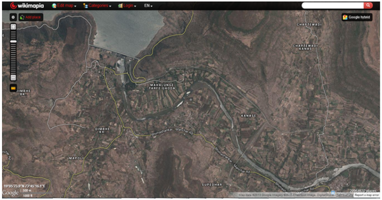
- Dimbhe reservoir covers an area of 17 sq. km.
- Capacity of 350 million cubic meters (MCM).
- Catchment of 400 sq. km., and includes the Bhimashankar temple area and sanctuary.
- 50 tribal hamlets with a population of about 30,000.
- The river, called Ghod, flows out of the reservoir and makes its way to join Bhima river.
- The towns of Ghodegaon (pop. 8000) and Manchar (pop. 15000) lie on this river.
- 10 thousand hectares of irrigated lands and an
- equal area of partially irrigated or rain-fed lands.
- Crops include Sugarcane, Maize, Rice, Grapes and other horticultural crops.

Close-up

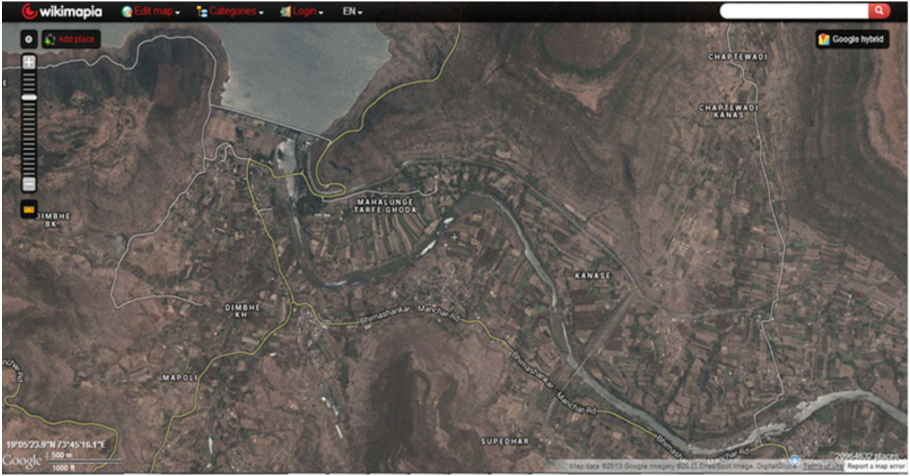

Buchkewadi watershed
vachape
Dimbhe Dam
Chikhali
Avhat
Walad
Tivaldara

Downnstream System

- Close-up of the reservoir, the dam and the gates discharging water.
- Left-bank canal and the spur of its its bifurcation into a right-bank canal, which actually crosses the river.
- Most of the farmers who irrigate their lands do it by *lift irrigation schemes* from KT weirs.
- A substantial component of the ground-water is recharged by the reservoir and the river and canal flows.
- Some farmers are indirect beneficiaries of the irrigation project.



Downstream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CHAPTEWADI
CHAPTEWADI KANAS
MAHALUNGE TARFE GHODA
DIMBHE BK.
KANASE
DIMBHE KH.
Bhimashankar - Manchar Rd
MAPOLI
SUPEDHAR
Manchar Rd
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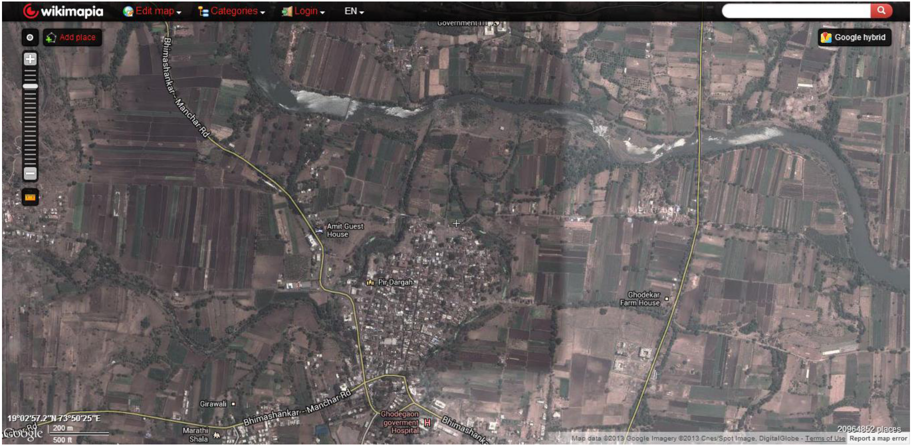
500 m
1000 ft
Report a map error

Ghodegaon



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Edit map
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Google hybrid
Bhimashankar--Manchar Rd
Amit Guest House
Pir Dargah
Ghodekar Farm House
Girawali
Bhimashankar--Manchar Rd
Marathi Shala
Ghodegaon goverment Hospital
19°02'57.2"N 73°50'25"E
200 m
500 ft
20964852 places
Map data ©2013 Google Imagery ©2013 Cnes/Spot Image, DigitalGlobe - Terms of Use
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Discharge and KT Weir

Salient Features

1	Name of Project	:	Musai M.I.Scheme	Dolkhamb M.I.Scheme.
2	Source	:	Local Nalla	Local Nalla
	Location: State	:	Maharashtra	Maharashtra
	District	:	Thane	Thane
	Taluka	:	Shahapur	Shahapur
3	Village	:	Musai	Dolkhamb
4	Catchment Area	:	1.76 Sq.mile	3.68 Sq.miles
5	Average Annual Rainfall	:	107.7"	107.46"
6	75% dependable yield	:	244 Mcft.	-
7	Gross Storage	:	134.26 Mcft.	166.08 Mcft.
8	Dead Storage	:	5.75 Mcft.	9.32 Mcft.
9	Live Storage	:	128.51 Mcft.	156.76 Mcft.
10	Reservation for U/s	:	-	-
11	Annual Gross Utilisation	:	134.26 Mcft.	166.08 Mcft.
12	Top of Dam Level	:	103.00 m.	134.00 m.
13	H.F.L.	:	101.50 m.	132.50 m.
14	F.R.L.	:	100.00 m.	131.00 m.
15	M.D.D.L.	:	89.00 m.	120.00 m.
16	Max. Height of Dam	:	89.00 m.	19.76 m.
17	Type of Dam	:	17.90 m.	Earthen Dam.
18	Length of Earthen Dam	:	Earthen Dam.	213 m.
19	Length of Waste Weir	:	44 m.	60 m.
20	Max.Flood discharge	:	35.52 Cusecs	9284 Cusecs
21	Location of Waste Weir	:	Left side	Right flank
	Submergence area	:		65.59 Hect.

1	Name of Project	:	Musai M.I.Scheme	Dolkhamb M.I.Scheme.
	CANAL			
22	Canal length	:	3.00 Km.	7.17 Km.
23				
24	Canal Capacity	:	12.72 Cusecs	10.21 Cusecs, 4.875 Cusec
25	Area under command	:	600 Acres	196 Hect.
	(Irrigable)			
	I) Gross Command	:	1300 Acres	980 Acres
	ii)Cultural Command	:	1200 Acres	780 Acres
	iii) Irrigable Command	:	600 Acres	496 Acres
	Village benefitted	:	1) Musai, 2) Khaire.	1) Dolkhamb 2) Hedwali
	Village (Taluka wise)	:	-	3) Bandanpada 4) Sakurli
27	Total Cost of the Project	:	Rs.11,110.00	Rs.17,03,275/-
28	B.C.Ratio	:		2.31

Budget

Annual Water Account for Minor Irrigation

Irrigation Year:- 2010-11
Name of Circle:- TIC Thar

Name of Division :- TMID Kalwa Thane	26	27	28	29	30	31	32
Project No.--->	**635**	**636**	**637**	**638**	**639**	**640**	**641**
Name of Scheme	**Adivali**	**Dolkhamb**	**Jambhe**	**Kharade**	**Musai**	**Velholi**	**Hattipada**
Type viz. LMI, MI, LIS, ST etc.	MI	MI	MI	MI	MI	MI	MI
District	Thane	Thane	Thane	Thane	Thane	Thane	Thane
Taluka	Shahapur	Shahapur	Shahapur	Shahapur	Shahapur	Shahapur	Vasai
Sub-basin No.	**21**	**21**	**21**	**21**	**21**	**21**	**21**
1. Designed Storage in Mcum							
a. Gross	2.220	4.703	5.182	2.316	3.800	3.245	2.058
b. Live	2.030	4.439	4.842	2.054	3.640	2.997	1.923
2. Maximum live storage observed in the year	2.030	4.439	4.842	2.054	3.640	2.997	1.923
3. Projected water use in Mcum for							
a. Kharif	0.000	0.000	0.000	0.000	0.000	0.000	0.000
b. Rabi	2.030	4.439	4.842	2.054	3.640	2.997	1.923
c. Hot weather	0.000	0.000	0.000	0.000	0.000	0.000	0.000
d Non irrigation	0.000	0.000	0.000	0.000	0.000	0.000	0.000
e.Total (3 a+3b+3c+3d)	**2.030**	**4.439**	**4.842**	**2.054**	**3.640**	**2.997**	**1.923**
4. Water drawn at canal head for irrigation							
a. Kharif	0.000	0.000	0.000	0.000	0.000	0.000	0.000
b. Rabi	0.945	0.400	1.357	0.950	1.290	1.560	0.300
c. Hot weather	0.000	0.000	0.000	0.000	0.000	0.000	0.000
d Total (4a+4b+4c)	**0.95**	**0.00**	**1.36**	**0.95**	**1.29**	**1.56**	**0.30**
5. Lifts From Tank							
a. Kharif	0.000	0.000	0.000	0.000	0.000	0.000	0.000
b. Rabi	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c. Hot weather	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6. Evaporation Losses	0.179	0.609	0.350	0.195	0.515	0.420	0.240
7. Leakages through dam	0.668	1.887	0.000	0.028	0.625	0.260	1.271
8. Total (4d+5+6+7)	**1.792**	**2.496**	**1.707**	**1.173**	**2.430**	**2.240**	**1.811**
9. Actual Area Irrigated by Canals							
a. Kharif							
i) Area							
ii) Irrigation System Performance (ha/M	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Systems

- **The Irrigation System**. State agency which maintains the dam, reservoir and KT weirs. It operates the gates and the canals so that water is made available to the agriculture and the domestic system periodically. Fees from farmers and from domestic users.
- **The Agricultural System**. Private farmers need for water. Lift irrigation systems which are collectively owned and maintained. Partially irrigated and rain-fed farms. Crop-water demand, source and application of water. Energy costs for lift irrigation, extraction from wells and bore-wells. Key variable:soil moisture.
- **The Domestic Use system**. Rural and urban consumer.Key assets:engineering at the source, the transmission, the distribution and discharge. Key variables
  - (i) ownership of the system, (ii) the level of service, (iii) financial and technical viability (iv) fees and cess paid to the irrigation system, (v) fees collected from users.

The Physical System

This is largely the water in the system which must flow according to physical laws and which must transit from one state to another and one location to another. This may be subdivided into four categories of scientific data.

1. **Laws**. Three primary equations, viz., (i) surface water flow, (ii) ground-water flow, and (iii) conservation of mass.
2. **Models**. Several empirical systems such as infiltration, precipitation, absorption of water by plants, evapo-transpiration and so on.
3. **Parameters**. Several natural physical parameters, e.g., the lay of the land, conductivity of soils and other soil parameters, climatic data.
4. **Parameters and boundary conditions**. Parameters forced by the human systems. This includes location of wells and their extraction, crop water demand and its location, specification of engineered assets such as canals and channels and so on.

The System

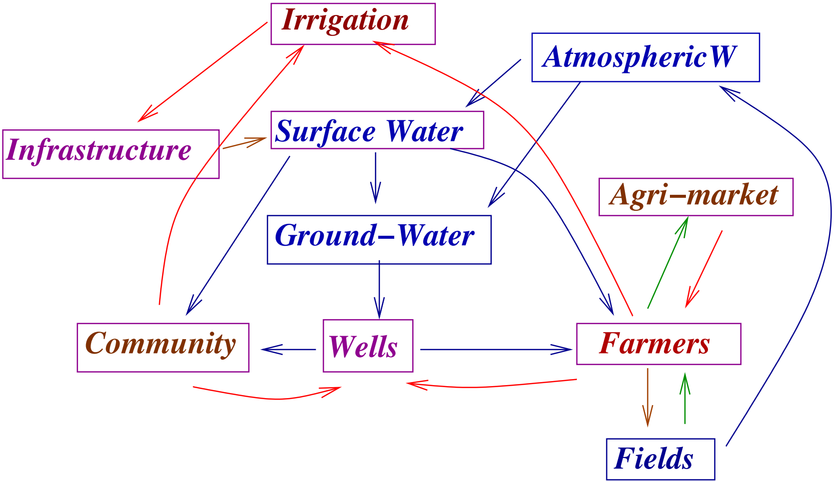


Figure: The Ghodegaon Cycle

Tables

A pictorial representation of the system is shown in Fig. 1.The boxes show two different types of entities: various scientific entities which are used in the laws and models of the physical system, and various interacting social associations/structures, as given in the table below:

Agent/Structure	Type
Irrigation	State
Farmers	Civil Society
Community	Community
Agri-market	Market
Infrastructure, Wells, Fields	Asset
Surface water, Ground-water, Atmospheric water	Stocks

Objectives

Multiple inter-linked systems-irrigation, agriculture, drinking water, down-stream systems.

The Planning Approach

$$\text{Supply} \Leftrightarrow \text{Allocation} \Leftrightarrow \text{Demand}$$

Principles

sustainability, efficiency and equity

- choice of crops, a choice of irrigation techniques, tariffs so that the irrgation system is paid for and yet the farmer finds a market for his/her crops.
- surface and groundwater do not get polluted
- adequate water for domestic use and also for people downstream of Ghodegaon.

The Design Cycle

Development Outcomes ⇒ Bio-physical Outcomes ⇒ Designs and Plans

Development Outcomes

- Socio-economic, normative concerns such as equity, access.
- More cropping area. More certain and more secure water.
- Good quality drinking water. easy to maintain systems.

Bio-physical Outcomes

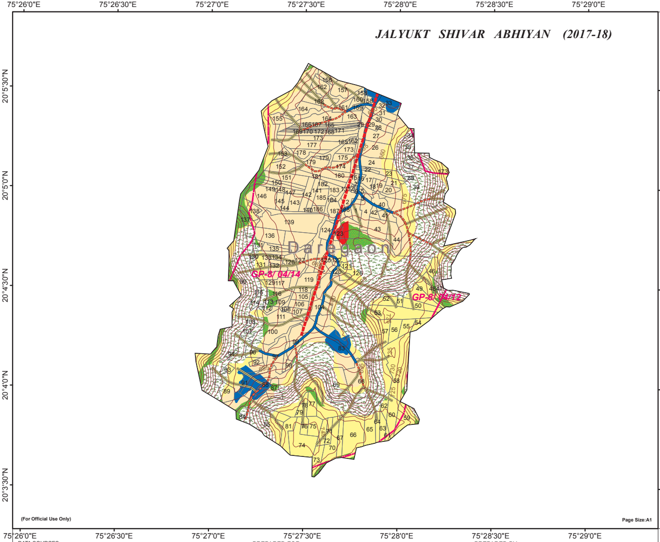
- Science and Technology Choice, Sustainability.
- Water requirements, norms. Specific flows and stcoks. Distribution Policy.

Design and Plans

- Interventions, Efficiency.
- Overall plans. Major and minor structures.

ACTIONPLAN MAP (Watershed No:- GP-8/4/14)

Village-Daregaon ,Taluka -Fulambari, District -Aurangabad



N
W E
S

0 0.225 0.45 0.9
Kilometers

SCALE - 1:20,000

In Map Show Existing Activities with Red Colour and Proposed Activities with Green Colour

Legend

- Linaments/Dyke
- Contour 5 Meter
- Watershed Boundary
- Survey/Gat No. Boundary
- Village Boundary

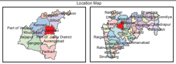
Drainage Line Treatment

- Gully Plug or LBS
- Earthen Nalla Bund/ Gabian Bandhara
- Nala Desilting/C.N.B./K.T.

Area Treatment

- Dry land Agriculture/Contour Bunding/ Farmpond
- Afforestation/ Dry Land Horticulture/Plantation
- CCT/Deep CCT/WAT/Forest Pond
- Compartment Bunding/Graded Bunding/Fram Pond/Well Recharge
- River/ Waterbody
- Village Area

Location Map



DATA SOURCES::

Village Map:Directorate of Land Records
Linaments/Dyke:Derived from SatelliteData MRSAC,
Actionplan: MRSAC
Contour 5mt:Derived from SRTM data MRSAC,
Watershed -AISLUS & GSDA,
Drainage:GSDA,Pune

PREPARED FOR::

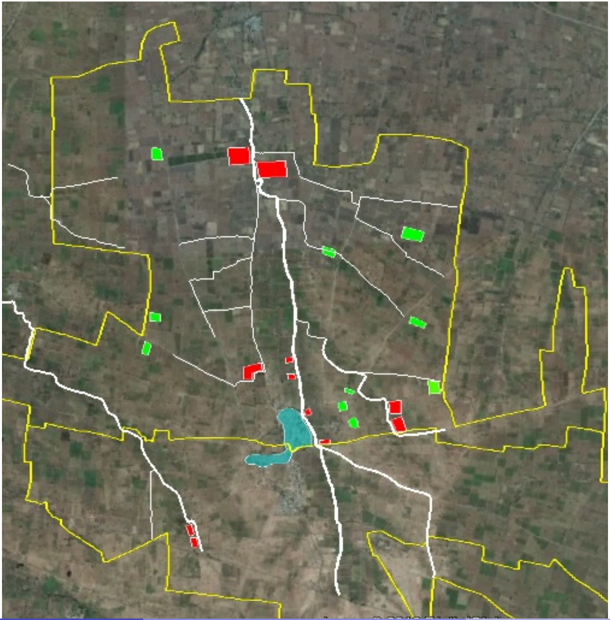
Vasundhara Watershed Development Agency,
Maharashtra, Pune-1
And
Director of Soil and Water Conservation
Maharashtra, Pune-1

MRSAC

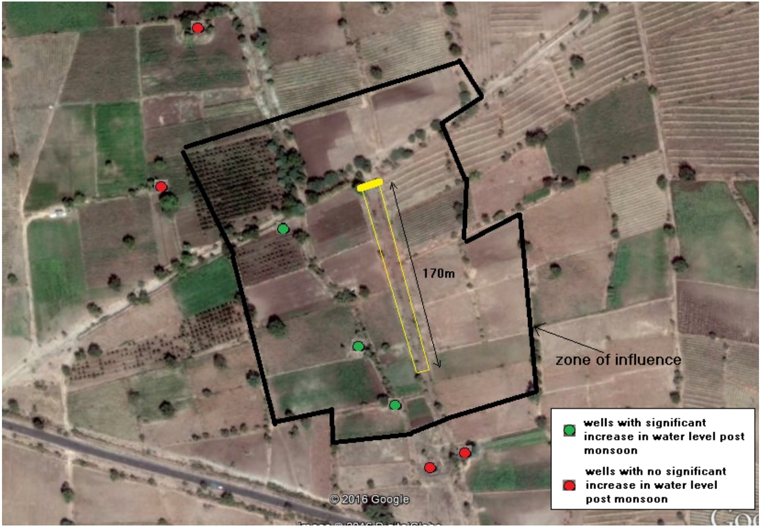
PREPARED BY::

Maharashtra Remote Sensing
Applications Centre,
Dept. of Planning,Nagpur,
Govt. of Maharashtra.
And GSDA,Pune

Variable Access to Water



Interventions and their influence



The Development Question

How did it come to be so? What is the present? How do we get out?

(i) Poor knowledge formation. In elementary education, higher and professional education, practices, absence of scientific methodology, in adequate comprehension of society, inadequate understanding of the vicinity.

(ii) Information asymmetry. Transaction between informationally un-equals. In the market, in the court, at the *gram sabha*. RTI, IT seen as antidotes.

(iii) Malfunctioning institutions. Insufficient capital, poor and outdated job definitions, no monitoring, evaluation or assessments, loss of trust.

(iv) Collective Failure. Historical. Inability to act for collective good. Loss of culture. Divergent agenda.

(v) Resource constraints. Actual physical limits. Poor efficiency and poor indigenous technology.

Mess Food

Agent	Gives	Gets	Agent	Based On
Students	Elect	Serves	Secretary	Quality
Students	Pay	Facility	Manager	Bill
Secretary	Supervises		Manager	Competence
Manager	Supervises		Worker	Output
Manager	Pays	Supplies	Supplier	Quality
Manager	Pays	Work	Workers	Hours
Institute	Pays		Workers	Attendance
Workers	Serve		Students	Food
Secretary	Informs		Institute	QoS

An Example

Cotton farmer from Vidarbha where farmer suicides have taken a great toll.

- *Poor knowledge formation*, develop good practices.
- ill-informed in buying inputs
- information asymmetry: poor margins at the *mandi*,
- too little water for him to water his crop
- or too few savings to store his harvest till a better price emerges.

More examples

- A missing bridge to cross a river for school-going children. This missing asset may be at once a resource constraint, i.e., the inability of the government to build the bridge or also a knowledge weakness, i.e., an inability of the government to measure the loss of social value and see whether it compensates for the cost of the bridge, or finally, the institutional failure of the government to enforce its own directives to lower level staff.
- tragedy of the commons which is variation of a failure to act collectively. Consider, for example, *Kalamb*, a community in Karjat taluka which had a community water supply scheme which gives 400 liters per day per household. Only when all pay, is the scheme financially sustainable. However, a few richer households want a higher quantum of water than can be met by the scheme. Since this demand is unmet, these households may dig a bore-well to meet their demand and thus opt out of the public scheme.

The Role of Science and technology

- Methods and Outcomes. The law vs. how to arrive at it.
- Gadgets and Processes. The device vs. where it embeds.

The S&T practices within a society are important determinants of its development

- Adaptation and innovation to changing situations.
- more efficient use of resources, production.
- Public comprehension. Better informed decisions.
- Better design of institutions.

The Development Professional

- A cultural or civil-society agent. Trust and prestige, role-model, thought leadership in the public sphere.
- Core values but otherwise neutral. Methodological and process-driven contributions.

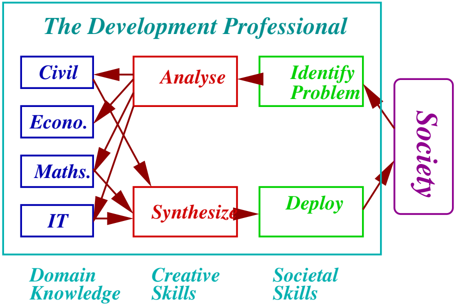


Figure: Activities of the Development Professional

The Development Professional

- A cultural or civil-society agent. Trust and prestige, role-model, thought leadership in the public sphere.
- Core values but otherwise neutral. Methodological and process-driven contributions.

(i) identify stake-holders and measure the key attributes of the problem.
(ii) identify the key agents and processes.
(iii) form an inter-disciplinary historical or regional narrative.
(iv) decompose the problem into disciplinary sub-problems.
(v) solve of the subproblems and synthesis.
(vi) deliver value to the stake-holders and charge fees.

Thanks