

ADAPTATION STRATEGY FOR CLIMATE CHANGE Towards Sustainable Water Resource Management



K M L Mathur
Past President
IWWA
26th October, 2017.
Takamatsu, Japan

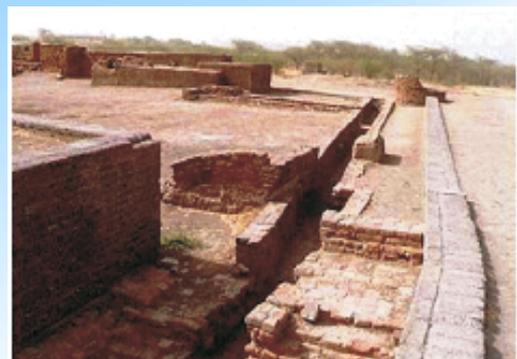
HISTORY OF INDIA

- ▶ **Prime importance on water since ancient times**
 - Ancient civilizations developed near rivers
 - Rivers considered as deities in Indian culture

- ▶ **Evidences of water and wastewater management practices since 3000BC in Indus Valley Civilizations**
 - Drainage channels with covers for maintenance
 - Retention structures for sludge collection
 - Rain water harvesting measures in the form of reservoirs



Source:
<http://www.shunya.net/Pictures/WesternIndia/Gujarat/Dholavira/Dholavira03.jpg>



Source:
http://www.sewerhistory.org/images/w/wam/loth_wam10.jpg

HISTORY OF WATER IN INDIA

- ▶ Community approach also evident in many areas for conservation of water
 - Structures like Paar, Johads, Kund, Ahar and Bhandaras from Himalayas to arid deserts of Rajasthan
- ▶ Water supply infrastructure
 - Example: Katraj Lake near Pune which still functional after 250 years

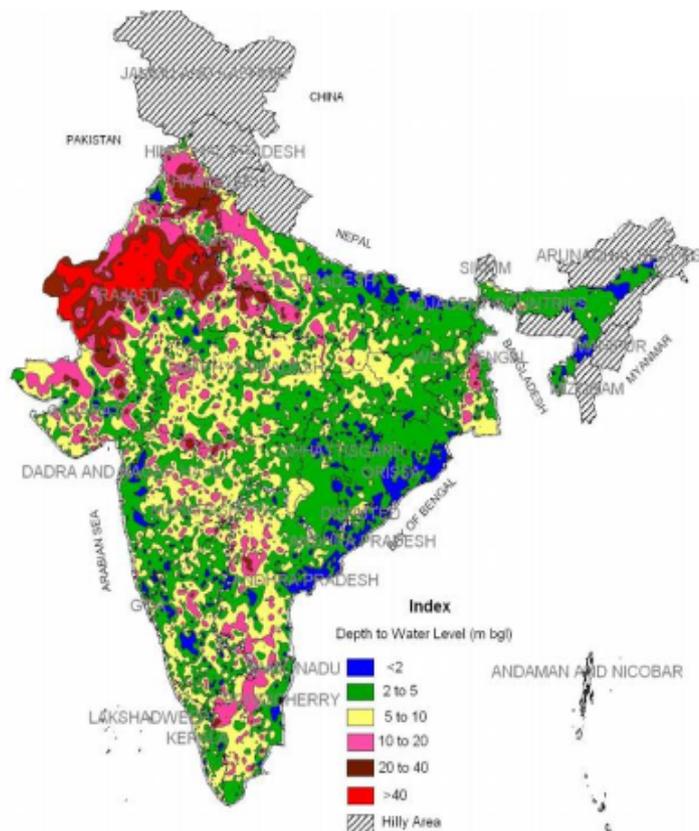


Source:
<http://socks-studio.com/2014/03/13/inhabiting-infrastructures-indian-stepwells/>



Source:
<http://www.thebetterindia.com/17159/jethu-singh-reviving-traditional-methods-rain-water-harvesting/>

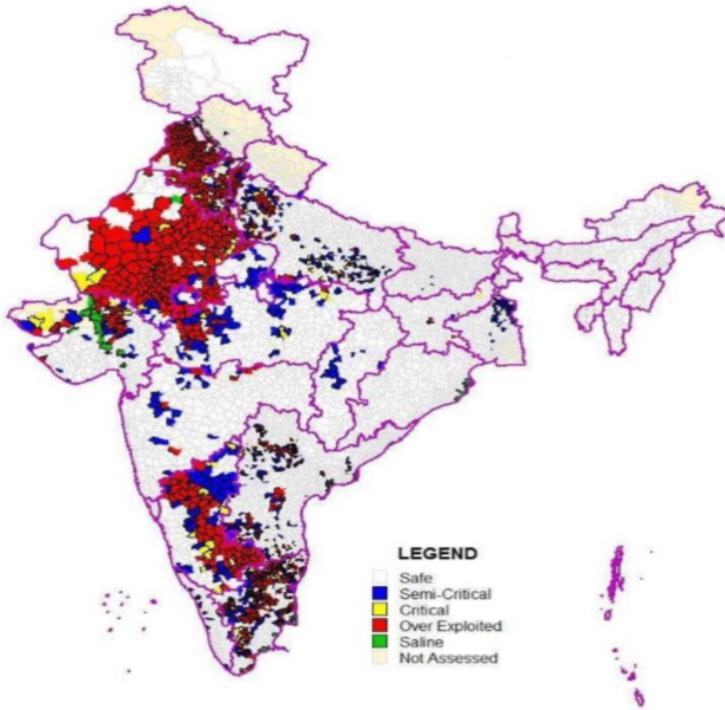
Figure 2: Depth to water level (pre-monsoon, 2014)



Note: m bgl denotes meters below ground level.
Sources: Central Ground Water Board; PRS.

- Availability of groundwater in the northwestern region of the country is at very low levels
- Significant pockets across the country where the depth of the water level is more than 10 meters.
- In areas where water level is below 10 meters, sophisticated equipment is required to extract it

Figure 3: Categorization of ground water assessment units



Note: Data as of 2011.
Sources: Ground water scenario in India, November 2014, Central Ground Water Board; PRS.

State	Ground water development in 2011 (%)
Andhra Pradesh	37
Arunachal Pradesh	0
Assam	14
Bihar	44
Chhattisgarh	35
Delhi	137
Goa	28
Gujarat	67
Haryana	133
Himachal Pradesh	71
Jammu & Kashmir	21
Jharkhand	32
Karnataka	64
Kerala	47
Madhya Pradesh	57
Maharashtra	53
Manipur	1
Meghalaya	0
Mizoram	3
Nagaland	6
Odisha	28
Puducherry	90
Punjab	172
Rajasthan	137
Sikkim	26
Tamil Nadu	77
Telangana	55
Tripura	7
Uttar Pradesh	74
Uttarakhand	57
West Bengal	40
Total *	62

Note: *Total includes union territories.

Water Availability In India

Parameters	Unit(Billion Cubic Meter/Year)
Annual Percipitation	4000
Average Annual Availability	1869
Estimated Utilizable Water Resources	1123
(i)Surface Water Resources	690
(ii)Ground Water Resources	433

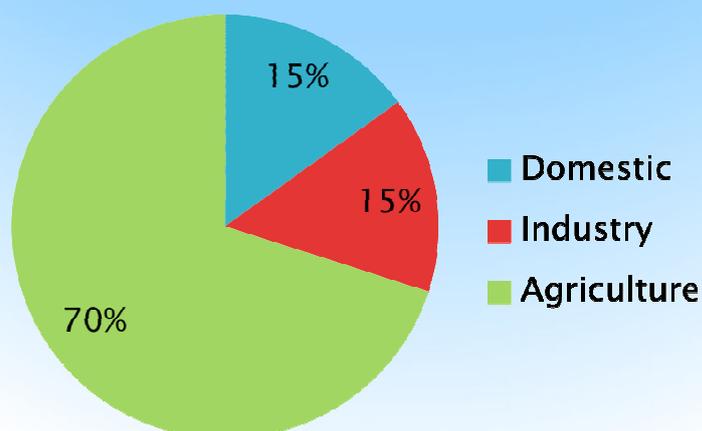
Top fifteen river basins in India: Average water flow and utilizable water

River basins	Average annual water flow (in Km ³ /year)	Utilizable flow (in Km ³ /year)	% of total average annual water flow in India	% of total utilizable water flow in India
Ganga–Brahmaputra–Meghna Basin	1202	274	61.6	40
West flowing rivers south of Tapi	201	36	10.3	5.2
Godavari	111	76	5.7	11
Indus	73	46	3.8	6.7
Krishna	70	58	3.6	8.4
Mahanadi	67	50	3.4	7.2
Narmada	46	35	2.3	5.0
Brahmni–Baitarani	28	18	1.5	2.7
East-flowing rivers between Mahanadi and Godavari	17	Un-assessed	0.9	Un-assessed
West-flowing rivers of Kachchh and Saurashtra including Luni	15	15	0.8	2.2
Tapi	15	15	0.8	2.1
Subarnarekha	12	6.8	0.6	1.0
Mahi	11	3.1	0.6	0.4
East-flowing rivers between Pennar and Cauvery	10	17	0.5	2.4
Rivers draining into Bangladesh	8.6	NA	0.4	NA
Total	1887	649.42	96.62	94.12
Total average annual water flow in all river basins (in Km³/year):				1953
Total utilizable water flow in all river basins (in Km³/year):				690

WATER STATISTICS

16% of world population and 4% of water resources usage of water in India.

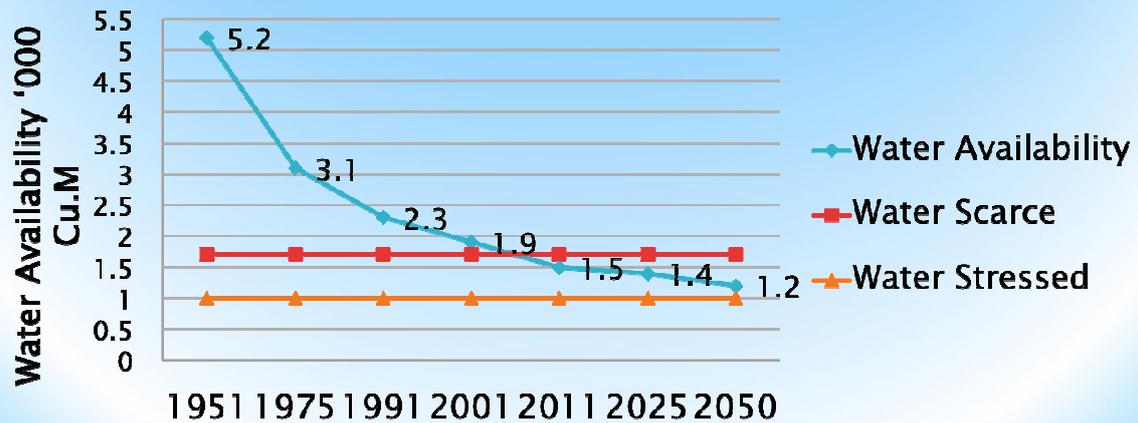
Usage of water in India



WATER STATISTICS

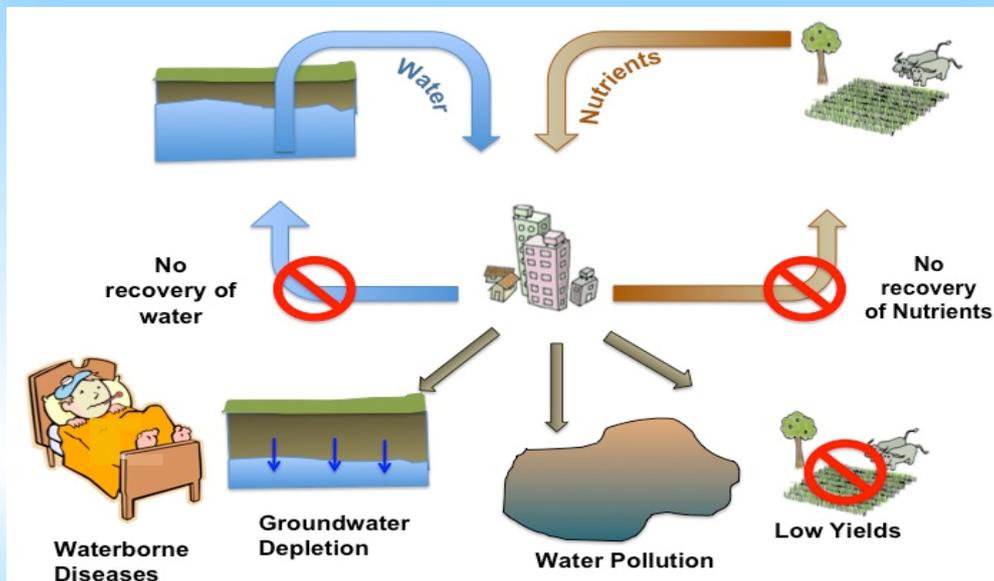
- Per capita water availability in India has dropped and is expected to further reduce in the future
- Increasing demand and population

Per Capita Water Availability in India



CURRENT WATER ISSUES

- Over exploitation of ground water resources
- End of the Pipe solutions
- Lack of sewage and effluent treatment



CURRENT WATER ISSUES

- **Inefficient operation and maintenance of wastewater treatment facilities by Municipal Bodies and SMEs at many places**
- **Water use productivity in India is very low (UNESCO, WWAP)**
- **Many SMEs can't afford ETPs. CETPs employed in few cases**
- **Distribution losses due to lack of maintenance and repair**
- **Service Level benchmark for NRW is fixed at 20%**
- **“In a study by Andey and Kelkar (2007), in four cities across India, to evaluate the influence of intermittent and continuous water service on NRW, it was showed that NRW increased from 19.5% to 35.8% under IWS, whereas it increased from 31 to 47.8% under continuous supply system” (Jayaramu and Kumar 2014)**

DROUGHT IN INDIA

- **Scanty rainfall due to climate change.**
- **Total 1.7 million rural habitation.**
- **About 25%, 4,41,390 faces drinking water scarcity every year.**

SHORT TERM MEASURES TO COMBAT DROUGHT

- **Repair and restoration of hand pumps on priority.**
- **Addition of riser pipe to bore holes to access deeper ground water.**
- **Laying temporary pipe lines.**
- **Feeding through water tankers.**
- **Hiring of private bore wells to augment water supply.**
- **Drilling and commissioning of additional bore wells for power pumps.**

LONG TERM MEASURES

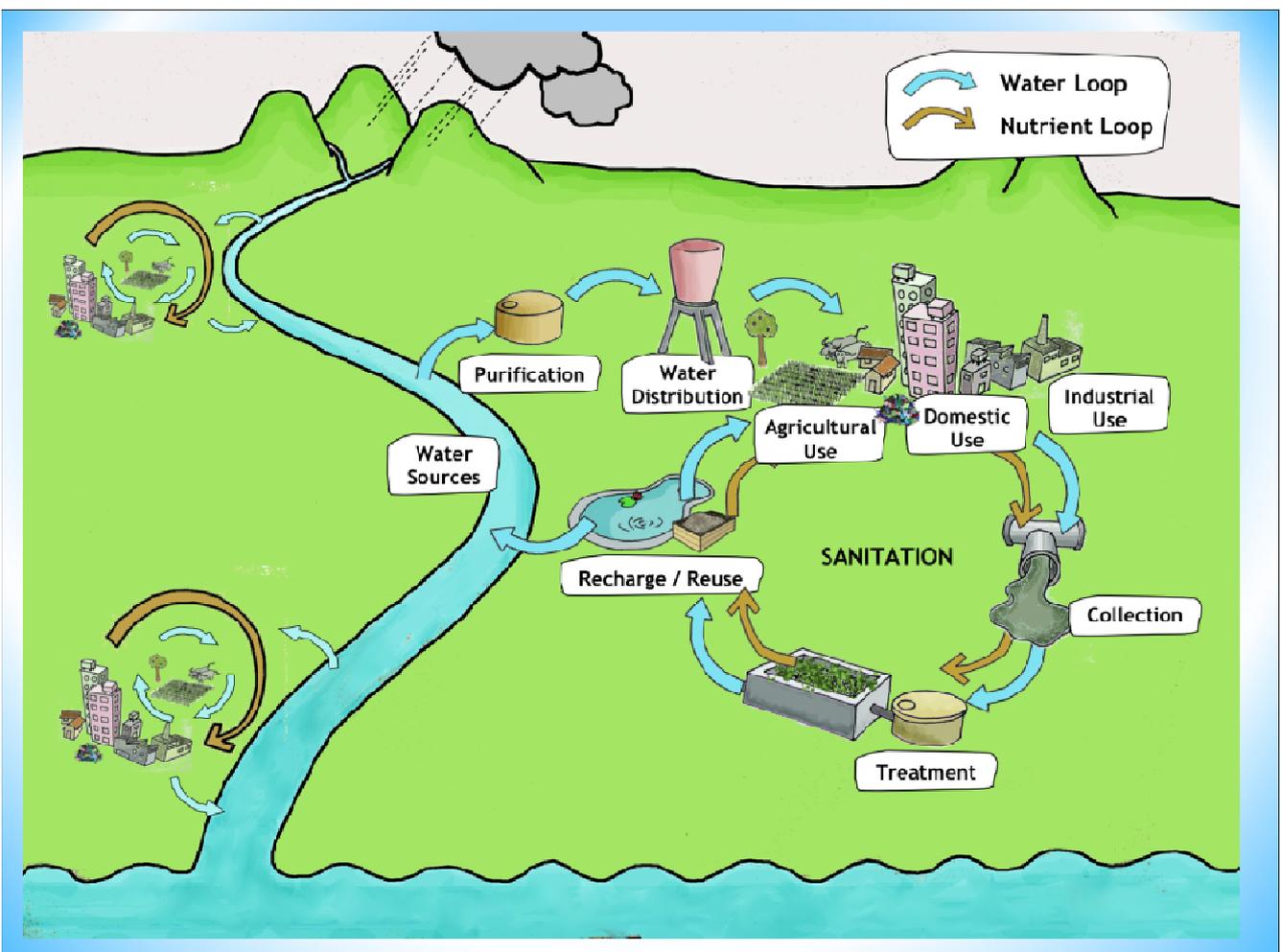
- **Construction of check dams/ sub surface barrier.**
- **Rain water harvesting structures.**
- **Interlinking of rivers.**
- **Use of recirculated sewage water for drinking use.**
- **Transforming flood irrigation to drip/ sprinkle irrigation.**

EQUITABLE DISTRIBUTION

- **National Water Policy recognizes the need for equitable distribution**
- **It also recommends judicious use of water including recycle and reuse**
- **Focus on subsidizing basic services for urban poor with schemes like JNNURM**
- **Issues like high NRW, lack of metering**

LAW AND LEGISLATION

- ▶ Environment Protection Act (1986)
- ▶ Water recognized as a basic need and a part of right to life
- ▶ Water Act (1974)
 - Prevention, Control and Abatement of Pollution
 - Ensure safe supply of water to people
 - Responsibility on State and ULBs to enact and enforce
- ▶ Rules and regulations at local level, written and unwritten
- ▶ Most control of water utilization with states rather than centre
- ▶ Pollution Control Boards at State and Central level
- ▶ National Water Policy, National Sanitation Policy, Municipality Act etc. all recognize the need of access, treatment and regulation of water sources



FUTURE OF WATER IN INDIA

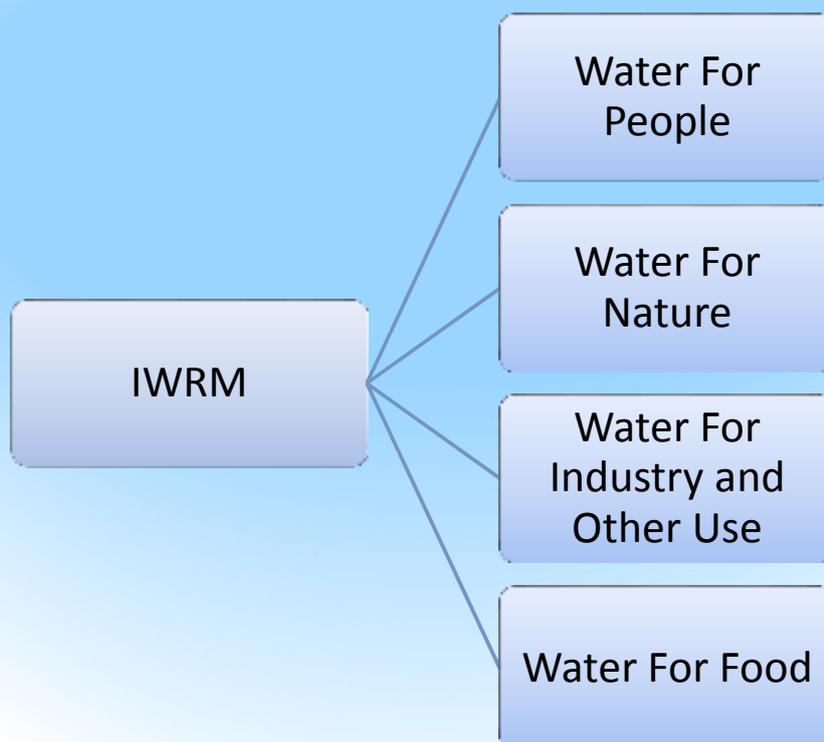
- **Risk of being a water scarce country owing to increasing demand and population**
- **Contamination of water resources and climate change can further aggravate the problem**
- **55% of all water is sourced from groundwater sources which are fast depleting**

SECURING INDIA'S WATER FOR FUTURE

- ▶ **Data Management and Dissemination for local adaptation and behavioral change**
- ▶ **Integrated watershed management to mitigate climate change**
- ▶ **Sustainable development**
 - **Adoption of unconventional and decentralized options along with centralized solutions**
 - **Maintaining environmental flow requirements**
 - **Encouraging water recycle and reuse**
- ▶ **More financing for water management with the help of private sector**

SECURING INDIA'S WATER FOR FUTURE

- ▶ Incentive for treatment and reuse coupled with punishment for defaulters with strict implementation
- ▶ Efficient water use by using low flow equipment's, increasing water productivity
- ▶ Technical skill development for better management of water resources
- ▶ Encouraging research and development in the water sector including research on traditional methods



Piplantri Village District RajSamand, Rajasthan



SUCCESS STORY – Village Piplantri Distt. Rajsamand, Rajasthan

Basic Information Piplantri Village

- Total Habitation – 7 nos.
- Total population – 5138 souls.
- Total families – 1100 nos.
- Total area – 2207.52 hectare
 - Cultivable area – 15 to 20 %
 - Water table – 15 to 20 meter
- No water supply facility in the village.
- No sanitation facility in the village.

WORKS TAKEN UNDER IWRM

- 4 nos anicuts .
- Rain water harvesting structure.
- Water shed development.

FUNDING AGENCY

- **NEGRA.**
- **Swajal Jhara.**
- **Nirmal Gram Programme.**
- **NGO under community development program.**

RESULTS

- **Water table increased by 10 to 12 meters. Now it is only 1.5 to 2 meters.**
- **Pipe water supply in village.**
- **Sanitation facility developed.**
- **Water sheds in 805 hectare out of which –**
 - **216.83 hectare arable**
 - **588.17 non arable**
 - **Hilly area converted to green by forestry**
 - **Horticulture plantation**
 - **Medical plants**
 - **Alovera plantation**
- **Enhancement in crop protection.**
- **Due to increase in water table crop area increased. Thus more production , more income.**
- **Due to employment in village migration stopped.**
- **No drought in future.**



Water Table After IWRM work.



Rain Water Harvesting Structure



Anicuts Constructed under IWRM.



Anicuts constructed under IWRM.



Afforestation work done in non arable area.

Save Water

For Future

THANKS

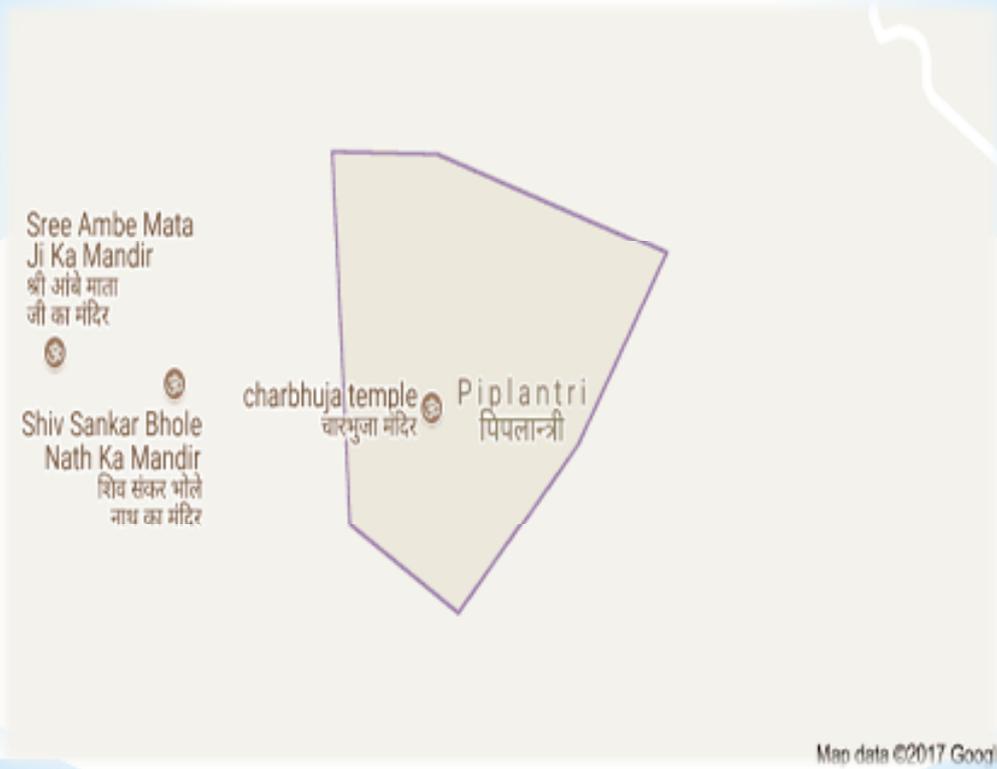


MAP OF RAJASTHAN



RAJSAMAND DISTRICT





Map data ©2017 Google

To slide 22