Water Crisis and Sustainable Solutions

RGICS Summer School
(22nd June 2020 to 20th July 2020)

RAJIV GANDHI
INSTITUTE FOR CONTEMPORARY STUDIES

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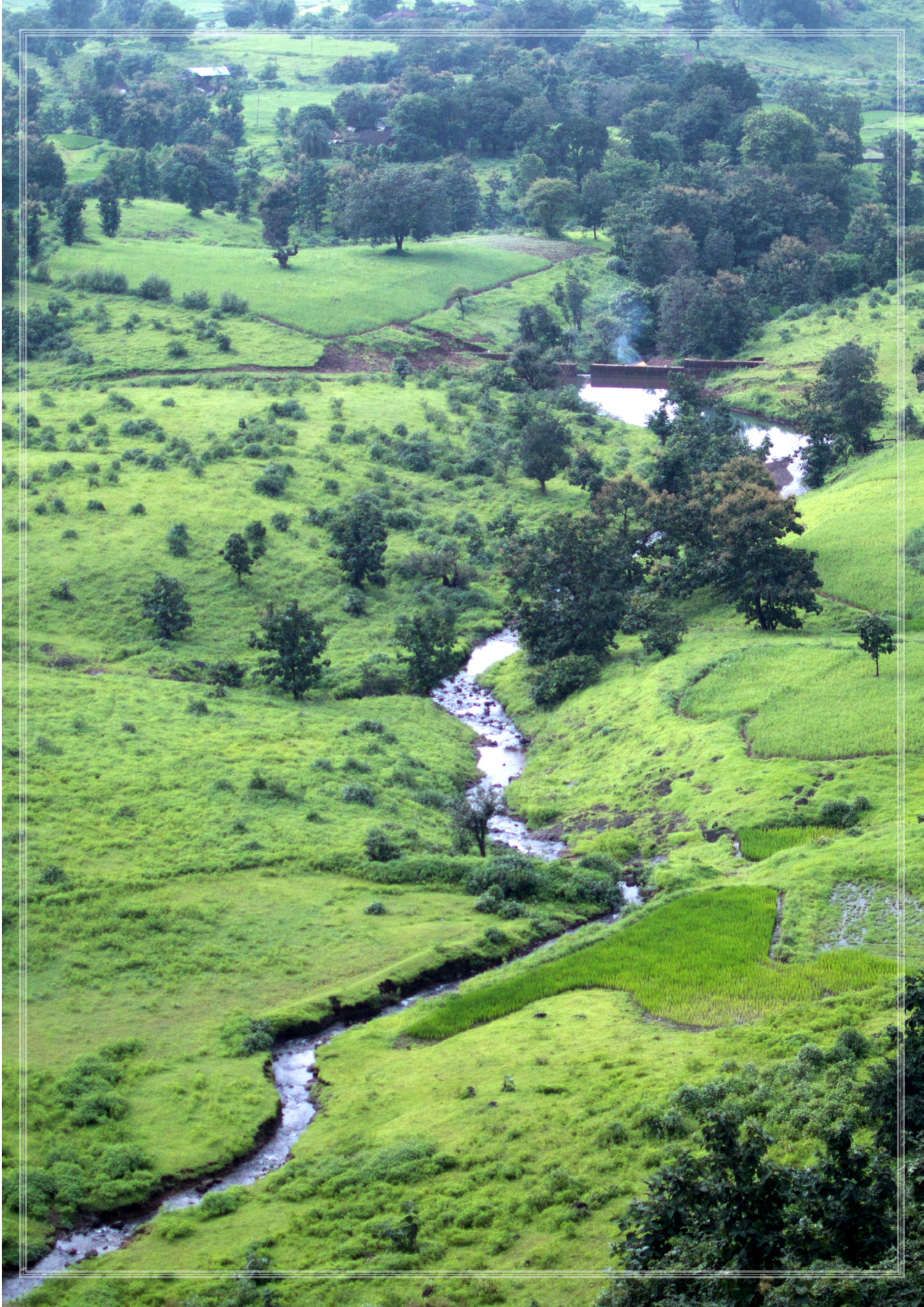

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Introduction

The Rajiv Gandhi Institute for Contemporary Studies (RGICS) under its policy research theme 'Environment, Natural Resources and Sustainability' has been working on number policy issues pertinent to natural resources such as water, land and forest. Our work on water in past two years includes production of policy papers, policy research on water crises, policy action research and video documentation of best water conservation and management practices. Our specific activities related to the water resources includes ideation of Ganga Sadbhavana Yatra in 2018 to build public support for clean and un-interrupted flow of the Ganga.

For experimenting innovative and sustainable ideas, we have set up two policy laboratory one each in Madhya Pradesh and Rajasthan. The focus of policy laboratory is to carry out policy action research projects. In Madhya Pradesh we have been working on rejuvenation of Ur River in the Tikamgarh district by providing planning and technical support to the local administration. In Rajasthan, we have been working on streamlining of traditional water harvesting structures of the Dang region in the public policies.

We at RGICS believe that the public policies should be inspired and informed by what is happening on the ground. In the words of eminent water researcher and environmentalist Late Mr. Anupam Mishra, "No matter, how much efforts you put in, a research work without reverence is nothing more than a heap of data. That can gratify your impulses, glorify golden past but cannot give direction for the future." To keep this crucial link in the mind, we always attempt to engage with all kinds of policy stakeholders. In the time of COVID-19, we decided to actively engage with students as policy stakeholders. The sustainability is an inter-generational phenomenon, so the involvement of children (the future) in policy discussion is highly desirable, if we are aiming for sustainable policy solutions. This has motivated us to organize a summer school for children using our research and policy work on the water resources.

Using the unique time we have during COVID-19 pandemic, we decided to organize a 'Summer School' for children on 'Water Crisis and Sustainable Solutions' from 22nd June to 20th July 2020. This program was designed innovatively to effectively engage children and instigate their thinking on various issues related to the water resources. The Summer School program was carried out under the 76 days long umbrella program 'Sadbhavana with Nature' of the Rajiv Gandhi Foundation to commemorate 76th birth anniversary of former prime minister of India Shri Rajiv Gandhi. The Sadbhavana with Nature program started on 5th June (World Environment Day) and ended on 20th August 2020 on the birthday of Mr. Rajiv Gandhi.

The RGICS Summer School on 'Water Crisis and Sustainable Solutions' is a course cum research opportunity designed for students in the age group of 15 years and above. The program aims to motivate students to understand water crisis around them and come up with sustainable solutions to address their local water problems. The program consists of four knowledge sessions and four research worksheets. Knowledge sessions were delivered by public policy professionals of RGICS along with people working on the issues of water on the ground in different parts of the country. This course cum research opportunity is being offered on the web/social media platform of Rajiv Gandhi Foundation.

The Course Design

The design of the RGICS Summer School goes beyond the conventional structure of summer schools. The idea was not to simply deliver knowledge session but to make participants of the summer school to explore around them and build understanding on their local water issues. Knowledge sessions were organized on different issues to orient participants on range water issues. Each session was followed by a worksheet on related topic. The purpose of the worksheet was to contextualize the academic knowledge gained through knowledge session. These worksheets were designed to help participants to explore and understand water issues around them in more comprehensive manner.

It had two important components to develop deeper understanding of participants on their local water issues. The first component was knowledge session and second component was field research by the participants using prescribed worksheet.

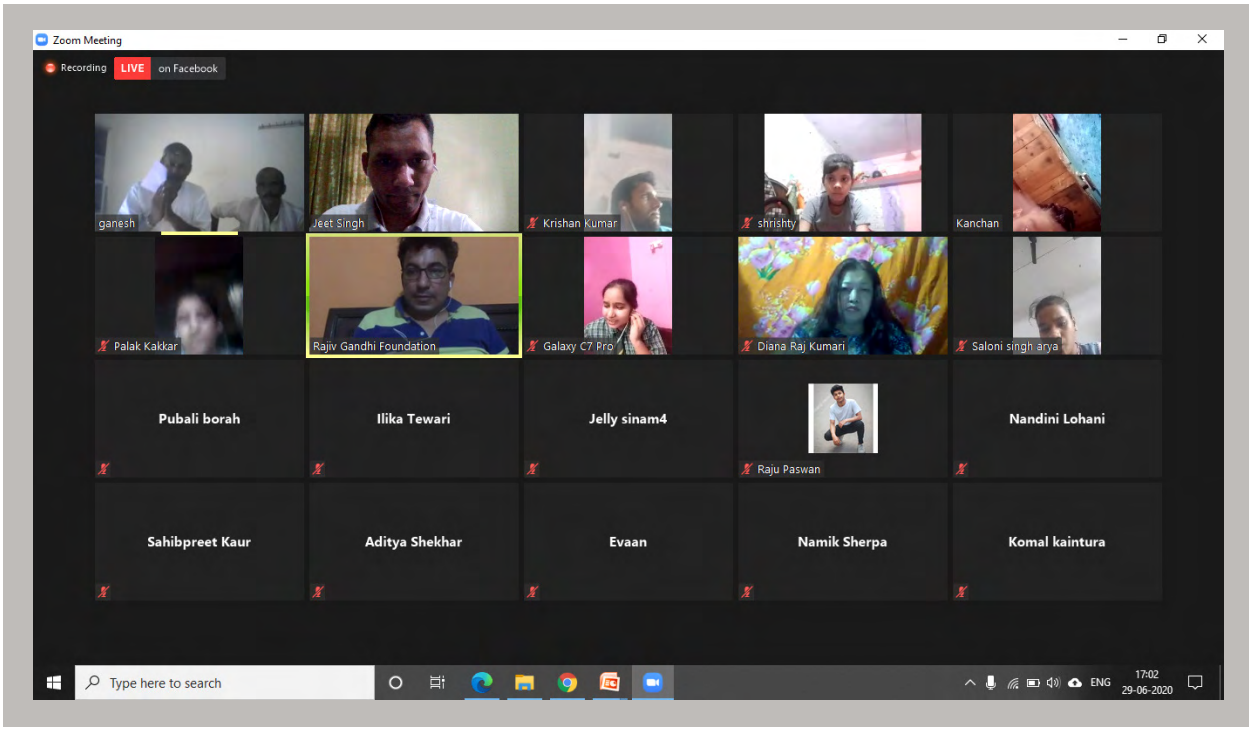
1. **Knowledge Sessions:** In total, four knowledge sessions were delivered on zoom app. These sessions were also telecasted through facebook to reach out to our participants in remote rural areas low internet connectivity. Knowledge sessions were aimed to provide basic information to our participants on different issues related to the water. The topic of these sessions includes Overview of the Hydrological Cycle, India's Water Crisis, Water Pollution and Sustainable Methods of Water Planning & Managements. These knowledge sessions were delivered by policy researchers and practitioners on the ground working on different issues related to the water resource management. We also used few documentaries and short videos to orient our participants about great work done by various people all across the globe to conserve water.
2. **Field Research:** After every knowledge session, participants were given a worksheet to explore water issues in their own village, town or city. These worksheets were design to allow participants to contextualize learning from knowledge session in their own eco-system. It helped them to explore and understand water resources around them.

What it offered:

1- An opportunity to understand water issues around you
2- Development of skill of researching
3- Provide solutions for sustainable development
4- Produce quality research report under guidance of professional researchers

Objectives of the Course/research:

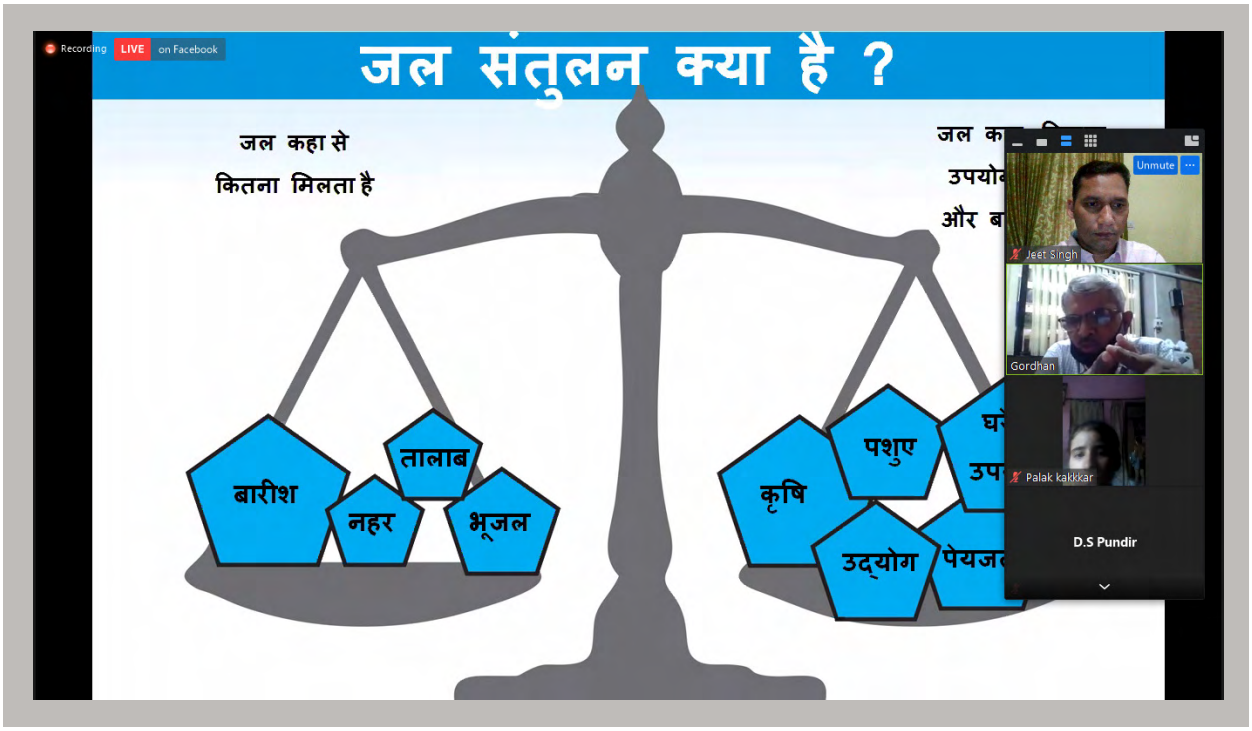
1- To build eco-friendly perspective of children on water resources around them.
2- To instigate students to look for sustainable solutions for water crisis around them.



Our Participants:

Our partner organization and associates in different states of the India helped us in recruiting participants for this summer school. We received 26 applications in total and out these 17 applicants participated in the summer school on regular basis. These applicants were from state like Jammu and Kashmir, Uttarakhand, Punjab, Bihar, Assam, Chhattisgarh and Delhi. Most of these participants also collected water related data using worksheet prepared for the field research.

Our participants were in the age group of 16 to 20 years with different level of education. While some of these participants were from big cities like Delhi, Jalandhar and Guwahati many of them were from small town and villages. Overall, we had a very diverse group of participants for this summer school.



Our Resource Persons:

Following resource persons helped us delivering knowledge session and guiding participants for their research work.

- Mr. Vijay Mahajan – Director, RGICS, New Delhi
- Mr. Jeet Singh- Fellow, (ENR&S), RGICS, New Delhi
- Prof. Sanjay Sharma, Engineer and Water Practitioner in Tikamgarh (Madhya Pradesh)
- Mr. Radha Krishna, Water Practitioner, Gram Gaurav Sansthan, Karauli (Rajasthan)
- Mr. Debesh Krishana Das, Teacher, Himalyan English School, Ghansali (Uttarakhand)
- Mr. Gordhan Kantariya, Training Coordinator, Development Support Centre, Ahmadabad (Gujarat)

Organizing and Support Team:

Overall Guidance - Mr. Vijay Mahajan, Director, RGICS
Course Director - Mr. Jeet Singh, Fellow, RGICS
Course Coordinator - Ms. Tanya Aggarwal, Intern, RGICS
Organizing Support - Mr. Ankush Gupta, Mr. Arun, Ms. Sujatha K.P. and Ms. Kiran

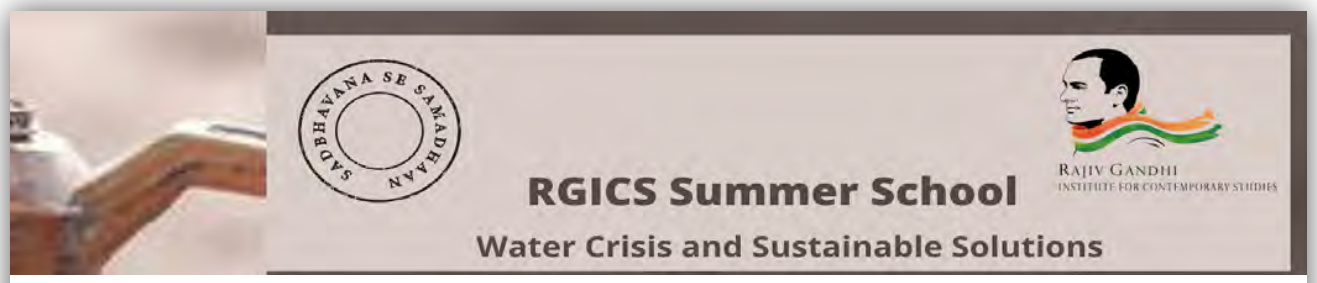
Schedule of the Summer School

Session	Topic	Main Content	Worksheet for Participants
I (22 June 2020)	Overview of the hydrological Cycle	• The hydrological cycle • Water bodies and their importance	A worksheet for participants to fill details of active and depleted sources of freshwater in their village/city/locality
II (29 June 2020)	India's Water Crisis	• Precipitation and its distribution • Disappearing sources of fresh water • Water use (demand vs supply gap) • Overview of Water Crisis in the Dang region and solution offered by GGS/RGF	A worksheet to identify major issues related to water crisis in their village/city/locality
III (06 Jul 2020)	Water Pollution	• Contaminated drinking water • Sources of water pollution (industrial and domestic sludge discharge) • Social and Economic Consequences of Water Pollution	A worksheet to identify major water quality issues in their village/city/locality
IV (13 Jul 2020)	Sustainable methods of Water Planning and management	• Integrated Water Resources Management • Water Balance Sheet- A case of DSC work in Meghraj (Gujarat) • Sankey Diagram for urban water planning	A worksheet to suggest ways to resolve water crises in their village/city/locality
V (20 Jul 2020)	Presentation and Discussion on Worksheets		

II

Knowledge Sessions

Knowledge sessions on four different topics were delivered online using zoom app. These sessions were also telecasted through facebook page. The purpose of these sessions was to orient participants about basics of water resources and issues related to it. Methods such as presentations, videos, case studies, guest lecturers by experts and participant led discussions were used to make these sessions effective and engaging. All power point presentations of knowledge sessions are presented here in this section.



The Hydrological Cycle

Jeet Singh

Rajiv Gandhi Institute for Contemporary Studies (RGICS), New Delhi

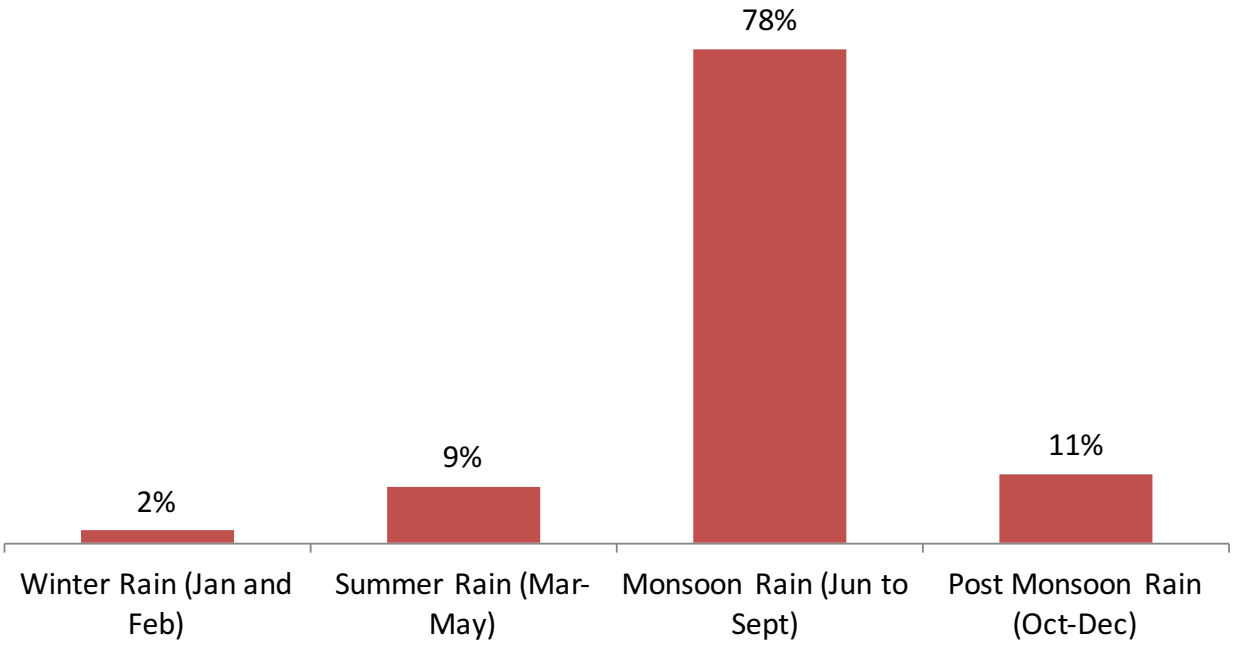
22nd June 2020

What is the Main Source of fresh the Water

- River?
- Lake?
- Glaciers?
- Ground water?
- Pond?
- Streams?

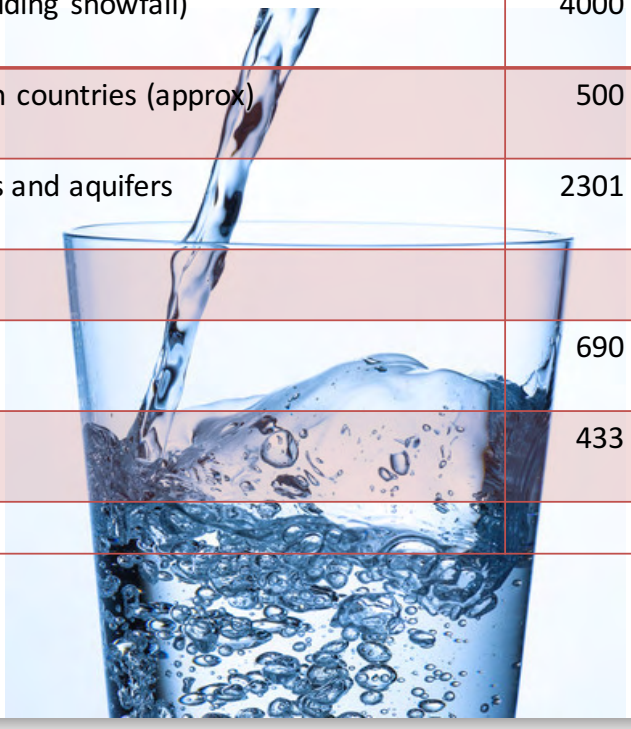
Rainfall is the main source of Water

Rainfall in India

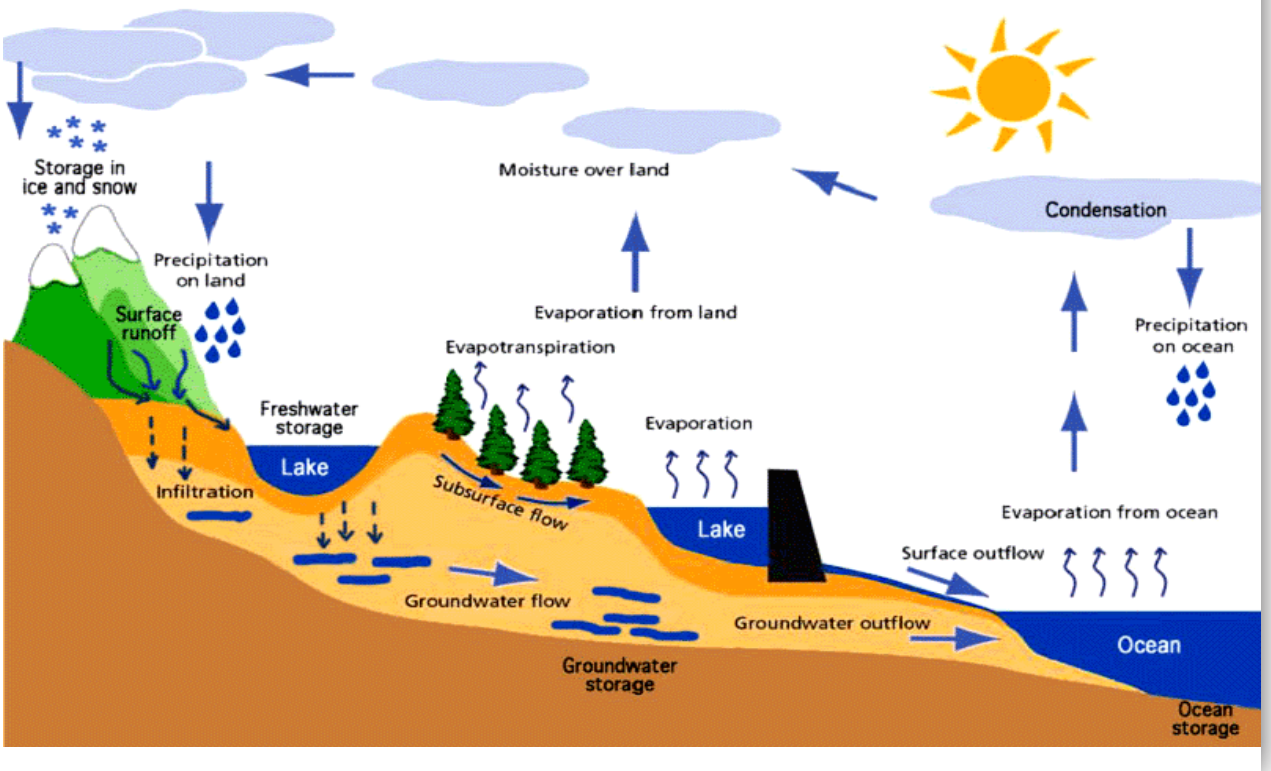


Total Available Water in India

Estimated annual precipitation (including snowfall)	4000 cbkm
Run-off received from upper riparian countries (approx)	500 cbkm
Average annual natural flow in rivers and aquifers	2301 cbkm
Estimated utilizable water	
(i) Surface	690 cbkm
(i) (ii) Ground	433 cbkm
cbkm means cubic kilometre	

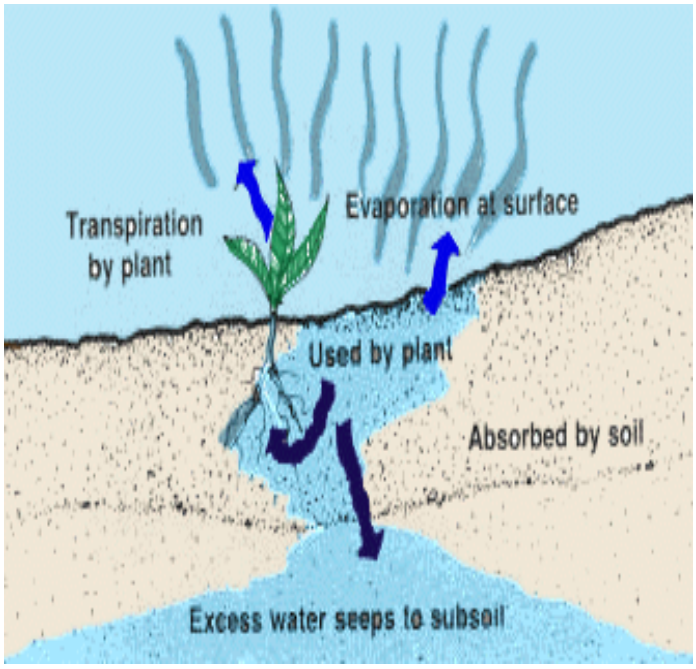


Hydrological Cycle

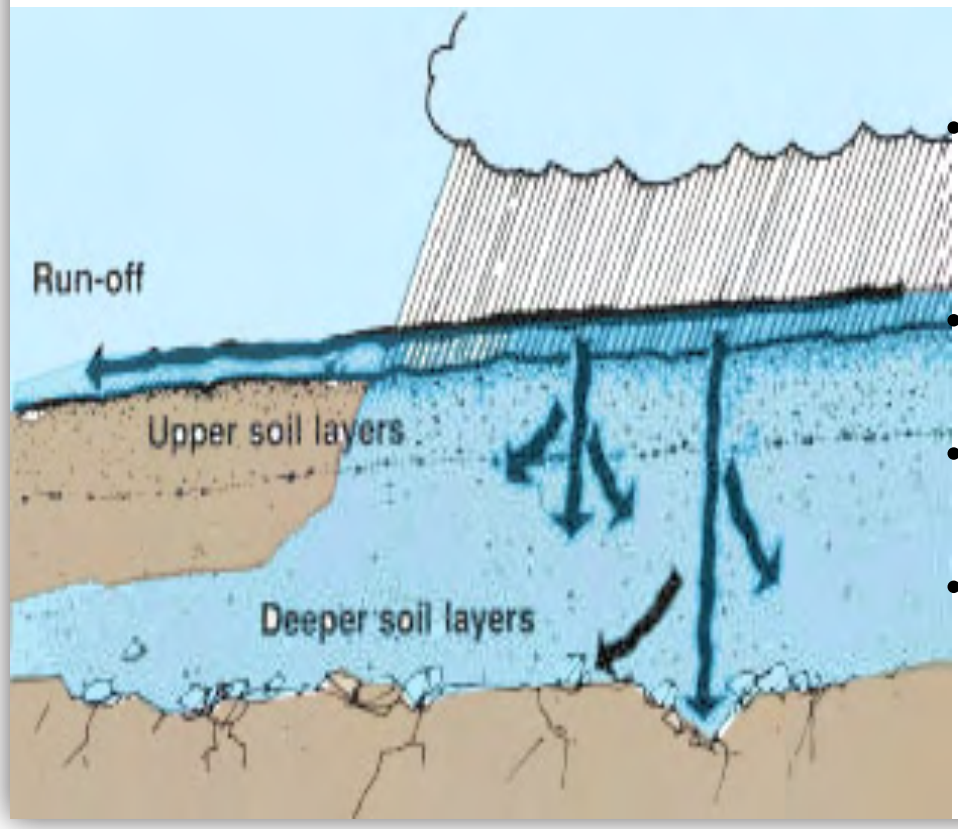


What happens to water that infiltrates into the soil?

- Water absorbed by soil- used by plants and rest evaporate
- Ground Water - Water not absorbed by soil seeps through to the subsoil

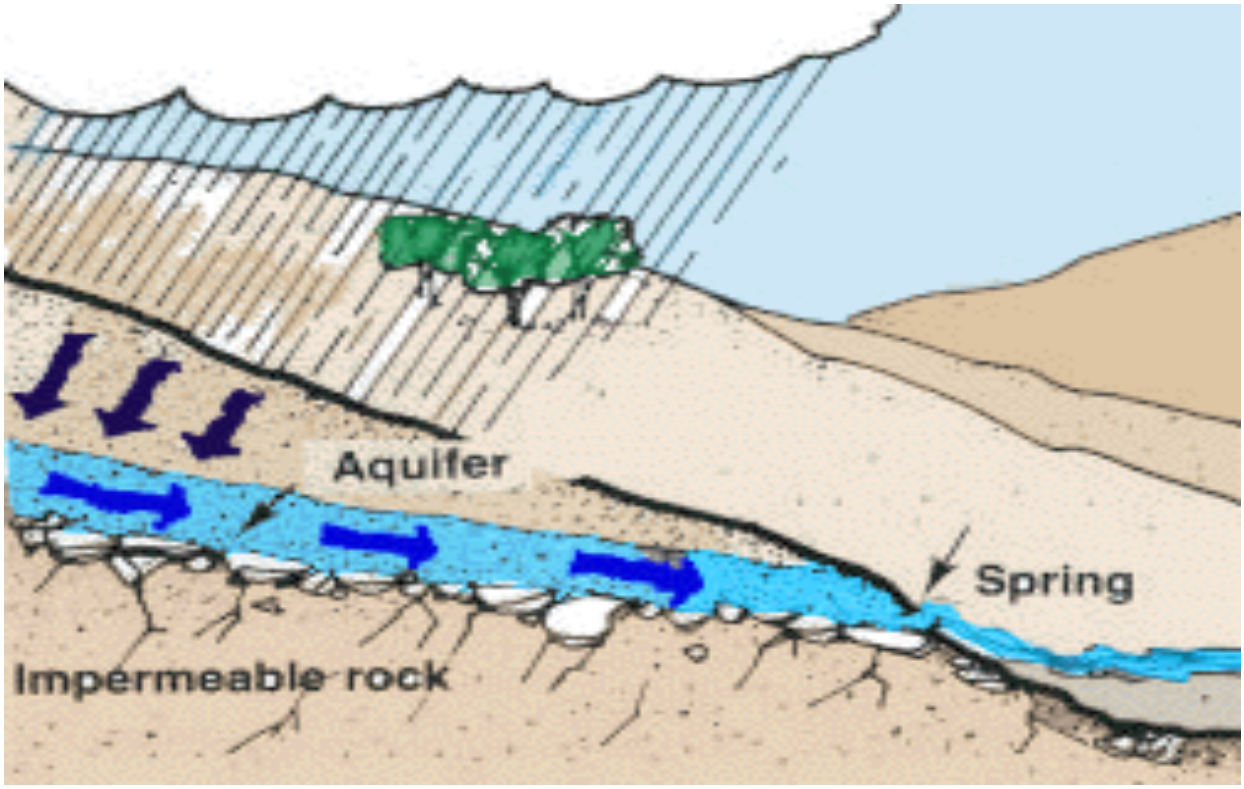


Rainwater infiltration and run-off

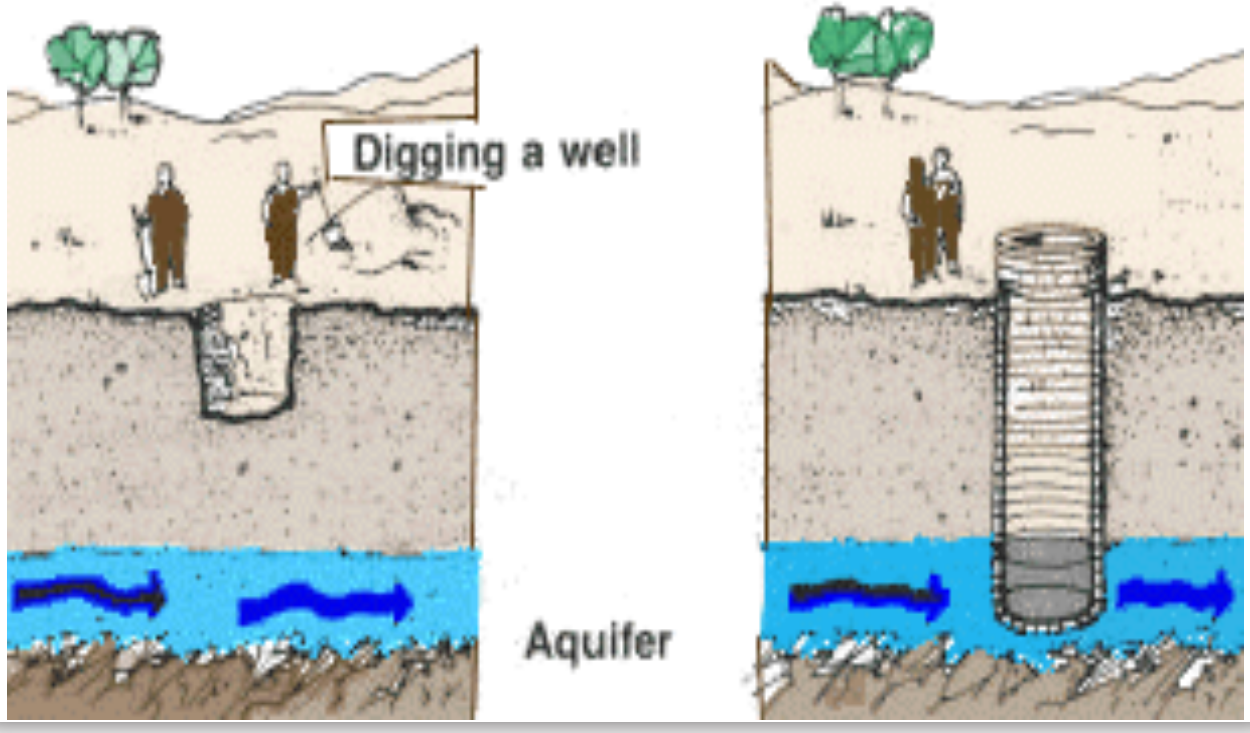


- ***Permeability*** *of the soil surface*
- ***Intensity*** *of rainfall*
- *Presence of* ***vegetation***
- *Local* ***topography***

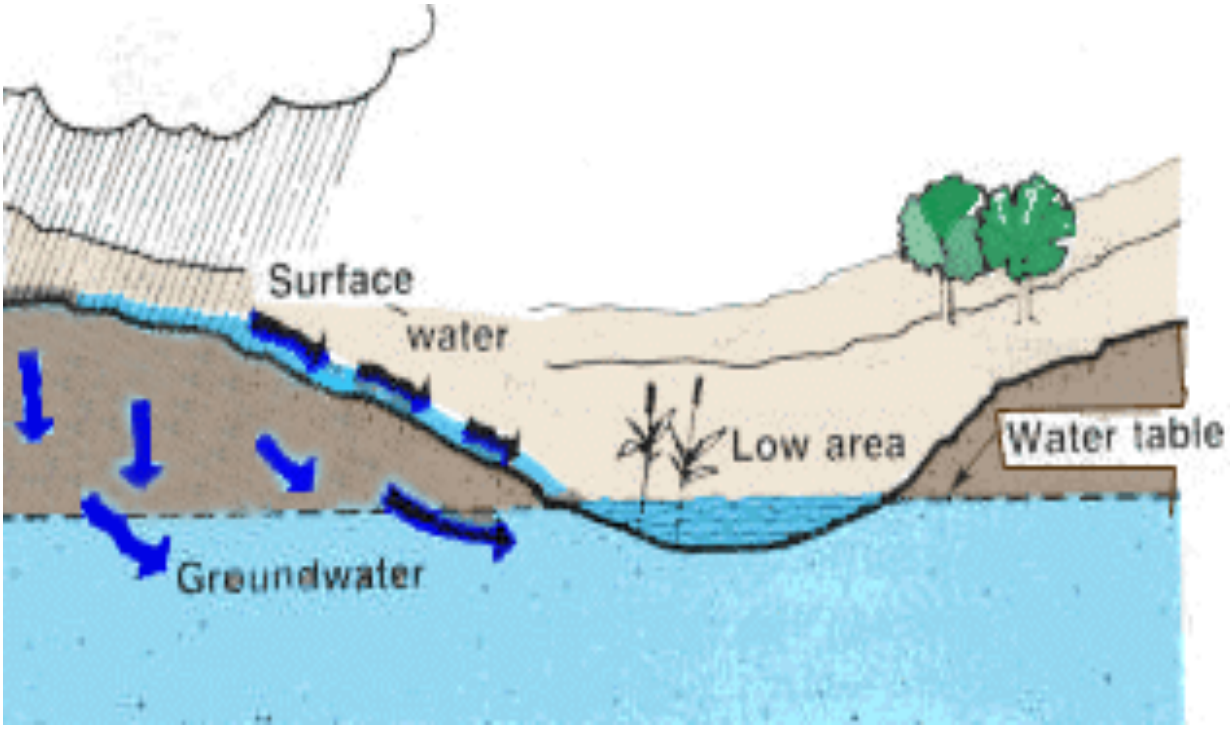
Springs are sources of infiltrated water



wells are sources of infiltrated water

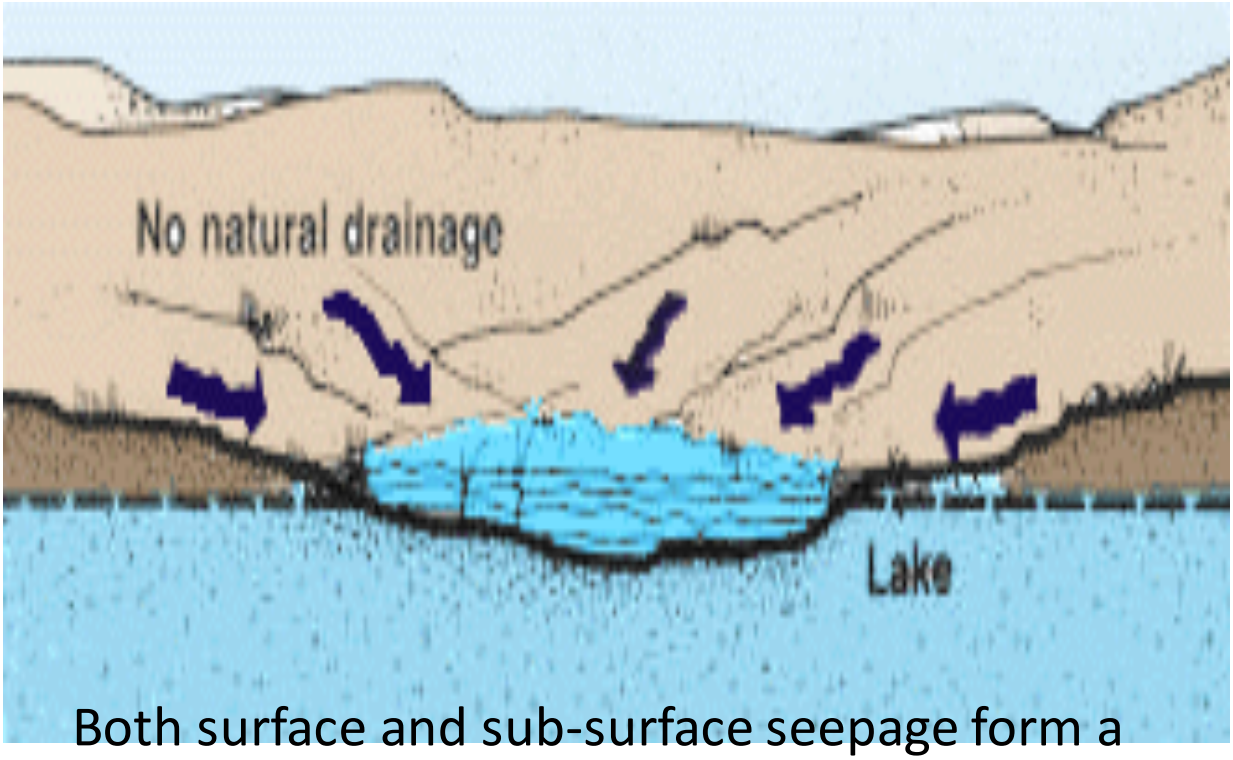


What happens to water run-off?



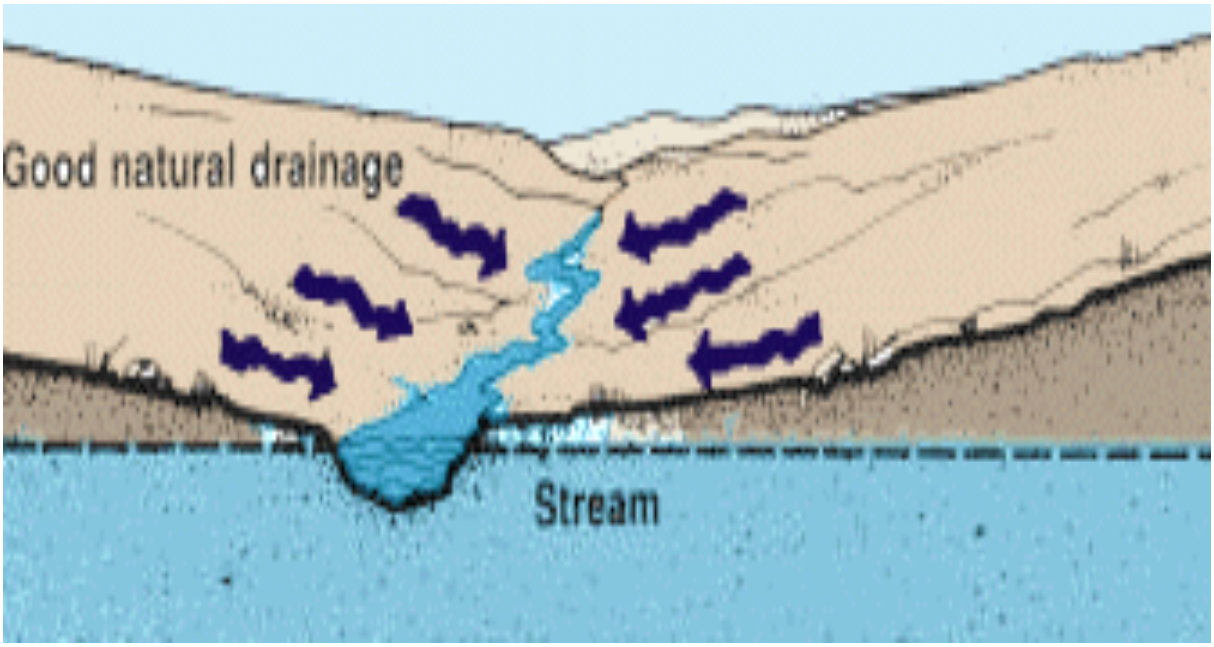
High level of water table leads to water accumulation on the surface

Lakes are sources of water run-off



Both surface and sub-surface seepage form a lake

Streams are sources of water run-off



Both surface runoff and sub surface seepage form a stream

RGICS Summer School

Water Crisis and Sustainable Solutions

India's Water Crisis

Jeet Singh

Rajiv Gandhi Institute for Contemporary Studies (RGICS), New Delhi

29th June 2020

India's Water Crisis- No Access

- 60 crore people face **high-to-extreme water stress**.
- 75% of households do **not have drinking water on premise.**
- 84% rural households do **not have piped water access**.

India's Water Crisis- Polluted Water

- 70% of our water is **contaminated**
- Nearly 2 lakh people die every year due to **waterborne diseases**.

India's Water Crisis- No or Excess Availability

- 21 cities including Delhi, Bengaluru, Chennai and Hyderabad will **run out of ground water** by 2020
- 10350 **farmers committed suicide** in 2018 due to drought and flood

Water Crisis: Where in India?

Shimla in the Mountains

Chennai at the Coast

Water Crisis: Where in India?

Budelkhand the driest region

Kerala the Tropical Region

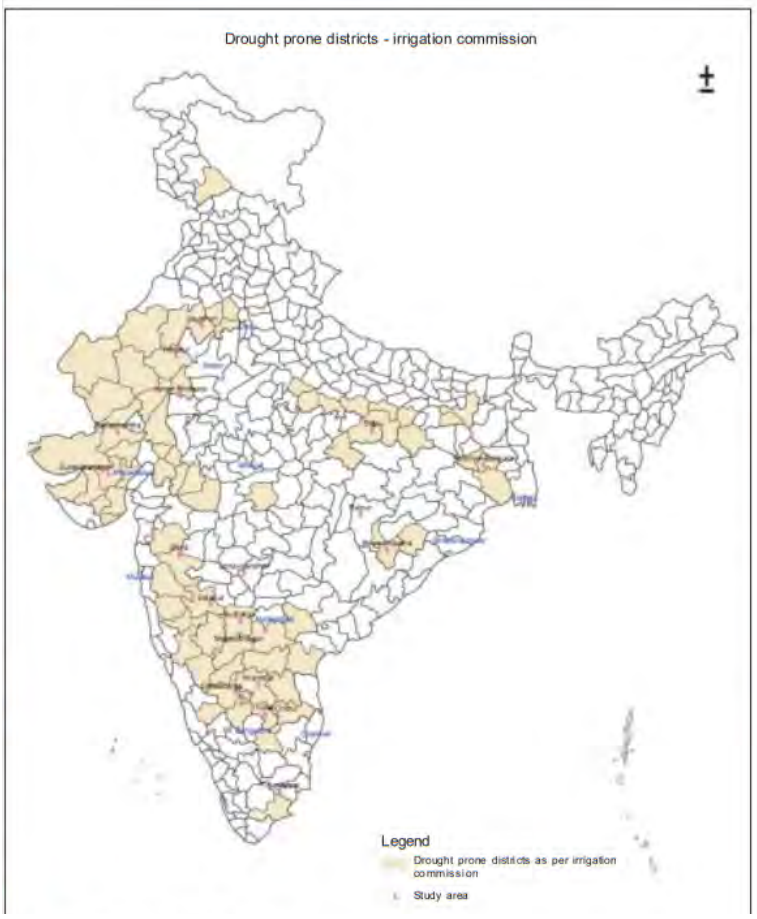
Water Crisis: Where in India?

Meghalaya (East)

Gujarat (West

The Drought

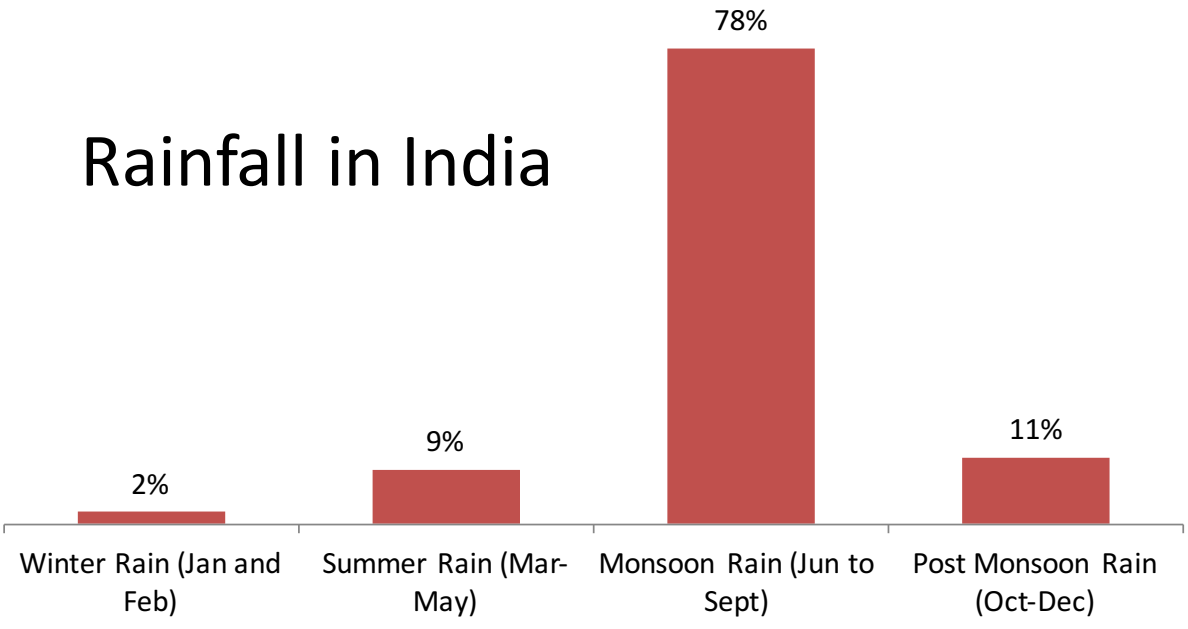
- 35% area of India which receives rainfall between 750 mm and 1125 mm is considered **drought prone**.
- 33% area of India receiving less than 750 mm is **chronically drought prone**.



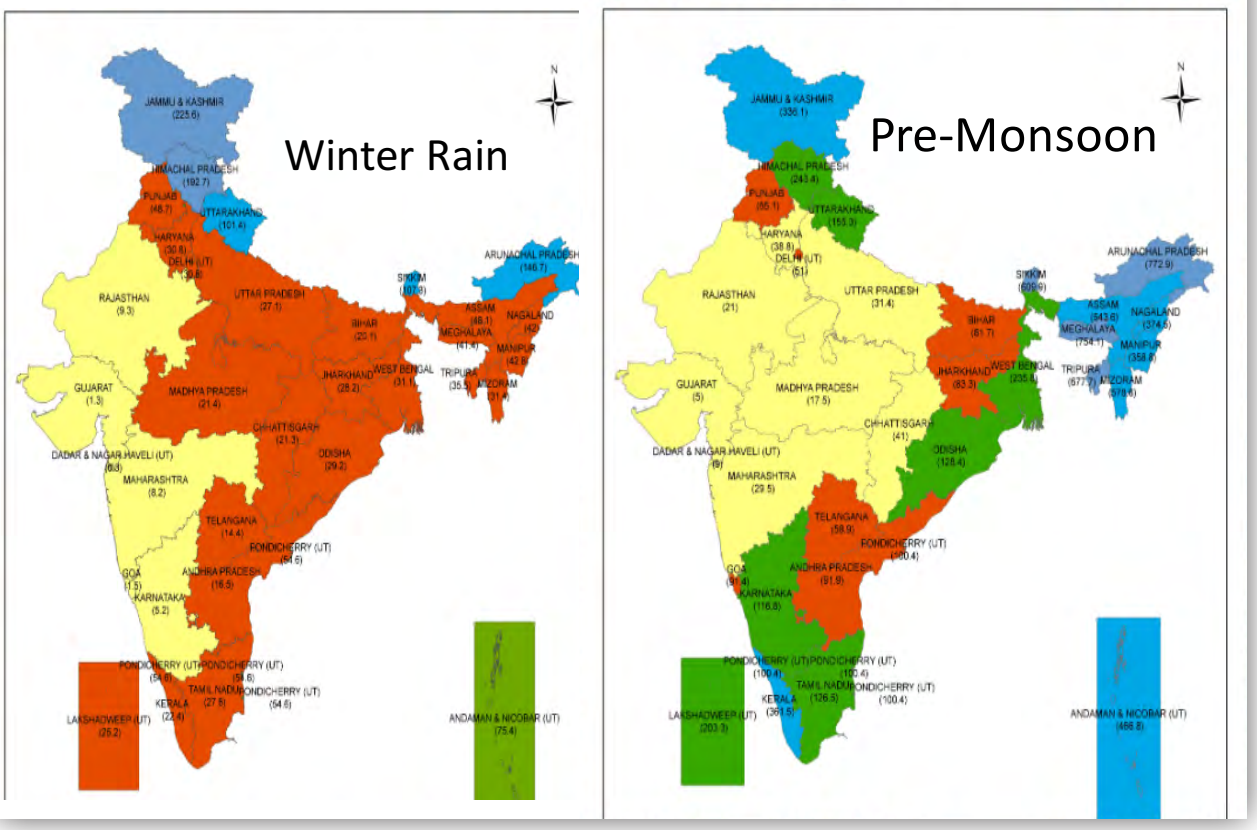
The Flood

Nearly **12% of the total geographical** area of India is Flood Prone

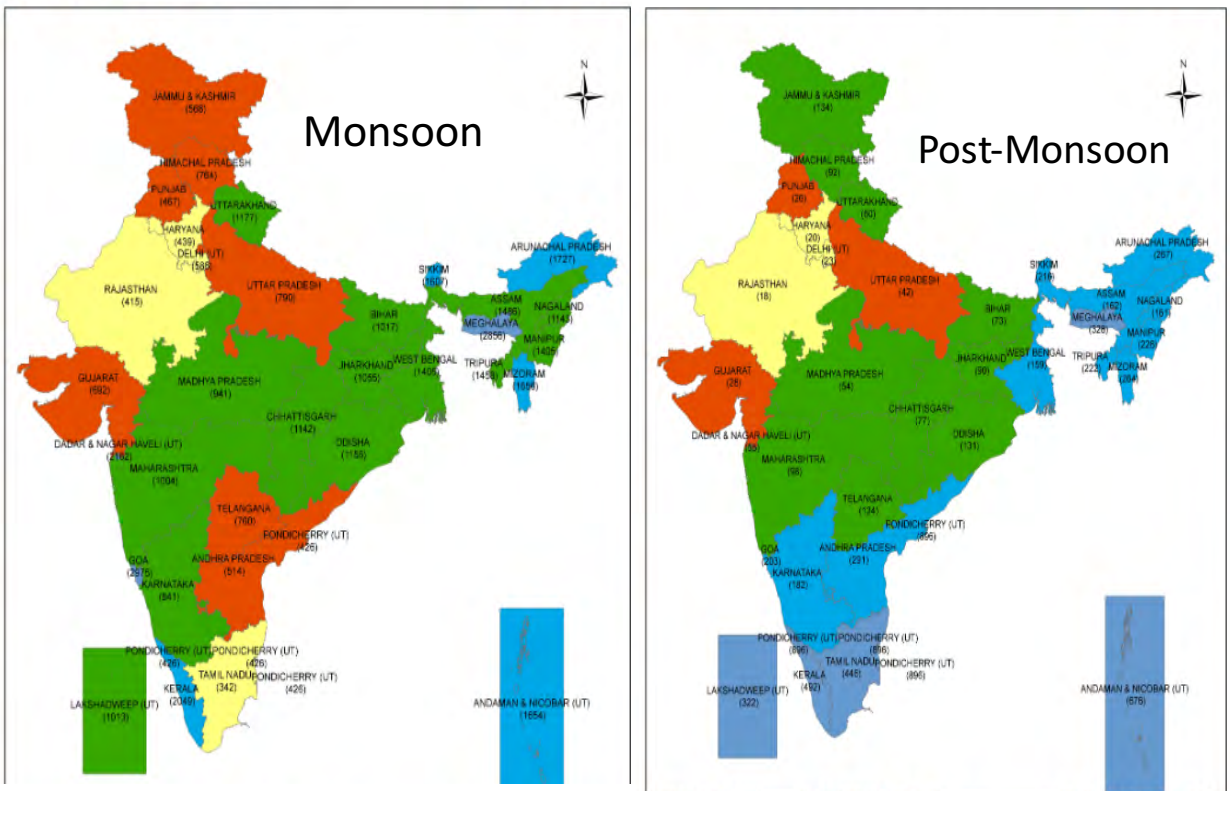
Temporal Factor of Crisis



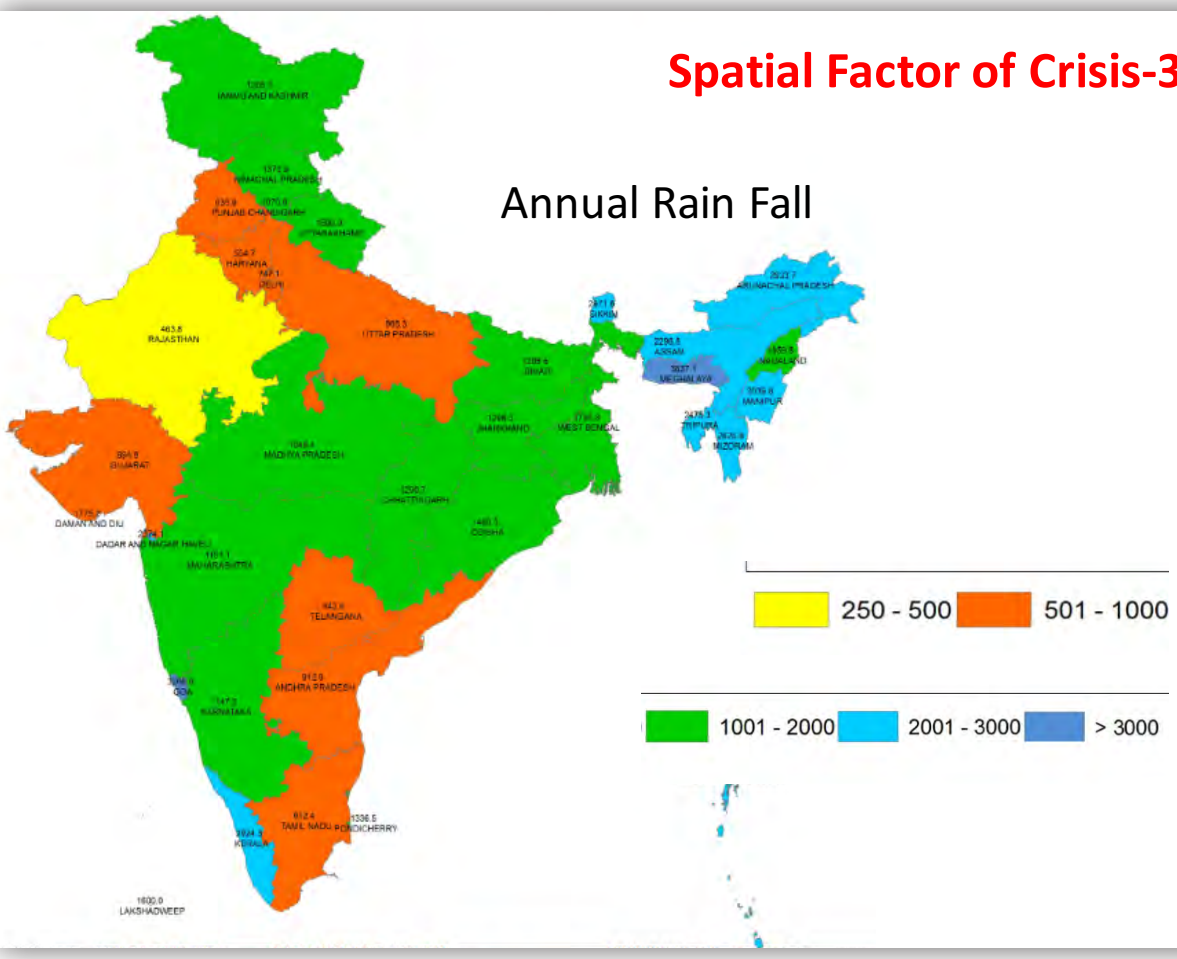
Spatial Factor of Crisis-1



Spatial Factor of Crisis-2



Spatial Factor of Crisis-3

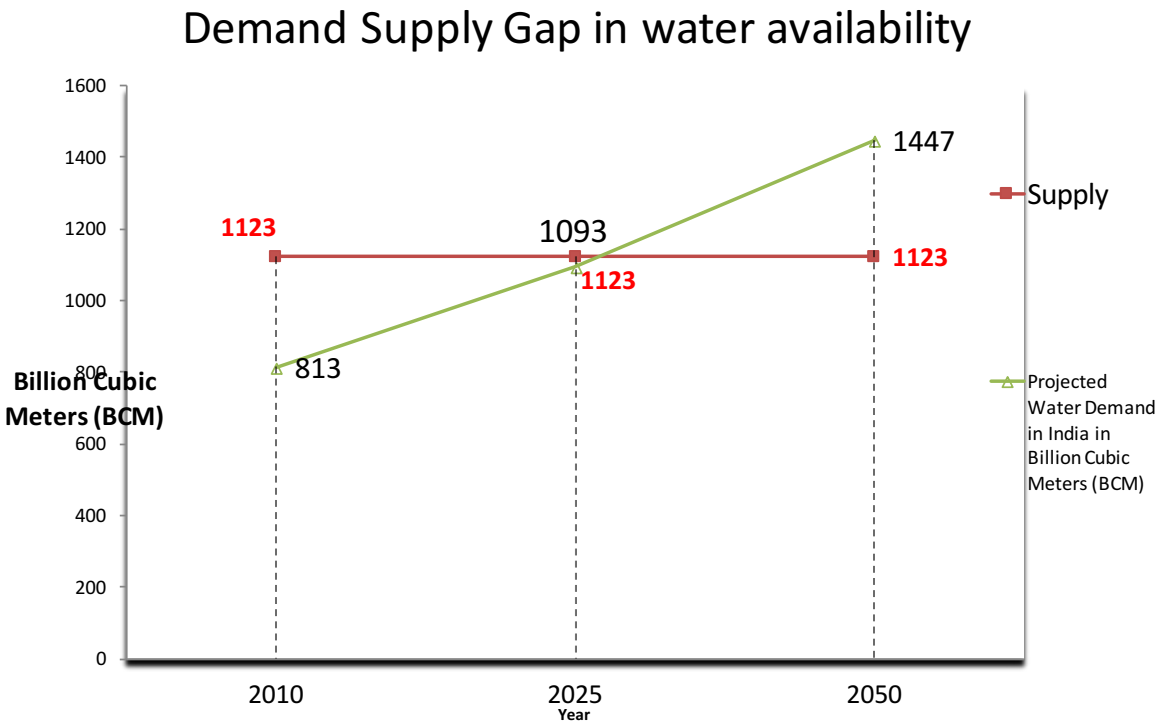


Management Related Factors of the Crisis-1

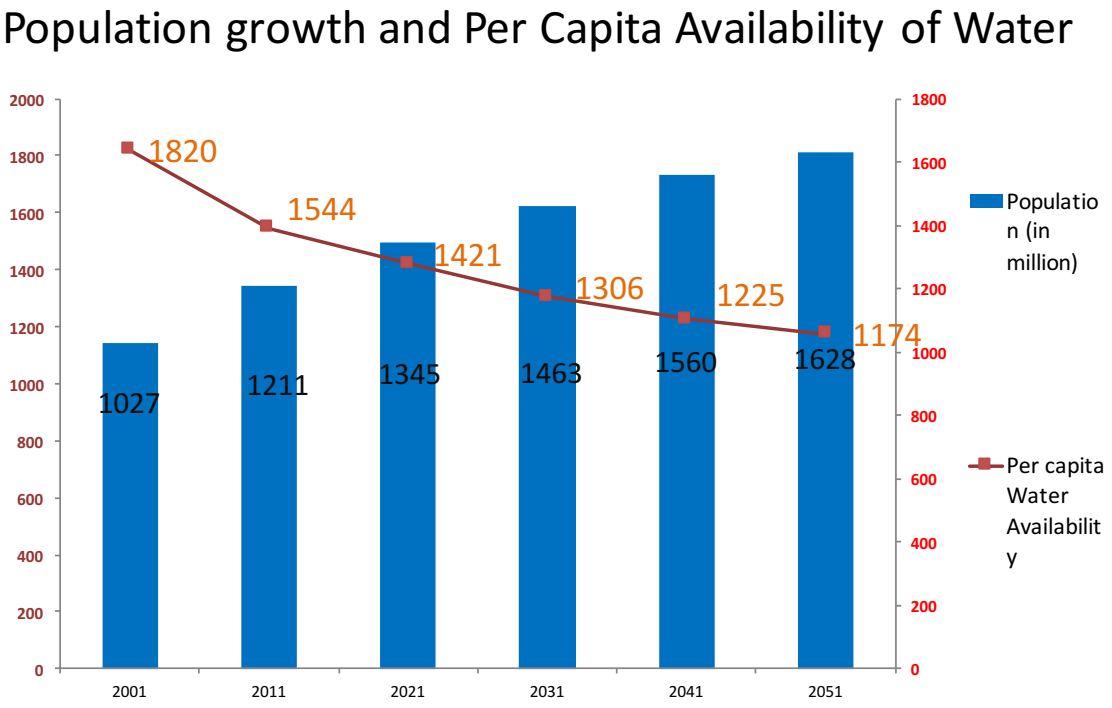
Water Demand in India

Sector	Total Water Demand (cbkm)	% of total water demand
Irrigation	688	84.7%
Drinking Water	56	6.9%
Industry	12	1.4%
Energy	5	0.6%
Other	52	6.4%
Total	813	100%

Management Related Factors of the Crisis-2



Management Related Factors of the Crisis-3



RGICS Summer School

Water Crisis and Sustainable Solutions

Water Pollution

Jeet Singh

Rajiv Gandhi Institute for Contemporary Studies (RGICS), New Delhi

6th July 2020

Water Pollution

When toxic substances (Chemical, heavy metal and microorganism) enter lakes, streams, rivers, oceans, and other water bodies, they get dissolved or lie suspended in water or get deposited on the bed.

Major Pollutant

- **Organic Material**
- **Total Coliforms** Organism from untreated sewage water
- **Chemicals and heavy metals:** Lead (Pb), arsenic (As), mercury (Hg), chromium (Cr) specially hexavalent chromium, nickel (Ni), barium (Ba), cadmium (Cd), cobalt (Co), selenium (Se), vanadium (V)

Water Quality Category

Use based Classification of Surface Waters in India		
Designated-best-Use/ Beneficial Use	**Classification of water**	**Criteria**
Drinking water source without conventional treatment but after disinfection	A	1. Total Coliforms Organism MPN/100 ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6 mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C 2 mg/l or less
Outdoor bathing (organised)	B	1. Total Coliforms Organism MPN/100 ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5 mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C 3 mg/l or less

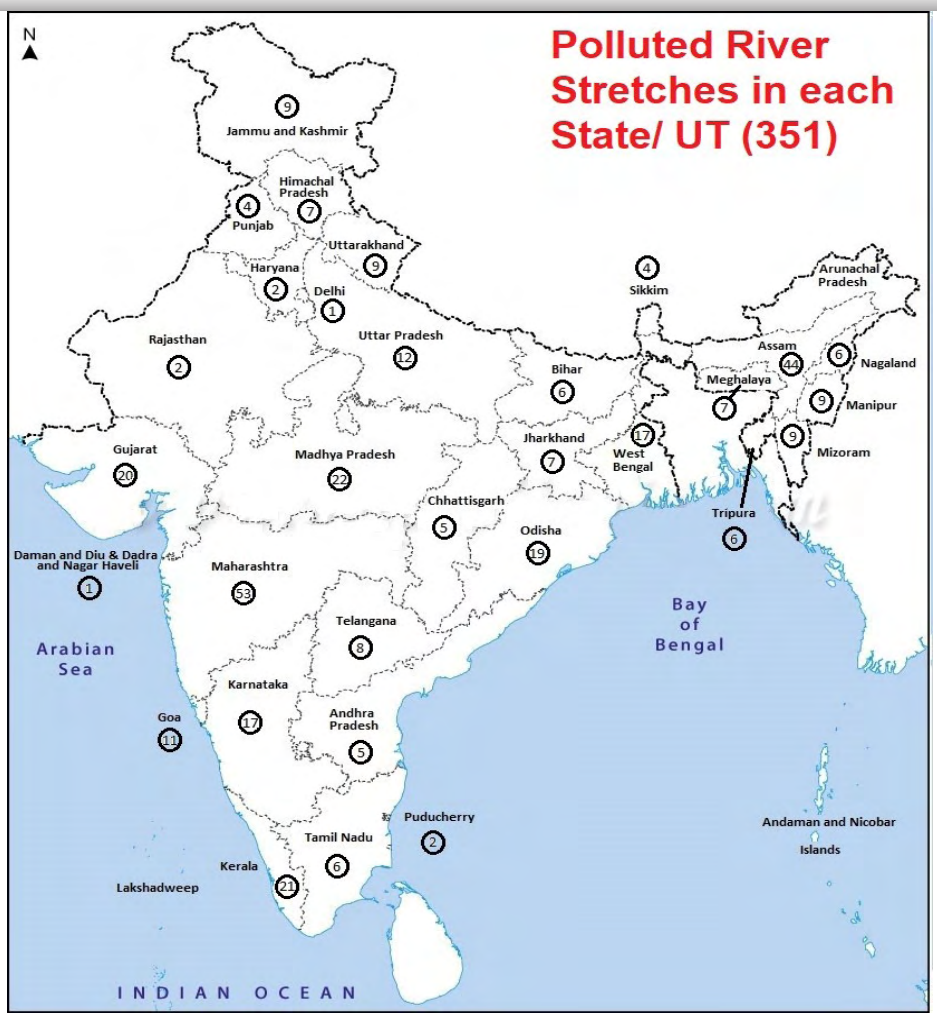
Point Sources of Water Pollution

- Wastewater from an industry,
- Contamination from leaking septic systems,
- Chemical and oil spills,
- Industrial Discharge

Non Point Sources of Water Pollution

*Agricultural runoff *Leakage from Septic Tanks

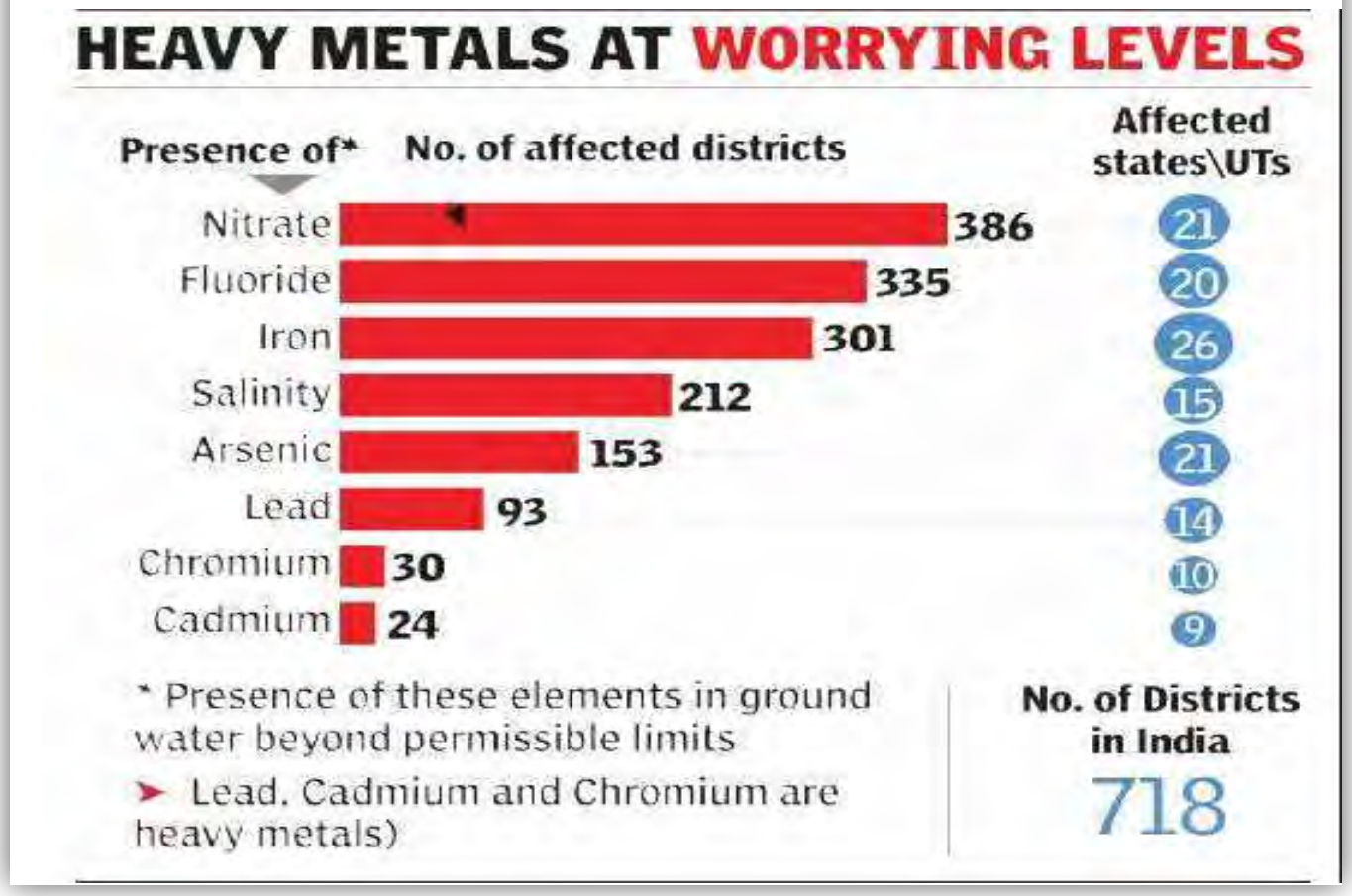
*Littering and garbage dumping



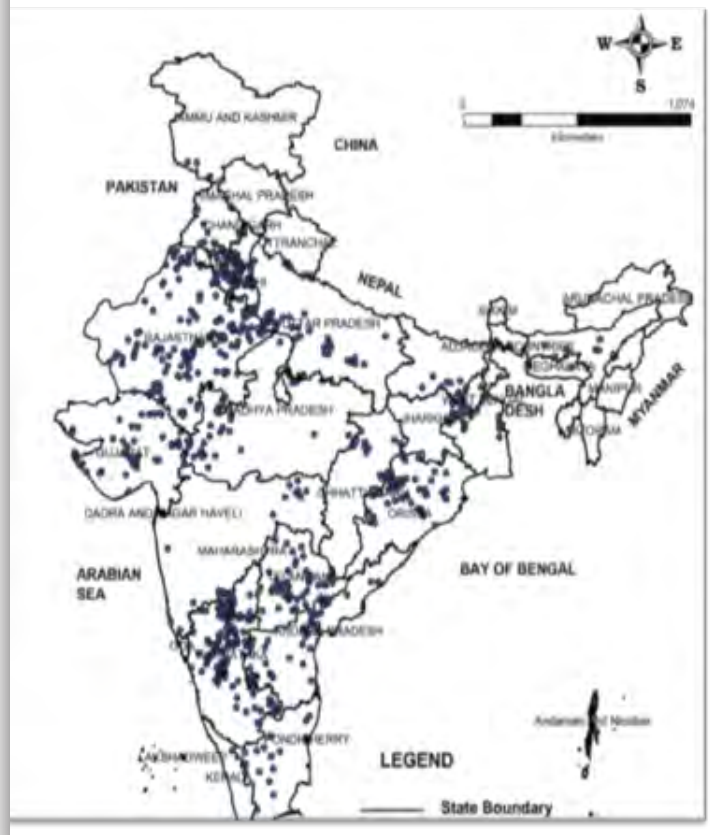
Ground Water Pollution

- Groundwater gets polluted when make their way into an aquifer.
- Ridding groundwater of contaminants can be difficult to impossible, as well as costly.
- Once polluted, an aquifer may be unusable for decades, or even thousands of years.
- Groundwater can also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans.

Ground Water Pollution in India

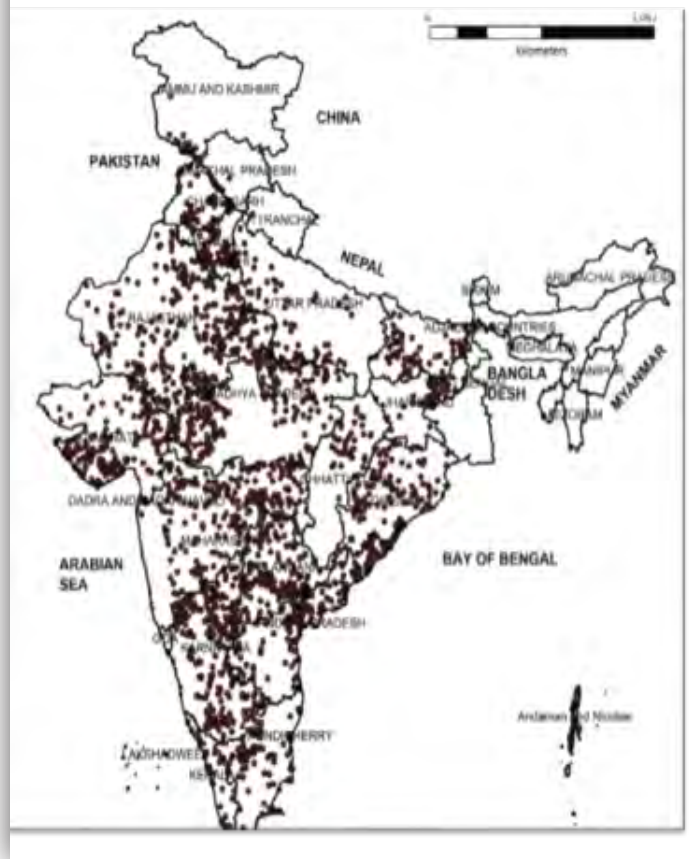


Areas Affected with Fluoride Contamination

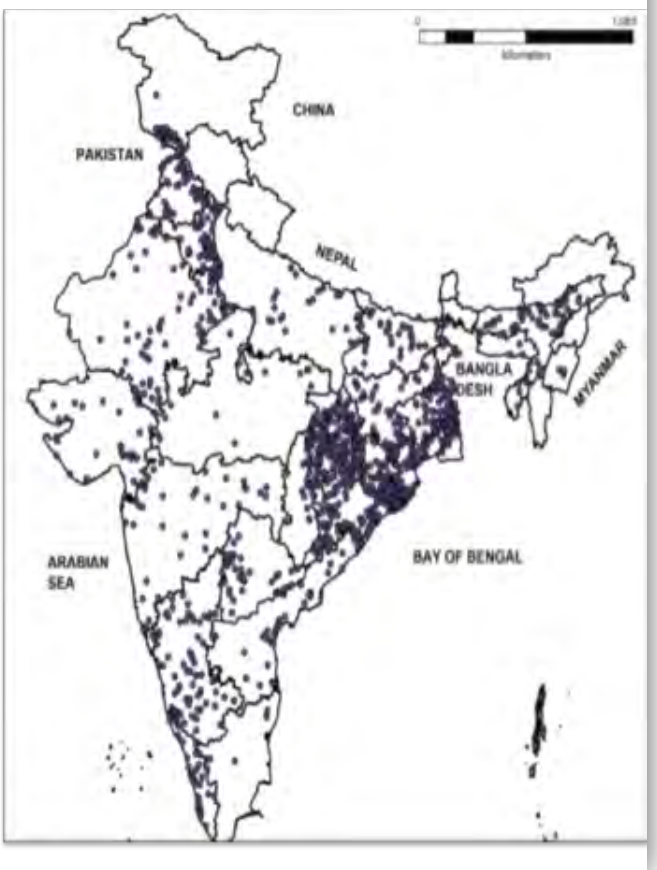


Areas Affected with Arsenic Contamination

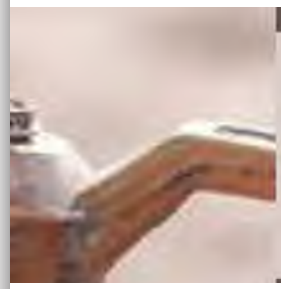
Areas Affected with Nitrate Contamination



Areas Affected with Iron Contamination



Thank You



SADBHAVANA SE SAMADHAN

RGICS Summer School

Water Crisis and Sustainable Solutions

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Sustainable Methods of Water Planning and Management

Jeet Singh

Rajiv Gandhi Institute for Contemporary Studies (RGICS), New Delhi

13th July 2020

Ridge Area Treatment

- Trenching

Plantation

Drainage line treatment

Gully Plugging

Check Dam

Plantation

Development of water harvesting structures

Farm Pond

Percolation Tanks

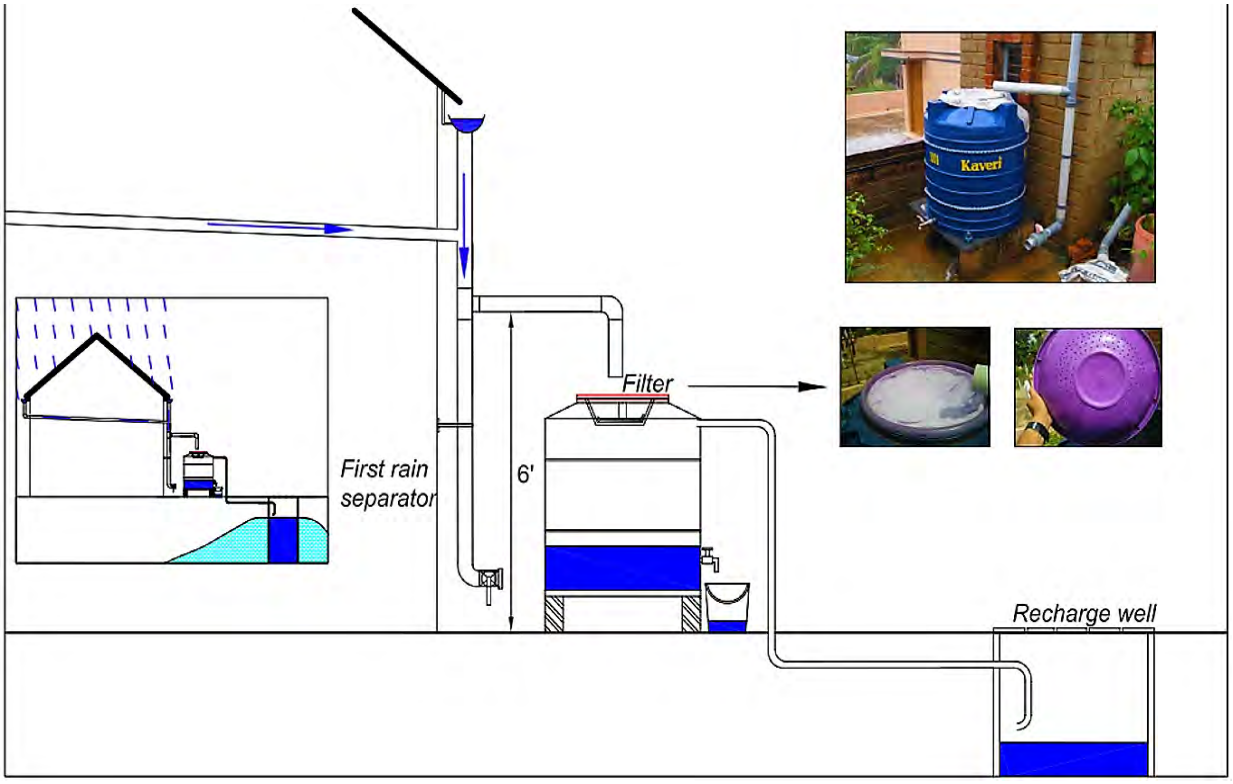
Water Management

- **Land Development-** field bunds, contour and graded bunds fortified with plantation,
- **Crop- water saving technologies** such as drip irrigation or innovative management practices
- **Pasture development**
- **Nursery raising** for fodder, fuel, timber and horticultural species.

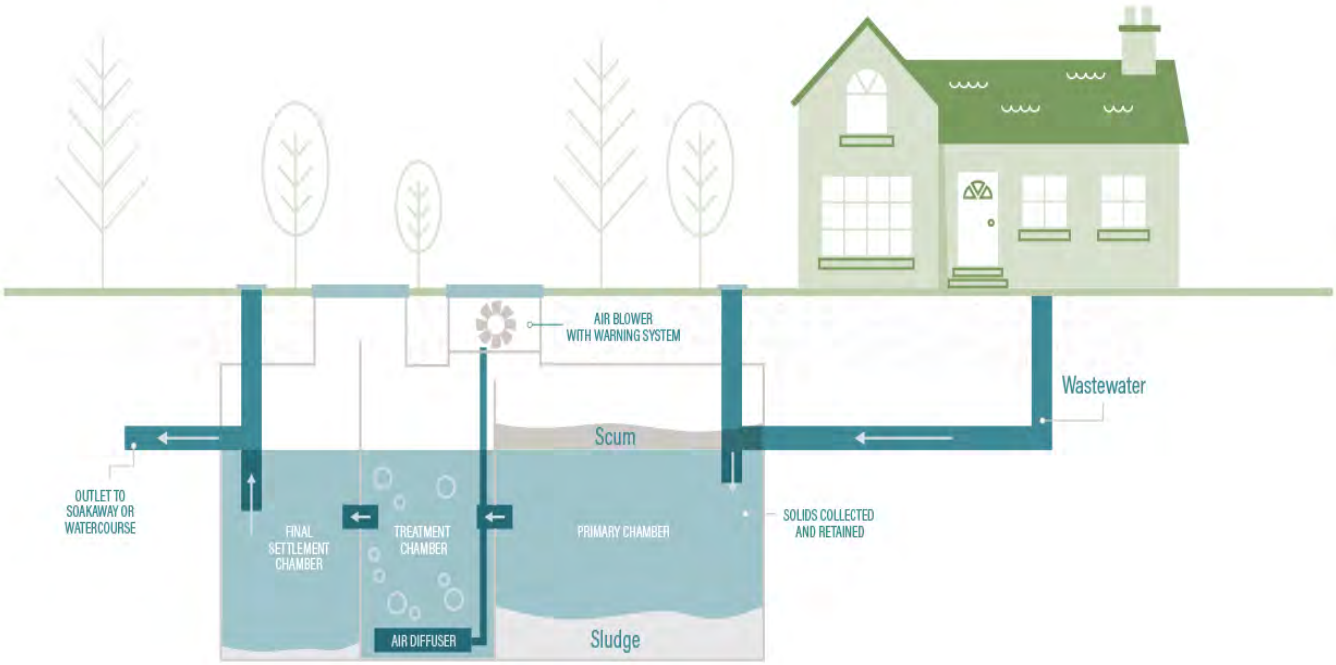
Various Approaches

- Watershed Management
- River Basin Management
- Landscape Approach

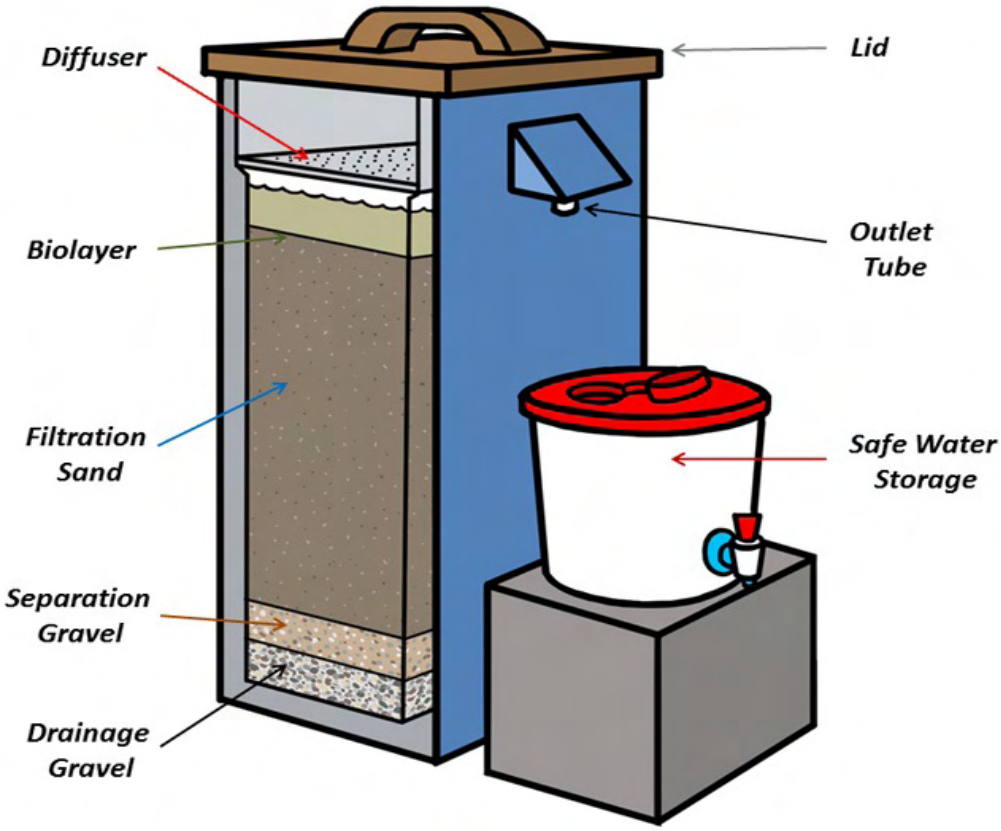
Roof Top Rain Water Harvesting



Waste Water Treatment

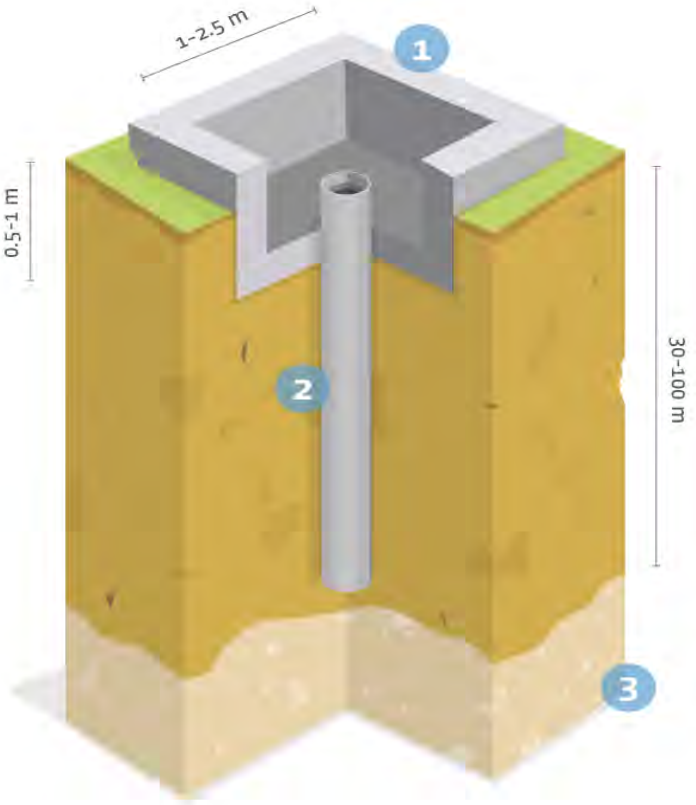


Bio Sand Filter



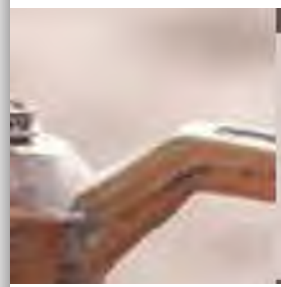
The Bhungroo

The technology is open source so that it is scalable in other places. Bhungroo does have a non-negotiable principle, however—that the technology should be used by poor people only.



1. The land on which the unit is made has a slight tilt or gradient to ensure drainage through the pit. The cemented area of the pit is usually 1 to 2.5 metres in width and breadth, and 0.5 to 1 metres in depth.
2. The pipe has a diameter of 10 to 15 centimeters, and goes to a depth of 30 and 100 metres.
3. The subsoil strata must have a coarse sand soil layer within a depth of 120 metres.

Thank You



SADBHAVANA SE SAMADHAN

RGICS Summer School

Water Crisis and Sustainable Solutions

Rajiv Gandhi
Institute for Contemporary Studies

III

Field Research

Field research was important component of the summer school. It was designed to help participants to explore and understand water issues around them. In this exercise, team of policy researchers from RGICS provided them guidance and handholding support through telephone and online platforms. 10 out of 17 participants filled their worksheets and shared with us. A compilation of their field research is presented here in this report in the matrix form.

Jorhat (Assam)

Pubali Borah
Age- 16 year

Study Area	
Geographical characteristics	• Jorhat city is has plain geographical characteristics.
Estimated population	• 300 - 400
Major occupations of the local people	• Agriculture

Quantity of the Fresh Water	
Domestic water supply	• Ground Water
Months with high rain	• June
Months with no or less rain	• December
Observed changes in the life and livelihood of people during dry season	• People are forced to collect water from various sources for their homes. People face difficulty in agriculture. It becomes very hard for people to maintain fisheries

Quality of the Fresh Water	
Point source of water pollution	• **Factories** - The residuals and waste disposals of the factories pollute the adjacent rivers, ponds and water of agriculture land.
Non point source of water pollution	• **Tea Gardens** - All water sources adjacent to the tea gardens are polluted by the use of pesticides on the tea plants.

Sustainable Water Solutions	
For revival of water drying water sources	• We can revive the depleted sources by digging it deeper and by minimising the use of water from such sources.

For conservation of rain water	• Since my research are has heavy rainfall throughout the year, we can collect the rain water reservoirs and use it for various purposes like drinking, washing, gardening, irrigation etc.
For preventing water from pollution	• Minimise use of pesticides in the tea gardens • Proper drainage for sewage

Dahariya (Uttarakhand)

Ilika Tiwar
Age- 20 year

Study Area	
Geographical characteristics	• Dahariya is a locality of Haldwani town in the foothills of Uttarakhand
Estimated population	• 5,000
Major occupations of the local people	• Government servants, shopkeepers, farmers, labourers and retired persons.

Quantity of the Fresh Water	
Domestic water supply	• Piped water, tubewell and canal
Active sources of water	• Ground water and Gaula river
Depleted sources of water	• No such known sources. But the canals are used for water supply only during the rainy season otherwise they are dry.
Months with high rain	• July and August
Months with no or less rain	• April and May
Observed changes in the life and livelihood of people during dry season	• People start utilising water in limited quantities as they don't have access to much water. And a major change is seen in the life of farmers. They have to depend on a very few crops like maize.
Observed changes in the water sources during dry season	• The canals are dry and water flow in them during rainfall

Quality of the Fresh Water	
Point source of water pollution	• Defecation of faecal material near rivers • Decomposing garbage in rivers • Burning dead bodies
Non point source of water pollution	• Use of detergents pollute underground water indirectly • Use of fertilizers for crop production leads to underground water pollution • In my research area there are soak pits instead of sewage pipelines which pollute underground water

Sustainable Water Solutions	
For revival of water drying water sources	• No depleting sources of water
For conservation of rain water	• Roof top rain water harvesting is the best possible way in my area of research. Water tanks can be built to conserve rain water for further use
For preventing water from pollution	• Proper solid waste management • Construction of proper sewer lines • Less use of fertilizers for crop production

Serhava, West Champaran (Bihar)

Saloni Singh
Age- 16 year

Study Area	
Area of Study	• Village Serhava in West Champaran District of Bihar
Geographical characteristics	• Plain
Major occupations of the local people	• Farming is the main occupation of the people in my research area. Some of them own land and some are farm labourers.

Quantity of the Fresh Water	
Domestic water supply	• Domestic water is supplied through pipes, hand pumps and wells.
Active sources of water	• Piped water • Hand pumps • Wells • Water Tankers
Depleted sources of water	• I have not seen any depleted source of water in my area of study
Months with high rain	• *Ashada, Shravana and Bhadrapada* (July to September)
Months with no or less rain	• *Chaitra and Baisakha* (May and June)
Observed changes in the life and livelihood of people during dry season	• Dry season is difficult time for villagers in my study area. It is the time of summer as well, so working out in the field without water is really difficult for local people.
Water harvesting structures	• People are largely dependent on wells for supply of water, I have not seen any structure for water harvesting in my research area.

Quality of the Fresh Water	
Point source of water pollution	• Sugar Mill
Non point source of water pollution	• Agriculture runoff and land pollution

Sustainable Water Solutions	
For revival of water drying water sources	• Planting trees can help to increase the quantity and quality of water.

For conservation of rain water	• Water can be managed by rationalizing our agriculture. We need to grow water guzzling crops in the Monsoon season. We need to grow crops, which don't need irrigation in the dry season.
For preventing water from pollution	• Waste segregation and proper management of household waste will help to reduce water pollution in my research area.

Nainital (Uttarakhand)

Nandani Lohani
Age- 17 year

Study Area	
Area of Study	• Nainital is a tourist hill station located in the Uttarakhand Himalaya.
Geographical characteristics	• Hilly Terrain
Estimated population	• 41,377
Major occupations of the local people	• Tourism business: They are shopkeepers, guides, hotel staff, restaurant owners, cab drivers, etc

Quantity of the Fresh Water	
Domestic water supply	• Piped water
Active sources of water	• Nainital Lake (also called Naini Lake)
Depleted sources of water	• Sukhatal Lake
Months with high rain	• July
Months with no or less rain	• November
Observed changes in the life and livelihood of people during dry season	• people preserve water in buckets • People usually go to natural sources of drinking water like naulas, dharas (Parda dhara and Sipahi dhara) to get drinking water. These sources are at quite a distance from homes and thus getting water from there lead to wastage of time. • There is less water for cleaning and gardening • people try to save water by controlling its usage during activities like washing clothes or flushing toilets
Observed changes in the water sources during dry season	• The water level of the Nainital lake decreases rapidly and comes to a still about 15 to 20 feet below its full reservoir level. Simultaneously the quantity of water in the feeding naulas and dharas also decreases.
Water harvesting structures	• There are rooftop rainwater harvesting systems built on 500 sq. metre roof area. • There are sub-surface rainwater harvesting soak pits which help to recharge ground water.

Quality of the Fresh Water	
Point source of water pollution	• The trash that is being dumped into the lake by the tourists • Solid and liquid waste from small shops as well as kiosk owners near the lake is also affecting the Lake • Discharge of untreated wastewater, disposal of MSW (Municipal Solid Waste) and silt deposition. • The reasons for increased lead concentration were found to be anthropogenic activities (boat repairing, painting), presence of automobile workshop on the banks of the lake lead-bearing minerals present in the catchment rock formation
Non point source of water pollution	• Heavy construction activity- Most of the buildings that have been constructed in Nainital are very close to the lake's shore. The Lake Development Authority also does not permit construction up to 10 m from the shores of the lake, but this rule is being openly flouted in Nainital and other lake areas. • lead-bearing minerals present in the catchment rock formation • Thermal stratification- The water quality problems were partially caused by internal pollutant release from the sediments.

Sustainable Water Solutions	
For revival of water drying water sources	• Afforestation should be done near the catchment area of the lake and its sources. • The paths of all 29 naulas (streams) that feed the Nainital lake should be cleaned from the origin to the end to ensure better quality and quantity of water feeding the lake. • Cleaning of delta (malwa etc.) of the lake during July-August.
For conservation of rain water	• Each and every house should construct water harvesting structures
For preventing water from pollution	• People should be made well aware about maintaining the cleanliness of the water resources. • The authorities as well as the locals should make sure that no waste is thrown in the lake by anyone. Polluters should be fined heavily. • Awareness campaigns and lake-cleaning campaigns should be started and people should participate enthusiastically.

Dilmili, Bastar (Chhattisgarh)

Gaurav Pandey
Age- 20 year

Study Area	
Area of Study	• Village Dilmili is located in Bastar District of Chhattisgarh
Geographical characteristics	• The village has both hill and plain area
Estimated population	• 2990
Major occupations of the local people	• Agriculture is main occupation of people in the Dilmili villages. A large number of people are also dependent on daily wages.

Quantity of the Fresh Water	
Domestic water supply	• Wells, Hand Pumps and Ponds
Active sources of water	• Four wells, 7 Hand Pumps and 2 Ponds
Depleted sources of water	• The ground water table is rapidly depleting
Months with high rain	• July and August
Months with no or less rain	• April and May
Observed changes in the life and livelihood of people during dry season	• During the dry season, villager's change their means of livelihood. In this season, most people collect forest produce from forest to earn livelihood.
Observed changes in the water sources during dry season	• Water harvesting structures In the dry season, drying of wells and ponds is very common. Even the hand pumps release less water in the dry season.
Water harvesting structures	• Government has promoted construction and renovation of local ponds.

Quality of the Fresh Water	
Point source of water pollution	• Iron mining is a major point source of groundwater pollution in the region.
Non point source of water pollution	• Fertilizers such as Urea and Potash used in agriculture • Infiltration of soap water and Hospital waste • Waste generated by humans.

Sustainable Water Solutions	
For revival of water drying water sources	• Deepening of local ponds to accumulate more rain water
For conservation of rain water	• Construction of water tanks • Plantation in and around the village • Installation of roof top rainwater harvesting systems.
For preventing water from pollution	• Need to promote organic fertilizers and pesticides in agriculture. • Treatment of wastewater and Provision for management of solid wastes in the village. • Construction of toilets and waste water management systems.

Civil Lines (Delhi)

Tanya Aggarwal
Age- 16 year

Study Area	
Geographical characteristics	• Civil Lines in Delhi is located very close to the bank of river Yamuna.
Estimated population	• Civil Lines Tehsil of North district has total population of 688,616 as per the Census 2011.
Major occupations of the local people	• As per census data, in Civil Lines Tehsil 95.8% of workers describe their work as Main worker (employment or earning more than 6 months) while 4.2% were marginal workers providing livelihood for less than 6 months.

Quantity of the Fresh Water	
Domestic water supply	• Piped Water supplied by Delhi Jal Board
Active sources of water	• Surface source (91%)- Yamuna River, Bhakra storage, upper Ganga canal, Munak canal • Ground water (9%)
Depleted sources of water	• Delhi has resulted in **over development of ground water resources**. Thus in about 75% area of NCT Delhi ground water levels are declining at an alarming rate of 0.40 m per annum.
Months with high rain	• The normal annual rainfall of NCT Delhi is 611.8 mm out of which 81% of the annual rainfall is received during the monsoon months July, August and September.
Months with no or less rain	• January, February March, April, May, June October, November, December

Quality of the Fresh Water	
Point source of water pollution	• The main point source dischargers are factories and sewage treatment plants, which release treated wastewater
Non point source of water pollution	• Garbage Dumping and littering

Sustainable Water Solutions	
For revival of water drying water sources	• In order to increase the natural ground water resource rain water harvesting and artificial recharge to ground water has become increasingly important in ground water management. The subsurface geology, post monsoon depth to water level and declining ground water level conditions of the State indicate that the area is suitable for artificial recharge. The favorable aquifer zones down to depth of ground water level which is lying unsaturated presently may be suitable recharged through rain water harvesting.

Gopeshwar, (Uttarakhand)

Aditya Bisth
Age- 16 year

Study Area	
Geographical characteristics	• Gopeshwar- A small town in the mountains of Uttarakhand has hilly terrine
Estimated population	• 21,400
Major occupations of the local people	• Agriculture, Business and formal and informal jobs

Quantity of the Fresh Water	
Domestic water supply	• Piped water
Active sources of water	• Stream called Bal khila
Depleted sources of water	• None
Months with high rain	• July and August
Months with no or less rain	• November and December
Observed changes in the life and livelihood of people during dry season	• No big difference in the life and livelihood of people in the research area during dry season.
Observed changes in the water sources during dry season	• The volume of water decreases in the dry season

Quality of the Fresh Water	
Point source of water pollution	• Sewage discharge and washing clothes in the water streams are main point source of water pollution in the area.
Non point source of water pollution	• Garbage dumping by the Municipal council and littering by people in general are main non point sources of water pollution.

Sustainable Water Solutions	
For revival of water drying water sources	• Planting trees around major water bodies is can revive the flow of water.
For conservation of rain water	• Construction of water rain water harvesting structures in mountains such as Chal, Khal and Hauz is required.
For preventing water from pollution	• There is urgent need of constructing more sewage treatment plant in the town to prevent water from pollution.

Ghansali (Uttarakhand)

Study Area	
Geographical characteristics	• Ghansali is a small hilly town in the Tehari district of Uttarakhand
Estimated population	• Around 3,000
Major occupations of the local people	• Farming

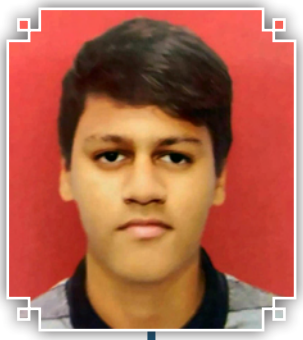
Pragya Singh
Age- 16 year

Quantity of the Fresh Water	
Domestic water supply	• Piped water and stream water
Active sources of water	• Tap water • Hand pump • Stream water
Depleted sources of water	• Streams and groundwater in dry summer months
Months with high rain	• July to September
Months with no or less rain	• June
Observed changes in the life and livelihood of people during dry season	• People use less water for their daily needs of water. They use less water in washing clothes, bathing, brushing, cooking and washing utensils. • Farmers need sufficient water but when there is scarcity of water they do farming in minimum water.
Observed changes in the water sources during dry season	• water is dirty • There is a large amount of contaminants in the water • Mostly, soil is dissolved, making it harmful to drink • Water is very salty which is not pure or good for our health.
Water harvesting structures	• In my research area we dig deep grounds in village to store rainwater • People store water in tanks on rooftops • People keep bottles and buckets for collecting rainwater

Quality of the Fresh Water	
Point source of water pollution	• Washing clothes in the river, and release of untreated sewage water.
Non point source of water pollution	• Throwing plastics and unburned dead bodies in the river.

Sustainable Water Solutions	
For revival of water drying water sources	• Making appropriate structures for rainwater harvesting.
For conservation of rain water	• More plantations in the mountains are best to conserve rainwater.
For preventing water from pollution	• Restricting throwing of garbage in the river and discharge of sewage.

South Delhi



Aditya Shekhar
Age- 16 year

Study Area	
Geographical characteristics	• Delhi is located amidst the ranges of Himalaya and the Aravalli.
Estimated population	• Nearly 2 crore
Major occupations of the local people	• Technology, Telecommunications, Hotels, Media, Banking and Tourism, Government jobs.

Quantity of the Fresh Water	
Domestic water supply	• Domestic water in Delhi is supplied through a water supply network comprising 11,350 km of pipeline and 105 underground reservoirs for Rationalized distribution of supply. It sources water from following sources- • Ganga River (330 MGD), Yamuna River (207 MGD), Bhakra Storage (218 MGD), and groundwater (80 MGD).
Active sources of water	• Surface Water: The main source of surface water in Delhi is the Yamuna River. • Groundwater is also an important source of water in Delhi.
Depleted sources of water	• Delhi's groundwater crisis has become severe. Groundwater levels have been dropping for years. • Yamuna river, truns heavy with pollutants and is thick with toxic waste.
Months with high rain	• The months of June, July, August and September have a high chance of precipitation.
Months with no or less rain	• Delhi has dry periods in February, March, April, May, October, November and December
Observed changes in the life and livelihood of people during dry season	• Personally I do not see any changes in my research area. However the farmers of Delhi do face a problem as they are highly dependent on the monsoon rainfall.
Observed changes in the water sources during dry season	• Delhi does face water shortage especially in unauthorized colonies and slums during the dry season.

Quality of the Fresh Water	
Point source of water pollution	• Discharge of Sewage and industrial waste
Non point source of water pollution	• Groundwater contamination and chemical usage in the fields, office premises and homes.

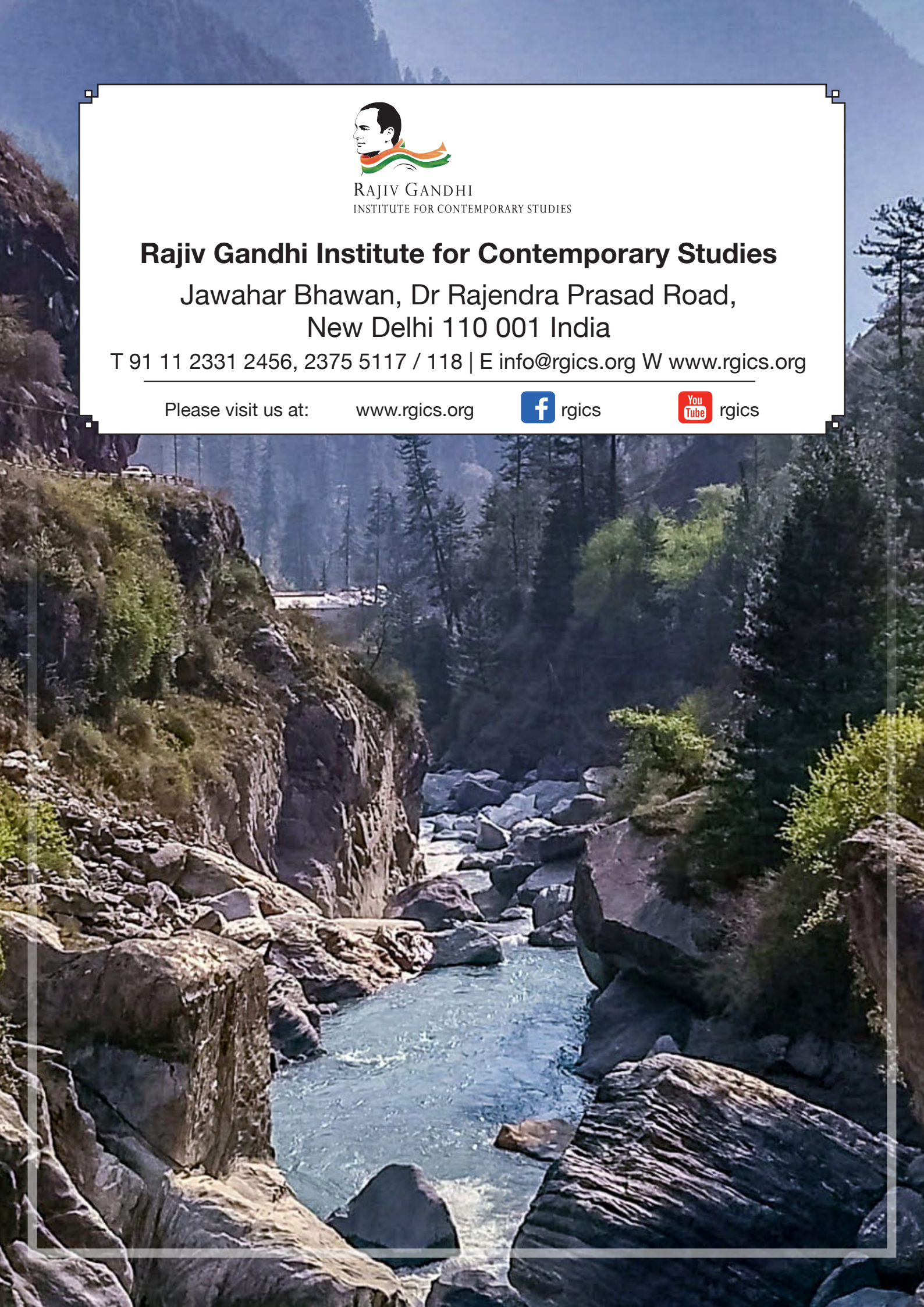
Sustainable Water Solutions	
For revival of water drying water sources	• Awareness amongst public and strict regulations can help in the revival of drying water sources.
For conservation of rain water	• Incentives for rain water harvesting will motivate people to harvest the rain water.
For preventing water from pollution	• Awareness and enforcement of regulation will help in the cleaning of water sources.

Bandipora (Jammu and Kashmir)

Yaqoob Ishaq
Age- 16 year

Study Area	
Geographical characteristics	• My area of research is Bandipora, Jammu and Kashmir. It is located on the northern banks of Wular lake - the second largest fresh water lake in Asia. Bandipora has a terrace garden similar to that of Nishat Bagh in Srinagar. • Bandipora is bound by mountains on three sides and by Wular lake on the fourth.
Estimated population	• Around 3.92 lakh, as per official census of 2011
Major occupations of the local people	• The economy of Jammu and Kashmir was predominantly dependant of agriculture and related activities. Horticulture played a vital role in the economic development of the state; produce included apples, apricots, cherries, plums, almonds and walnuts.

Quantity of the Fresh Water	
Domestic water supply	• The surface water resources of Kashmir valley are very large. The total run off that escapes down the rives or accumulates in a large number of lakes and marshes in a powerful indicator of this plentiful supply. The river systems of valley are fed by rain and snow.
Active sources of water	• Rivers of Jammu and Kashmir. Jammu and Kashmir has many lakes, rivers, and glaciers. Significant rivers that flow through Jammu and Kashmir from the Himalayas are Jhelum, Chenab, Sutlej, Ravi, and Indus. These river basins are located at a higher elevation facilitating huge hydro power potential.
Depleted sources of water	• The three distinct physiographic division of the state are drained by three river basins namely Chenab, Jhelum and Indus river. Apart from the river the state is also gifted with numbers of water bodies including tributaries, lakes and wetlands.
Months with high rain	• November, December January and march are the months with heavy rainfall & snowfall.
Months with no or less rain	• June, July, August, september, are the months with no or very less rainfall In kashmir
Observed changes in the life and livelihood of people during dry season	• Mostly in summer and winter season we face the reduction of water in kashmir.
Observed changes in the water sources during dry season	• There are some changes in life and work of people during dry months. During dry months people have to face many problems they have to travel long distance because or shortage of water in their houses.



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