Rejuvenation of Rivers

Climate Resilience | Livelihoods | Dignity
Living Examples

Epilogue, October 2022

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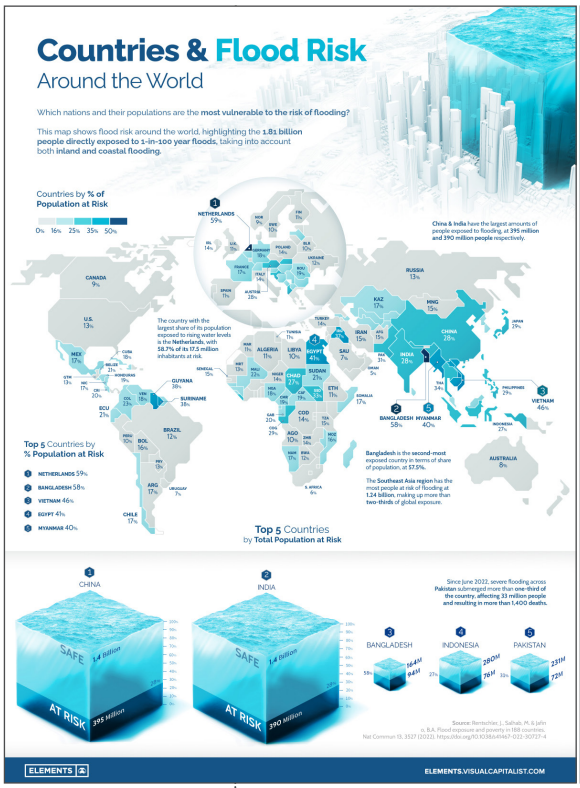
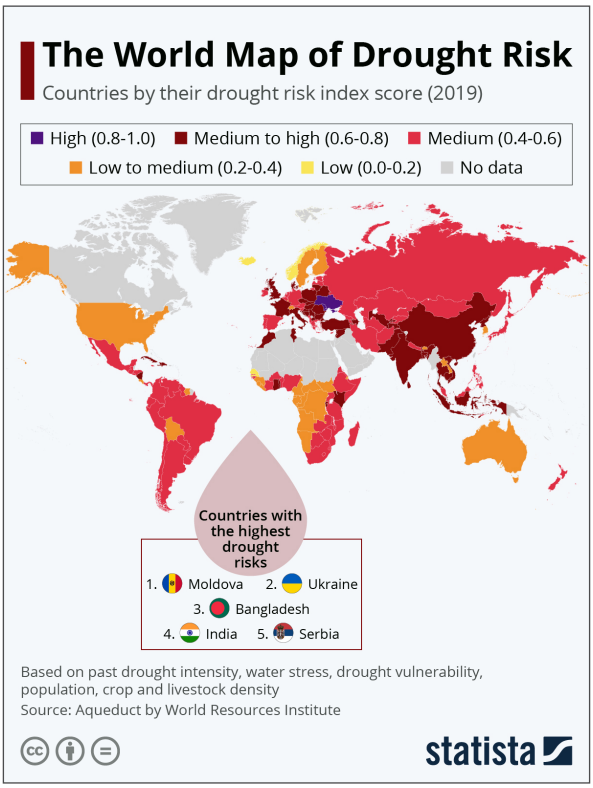
Indian Himalayan River Basins Council
Nurturing a fragile ecosystem





These maps indicate the risks, scale and spread of floods[1] and drought[2] and the countries most affected by drought between 2020-2022[3]

fig. 2: Countries affected by drought in 2020 - 2022

[1] Countries & flood risk around the world

[2] World map of drought riskhttps://cdn.statcdn.com/Infographic/images/normal/25101.jpeg

[3] World map of drought risk and countries affected by drought https://wwwunccd.int/sites/default/files/2022-05/Drought%20in%20Numbers.pdf

Epilogue

Nurturing nature with water: Why only focusing on carbon emissions is not enough

While climate change led to disasters, most of which were water-related, the solution to resilience against these disasters also lies in water. Climate change mitigation, adaptation and resilience is not possible without water.

The year 2022 has been one of climate shocks: As people and economies across the world are struggling to recover from COVID-19, high intensity cyclones, hurricanes and storms, unprecedented high temperatures, dumping of rain and drought are hitting populations across the world. Perhaps the most unexpected was the drought in Europe. Rivers dried up and buried history emerged. No continent has remained unaffected.

Since 2020, heat waves, drought, and floods have battered the world, some of which have been ascribed to climate change. For example,

In the last few years, drought and flood affected every continent. Climate change was a strong contributing factor

- In 2020, the number of people affected worldwide due to drought was nearly 19 million[i].
- In summer of 2022, drought across large parts of Europe, the US and China was made **20 times more likely** by climate change due to high temperatures. Rivers dried up, water shortages increased, soils dried up due to deficits in soil moisture and there were extensive fires. Compiling all the evidence together, scientists found that human induced climate change increased the 2022 root zone soil drought moisture. Their models showed that soil moisture drought will continue to increase with additional global warming[ii].
- Researchers from World Weather Attribution say that this type of drought would only happen once in 400 years, if not for human-caused climate change. They now expect this to happen every 30 years, given the extent of climate warming[iii].
- Droughts, floods extreme weather events are increasing in intensity from Madagascar in Africa to Iran in Middle East, to Asia and South America's Pentanal, the world's largest tropical wetland. In the first half of 2021 itself, drought was prevalent in most continents[iv].
- The deadly floods that swept across western Germany and parts of Belgium in 2021 shocked scientists. Within 24 hours, 15 cm of rainfall was dumped, swelling streams which then washed away houses and cars and triggered landslides. Then Prime Minister Angela Markel stated, "The German language can barely describe the devastation." It was then that the scientists realized that they needed to focus on smaller streams, and not only large rivers[v].
- The floods in Pakistan in 2022 affected more than 30 million people[vi] .

Droughts are amongst the greatest threats to sustainable development. This book describes living examples of climate mitigation, adaptation and resilience

- More than 1.8 billion people living worldwide are at risk of severe floods: Most reside in low- and middle-income countries in Asia, and four out of 10 live in poverty[vii].
- Looking at extreme rainfall this year, climate change
  - Likely increased extreme monsoon rainfall that led to flooding of highly vulnerable communities in Pakistan.
  - Increased heavy rainfall in Eastern Northeast Brazil.
  - Climate change-exacerbated rainfall caused devastating flooding in Eastern South Africa.
  - Increased rainfall associated with tropical cyclones hitting highly vulnerable communities in Madagascar, Mozambique, and Malawi[viii].
- Severe drought affects Africa more than any other continent: In the last 100 years, more than 200 drought events were recorded, accounting for 44 per cent of the global total. Over the past century, the highest total number of humans affected by drought were in Asia.

Droughts are among the greatest threats to sustainable development, especially in developing countries, and increasingly in developed nations too. The number and duration of droughts has increased by 29 percent since 2000, as compared to the two previous decades. When more than 2.3 billion people already face water stress, this is a huge problem. No country is immune to drought[ix].

It was against this background that the book **River rejuvenation: Climate resilience, livelihoods dignity: Living examples** was released during the World Water Week (WWW), held in Stockholm, Sweden in September 2022. The book was released on various platforms and with different groups, **highlighting the importance of water for climate change mitigation, adaptation and building resilience.** This book describes living examples of rainwater conservation which led to river rejuvenation, which in turn had led to rejuvenation of the ecology and livelihoods in the short term and mitigation and resilience in the long term.

The corelation of climate change with increased occurrences of drought and flood were raised by participants in several sessions and concern expressed on the impact of these disasters on ecosystems, food insecurity, livelihoods, migration, rising inequality, loss and damage to economies, health, education, gender, children, peace, and security. At the same time, the role of water in climate change mitigation, adaptation and developing resilience was also discussed.

To take these discussions forward and lead towards positive action, an independent **People's World Commission on Drought** and **Flood** (PWCDF) under the Chairmanship of Dr Rajendra Singh. The Commission will come into action from January 1, 2023, as a platform that brings different

stakeholders together for reducing risks to lives, livelihoods and ecosystems and building resilience through community driven nature rejuvenation.

Understanding drought and flood

Flood and drought have increased because of environmental destruction AND climate change. The rain that used to nurture and regenerate soil now erodes it, causing both flood and drought.

Increased droughts and floods are results of a nature-destructive, unequal and unsustainable growth model which has led to increasing temperatures on one hand, and a degradation of ecosystems which are natural carbon sinks on the other.

The areas affected, the number of occurrences, and the severity of droughts and floods have all grown significantly over the course of the last few decades. These extreme weather events have been attributed to a variety of causes, including natural phenomena, deforestation, disruptions in river flows and drainage, drying up of life-saving rivers, encroachment of riverbeds and other surface water bodies, excessive extraction of groundwater, and most recently, climate change. Natural ecosystems that protected against catastrophic weather events and provided a buffer against their effects are being destroyed.

Causes behind increase in extent, intensity and duration of drought and flood need to be understood: Why the rain that nurtures soil now erodes it, causing drought and flood

As nature destruction continues greenery is lost. The regeneration of the soil stops due to decrease of grass cover and greenery that acted as sponge, slowing the flow of rain, arresting it and recharging groundwater. Now, the rain that falls on the bald surface of the earth takes the soil with it, blocking causing siltation in rivers, and the riverbed rises, reducing water holding capacity of the river. Blocking, encroachment of water channels, ponds and other surface water bodies results in poor drainage and speedy flow of water, causing soil erosion. This causes flooding as water enters and continues to remain in villages and cities. Droughts and floods lead to displacement and forced migration: The poor, the disadvantaged, women, children, and youth are being forced to move away from their roots and relocate to urban areas and other countries to survive.

Rainwater increased soil moisture. Now, the rainfall causes soil erosion instead of increasing soil moisture and recharging groundwater. The rain runoff is rapid and this rapid flow creates drought-like conditions. As the water collects downstream, it causes flood. Thus, there is rapid rotation of flood and drought.

Achieving resilience: Global problems with local solutions through water conservation

Solutions to address climate change, largely focus on decarbonization and the use of renewable energy sources. However, even if there is a 100 per cent switch to clean energy, this will not be enough to mitigate and develop resilience against climate change.

Droughts and floods are global problems, but with local community-driven

Climate resilience is possible by slowing the flow of rain, and capturing it

solutions. Where communities work to get rid of the drought, the area becomes drought resilient. Floods can be avoided, or their impacts reduced. In the long term, climate change mitigation can be achieved.

Conservation, restoration, and improved land management actions increase carbon storage or avoid greenhouse gas emissions in landscapes and wetlands across the globe. Combined with innovations in clean energy and other efforts to decarbonize the world's economies, these natural climate solutions offer some of our best options in the response to climate change. **For this to happen, the key element is water. Water is key for climate change mitigation, adaptation, and resilience.**

How resilience be achieved: By slowing the flow of rain

Rapid rain runoff erodes. It erodes the fertile soil and carries it to surface waterbodies and rivers and causes siltation of riverbeds and ponds, tanks, and lakes. This reduces the water holding capacity, which in turn causes overflow and flooding. Coupled with intense rain spells, which have increased with climate change, drought and flood disasters increase.

Spells of drought and flood make soil fragile. In California, after the intense heat wave and drought, the rainfall was heavy. The soils were in no position to hold the moisture, and as a result the rain simply flowed away, without groundwater recharge.

The running water (rapid runoff) must be made to walk, the walking water should be made to crawl, and the crawling water should be diverted into ponds and groundwater aquifers, filling the emptying belly of the earth. This is possible by protecting forests, regenerating degraded forests, and increasing the area under forests and tree cover. Increasing greenery through grasslands also helps. Rivers must be rejuvenated.

Recharge of groundwater aquifers is possible through various measures that consider the local ecology, rainfall, and terrain. Traditional water conservation measures have existed in different parts of the world. In India, depending on the ecology, different water harvesting systems existed that captured the rain which was used for recharge or for direct use. Other Asian countries such as Bangladesh, Nepal, Pakistan, and Sri Lanka also have traditional water conservation methods. In Africa also, traditional wisdom is replete with natural ways of capturing every raindrop that falls, for example by making recharge pits and other structures to slow and capture the flow. Developed countries such as Singapore, Japan, Germany, New Zealand, and others also capture rain[x]. Efforts are on to capture flood runoff in California, US.

A. Experience with small ponds

Ponds provide water to humans, livestock, wildlife, plants, and other forms of life, increasing greenery, which in turn slows the rain and nourishes the soil. Ponds reduce possibility and intensity of floods. The heat of the universe makes a balance. The weather improves as local areas become cooler. Ponds provide livelihood and food on the table.

Pic: Indira Khurana

Ponds capture the rain and direct it to groundwater aquifers. Ponds serve as sponges capturing rainwater to be available later

In 1986, several wells had dried up in Gopalpura village of Alwar district of Rajasthan, India. Able villagers had migrated to urban areas in search of labour employment. The land lay unproductive and wasted. By June 1987 three large ponds and a small one was made in the village by the people and with the support of Tarun Bharat Sangh (TBS). In July meagre 130 mm of rain fell in a span of 48 hours. Because of the ponds, this water found its way into ground, recharging aquifers. Water levels rose in nearby 20 wells and agriculture began on 100 acres of the very same unproductive lands. By November of the same year, this water was used for agriculture downstream and along the pond. In the first year itself, wheat production was possible. Water was available for livestock, drinking water was available for the villagers.

Grass began to grow all along the pond. Trees began to flourish, and the nature ecosystem began to regenerate. The environment improved. Women's work burden of fetching water from far off places ended. Villagers no longer needed to migrate. As the work expanded, other villagers also began to capture the rain for groundwater recharge. Farmers who would work as labour for traders that transported vegetables to urban centres now supply vegetables and other produce which the same businesses transport to agricultural produce hubs in cities such as Delhi.

Continuous work of rainwater conservation has led to revival of small rivers: Arwari, Ruparel, Bhagani, Sarsa, Jahazwali, Sherni and Maheshwara and in Maharashtra to the revival of the Mahakali and Agrani. Healthy and rejuvenated rivers are important for climate resilience.

Flowing rivers act as a cushion against drought and flood, soaking up excess water during heavy rains and releasing water during lean season.

Over the past 35 years, some 11,000 plus small and large ponds, johads and other water conservation structures were constructed through community driven efforts in the region. The myriad and sometimes unexpected returns on investment over the years, the 'domino effect' in the short and the long term surprised even the TBS team. This work experience of TBS paved the way for climate change adaptation.

For climate adaptation the cropping pattern needs to be linked to the monsoon pattern

B. How water conservation led to a climate change adaptation model:

While the benefits of the returns of water conservation were being enjoyed, TBS and the communities, realised the importance of using water judiciously and for this there would a need to take collective decisions and abide with these. Practises needed to be adapted. Behaviour change was essential. Some of the steps taken for this included:

- Connecting heart, mind and action of farmers with nature: Along with water conservation works, farmers were encouraged to love and respect nature and avoid chemicalization and mechanization in agriculture. This change brought about an improvement in the lives, livelihoods, health, and conscience of the farmer. This process of adaptation was made possible by the creation of indigenous fertilizers and seeds.

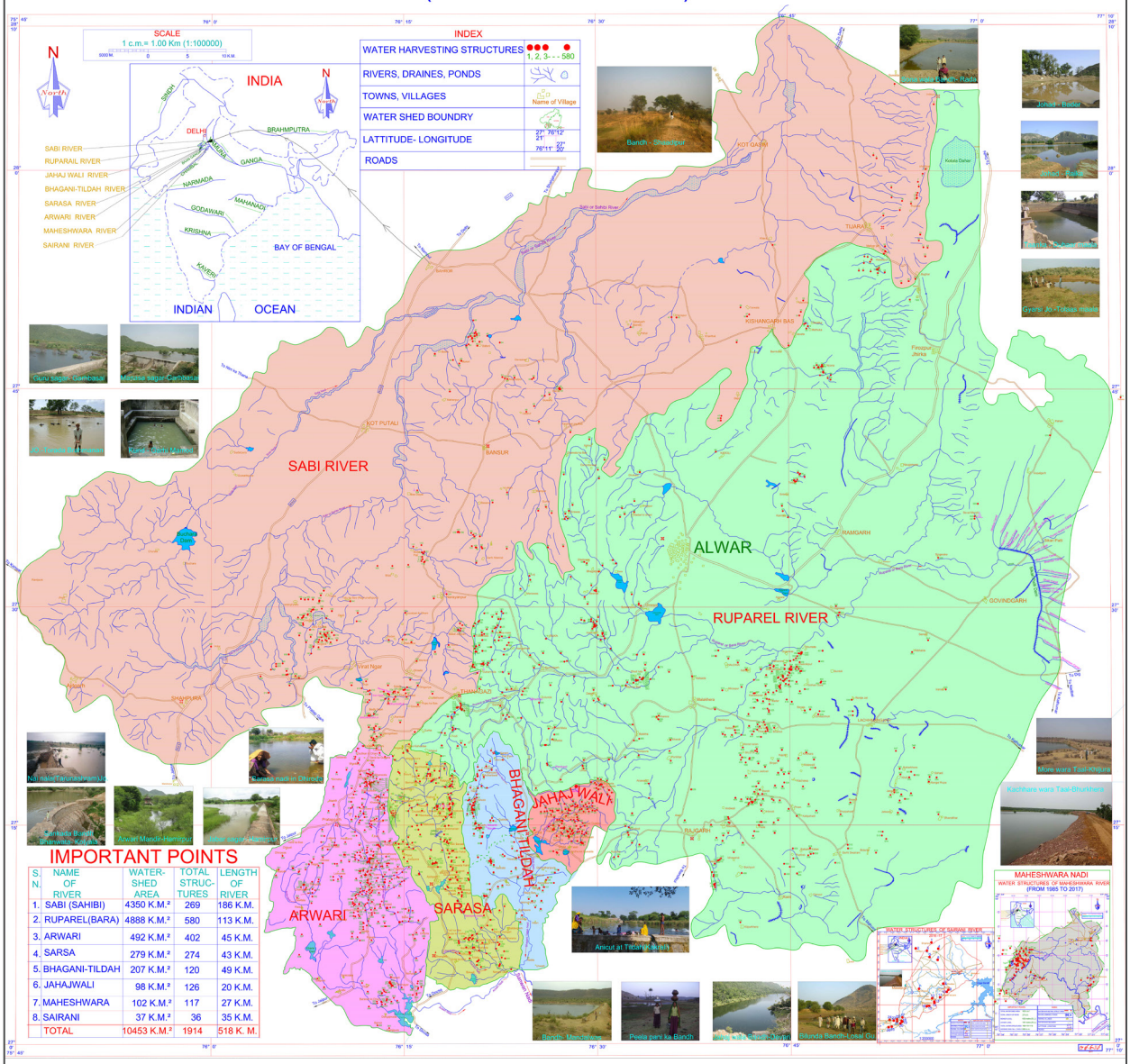
- Linking of the crop cycle with the rain cycle: When local agrobiodiversity is understood and cultivated, the water use is less. For example, crops of tur, moong, urad, sesame, jowar, bajra were produced more in Kharif, because it takes less moisture from the soil and survives even in drought. In Rabi crops, more promotion was given to gram, mustard crops. In the entire region, the work of growing crops with very little water, not using mechanical energy, was done with the natural energy of rain and sun. The crops cultivated absorb carbon emissions from the atmosphere, which are fixed in the soil. **Thus, it also led to capturing atmospheric carbon**.

- Formation of river parliament: To ensure that the river remained rejuvenated, a river Parliament was formed to take collective decisions about water use. Women played a significant role in this Parliament, threatening to leave their spouses if they cultivated water intensive crops.

- This adaptation was also helpful in preventing floods and droughts: Because of low use of chemical fertilizers, pesticides, herbicides, the water holding capacity of the soil and soil moisture was maintained for longer durations of time. Thus, rainfall could be absorbed and cultivation made possible due to soil moisture.

RAIN WATER HARVESTING STRUCTURES BUILT BY TARUN BHARAT SANGH WITH COMMUNITY PARTICIPATION FOR REJUVENATION OF EIGHT RIVERS

(FROM 1985 TO 2017)



IMPORTANT POINTS

S. N.	NAME OF RIVER	WATER-SHED AREA	TOTAL STRUC-TURES	LENGTH OF RIVER
1.	SABI (SAHIBI)	4350 K.M.²	269	186 K.M.
2.	RUPAREL(BARA)	4888 K.M.²	580	113 K.M.
3.	ARWARI	492 K.M.²	402	45 K.M.
4.	SARSA	279 K.M.²	274	43 K.M.
5.	BHAGANI-TILDAH	207 K.M.²	120	49 K.M.
6.	JAHAJWALI	98 K.M.²	126	20 K.M.
7.	MAHESHWARA	102 K.M.²	117	27 K.M.
8.	SAIRANI	37 K.M.²	36	35 K.M.
	TOTAL	10453 K.M.²	1914	518 K. M.

C. With adaptation comes resilience

Cities are now creating waterbodies that serve as sponges to capture rain, thereby reducing flood intensity and enabling water availability for subsequent use

With the help of TBS, communities contributed both their financial and physical resources constructed 1,914 water conservation structures, which led to revival of 518 km of channels/river length in a watershed development including groundwater development in an area of 10,453 sq km (see map below). This development provided space to store rainwater that flowed from the catchment, leading to groundwater recharge and flow of groundwater to the river in lean season, which in turn has led to the revival of agriculture, animal husbandry, increased tree cover, revival of forests and associated diversity, including wildlife, resulting in economic growth, reverse migration, employment opportunities to outsiders.

In the last three years there has been scanty rainfall in the area, but by the judicious use of water (adaptation), by adopting crop pattern with low rainfall, the drought situation was averted, and water was available in small tanks/ ponds and the rivers. This year, the late season heavy rainfall during the return monsoon, the tanks are once again full, which in turn will provide water security for subsequent 2-3 years in case of scanty rainfall and with adaptation practises of linking of the crop pattern with the rainfall. **Moreover, with the space created to absorb water, the structures and revived rivers/ channels acted as sponges to soak up the water, and thus flooding was avoided.**

The need for cities to have 'sponges' to absorb water

The book described how river rejuvenation, ponds, canal rejuvenation act as sponge to the ill effects of heavy rainfall and flash floods. **The concept of waterbodies and aquifers serving as sponges to absorb excess water and release it when required in now being used for urban areas also.**

Urban designers have articulated the idea of 'Sponge City' designed to withstand extreme flooding[xi]. In the article, Scott Hawken, Director of the Landscape Architecture and Urban Design programs at the University of Adelaide in Australia. "It's about working with water intelligently – letting it infiltrate – so flooding is less dangerous."

Sponge cities can boost climate resiliency beyond just flood mitigation. In Austria, sponge projects have proven effective in lessening the impact of flooding's opposite – drought – by filtering and storing rainwater so that it can be used for irrigation and plumbing systems. In Germany's capital, sponge designs, are being used to cool the air in some neighbourhoods. In one of the ambitious projects being executed at decommissioned Tegel Airport in Berlin, this 3 sq. mile development, that when complete climate resilience neighbourhood called the Schumacher quarter with room for 10,000 residents. This will eschew conventional drainage in favour of ground level gradations that will direct rainwater into pools, from where the water will be put to different purposes.

The recent flooding in urban areas has reinforced the need for urbanization planning that keeps intact the existing drainage channels and urban ponds

and lakes. It makes even more sense if new waterbodies are created and connected with the existing ones. This will help curtail flooding and save water for the lean seasons, thus creating resilience and even lowering the temperatures of the built-up areas in hot climate zones.

Conclusion

It is the presence of the sun's rays that forests, grasslands, waterbodies, and wetlands thrive. When these are robust and healthy, they fulfil their role in climate regulation. But if we were to look down on the earth, we will see vast lands that are bald due to deforestation caused by over grazing, industrial agriculture, infrastructure creation. This is reducing nature's capacity to play its role and counter carbon emissions. So, it is necessary to rejuvenate waterbodies, recharging groundwater, thereby reviving the natural ecosystems of forests, grasslands, and wetlands: **Developing resilience begins with water**[xii]**.**

Scientists specializing in conservation, climate modelling and economists form different global institutions have found that nature's ability to mitigate climate change in about 39 per cent more than previously projected[xiii]. **Nature's climate mitigation ability depends on its nurturing, and for nurturing, it needs water.**

Decentralized community driven water conservation and rejuvenation of rivers/ waterbodies is critical for climate mitigation, adaptation and resilience

It is critical to meet carbon emission commitments. However, this is not enough. To cool the planet and reduce water-related disasters of drought and flood, the solution lies in greening the earth. For this the key element is water. **Appropriate decentralized water conservation and rejuvenation of rivers/ waterbodies is critical for local climate mitigation, adaptation, and resilience.**

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