

Student Leadership Conference on Development at The United Nations



Water and Sanitation
Monday, February 18th, 2019
9:30 Am to 3:30 PM (EST)

Locations: United Nations, NY and Regional sites in India, Mexico, Philippines, Republic of Georgia, Saudi Arabia, plus social media applications around the world

Co-Sponsors: Chorus Call, Inc. Colegio Carol Baur, Global Education Motivators, I Am Sam and Multinational



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Student Leadership Conference on Development at the United Nations

SLCD@UN 2019

Ensuring Available and Sustainable Water and Sanitation for All

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“Safe water and adequate sanitation underpin poverty reduction, economic growth and healthy ecosystems. They contribute to social well-being, inclusive growth and sustainable livelihoods.

But, growing demands for water, coupled with poor water management, have increased water stress in many parts of the world. Climate change is adding to the pressure – and it is running faster than we are.

- **António Guterres, UN Secretary-General**
Remarks at Launch of International Decade for Action
"Water for Sustainable Development" 2018-2028

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ABOUT THE CONFERENCE

Background

The Student Leadership Conference on Development is in its 10th year. Created in 2010, to support the Millennium Development Goals, the conference looks to bring students together from around the world to tackle the real and pressing development issues facing our world today. This year, the conference will be on Water and Sanitation and the Sustainable Development Goals (SDGs), using support resources from the United Nations, the Sustainable Development Solutions Network, NGOs, and other credible sources.

Within the theme of Water and Sanitation and the Sustainable Development Goals, we will focus on three major areas – Resource Management and Innovation, Infrastructure, and Education. The main Goal on which the conference will center is *SDG #6 - Ensure availability and sustainable management of water and sanitation for all.*¹ Access to safe water and sanitation and sound management of freshwater ecosystems are essential to human health and to environmental sustainability and economic prosperity.

In December 2017, United Nations Member States adopted United Nations General Assembly resolution 71/222 on an International Decade for Action on 'Water for Sustainable Development' 2018-2028. The Water Action Decade will accelerate efforts towards meeting water-related challenges, including limited access to safe water and sanitation, increasing pressure on water resources and ecosystems, and an exacerbated risk of droughts and floods.

Conference Objectives and Timeline:

Students in participating countries worldwide will come together in **February 2019** to complete a Plan of Action that will be developed in the weeks and months leading up to the conference in each of their communities. This Plan of Action will be a collaboration across cultures with real, practical ideas that can be implemented by conference participants and their peers.

This Plan, if approved by a majority of the participants, will be taken back to their schools and communities and put into action. Students will be asked to do community work on March 22, World Water Day. They also will reconvene at the end of the school year to share which parts of the Plan have been undertaken in their home countries.

Conference Timeline:

Fall 2018-Winter 2019:	Various GEM programs and interactions with youth groups and individuals in partial preparation for SLCD@UN.
February 15-16, 2019:	Preparation via on-line work and training with students
February 18, 2019:	Student Leadership training in New York City, NY
UN	Student Leadership Conference on Development at the UN
March 22 2019	World Water Day (Optional Day for youth work)
May, 2019:	(1) End of Year Videoconference to share accomplishments with each other on Plan of Action and (2) formal presentation of the Plan of Action to the United Nations in New York.

Sub Theme Selections:

Leaders and delegates start preparations by choosing one of the three subthemes and prepare to be knowledgeable about it and involved in finding solutions to problems associated with the Sub Theme.

This year's Sub Theme Topics are: (a) Water and Sanitation Resource Management and Innovation (b) Water and Sanitation Infrastructure and (c) Water Pollution. Special background documents will be available to help participants with their work.

As previously mentioned, this year the Student Leadership Conference on Development will be focusing on Sustainable Development Goal (SDG) SDG #6 - Ensure availability and sustainable management of water and sanitation for all. Each of the subthemes tie into specific targets outlined in SDG #6 (there may be some overlap with other SDGs, which students are welcome to explore). Some of SDG targets are found on pages 3&4.

How to Participate in the Conference:

Student Leaders are usually selected based on a school recommendation. Student Leaders can also be selected through participation in the online groups, or by contacting GEM directly. Student Leaders run the conference. The roles of leaders will be determined in New York City in February 2019 by the leadership team in conjunction with GEM staff.

Levels of Participation:

Students can participate at the following levels:

1. International Student Leaders at the United Nations
2. Regional Student Leaders and delegates at the videoconferencing sites (Chosen by host sites)
3. Voting delegates at the United Nations or videoconferencing sites
4. Online contributors via webcast and twitter feed.

About the Sustainable Development Goals

Former UN Secretary-General Ban Ki-moon said the new Sustainable Development Goals “*Encompass a universal, transformative and integrated agenda that heralds an historic turning point for our world. This is the people’s agenda, a plan of action for ending poverty in all its dimensions, irreversibly, everywhere and leaving no one behind. It seeks to ensure peace and prosperity and forge partnerships with people and planet at the core. The integrated, interlinked and indivisible 17 Sustainable Development Goals are the people’s goals and demonstrate the scale, universality and ambition of this new agenda.*”



Goals 1 – 6 are a continuation of the Millennium Development Goals. Goals 7 – 16 are expanded areas of sustainable development. Goal 17 is the developed world working with the developing world to achieve the goals.

Within the goals are 169 targets to be met. The proposed targets under Goal One, for example, include reducing, by at least half, the number of people living in the poverty by 2030 and

eradicating extreme poverty (people living on less than \$1.25 a day). Details on all the goals with targets and indicators can be found at the Sustainable Development Goals Knowledge Platform ⁱⁱ.

Regarding Indicators, there are 229. They are an added detail to help see where we are related to achieving the goals. For example, SDG1 looks at population, and also separately, the working poor. The Indicators look at poverty related to sex, age, employment status, and geographical location. This helps to show progress or lack of progress. It is real data to help make all of us see if we are on track to reach the goal as stated.

Become more aware about these goals and feel good about your world being better in the future. The SDGs are an important happening in your life. Be part of the solution to achieving them.

Key Sustainable Development Goal Targets for the Conferenceⁱⁱⁱ:

SDG#6 - Ensure availability and sustainable management of water and sanitation for all

6.1 - By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 - By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 - By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 - By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 - By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 - By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a - By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b - Support and strengthen the participation of local communities in improving water and sanitation management

SDG # 11 –Sustainable Cities and Communities

11.5 - By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product

caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

11.b - By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

SDG#12 – Responsible Consumption and Production

12.5 - By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

12.8 - By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

SDG #14 – Life Below Water

14.2 - By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

SDG #15 –Life on Land

15.1 - By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.4 - By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development

SDG # 17 – Partnerships for the Goals

17.7 - Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favorable terms, including on concessional and preferential terms, as mutually agreed

17.9 - Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation

Introduction to Water and Sanitation:

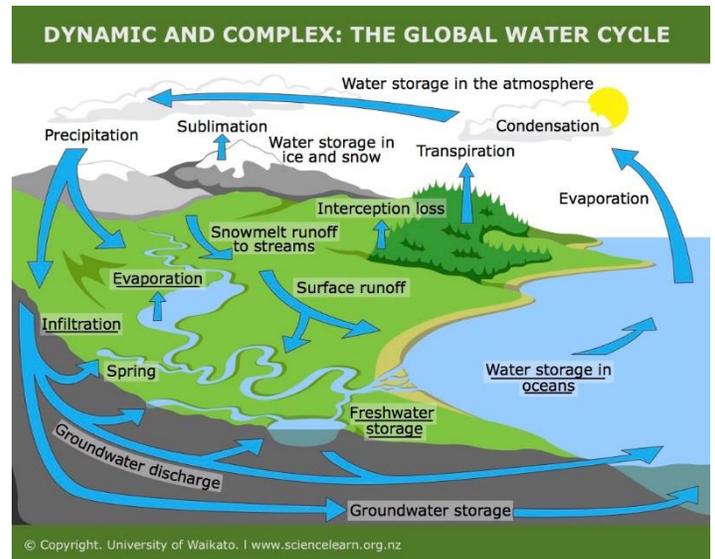
Why is water important?

Water is the only consistent and absolute requirement for life on Earth. We all drink water, bathe in water, cook with water, and are made of water. Water existed in our solar system before the formation of the sun, and can be found on our Moon, Mars, Mercury, comets, and on other moons.^{iv} Water is a solvent, a solute, a reactant, and a catalyst. The water molecule (H₂O) is the second most common molecule in the Universe, after hydrogen. There are 100 times as many water molecules in our bodies than the sum of all the other molecules put together. Humans can't live for more than a few days without water.

Cycle of Water:

Water on Earth is a closed system and is in continuous circulation. What affects water in one part of the cycle will eventually impact water everywhere. Pollutants, fertilizers, human waste, animal waste, medical waste - they all end up in the water we use daily.

The water cycle is fueled by the sun through evaporation. Evaporated water becomes clouds, which then forms rain, which flows into rivers and lakes and seeps into groundwater. Climate change intensifies the water cycle. This happens due to an increase in air temperatures, which leads to more water evaporation into the air. Warmer air can hold more water vapor, which then leads to more intense rainstorms, causing major problems like extreme flooding in coastal communities around the world.^v



Water in Everyday Life:

How much water do you use each day? What are the hidden uses of water?

Misuse of Water:

Water and Sanitation Today:

The United Nations Report of the Secretary General on the Progress towards the Sustainable Development Goals in 2015

- 6.6 billion people (over 90 per cent of the world's population) used improved drinking water sources
- 4.9 billion people (over two thirds of the world's population) used improved sanitation facilities.

According to the report, those without access to improved drinking water and sanitation live predominantly in rural areas. In order to achieve universal access to basic sanitation and end the unsafe practice of open defecation, substantial progress will be needed in the rural areas of Central and Southern Asia, Eastern and South Eastern Asia, and sub Saharan Africa.^{vi}

International Efforts to Improve Access to Water and Sanitation

Glossary:

COP21 - The Paris Climate Conference is officially known as the 21st Conference of the Parties (or "COP") to the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations body which is responsible for climate and based in Bonn, Germany. The Conference will also serve as the 11th Meeting of the Parties to the Kyoto Protocol.

The COP meets each year to take decisions that further the implementation of the Convention and to combat climate change. COP21 will take place at the same time as CMP11, the 11th meeting of the

Parties to the Kyoto Protocol, which oversees the implementation of the Kyoto Protocol and the decisions made to increase its effectiveness.

Eutrophication - excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen.

Greenhouse Effect – As part of the process by which the Earth cools, thermal radiation is emitted by the Earth towards outer space. Some of this radiation is captured by certain gases in the atmosphere (greenhouse gases) and re-emitted in all directions returning some of the heat to the Earth. This is the greenhouse effect. Greenhouse gases which are released into the atmosphere as a result of natural processes result in what is called the “natural greenhouse effect”. Greenhouse gases which are released into the atmosphere as a result of human activity result in what is called the “enhanced greenhouse effect”.

Inter alia – (Latin) Among other things

Resources:

Sustainable Development Solutions Network - <http://unsdsn.org/>

<https://sustainabledevelopment.un.org/hlpf>

<https://sustainabledevelopment.un.org/sdg6>

<https://www.un.org/sq/en/content/sq/speeches/2018-03-22/decade-action-water-sustainable-development-remarks>

<http://www.wateractiondecade.org/about/>

<https://programme.worldwaterweek.org/event/7836-water-action-decade-event>

<https://www.un.org/pqa/72/event-latest/launch-of-the-international-decade-of-water-for-sustainable-development-2018-2028/>

National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Carbon Cycle - <http://www.noaa.gov/resource-collections/carbon-cycle>

Climate Education <http://www.noaa.gov/resource-collections/climate-education-resources>

Climate Communication Science and Outreach - <https://www.climatecommunication.org/>

National Wildlife Federation - <http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Global-Warming-is-Causing-Extreme-Weather.aspx>

Subtheme A: Water and Sanitation Resource Management and Innovation

"We never know the worth of water till the well is dry."

- Thomas Fuller
Historian and Author.

Sustainable Development Goals Pertaining to this Sub Theme ⁱ

- Goal 2.** Clean water and the proper management of this resource prevent lack of food
- Goal 3.** With water management, less of this resource will be wasted and everyone around the world will receive the water needed
- Goal 4.** A quality education about water sanitation will help develop innovative ways to conserve water as well as manage it
- Goal 6.** Find new ways to sustain sanitary water and ensure families have access to clean water
- Goal 7.** Developing new methods to store and obtain clean water will result in affordable and clean energy
- Goal 8.** Resource management will allow people to become apart of the economy by obtaining a job
- Goal 9.** Construct innovative ways to access clean water, improve infrastructure so sanitary water is easily obtainable
- Goal 11.** Provide cities and communities with clean water and reduce waste
- Goal 12.** Manage water consumption to limit the amount of water being wasted
- Goal 13.** Develop ways to ensure there is no contamination of clean, safe drinking water
- Goal 17.** Strengthen partnerships and develop innovative ideas among countries to store and deliver clean water to people in need of it

Note: for all bolded words, please see "Key Terms"

Introduction

For all humans and living beings, water is the constant necessity that is needed to survive. Our bodies have different ways of telling us that we need to consume water, whether it be dark colored urine, muscle cramps, or that feeling of a dry mouth. Sadly, many people around the world do not have access to sanitary drinking water and experience these symptoms. Clean water is not easily accessible across the world and people are forced to travel great distances in order to get safe drinking water. With proper resource management and innovative ideas, every human will have easy access to clean and sanitary drinking water.

Water is used for many reasons. The ordinary uses of water include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene.ⁱⁱ Water should be **physically**

accessible to everyone. Many country women in Asia and Africa must travel an average distance of 6 kilometers to get access to sanitary water. Water safety and water quality are fundamental to human development and well-being. Providing access to safe water is one of the most effective instruments in promoting health and reducing poverty.ⁱⁱⁱ

Water Scarcity affects every continent around the globe. Roughly, one-fifth of the world's population is affected by water scarcity, whether the problem be a lack of infrastructure to transport the clean water to communities and cities in desperate need of it or the unequal distribution of this resource. Approximately 500 million people are approaching the water scarcity situation.^{iv} With water use growing at more than twice the rate of population growth, water shortages are becoming a common occurrence in a number of regions.

Problem

More than 2 billion people lack access to safe drinking water and more than double that number lack access to safe sanitation. With a rapidly growing global population, demand for water is expected to increase by nearly one-third by 2050.¹ In the face of accelerated consumption, increasing environmental degradation and the multi-faceted impacts of climate change, we clearly need new ways to manage competing demands on our precious freshwater resources.

Water scarcity affects more than 40% of the global population. Water-related disasters account for 70% of all deaths related to natural disasters. Feeding 9 billion people by 2050 will require a 60% increase in agricultural production, (which consumes 70% of the resource today), and a 15% increase in water withdrawals. Besides this increasing demand, the resource is already scarce in many parts of the world. Estimates indicate that 40% of the world population live in water scarce areas, and approximately ¼ of world's GDP is exposed to this challenge.² By 2025, about 1.8 billion people will be living in regions or countries with absolute water scarcity. Water security is a major – and often growing –challenge for many countries today.

What are the Causes?³

- An increase and exacerbation of sources of contamination.
- Alterations of the sources of water resources - with scarcity and decreased availability.
- Increased vulnerability of the human population due to contamination and difficulty of access to good quality water and sanitation which can be linked with an increase on (potable and treated).
- Lack of education on proper sanitation practices and standards.
- Poor governance

¹ Water Resource Management: Innovation and challenges in a Changing World
<http://unesdoc.unesco.org/images/0026/002614/261424e.pdf>

² Statistics from the World Bank. <https://www.worldbank.org/en/topic/waterresourcemanagement>

³ Water resources in the future:problems and solutions. http://www.scielo.br/scielo.php?pid=S0103-40142008000200002&script=sci_arttext&tlng=en

Case Study 1 - Myanmar

Myanmar is located in the continent of Asia and shares a border with India, China, Bangladesh, Thailand and Laos. Myanmar is a country that has abundant water resources. The potential water resources volume for Myanmar is about 1082 km³ for surface water and 495 cubic km for groundwater. 89% of the total water use goes to agriculture while only 10% is used domestically, leaving 1% of water use for industries. Myanmar is only utilizing roughly 5% of their potential water resources.⁴ There is substantial room for further development of Myanmar's water resources.

Despite the abundance of water resources in and surrounding Myanmar, the country is not free from water related issues. Water scarcity in Myanmar is the result of uneven rainfall throughout the **seasons** as well as the increasing water demand in cities. The increasing water demand in cities is due to population increase and **urbanization**. Water demand in rural areas has also increased due to expansion of irrigated agriculture and other rural-based economic activities. There is increasing pressure on use of **surface water** and extraction of **groundwater**. Control and management of surface water and groundwater is therefore important for sustainable development of the country in future.

17 million people do not have access to clean water, that is almost 1 in 3 of the population without this essential.⁵ The lack of infrastructure in Myanmar results in 19 million people not having a decent toilet. The use of unprotected wells is high in the less urban areas of the country. In order for the water to be considered safe to drink, **water treatment** is necessary. It is estimated that 12.2% of the population does not use water treatment, and unsafe drinking-water coverage is 33.1%.⁶

What Can Be Done?

Educating the Public

It is needed for the authority concerned to raise awareness to the public through education and to convey the importance of water resources for the economic, social and all-round development of all the sectors. Bringing awareness to the situation is the first step in the right direction.



⁴ Case Study: Integrated Water Resources Management in Myanmar.

http://www.un.org/waterforlifedecade/waterandsustainabledevelopment2015/pdf/Htun_Lwin_oo_MyanmarGDG.pdf

⁵ Water Aid, Myanmar. <https://www.wateraid.org/au/where-we-work/myanmar>

⁶ Sanitation, drinking-water and hygiene status overview.

http://www.who.int/water_sanitation_health/monitoring/investments/myanmar-10-nov.pdf

Storage of Water/ Reservoirs

Given the seasonal nature of rainfall, communities need to retain and store rainwater and runoff received during the wet season for use in the dry season. In the past 20 years, many small reservoirs, ponds, and tanks have been constructed by **MOAI** to provide water for small-scale irrigation, livestock and most importantly, domestic use. Many of these small reservoirs are prone to **siltation** and embankment failure so an improvement in infrastructure is also necessary.

Rainwater Harvesting

Ponds and small dams for rainwater harvesting emerge as the preferred option for improving water supplies for villages in many contexts in Myanmar. These ponds and small dams can provide water for 7-8 months a year.⁷ The problem that comes with harvesting rainwater is evaporation. The way to help lessen the loss of water due to evaporation is to construct deeper ponds. Seepage losses are also an issue but can be countered by sitting dams on areas of clay soils, compacting the base during construction or lining the pond with clay.

Better Resource Management

The government must collect data on the amount of water that is available. This is of particular importance and urgency for the management of groundwater resources. Continued groundwater development, without assessing the availability of the resource, runs the risk of lost investment through overexploitation and inappropriate siting of wells. In 2014, the World Bank announced a 100 million USD donation for the Ayeyarwady River Basin Management Project. This aims to strengthen water resources management and planning. Allowing for informed decisions about future investments in developing the river basin project.

Improve Infrastructure

Urban areas, such as cities, are some of the only regions in Myanmar that have pipes. The tap water is not recommended to be drunk as it can be contaminated and unsafe. People in rural areas of the country do not have access to water via pipes. Improving the infrastructure can be done by completing a variety of items such as, deepening wells to access more sanitary water, construct and improve dams to trap more water and reduce the evaporation and drying of said dams, improving irrigation infrastructure, and many more. The improvement of infrastructure will not only create jobs but increase the well being of the Burmese people.

Case Study 2 - Somalia

Somalia is located in the Horn of Africa. It is bordered by Ethiopia to the west, Djibouti to the northwest, the Gulf of Aden to the north, the Guardafui Channel and Indian Ocean to the east, and Kenya to the

⁷ Rainwater Harvesting: Village ponds and farm dams.

<http://www.iwmi.cgiar.org/Publications/Other/Reports/PDF/improving-water-management-in-myanmars-dry-zone-for-food-security-livelihoods-and-health.pdf>

southwest. Somalia has irregular rainfall as well as occasional monsoons from the months of May-October.⁸

Somalia is one of four countries facing the threat of famine, and the situation is rapidly deteriorating. Parts of the country have not received any rain for three consecutive years. In some areas, crops have been completely wiped out and livestock has died; communities have been forced to sell assets and to borrow food and money to survive. Half of the population – 6.2 million people out of the country's 12.3 million - do not have access to nutritious food. Of these, nearly 3 million are in need of urgent life-saving assistance.⁹ To make matters worse, the price of water has risen dramatically. A family with an average-sized livestock herd now has to pay anywhere from US \$200 to \$400 per month for water. These costs can be catastrophic for farmers trying to earn a living.¹⁰



What Can Be Done?

Implementation of the IWRM

Building collaboration between the groups (Government, regional States, private sector and the community) must be set as a priority to establish a cohesive force or connection. This unified potency with the same vision might institute a framework to safeguard water resources planning and development and natural resources conservation.¹¹ The implementation of **IWRM** in Somalia could help reduce water scarcity as well as the reduction of tension.

Flood Water Used For Food

Seasonal floods occur in different parts of the country and the utilization of these flood waters could prove vital for life in Somalia. These floods can become destructive forces, leading into degraded, eroded and depleted soils with loss of pasture and farm lands. The consequences of these destructive forces could be reduced by harvesting it and transforming it into sources of livelihood for the community through flood based farming/**spate irrigation** to increase food production.



Dams

The sand dam is one of the water harvesting structures built by UNDP in partnership with the Global Environment Facility. It aims to reduce the impacts of climate change-induced disasters like droughts

⁸ Climate in Somalia - <https://www.cia.gov/library/publications/the-world-factbook/geos/so.html>

⁹ <https://stories.undp.org/in-search-of-water>

¹⁰ The Search for Water - <https://stories.undp.org/in-search-of-water>

¹¹ Implimentation of IWRM in Somalia -

https://www.hiiraan.com/op4/2015/jan/97675/utilization_of_water_resource_in_somalia.aspx

and floods. Communities must travel to the dam to collect water. Sand dams are a low cost, low maintenance technology that retains rainwater and recharges groundwater.

Success Story- India

*Drought-free in Maharashtra – six small villages, one big lesson¹²
(2012-2013)*

Maharashtra is a state in the western region of India and is the second-most populous state and third largest state by area. The state declared drought in 125 out of 358 **talukas** during kharif 2012-13, and then declared water scarcity in 3,905 villages in rabi 2012-13. This region is often plagued by droughts and they are not an uncommon occurrence. Thapewadi, Phalakewadi and Muthalane villages in Pune, Randulabad villages of Satara, and Satichiwadi and Shelkewadi villages of Ahmednagar are all villages in drought-affected districts of Maharashtra but they are unlike their neighbours.



The six villages were able to maintain safe drinking water despite other districts being affected by drought. They were able to do this by proper resource management. The water was good quality, the supply of water is regular, and everyone in the community gets equal amounts of water.

All six villages lie in Maharashtra, particularly the Western Ghats. This means they are at the back-facing side of the Ghats, translating to: lesser clouds and lower rainfall, hence droughts being a common occurrence. During a drought in 2003, women had to walk 2-3 km to fetch drinking water. Drought was never a surprise for people in this area but they did not know how to properly manage their water resources.

How were they able to do this?

With the villages lacking the knowledge on how to properly manage their resources, two NGOs (Watershed Organisation Trust (WOTR) and Advanced Center for Water Resources Development and Management (ACWADAM)) stepped in and brought the villagers together to understand the issues they were facing and how to deal with them.

The first step for the villagers was to map their water resources. Next they were to ask themselves questions like, how much natural supply of water was available?, what are the various uses of this water within the village? (for drinking, agriculture, domestic needs, livestock, etc...) This helped them understand the demand of water and how much supply they had.

The villagers used systems that the two NGOs taught them. They monitored the water levels year round by checking the levels in different sources periodically. If they noticed a reduction in a well, then water

¹² Drought-free in Maharashtra - six small villages, one big lesson.

<http://www.indiawaterportal.org/articles/drought-free-maharashtra-six-small-villages-one-big-lesson>

supply to the villagers would be reduced proportionately. Another system used by the villagers was choosing the right crops. Some crops require more water than others so depending on the water usage through the year the villagers understood how much water would be available during crop season. The villagers also redistributed their water use based on supply, they would allocate water from agricultural needs to domestic use needs and vice versa. Water meters were also installed inside the communities homes, helping them become conscious of their domestic water usage.

Despite all of these amazing steps these villagers took to insure they would have water during the drought, the most notable was how they came together collectively and were able to agree on these initiatives.

Key Terms:

Physically Accessible: Everyone has the right to a water and sanitation service that is physically accessible within, or in the immediate vicinity of the household, educational institution, workplace or health institution. According to WHO, the water source has to be within 1,000 metres of the home and collection time should not exceed 30 minutes.

Water Scarcity: a natural and human-made phenomenon that causes a lack of clean water. There is enough freshwater on the planet for seven billion people, but due to unequal distribution, pollution and poor resource management some areas see a lack of sanitary water.

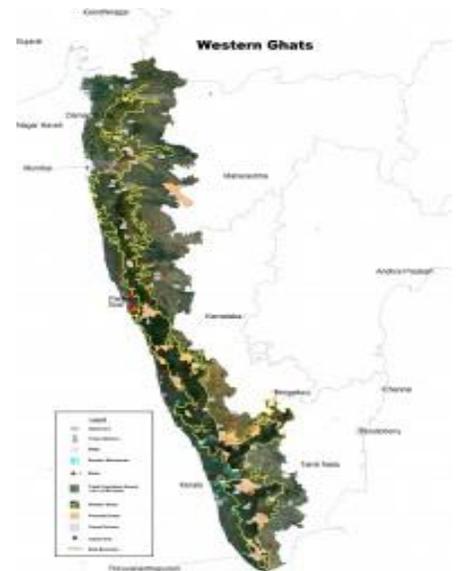
Myanmar Seasons: The cool season in Myanmar last from November to February and is generally warm to hot temperature wise. The hot season lasts from March to May and is intensely hot in most of the country. In both the cool and hot seasons, rain is a very unlikely experience. The Rainy season lasts from June to October, also known as the monsoon season, with high rainfall.

Urbanization: process by which a large number of people becomes permanently concentrated in relatively small areas, forming cities.

Surface Water: water that collects on the surface of the ground. An example of this is the top layer of a body of water. (pond, lake, etc...)

Groundwater: water held underground in the soil or in pores and crevices in rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

Water treatment: any process that improves the quality of water to make it more acceptable for a specific end-use. The end use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation or many other uses, including being safely returned to the environment.



Siltation: a process by which water becomes dirty as a result of fine mineral particles in the water. When sediment, or silt, is suspended in water, this is an example of siltation.

MOAI: Ministry of Agriculture and Irrigation. A ministry in the Burmese government responsible for agriculture and irrigation. Formerly known as the Ministry of Agriculture

Taluka: A tehsil (also known as a mandal, taluk, taluq or taluka) is an administrative division in some countries of South Asia. It is an area of land with a city or town that serves as its administrative centre, with possible additional towns, and usually a number of villages.

Integrated Water Resource Management (IWRM): is a process that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

Spate Irrigation: Spate irrigation uses seasonal floods of rivers, streams, ponds and lakes to fill water storage canals. If irrigation is the manipulation of water for use in growing crops, spate irrigation is perhaps the most ancient method devised.

Additional Sources:

<http://www.un.org/waterforlifedecade/scarcity.shtml>

http://www.who.int/water_sanitation_health/water-quality/en/

***(great resource)** http://www.un.org/waterforlifedecade/human_right_to_water.shtml

http://www.un.org/waterforlifedecade/waterandsustainabledevelopment2015/pdf/Htun_Lwin_oo_MyanmarGDG.pdf

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ⁱ Sustainable development goals. Retrieved from <http://unsdsn.org/what-we-do/sustainable-development-goals/about-the-sdgs/>

ⁱⁱ http://www.un.org/waterforlifedecade/human_right_to_water.shtml

ⁱⁱⁱ http://www.who.int/water_sanitation_health/water-quality/en/

^{iv} <http://www.un.org/waterforlifedecade/scarcity.shtml>

Subtheme B: Water Sanitation and Infrastructure

“Access to a secure, safe and sufficient source of fresh water is a fundamental requirement for the survival, well-being and socio-economic development of all humanity. Yet, we continue to act as if fresh water were a perpetually abundant resource. It is not.”

- Kofi Annan

Seventh Secretary-General of the United Nations.

Sustainable Development Goals Pertaining to this Subtheme^{vii}

- Goal 2.** Clean Water and Infrastructure positively impacts food security.
- Goal 3.** The development of proper infrastructure and sanitary water has a direct and positive impact on a community’s health and well-being.
- Goal 5.** Access to clean water expands educational opportunities for poor families around the globe.
- Goal 6.** Eradicate infectious diseases through access to clean water and proper sanitation practices.
- Goal 8.** Improve livelihood choices and promote economic growth through clean water and development of sustainable infrastructure.
- Goal 9.** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation to ensure continued access to clean water.
- Goal 10.** Reduce inequality within and among countries through equal access to safe water sources.
- Goal 11.** Make cities and human settlements safe, healthy and sustainable.
- Goal 12.** Ensure sustainable and responsible consumption of water sources.
- Goal 13.** Develop environmentally sustainable infrastructure to reduce waste, contamination of water sources and depletion of natural resources.
- Goal 17.** Strengthen the means of implementation and revitalize the global partnership for sustainable development

Note: for all bolded words, please see “Key Terms”

Introduction

Access to clean water, adequate sanitation practices, as well as the improvement and development of resilient infrastructure have a positive impact on food security, livelihood choices and educational opportunities for poor families around the world. Investment in infrastructure empowers communities, creates opportunities, and improves quality of life for the community.

Access to clean water for everyone is key to reaching the Sustainable Development Goals as seen in the previous section. Clean water goes hand in hand with creating more stable and safe communities, it creates economic opportunities and will lead to greater health and wellbeing around the globe. With proper care and management, the planet’s fresh water sources are enough to provide clean, accessible water for all. For this reason, it is crucial to develop resilient and sustainable infrastructures that will reduce water waste and grant access to clean and safe water to remote communities.

Water sanitation: Access to clean and safe water for domestic use is a basic human right. In order for water to be considered safe, it must be free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person's health.^{viii} Guidelines for water safety are usually set by National and local governments. However, these standards are not always ideal or as effective from one country to another. The World Health Organization (WHO) has set forth a series of guidelines for drinking water quality.^{ix} The guidelines serve as a base for countries to develop and implement their own water safety programs and measures.

Infrastructure: Investment in infrastructure and the development of sustainable industries promotes economic growth, **social development, gender equality** through education, and improves sanitation practices. The global economic landscape has created large inequalities that can be remedied with investment in infrastructure, which in turn makes opportunities accessible to all people. Proper infrastructure and the development of new technologies such as clean energy go hand in hand with climate action as well.

Without **proper sanitation facilities,**

people have no choice but to use inadequate communal latrines or to practice open defecation. For women and girls, finding a place to go to the toilet outside, often having to wait until the cover of darkness, can leave them vulnerable to abuse and sexual assault.

Problem

Millions of people die every year from diseases associated with inadequate water supply, poor **sanitation** and hygiene as a result of poor infrastructure. Lack of water supply and storage systems affects the world's poorest countries in times of drought leading to increased hunger and malnutrition, food shortages, and even famine.

There are 2.1 billion people who do not have access to safely managed water, 844 million of those even lack a basic drinking water service. In addition, there are 4.5 billion people who do not have safely managed sanitation and 2.3 billion who still do not have basic sanitation services. According to the World Bank, 362,000 children under the age of 5 die every year due to diarrhea related to poor sanitation and contaminated water, which are also linked to transmission of diseases such as cholera, dysentery, hepatitis A, and typhoid.^x

Many **developing countries** in the world still lack basic infrastructure such as roads, communication technologies, sanitation, electrical power, and water systems. In developing countries, barely 30 per cent of agricultural production undergoes industrial processing.¹³ With the proper infrastructure in place, a country can manage its water supply, eradicate food shortages, have equal access to clean water for its people, and create safer, more sustainable communities.

What are the Causes?¹⁴

- At least 892 million people continue to **practice open defecation.**

¹³ Sustainable development goals. Goal 9 pdf. <https://www.un.org/sustainabledevelopment/infrastructure-industrialization/>

¹⁴ Statistics from The UN's Sustainable Development Goals, UNICEF, and World Bank Group.

- Women and girls are responsible for water collection in 80 per cent of households without access to water on premises.
- More than 80 per cent of wastewater resulting from human activities is discharged into rivers or sea without any pollution removal.
- Outdated and poor infrastructure.
- Lack of education on proper sanitation practices and standards.
- Poverty and lack of economic resources.
- Overpopulation.
- Lack of safely managed sanitation

Case Study 1- Tajikistan

Located on the western tip of the Himalayas, Tajikistan is surrounded by fresh water sources such as rivers, lakes, and glaciers. However, safe drinking water, sanitation and hygiene are some of the most limited, inaccessible, and unequally distributed services in the country. The country's existing sewerage, drinking water, and other water systems infrastructure was built before the 1980s. The infrastructure has not been updated, undergone maintenance, or been renovated since the fall of the Soviet Union. "It is either in poor condition or entirely absent, especially in rural areas and small towns."¹⁵ The country lacks the economic and structural resources to better sanitation methods and develop new infrastructure.

Tajikistan has made significant progress since 2000 in providing access to improved or basic water sources from 45% in 2000 to 71% of the rural population in 2016.¹⁶ However, this was accomplished mainly by replacing **surface water** with water from public standpipes and from people's neighbors. Even though there was an effort made, the country had failed to reach the Millennium Development Goal on drinking water.



Water Sanitation

Even though drinking water has shown high levels of coliform bacteria and poor **palatability**, low E. coli rates suggest fecal contamination is not a major concern. Access to safely managed water sources¹⁷ varies among the population. Only 57% of urban households have access to safely managed water and only 31% of rural households have so.

Access to sanitation in Tajikistan has improved, but the country's conditions remain as some of the poorest in Central Asia. According to the World Bank, only 1.7% of the population in rural areas has access to flush toilets connected to a sewer system, in contrast to 60% of those in urban areas.

¹⁵ "World Bank Group. 2017. Glass Half Full : Poverty Diagnostic of Water Supply, Sanitation, and Hygiene Conditions in Tajikistan. World Bank, Washington, DC. © World Bank.

<https://openknowledge.worldbank.org/handle/10986/27830> License: CC BY 3.0 IGO."

¹⁶ Ibid.

¹⁷ Safely managed water sources are those that are improved, available when needed, and free of fecal contamination.

Inequalities are more pronounced across regions, while the capital Dushanbe accounts for more than four-fifths of all sewer connections across the country.

Infrastructure

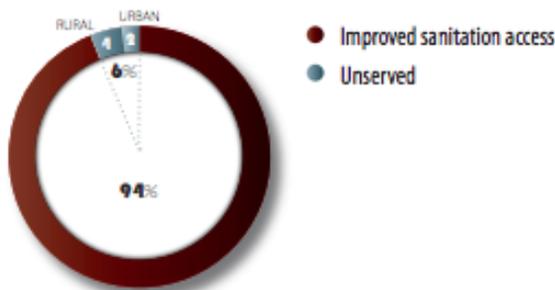
The World Bank found that over 80% of the population in Tajikistan has piped water connections in their dwelling or premises in urban areas. However, even when households have access to water, there are significant challenges with regard to the availability and continuity of water supplies. One in four households in Tajikistan does not have access to sufficient quantities of water when needed. Service is interrupted for long periods because of breakdowns in water supply infrastructure.

Among households that report they pay for water, expenditures on cold water supply make up 5% of their total annual expenditure. Households that pay for non-piped water services also incur higher per unit costs than households with piped connections. Typically, households also pay for the costs of repairs, water treatment, and water transportation. On average households will spend 17.4 minutes each day to reach their water source, collect water, and return home.

xi

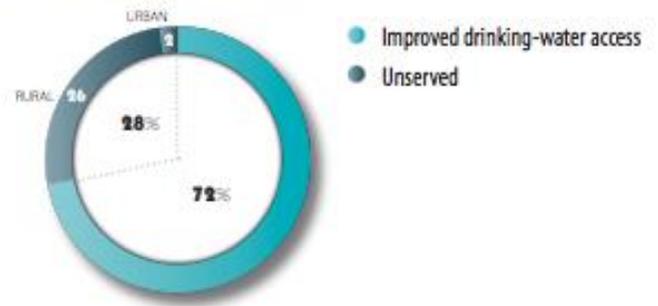
EQUITY IN ACCESS¹

Figure 3. Population with access to improved sanitation facilities



¹ Progress on Drinking-Water and Sanitation – 2014 Update, WHO/UNICEF 2014.

Figure 4. Population with access to improved drinking-water sources



What Can Be Done?

Investment in Infrastructure

Investment in resilient and sustainable infrastructure will create thousands of jobs, improve sanitation, reduce social inequalities, reduce gender inequalities, expand educational opportunities, and promote economic growth. In order to ensure sustainable development however, it is important to implement special training programs for the proper maintenance of infrastructure.

Improved Sanitation Facilities in Rural Settlements:

Due to a lack of improved sanitation facilities and access to water, people must resort to using inadequate communal latrines or practice open defecation. This notably affects women and girls since finding a place to go to the toilet outside often means having to wait until the cover of darkness and can leave them vulnerable to abuse and sexual assault.

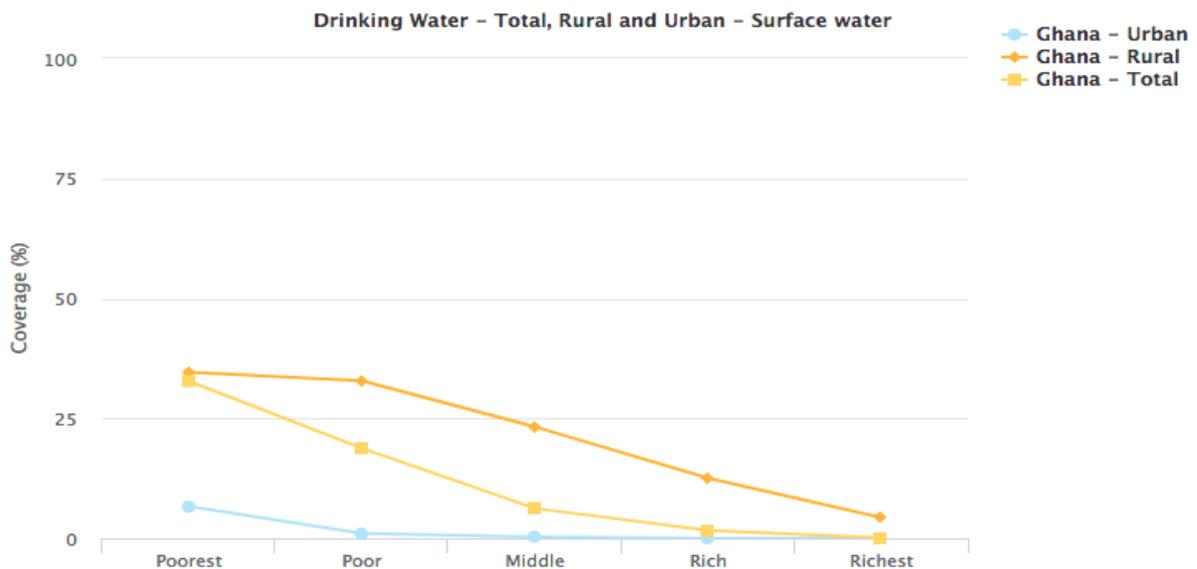
Foreign Investment

Tajikistan's current sewer and piping systems are in desperate need to be rehabilitated, improved, and in most cases completely replaced. This is a task that requires large sums of money that the country does not have, therefore making it impossible to accomplish without attracting investment.

Case Study 2 – Ghana

Ghana has made significant progress providing access to improved water sources to 80% of the population and eliminating Guinea worm from the country. However, despite these successes, about 4,000 Ghanaian children die each year from diarrhea, even more die from pneumonia, and about 23% of Ghanaian children suffer from stunting (chronic malnutrition linked to poor water and sanitation). In addition, five million Ghanaians still use water from unsafe sources.

Additionally, there are about six million people (about 22% of the population) in Ghana that rely on surface water to meet their daily water needs, exposing them to water-related illness and disease. Shockingly, 70% of all diseases in Ghana are caused by unsafe water and poor sanitation.¹⁸



19

Access to Clean Water

Only a small percentage of the population in Ghana has access to clean water. Most households do not have the economic means to invest in piping or to acquire safe drinking water. As a result, those living in

¹⁸ *Note that this statistic was taken from the NGO water.org. I have requested that they provide their sources and whether they are collecting the data and interpreting it themselves or if it is from an already reputable source (WHO, UN, World Bank Group, UNICEF, etc). <https://water.org/our-impact/ghana/>

¹⁹ Created using data provided by the WHO and UNICEF. Can access an interactive version through the following link: <https://washdata.org/data#!/dashboard/1529>

poverty must pay a higher amount per liter for water service from private vendors than those whose household is connected to piped water services.

Infrastructure and Sanitation Facilities

Less than 15% of Ghanaian households have handwashing facilities. Handwashing can reduce diarrhea and pneumonia by up to 50%. While Improved sanitation can reduce diarrhea rates by 36%, only 15% of Ghanaians have access to improved sanitation, well short of the 2015 goal of 54%. In addition, one in five Ghanaians have no access to a toilet and defecate in the open, with open defecation rates over 70% in Northern Ghana, reflecting significant national inequalities.^{xii}

In addition, access to household toilet facilities in the country remains limited to 18% of households in urban areas and to 9% in rural areas. This means that in Ghana, only 1 in 7 people of the population has access to such facilities. It's also important to note that 2 out of 5 basic schools do not have toilets and that 3,600 Ghanaian children die every year from diarrhea as a result of this situation.^{xiii}



What Can Be Done?

Latrines in households and schools

In order to eradicate open defecation in Ghana the people must have equal access to basic toilets. Basic toilets prevent the spread of deadly diseases, provide

Education for everyone

Educating the public on proper hygiene practices such as the importance of hand washing and safe cooking methods. However, it is often the case that even when people do have knowledge of good hygiene practices, they lack the soap, safe water and washing facilities needed to prevent the spread of disease in their community. In addition, behavior change programmes are needed to ensure toilets and/or latrines are used when introduced to a household that previously lacked them.

Reducing Water Costs

Water should be equally **affordable** for all people. Water costs can be reduced through investing in improvement of household water connections, rainwater harvesting equipment, wells, and latrines. However, real sustainable change requires investment in resilient infrastructure that can provide water storage systems, water distribution, supply management, and water sanitation facilities. Infrastructure development in Ghana is dependent on foreign investment, which the government has recognized and is working on attracting public and private foreign investment.^{xiv}

Success Story: - China

Hai Basin Integrated Water and Environment Management Project for China (Sept. 2004- June 2011)^{xv}

The Hai Basin Integrated Water and Environment Management Project has effectively promoted an integrated approach to water resource management and pollution control in the Hai Basin in northern China and contributed to the restoration and protection of marine environment, ecosystem and biodiversity in the Bohai Sea. The project was implemented in 16 counties in northern China. Over 20 million people benefited from it.

Challenge

The Hai Basin spreads over six provinces and the municipalities of Beijing and Tianjin, which account for 15 percent of China's GDP. It suffered from serious water-related problems, including water pollution, water scarcity, diminishing water supplies and flooding. Water availability per capita in the Hai Basin was only 14 percent of the national average and about four percent of the global average. Over-exploitation of groundwater, overuse of surface water resulting in inadequate environmental flows, along with groundwater and surface water pollution, led to the decline and deterioration of water resources and damaged the freshwater and coastal environments of the Hai Basin.

The Basin discharges into the Bohai Sea, which is an important ecosystem and fishery resource. However, heavy land-based pollution from urban, industrial, agricultural, and other sources in the Hai Basin, combined with overfishing, reduction of freshwater inflows, and habitat loss, threatened the fishery and steadily diminished many of the Bohai Sea's ecological functions.

What was done to improve conditions?

The World Bank collaborated with the Chinese Government to develop and implement an "integrated approach to water and environmental management". Integrated water and environment management (IWEM) planning was the key management measure implemented by the project. IWEM "provides the context within law, policy, institutional arrangements, and operational practices for the development of practical approaches to carry out top-down, bottom-up, vertical and horizontal cooperation at the basin, sub-basin and county level."

Results:

- The project has effectively promoted an integrated approach to water resource management and pollution control in the Hai Basin in northern China and contributed to the restoration and protection of marine environment, ecosystem and biodiversity in the Bohai Sea.
- The project was implemented in 16 counties in northern China and over 20 million people have benefited from it.²⁰
- Over 400 water users associations were established so that the communities decided themselves on how they manage water resources, particularly on water savings and operation and maintenance of the on-farm water systems.
- Practical approaches to improving water and environment management were developed, which can be replicated throughout the Hai Basin and in other Chinese basins.

Key Terms:

Access to Water: Water should be physically accessible. Everyone has the right to a water and sanitation service that is physically accessible within, or in the immediate vicinity of the household, educational

²⁰ <http://www.worldbank.org/en/news/feature/2012/09/03/china-improving-water-resource-management-pollution-control-in-hai-basin>

institution, workplace or health institution. According to WHO, the water source has to be within 1,000 meters of the home and collection time should not exceed 30 minutes.^{xvi}

Affordable water: Water, and water facilities and services, must be affordable for all. The United Nations Development Programme (UNDP) suggests that water costs should not exceed 3 per cent of household income.

Social development: The World Bank defines social development as the promotion of social inclusion of the poor and vulnerable by empowering people, building cohesive and resilient societies, and making institutions accessible and accountable to citizens.

Proper sanitation facilities: a facility that safely separates human waste from human contact.

Safe Drinking Water: Water free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person's health. Measures of drinking-water safety are usually defined by national and/or local standards for drinking-water quality. The World Health Organization (WHO) Guidelines for drinking-water quality provide a basis for the development of national standards that, if properly implemented, will ensure the safety of drinking-water.

Palatable Water: Water that is free from objectionable tastes, odors, colors, and turbidity.**Surface Water:** water that collects on the surface of the ground; the top layer of a body of water.

Urbanization: process by which a large number of people becomes permanently concentrated in relatively small areas, forming cities.

Sanitation: safe collection and disposal of human excreta (feces and urine) and the management of solid wastes (household trash, industrial waste, etc).

GDP: Gross Domestic Product; the broadest quantitative measure of a nation's total economic activity. More specifically, GDP represents the monetary value of all goods and services produced within a nation's geographic borders over a specified period of time.

Developing Countries: poor agricultural countries that are seeking to become more advanced economically and socially.

Open Defecation: the practice whereby people go out in fields, bushes, forests, open bodies of water, or other open spaces rather than using the toilet to defecate.

Economic Development: efforts that seek to improve the economic well-being and quality of life for a community by creating and/or retaining jobs and supporting or growing incomes and the tax base.

Gender Equality: the equal treatment or perceptions of individuals based on their gender. Inequality arises from differences in socially constructed gender roles as well as biologically through chromosomes, brain structure, and hormonal differences.

Additional Sources:

http://www.who.int/water_sanitation_health/publications/potable-reuse-guidelines/en/
*(great resource) http://www.un.org/waterforlifedecade/human_right_to_water.shtml
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Water Scarcity interactive world map-

<http://www.wri.org/applications/maps/aqueductatlas/#x=19.07&y=72.25&s=ws!20!28!c&t=waterrisk&w=def&q=0&i=BWS-16!WSV-4!SV-2!HFO-4!DRO-4!STOR-8!GW-8!WRI-4!ECOS-2!MC-4!WCG-8!ECOV-2!&tr=ind-1!prj-1&l=3&b=terrain&m=group>

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ⁱ <https://sustainabledevelopment.un.org/sdg6>

ⁱⁱ Sustainable Development Knowledge Platform <https://sustainabledevelopment.un.org/?menu=1300>

ⁱⁱⁱ Sustainable Development Knowledge Platform <https://sustainabledevelopment.un.org/sdgs>

^{iv} <http://www.sciencemag.org/news/2014/09/half-earths-water-formed-sun-was-born>

^v <https://www.climaterealityproject.org/blog/climate-change-impacting-water-cycle>

^{vi} http://www.un.org/ga/search/view_doc.asp?symbol=E/2017/66&Lang=E

^{vii} *Sustainable development goals*. Retrieved from <http://sustainabledevelopment.un.org/focussdgs.html>

^{viii} http://www.un.org/waterforlifedecade/human_right_to_water.shtml

^{ix} http://www.who.int/water_sanitation_health/publications/potable-reuse-guidelines/en/

^x <http://www.worldbank.org/en/topic/water/overview>

^{xi} http://www.who.int/water_sanitation_health/monitoring/investments/tajikistan5-jan-16.pdf

^{xii} <https://www.unicef.org/ghana/wes.html>

^{xiii} https://www.unicef.org/ghana/media_10965.html

^{xiv} <https://www.worldfinance.com/inward-investment/middle-east-and-africa/ghana-steps-up-infrastructure-investment-programme>

^{xv} <http://projects.worldbank.org/P075035/hai-basin-integrated-water-environment-management-project?lang=en&tab=documents&subTab=projectDocuments>

^{xvi} http://www.un.org/waterforlifedecade/human_right_to_water.shtml

Subtheme C: Water Pollution

“This is not a partisan debate; it is a human one. Clean air and water, and a livable climate are inalienable human rights. Solving this crisis is not a question of politics. It is our moral obligation.”

– Leonardo DiCaprio

Actor and United Nations Messenger of Peace

Sustainable Development Goals Pertaining to this Subtheme^{xvi}

- Goal 1.** Reduce poverty by water being accessible and useable to all masses
- Goal 2.** Reducing world hunger and impoverishment with clean accessible water for better and increased food production and availability
- Goal 3.** Sanitary water resulting in improved health and well-being for all individuals preventing diseases related to hygiene as well as unsanitary consumptions
- Goal 6.** Ensure availability and sustainable management of water and sanitation for all
- Goal 7.** Proper water supply and storage will result in environmentally friendly, renewable and sustainable clean energy
- Goal 11.** Proper water infrastructure facilities as well as waste disposal facilities will result in sustainable communities and cities
- Goal 12.** Industries regulating their waste disposal and discharge as well as the general public consuming water wisely ties into responsible production and consumption
- Goal 13.** Reduced pollution is directly correlated with mitigating and reversing adverse climate change and its effects
- Goal 14.** Directly related to the sustenance of life below water as reversing and solving water pollution results in the habitat of all marine life being protected
- Goal 15.** Proper availability of clean water results in the nourishment and sustenance of life on line such as animals as well as proper healthy growth of plant-based life as well
- Goal 17.** Strengthen the means of implementation and revitalize the global partnership for sustainable development

Note: for all bolded words, please see “Key Terms”

Introduction

From since the beginning of time, one basic human necessity that is vital for the sustenance of all living things, hasn't changed; water. It is critical not only for energy production, food production and socio-economic development, but is also responsible for healthy ecosystems and adapting to or mitigating climate change. Thus, it is safe to say water is necessary for societal sustenance and growth as well as environmental safeguarding and preservation.

Water is also the main right of any living organism, including human beings. As the population of our planet grows, we are faced with an increasing need to balance the demands on water resources and ensure communities have enough water for their needs. This was recognized in July 2010 by the United Nations General Assembly, where it was established that every human being has a right to have access to safe, acceptable, physically accessible and affordable water that is sufficient for their domestic and personal use. Specifically, females must have access to private and clean sanitation facilities to assist menstruation and maternity in safety and with respect and dignity.

This ties into how water cannot be void of being **sanitary**, and why water pollution is an eminent problem our planet faces that is in dire need of attention so as to ensure the reduction of diseases, improvement of health, economic and educational productivity, around the globe. According to the World Wildlife Fund (WWF), **Water Pollution** is when *toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them, lying suspended in the water or depositing on the bed. This degrades the quality of water. Water pollution is defined as the presence in groundwater of toxic chemicals and biological agents that exceed what is naturally found in the water and may pose a threat to human health and/or the environment.*

Problem

Today unclean water and insufficient sanitation are a leading cause of child **mortality** due to childhood diarrhea; which is associated with insufficient, unclean water supply with contaminants and communicable disease pathogens.

1.8 billion people world-wide are estimated to be drinking water that is unprotected against faeces contamination according to the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, whereas in developing countries more than 80% of sewage is released untreated into rivers, lakes and coastal areas. ^{xvi}

Health can be directly and negatively affected by polluted water by drinking, bathing, showering and swimming in polluted water, as well as by breathing in vapors of a polluted water source by being in close proximity to it, consuming food such as vegetables irrigated or grown with polluted water or meat from animals fed with polluted water.

There are three main types of water pollution^{xvi}:

1) Chemical

Being the most common type of water pollution, this can be due to crude oil and/or other petroleum products, fertilizers, chlorinated or petroleum solvents, PCBs, pesticides/herbicides or metals and their compounds being discharged or seeping into the water.

2) Radiological

This type of water pollution usually occurs in bodies of water near factories or plants dealing with radioactive materials where their by-products are released or seep into the water.

3) Biological

Where in biological waste materials, whether it be due to improper disposal of human or animal wastes or decaying organic materials left in water, contaminate water sources. It can also be due to various micro-organisms or algae present in a large number in the water source.

What are the Causes?

- Many industries such as leather and chemicals industries which are heavily polluting have started to move from high-income countries to emerging market economies
- In terms of pure water source contamination such as rivers, increased food production needs project a 10-15% increase in nitrogen loads into coastal ecosystems, a trend that was also seen throughout 1970-1995
- **Eutrophication**, is the most prevalent water quality problem globally, which is a result of high-nutrient loads, primarily phosphorus and nitrogen, in water systems substantially impairs beneficial uses of water, and this process is the most prevalent problem and threat to water pollution
- Virtually all goods-producing activities generate pollutants as unwanted by-products that end up in rivers, streams, coasts/shores and oceans
- Lack of awareness of the general public especially in developing countries results in people contaminating rivers, streams and beaches with litter such as non-biodegradable plastic bags and even human wastes
- Leniency in sanctions and laws implemented on large corporate or multinational companies whose industries are not penalized or monitored in terms of proper waste disposal

Case Study 1 – China

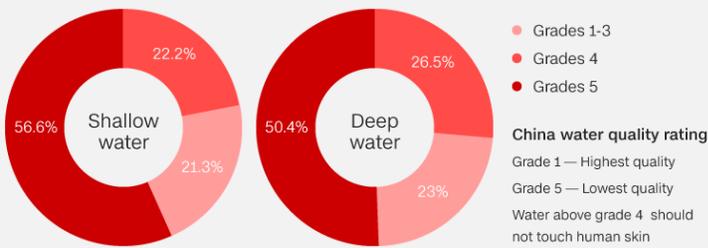
According to official standards, 85% of the water in Shanghai's major rivers was undrinkable in 2015, 56.4% of it unfit for any purpose. ^{xvi} The new water quality report found water in other major cities of China to be severely polluted or functionless as well.

Industries in China not being monitored efficiently and failure on the government's part on cracking down those industries that pollute the water resulted in a great deal of their water shortage problem that occurs today.

Furthermore, the system for sewerage treatment across the nation is extremely insufficient, which especially in urban areas, may result in water reaching homes and business to contain hazardous materials. Rapid **urbanization** and the poor planning of cities has resulted in any useful efficient sources of water to not be taken advantage of as should be possible, such as rainwater flooding cities after heavy rainfall.

The pollution of water has also added to the chronic water shortage problem China has, which is putting the country's economic growth at great risk. While industrial pollution is the most frequently discussed source of pollution, land use and degradation accounts for about half of the pollution found in China's water.

Northern China groundwater pollution



CNN Source: Ministry of Land and Resources (via CHINA WATER RISK)

The rural, post-industrialization China is facing a new problem, a new kind of village being created called the **cancer village**. These are the villages located near factories and that rely on the rivers near these factories for water for ingesting and cleaning purposes. The people in these villages exposed to this water have a shockingly high rate of cancer; of the esophagus, rectum, liver and stomach, and commonly in the youth. Due to poverty in these areas, the death rate due to cancer is high as they cannot afford treatment.

What Can Be Done?

Protecting Forests and Improving Agriculture

By protecting forests and improving agricultural practices, the country can improve water quality. It has been projected that by targeting conservation strategies to roughly 1.4 million hectares, sediment and nutrient pollution could be measurably reduced, improving water quality for more than 150 million people by these natural methods alone.

Increased government regulations and deadlines

According to the global Water Forum, the central government of China is increasing efforts to mitigate and remedy water pollution, setting detailed objectives and standards for water managers as well as setting aside budgets to help implement plans, such as the 'Water Pollution Prevention and Control Action Plan' set up in April 2015.

Water funds

Setting aside a specific fund to be used for the purpose of rectifying water pollution may certainly help, considering the large population of the country as an asset; even a small contribution from each member of society can go a long way and collectively make a very impactful difference.

Public awareness

An increase in public awareness across the nation or targeting specific areas of the nation can result in a lot of improvements in trying to solve this crisis. An example of this is the 'Detox campaign' which launched in 2011 aimed to expose the direct links between global clothing brands, their suppliers and toxic water pollution in China. This helped identify **carcinogenic** harmful chemicals that become a part of the water in China due to the factories and industries of these global clothing brands.

Environmentally friendly products

Whether in their industrial use or on a domestic level, if waste control is regulated from the start of the process itself, it would result in less overall waste products and by-products that might end up in the water. Choosing **PCB** free substances instead of those with chemical solvents, replacing plastic bags with environmentally friendly ones, or companies and institutions replacing the products they need to function with earth-friendly options, will all go a long way considering China's main occupation to be their production industry and their factories and products being one of the main sources of the country's overall economic status and growth.

Case Study 2 – India

A study conducted in 2007 found that the discharge of untreated sewage is the single most important source of pollution of ground and surface water in India. There is a huge gap between the generation and treatment of domestic waste water in India. The problem is not only that India lacks sufficient water treatment capacity but also that the sewage treatment plants that exist are either not maintained properly or are not in operation.

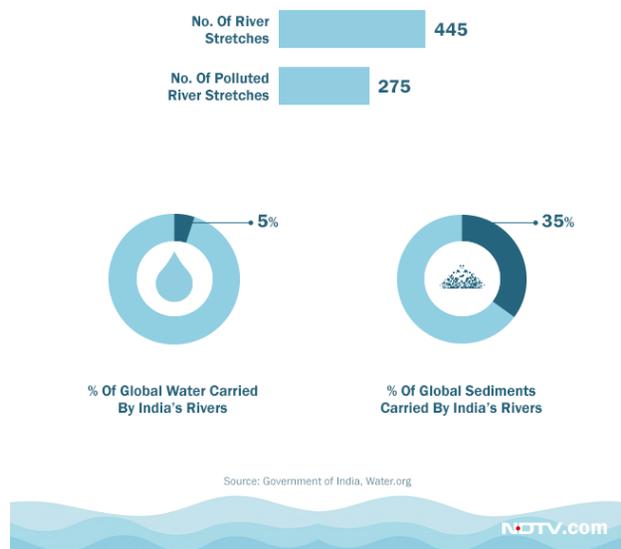
According to a report released by the Centre for Science and Environment (CSE), the cities in India produce approximately 40,000 million liters of sewage on a daily basis out of which only 20% or less is treated. This is further confirmed by a 2011 survey by the Central Pollution Control Board that only out of the 8000 towns in the country, 160 had both sewerage systems and a sewage treatment plant.

This untreated sewage seeps into groundwater, washes up in rivers lakes and streams and ends up in the ocean as well. Due to the leaching of sewage into groundwater, for example, laboratory tests revealed that nitrate levels were higher than the prescribed levels all across the country.

Water pollution is also prevalent there due to the waste runoff from the agricultural sector as well as units that are unregulated and belong to the small-scale industry not monitoring their wastes.

Furthermore however water pollution in India is also being attributed to the failure of the government to regulate the use of water in the country, which is already a large concern given that the country's annual consumption is expected to approximately double by the year 2050. ^{xvi}

INDIA'S DYING RIVERS | EXTENT OF POLLUTION



What Can Be Done?

Unanimous and consensual government reforms

A big problem in India is the division amongst governmental reforms across the country and failure to compliance in each individual state as well as a country as a whole. Environmentalists blame the inadequacy of the government in regulating and establishing strict laws that call for reform in different sectors related to the water pollution crisis in the country.

Increasing awareness

A large barrier to proper waste disposal is the lack of awareness in the Indian population in terms of how essential it is to properly dispose of waste as well as how and why preserving clean water is essential. A need for them to be educated on the matter of clean water supply and hygiene is essential, as well as health issues and diseases and prevention methods in regards to water pollution.

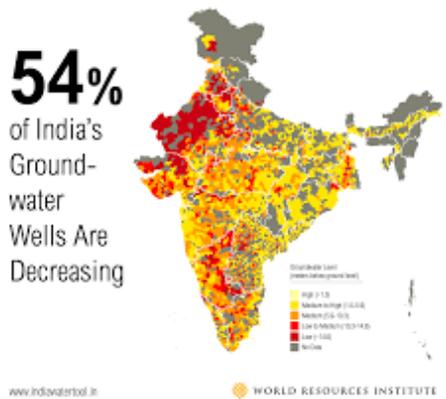
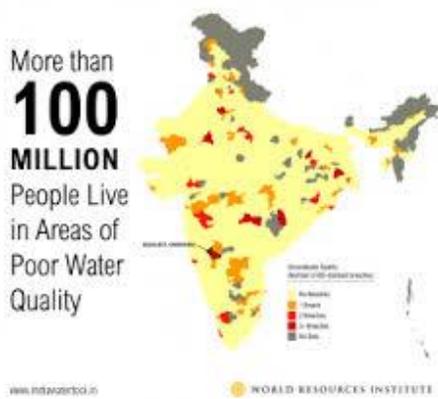
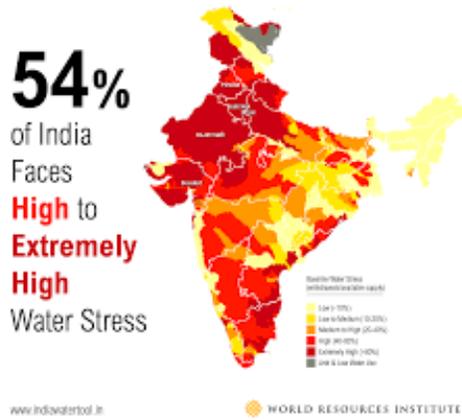
Increased sanitation facilities

The country's biggest problem infrastructure-wise is their lack of proper sanitation facilities across the nation. Around 564 million Indians (which constitutes nearly half their population) still defecate in the open; in forests/fields, along highways and next to ponds or on the beach, according to UNICEF. This is a great contributor to water pollution in the country and proper installation and accessibility to sanitation services would result in a significant reduction in the amount of wastes that make it into the water.

Managing agricultural based problems

Being a primarily agriculture-based country, agricultural issues such as leaching of pesticides and herbicides into the groundwater or seeping into riverbeds/river water is a primary concern for India. Steps can be taken to improve the environmental effects agriculture has on water sources, such as preventing soil erosion by planting trees in the coastal areas or near river banks to prevent water runoff and mitigate flooding during monsoon season, which ultimately helps water regulation and pollution. Implementing policies and regulated rules for the

agricultural sector to keep the use of their chemical compounds to a minimum as well as encouragement for using natural based fertilizers will also go a long way to help this issue.



Success Story:
January 2016, Duliajan, India

A research unit of the company Oil India successfully helped to reduce oil content in bodies of water at drilling pits, resulting in the water being conducive for aquatic and marine life once more. According to a statement by the **PSU**, '*For the first time, such an integrated approach of bio-remediating oil contamination in water bodies (effluent pits) has been tried out in Oil India (OIL)*'.



Oil spill in Mumbai

The process begun in the August of 2015, when Oil India began its initiative of 'Pilot Scale Bio-Remediation' which brought down the oil content in DEPs to a staggering level of 10**ppm** from 2,00,000ppm.^{xvi}

The company achieved this by using advanced technology to augment the rate of bio-degradation in floating oil next to the oil-drill pits, with the help of micro-organisms that naturally occur in the environment used in conjuncture with a bacterial species that is capable of rapid degradation of oil contamination in water.

The company also used internationally accepted standards and protocols to measure their progress.

According to the Central Pollution Control Board, the results obtained after measuring the toxicity of the treated water near the oil drills found that the levels of toxicity conformed to the Standards for Discharge of Environmental Pollutants.

Key Terms:

Poverty: the state of being extremely poor

Cancer Village: hot-spots of unusually high numbers of cancer victims in a village/area

PSU: Public Sector Undertaking, a state owned enterprise in India

Sanitary: relating to the conditions that affect hygiene and health, especially the supply of sewage facilities and clean drinking water

Mortality: the state of being subject to death/death rates

Eutrophication: the excessive richness of nutrients in a body of water such as a lake, frequently due to run-off from the land, which causes a dense growth of plant life in the body of water

Urbanization: the process of making an area more urban i.e. an increase in the populations of cities and towns

Carcinogenic: having the potential to cause cancer

PCB: (Polychlorinated biphenyls) an organic chlorine compound used as coolants and lubricants in transformers, capacitors, and other electrical equipment that build up in the environment that do not decompose, having harmful effects

PPM: Parts Per Million

Additional Sources:

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<http://www.unwater.org>

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