

Water Classroom 3-5 (version 2)

Water and Disasters

Teaching plan for learning on water for middle school students

Under a project initiated by the Living Waters Museum, Centre for Water Research, IISER Pune and Research and supported by Transforming Education for Sustainable Futures, IIHS, Bangalore

3-5-1 Proposed plan

Teaching Plan number	WC-3-5
Topic	Water and Disasters
Discipline	Social studies, biology
Time	85 mins (can be divided into multiple sessions)
Prior learning	It will be helpful if the students have completed topics on Water and Agriculture – 3-2(1 &2), Where does my water come from? – topic 1-2, Wastewater – topic 3-3 and Water and access – topics 2-2 and 2-3.
Learning Objectives	<ul style="list-style-type: none">● Students will be able to <i>define</i> hazards and disasters.● Students will <i>analyze</i> how disasters can influence water-related challenges
Learning Outcomes	<ul style="list-style-type: none">● Student can <i>list</i> water related disasters.● Students can <i>differentiate</i> between hazards and disasters.● Students can <i>point out</i> the impacts of water disasters on water quality, water quantity and water access in

	the future.
Materials/resources	Whiteboard/blackboard, PowerPoint slides, projector, 3-4 kinds of newspaper cuttings reporting about water-related disasters and different kinds of losses to property and life – in your city, in India or in the world.
Use of teaching time	<p>2-3 mins</p> <p>Educator/facilitator will introduce the topic to students.</p> <p>10-12 mins</p> <ul style="list-style-type: none"> - Educator/facilitator will ask students to name different kinds of disasters they are aware of; student will list out different kinds of disasters. Facilitator/educator may write these on the board. <p><i>Refer to Background content for educators/facilitators - section 3-5-2a. Students need NOT know or list all disasters.</i></p> <ul style="list-style-type: none"> - Facilitator/educator will ask the following question - If there is an earthquake in a remote desert and not a single house is destroyed, is it still a disaster? If Yes- Why and If No, Why not. (Answer – No) - They will use another example – Is a tsunami in middle of Indian Ocean a Hazard or a Disasters. - (Answer – No) - The facilitator/educator explains the difference between hazards and disasters.

Refer to Background content for educators/facilitators – 3-5-2a.

7-10 mins

Students will work in groups.

Facilitator/educator will give one newspaper cutting of a water-related hazard/disaster to each group.

Students will be asked to discuss and analyze whether it is a hazard or a disaster and why.

Facilitator/educator will ask one member of each group to present to the class in 1 min - the content of the newspaper cutting, whether it is a disaster or a hazard and why.

(Note – majority of the newspaper cuttings are about disasters unless they mention a hazard or a warning.)

10-12 min

Facilitator/educator will refer to WC-3-5-Activity-1 and confirm that students know how to read the map and legends (list that informs the reader what different notations or colours on the map refer to). If not, they will explain the map and the colours.

Then they will give students 7-10 mins to answer the questions on worksheet for WC-3-5-Activity-1.

5-8 mins

Facilitator/educator will discuss the answers.

For the question referring to how drought in Pune district

affects Pune city – facilitator/educator may prompt the students to relate it to topic 3-2(1 & 2) – how agricultural produce gets affected by changes in water quality/ quantity and how that affects the city.

This can be used to explore the interdependence between the city and its surrounding rural/ semi- rural areas for sustenance.

7-10 min

Facilitator/educator will introduce students to floods in Pune and to the historical Panshet flood of 1961?.

They will discuss the reasons why these floods occurred:

- the Panshet flood happened due to a human error in engineering and politics behind opening the dam gates.
- Other more recent floods in Pune have occurred due to natural reasons like cloudbursts (linked to climate change) as well as due to improper urban planning.

Refer to Background content for educator/facilitator – section 3-2-2b:case study 1.

Facilitator/educator may ask if there are man-made reasons that have also contributed to these floods in Pune, eg. the one in 2019 in the Ambil Odha stream. This can bring up the issues that even though weather and climate can be reasons for heavy and unexpected rainfall which may cause floods, improper urban planning due to building river embankments, covering nallas, allowing encroachments and construction on/ near the stream/ river banks etc. block the proper flow of

	<p>water along its watershed and into the rivers (see below).</p> <p>Facilitator may refer to the video from topic-1-2- Where does my water come from:</p> <p>https://www.youtube.com/watch?v=w_YfL9mYb8Q&list=PL_Fnbk2-zebmJpEd2rkK9BOQrxrTbRkv-&index=4&t=3s</p> <p>This video discusses how human activities blocking the watersheds of the nallas and the rivers in Pune can cause floods.</p> <p>10-15 mins</p> <p>Educator/facilitator will ask students to listen to the following audios and write down the impacts of the floods on water supply/systems.</p> <p>- Play for students Audio 2 and 3 from -</p> <p>https://punyachepaani.livingwatersmuseum.org/story/pune-paradox/</p> <p>Audio 2 is in Marathi – translation to English is appended.</p> <p>Students may choose to read this or it can be given as a homework.</p> <p>Audio 3 is in English.</p> <p>- Play for students this audio story from the 2019 Ambil Odha stream floods - A/V (in English)</p> <p>https://www.instagram.com/p/CaR9wWzlpqg/?hl=en</p> <p>10-15 mins</p> <p>Facilitator/educator will ask students to describe the impacts of the floods and list them out on the board. They will tune the</p>
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discussion to understand how one disaster can cascade into more disasters (related to water quality, quantity, access, sanitation, health, and social aspects).

Using case study 1 –

A flood can paradoxically lead to water scarcity (also noted in the audios) due to contamination of or damage to the water supply. Floods can also lead to problems with sanitation like breakage of sewer lines which cause health concerns from spread of waterborne diseases eg. diarrhoea, typhoid (refer to topic 3-3).

Disasters also bring to light the structural inequalities (refer to topic 2-2 and 2-3) and their effects on access to water and household management of water.

OR

Using case study 2 –

Refer to Background content for educator/facilitator – section 3-2-2b:case study 2.

Concerns post-tsunami can be diverse:

- a. Pollutants, microorganisms, debris - degradation of water filtration systems – foreign substances in water (contamination), broken pipes, power cuts.
- b. The threat of outbreaks of waterborne diseases such as diarrhoea, cholera, typhoid and hepatitis,
- c. (~Tsunami) Drinking brackish water - dehydration, aquifers become contaminated with sea water. A World

	<p>Health Organization (WHO) release two days after the event was typical: "Poor quality and quantity of water and insufficient sanitation, overcrowding and poor hygiene in temporary camps will bring forward the risk for outbreaks of different diarrhoeal diseases. Thorough and sustained water purification is an absolute priority."</p> <p>d. Water quality/filtration</p> <p>This case study can allow the facilitator/educator to discuss groundwater contamination and clear any misconceptions about what happens if seawater flows into rivers.</p>
Differentiation	<p>Depending on the time and the interest the discussion can be limited to floods (case study 1) or also include case study 2 about tsunami.</p> <p>We have suggested that several previous topics can intersect in the learning of this topic – this may or may not be referred to depending on the students' prior learning, time availability and other factors.</p>
Additional activities	<p>Listening to audios about floods or reading their translations or transcriptions can be given as homework.</p> <p>Reading case study 2 can be given as homework and can be discussed as mentioned above.</p>
Anticipated challenges and solutions	<p>Reading a map and legends is not something that students may be aware of. This can be discussed before WC-3-5-Activity-1.</p> <p>The discussion and learning will be student-driven –</p>

	<p>depending on how much they recall from the previous sessions. Facilitator/educator may keep some resources ready to use during the session or give them preparatory homework.</p> <p>Sometimes students are not clear that seawater does not flow up the rivers and therefore estuaries are not a direct source of potable water. Facilitator/educator may need to clarify this. They can use topic 4-1 – Climate and Water – to explain this and the water cycle.</p>
Keywords	<p>hazard, disaster, floods, Tsunami, loss, vulnerability, cloudbursts, climate change, encroachments, watershed, waterborne diseases, infrastructure</p>

3-5-2 Background content for the educator/facilitator:

3-5-2a Difference between a Hazard and a Disaster

Hazard - A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

Disaster - A process, phenomenon or human activity that causes loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

A hazard is any phenomenon that has the potential to cause destruction to life and property. A hazard becomes a disaster when the potential to cause destruction is fulfilled. When there is harm to the life and property of humans, the hazard is termed a disaster.

All disasters are hazards, but all hazards are not disasters.

Here are a few more examples:

- Heavy rainfall (Hazard) - Flood (Disaster)
- Lack of rainfall (Hazard) - Drought (Disaster)
- Earthquake (Hazard) - Earthquake causing damage (Disaster)

Different kinds of hazards that can lead to disasters -

- Geological - *Earthquake, Tsunami, Volcanic eruption, Landslide, Dam burst, Mine fire*
- Water and climate related - *Flood, Urban floods, Flash floods, Drought, Hailstorm, Avalanche, Cloudburst, Heat and cold wave, Tropical Cyclone, Hurricane/Tornados, Forest fire, Avalanche*
- Environmental - *Pollution, Deforestation, Desertification, Pest infection*

- Biological - *Human/ animal epidemic/ pandemic, pest infections*
- Chemical/ Industrial/ Nuclear ~ *related disasters, oil spills, fire*
- Others - *forest fires, mine flooding*

A chart of possible losses (vulnerabilities) due to a hazard, which would make it a disaster, can be found at -

<http://www.charim.net/methodology/53>

3-5-2b Case studies

Case study 1 - Floods in Pune (including 1961? Panshet flood)

<https://punyachepaani.livingwatersmuseum.org/story/pune-paradox/>

In the horizontal scroll section, use **Audio clips 2 and 3** for students.

Translation of Audio clip 2 – appended.

(audio interviews collected by Mukta Deodhar. Translated by Marathi club, IISER Pune and Mukta Deodhar.)

Another audio A/V clip about 2019 Ambil Odha floods -

<https://www.instagram.com/p/CaR9wWzlpqq/?hl=en>

Case study 2 - Tsunami in Indian Ocean

The earthquake that generated the great Indian Ocean tsunami of 2004 is estimated to have released the energy of 23,000 Hiroshima-type atomic bombs, according to the U.S.

Geological Survey (USGS). The earthquake that occurred on December 26, 2004 was an undersea earthquake that originated in the Indian Ocean off the West coast of Indonesia and generated tsunamis that were among the worst disasters in modern history. At a magnitude of 9.0, it was the largest earthquake since the 9.2 magnitude earthquake off Alaska in 1964.

The earthquake was the result of the sliding of the portion of the Earth's crust known as the

India plate under the section called the Burma plate. Tsunamis have been relatively rare in the Indian Ocean. They are most prevalent in the Pacific. The Indian Ocean tsunami caused waves as high as 50 feet (15 meters) in some places, according to news reports. The resulting tsunamis devastated the shores of Indonesia, Sri Lanka, India, Thailand and other countries. Tsunami waves even reached the East coast of Africa some 2800 miles away from the epicenter!

Tsunami waves poisoned the fresh water supplies and the soil by salt water infiltration and deposition of a salt layer over arable land. It has been reported that in the Maldives, 16 to 17 coral reef atolls that were overcome by sea waves are totally without fresh water and could be rendered inhabitable for decades. Uncountable wells that served communities were invaded by sea, sand and earth; and aquifers were invaded through porous rock. Salted-over soil becomes sterile, and it is difficult and costly to restore this soil to make it fit for agriculture again. It also causes the death of plants and important soil microorganisms.

The flood waters of the Tsunami contaminated water supply systems and in many cases destroyed them. Millions of people still lack safe water and are at risk of potentially deadly water borne diseases like cholera, diarrhea, malaria and typhoid because of the tsunami. With over 150,000 people dead from the Tsunami, waterborne epidemics or outbreaks are a major concern (WHO, 2004). After the 2004 Indian Ocean tsunami, contaminated water supplies and destruction of infrastructure threatened the lives of many survivors of the disaster. The tsunami impacted water quality by flooding septic tanks and causing their contents to contaminate ground and surface water. Seawater also penetrated into groundwater tables, making the water unfit for human consumption. The tsunami also destroyed rural water supply systems across the region.

The impact of the Asian Tsunami related to people's access to water can be described in three time frames: immediate, medium-term and long-term. Immediate impacts include physical destruction of water and wastewater treatment plants, supply pipes and sewers.

Some plants not physically destroyed can be severely affected by power failures and worker unavailability. Immediate impacts include cross contamination of water supplies, salt and silt in supply sources makes water unusable for consumption and possible contaminations from biological (human and animal corpses, dead vegetation etc) sources. Aquifer contamination by salt water is one of the severe long-term impacts and also the most difficult to treat. Other long-term impacts may include pollution from chemical and oil spills. The United Nations Environment Program (UNEP) estimated that the recent Indian Ocean tsunami extensively damaged Indonesia's coastal environment, causing 675 million dollars in losses to natural habitats and important ecosystem functions.

References:

https://www.researchgate.net/publication/233711193_Impact_of_Tsunami_Disaster_on_the_Water_Environment
<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.883.9829&rep=rep1&type=pdf>
<https://punyachepaani.livingwatersmuseum.org/story/pune-paradox/>

Water classrooms WC-3-5-ACTIVITY-1

Student Name: _____

Class: _____

Date: _____

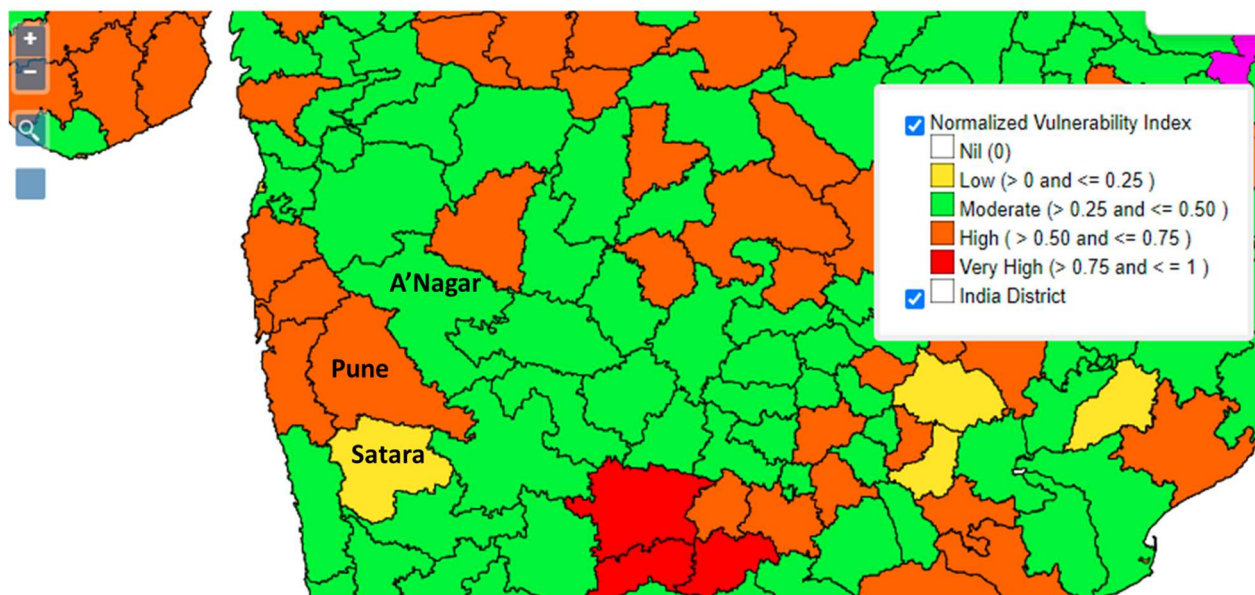
The (partial) map of India shows different districts and their vulnerability to drought.

Three districts are labeled - Pune, Satara, Ahmednagar (A'Nagar).

For this exercise, we assume that rainfall and water management is similar in the three districts. Compare the colours of the districts to the suggested levels of vulnerability given in the white box (nil, low, moderate, high, very high) and answer the questions below.

The image is downloaded on 28 July 2022 from

<https://imd pune.gov.in/hazardatlas/droughtnew.html>



1. Rate district vulnerability to drought? _____ > _____ > _____
2. In case of no rainfall, which district may suffer the most? _____

(contd. on next page)

3. Which district is likely to need the best disaster management? _____
4. Will vulnerability to drought influence the efforts needed for water management?
- a. Yes
 - b. No

Give reasons:

5. How do you think Pune gets affected when there is drought in the semi-rural/ rural areas around Pune?