

Global Precipitation Measurement Mission

Expert Group- Freshwater Resources in Pakistan

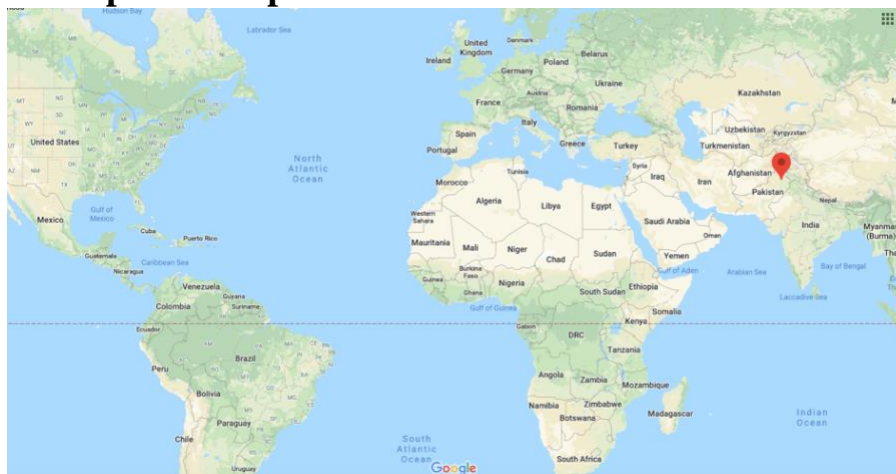


Figure 1: Location of Sargodha, Pakistan. Developed using [Google Maps](#)

When you turn on your faucet and get water, have you ever wondered where that water comes from? In the United States, most of our water is delivered through a public supplier such as the local county water department. These water suppliers get the water from either a groundwater source, such as a well, or from a surface-water resource, such as a river, lake, or reservoir. In some locations, especially rural communities, people may get their water from wells. In the U.S., the average person uses about 300 to 374 liters/80 to 100 gallons per day for indoor home uses. You can see about how much water you are using in your home through [this](#) form.

Today, Pakistan does not have enough freshwater resources to meet the needs of all the people who live there. It is known as a “water scarce” country, and freshwater availability is less than 0.001 liter/0.00026 gallon per person per day. There are many reasons for this freshwater scarcity. One of the reasons is that water management has not been a big focus of the government until recently. Agriculture is the biggest water user in Pakistan, and about 90% of the crops use irrigation, rather than relying on rainfall, to water their crops.



Figure 2: By [Openstreetmap contributors](#)

Pakistan’s main freshwater source for irrigation is the Indus Basin System. A “river basin” is land that the water in the area runs into, similar to a “watershed”. This river basin system irrigates over 45 million acres of farm land throughout the country. The Indus River is one of the longest rivers in Asia, and it runs from the far northern part of the country down to the Indian Ocean. The blue line shows us where the Indus river is located.

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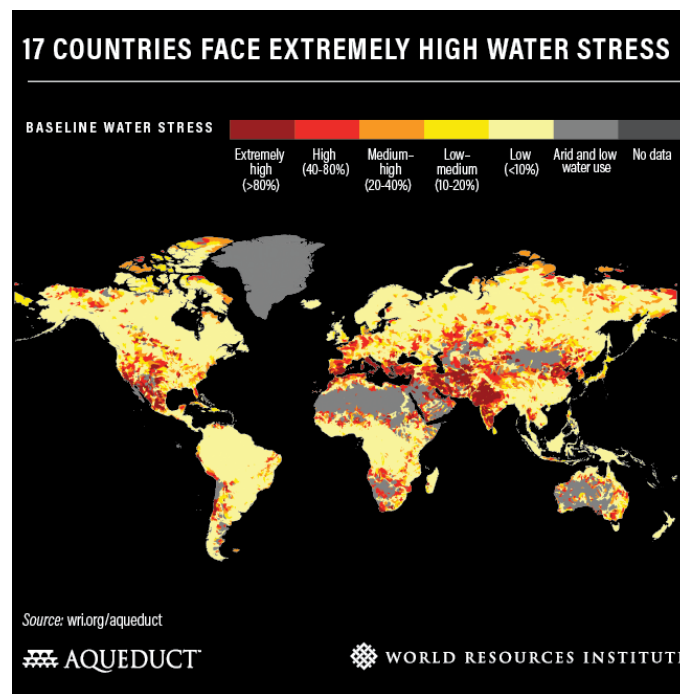


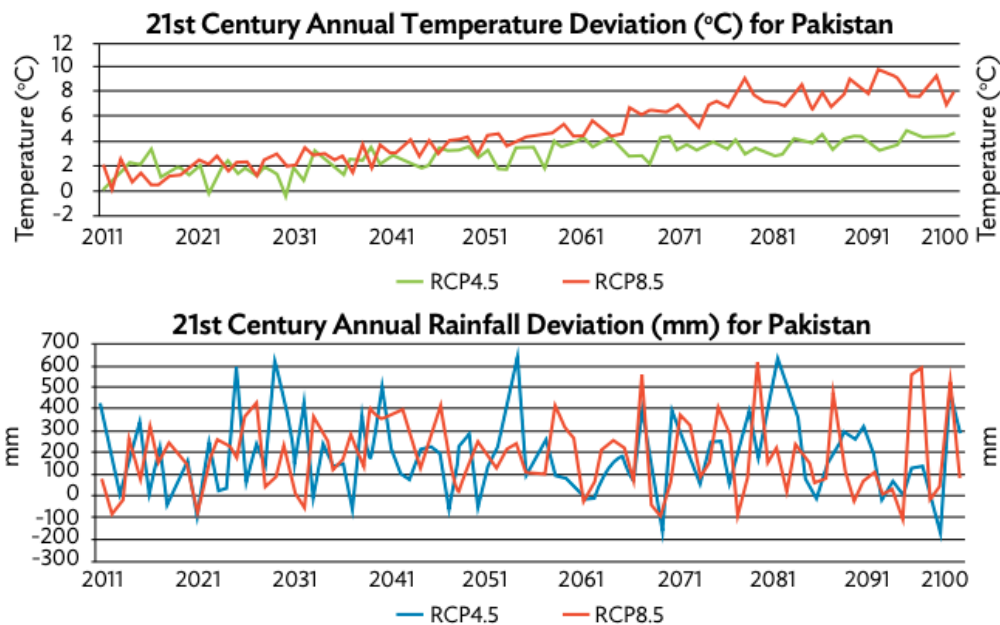
Figure 3: Countries Facing Lack of Freshwater Resources/ Image credit: WRI

The figure above shows which locations around the world are facing problems with not having enough freshwater resources. You can see that Pakistan falls into the dark red, meaning it is a country with extremely high “water stress”. That is another way of saying that there isn’t enough freshwater for people in that country to have access to enough freshwater to meet their needs. As you have probably noticed, some places in the world get a lot of precipitation, whereas other countries don’t get enough.

There are many impacts of having either too much or too little precipitation. Watch the video “[Where the Rain Falls](#)” (11:45) to learn how rainfall variability, food security, and migration interact. While this video is not focusing specifically on Pakistan, we can gain a larger perspective for the impact of precipitation and the inequitable availability of freshwater resources on developing countries. You can learn more about this issue [here](#).

Climate change will impact freshwater availability in Pakistan in the future. Climate change is primarily due to the increase in the concentration of greenhouse gases (GHGs) like carbon dioxide, methane and nitrous oxide through anthropogenic (human) activities. These gases trap the sunlight and increase the earth’s overall temperature. The National Climate Change Policy (NCCP) of 2012 has stated that there is anticipated to be a “considerable increase in the frequency and intensity of extreme weather events, coupled with erratic monsoon rains causing frequent and intense floods and droughts”. The graph below shows two potential climate change projections and indicates how each of these would impact both temperature and precipitation in Pakistan. This higher temperature may negatively affect the growth process of wheat and hence decreases the productivity of wheat.

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mm = millimeter, RCP4.5 and RCP8.5= Representative Concentration Pathways (RCPs) are emission IPCC AR5 scenarios. RCP4.5 is a stabilization scenario where greenhouse gas emissions stabilize by 2100. In RCP8.5 radiative forcing does not peak by year 2100.

Source: Pakistan Meteorological Department. 2015. High Resolution Climate Scenarios. http://www.pmd.gov.pk/rnd/rndweb/rnd_new/climchange_ar5.php

Figure 3: *Pakistan's Mean Annual Temperature and Precipitation Deviation*

Some of the reasons that farmers are facing a shortage of freshwater for irrigation include dated farming methods, reduced water availability, dam silting, and an increasing population in the catchment areas. Pakistan is the sixth most populated country in the world, with a population of 184.5 million people. At the current average annual population growth rate of 2%, it is projected to be the fifth most populous country by 2050. The rivers which feed into the Indus river basin have reduced the per person water availability from 5,000 cubic meters in 1951 to less than 1,000 cubic liters in 2010. Today over 85% of Pakistan's wheat production is dependent upon irrigated water.

The WRI (World Resources Institute) found that one of the best ways to reduce the use of valuable freshwater resources is to increase agricultural *efficiency*, meaning finding ways for farmers to plan ahead and be very careful with how much water they use. Farmers can reduce their use of freshwater on their crops by using "*precision watering*". There are many engineers working around the world to develop technologies that improve farmers access to precipitation data. Dr. Hossain Faisal, a Civil & Environmental Engineering professor at University of Washington, is using data from one of NASA's Earth observing satellite missions to do just that. You will learn more about him and his work later in this lesson.

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