Thirst

Module 9 • i2P • H2O Tour

"When the well is dry, we know the worth of water."

- Benjamin Franklin, (1706-1790), Poor Richard's Almanac, 1746

THIRST

One must be watchful running across a desert for fear of becoming dehydrated. Careful planning is necessary to ensure that one can find sources of clean drinking water along the route. This is particularly so in a country such as Tunisia where there's a scarcity of water resources. As such, when Ray and i2P team cross the Tunisian desert in the spring of 2010, the adventurers will be accompanied by Land Rovers with stores of drinking water in case of emergency. i2P runners must drink regularly to ensure hydration since actively exercising athletes do not always experience the sensation of thirst in time to avoid dehydration (see Ray's experience in Death Valley: Module 3).

What causes the sensation of thirst?

Thirst is the complex interaction of a number of physiologic processes triggered by a variety of factors that ultimately lead to the conscious sensation of thirst. The genesis of the sensation of thirst can involve the kidneys, the heart, the blood vessels and the brain. There are thought to be 4 principle physiologic triggers for thirst (see: physiology of thirst):

- Low blood pressure in the arteries (hypotension);
- Low blood volume in the great veins and the heart(hypovolemia);
- High cell salt content in the brain (hypertonicity);
- Low blood pressure to the kidneys (renal hypotension).

We all experience thirst many times a day, yet few stop to consider what causes the sensation to occur. Many people are simply too busy being thirsty to consider how the feeling is produced. In countries like Canada, which has more water per capita that almost any other country in the world, the sense of thirst is a readily satisfied feeling; a passing sensation by virtue of the prevalence of water. This cannot be said for many parts of the world were

Did You Know?

Listed are the countries with the worlds richest water resources according to the Water Poverty Index.

1. Finland
2. Canada
3. Iceland
4. Norway
5. Guyana
6. Suriname
7. Austria
8. Ireland
9. Sweden
10. Switzerland.

Figure 1: Average water use per person per nation (source: United Nations Human Development Report).

people must live with, and endure thirst on a regular and ongoing basis. Thirst can be a way of life. Places in the world where people go thirsty are said to suffer from *water insecurity.*

Student Activity

For a one day period track the total amount of water you used.

Submit online survey.

World Domestic Water Usage

Every day people around the world use water for sanitation, bathing, cooking and drinking. Water used for these purposes is called domestic water. To meet these basic domestic needs an individual requires between 20 and 50 liters of water a day (see: United Nations water). But daily water use in different countries varies greatly around the world. An average person in North America, for example, will use 105.7 gallons (400 liters) of water per day while a person in Europe uses an average of 52.3 gallons (200 liters) of water per day. This means that Europeans and North Americans use 4-8 times the amount of water that is needed for basic daily requirements. In contrast, in many developing countries, the average daily water use per person can fall well below the water poverty threshold of 20 liters a day (see: global water use).

Water Scarcity

The United Nations estimates that there are 1.1 billion people in the world who live below the water poverty line of 20 liters of water a day. As water resources become increasingly more scarce, the number of people that will be living with water poverty is expected to rise in the coming years. There are two principle causes of water scarcity:

- Economic water scarcity;
- Physical water scarcity.

Did You Know?

Toilet statistics.

Most standard flush toilets use 3.6 liters of water. Toilets consume on average 25% of domestic water use in the United States.

In the United Kingdom the average person uses more than 50 liters of water a day flushing toilets—more than 10 times the total water available to people lacking access to an improved water source in much of rural Sub-Saharan Africa.

Figure 2: Flushing toilets consumes a lot of water (source:Wikimedia Commons).

Economic water scarcity is found in impoverished countries where people cannot afford to purchase water, or create infrastructure to provide clean water. Economic water scarcity is found predominantly in poor developing countries in sub-Saharan Africa, while pockets are found in South East Asia and South America (see figure 2). In these nations water itself may not always be scarce, but a means of obtaining clean water might be. What occurs, in practical terms, is that people faced with economic water scarcity must often walk great distances to obtain water from a dirty well or culvert. The scarcity of clean water in these countries

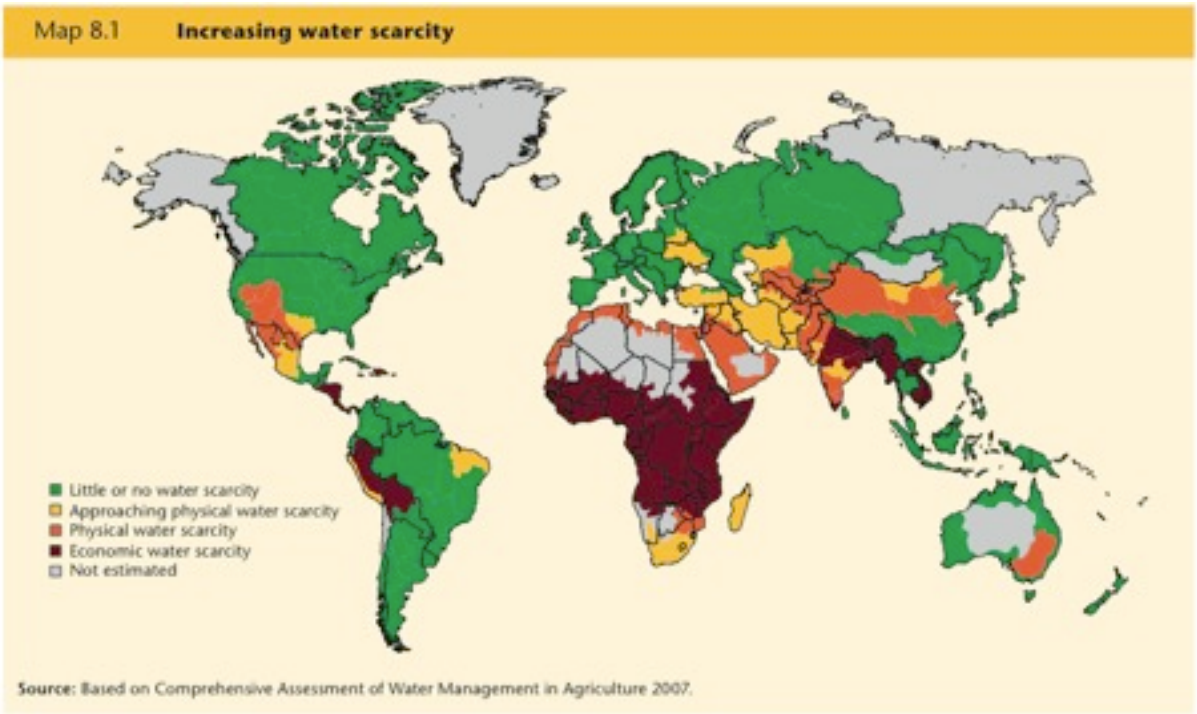

Figure 2: World water scarcity, physical & economic (source: United Nations water report 2009)

often means inflated prices with the cost of water often being 5 to 10 times greater in developing nations than in wealthy ones.

> Did You Know?
> Homeowners in Washington, DC, pay about $350 (72Â¢ per cubic meter) for that amount. Buying that same amount of water from a vendor in the slums of Guatemala City would cost more than $1,700.

Physical water scarcity is found in regions that are running out of fresh water resources. Physical water scarcity is found in countries such as Tunisia,the nations of North Africa and the Middle East where fresh water resources are seriously limited.(see: figure 2). Other regions faced with physical water scarcity are some of the most populous in the world, including northern China, central Asia, India and the American South West.

The Water Crisis: Prevalence

Less than 1% of the world's fresh water (or about 0.007% of all water on earth) is readily accessible for direct safe human use without treatment or sanitization. To compound this problem of limited supply to fresh water, there is inadequate access to water sanitation and waste disposal for 2.5 billion people. Without proper sewage disposal, clean water can be contaminated by untreated effluent. Lack of fresh water combined with poor sanitization contributes to inadequate access to safe drinking water for about 884 million people (one in eight people). Many countries, among them Tunisia, have a significant population of people whose only source of water is contaminated, a situation that long ago reached crisis proportions worldwide (see table 1).

Illness

Water poverty and limited access to clean water causes many problems, among them:

- Hunger from decreased agricultural yields.
- Overuse of groundwater resources.
- Pollution of limited water resources.
- Interference with education.
- Regional conflict and war.

Arguably, however, the most troubling consequence of clean

Table 1: Rates of contaminated water use by country

Country	Number of people in millions whose source of water is contaminated
Sudan	12.3
Venezuela	5.0
Zimbabwe	2.7
Tunisia	2.1
Cuba	1.2

water shortages is the cost in human life resulting from water-born disease. 3.6 million people die each year from water-related illness; 43% of these water-related deaths are due to diarrhea and 98% of water-related deaths occur in the developing world. The water crisis causes such significant illness that half of the world's hospital beds are occupied by patients who have been hospitalized due to water-related illness. The demographic hardest hit by water born illness is children; every 15 seconds a child dies from a water-related disease. 84% of water-related deaths are in children ages 14 and under, and waterborne diseases are the leading cause of death in the world for children under age five.

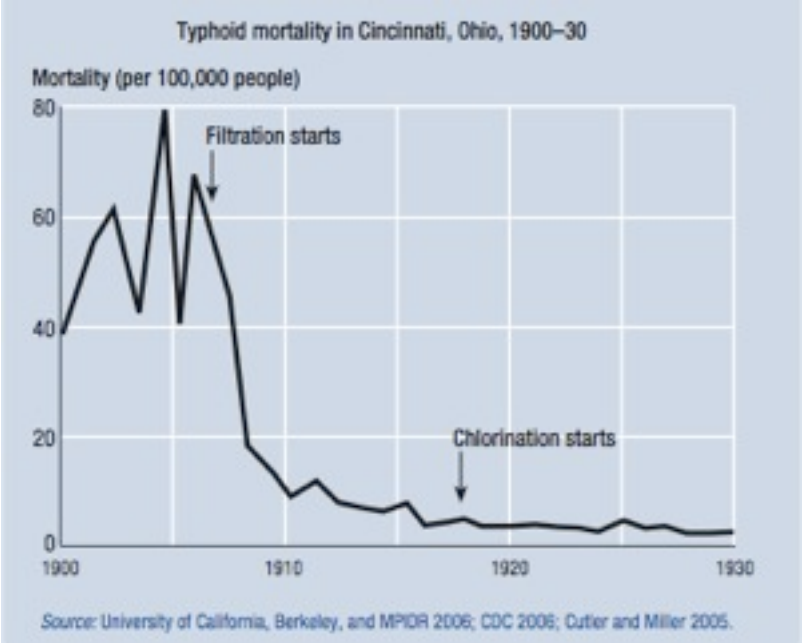

Figure 2: Typhoid Mortality in Cincinnati before and after water filtration and treatment implementation (source: United Nations Human Development Report)

The relationship between water born illness and dirty water has been demonstrated time and again. In the developed world the incidence of death from typhoid and other water-born disease fell dramatically with the advent of water filtration and municipal water treatment. This is evidenced in the virtual elimination of typhoid mortality in Cincinnati Ohio about 100 years ago when water filtration and treatment was introduced. Similar reductions in mortality from water-born illnesses have been witnessed wherever water treatment systems have been instituted. This is why the vast majority of deaths from water born illness today occur in the developing world where an estimated 1.1 billion people do not have access to clean drinking water.

Investing in the Future

As evidenced by the impact of municipal water treatment on water-born disease in Cincinnati, many of the negative effects of the world water crisis would be positively influenced by improved sanitation. For example, investing in drinking water and

sanitation could result in 272 million school attendance days a year, 1.5 billion healthy days for children under five years of age, $3.6 billion a year in earnings from those whose deaths would be prevented and health-care savings of $340 million and $7 billion a year for individuals and health agencies, respectively. Although some may argue that it would be expensive to implement the changes necessary for positive outcomes, some organizations suggest that investing in water and sanitation would lead to economic returns on top of the desired health benefits. The forecasters have indicated that the investment of $11.3 billion per year is needed to meet drinking water and sanitation

Figure 4: Cracked and dry earth (source: Wikimedia Commons)

goals in much of the developing world would result in a return of $84 billion a year based on an average economic return of eight US dollars for every one dollar invested.

Innovation

Although the cleaning of existing water resources will help improve water access for those with access to contaminated water sources (economic water scarcity), but will not assist those countries facing physical water scarcity. In Tunisia and other North African countries where there is limited fresh water renewal, the groundwater resources are being depleted with bleak predictions for water shortages to worsen. Technology exists that desalinates sea water to fresh water but this technology is prohibitively expensive, often out of the fiscal reach of many developing countries.

A University of Ottawa chemical engineering student named Rasool Qtaisha may have invented an economically viable means of desalinating seawater. Mr. Qtaisha, a Jordanian native and is well acquainted with water shortages, has now invented a desalination process that is 600 - 700% more efficient than current technology (see: desalination innovation). This would result in a remarkable savings in fresh water production cost and make the process more affordable for many developing nations. This may provide some hope for thirsty developing nations now facing dwindling water resources.