ENVIRONMENTALLY SPEAKING

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Drip, drip, drip: where is the water?

During times when many of us have our minds on matters conceivably much more critical than environmental ones, it is difficult to concentrate on the more mundane matters of clean water and clean air. Unfortunately, while our nation's attention seems fully consumed with the whereabouts of bin Laden and the anthrax perpetrator(s), water and air continues to be overused and/or contaminated. In reflecting on this odd state of affairs, we begin to understand how easily it is for us to forget about one of the basic necessities of humanity — clean water.

Considering that water constitutes about 60 percent of our body weight, it is not surprising that it is a critical resource to human beings. (Even larger percentages of water are found various parts of the body: the human brain (70 percent); blood (82 percent); and, lungs (90 percent).) Given its material chemical importance, it is no wonder that we have to replenish our individual water content on a regular basis. On a collective basis we also need huge volumes of water to "feed" our agricultural needs, such as corn, soybeans, cows, etc. Seeing how reliant humans are upon water, it would appear that we would be much more informed about its distribution and availability.

On a global basis fresh water only makes up a very small amount of all water accessible. Most water on Earth is in the oceans (97 percent). The remaining portion (~3 percent) is in frozen (in glaciers) or is below the land surface, i.e., groundwater found in aquifers. Amazingly all the water in lakes, inland seas, rivers, and the atmosphere amounts to only 0.023 percent (or two-parts per ten-thousand) of all the water on our planet. Of the fresh water available to us, 72 percent is frozen, which leaves 22 percent remaining in our aquifers and 6 percent in our lakes; only a trace can be found in rivers and our atmosphere. More significant to us, 95 percent of the available fresh water in the United States is underground. Obviously then, assuming that we aren't going to melt semi-permanent mountain or polar glaciers (something that would exacerbate "global warming"), the availability of this most important of human resources is restricted to that which we can obtain through extraction from underground or that which we can secure via reservoirs, lakes, etc.

Water has been referred to as the most "taken-for-granted" resource. In almost every American home, if one wants water one only needs to turn the faucet. Something very significant belies this apparent overabundance of liquid water (H_2O) in our surroundings. Namely, the vast majority of the water on the Earth isn't consumable by humans in its present form — largely because it has way too much salt. In fact, even the water that isn't overly salty is "tied-up" in glaciers and thus not of much use to us in our daily rituals — such as clothes washing and bathing. What is left to use then? Well, not very much, and that which is left is very unevenly distributed geographically and, thus, politically. Hence, the near future may be a time when nation states fight over water as much, or more so, than they now do oil.

In our relatively recent history, there are many reasons to think that, as a resource, water is a serious political and human rights concern. Consider that 1 billion (1,000,000,000) people on Earth (about 15 percent of the modern human population) don't have access to clean drinking water and 2.5 billion still do not have access to adequate sanitation (Gleick). Israel, Jordan and Syria have been involved in many clashes over the past 40 years over the "allocation, control and diversion of the Yarmouk and Jordan rivers" (Gleick). Since the late 1960s, Israel has also controlled nearly every last drop of water from the West Bank and Gaza Strip, leaving the Palestinians "parched" and dependant on "equitable" Israeli governance for its own well-being. India and Pakistan were involved in many conflicts over rights to the waters of the Indus River Valley during the middle of the 20th century; a 1960 treaty resolved these disputes rather peacefully however. In the U.S., the water from the Ogallala aquifer, one of the largest in the world stretching from southern South Dakota to southern New Mexico, has fueled the agricultural boom of the 20th century via irrigation projects. Recent water losses from this aquifer, which have been on a yearly basis equivalent in volume to 2 percent of Lake Erie, have many farmers currently wondering about the sustainability of their "modern" agricultural practices.

Clean water can also be a serious health issue. Many of us in the United States take for granted that the potable water from our taps, hoses, and faucets is free of noxious elements. Our tap water is potable because it has been treated and cleansed of dangerous bacteria and most chemicals. In our society, "clean" water can be obtained relatively easily, thus, it is rare that any one of us has to deal with the problems associated with "dirty" water — dirty here referring to water contaminated with high levels of toxic materials or laden with diseases such as cholera or typhoid. According to a recent United Nations report, waterborne contagions around the world are responsible for the deaths of ~15,000 children every **day** — a terribly demoralizing statistic when one considers that almost all of these are preventable. Society needs to take a long look at making clean water a basic human right.

And even though our local tap water is free of the above problems, many people seem queasy about drinking it. Stores are well-stocked with a litany of different bottled water options, including spring, mineral, sparkling, seltzer, purified, and distilled forms, and television commercials make clear associations between bottled water and health and freshness. Yet, many consumers, according to Lui Spinillo of the Galesburg Water Department, don't realize that tap water from municipalities undergoes more stringent tests than bottled waters. Additionally, tap water often has fluoride to prevent tooth decay and many important minerals that are often taken out of bottled water, such as potassium, calcium and magnesium. Further, and perhaps most impressively, tap water comes at a greatly reduced cost to the consumer. A typical gallon of bottled water in the store costs approximately the same as 1,000 gallons of Galesburg municipal water; Galesburg's tap water comes from a rich aquifer some 32 miles west of town under the Mississippi River. But it isn't surprising that consumers get confused when bottled water comes in so many forms and is so well-publicized.

Yet while we are largely reliant on groundwater for our water needs, the water below the surface is continually being subjected to many forms of pollution. Many agricultural products once applied to fields, particularly fertilizers and pesticides, leach down through the soil and make their way ultimately into our groundwater. Nearly 25 percent of the 1.4 million underground tanks found in North America which contain gasoline and other hazardous substances are thought to be leaking at this very moment. Over a third of the 20 million septic tanks are also thought to be operating improperly and, thereby, contaminating groundwater with bacteria, nitrates, and other toxic agents. Amazingly, 90 percent of all landfills (i.e., the "mysterious" place that our garbage ends up) in North America do not have liners to stop leachate from seeping into the groundwater; worse yet, 60 percent of all landfills do not have restrictions on the waste that they accept (Enger & Smith). Seemingly, we are bombarding our precious resource with a regular input of poisons of many varieties.

So with all these revealed problems surrounding water, what can the average person do to conserve it and thereby reduce the associated byproducts of wasting fresh water? Well there are many simple things that can help. Agriculture consumes the greatest amount of water of all human activities and while it takes about 175 gallons of water to produce a pound of corn (largely due to inefficiencies in the farming process), "a pound of beef requires the use of between 2,000 and 8,500 gallons" of water (Gleick). Obviously, changing one's diet from one heavily dependant on meats to one much more focussed on vegetables and fruits is a major way to reduce water use. Every gallon of gasoline at the fill-up station requires "hundreds of gallons of water ...to produce, deliver and sell" it (Gleick). So cutting back on your commuting (or driving a much more energy-efficient automobile) is one of the simplest ways to cut back on water use. Most shower heads release about 4 gallons

per minute, but low flow heads (which can be obtained from any hardware store) release no more than 1.6 gallons per minute, without compromising one's ability to get clean. Over the course of a year, this small change amounts to over 6,000 gallons of water saved per person! Older (pre-1990) toilets literally flush 6 gallons right down the drain. Newer toilets are mandated by Congress to require only 1.6 gallons per flush. Again, over the course of a year, the use of newer toilets saves more than 5,000 gallons of water per person. So perhaps for the holidays everyone should ask for a low flow shower head, a toilet bowl, and a bag of rice. Unfortunately, such idealism seems reserved for fiction. Who knows though, this is the 21st century.

On a national level, more substantive changes will need to be considered to avert future shortages. Among the changes proposed, conservation is a key player. The agricultural methods that rely heavily on irrigation for support can be made much more efficient by reducing evaporative loss and runoff. The increased purchase and use of water-efficient machines appliances, particularly automobiles, washing machines and dishwashers, can also make a substantial contribution to conservation. Through the use of wastewater (or the water that gets washed down the drain during dishwashing, teeth brushing, etc.; a/k/a., grey water) for agricultural irrigation, many countries are reducing the draw on limited aquifer sources. Israel is treating and using 70 percent of its wastewater for irrigating nonfood crops with great success (Gleick). Lastly, a few nations, especially those with very limited access to groundwater, have made great strides in the process of desalination (i.e., the removal of salt from ocean water). This process is well-developed but still prohibitively expensive for the vast majority of people on Earth, but may become more feasible as renewable energy sources, such as solar and wind, become more widespread. These efforts represent a starting point for humans willing to take our water resources more seriously in order to avoid future international conflict and instability, something all of us surely desire.

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* Enger, E.D. & B.F. Smith (2000) *Environmental Science: A Study of Interrelationships.* Boston: McGraw Hill.

* Gleick, P.H. (2001) "Making Every Drop Count." *Scientific American*, 284 (2): 41-45.