Fresh Solutions

Supplementary Materials

Desalination

Global water use has tripled in the last 50 years and demands for water are increasing due to population growth and increased demands from agriculture, industry, and households.

Desalination of salt water is a way to generate freshwater in places with inadequate supplies and is increasingly used to meet demands for water, especially in drier climates. Desalination removes salt from seawater resulting in drinkable water and salt residue. The left over salt is typically discarded and diluted before being released back into the sea. Water can be desalinized either by heating it under extremely hot temperatures (called distillation), or by forcing water through a filter under a high amount of pressure (called reverse osmosis).

The desalination process requires a lot of energy, which emits greenhouse gases into the atmosphere if that energy comes from fossil fuels. In California, it actually takes less energy to transport water to San Diego from the mountains of Northern California than it does to desalinate water in San Diego itself![1] In addition, desalination plants are expensive to operate and can cost hundreds of millions of dollars to build.

Desalination technology has improved greatly in the past 20 years and the costs are than one-fifth what they were in the 1990's. This is in large part due to improved reverse osmosis technology that has significantly reduced the energy needed to desalinate a gallon of water.[2]

However, people may perceive desalination as easier than saving water or changing habits and lifestyles. In California for example, a study by the Pacific Institute found that smarter water management and water recycling could save enough water for 125 desal plants![3]

The bright side is that earth has plentiful salt water! Desalination can provide a reliable source of water to dry areas and in some places it is the only way to provide adequate freshwater. Freshwater from desalination doesn't compete with surface water supplies available for other animals and ecosystems. However, disposal of the salt residue left over from desalination can be troublesome and can pollute marine ecosystems.[4]

To learn about other solutions to global water issues, read more at **Fresh Solutions**.

[1] Little, Amanda (July 22, 2015)
[2] World Business Council for Sustainable Development (2009)
[3] The Pacific Institute and the Natural Resources Defense Council (2014)
[4] KQED Science (March 30, 2015)

Weighing the Benefits and Drawbacks of Desalination

For a complex problem, we need to evaluate how a solution fares across multiple dimensions:	Benefits	Drawbacks
Environmental Factors		
Social & Cultural Factors		
Economic Factors		

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Weighing the Benefits and Drawbacks of Desalination

For a complex problem, we need to evaluate how a solution fares across multiple dimensions:	Benefits	Drawbacks
Environmental Factors	• The earth has plenty of salt water. • By making our own freshwater, we save lakes and rivers for other animals and plants.	• What do we do with all the salt that ends up as a waste product? • Uses a lot of energy, so we are using fossil fuels and releasing carbon into the atmosphere. • Sea life may be harmed near intake/output pipes.
Social & Cultural Factors	• Reliable supply of water for places that are always dry, like Israel. • May be easier to make more freshwater than convince people to change behavior.[3] • Could solve our freshwater needs.	• May make people less likely to reduce their water use • Large building and pipes might be an eyesore (*Not in **my** backyard!*)
Economic Factors	• Technology is getting better and better, so costs are going down.[1] • Provides jobs for people in construction, and then to run the plant.	• Expensive to build. • Expensive to operate each year—cost of energy to run the plant. • Water bills for people might go up. • Some plants will close if they don't have "business" during wet years.

Additional resources

KQED: Why isn't desalination the answer to all California's water problems?
Public Radio International: We're running out of water. Is desalination the answer?
LA Times Editorial Board: In Huntington Beach, a desalination plant that makes sense
Teacher tip: *Discuss with your students how an editorial or "op-ed" is different than other journalism found in the newspaper.*

Fresh Solutions

Supplementary Materials

Drip Irrigation

Globally 70 percent of freshwater is used for agriculture, to grow the food we eat and the cotton we wear. But the amount of water it takes to grow crops depends on the different practices used on farms.

A lot of farmers use sprinklers to irrigate crops, and this kind of irrigation wastes a great deal of water. If you've ever watered your garden or yard with a sprinkler on a sunny day, you can see water evaporate above the sprinkler—that's water that won't make it to the soil where it's needed.

There are different ways to irrigate crops that can save water. 'Drip irrigation' delivers small amounts of water directly to the soil where the plant is grown and is more efficient than conventional sprinklers. A drip irrigation system can be a series of water hoses with small holes in them that deliver small amounts of water where it is needed. Drip irrigation minimizes water loss from evaporation and runoff, and uses 20 to 50 percent less water than conventional sprinklers.[1]

Drip irrigation systems can cost a lot of money upfront, but also have the potential to increase crop yields[2], which benefits farmers in the long run. Some farmers have been using drip irrigation technology with sensors that tell the farmer where there are dry spots. Farmers can use these sensors to water fields precisely where water is needed.

To learn about other solutions to global water issues, read more at **Fresh Solutions**.

[1] U.S. EPA Water Sense (Accessed November 11, 2015)
[2] Fishman, Charles (August, 2015)

Weighing the Benefits and Drawbacks of Drip Irrigation

For a complex problem, we need to evaluate how a solution fares across multiple dimensions:	Benefits	Drawbacks
Environmental Factors		
Social & Cultural Factors		
Economic Factors		

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Supplementary Materials

Weighing the Benefits and Drawbacks of Drip Irrigation

For a complex problem, we need to evaluate how a solution fares across multiple dimensions:	Benefits	Drawbacks
Environmental Factors	• Reduces groundwater use for agriculture. • Leaves more surface water for other animals and ecosystems.	• Irrigation uses a lot of groundwater, which takes many years to replenish.
Social & Cultural Factors	• Drip irrigation with remote sensors can save farmers time by telling them precisely where water is needed.	
Economic Factors	• Reduce the water costs of irrigation. • Better crop yields means more income for farmers.	• Large upfront cost to drip irrigation infrastructure.

Additional Resources

Check out how much water it takes to produce different kinds of food at Waterfootprint.org
U.S. Environmental Protection Agency Water Sense: Water-Saving Technologies
New York Times Opinion: How California Is Winning the Drought
ENSIA: How to grow more food with less water