

COMMONWEALTH OF AUSTRALIA

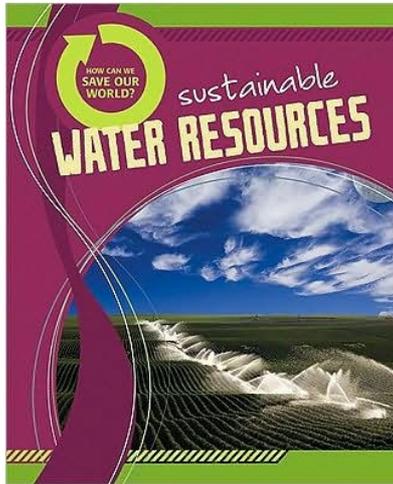
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Rooney, A. (2009). *Sustainable water resources*. London: Franklin Watts.



CHAPTER 4

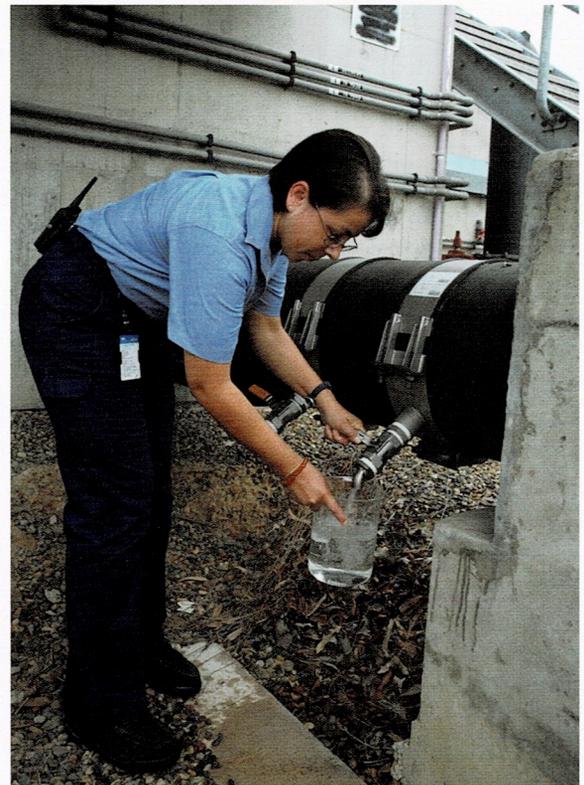
Technological Solutions

Technology can help to provide the world with clean water and process wastewater. Yet some of the technological solutions of the past have made the problem worse. Sustainable solutions are needed that do not contribute to climate change.

New water for old

Much of the water we use returns to nature in a dirty state. The polluted water is dangerous to human health and damaging to wildlife, so it must be cleaned if our use of water is to be sustainable. This could be done using technologies already available. Used water that is not excessively dirty—water from baths, cooking, and washing clothes, for example—is called gray water. Sometimes it can be reused without processing; it may be used to flush toilets or water gardens.

In industrialized countries, water that is flushed down the drains goes to sewage treatment plants. Water from industrial processes can be captured, cleaned, and recycled too, although some pollutants must be removed by chemical reactions. In some places, water is cleaned in this way before it is returned to nature. In other areas, more money must be invested in the equipment needed to make sure water is properly cleaned.



A worker at a sewage treatment plant in Sydney, Australia, draws off a sample of reclaimed water.

SUSTAINABLE TECHNOLOGIES

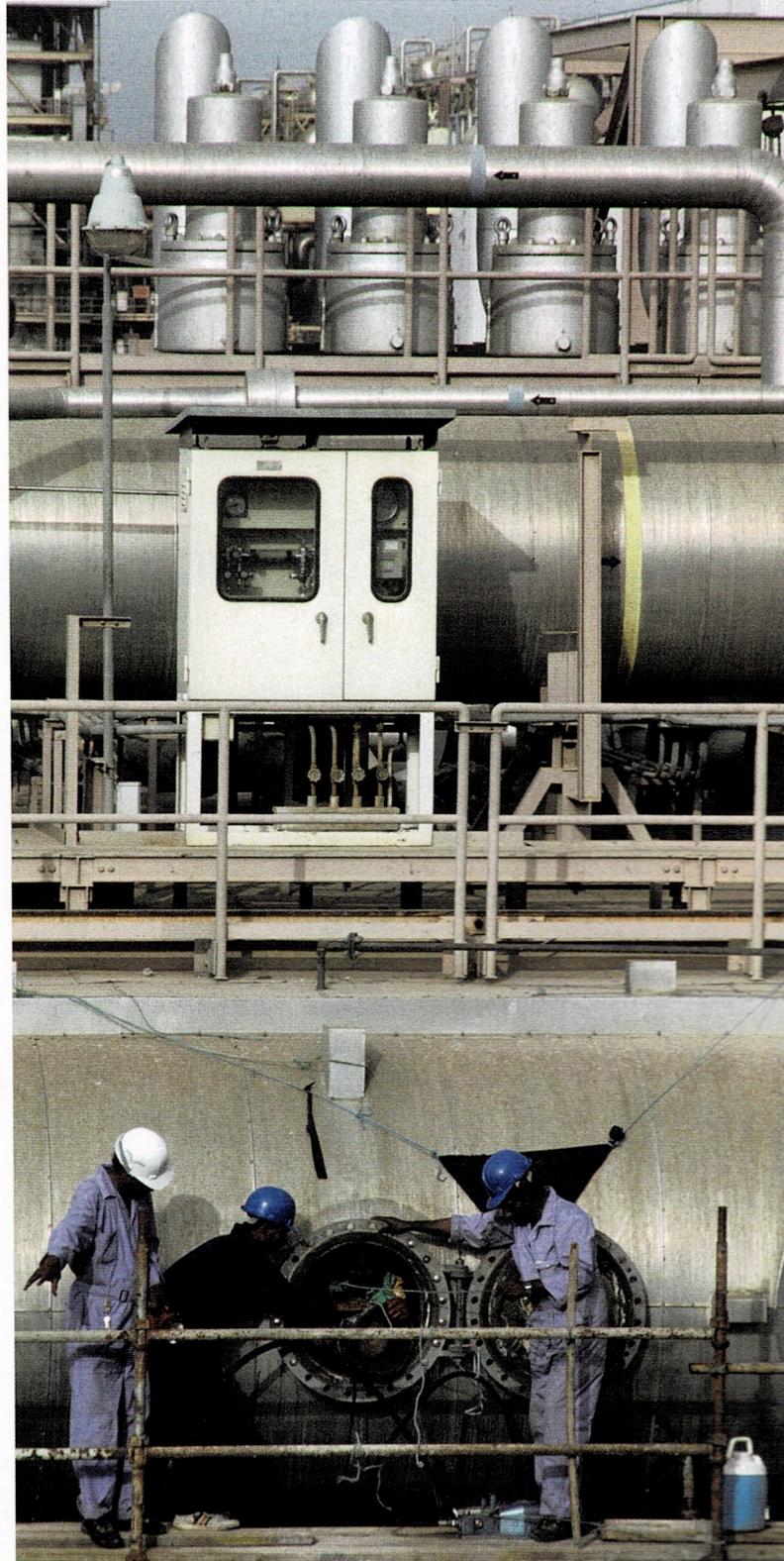


Treating wastewater

Wastewater collected at a sewage treatment plant is processed in several stages. First, solid waste is removed. Floating waste is raked off the top of the water and sinking waste, such as stones and sand, is allowed to settle out. Next, grease is skimmed from the top, and sediment is allowed to fall to the bottom. Next, microorganisms are used to break down biological waste. Biological material called floc collects and is filtered from the water. Finally, chemical by-products of the biological processes are removed, and the water is disinfected.

Desalination

Desalination means removing salt from water to make fresh water. It is used to process seawater so that it can be used for drinking and irrigation. Ships and submarines have used desalinated water for many years. Now some coastal areas are building large desalination plants to produce water for whole towns and cities. The largest is the Jebel Ali plant in the United Arab Emirates. It produces 2,470 gallons (9,500 liters) a second—nearly 10 times as much as the largest desalination plant in the US. By the beginning of 2008, there were 13,080 desalination plants around the world, producing more than 15 billion gallons (55 billion liters) of water a day.



Kuwait is a desert country with very little rainfall. This desalination plant in Doha, Kuwait, supplies all the drinking water for people living in the area.

Problems with desalination

Many desalination plants are in the Middle East, where oil to run them is cheap and plentiful. However, oil-fired plants produce large amounts of carbon emissions. These contribute to the buildup of greenhouse gases, which is causing climate change.

Desalination plants produce salt as a by-product. This must be removed to a place where it cannot enter the water table or rivers. Many scientists believe that the salt and carbon emissions produced by most desalination plants outweigh the benefits of the fresh water produced.

Desalination for the future

Conventional desalination plants either boil water at low pressure, using distillation to produce fresh water, or force water through a membrane. Salt cannot pass through the membrane and is left behind. This uses less energy than distillation.

A new type of membrane was announced in 2008 that should make the desalination process six or seven times more efficient. Desalination would require less energy and could be powered by solar panels or wind energy to produce fresh water without carbon emissions. A desalination plant in Perth, Australia, is already partly powered by wind energy, and a new plant planned for Sydney will be powered entirely by renewable energy.

Fog harvesting

Fog consists of droplets of water suspended in the air. It can be collected to supply fresh water. The first full-scale fog-harvesting system was built in the fishing village of Chungungo, Chile, in 1987. Chungungo had previously relied on water delivered by truck. After the fog-harvesting system was introduced, the village was able to provide its own drinking water and had enough to spare to begin growing crops for sale.

Fog harvesting produces a good yield only in areas where the wind direction is predictable and there is a raised area on which the system can be built. There must be a predictable foggy period. High coastal dunes or hills and some mountain areas with low-lying cloud are good for fog harvesting. In some places, fog is seasonal, so the water is not available all year.

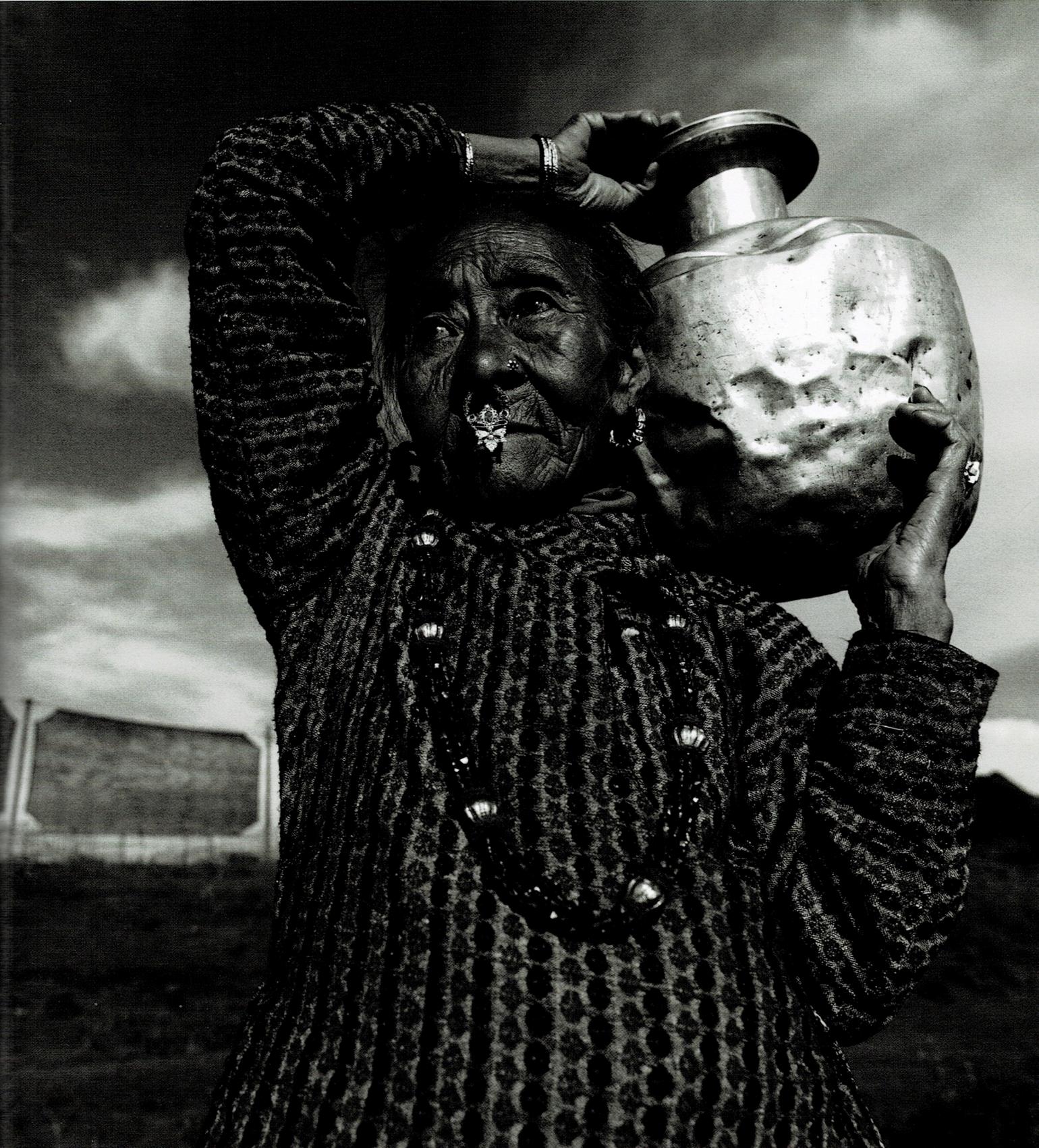
A woman carries water harvested from fog near the Indian border in Megma, Nepal. The fog-harvesting system has provided sufficient water for a school in the village.

SUSTAINABLE TECHNOLOGIES



The fog-harvesting system

A fog-harvesting system is made from layers of nylon net stretched across a frame set across the wind. The water in the fog condenses on the netting and trickles down to a collecting trough at the base of the net. Gravity carries the water along the trough to collect in a tank. In some places, water can also be delivered to the point of use by gravity. Up to 30 percent of the water carried in the fog can be harvested.





Chewang Norphel, director of the Leh Nutrition Project in Tibet, shows a water channel that diverts water to make an artificial glacier close to a village near Leh, Ladakh.

Artificial glaciers

Ladakh is a region in the Himalayas between Pakistan and China. It gets only 2.7 inches (7 cm) of rainfall a year. Glaciers are a crucial source of water for farmers in Ladakh, but often the meltwaters come too late to irrigate crops. Artificial glaciers are now providing a new source of water. With a system of pipes, water from a stream is directed to a shady valley and from there flows over a sloping hillside. Low stone embankments stop the water, forcing it to collect in shallow pools. In winter, the pools freeze to make a long, shallow glacier. This melts before the taller glaciers, giving the farmers water at the start of the growing season. The largest artificial glacier built so far is 985 feet (300 m) long, 148 feet (45 m) wide and 3.3 feet (1 m) deep. It supplies all the water for a village of 700 people. Because the technology is simple, artificial glaciers can be built by local people from cheap components.

Seeding clouds

Rains that do not come when expected often cost farmers their crops and can cause famine. One way of dealing with this is to "seed" rain clouds, forcing rain to fall. Due to water shortages, cloud seeding is widely used in China to encourage rainfall and prevent drought.

It is difficult to control rainfall though, so some areas may get more than others. This can lead to disputes if people believe "their" rain has been forced to fall elsewhere. Scientists are uncertain whether cloud seeding produces more rain or just moves rain from one place to another. In either case, it can make rain fall where farmers need it but must be used carefully to avoid disadvantaging one region to help another.

SUSTAINABLE TECHNOLOGIES



Cloud seeding

Aircraft or ground-launched rockets fire crystals of silver iodide or dry ice (solid carbon dioxide) into a cloud. The seeding causes tiny water droplets to cluster into large drops. These freeze into snow, then fall, melting as they travel through warmer air. More moist air is pulled up into the cloud, so the cloud re-forms.

