KNOW SOIL KNOW LIFE

THE CHALLENGE OF SALINIZATION

HISTORICAL CASE: MESOPOTAMIA

Conditions in early Mesopotamia (now southern Iraq) were a lot like they are there today: hot and dry. The Tigris and Euphrates Rivers provided water from the mountains for this early civilization. The soil in this region is very fertile, and the ancient Mesopotamians built irrigation projects to bring water into the dry desert region. Unlike the Egyptians, who could rely on the seasonal flooding of the Nile and irrigate accordingly, the Mesopotamians dealt with rivers that were more unpredictable. Despite this, the people were able to adapt and a massive civilization developed.

This region used to be the breadbasket of an empire, producing large quantities of wheat thanks to irrigation. The region boasted a strong labor force, both agricultural and urban. Farming thrived in this region for 3,000 to 4,000 years before things started to change.

The soils eventually accumulated dangerous amounts of salts because of low permeability and low precipitation. Over-irrigation caused the water table to rise, bringing up more salts, turning the fields white. Crop yields declined, and the cities did not have enough food. Historians believe that the rising soil salinity caused farmers to switch from wheat to more salt-tolerant barley between 2100 and 1900 BC.

By 1800 BC, even barley could not grow because of the ever-increasing accumulation of salts. The priests, administrators, merchants, and soldiers could not have the food they needed to practice their crafts. The cities fell into unrest when people could not get enough to eat and many moved elsewhere. Between 2100 and 1700 BC, three-fifths of the Sumerian population of Mesopotamia moved north.

Many of the great Sumerian cities never recovered, and only their ruins exist today.

MODERN CASE: AUSTRALIA

The continent of Australia is home to unique vegetation and wildlife that has adapted to small amounts of rainfall and a high salt content in the weathered rocks. Once Europeans settled in Australia, much of this native vegetation was cleared for crops, which need regular supplies of water. More water in the soil from irrigation meant that the water table rose, and with it came the salts that weathered from dissolved rocks, creating what are known as saline seeps.

In some parts of Australia, the groundwater does not move quickly, and annual precipitation rates are low, so trying to fix these seep regions may take several hundred years. The problem affects not only Australia's marginal desert-like lands, but also the more productive agricultural regions. Severe salinization is a very big problem in the western wheat-growing region. Australia has about 5.7 million hectares (14 million acres) at risk for developing salinity problems, with more than 2.5 million hectares (6.2 million acres) already affected; this risk is predicted to rise to 17 million hectares (42 million acres) by 2050. Some estimates of lost agricultural production amount to more than $150 million (Australian) each year.

High levels of salt cause damages in the field and substantial damage in downstream ecosystems. In many parts of Australia, water has become brackish and saline and can no longer be used. Plants and animals, even native ones, cannot handle very high salt concentrations. Even if native vegetation in affected regions would be restored, some of these cleared areas could not recover.

Urban areas are also affected, as salts can cause rust and corrosion of metals, lead to breaks in pipes, and destroy roads. There is no easy solution to salinization. Solutions will require management, technology, and strategy changes.

LOOKING AHEAD: GREENING THE JORDANIAN DESERT

Not long ago, the area near the Dead Sea was a salty, dusty mess. Irrigation mismanagement, drought, and overgrazing had left little behind but a few scraggly plants and salt crusts. The country of Jordan is currently more than 90% desert, has high temperatures, very little rain, and very little chance of creating productive farmlands. The people in the region are very poor. However, a project —continued on reverse

KNOW SOIL KNOW LIFE

THE CHALLENGE OF SALINIZATION—2

in permaculture, started by an Australian, has worked to tum more than several thousand square meters into a green, lush growing area for fruit trees and crops.

Permaculture combines agroforestry, sustainable farming and development, organic farming, agroecology, and social development. The overall idea is to help people be more productive and self-reliant. The permaculture project in Jordan teaches participants that the first step in any self-sufficient system is to suppress evaporation while harvesting incoming water. This reduces the amount of salty groundwater rising in the soil profile and reduces surface salinity.

The suppression of water evaporation can be done in several different ways. A farmer can place mulch over the soil surface, which both increases the moisture in the soil and decreases exposure to the sun's evaporating rays, lowering the accumulation of salts. The construction of sunken beds, which involves digging a pit so that water can flow down to where plants arc growing, also helps to harvest incoming water. Rainwater has many fewer dissolved salts than groundwater, so plants have an easier time using rainwater. This technique may even capture enough water to leach out dangerous salts from the soil. The project also provides shaded tarps to place over crops to reduce evapotranspiration. The less evapotranspiration, the less water a plant needs to pull from the soil, reducing the chances of pulling up and accumulating salts in the topsoil.

This project has succeeded in combining various sustainable agricultural ideas, as well as reclaiming the salty desert land and bringing a better livelihood to the people of the region. It is a good example of how humans can adapt to the environment and find new solutions to difficult problems.

Resource: *Know Soil, Know Life*, David L. Lindbo, Deb A. Kozlowski, & Clay Robinson, Editors
Soil Science Society of America, 2012
www.soils4teachers.org

Soil Science Society of America