

# Irrigating Crops with Seawater

**As the world's population grows and freshwater stores become more precious, researchers are looking to the sea for the water to irrigate selected crops**

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§1 Earth may be the Ocean Planet, but most terrestrial creatures—including humans—depend for food on plants irrigated by freshwater from rainfall, rivers, lakes, springs and streams. None of the top five plants eaten by people—wheat, corn, rice, potatoes and soybeans—can tolerate salt: expose them to seawater, and they droop, shrivel and die within days.

§2 One of the most urgent global problems is finding enough water and land to support the world's food needs. The United Nations Food and Agriculture Organization estimates that an additional 200 million hectares (494.2 million acres) of new cropland—an area the size of Arizona, New Mexico, Utah, Colorado, Idaho, Wyoming and Montana combined—will be needed over the next 30 years just to feed the burgeoning populations of the tropics and subtropics. Yet only 93 million hectares are available in these nations for farms to expand—and much of that land is forested and should be preserved.

§3 Clearly, we need alternative sources of water and land on which to grow crops. With help from our colleagues, we have tested the feasibility of seawater agriculture and have found that it works well in the sandy soils of desert environments. Seawater agriculture is defined as growing salt-tolerant crops on land using water pumped from the ocean for irrigation. There is no shortage of seawater: 97 percent of the water on earth is in the oceans. Desert land is also plentiful: 43 percent of the earth's total land surface is arid or semiarid, but only a small fraction is close enough to the sea to make seawater farming feasible. We estimate that 15 percent of undeveloped land in the world's coastal and inland salt deserts could be suitable for growing crops using saltwater agriculture. This amounts to 130 million hectares of new cropland that could be brought into human or animal food production—without cutting down forests or diverting more scarce freshwater for use in agriculture.

§4 Seawater agriculture is an old idea that was first taken seriously after World War II. In 1949 ecologist Hugo Boyko and horticulturalist Elisabeth Boyko went to the Red Sea town of Eilat during the formation of the state of Israel to create landscaping that would attract settlers. Lacking freshwater, the Boykos used a brackish well and seawater pumped directly from the ocean and showed that many plants would grow beyond their normal salinity limits in sandy soil [see "Salt-Water Agriculture," by Hugo Boyko, *Scientific American*, March 1967]. Although many of the Boykos' ideas of how plants tolerate salts have not stood the test of time, their work stimulated widespread interest, including our own, in extending the salinity constraints of traditional irrigated agriculture.

§5 Seawater agriculture must fulfill two requirements to be cost-effective. First, it must produce useful crops at yields high enough to justify the expense of pumping irrigation water from the sea. Second, researchers must develop agronomic techniques for growing seawater-irrigated crops in a sustainable manner—one that does not damage the environment. Clearing these hurdles has proved a daunting task, but we have had some success.