

Vertical gardens beat soil made salty by climate change

By Amy Yee, Scientific American on 02.09.15

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Bangladeshi women work at an agriculture field in Rangpur, 248 kilometers (155 miles), north of Dhaka, Bangladesh, Feb. 11, 2009. AP Photo/Pavel Rahman

KHULNA, Bangladesh — The soil in Chandipur village in southwestern Bangladesh has become increasingly salty because of incursions of seawater. The situation became particularly acute in the aftermath of Cyclone Aila in 2009, which brought storm surges that broke embankments and flooded farmland. After 2009, vegetable crops planted in the ground there yielded only meager returns — if they didn't fail completely.

But for the past three years hundreds of villagers have enjoyed the bounty of so-called vertical gardens — essentially crops grown in a variety of containers in backyards and on the rooftops of their humble homes. Despite their modest size, these gardens produce quite a bit. Shakuri Rani Debnath, a 30-something resident of Chandipur, says hers generated nearly 200 kilograms of vegetables this summer, including pumpkins, squash, cauliflower, tomatoes, spinach and chili peppers.

As a delta formed by three of Asia's largest rivers, Bangladesh is naturally prone to flooding and water-logging. And with most of its land at or below sea level, the country is highly vulnerable to extreme weather exacerbated by climate change. Rising sea levels, storm surges and violent storms have compounded the problem of increasing soil salinity across the country, particularly in coastal areas alongside brackish rivers.

The resulting decline in cultivable land is a pressing concern for Bangladesh, one of the world's most densely populated countries. (Imagine half the U.S. population living in a space about the size of Iowa.) Bangladesh's population will likely increase from about 156 million today to around 250 million by 2050. Vertical gardens are one simple way that the rural poor can adapt to climate change and increase food supply using scarce resources. They could complement other, more sophisticated solutions, such as the cultivation of salt-tolerant rice and other hardy crops such as sunflowers. "There is no country with such population density where natural resources are stretched to their very limits," says Craig Meisner, south Asia regional director and country director for Bangladesh at WorldFish, an international nonprofit organization headquartered in Malaysia. WorldFish implemented the vertical gardens in southern Bangladesh, along with other means of coping with climate change. If adaptation "fails here, it will certainly fail in many other countries," Meisner remarks. "However, if it succeeds here, it gives hope for the world's future."

Vertical gardens work because soil salinity actually fluctuates. Salinity decreases during Bangladesh's monsoon season from roughly July to October, when about 1.5 meters of rain flushes and dilutes salt from soil. During the hot, dry months, however, the soil loses moisture and the salinity returns, explains Meisner, whose background is as an agricultural scientist. So far, WorldFish is implementing vertical gardens only in Bangladesh, although examples of similar, local designs exist in other parts of the world. In theory, vertical gardens can work in salty soil in any area that gets heavy rainfall.

Working with local nonprofits, WorldFish trained about 200 villagers in four districts in saline-affected areas of southwestern Bangladesh to make vertical gardens. Others not in the program have copied their neighbors' designs after seeing how well they worked. WorldFish plans to expand the program to include 5,000 people over the next two years.

Growing the vertical gardens is a relatively straightforward process. Villagers harvest soil after the rains, around November, and use it later during planting season. They put the soil into containers and mix it with fertilizer made of dried water hyacinth, soil, coconut husks and cow manure. The containers range from plastic rice and concrete sacks to large, specially constructed "towers" made of simple plastic sheets encased by bamboo rings.

To prevent water-logging, the containers are raised off the ground on bricks and filled with brick chips that improve water circulation and drainage. Small holes are cut into the sides where short-rooted vegetables such as Indian spinach and tomatoes can grow. Long-rooted vegetables such as gourds grow on top. These sacks can produce up to eight kilograms of vegetables in one season with an investment of 100 to 150 taka (about \$1.30 to \$2) per bag. The tower variety of container measures more than 1.2 meters across and

can produce more than 100 kilograms of vegetables. One tower requires an investment of about 900 to 1,000 taka (around \$11.50 to \$13.00) to buy materials and seeds. WorldFish provides seeds and some materials to villagers in the first year.

The result is a garden like the one that belongs to Shobitha Debna, a 35-year-old mother in Chandipur. The garden occupies just a corner of Debna's dirt yard, yet it yields hundreds of kilograms of pumpkins, gourds, green beans, eggplant, red amaranth, beets, carrots, cauliflower, coriander, cabbage, green chili peppers and spinach each season. In addition, the tin roof of Debna's home harbors a lush tangle of leaves and vines that sprout fat bottle gourds. The vines grow from just a few large, plastic sacks that once held animal feed. Extra food like this goes a long way for the rural poor in Bangladesh, who eke out a living on a few dollars a day.

Debna says she used to grow just one or two kinds of vegetables but now her vertical garden yields a cornucopia that feeds her family. Finding enough fresh water for her garden can be a challenge, she admits. But so far that hasn't stopped a bounty of vegetables from flourishing in soil that lay fallow not so long ago.

Quiz

- 1 Which paragraph from the article explains why salty soil is a big problem for Bangladesh in particular?
 - (A) But for the past three years hundreds of villagers have enjoyed the bounty of so-called vertical gardens — essentially crops grown in a variety of containers in backyards and on the rooftops of their humble homes. Despite their modest size, these gardens produce quite a bit. Shakuri Rani Debnath, a 30-something resident of Chandipur, says hers generated nearly 200 kilograms of vegetables this summer, including pumpkins, squash, cauliflower, tomatoes, spinach and chili peppers.
 - (B) Vertical gardens work because soil salinity actually fluctuates. Salinity decreases during Bangladesh’s monsoon season from roughly July to October, when about 1.5 meters of rain flushes and dilutes salt from soil. During the hot, dry months, however, the soil loses moisture and the salinity returns, explains Meisner, whose background is as an agricultural scientist. So far, WorldFish is implementing vertical gardens only in Bangladesh, although examples of similar, local designs exist in other
 - (C) Growing the vertical gardens is a relatively straightforward process. Villagers harvest soil after the rains, around November, and use it later during planting season. They put the soil into containers and mix it with fertilizer made of dried water hyacinth, soil, coconut husks and cow manure. The containers range from plastic rice and concrete sacks to large, specially constructed “towers” made of simple plastic sheets encased by bamboo rings.
 - (D) As a delta formed by three of Asia’s largest rivers, Bangladesh is naturally prone to flooding and water-logging. And with most of its land at or below sea level, the country is highly vulnerable to extreme weather exacerbated by climate change. Rising sea levels, storm surges and violent storms have compounded the problem of increasing soil salinity across the country, particularly in coastal areas alongside brackish rivers.
- 2 Which matter is left uncertain in the article?
 - (A) what kinds of vegetables might be grown in a vertical garden in Bangladesh
 - (B) which other places might benefit from vertical gardens aside from Bangladesh
 - (C) which problems associated with traditional gardens led to the adoption of vertical gardens in Bangladesh
 - (D) what the benefits are of vertical gardens over traditional gardens for farmers in Bangladesh

- 3 Read the sentence from the article.

Salinity decreases during Bangladesh's monsoon season from roughly July to October, when about 1.5 meters of rain flushes and dilutes salt from soil.

The sentence contributes to the author's portrayal of each of the following EXCEPT:

- (A) seasonal flooding in Bangladesh
- (B) what enables vertical gardens to be successful in Bangladesh
- (C) how salinity contributes to crop failure in Bangladesh
- (D) soil salinity in Bangladesh

- 4 Read the concluding sentence of the article.

But so far that hasn't stopped a bounty of vegetables from flourishing in soil that lay fallow not so long ago.

Fill in the blank. By concluding the article with the sentence above, the author establishes the tone of the article as mostly

- (A) skeptical
- (B) hopeful
- (C) informative
- (D) analytical

Answer Key

- 1 Which paragraph from the article explains why salty soil is a big problem for Bangladesh in particular?
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 - (D) **As a delta formed by three of Asia’s largest rivers, Bangladesh is naturally prone to flooding and water-logging. And with most of its land at or below sea level, the country is highly vulnerable to extreme weather exacerbated by climate change. Rising sea levels, storm surges and violent storms have compounded the problem of increasing soil salinity across the country, particularly in coastal areas alongside brackish rivers.**

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