Managing flooding with healthy soils

Article #4 in the Healthy Soils Project

For most urban dwellers, the health of agricultural soils may seem unimportant and not particularly interesting. Yet these soils impact our climate, our water supplies, and the nutritional value of our food. And another, often overlooked reason that urban dwellers should care about our soils is the potential for flood reduction.

Flooding is the most common, costly, and deadly of all natural disasters in the United States – and it's only getting worse. Greenspace lands (protected areas of undeveloped landscape) have been identified as an important part of the solution for urban flooding.[1] What hasn't been explored as much is the management of those greenspaces.

Healthy soils can absorb water many times faster than conventionally managed soil. A 2012 study by the National Resource Conservation Service found that it took 7 minutes for conventional rangeland to absorb the same amount of water that took only 10 seconds on rotationally grazed soil.[2] Using herbicide to convert grasslands to cropland resulted in soils that took 31 minutes to absorb the same amount of water! In other words, the same acreage managed for healthy soils could absorb far more water in much less time; a critical benefit during a heavy rainfall.

What does that mean in real-life terms? Possibly the difference between several feet of flooding and ***no*** flooding during a severe hurricane. That's what happened on Laughing Frog Farm, a regenerative farm in Hempstead, Texas. During three days in August 2018, Hurricane Harvey dumped more than 50 inches of rain on the farm.

"For 16 years, the farm has used intensive organic practices to increase the organic matter in our soil," said its owner, Glen Miracle. "As a result, our soil has an excellent structure for capturing and holding water." Photos of Laughing Frog Farm and a nearby test farm operated by Texas A&M University, both taken the day after the rain ended, show the startling difference.

[1] Journal of the American Planning Association, "Greenspace After a Disaster: The Need to Close the Gap With Recovery for Greater Resilience," April 1, 2020. Available at https://www.tandfonline.com/doi/abs/10.1080/01944363.2020.1730223

[2] Natural Resources Conservation Service/South Dakota. Available at https://www.youtube.com/watch?v=IqB4z7lGzsg&feature=youtu.be

Consider the resulting benefits – both in financial and human terms – if farms like Laughing Frog Farm ringed every city.

In 2018, the same year as Hurricane Harvey, the first nationwide assessment on urban flooding declared it a significant and hidden threat. More than 10 percent of the U.S. population – some 30 million people – live in designated floodplains. While many live along the coast, there are also many who live inland in urban cities; and both types of areas have increasing populations, which means that potential impact continues to increase. [3] In Texas alone, at least 2.8 million people are exposed to high or moderate river-related flood risk.[4]

And flooding also commonly occurs outside these designated floodplains. Over 83 percent of respondents participating in the national assessment said their community had experienced urban flooding. In fact, 13 of the 14 disasters that cost the U.S. more than $1 billion in damage in 2019 were flood-related events (hurricanes, tropical cyclones, severe storms, and others).[5]

These issues will only get worse with climate change. Changing precipitation patterns and sea level rise mean flood events occur more frequently, with more intensity, and sometimes in unpredictable ways. Nationwide, heavy precipitation increased by 40 percent in the past five decades.[6] Hurricanes are stronger and lasting longer. Some coastal cities in the United States already are experiencing an inch of sea level rise per year.[7]

But we are not helpless in the face of the threat of floods. While there are still only a few studies on these issues, the ones that exist reflect the high value of healthy soils. For example:

- A 2015 Texas A&M University study that looked at cattle ranches showed grazing on land restored to native prairie plantings led to a 49% reduction in surface runoff and a 29% increase in water infiltration of the soil.[8]
- A 2015 report by the Harris County (Texas) Flood Control District found that 2 acres of upstream native prairie would entirely offset the increased runoff from 1 acre of a new subdivision and reduce runoff from a 100-year flood event by 35%.[9]
- A 2019 study estimated that healthy soils on the Katy Prairie of Texas provided hydrological ecosystems services to the Houston area valued at $331-$647 million for

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[3] U.S. Water Alliance, Water Rising: Equitable Approaches to Urban Flooding, available at http://uswateralliance.org/sites/uswateralliance.org/files/publications/Final_USWA_Water%20Rising_0.pdf

[4] Texas Water Development Board, State Flood Assessment (Jan. 2019), p.12 https://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/State-Flood-Assessment-report-86th-Legislation.pdf

[5] U.S. Water Alliance, Water Rising: Equitable Approaches to Urban Flooding, available at http://uswateralliance.org/sites/uswateralliance.org/files/publications/Final_USWA_Water%20Rising_0.pdf

[6] U.S. Water Alliance, Water Rising: Equitable Approaches to Urban Flooding, available at http://uswateralliance.org/sites/uswateralliance.org/files/publications/Final_USWA_Water%20Rising_0.pdf

[7] Jim Morrison, "Flooding Hot Spots: Why Seas are Rising Faster on the U.S. East Coast," Yale Environment 360, Yale School of Forestry and Environmental Studies, April 24, 2018, https://e360.yale.edu/features/flooding-hot-spots-why-seas-are-rising-faster-on-the-u.s.-east-coast

[8] Park, Jong-Yoon, et al. *Evaluating the ranch and watershed scale impacts of using traditional and adaptive multi-paddock grazing on runoff, sediment and nutrient losses in North Texas.* USA. Agriculture, Ecosystems & Environment 240 (2017): 32-44.

[9] "Final Study Report: Cypress Creek Overflow Report." Harris County Flood Control District (Aug 2015).

reduction in impact of 10- to 50-year flood events – mostly due to reduced costs for downstream engineered reservoirs and corridors.[10]

Soil conservation practices can increase water infiltration and retention, slow runoff, and reduce the silt and agricultural chemicals that contaminate water that then leaves the farm to further spread contamination. Similar benefits result from the use of cover crops, reduced tillage, permanent pasture, riparian buffer strips (plantings along the edges of streams and rivers), and other conservation and soil quality practices.

The decision to use or not use these conservation practices is often simply based on a cost-benefit analysis by the individual farmer. The farmer considers a complexity of factors including not only the actual cost of implementing changes, but the costs of NOT implementing the changes, the costs of labor reallocation (particularly during "crunch time" at the farm), and multiple other factors.

Yet the benefits of these practices extend far past the farm. Both nearby neighbors and more distant urban dwellers gain when we have healthy agricultural soils. Unfortunately, many of our government programs actively discourage farmers from taking measures to improve soil health, and the few programs that are intended to help are too small to drive the sort of changes that are needed. The next article in this series will explore the economic and government issues.

Soil can heal so much of the suffering we face with each new natural disaster. But first, we must heal the soil. The benefits – both short- and long-term – are clear.

[10] Apfelbaum, S., et. al. *Ecosystem Services Valuation for the Katy Prairie Conservancy and Adjacent Lands: Waller & Harris Counties, Texas* Special Report by Applied Ecological Services, Brodhead, WI (April 2019).