Spring 2019

Spring 2019 News: Rain gardens reduce urban runof, protect environment

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Rain gardens reduce urban runoff, protect environment

BY CHRISTIE DELFANIAN | MARCH 25, 2019

Dakota Rural Action volunteers and South Dakota State University graduate student Farhana Akhter, center in pink shirt, plant perennial plants and flowers and lay sod on the berms that will keep the runoff water in a rain garden. Material costs are generally low, but building the garden is labor intensive, according to SDSU Assistant Professor John McMaine.

A garden filled with native shrubs and perennial grasses and flowers can both beautify a yard and protect the environment.

Water coming off roofs, patios and driveways flows through the rain garden to reduce runoff and to filter pollutants, according to Assistant Professor John McMaine of the South Dakota State University Department of Agricultural and Biosystems Engineering. He has been doing research on rain gardens since 2012.

McMaine taught 25 to 30 people how to design and build a rain garden through one-day workshops hosted by SDSU Extension and Dakota Rural Action, a family agriculture and conservation group. In the morning, participants in Brookings, Watertown and Sioux Falls learned the basic concepts and then designed rain gardens in the afternoon.

Assistant Professor John McMaine, left, digs a trench to begin building a rain garden at a Sioux Falls home.

On the water quantity side, a rain garden reduces peak flow and total water volume. In terms of water quality, the rain garden filters nutrients, such as nitrogen, and heavy metals, like copper, from the runoff.

“We’re able to hold the water for a longer time and let it soak into the ground—we’re getting the area back to its predevelopment hydrology,” McMaine said. As an SDSU Extension water management engineer and South Dakota Agricultural Experiment Station researcher, his work focuses on helping South Dakotans address problems related to water quality and quantity in urban and agricultural areas.

In addition, McMaine and Dakota Rural Action volunteers built a rain garden at a Sioux Falls residence. “People are hesitant to put in rain gardens until they can see how they work,” McMaine said. He and a graduate student will also gather research data at the site.

The project was supported by an Environmental Protection Agency 319 Information and Education Minigrant administered by the South Dakota Discovery Center. The East Dakota Water Development District also provided matching funds.

Eowyn Corral, program director of Dakota Rural Action, said, “With more and more people living in our urban areas, we have more capacity and responsibility to have a positive impact on our water quality.”

Connecting community

“It was a really good opportunity for us to connect John’s academic, science-based approach to water quality with our community organizing and building around water quality,” Corral said. “It’s taking science and applying it to homeowners’ backyards to impact water quality on the Big Sioux River Watershed.”

For homeowners Tony Helland and Kelsie Thomas, it was about living their values. Both are members of

Homegrown Sioux Empire, the Sioux Falls chapter of Dakota Rural Action.

“This is what sustainability looks like to our family. It is a passion we share and a fun way to get involved in Homegrown,” Thomas said. She and Helland, who purchased their home in November 2017, attended the Brookings rain garden workshop.

“When we looked at the grade of the lot, we knew we were losing topsoil during heavy rains,” Helland said. “We wanted to keep the water on our property rather than letting it go down the hill.”

For the rain garden, McMaine made a composite design incorporating multiple ideas from the workshop participants as well as some unique features. “Where you are at makes a difference, in terms of what you do, but design and construction modifications can be made so a rain garden can fit in almost any setting,” he said.

Building rain garden

About 25 volunteers helped build the rain garden, which is 12 feet wide and 20 feet long and divided into two troughs. Both sections collect runoff, but biochar was added to one trough. “We are looking at the impact of biochar versus native soil and its capacity to capture and reduce pollutants,” McMaine said.

“Typically, we rely on the capacity of the soil to infiltrate everything, especially in a residential rain garden,” McMaine said. However, in soils with a high clay content or in more highly developed areas such as commercial developments, additional measures are used to ensure the water drains in the recommended 24 to 48 hours. The underdrain in the rain garden demonstrates one of those measures.

Another unique feature is an upturned elbow at the end of the underdrain system. “This gives us assurance that water will not leave the underdrain system unless it’s to a particular elevation. This helps promote denitrification,” he explained.

This spring, McMaine will begin gathering data, including pollutant removal and flow rates through the rain garden. In the fall, he will present those results in a follow-up workshop.

In addition to determining baseline performance, he hopes to secure funding to monitor the rain garden for five years to answer some key research questions: “As the system continues to mature, is the performance improved? Are there more active biological communities to break down pollutants or does the performance decrease through sedimentation or breakdown of the top mulch layer?”

Helland said, “This is a small step that, if it caught on, could really help water management issues on a city level.” He hopes to build a second rain garden in the front yard.

“Rain gardens and related practices implemented at the municipality level in South Dakota could have a significant impact on urban runoff and water quality,” McMaine said.

Corral said, “We can all be part of the solution and when it beautifies your backyard and increases biodiversity, there are endless benefits to adding a rain garden.”

Water from the downspouts drains through the PVC pipe into the two troughs of the rain garden.

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