UNIVERSITY COMMUNICATIONS
NEWS@UW-MADISON

RESEARCH

'Rain gardens' help recharge ground water

(Posted: 04/22/02 Wisconsin Week: April 17, 2002)

Madeline Fisher

A rain garden under construction at the Dane County Heritage Center will help capture rainfall to recharge ground water in the area. Photo: Alejandro Dussailant

For those of us who spent winter days dreaming of tulips and sunflowers, tomatoes and snap peas, gardening means one thing — growing plants.

But the gardens blooming in the minds of two university engineers cultivate sand and gravel, water budgets and storage capacity.

Kenneth Potter, a civil and environmental engineering professor, and doctoral student Alejandro Dussaillant, have spent hours determining the right garden conditions, not for growing plants, but for catching storm water and coaxing it deep into the ground.

Potter and Dussaillant design these "rain gardens" for one primary purpose: to replenish, or recharge, dwindling ground water supplies.

Through the research, Potter hopes to convince city planners and commercial developers that rain gardens represent a viable way to mitigate the polluted storm water runoff and ground

water loss that often accompany urban development.

"What we've been able to do is some modeling analysis to show how effective rain gardens can be [for restoring ground water]," Potter says. "And the most exciting thing we've come up with is that a rain garden can be relatively small and have maximum impact on ground-water recharge."

Potter's rain garden work stems from his concern about the effects of urban development on natural systems. He explains that water in the ground and at the surface balance each other; one increases only at the expense of the other. As urban development proceeds, the land becomes covered with impervious surfaces — like rooftops, roads and parking lots — that don't allow rainwater to penetrate the ground. Instead, it washes into the gutters and sewers of city streets, eventually ending up as surface water.

Not only does increased runoff cause higher lake levels and flashier stream flows, but water quality declines because storm water picks up sediments and pollutants as it flows over ground.

Cities and suburbs deplete ground water by tapping it as a water supply. Dane County pumps ground water at twice its recharge rate, Potter says. Lower water tables spell trouble for ground-water-fed streams, lakes and wetlands, which dry up or are supplied instead by dirtier and warmer surface water.

Lake Wingra, Potter says, is a

prime example. Once almost entirely spring-fed, the lake now receives most of its water as surface runoff.

Rain gardens, he says, provide one way to help counter these effects. Rain gardens help capture rainwater directed from roofs or other surfaces. Constructed to lie a few inches below ground, they typically consist of two layers: a top, soil layer for growing plants and a lower, permeable layer of sand and gravel. When it rains, water initially pools in the garden's plant zone, percolating quickly from there into the permeable layer underneath. The permeable zone then stores water until it seeps into subsoil.

Although a sunken gravel bed would work just fine to restore ground water, designing these systems as aesthetically pleasing gardens is what entices people to build them, Potter says. Models developed by Potter and Dussaillant allow rain gardeners to sow their favorite plants, even though the plants may tolerate varying amounts of flooding and drying.

"We have a computer model that will enable us to design a rain garden that has multiple layers in it so it can be tailored to whatever are the specific needs [of the plants]," Potter says.

Potter would like to apply his research at commercial developments — places like condominium sites, office parks and parking lots — where space is at a premium and landscaping is very expensive.

Rain gardens don't have to be large to be effective. "The way

we calibrate the size of a rain garden is how big it is compared to the impervious surface," Potter says. "If you're mainly interested in ground water recharge, a rain garden does best if it's only about a tenth of the impervious surface."

The concept of a smaller garden functioning better than a larger one seems counterintuitive. But Potter says the idea actually borrows from nature.

When rain falls over a large surface like a lawn, he explains, rapid evaporation and uptake by plants permit relatively little water to infiltrate the ground. By focusing the same volume of rain into a much smaller, more permeable area, a rain garden forces water quickly into the ground before plants and evaporation can consume it. Potter says that dry streambeds and prairie potholes recharge ground water in much the same way during spring storms and flooding.

Rain gardens may improve water quality as well, capturing common contaminants such as excess nitrogen and phosphorus.

Dussaillant cautions that rain gardens should be seen as one part of an integrated storm water plan that includes many other options for local infiltration.

Potter says that to have an impact, widespread rain gardening would require a lot of people to work together. "Once people buy into this it's something they can get really excited about. It's like recycling. When we first did it, a lot of people sat around saying "Why

should I do this?' Now people just do it automatically."

(View a full news release version of this story)