Small landscape changes can mean big freshwater gains

November 17 2015, by Jenny Seifert

A typical bird's-eye view of the Midwest offers a patchwork landscape covered mostly by agriculture but mottled with forest, wetland, grassland, buildings and pavement. This pattern influences the quality and supply of the many natural benefits the landscape provides people, including freshwater.

A new opportunity for improving the health and supply of Wisconsin's lakes, waterways and groundwater has emerged from a recent study in the journal *Ecosphere* by the University of Wisconsin-Madison's Water Sustainability and Climate Project. Making small tweaks to how large some of those patches in the pattern are could mean big freshwater benefits, especially where making drastic changes to the landscape would be hard, as is the case throughout much of the state.

"Our findings have important implications for managing and restoring landscapes to enhance the goods and services water provides us," says Jiangxiao Qiu, the study's lead author and a graduate student in the Department of Zoology.

A landscape pattern consists of its composition, or the kinds and amounts of land-cover patches, and its configuration, or the layout of those patches. Qiu and co-author Monica Turner, the Eugene P. Odum Professor of Ecology and Vilas Research Professor of Zoology, found that while both composition and configuration matter, a landscape's composition has a stronger influence on water quality and supply.

"Altering the arrangement of the land-cover patches is not enough to improve freshwater services. You need to change their types and proportions," says Qiu, clarifying that their findings are specific to landscapes that are predominantly agricultural, such as their study site, Wisconsin's Yahara Watershed. Different landscapes could have different results.

While the implications of their findings apply to the three freshwater services they studied—surface water quality, groundwater quality, and groundwater supply—Qiu says adjusting the landscape composition may be most effective for enhancing surface water quality.

Landscape pattern influences how nutrients—especially phosphorus and nitrogen—move from land to water, subsequently impacting water quality. Natural buffers placed between cropland and lakes and streams can help protect the water from nutrients that erode from the land. These include nutrient-grabbing forests and prairies.

In fact, Qiu and Turner found that reducing the amount of cropland to below 60 percent or restoring wetlands to above six percent of a given area could bring about significant improvements to surface water quality.

But Qiu and Turner aren't calling for slashing cornfields or removing city blocks. Instead, they say it is possible to get big gains in freshwater benefits by making small changes in targeted places, such as adding rain gardens or parks to urban areas.

"When we make changes in our landscapes, it's nice when we can get the most out of those changes, increasing the benefits we get from nature while minimizing costs," says Turner.