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The rain, the plain and the drain

How a geographer and an engineer are marrying their expertise to study changing weather, challenging landscapes and the ways we manage water

For Shawn and Stacy Hutchinson, several pairings are key to their research. Geography and engineering. Military experiences and academic backgrounds. Husband and wife.

The two married Kansas State University professors are using these partnerships to understand how humans and the military affect landscapes and influence hydrology.

"We are trying to protect natural resources," said Stacy Hutchinson, associate professor of biological and agricultural engineering. "There is a range of change and human influence on landscapes, and we are trying to figure out how the natural water cycle is affected by this. We also want to understand how this affects our safety and livelihood, as well as flooding, water pollution, soil erosion and the loss of agricultural crops."

During the past four years, the husband-wife team has received more than $1 million to support the research. Shawn Hutchinson, associate professor of geography, studies methods for monitoring and forecasting environmental change — from natural and human causes — and designs digital decision support systems to better visualize landscape dynamics. Stacy Hutchinson uses this information to create better stormwater systems that prevent soil erosion and improve the natural flow of water. Together the researchers have created a Web application that monitors landscape health.

While much of their research has focused on the effects of urbanization or agricultural production on landscapes, the Hutchinsons are now studying the less-understood effects of military training on landscapes. Both served in the U.S. Army and are using their military backgrounds to help nearby Fort Riley, home of the Army's 1st Infantry Division.

Military landscape disturbance is driven by national security needs, Shawn Hutchinson said. Nearly every square inch of military land is affected from events and training exercises that use tanks, dismounted

infantry or wheeled vehicles, depending on the current military warfighting doctrine. A healthy landscape keeps soldiers safe and provides realistic training conditions, while mismanaged training lands can cause a variety of issues such as erosional gullies that can damage equipment and injure soldiers.

"Environmental damage can cause a less realistic training environment for soldiers," Shawn Hutchinson said. "It's the difference between training on a completely barren landscape versus a landscape with trees and healthy grasses that provide cover. Sustainably managed training lands, then, benefit the environment, soldiers and military readiness."

To measure landscape changes, the researchers turn to geospatial maps. Shawn Hutchinson is the director of Kansas State University's Geographic Information Systems Spatial Analysis Laboratory and creates digital maps using Fort Riley satellite images for areas of land as small as 30 meters by 30 meters. The images show how the landscape is affected by various activities — weather, wildfires and even training exercises.

Every 16 days, new images show Fort Riley's changing landscape greenness, which is closely related to the amount and condition of the installation's vegetation. The researchers use this information to assess the current health of the training land vegetation and how this will affect water runoff during a storm. They also study weather patterns and various rainfall amounts to determine flooding potential.

"We can delineate a watershed, capture a near-real time estimate of vegetation condition and use this information to design stormwater management systems and size them correctly," Stacy Hutchinson said. "We also want to understand how much rain we are getting and how frequently because that helps us to size stormwater systems appropriately so that we don't have excess flooding."

Shawn Hutchinson posts the satellite images and information on a custom-designed Web application so that military officials can quickly see and fix landscape problems before they become too large and even more costly to repair. Using the same imaging technology, the researchers also can apply their work to similar problems that may occur on urban or agricultural landscapes.

As they move forward, the Hutchinsons want their framework for monitoring military lands to become a model for other military installations and Department of Defense-owned land. The department is the steward of the second-highest total area of land in the U.S.

"When you add up all the Department of Defense land in the United States, it makes a huge imprint on air, water and all kinds of pollution and measures of environmental quality," Shawn Hutchinson said. "The underlying theme of military lands is sustainability. The nation is going to need its military installations, like Fort Riley, well into the future. The Department of Defense can't afford to do something now that would prevent utilizing the land in a safe manner 20 years from now."

Professors Stacy and Shawn Hutchinson are looking at how humans and the military affect landscapes and influence hydrology.

By Jennifer Tidball, Communications and Marketing

Surveying stormwater

Stacy Hutchinson, associate professor of biological and agricultural engineering, is updating rainfall distribution data to ensure current urban and agricultural stormwater management systems can handle future weather changes. She and her husband, Shawn Hutchinson, associate professor of geography, are studying how climate change and land cover change — which is the conversion of natural prairie and agricultural land to urban and suburban land — affect flooding potential.

That work is funded as part of the $20 million Kansas National Science Foundation Experimental Program to Stimulate Competitive Research project researching global climate change and renewable energy research.

By Jennifer Tidball, Communications and Marketing