Story by Kathy Wythe

Combating soil erosion

AgriLife scientists discovering what works for Fort Hood

When most people think of Fort Hood, they think of the military readying troops for combat. When a group of Texas AgriLife Research scientists think of Fort Hood, it's combating soil erosion.

Fort Hood is one of the largest military installations in the United States. It has more than 214,000 acres and the largest concentration of armor in the country. Soldiers in heavy tanks and armored vehicles are continually conducting training exercises on the land. This training has caused compacted ground, loss of plant cover, and accelerated soil erosion that deposits excess sediment in area streams and lakes.

AgriLife Research scientists in Temple and College Station are working with the USDA's Natural Resources Conservation Service (NRCS) and the military's Integrated Training Area Management (ITAM) to combat this soil erosion while maintaining sustainability of the training mission and ensuring high quality natural resources in the watersheds.

In the initial stages of this partnership, Dr. Dennis Hoffman, senior research scientist, and other researchers at Texas AgriLife Research Blackland Research and Extension Center began monitoring water quality. They measured nutrient and sediment losses across many of Fort Hood's watersheds. As a result of the monitoring NRCS and ITAM put in more than 30 sediment retention ponds to trap sediment contained in stormwater runoff.

"We then began to monitor watersheds to estimate sediment trapping as a result of the ponds," Hoffman said.

NRCS and ITAM began to implement additional conservation to reduce erosion. These practices included gully plugs (small rock dams built to stop gully erosion) and contour ripping (deep plowing of the ground), which reduces soil compaction. Less soil compaction allows water to soak into the soil and reduces runoff and erosion. Hoffman's group then determined the effectiveness of these practices.

"Our monitoring showed a remarkable reduction in runoff and erosion as a result of those conservation practices," Hoffman said. One area of the training lands monitored was Shoal Creek. Monitoring showed a 90 percent reduction in sediment running into the creek.

"Our research has shown that these conservation practices work really well," Hoffman said.

With their long-term monitoring, the researchers are able to keep a pulse on the effectiveness of these practices and know when a practice might need to be restored. "It's pretty cheap insurance because it gives you an idea when you need to go in and fix it," Hoffman said.

In 2003, a new project, *Range Revegetation Pilot Project for Fort Hood, Texas*, was initiated with federal funding through NRCS to the Texas Water Resources Institute. The revegetation project brought composted dairy manure from the Bosque River watershed to Fort Hood to use as a soil amendment to test its impact on increasing vegetation to help control erosion. Taking the compost out of the Bosque River watershed also helped relieve that watershed of excess phosphorus found in compost, said Dr. William Fox, assistant professor at Blackland.

"Two major environmental problems were addressed at the same time," Fox said. "Excessive nutrients in one watershed are being used to fertilize nutrient-starved soil in another."

To date the project has purchased, transported, and applied more than 20,000 tons of composted dairy manure from the North Bosque River watershed and established research and demonstration plots on approximately 1,700 acres of training lands on Fort Hood.

Fox said that their research has shown that compost does increase the vegetation on some landscapes at Fort Hood, and they have developed science-based standard operating procedures for applying compost.

Using compost alone for large-scale land application, however, is not sufficient, he said.

"Although compost can help us grow more desirable vegetation without nutrients becoming a problem in the watersheds, the costs associated with large-scale applications are great," Fox said. "So now we are working to understand how we can integrate compost with other erosion control practices to optimize its benefits with much lower costs.

"There is a place for using compost in the toolbox. It's just not with large-scale application."

The project is continuing through 2009 with research on using compost to establish vegetation buffers near the bank of the streams as well as using compost in coordination with contour ripping practices.

Preliminary results show that putting compost and grass seeds over the contour rips helps establish vegetation buffers and reduces run-off, Fox said.

In research conducted by graduate student Lisa Prcin of Blackland and her advisor Dr. Fred Smeins of Texas A&M University's Ecosystem Science and Management Department, the combination of contour ripping and compost reduced run-off by 55 percent compared to a 35 percent reduction with contour ripping alone.

Using compost with the contour ripping also reduces the cost of compost by reducing the amount of compost applied while increasing the efficacy of the contour ripping practice, Fox said. ⇨

"What we have found out," he said, "is that we need mechanical practices in the form of contour ripping, structural in the form of gully plugs, and natural processes, like compost amendments and reseeding, to address erosion from a systems approach and ultimately stem the flow of sediment into Lake Belton.

"Developing an understanding on how these practices interrelate and the efficacy of erosion control provides military land managers with information for their conservation planning programs," Fox said.

With the start of the federally funded *Fort Hood Training Lands Restoration and Maintenance* project in Fiscal Year 2007, AgriLife Research, ITAM, and NRCS are applying suites of conservation to the more than 67,000 acres of training lands on west Fort Hood.

Along with implementing these practices, the next step will be to enhance and apply decision support tools such as simulation modeling to the training lands. Fox explained that these tools will provide military land managers with more information for implementing their conservation programs. The first tool the researchers are using is the Agricultural Policy/Environmental eXtender (APEX) model, a watershed-scale hydrologic model currently used to assess croplands to determine erosion impacts. This tool has already been applied on Fort Hood scenarios and continues to be enhanced to meet the needs for application to military land systems, Fox said.

"This enhancement would allow land managers to run simulations of different suites of erosion control practices on specific landscapes and estimate the impact of these on training lands and natural resources prior to implementing conservation practices on the ground," Fox said. "These decision support tools will help the military spend money more cost effectively for erosion control and provide opportunities for military land managers to address both training and natural resources management issues with a systematic approach."

Once these tools are fully adapted, they can be applied nationally and internationally, on military posts and non-military lands, he said. "We plan on ultimately ending up with a product that can provide proactive planning for many entities nationwide."

Building upon the successes of the Fort Hood restoration projects, a team of Texas A&M scientists was recently awarded $647,000 by USDA Cooperative State Research, Education and Extension Service to conduct further research on the impacts of conservation practices on restoration of grazing land systems. This team will be using state-of-the-art computer simulation models to quantify impacts of multiple practices including re-seeding, contour ripping, and brush control.

"We plan on ultimately ending up with a product that can provide proactive planning for many entities nationwide."

—Dr. William Fox, assistant professor at Blackland

Fort Hood soldiers in heavy tanks and armored vehicles are continually conducting training exercise on the training lands, creating significant soil erosion and water quality issues.