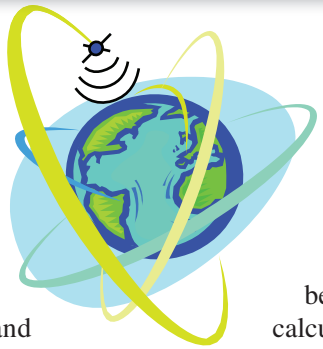
Spying on Crop Residue



Craig Daughtry and Paul Doraiswamy are developing techniques to figure out from satellite sensors how much of America's croplands are being farmed using conservation tillage or reduced tillage. They are also developing techniques for using satellite sensors and GIS (Geographic Information Systems) to identify farm fields that can sustain more residue removal for ethanol production without harm.

Daughtry is an agronomist and Doraiswamy an agricultural meteorologist with the ARS Hydrology and Remote Sensing Laboratory in Beltsville, Maryland.

"Tillage intensity" is defined by the percentage of soil covered by residue from the previous crop. At least one-third of the soil must be hidden by residue to qualify as "conservation tillage." Less than 15 percent cover is "intensive tillage," and anything in between is considered a form of "reduced tillage." Conservation tillage leaves the most crop residue on the soil surface after harvest and keeps the most soil and fertilizers in place.

Whether it's Congress asking for an accounting of the amount of land in conservation tillage under the last Farm Bill or USDA wanting to know how much residue is being removed for biofuel production, "it's important to get the percentage of residue cover right for protecting the environment," Daughtry says.

But current methods for making these types of estimates are labor intensive.

The Conservation Technology Information Center estimates that 40 percent of America's cropland was planted with conservation tillage last year. They get their percentages by driving around farmland in each county and stopping every mile for a look.

USDA's Natural Resources Conservation Service (NRCS) judges compliance by laying a line-transect in farm fields enrolled in voluntary conservation plans that require conservation tillage. "They use a 50-foot length of string with beads spaced every 6 inches, stretched diagonally across sample crop rows," Daughtry says. "Then they note whether there is crop residue or bare soil at each bead and use that finding to calculate the percentage of soil covered by crop residue."

Daughtry, Doraiswamy, and colleagues have been working over the past decade to devise ways to estimate crop residue more quickly and accurately by having satellites take an infrared look at entire regions of the United States. They began with lab work and field tests in Beltsville and moved on to fieldwork throughout the country.

Images from satellites and airplanes can measure the visible and infrared light reflected from fields and determine the amount of crop residue cover in each field. Four years ago, the researchers began focusing on Midwest corn and soybean fields, sending teams out each spring to Indiana, Illinois, and Iowa to check crop-residue levels and compare their ground-truth data to infrared images taken from aircraft and experimental satellites. They are also doing this on Maryland's Eastern Shore.

"Last year we added the fall measurements to see how much residue could safely be removed to make ethanol and maintain adequate residue cover for soil conservation," Daughtry says.

He and colleagues are working with NASA (National Aeronautics and Space Administration) to develop an accurate measurement method for use by NRCS managers.—By **Don Comis,** ARS.

This research is part of Soil Resource Management, an ARS national program (#202) described on the World Wide Web at www.nps.ars.usda.gov.

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In a cornfield at Beltsville, Maryland, agronomist Craig Daughtry (left) and remote-sensing specialist Andy Russ use a portable spectroradiometer to measure reflectance of crop residues and soil. To improve regional assessments of soil tillage intensity, the group is developing remote-sensing tools to measure crop residue cover using aircraft and satellite imagery.