UCDAVIS COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

IMPACT

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IMPACT is a series of publications highlighting how UC Davis' College of Agricultural and Environmental Sciences makes a difference in the lives of Californians. Through research, teaching and outreach programs, UC Davis research touches almost all aspects of Californian life. Today, millions of people eat safer foods, breathe cleaner air and drink healthier water with the help of our researchers. We're making discovery work -- for California and the world.

STORING CARBON IN SOILS

THE ISSUE

Fossil fuel burning emits carbon dioxide, a greenhouse gas, into the atmosphere faster than it can be converted to plant material through photosynthesis. Greenhouse gases trap radiation emitted by the Earth and cause surface temperatures to rise. Plants and soils can slow the cycling of carbon dioxide by storing the carbon in a process called carbon sequestration. Modifying agricultural practices may increase carbon storage in California's soils and help slow the rate of global warming.

WHAT WE'RE DOING

Researchers in the College of Agricultural and Environmental Sciences are studying soils in California — learning how to improve soil management practices that promote carbon storage, assessing the economic implications of these new practices, and examining policy options for promoting their adoption.

Analyzing soil organisms. Soil microorganisms are the primary catalysts of soil carbon sequestration. Professor Kate Scow's microbial ecology lab, in the Department of Land, Air and Water Resources, is studying the microbial communities involved in carbon sequestration and finding ways to improve soil conditions for those organisms. In the same department, Professor and Cooperative Extension Specialist Louise Jackson is working with other researchers to show how roots increase populations of specific types of bacteria, fungi and nematodes, and thereby enhance the cycling and retention of carbon and nutrients in the soil.

Legumes are plants that increase nitrogen availability in soil, which in turn increases soil quality and carbon sequestration potential. Jackson is conducting long-term experiments to test the rate at which fallowed agricultural lands can gradually store carbon in soil and in above-ground biomass after planting native legumes and perennial bunchgrasses.

Earthworms can convert decomposing plant materials into soil organic matter that can be retained for long periods of time. Through funding from the Kearney Foundation and the California Department of Food and Agriculture, soil scientist Johan Six, Department

of Agronomy and Range Science, is measuring the effects of earthworm populations on carbon and nitrogen storage in soils. Working with his graduate students, Six's research shows that earthworms can stabilize carbon within soil aggregates.

Protection of soil carbon in soil aggregates. Soil aggregates form by the interaction of soil organic matter and mineral soil particles. Soil aggregates partly protect the organic matter from decomposition by soil microorganisms and help promote carbon sequestration. Through the university's Agroecosystems Research Lab, Six is working on several projects that study the effects of soil aggregation and soil mineral/organic matter interactions on soil carbon storage. Based on these results, Six uses computer simulations to predict the limits of soils in California to sequester carbon.

Improving carbon sequestration in arid soils. Arid soils store carbon in the form of inorganic calcium carbonate. Department of Land, Air and Water Resources professor Michael Singer is studying inorganic carbon storage in California's arid soils at several sites in the San Joaquin Valley. He discovered that wastewater irrigation of arid soils with increases the amount of carbon retained. Graduate student and Kearney Foundation scholarship winner Gil Eshel works on this project.

Researching sustainable farming practices. Conservation tillage is a farming practice that promotes carbon sequestration by reducing tillage operations that disturb the soil and cause soil matter to decompose quickly, thus emitting more carbon into the atmosphere. Jeff Mitchell, Extension specialist in the Department of Vegetable Crops, and William Horwath, professor in the Department of Land, Air and Water Resources, are among the scientists involved in the university's Sustainable Agriculture Farming Systems project, which compares the effects of conventional farming practices versus conservation tillage on soil carbon storage and other indicators of soil quality. Their work at the Long Term Research in Agricultural Systems field site in Davis shows that adoption of conservation tillage management practices may be a viable option for California farmers to help improve environmental quality.

Promoting carbon sequestration to farmers. In August 2004, adjunct professor Stephen Vosti, Center for Natural Resources Policy Analysis and Department of Agricultural and Resource Economics, led a workshop that provided a tool for assessing the economic effects of various soil management practices. He developed guidelines that will allow researchers to understand potential obstacles that discourage producers from adopting these practices and will help identify social and economic policies that will encourage farmers to adopt soil management practices that increase carbon storage.

A SHARED VISION

Until new technology and better energy conservation practices reduce our dependence on fossil fuels for energy, university research will help agricultural producers develop farming practices that increase soil carbon storage, improve soil quality, and help slow global warming.

That's impact…science protecting our environment and keeping agriculture viable.

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