

# Smoldered-Earth Policy

Created by ancient Amazonian natives, fertile, dark soils retain abundant carbon

Shortly after the U.S. Civil War, a research expedition encountered a group of Confederate expatriates living in Brazil. The refugees had quickly taken to growing sugarcane on plots of earth that were darker and more fertile than the surrounding soil, Cornell University's Charles Hartt noted in the 1870s.

The same dark earth, *terra preta* in Portuguese, is now attracting renewed scientific attention for its high productivity, mysterious past, and capacity to store carbon. Researchers on Feb. 18 at the annual meeting of the American Association for the Advancement of Science in St. Louis presented evidence that new production of the fertile soil could aid agriculture and limit global greenhouse-gas emissions.

Prehistoric farmers created

dark earth, perhaps intentionally, when they worked charcoal and nutrient-rich debris into Amazonian soils, which are naturally poor at holding nutrients. The amendments produced "better nutrient retention and soil fertility," says soil scientist Johannes Lehmann of Cornell.

Charcoal forms when organic matter smolders, or burns at low temperatures and with limited oxygen. Nutrients such as phosphorus and potassium readily adhere to charcoal, and the combination creates a good habitat for microorganisms. The soil microbes transform the materials into dark earth, says geographer William I. Woods of the University of Kansas in Lawrence.

If some of today's Amazonian farmers were to use smoldering fires to produce dark earth rather than clear fields

with common slash-and-burn methods, they "would not only dramatically improve soil and increase crop production but also could provide a long-term sink for atmospheric carbon dioxide," says Lehmann.

Slash-and-burn land clearing releases about 97 percent of the carbon that's in vegetation. Smoldering the same fuel to form charcoal releases only about 50 percent of the original carbon, Lehmann previously reported. The rest of that carbon remains in dark earth for centuries.

However, dark earth requires extra nutrients, such as those in compost. International agreements on greenhouse gases don't provide financial incentives for farmers to make the effort to create dark earth, Woods says.

Nevertheless, ongoing field

experiments in Brazil suggest that the fertility associated with *terra preta* could provide its own incentive, reports Beáta Madari of the Brazilian Agricultural Research Corporation in Rio de Janeiro.

Brazil contains a wide range of dark earths with varying compositions. The scientists found differences between the soils used for ancient backyard gardens, which received more nutrients, and soils from distant fields.

Farmers of the time "certainly would have immediately learned about the properties of that soil, however [it] formed," says anthropologist Michael J. Heckenberger of the University of Florida in Gainesville. But the knowledge about how to make dark earth disappeared after contact with Europeans decimated the indigenous population. —B. HARDER