Payback time for soil carbon from pasture conversion to sugarcane production

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The reduction of soil carbon stock caused by the conversion of pasture areas into sugarcane plantations – a very common change in Brazil in recent years – may be offset within two or three years of cultivation.

The calculation appears in a study conducted by researchers at the Center for Nuclear Energy in Agriculture (CENA) of the University of São Paulo (USP) in collaboration with colleagues from the Luiz de Queiroz College of Agriculture (Esalq), also at USP. The study also included researchers from the Federal Institute of Alagoas (IFAL), the Brazilian Bioethanol Science and Technology Laboratory, the Institut de Recherche pour le Développement in France and Harvard University, Colorado State University and the Shell Technology Center Houston in the United States.

Findings from the project "Soil carbon stocks on land-use change process to sugarcane production in South-Central Brazil," carried out with funding from FAPESP, were described in an article published in the online version of the journal *Nature Climate Change*.

"The study indicates that the soil carbon balance of pasture areas converted for the cultivation of sugarcane designed for ethanol production is not as negative as originally estimated," said Carlos Clemente Cerri, project coordinator and researcher at CENA.

According to Cerri, soil from pasture areas has a carbon stock whose volume varies only slightly over the years. However, the process of

preparing this type of soil for conversion to sugarcane plantations causes part of the carbon stock to be emitted into the atmosphere as carbon dioxide (CO_2).

In contrast, depending on the type of management, the introduction of sugarcane to pasture areas could compensate for, or even add to, the initial soil carbon stock when the organic matter and plant residue penetrate the ground.

Moreover, the ethanol produced from sugarcane grown in these areas over time ultimately offsets the CO_2 emissions that occur during the conversion process because biofuel contributes toward reducing the burning of fossil fuel, explained the researcher.

The researchers conducted measurements and collected 6,000 soil samples from 135 regions in south-central Brazil, which is responsible for more than 90% of Brazil's sugarcane production.

At each of the sites, soil samples were collected from areas of sugarcane cultivation and from other areas to be used as reference. These reference areas included pastures, annual cropland (soybean, sorghum and corn) and Cerrado native vegetation.

According to the researchers, the study findings could contribute toward guiding expansion policies for sugarcane production aimed at producing ethanol to ensure the biofuel's sustainability - Ethanol demand in Brazil is expected to jump from an annual total of 25 million liters to 61.6 billion liters by 2021.

The professor indicated that to reach this number, the area of sugarcane production in Brazil would need to expand from the current 9.7 million hectares to 17 million hectares.

Cerri notes that among the options for reaching the target area, the priority for expansion of production is expected to be the conversion of degraded lands, principally those used as pastures, into sugarcane plantations.

Between 2000 and 2010, three million Brazilian hectares were converted to sugarcane cultivation areas. More than 70% of this land consisted of pastures, and 25% had been used for growing grains, said the study's researchers.

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