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Greater focus needed on carbon sequestration in the world's soil

The world's soils have the potential to store about 3000 megatonnes of carbon per year by the end of the 21st century, according to a new study. It suggests that restoring carbon to cropland and peat soils through practices such as afforestation and no-till farming could help solve global problems of food insecurity and climate change.

Most countries suffering from food shortages are in the developing world where farming typically consists of small landholders using intensive practices. As a result the soils have low levels of organic carbon, making them prone to soil erosion, low levels of nutrients, poor water retention and less biodiversity. Poor soil quality means that crop yields are more dependent on rainfall and temperature and more affected by pest infestations.

The loss of soil organic carbon (SOC) can be remedied using recommended management practices (RMPs), such as afforestation, conversion of degraded and marginal cropland to pasture, no-till farming, use of compost/manure and crop rotations. Using figures on carbon sequestration gained by different practices, the study estimated that, depending on soils and climate, the potential of these RMPs for the next 50 to 100 years is in the range of 100-1000 kg of carbon per hectare per year. On a global scale, this could translate to as much as 3000 megatonnes a year. Not only would this improve the state of soils and food security but, according to previous research[1], it could also reduce atmospheric CO_2 by 50 parts per million by 2100.

The study investigated the potential impact of this restoration of soil SOC on crop yield. By pulling together information on the relationship between SOC in the root zone and crop yield in various parts of the world, the study concluded that SOC tended to contribute more to productivity in soils that were coarse, poor quality, received low rates of chemical fertilisers and were rain fed rather than irrigated. Depending on climate and other variables, it estimated the proposed increase in SOC could increase cereal and grain legume production in developing countries by 32 million tonnes per year, and roots and tuber production by 9 million tonnes per year.

Finally, the study offered a rough estimate of the cost effectiveness of paying farmers to improve the sequestration of carbon in soil. If farmers were compensated at a rate equivalent to the cost of carbon capture and storage, roughly $367 per tonne of carbon[2], then even at the modest rate of carbon sequestration of 250 kg per hectare per year this would equate to $90 per hectare per year. Rewarding farmers even at $25/ha/yr ($10/acre/yr) could provide an incentive for adopting RMPs by small land holders and resource-poor farmers. As such the study suggests that paying farmers and managers to use RMPs to sequester carbon, either through schemes such as the Clean Development Mechanism or by paying for ecosystem services, is an important strategy to improve both regional and global food security. It suggested the concept of "farming carbon" where credits gained by sequestering soil carbon could be sold and traded using transparent and fair prices based on the valuation of ecosystem services.

1. See: Hansen. J. *et al*. (2008) Target atmospheric CO2: where should humanity aim? *Open Atmospheric Science Journal.* 2:217-231.
2. See: McKinsey & Co. (2009) Pathways to low-carbon economy. Version 2 of the global greenhouse gas abatement cost curve. P190.

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