

Economics of Sequestering Carbon in the U.S. Agricultural Sector

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Chapter 1: Introduction

Increasing the quantity of carbon sequestered—or stored—in soils and biomass is an alternative to reducing emissions of carbon and other greenhouse gases (GHG) in an overall strategy to mitigate global climate change and its negative economic and environmental effects. In February 2002, the President directed the Secretary of Agriculture to develop recommendations for incentives designed to encourage owners of agricultural and forest lands to adopt production practices and land uses that extract carbon from the atmosphere and sequester it in terrestrial sinks. This report provides information useful for evaluating the economic implications of several frequently discussed designs for incentive programs that might be used to expand such land uses and production practices in the U.S. farm sector.

Recent studies indicate that U.S. agricultural soils are now being managed as a modest carbon sink—accounting for net sequestration of 4 million metric tons (MMT) of carbon annually (U.S. EPA, 2003).¹ It is generally believed that these soils could be managed to store significantly more carbon. Sperow et al. (2003) estimate that U.S. croplands could be managed to sequester an additional 60-70 MMT of carbon per year. Lal et al (1998) put this figure at 75-208 MMT. Follett et al. (2001) estimate that U.S. grazing lands could be managed to sequester an additional 29-110 MMT of carbon per year. These studies do not consider the option of sequestering carbon by shifting marginal croplands and grazing lands to forest. Hence, even in the absence of afforestation, the estimates in these studies suggest it may be technically possible to sequester an additional 89-318 MMT of carbon annually on U.S. croplands and grazing lands. Based on 2001 emissions, this level of carbon sequestration

would offset between 5 and 17 percent of gross U.S. GHG emissions.²

From a policy standpoint, it is important to note that the carbon sequestration assessments of Sperow et al., Lal et al., and Follett et al. do not take into account the cost to store the additional carbon in agricultural soils. The marginal cost of sequestering additional units of carbon would be expected to rise as the quantity sequestered increases. Consequently, the cost of increasing the carbon content of all agricultural soils to the levels suggested by these studies could be very high. Further, it may be more cost effective to sequester carbon by changing the use of some lands now engaged in commodity production, for example, by shifting cropland or pasture to forest.

This study explores the economic potential of the U.S. farm sector to store additional carbon, and the resulting implications for land-use changes and the economic well-being of producers and consumers. To assess this potential, we adapt the U.S. Agricultural Sector Model (USMP) to include sequestration and emissions parameters associated with switching into and out of land uses and production practices that build carbon levels in soils and biomass. The cropland management and grassland conversion parameters are based on the Intergovernmental Panel on Climate Change (IPCC) GHG inventory procedures (1997). Forestry parameters are from U.S. Forest Service estimates (Birdsey, 1996). With this information as a base, we incorporate incentive payments for afforesting croplands and pasture, shifting cropland to permanent grasses, and increasing the use of production practices (particularly no-till) and rotations that raise soil-carbon levels. We run model simulations reflecting four alternative payment structures and six alternative payment levels for additional carbon sequestration from adoption of these activities.

¹ For perspective, the U.S. Environmental Protection Agency (2003) estimates 2001 net sequestration in U.S. forests at 207 MMT of carbon.

² For 2001, the U.S. Environmental Protection Agency (2003) estimates gross U.S. emissions of greenhouse gases at 1,892 MMTCE, including carbon emissions of 1,580 MMT.