LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

Assessing soil quality impacts after conversion of marginal cropland to productive conservation

Abstract: Planting trees on poor quality cropland may yield some benefits for increasing soil organic carbon. Test plots in four parts of Iowa were examined to determine the level of benefits possible to achieve.

At four contrasting locations across the state, planting trees did result in a relatively rapid and sustained increase in surface soil organic matter content. This result suggests that conversion of marginal agricultural lands to forestry practices will improve soil quality and has potential to enhance related ecosystem assets associated with water quality and availability, nutrient cycling and carbon storage.

ECOLOGY

What was done and why?

Forest ecosystems offer great potential to improve soil quality of degraded or marginal cropland by reducing soil disturbance and by providing permanent ground cover. The potential of perennial vegetation to increase soil organic matter content in the surface layer is of great interest because organic matter is a critical soil quality factor through its role in carbon (C) and nutrient cycling, enhancing soil fauna and improving infiltration and water-holding capacity.

In this project, investigators identified the spatial distribution of marginally productive cropland in Iowa and the areas where this land has transitioned from row crop production to a forestry practice. The marginally productive farmland could be fields that have low native productivity, low productivity due to erosion or other degradation, or are too small, steep or dissected to use modern farm equipment.

The objective of the project was to determine whether planting trees on low productivity and/or eroded cropland, either in an agroforestry system as afforestation or reforestation, has a significant benefit for increasing soil organic carbon (SOC).

What did we learn?

Converting highly erodible, low productivity cropland to forestry or agroforestry practices has great potential to reduce energy inputs and increase net ecosystem productivity. Forest restoration or afforestation practices also have additional potential as bioenergy sources, either through cellulosic fermentation for liquid fuels or as combustion materials for generating electricity. Short-rotation softwood species already are being utilized for bioenergy in other states.

Quantifying the impact of forest restoration on soil properties is critical information for policy makers and agency personnel in conducting a comprehensive environmental assessment of these practices. Further research on the benefits of increased SOC on ecosystem assets is needed to delineate the full impact of such land use changes on soil, water and biological resources.

Investigators:

Thomas Sauer
David E. James and
Cynthia Cambardella
USDA-ARS National Soil Tilth Laboratory

More details:
www.leopold.iastate.edu/research/grants/2009-1/E2006-17.pdf