California Agricultural Soils
Potential for Carbon Sequestration

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Rising atmospheric carbon dioxide levels has raised concern with respect to driving global climate change and the potential for global warming. Concern over rising levels of atmospheric carbon dioxide expressed by parties to the United Nations framework convention on climate change in 1995, resulted in the Kyoto protocol. The Kyoto protocol calls for a reduction in greenhouse gases, which may be accomplished by transferring carbon dioxide from the atmosphere to sinks. In this context, a sink is any reservoir or process that actively removes carbon from the atmosphere. Global carbon sinks include aquatic and terrestrial ecosystems, with soils implicated as a major terrestrial carbon pool (see chart 1 and 2).

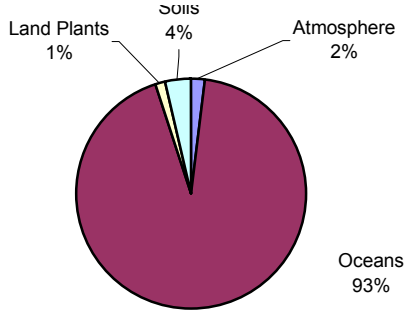


Chart 1. Global Carbon Pools

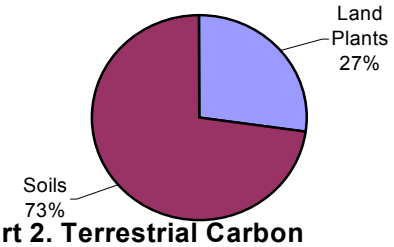
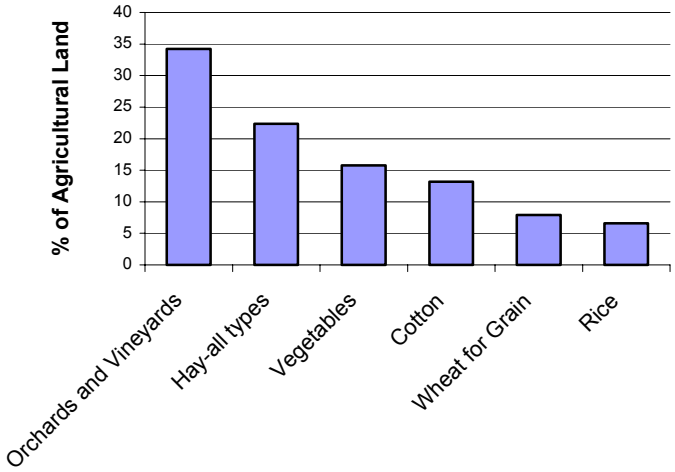


Chart 2. Terrestrial Carbon Pools

Soils under agricultural are believed to be a significant sink for atmospheric carbon dioxide, with the ability to sequester a significant amount of atmospheric carbon dioxide through the formation of soil organic matter. Soil organic matter is a carbon rich substance produced from the activity of soil microorganisms that decompose plant material. This organic matter sink will account for 20 to 30% of the carbon dioxide reduction required to maintain the atmospheric carbon dioxide level at 550 parts per million 100 years from the present Currently the atmospheric carbon dioxide level is 360 parts per million.

Agriculture accounts for nearly one third (28%) of the land base in California. These agricultural systems are intensively managed and present the greatest opportunity for soil carbon management. A major difference between California agricultural land and Midwest farmland is the tremendous diversity of crops and land use (see chart 3). This diversity will enhance the potential to utilize these soils as sinks for carbon dioxide.

Chart 3. Crop Type and Distribution



California soils are relatively carbon poor in comparison to Midwest soils because of intensive tillage and fertilization practices used. For this reason, there is a greater potential for increasing total soil carbon storage compared to other regions. Recent research in California quantifying the effects of management techniques on soil organic carbon shows a 36% increase in soil organic carbon (5 tons carbon per hectare) over 12 years by changing from conventional agriculture to organically managed cropping practices. By utilizing a winter leguminous cover crop, a gain of 3 tons carbon per hectare can be obtained.

The conversion to conservation tillage may provide growers additional ways to sequester soil carbon. Using an equation from Lal, et. al, (1998) the potential for carbon sequestration in California cropland maybe estimated. These calculations assume that currently less than 1% of cropland in California utilizes conservation tillage, which has been shown to increase carbon supplies in agricultural soils through reduced soil disturbance. California currently has 4.4Mha cropland that could be brought under some form of conservation tillage or utilize a winter cover crop in rotation with main crops. It is estimated that on the order of 1.4 million metric tons of carbon per year can be sequestered in systems using conservation tillage or winter cover crops. This is on the order of 4% to 8% of the total C that is estimated to be sequestered in U.S. cropland in the next 25 years if conservation tillage is adopted widely.

For these reasons, California agriculture provides a unique opportunity to offset rising carbon dioxide levels and help in reducing the effects of climate change.