Soil Carbon Sequestration in California Agriculture

Kate Scow, Director Kearney Foundation, Dept LAWR, UC Davis

<u>Workshop sponsored by:</u>

Kearney Foundation of Soil Science
California Dept of Food and Agriculture
California Energy Commission
Conservation Tillage Workgroup

Meeting Objectives

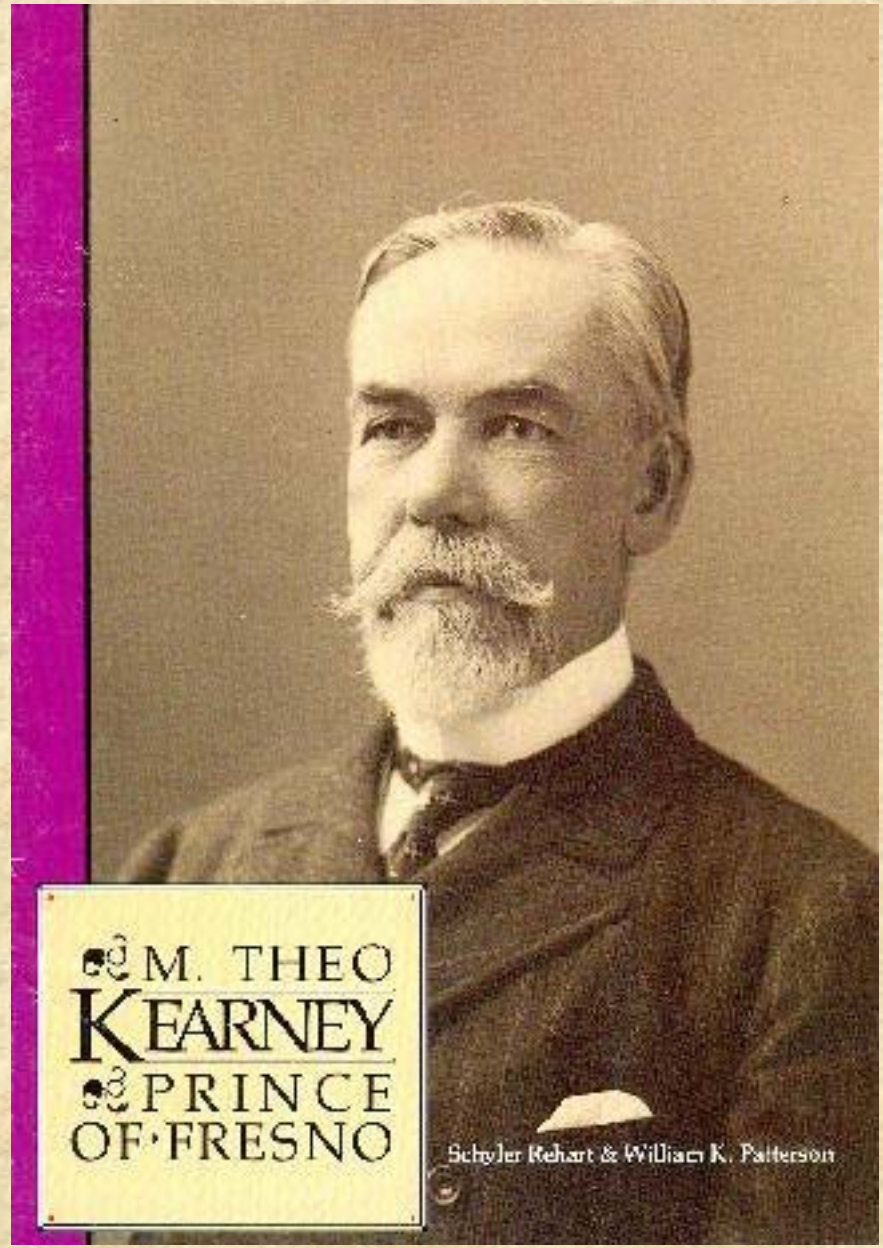
1. What are new developments in State regarding climate change and carbon sequestration/GHG emissions?--Guido Franco CEC and Steve Shaffer CDFA

2. What is recent research on measurement and management of carbon sequestration/GHG emissions in agriculture?--Jeff Mitchell, Johan Six, Louise Jackson

3. Analysis of costs and benefits of carbon sequestration--Steve Vosti

4. C sequestration in the Northwest--Karl Kupers

5. What are major issues, research gaps for growers?



Kearney Foundation

- Kearney Foundation of Soil Science established 1951.

- New mission selected every 5 yrs to conduct basic research and solve problems on contemporary agricultural/environmental issues in CA and support research in soils, plant nutrition and water science

2001-2006: Soil Carbon and California Terrestrial Ecosystems

- *Understand mechanisms and processes governing storage and flow of carbon in soils of CA's diverse ecosystems;*

- *Quantify impacts of inputs of water, nutrients, and pollutants, as well as physical disturbance, on storage, transformations and transport of carbon in soils;*

- *Assess roles of soils in emissions and consumption of greenhouse gases,*

- *Identify and analyze strategies and policy options for soil carbon management*

Projects Funded:

- **30 Kearney research projects across UC campuses**
- 3 projects funded by joint CDFA Specialty Crops/Kearney Foundation program
- 1 project funded funded by joint CEC/Kearney Foundation program
- **18 graduate fellowships funding research on soil carbon**

EXAMPLES OF KEARNEY FUNDED RESEARCH

1. Stabilization of organic matter in soils

*Residue quality (e.g., C/N, tannins, lignin, etc.) in regulating organic matter turnover
*Plant residue effects on microbial function and soil C dynamics
*Pedogenic factors in regulating soil carbon storage
*Carbonate chemistry as a source/sink of carbon in soils

2. Transformation of trace gas in soils

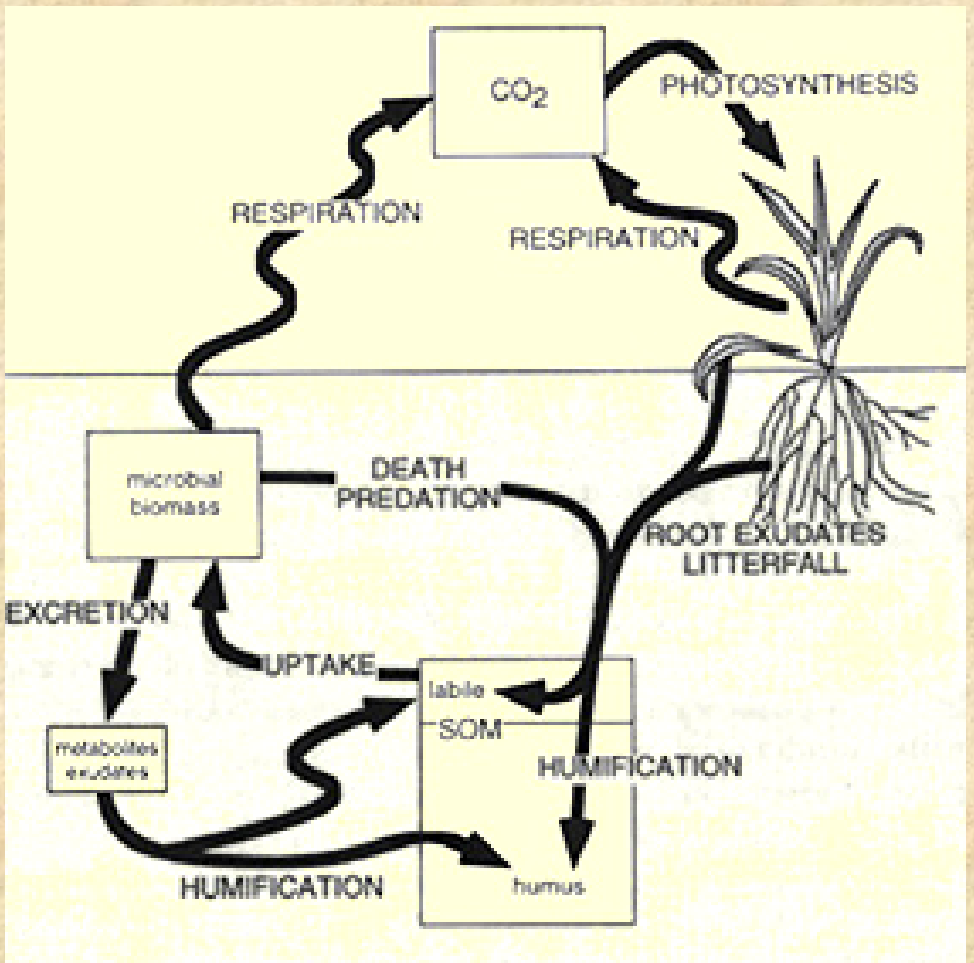
*Microbial processes on the dynamics of trace gas formation
*Factors affecting trace gas fluxes between the atmosphere and soil

3. Impacts of management

*Effect of management practices (N fertilization, irrigation, minimum tillage, wetland drainage) on carbon storage and trace gas dynamics
*Soil carbon sequestration effects on fertilizer use efficiency
*Role of soil carbon in maintaining surface and subsurface water quality
*Development of water storage strategies through enhanced soil structure and water penetration

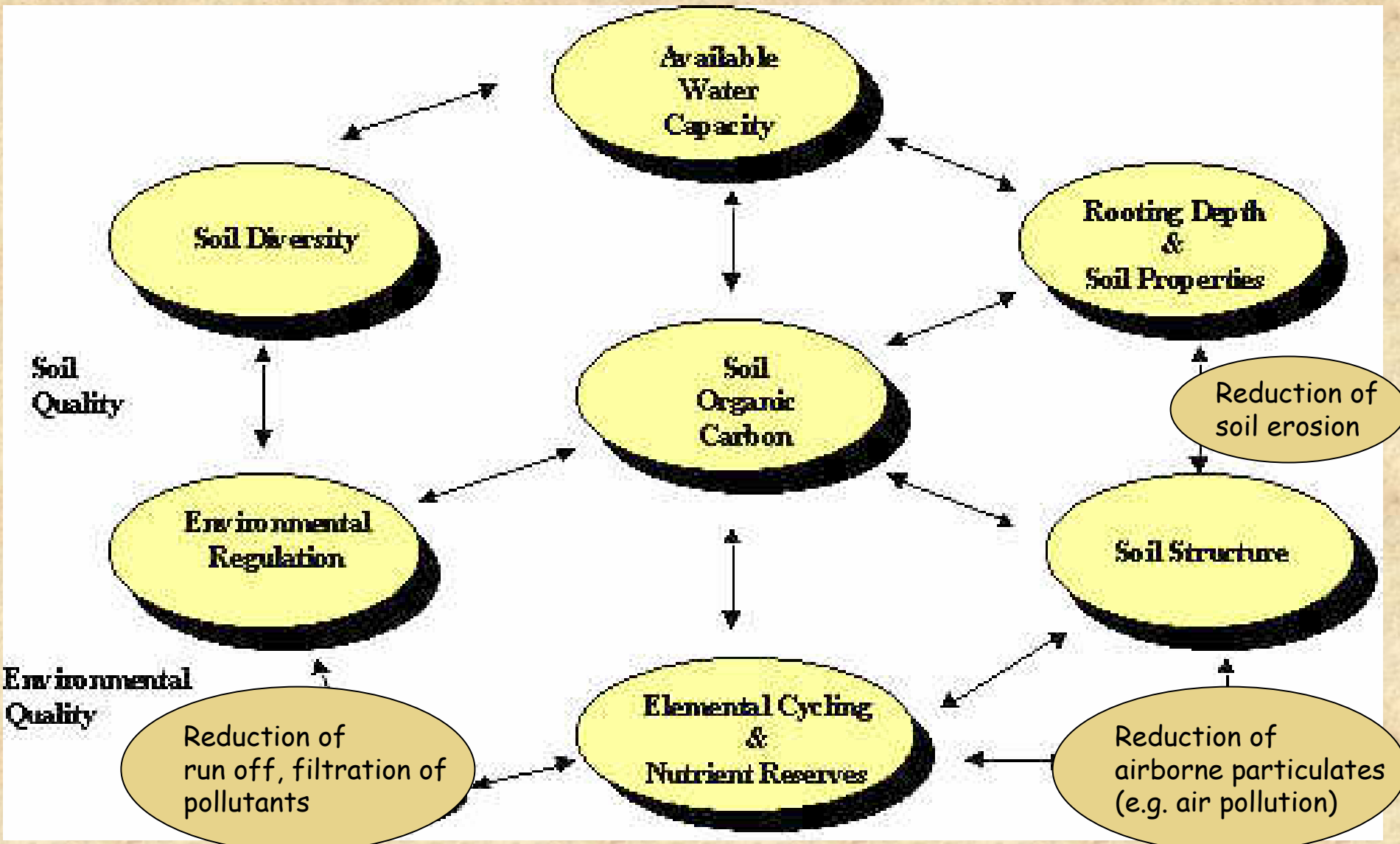
Opportunities for C sequestration in soil

- Carbon sequestration is long term storage of C in environment (soil, water, biota, rocks)

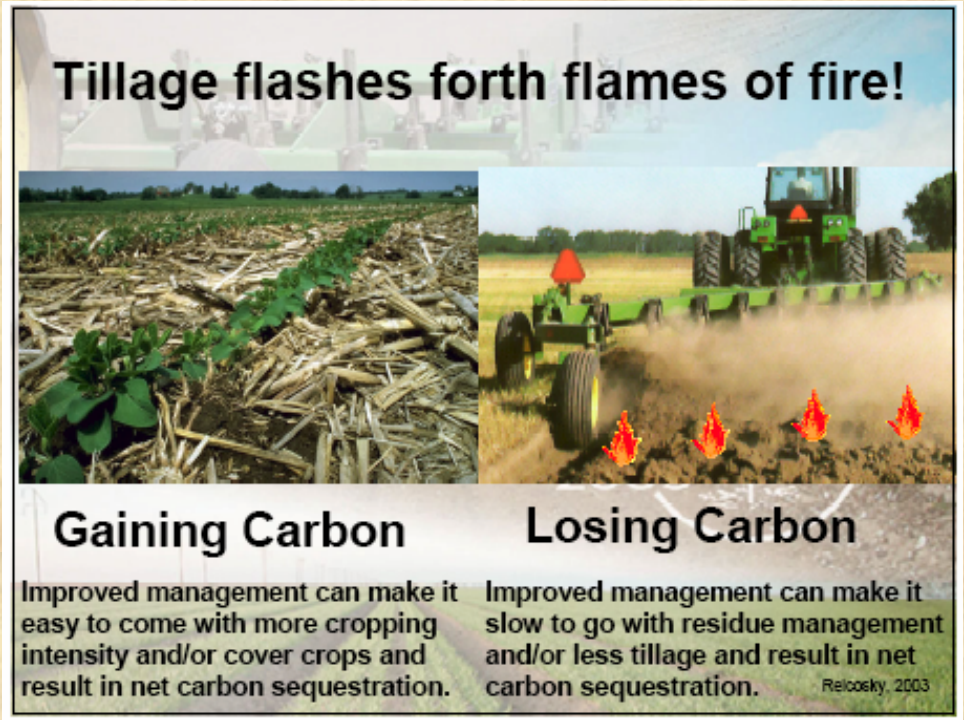


- Soils contain 75% of terrestrial C pool
- Soil C can be increased by reducing losses and increasing inputs

SOIL CARBON HAS MANY OTHER BENEFITS



Opportunities for Reducing Greenhouse Gas Emissions



Croplands . . .

- Less tillage
- Increase crop intensity, reduce fallow
- Use of cover crops
- Fertility and water management
- High biomass crops

Animal Agriculture. . .

- Improved feed and forage
- Methane capture

Rangeland or Pasture . . .

- Management of marginal lands
- Adding legumes
- Improved grazing management
- Fertility and water management

Estimates of potential C sequestration in US soils

75-200 Tg C in croplands (Lal et al. 1998)

30-90 Tg C in grazing lands (Follett et al. 2001)

- ***Assumes widespread adoption of improved management practices.***
- ***Does not account for changes in other greenhouse gases (nitrous oxide and methane) that may be by-products of management changes.***

THUS C sequestration in terrestrial ecosystems can account for about 6.4% of emissions (based on 5000 Tg C per yr in 1990).

Increasing C sequestration in soil is only temporary and partial solution to the greenhouse gas problem.

Thanks to:

Gladis Lopez Kearney Foundation
Jeff Mitchell/Diana Nix
John Beyer NRCS Fresno
Ed Scott Westside
Karl Kupers