Climate Smart Agriculture Program
EARTH WEEK 2017
THE GREENHOUSE EFFECT

- Some solar radiation is reflected by Earth and the atmosphere.
- Some radiation is absorbed by Earth’s surface and warms it.
- Infrared radiation is emitted by Earth’s surface.
- Some of the infrared radiation passes through the atmosphere.
  - Some is absorbed by greenhouse gases and re-emitted in all directions by the atmosphere. The effect of this is to warm Earth’s surface and the lower atmosphere.
The Carbon Cycle

Atmospheric Carbon Net Annual Increase: 4

Numbers in parentheses refer to stored carbon pools. Red indicates carbon from human emissions.

Net terrestrial uptake: 3

Soil carbon

Microbial respiration and decomposition

Net ocean uptake: 2

Deep ocean (37,000)

Reactive sediments (6000)

Surface ocean (1000)

Phytoplankton photosynthesis

Respiration and decomposition

Air-sea gas exchange

Fossil fuels, cement, and land-use change

Plant respiration

Plant biomass (550)

120 ± 3

Photosynthesis

Atmosphere (800)

Net terrestrial uptake

Soil (2500)

Fossil pool (10,000)
How does carbon affect the climate?

Temperature and CO₂ from Antarctic ice cores over the past 800,000 years
We’re making the planet warmer every year
Climate change = more extreme weather events

Source: EM-DAT: The CRED/OFDA International Disaster Database
Great Barrier Reef
Since 1979, more than 40% of the Polar Ice Cap has melted away.
Greenhouse Gas Emissions by Economic Sector

- Electricity and Heat Production: 25%
- Agriculture, Forestry and Other Land Use: 24%
- Transportation: 14%
- Industry: 21%
- Buildings: 6%
- Other Energy: 10%
Greenhouse gas emissions have increased dramatically since the industrial revolution.
Global Warming Potential per number molecules

- Carbon Dioxide: 1
- Methane: 25
- Nitrous Oxide: 298
Top Sources of CH4 Emissions

- Natural Gas Systems
- Enteric Fermentation
- Landfills
- Petroleum Systems
- Coal Mining
- Manure Management

Million Metric Tons CO2 Equivalency
Top Sources of N2O Emissions

- Ag soil management
- Stationary combustion
- Manure management

Million Metric Tons CO2 Equivalency
Most nitrous oxide emissions come from agricultural areas (Central Valley)
Food waste exacerbates every environmental issue
Climate change causes desertification.
Climate change causes decreased crop yields
California’s economy and food security will suffer
Carbon sequestration

**Black Carbon**
- Photosynthesis
- Plant respiration
  - Fossil fuels, cement, and land-use change
- Net terrestrial uptake
  - Soil carbon
  - Microbial respiration and decomposition
- Soil (2300)
- Fossil pool (10,000)

**Brown Carbon**
- Atmospheric Carbon (800)
- 120 +3
- Plant biomass (550)

**Green Carbon**
- Net ocean uptake (2)

**Blue Carbon**
- Surface ocean (1000)
- Respiration and decomposition
- Phytoplankton photosynthesis
- Air-sea gas exchange
- Net ocean uptake
- Deep ocean (37,000)
- Reactive sediments (6000)
How do we increase soil carbon?

- Reduce synthetic chemical applications
- Cover crops
- Crop rotations
- No till
- Agroforestry
- Composting
- Sustainable grazing
Cover crops reduce erosion and sequester carbon all year
Cover crops build soil carbon
Cover crops retain moisture, build microbial communities, and can attract beneficial insects
Crop rotations build soil carbon

- **Legume**: beans, peas, lima beans, potatoes
- **Root**: onions, garlic, turnips, beets, carrots, radishes
- **Leaf**: lettuce, greens, herbs, spinach, brassicas, corn
- **Fruit**: tomatoes, cucumbers, peppers, eggplant, squash, melons
Tillage disrupts soil structure and releases carbon to the atmosphere
No-till allows organic matter to accumulate.
Less tillage = more organic matter (soil carbon)
Agroforestry builds soil carbon
Compost builds soil carbon
Composted soils have much higher soil carbon, microbial activity, water holding capacity, and porosity.
Compost helps absorb and retain moisture
Sustainable/rotational grazing builds soil carbon
What are the co-benefits of more soil carbon?

- Feeds microbes
- Strengthens soil foodweb
- Better retention of nutrients and water
- Builds soil structure
- Prevents erosion
- Buffers pH and temperature
Support farms that practice sustainable management

Waste Less!

Buy more!
- Real food
- Local
- Seasonal
- Organic
- No spray/transition
Questions?