USDA Soil Carbon Research and Management

- NIFA (Sandeep Kumar, National Program Leader, NIFA)
- ARS (Peter Vadas, National Program Leader, ARS)
- FS (Anne Marsh, National Program Leader, Forest Service)
- NRCS (Michael Robotham, SSRA Senior Scientist, NRCS)

AFRI grants support Research, Education and Extension activities in 6 Farm Bill priority areas:

1. Plant health and production, and plant products

2. Animal health and production, and animal products

3. Food safety, nutrition, and health

4. Bioenergy, natural resources, and environment

5. Agriculture systems and technology

6. Agriculture economics and rural communities

Agriculture & Food Research Initiative

Three Requests for Applications (RFAs)

1. Foundational and Applied Science

2. Education and Workforce Development

3. Sustainable Agricultural Systems

AFRI Grant Types

- Standard Grants

- Coordinated Agricultural Projects (CAP)

- Conference Grants

- Food and Agriculture Science Enhancement (FASE) Grants
  - New Investigator Grants – two types
  - Strengthening Grants – several types
  - Pre- and Postdoctoral Fellowship Grants

AFRI Programs that support Soil Carbon (C)

- **Soil Health (A1401)**
  - Research to advance scientific understanding of soil C, physical and biogeochemical processes and interactions

- **Sustainable Agroecosystems: Health, Functions, Processes and Management (A1451)**

- **Crosscutting: Agricultural Microbiomes in Plant Systems and Natural Resources (A1402)**
  - molecular mechanisms and signal exchange involved in microbiome assembly and interactions in various environments (e.g., stress, diseases or growth stages), and microbial processes helps in enhancing soil C and health

- **Crosscutting: Critical Agricultural Research and Extension (A1701)**
  - a clear, time-sensitive, stakeholder-identified need or problem for agriculture; enhancing soil health (C), nutrient management etc.

- **Crosscutting: Climate Hub Partnerships (A1721)**
  - address climate change through improved practices, managing emissions and soil C, and others through regional partnerships including USDA Climate Hubs and Extension

- **Sustainable Agriculture Systems**
  - Larger grants ($10M) that supports soil (C and other parameters), air and water management using sustainable production systems

AFRI Programs that support Soil Carbon (C)

- **Small Business Innovation Research (SBIR) Program**
  - SBIR 8.4 Conservation of Natural Resources
    - develop innovative technologies that are developed with the purpose to conserve, monitor, improve and/or protect the quality and/or quantity of natural resources; e.g., soil C, air, water and nutrient management.

- **Sustainable Agriculture Research and Education (SARE)**
  - Regional program with four Host Institutions. Each institution runs several grant programs to:
  - Maintain and enhance the quality and productivity of the soil; Conserve soil, water, energy, natural resources, and fish and wildlife habitat; Maintain and enhance the quality of surface and ground water; Protect the health and safety of persons involved in the food and farm system; Promote the well-being of animals; and Increase employment opportunities in agriculture

- **Organic Agriculture Program**

- **Farm of the Future**

USDA-ARS: Highlights

- **90+ research locations, including overseas labs**

- **2000 scientists**

- **660 research projects in 15 National Programs**

- **$1.5 billion annual budget**
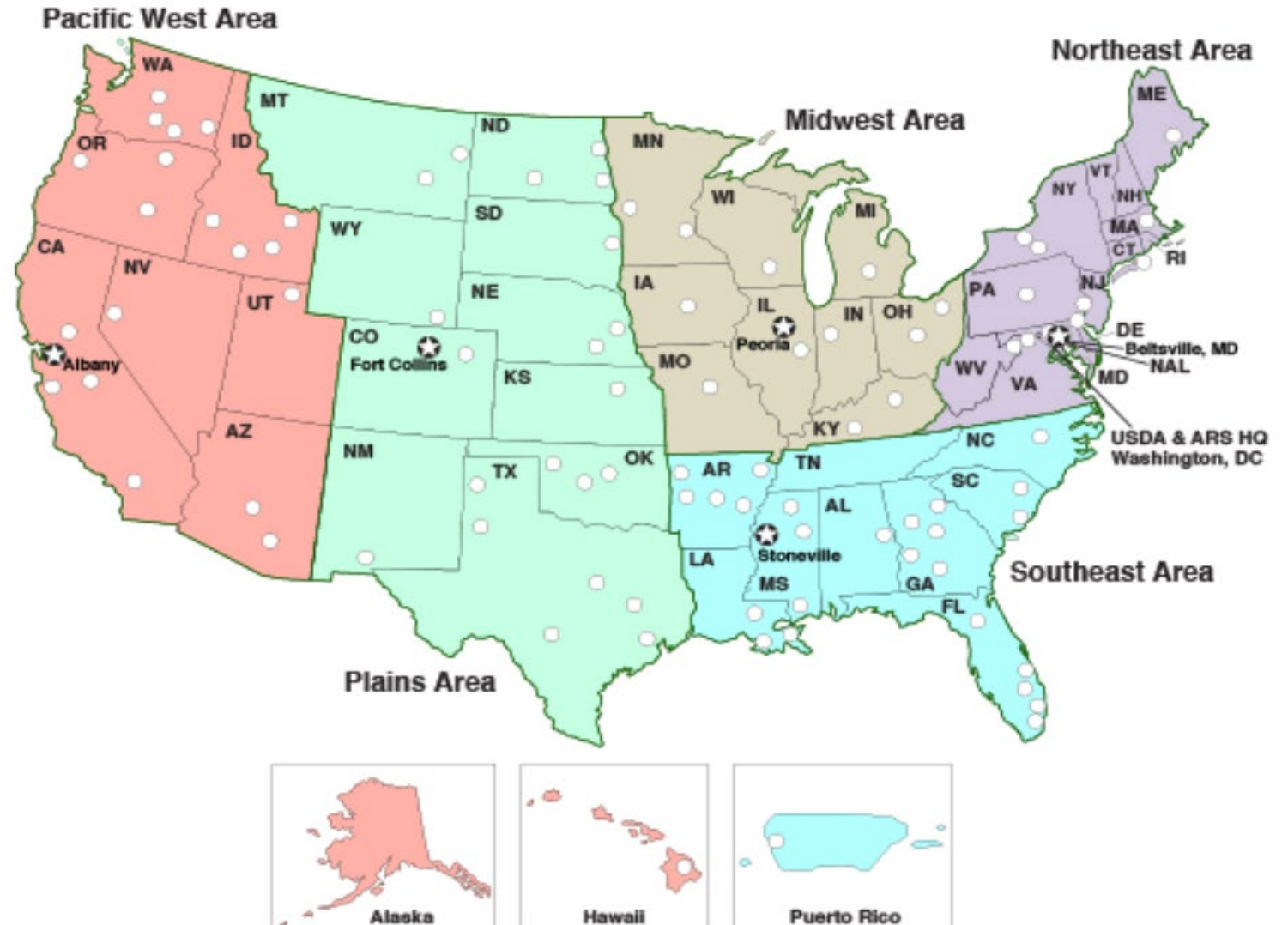
National Research Programs

Nutrition, Food Safety/Quality
- Human Nutrition
- Food Safety
- Product Quality and New Uses

Animal Production and Protection
- Food Animal Production
- Animal Health
- Veterinary, Medical, and Urban Entomology
- Aquaculture

Crop Production and Protection
- Plant Genetic Resources, Genomics and Genetic Improvement
- Plant Diseases
- Crop Protection and Quarantine
- Crop Production

Natural Resources and Sustainable Agricultural Systems
- Water Availability and Watershed Management
- Soil and Air
- Grass, Forage, and Rangeland Agroecosystems
- Sustainable Agricultural Systems Research

Comprehensive Approach to Climate Research:
Adaptation and Mitigation

- **Resilience to climate and weather extremes** (Adaptation)

- **Minimize GHG emissions** (Mitigation)

- **Manage Carbon and Bio-Energy** (Mitigation)

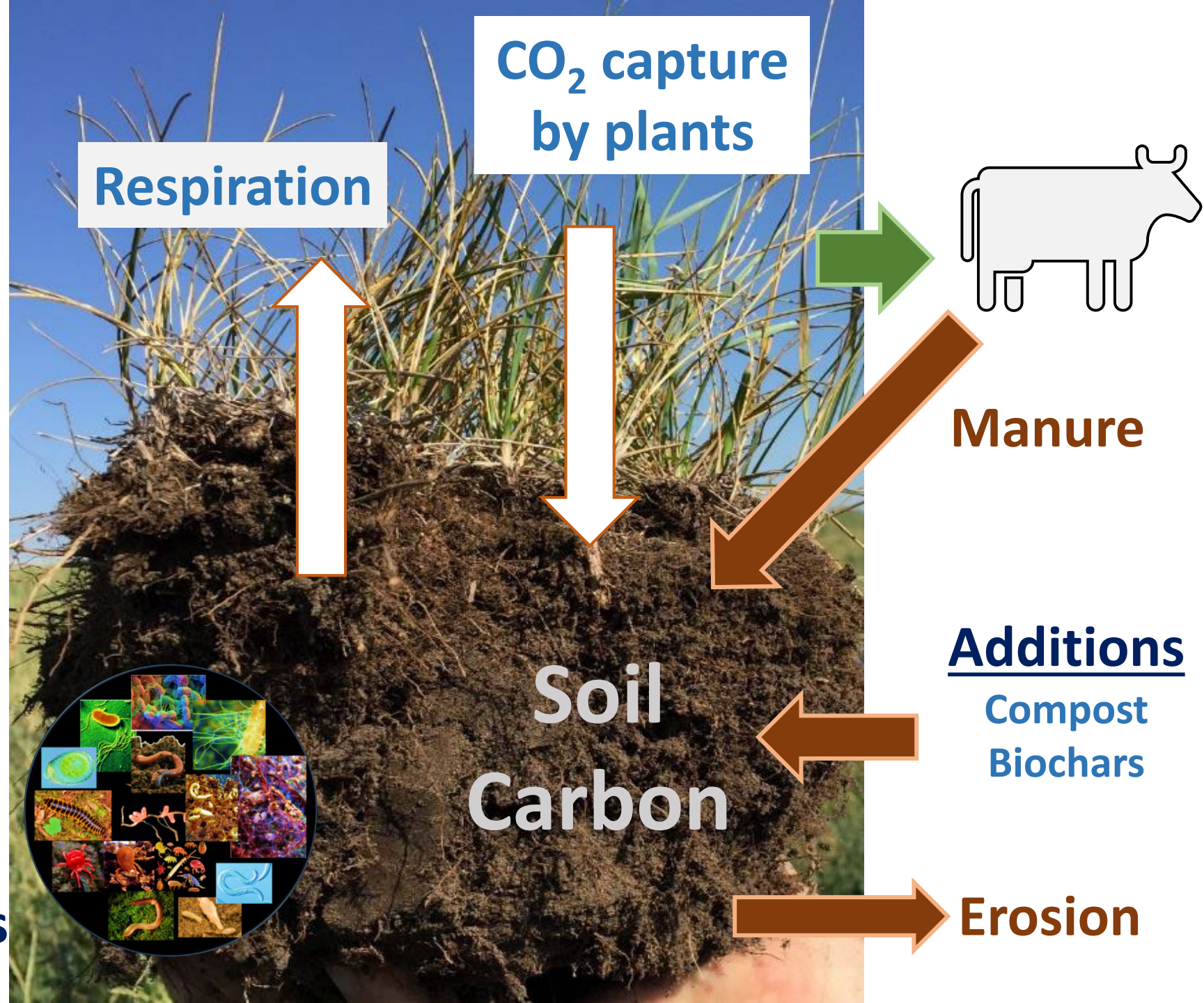- **Measure, monitor, verify**

- **Systems analysis**
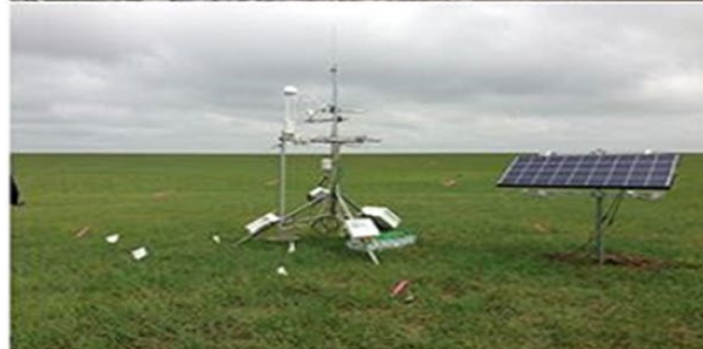
Soil Carbon Cycle

- **Maximize inputs resistant to decay**
- **Minimize losses**
- **Stack Practices**

Soil Organisms

Respiration

CO$_2$ capture by plants

Manure

Additions
Compost
Biochars

Soil Carbon

Erosion

Maximize Inputs

- **Cover crops, living mulch, perennials**
- **Soil amendments**
- **Silvopasture, agroforestry**
- **Breed crops for greater and deeper root biomass**

Minimize Losses

Photo: USDA-NRCS

- **Reduce tillage**
- **Prevent soil erosion**
- **Minimize wildfires**
- **Land restoration**

Soil Microbiome

- **Understand how GxExM impacts microbiomes**
- **Analytical techniques to identify and quantify microbes and their role**
- **Plant-ecotype dynamics that optimize productivity and soil C**
- **Optimize soil amendments for microbiomes**

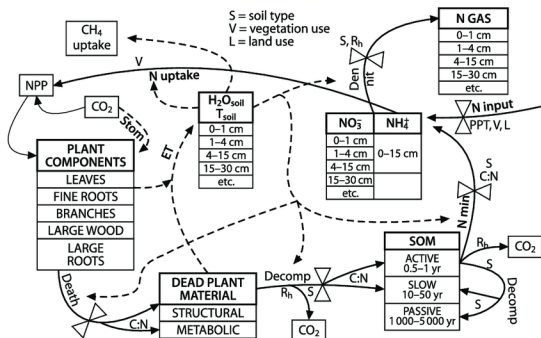# System Models and National Greenhouse Inventory

Measure at different scales for many practices and settings (GRACEnet, REAP, LTAR)

Databases (AgCROS)

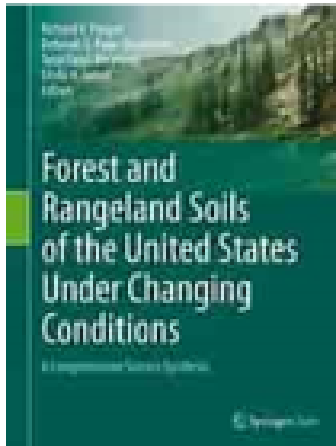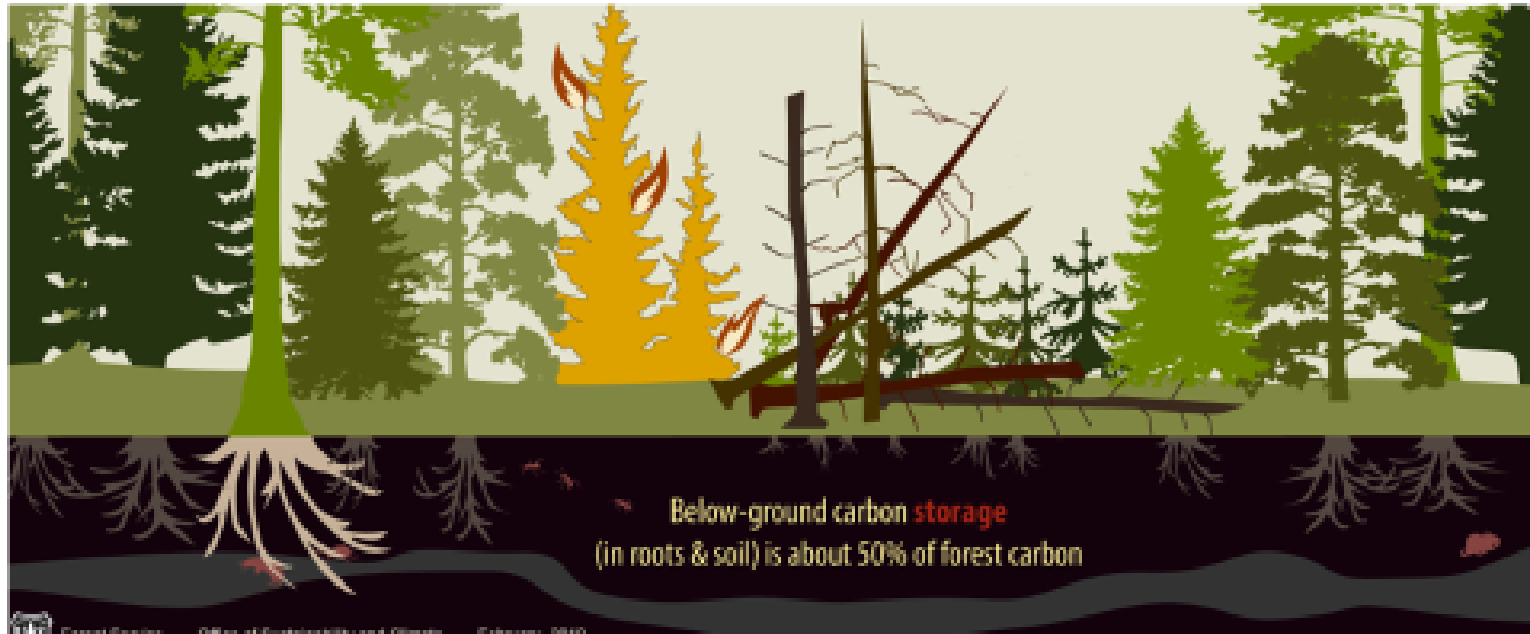**Models to calculate GHG fluxes, C (DayCent)**

**National Greenhouse Inventory**

National Resource Inventory

Forest Service Soil Carbon Research

- Inventory and trend analysis

    Forest Inventory and Analysis Program

- Applied science for sustainable forest and rangeland management

    Experimental Forests and Ranges

    Long Term Soil Productivity Network

    C cycling, sequestration mechanisms

    Disturbance, elevated CO_2, warming

    Biochar

R&D publications Treesearch:

https://www.fs.usda.gov/treesearch
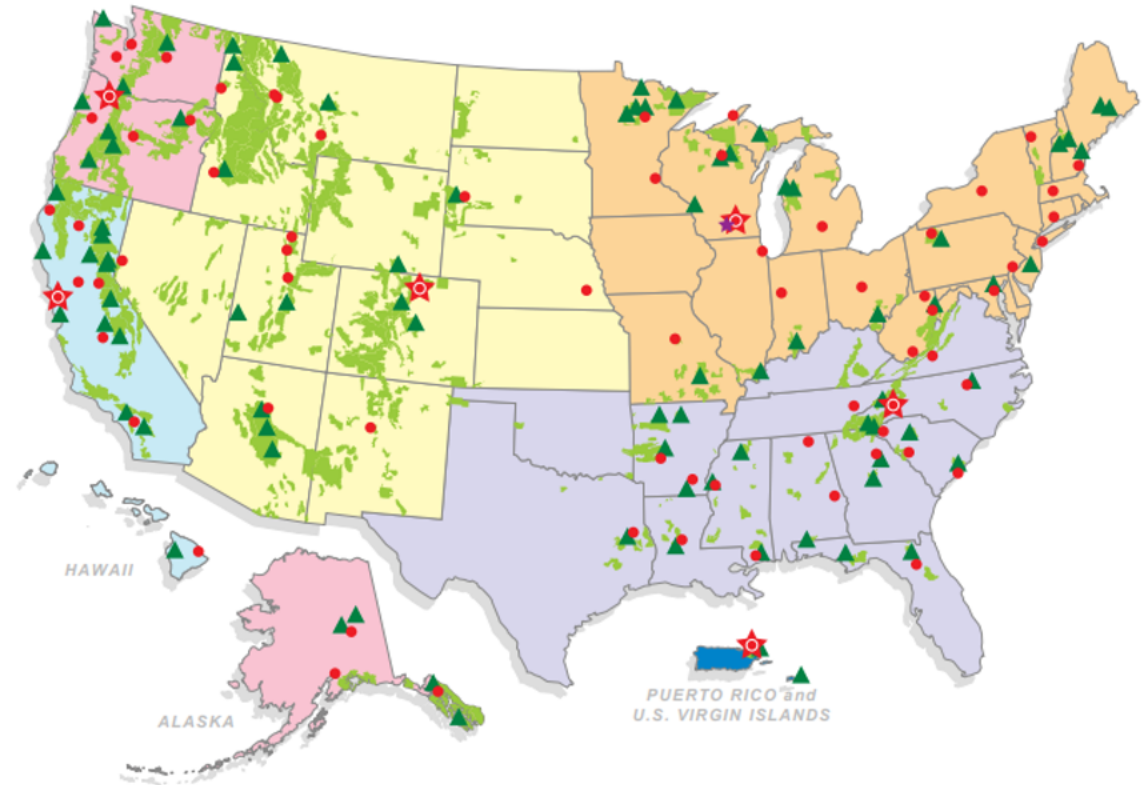
Legend:
- National Forest Lands
- Experimental Forests, Ranges, and Watersheds
- Research Station Headquarters
- Research Lab Location
- Forest Products Laboratory
- Int'l Institute of Tropical Forestry

Research Stations:
- Northern
- Southern
- Rocky Mountain
- Pacific Northwest
- Pacific Southwest

National Forest System: Planning and Management (carbon as a consideration)

- Monitoring, BMPs for soil carbon on National Forests and Grasslands

- Mine land reclamation (with R&D)

- Burned Area Emergency Response Program (BAER) and Collaborative Forestry Landscape Restoration Program (CFLRP) (with partners)
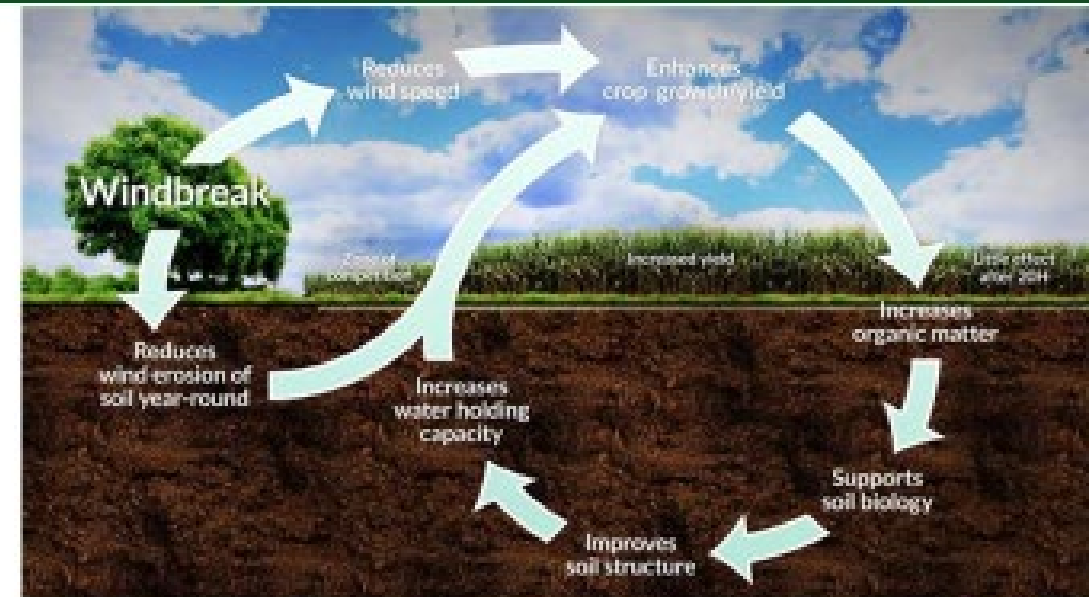
State and Private Forestry

- National Agroforestry Center (with R&D) – research and tech transfer

- Community Forestry (Shared Stewardship, Urban and Community Forestry, Forest Legacy, Markets and Ecosystem Services)

USDA Climate Hubs

- Science and data synthesis; tool/technology co-development and support; outreach, convening and training

Windbreak

Reduces wind speed

Enhances crop growth/yield

Reduces wind erosion of soil year-round

Increases water holding capacity

Improves soil structure

Supports soil biology

Increases organic matter

PACIFIC NORTHWEST BIOCHAR ATLAS

REGIONAL RESOURCES
for users and producers

NRCS and FPAC Activities related to Soil Carbon

Michael Robotham, SSRA Senior Scientist, NRCS   USDA-DOE Carbon Workshop   March 28, 2022

nrcs.usda.gov/

Ongoing Programs / Activities

- Current data collection efforts
  - Dynamic Soil Properties for Soil Health (#DSP4SH) - NRCS
  - Soil Health On Farm Conservation Innovation Trials (SH-OFCIT) – NRCS
  - Conservation Reserve Program Monitoring, Assessment and Evaluation (CRP-MAE) – FSA

- Current modeling support efforts
  - COMET-Farm and COMET-Planner – NRCS, Colorado State University
  - Conservation Effects Assessment Project (CEAP) – NRCS, ARS, Texas A&M

- Activities under discussion
  - Soil carbon monitoring and assessment network – tied to Soil Survey and NRI
  - Soil carbon data collection and assessment under EQIP (Farm Bill) authorities

Partnerships for Climate-Smart Commodities

- New program – announced by Sec. Vilsack on 2/7

- Up to $1 Billion allocated funds from Commodity Credit Corporation

- Pilot projects working with ag/forestry producers to:
    - Implement climate-smart production practices, activities, and systems on working lands
    - Measure/quantify, monitor and verify the carbon and greenhouse gas (GHG) benefits associated with those practices
    - Develop markets and promote the resulting climate-smart commodities

- Two funding pools
    - April 8, 2022: ($5M - $100M)
    - May 27, 2022: ($250,000 to $4,999,999) – focus on historically underserved groups

- More information at: https://www.usda.gov/climate-solutions/climate-smart-commodities

Questions/Comments?

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