US contributions: Networks, and SCS and Inventories Flagships

Some potential partnerships:

A. International Soil Carbon Network
B. North American Carbon Assessment: State of the Carbon Cycle Report (SOCCR2)→Sustained Carbon Cycle Assessment (https://www.carboncyclescience.us/)
C. Climate Hubs
D. LTAR system
E. Soil Health initiative

IRG

- Carbon Cycle Science Interagency WG
  - SOCCR2
  - GCP
  - Interagency Carbon Cycle Science call-including NASA
- Climate Hubs
- Soil health networks
- International Soil Carbon Network
- Borlaug fellows
- GRACEnet: https://www.ars.usda.gov/anrds/gracenet/
- NUOnet: network to help gather and use big data related to efficient use of nutrients, agricultural production and ecosystem services
- INFEWS: Innovations at the nexus of Food Energy and Water
- Soil measurement and modeling tools: Dear Colleague Letter
- Carbon monitoring program (NASA)
- INFEWS modeling theme, management theme
- LTARs-many have international partners

SCS and Inventories Flagships

- Resilient agroecosystems in a changing climate (RACC):
  - Land use and land management changes
- Priorities for the draft FY 2017 carbon and BNRE rfa:
  - Carbon-priorities relevant to IRG:
    - managed landscapes
    - Terrestrial-aquatic interfaces
    - Integration of social science into carbon cycle science
    - Impacts of rising CO2 on ecosystems (including agroecosystems and aquaculture
    - Adaptive management
  - BNRE-priorities relevant to IRG
    - Microbiomes-interactions with food, soil, plant science
    - Soil health
    - Networks for synthesis and data management

Some key relevant themes of recently funded projects

- RACC:
  - Co-knowledge production with tribal communities
  - Cover crops
  - Soil N2O consumption
  - Resilience to drought—crops, grasslands and rangelands, lovestock production
  - Vulnerability analyses
  - integrated hydro-ecologic, socio-cultural, and decision analytic models
  - Overcoming perceptual barriers to climate change adaptation among ranchers in the western US

Relevant projects, continued

- Microbial communities related to livestock production systems and effects on and of climate change
  - Soil health and sustainable productivity: Unraveling the role of soil viral biodiversity in agroecosystem function
  - Biogeochemistry of Phosphate and Carbon Interactions in Agroecosystems: Coupling Experimental Data with Density Functional Theory
  - Climatic thresholds and carbon storage in dryland wheat agro-ecosystems
- Soil health in grazing lands
- Soil microbiome and “belowground processes” and linking to carbon and climate models

Relevant projects, continued

- Big data initiative
- Support for networks and workshops:
  - Putting the farmer in the driver's seat: Integrative web tool for improved soil health and carbon assessment, monitoring, and planning
  - Developing A Platform to Monitor N Footprint in Agro-Ecosystems
  - Improved analysis and extrapolation of nitrous oxide emissions from field measurements for improved N2O estimates and comparison to N2O methodologies

Opportunities

- **NSF/NIFA Signals in the soil**
  - Dear Colleague letter, aim to encourage convergent research that advances understanding dynamic underground processes via advances in sensor systems and dynamic models.
  - PEER
  - Supplements for international engagement
- Soil Organic Matter (SOM) Data Synthesis and Visualization Working Group
- Borlaug Fellows
- Networks for synthesis and data management (NIFA) and Research Coordination Networks (NSF)

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Catalog of Federal Domestic Assistance (CFDA) number

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SEARCH RESET

Funding Opportunity Title	Due Date
Agriculture and Food Research Initiative - Water for Food Production Systems Challenge Area	2017-08-02
Agriculture and Food Research Initiative - Food Safety Challenge Area	2017-06-21
Youth Farm Safety Education and Certification Program	2017-05-10
Crop Protection and Pest Management	2017-05-09
Minor Crop Pest Management Program Interregional Research Project #4 (IR-4)	2017-05-01

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PROGRAM

- Agriculture and Food Research Initiative (AFRI) (20)
- Environmental & Resource Economics Programs (19)
- Aquaculture (14)
- Weed Science (12)
- AFRI Foundational Program (9)

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ELIGIBILITY

- Other or Additional Information (See below) (87)
- 1890 Land-Grant Institutions (61)
- 1862 Land-Grant Institutions (60)
- 1994 Land-Grant Institutions (56)
- Hispanic-Serving Institutions (47)

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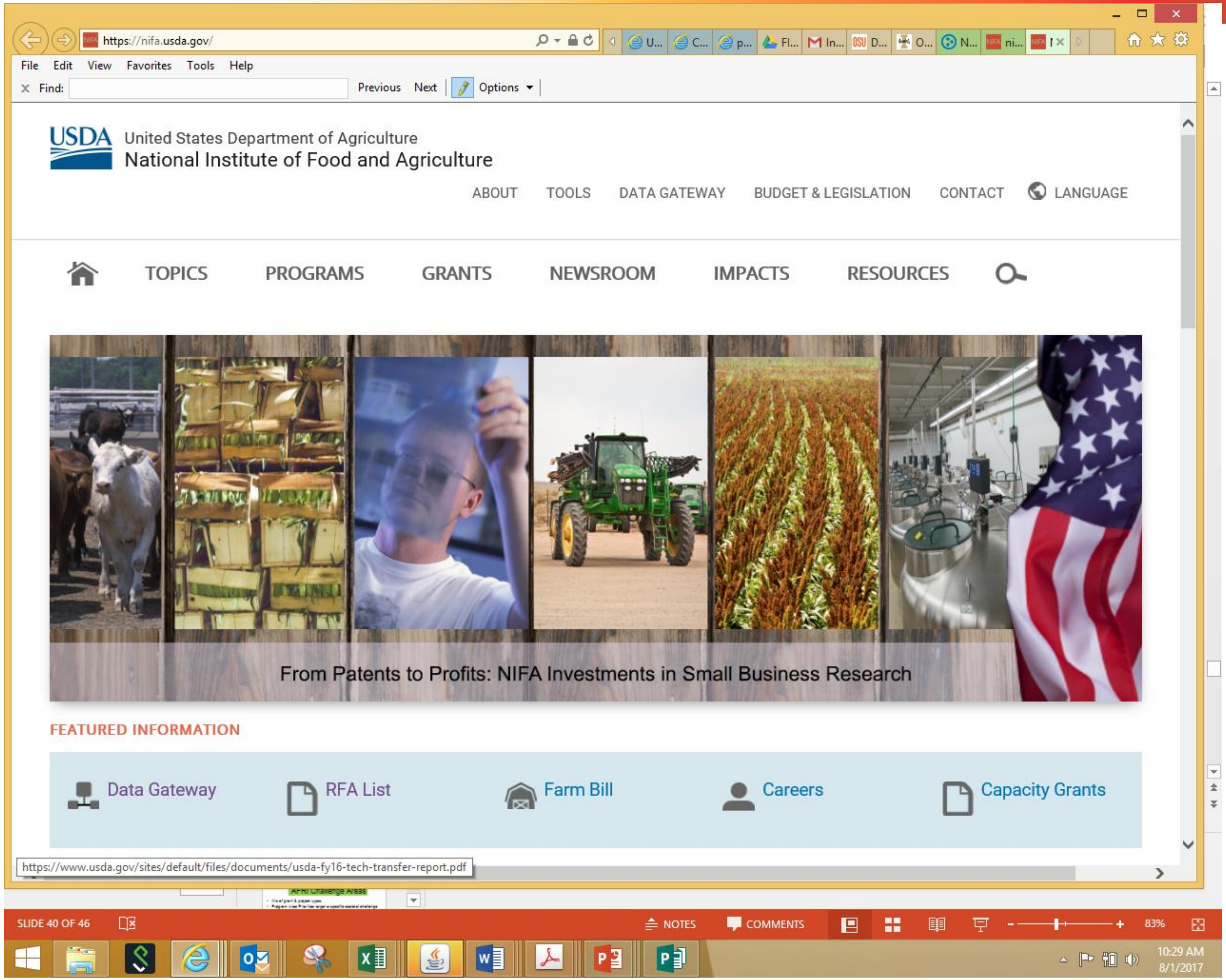
TOPIC

How to find projects we fund, including results and outcomes

- Our website: https://nifa.usda.gov/
  - – Go to Data Gateway
    - Search – get project descriptions, progress reports, final reports, publications, outcomes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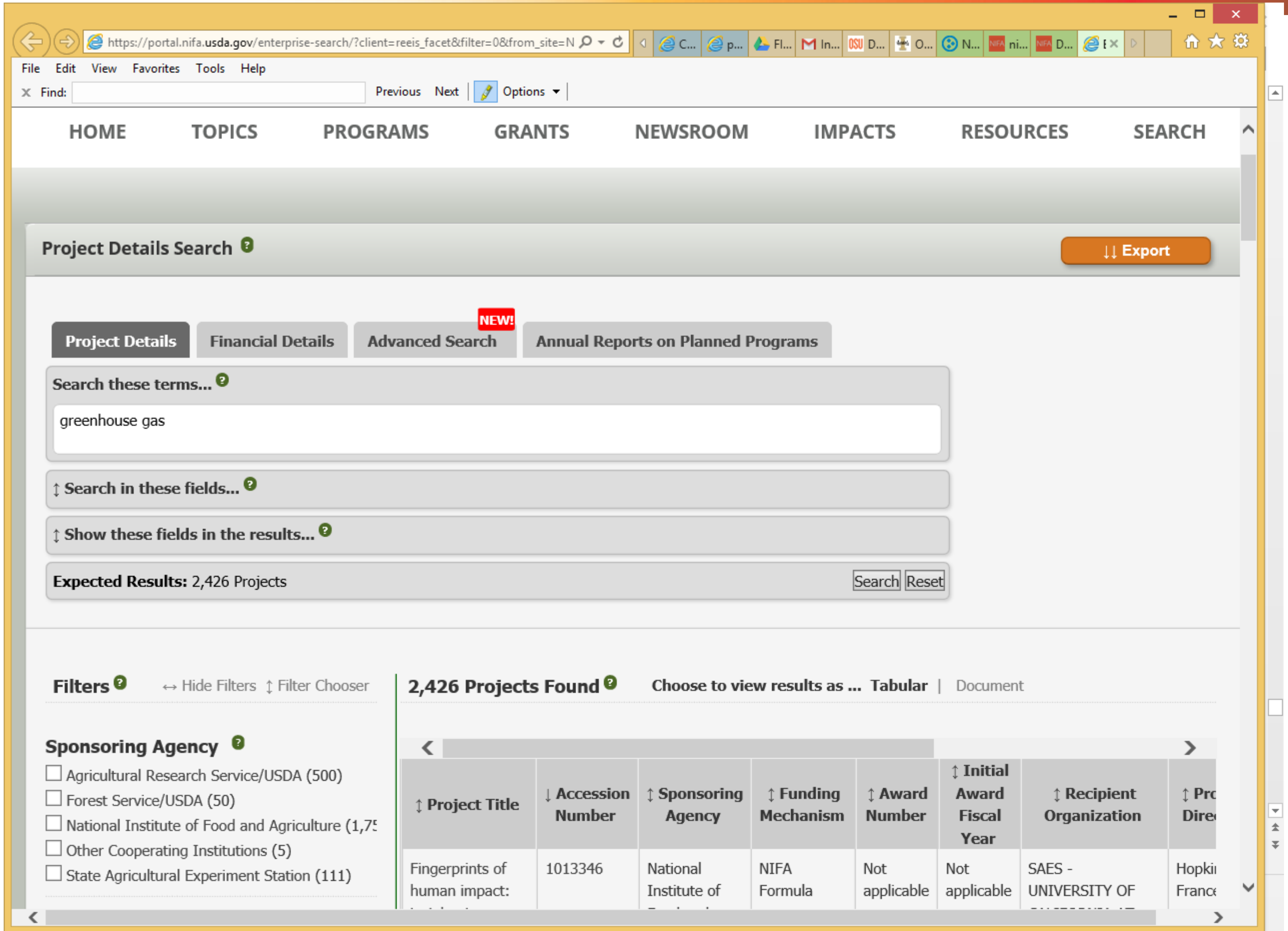
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Forest Service/USDA (50)
National Institute of Food and Agriculture (1,75
Other Cooperating Institutions (5)
State Agricultural Experiment Station (111)
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Funding Mechanism
Award Number
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SOCCR2 – Some Key findings Agriculture

- Agricultural regional carbon budgets & net emissions are directly affected by human decision making, →trends in food production and agricultural management can fluctuate significantly with changes in global markets, diets, consumer demand, regional policies, and incentives. [Very high confidence]
- Most carbon stocks on croplands are in the soil; however, cropland management practices can increase or decrease soil carbon stocks. Integration of practices that include keeping the land covered with growing plants (particularly, deep-rooted perennials and cover crops), protecting the soil from erosion, and improving nutrient management can increase soil carbon stocks. The magnitude and longevity of management-related carbon stock changes have strong environmental and regional differences, and they are subject to subsequent changes in management practices. [High confidence, Likely]
- Benefits such as reduced GHG emissions, lowered net global warming potential, increased water and air quality, reduced CH_4 flux in flooded or relatively anoxic systems, and increased food availability for a growing population can be achieved via the optimization of nitrogen fertilizer management to sustain crop yield and reduce nitrogen losses to air and water. [High confidence, Likely]
- Various strategies are available to mitigate livestock enteric or manure CH_4 emissions. Promising and readily applicable technologies can reduce enteric (CH_4) emissions from ruminants by 20% to 30%. Other mitigation technologies can reduce manure CH_4 emissions by 30% to 50% and up to 80%. Methane mitigation strategies have to be evaluated on a production-system scale to account for emission tradeoffs and co-benefits such as improved feed efficiency or productivity in livestock. [High confidence, Likely]
- Projected climate change likely will increase CH_4 emissions from livestock manure management locations, but it will have a lesser impact on enteric CH_4 emissions. Potential effects of climate change on agricultural soil carbon are difficult to assess, because they will vary according to the nature of the change, on-site ecosystem characteristics, and management type. [High confidence, likely]

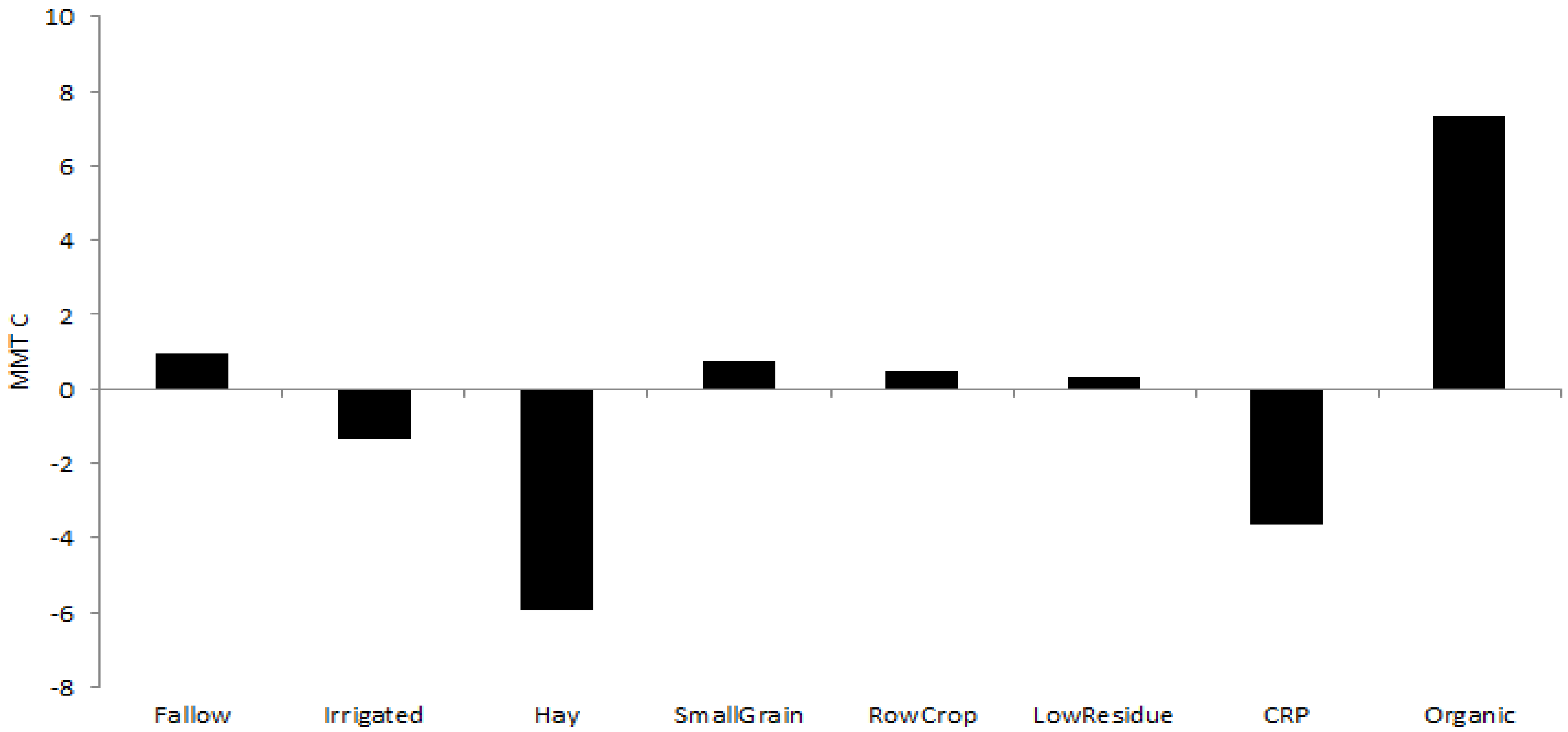

Figure 5.4. Soil carbon fluxes for major cropping systems in the United States. Values are annual means for 2003 to 2007. Note that categories are mutually exclusive, not all cropped land is included, and positive values represent carbon emissions. Category definitions were based on the majority land use over the 2003 to 2007 time period. For example, if a parcel was cropped with maize and/or soybean for at least 3 out of 5 years it was placed in the row-crops category. Similarly, if a land parcel was crop free during the growing season for at least 3 of 5 years, it was placed in the fallow category. [data from Del Grosso and Baranski (2016).]

Key finding Grasslands

- Total grassland carbon stocks in the conterminous United States, estimated to be about 7.4 petagrams (Pg, or 10^{15} grams) in 2005, are projected to increase to about 8.2 Pg by 2050. Although U.S. grasslands are expected to remain carbon sinks over this period, the uptake rate is projected to decline by about half. In the U.S. Great Plains, land-use and land-cover changes are expected to cause much of the change in carbon cycling as grasslands are converted to agricultural lands or to woody biomes. [Medium confidence]
- Increasing temperatures and rising atmospheric carbon dioxide (CO_2) concentrations interact to increase productivity in northern North American grasslands, partly due to longer growing seasons. These effects are mediated by variable precipitation, soil moisture, and nutrient availability. [High confidence, Very likely]
- Soil carbon in grasslands is likely to be moderately responsive to changes in climate over the next several decades. Field experiments in grasslands suggest that altered precipitation can increase soil carbon, while warming and elevated CO_2 may have only minimal effects despite altered productivity. [Medium confidence, Likely]
- Carbon stocks and net carbon uptake in grasslands can be maintained with appropriate land management including moderate levels of grazing. Fire suppression can lead to encroachment of woody vegetation and increasing carbon storage in mesic regions, at the expense of grassland vegetation. [High confidence, Likely]

Key findings Soils

- Estimates for soil carbon stocks in the conterminous United States plus Alaska range from 151 to 162 petagrams of carbon (Pg C), based on extensive sampling and analysis. Estimates for Canada average about 262 Pg C, but sampling is not as extensive there. Soil carbon for Mexico is calculated as 18 Pg C, but there is a great deal of uncertainty surrounding this value.
- Models of soil organic matter dynamics increasingly include process-level understanding of factors that affect soil carbon stabilization and destabilization. However, most Earth System Models (ESMs) are highly variable in predicting the direction and magnitude of carbon change under future scenarios. ESM estimates of global soil carbon change over this century range from a loss of 72 Pg C to a gain of 253 Pg C with a multimodel mean gain of 65 Pg C. ESMs projecting large gains do so largely by predicting increases in high-latitude soil organic carbon (SOC) that are not consistent with empirical studies that indicate significant losses of soil carbon over those time periods. ESM-predicted high-latitude SOC changes range from losses of 37 Pg C to gains of 146 Pg C with a multimodel mean gain of 39 Pg C. Most ESMs poorly represent permafrost dynamics and omit key processes such as priming and nutrient constraints. Soil carbon stocks are sensitive to agricultural development and practices, global warming, and development and loss of carbon-rich soils such as wetlands. Soils have lost, on average, 20% to 75% of their original top soil carbon (0 to 30 cm) with conversion to agriculture, with a mean estimate for Canada of 24% ± 6%. Management practices can mitigate agricultural soil carbon loss, particularly practices that increase organic residue inputs such as reduced summer fallow, cover cropping, effective fertilization that increases plant production, and reduced tillage in many systems. Increases due to effective agricultural management in regions of Canada are 2.9 ± 1.3 megagrams of carbon (Mg C) per hectare, in the range of values (3 to 7 Mg C per hectare) observed in United States. Forest soil carbon loss with harvest is small under standard management practices, and reversible at the century scale. However, afforestation of land in agriculture, industry, or wild grassland in the United States and Canadian border provinces increased SOC by 21% ± 9%. [High confidence, Very likely]

Key findings Soils

- Large uncertainties remain regarding soil carbon budgets, particularly the impact of lateral movement and transport of carbon (via erosion and management) across the landscape. The net carbon sink from the burial of eroded soil carbon and regeneration of soil carbon in eroded sites has been estimated at between 16 Pg C to 78 ± 22 Pg C since A.D. 1850. [Medium confidence]
- Evidence is strong for direct effects of increased temperature on loss of soil carbon, but warming and atmospheric carbon dioxide increases also may enhance plant production in many ecosystems, resulting in greater carbon inputs to soil. Globally, warming could cause the release of 55 ± 50 Pg C from a soil pool of 1400 ± 150 Pg C. The release of carbon from peatland soils, through both anthropogenic disturbances (e.g., harvest, development, and peatland drainage) and change in natural disturbance regimes (e.g., wildfires and permafrost thaw), has large uncertainties. Given the size of the peatland carbon pool, however, it could become a significant carbon flux to the atmosphere under future scenarios, because an estimated 5% to 15% of the terrestrial permafrost carbon pool is thought to be vulnerable to decomposition and release to the atmosphere. [Medium confidence]