Forests and Forest Products as a Natural Climate Solution for Michigan

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Forest Carbon and Climate Program
Department of Forestry
MICHIGAN STATE UNIVERSITY

Michigan Chapter SWCS 2023 ANR Seminar | March 10, 2023

FCCP Background

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Department of Forestry
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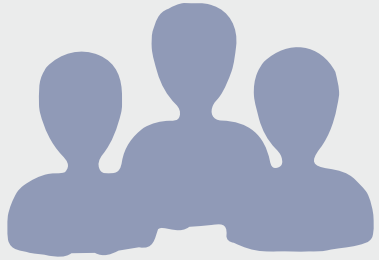
FCCP Expertise

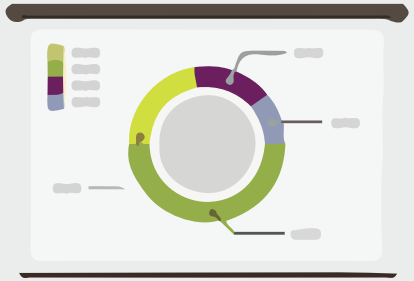
Forest ecology, biology, and management

Graphic design, animation, data visualization

Advanced statistical analysis, carbon modeling, survey design



Stakeholder engagement, program management



Writing, synthesis, and presentation for diverse audiences

PROFESSIONAL SHORT COURSE

Understanding Forest Carbon Management

- Launched 2019
- ~400 participants
- 20+ countries
- Natural resource managers, policymakers, C project managers/analysts, corporations, industry, NGO's

Course Sections:

- Course Introduction + Overview
- Forest Carbon Science
- Forest Carbon Policy
- Forest Carbon Projects
- Forest Carbon Management
- Forest Carbon Measurements
- Tools + Training
- Review + Communicate

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NIACS
Northern Institute of Applied Climate Science

USAID
DEL PUEBLO DE LOS ESTADOS UNIDOS DE AMÉRICA

FOREST, programa de cooperación técnica de USAID y el Servicio Forestal de los EEUU

SPEAKER LINEUP

3-4PM EST

2022-23 FORESTS + CLIMATE LEARNING EXCHANGE SERIES

OCT. 12

CAFRI Climate & Applied Forest Research Institute, State University of New York College of Environmental Science and Forestry

Yale School of the Environment, The Forest School

Innovative Approaches to Forest Carbon Monitoring and Measurement

Colin Beier, SUNY ESF
Mark Bradford, Yale

NOV. 2

The University of Maine

Assessing landscape-scale, climate-smart forest management strategies: Is it possible?

Aaron Weiskittel and Erin Simons-Legaard, The University of Maine

DEC. 7

Rayonier

Use of FIA Data to Determine the Carbon Footprint of a Large Forest Landowner

Thomas Fox, Rayonier, Inc.

JAN. 4

UF University of Florida

Tax Dimensions of Forest Carbon Projects

Tamara Cushing, University of Florida

FEB. 1

Department of Forestry, Michigan State University

Assessing the Economic Impacts of Forest Carbon Management

Raju Pokharel and Shivan Gc, Michigan State University

MAR. 1

The New School

The Nature Conservancy

Resilience, Equity, and Nature-Based Climate Solutions in New York City

Timon McPhearson, The New School
Emily Maxwell, The Nature Conservancy

APR. 5

University of Washington

Remote Sensing Technology for Improved Forest Carbon Inventoryng

Monika Moskal, University of Washington

MAY. 3

The University of Vermont Forestry

Looking at Forest Carbon from Multiple Dimensions: Evaluating Tradeoffs and Opportunities to Forest Carbon Management

Tony D'Amato, University of Vermont

JUN. 7

Department of Forestry, Michigan State University

UAS

Dimensions of Urban and Community Forestry

Asia Dowtin, Michigan State University
Beattra Wilson, U.S. Forest Service

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SAF

Additional Sponsors

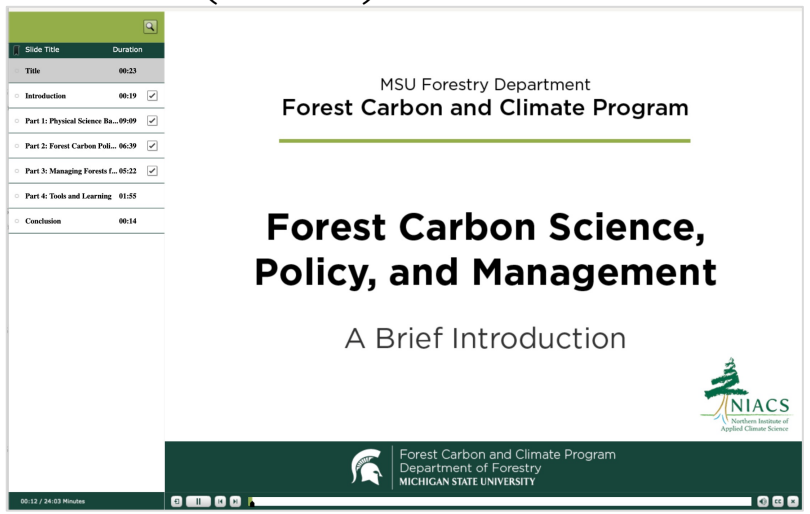
NCX

RENEWWEST

Open Source Library (FCCP ORL)

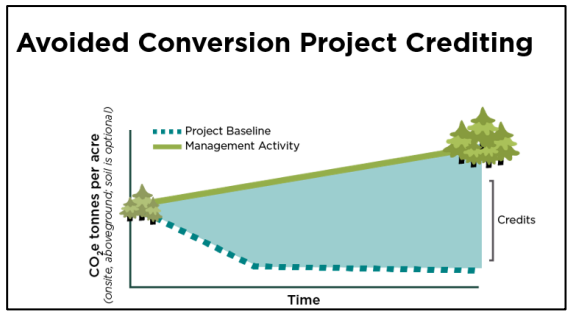
Interactive Module

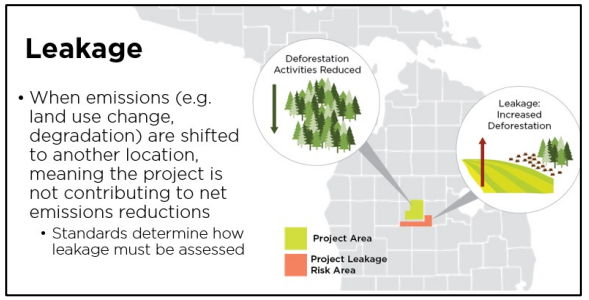
USDA Climate Change Resource Center (CCRC)

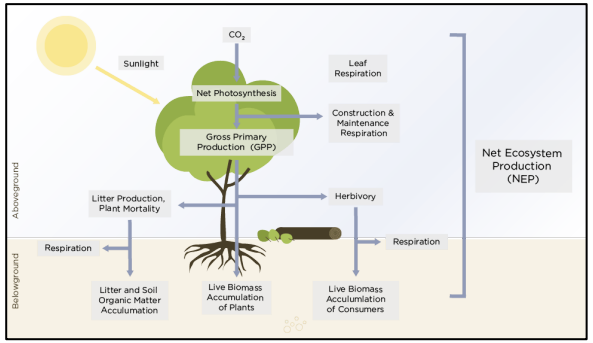


https://www.fs.usda.gov/ccrc/education/forest-carbon-science-policy-and-management

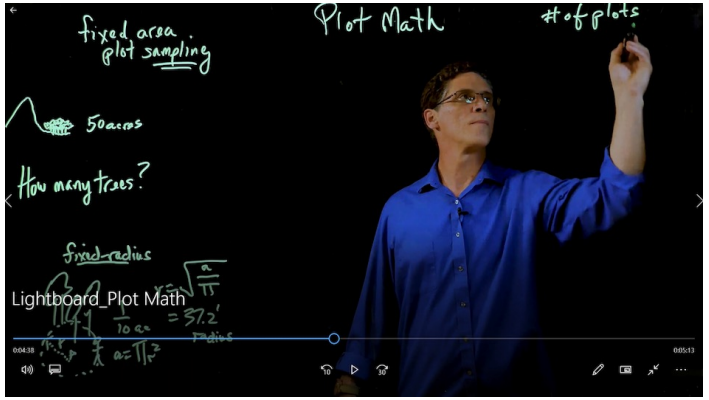
Graphics/Slides



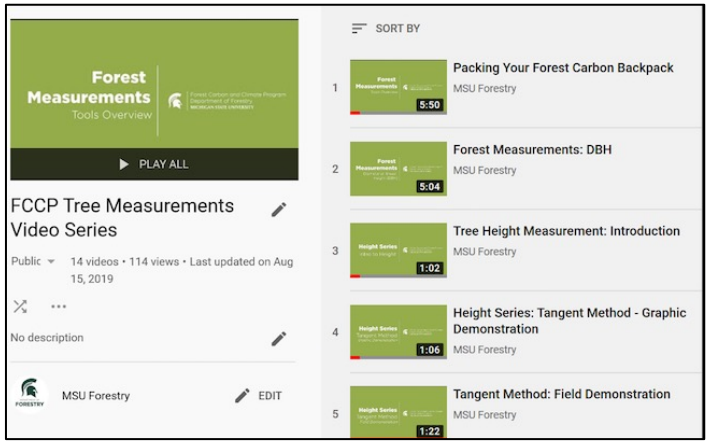




Videos



Light-board carbon calculation demonstration with Dr. David MacFarlane



Intensives on Forests, Climate, and Carbon - US Regions

- Focused content designed to take learners beyond the basics of forest carbon science
  - In-depth analysis of trends, challenges, and opportunities for a chosen US region
- Original maps and figures
  - Created using spatial analyses and FIA data
  - Illustrate status and trends of forests and forest carbon dynamics within each region

Forest Background

Climate Change & Forest Disturbance

Carbon & Climate Impacts by Forest Type

Adaptive Management

Background: Forests and Climate

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The Greenhouse Effect

Sun

Atmosphere

Greenhouse Gases

1. Solar radiation passes through the clear atmosphere.

2. Some solar radiation is reflected by the atmosphere and earth's surface

3. Remaining solar radiation passes to earth's surface

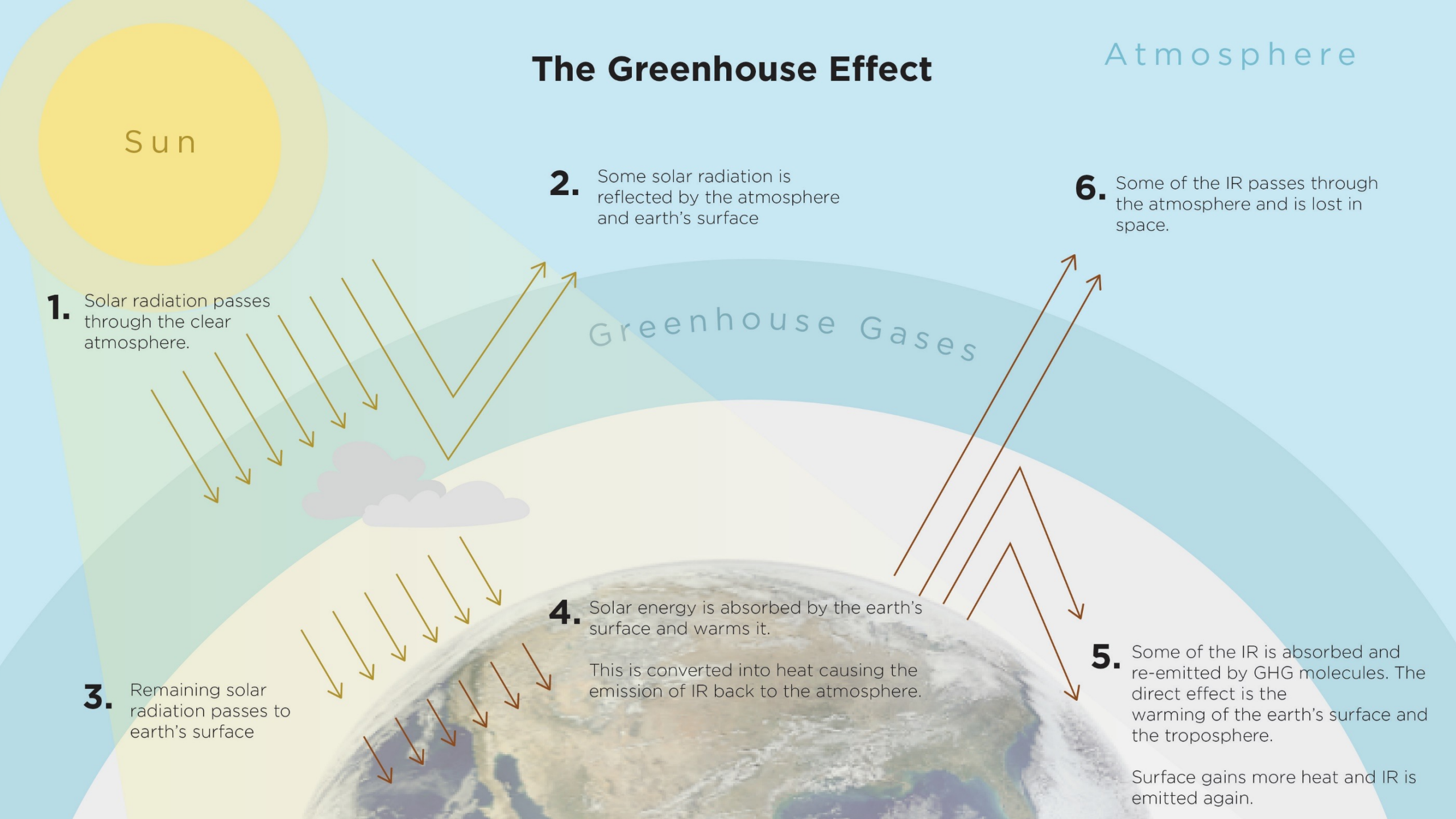
4. Solar energy is absorbed by the earth's surface and warms it.

This is converted into heat causing the emission of IR back to the atmosphere.

5. Some of the IR is absorbed and re-emitted by GHG molecules. The direct effect is the warming of the earth's surface and the troposphere.

Surface gains more heat and IR is emitted again.

6. Some of the IR passes through the atmosphere and is lost in space.



Recent Trends in CO_2 and Temperature

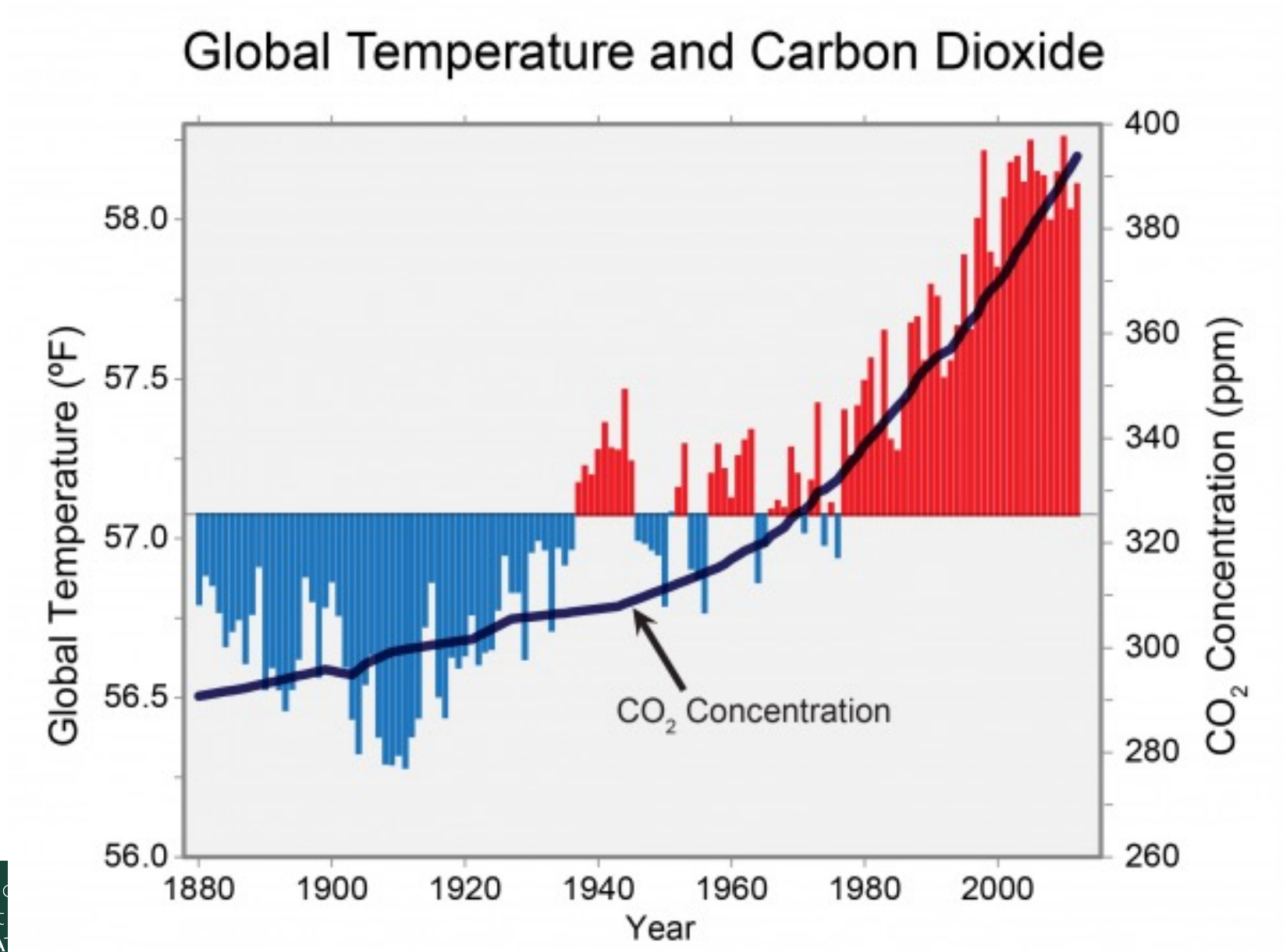


Image: https://www.globalchange.gov/browse/multimedia/global-temperature-and-carbon-dioxide

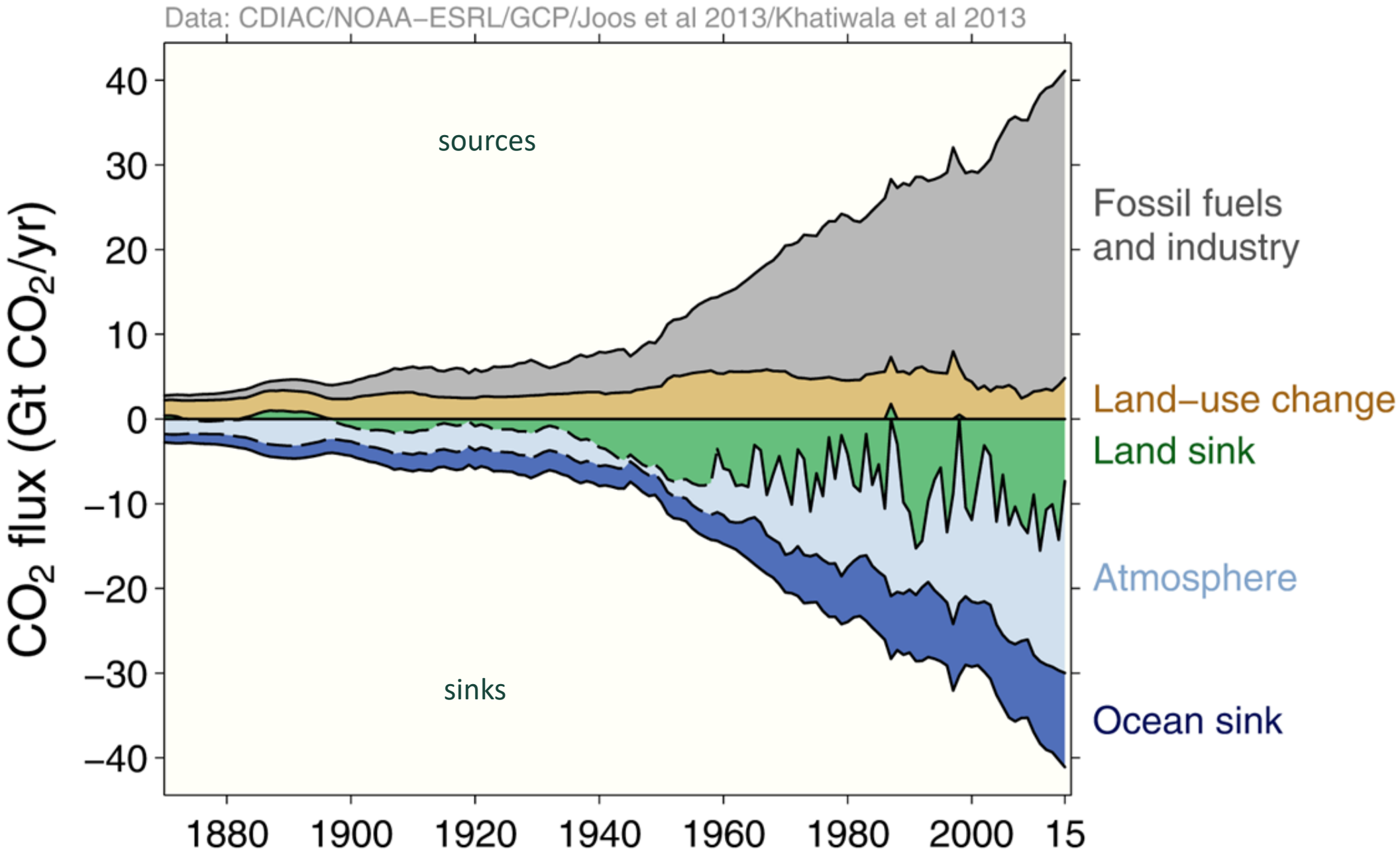


Image Source: http://www.globalcarbonproject.org/carbonbudget/16/presentation.htm

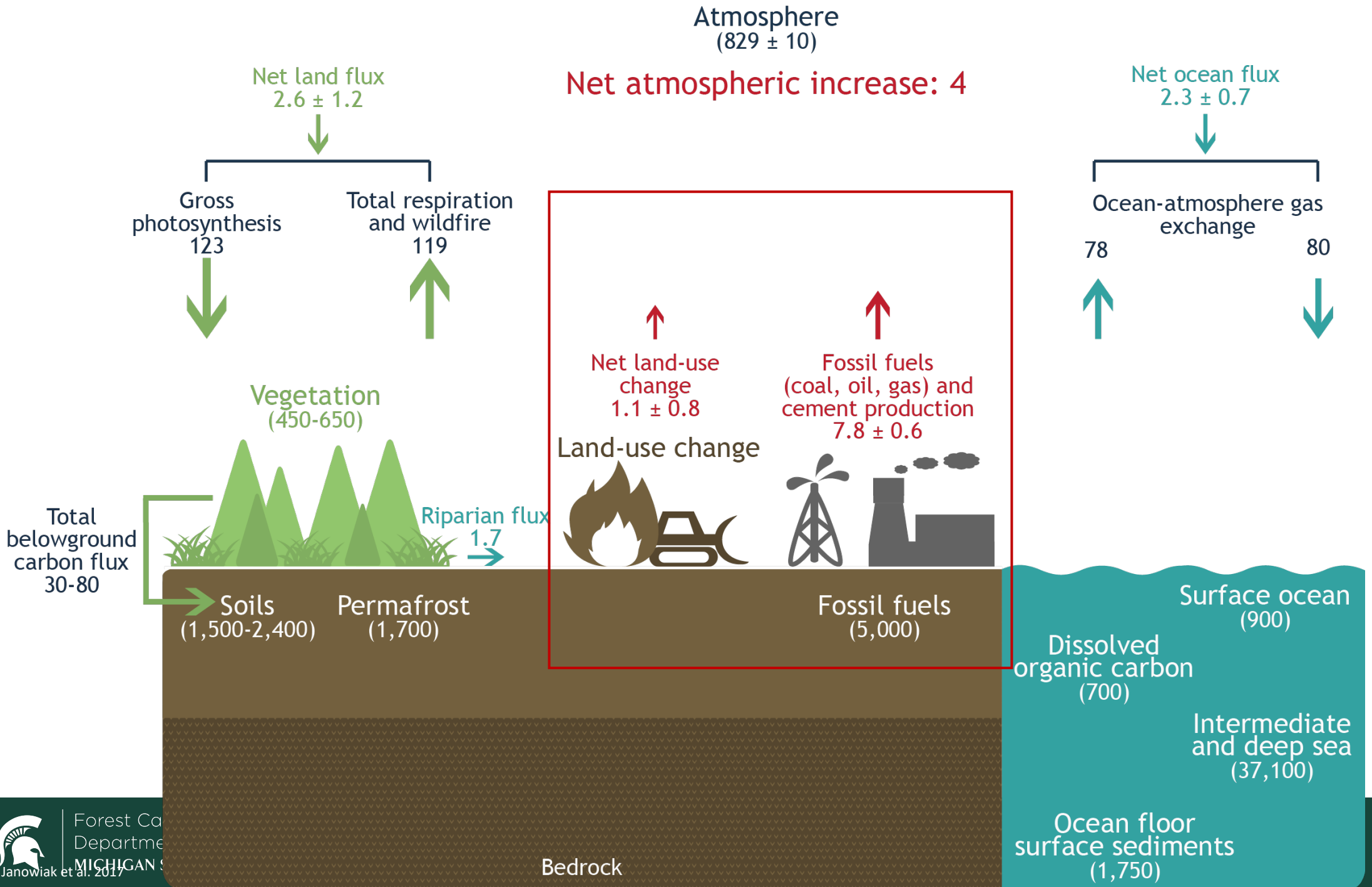


Image Source: Janowiak et al. 2017

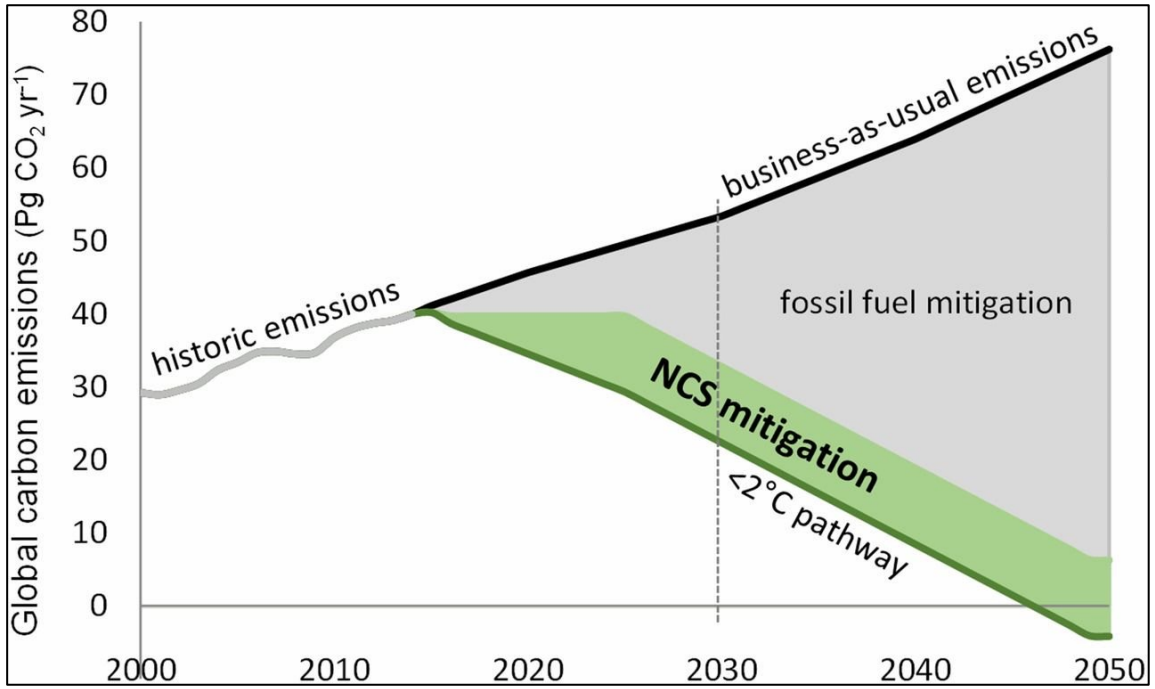
What are “NCS”?

Natural climate solutions: conservation, restoration, and improved land management actions in landscapes and wetlands that:

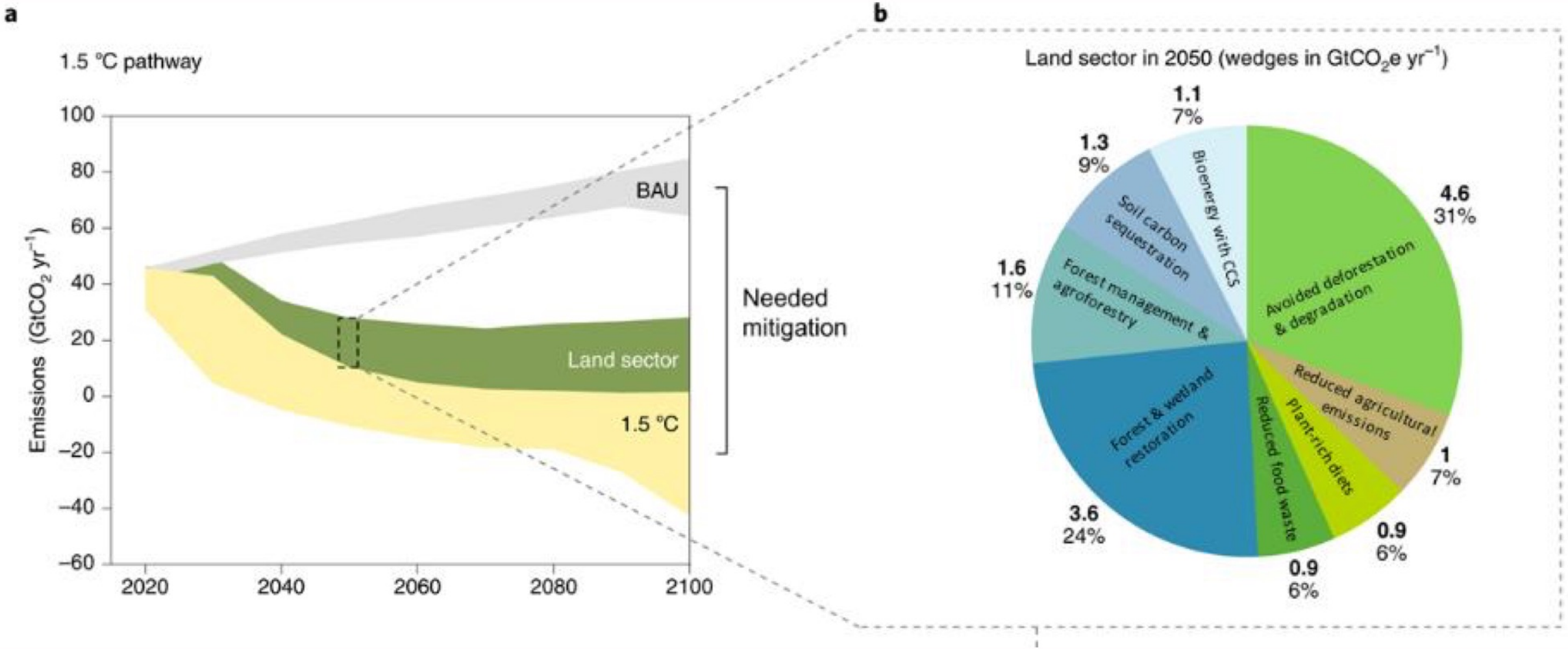
1. increase carbon storage, or
2. avoid greenhouse gas emissions

NCS offer some of the best options in the response to climate change (Griscom et al. 2017)

- When combined with clean energy and other efforts to decarbonize economies
- **Can provide roughly 37% of CO_2 mitigation** needed by 2030 for a >66% change of holding warming below 2 °C

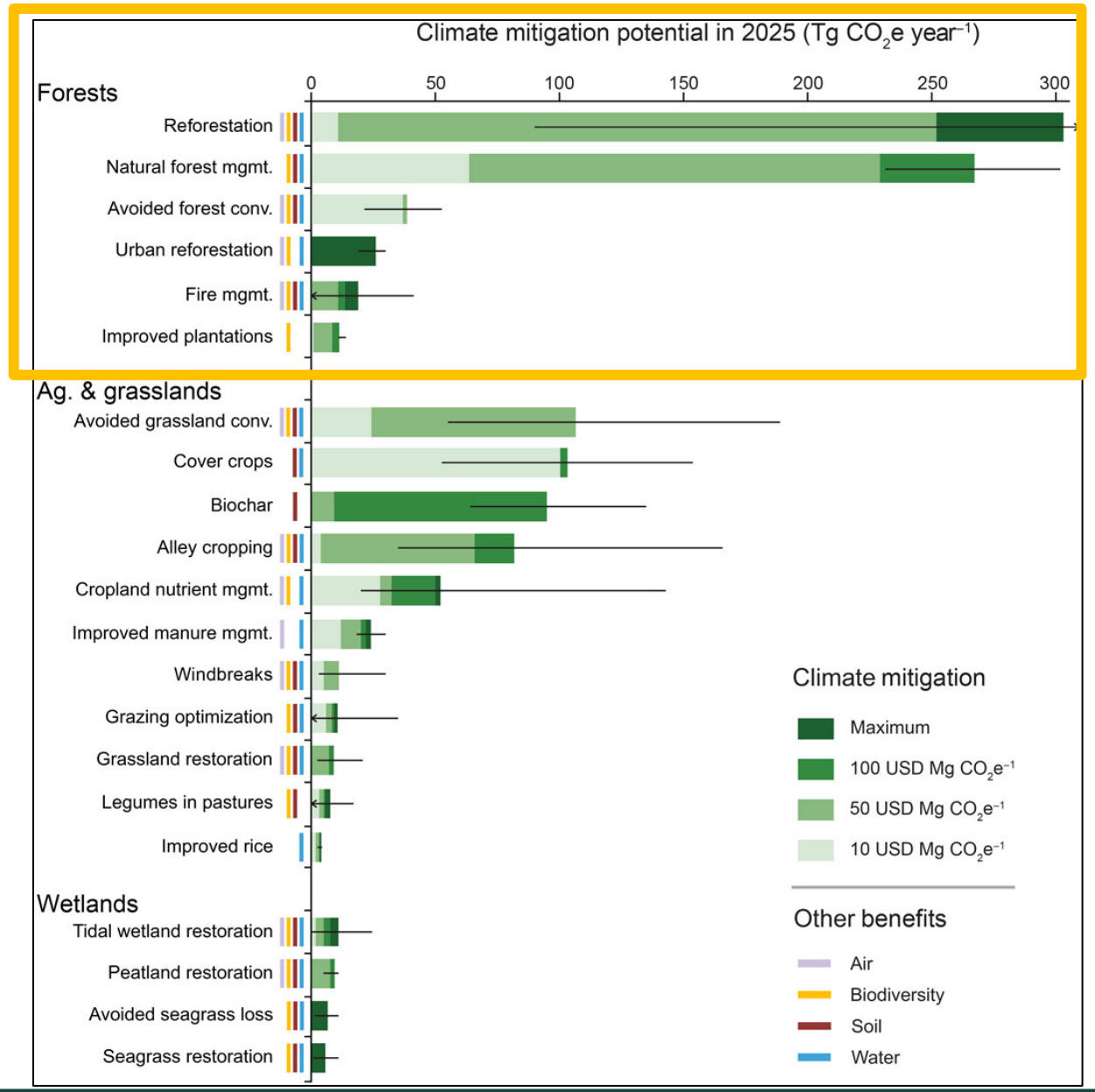


Griscom et al. 2017


a
1.5 °C pathway
Emissions (GtCO2 yr−1)
100
80
60
40
20
0
−20
−40
−60
2020
2040
2060
2080
2100
BAU
Land sector
1.5 °C
Needed mitigation
b
Land sector in 2050 (wedges in GtCO2e yr−1)
1.1
7%
Bioenergy with CCS
1.3
9%
Soil carbon sequestration
1.6
11%
Forest management & agroforestry
4.6
31%
Avoided deforestation & degradation
1
7%
Reduced agricultural emissions
0.9
6%
Plant-rich diets
0.9
6%
Reduced food waste
3.6
24%
Forest & wetland restoration

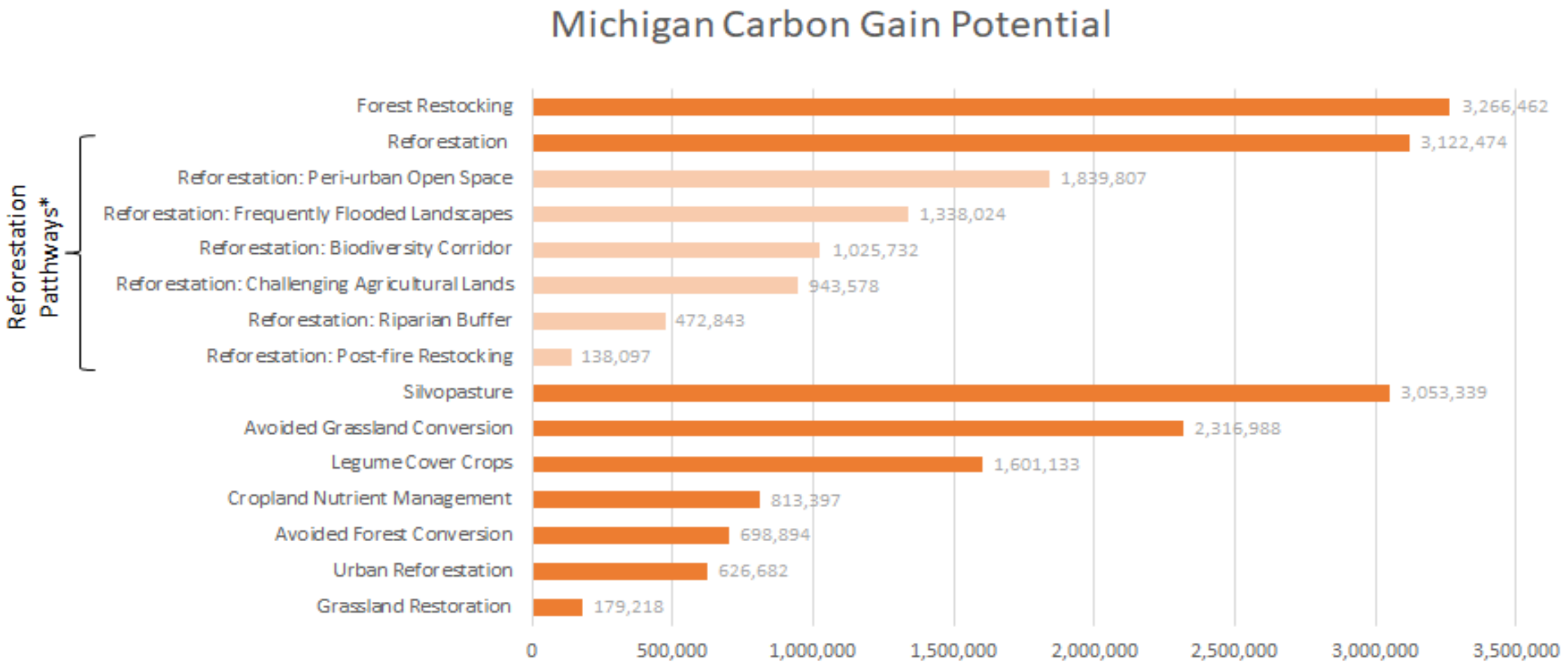
NCS Opportunities

- Reforestation = highest climate mitigation potential across 21 NCS assessed for the US
- Opportunity Assessment conducted in 2019 for MI (next slide)
- **Reforestation pathway: 3,122,474 tCO2e/yr**
  - C gain rates represent a 20-yr annual average
  - **2nd highest C gain potential of all pathways assessed**
  - Reflects potential on all lands in the state that were historically forested but now have <25% tree cover



Fargione et al. 2018

MI Opportunities



**Reforestation subpathways are not mutually exclusive.*

The Nature Conservancy

Agriculture

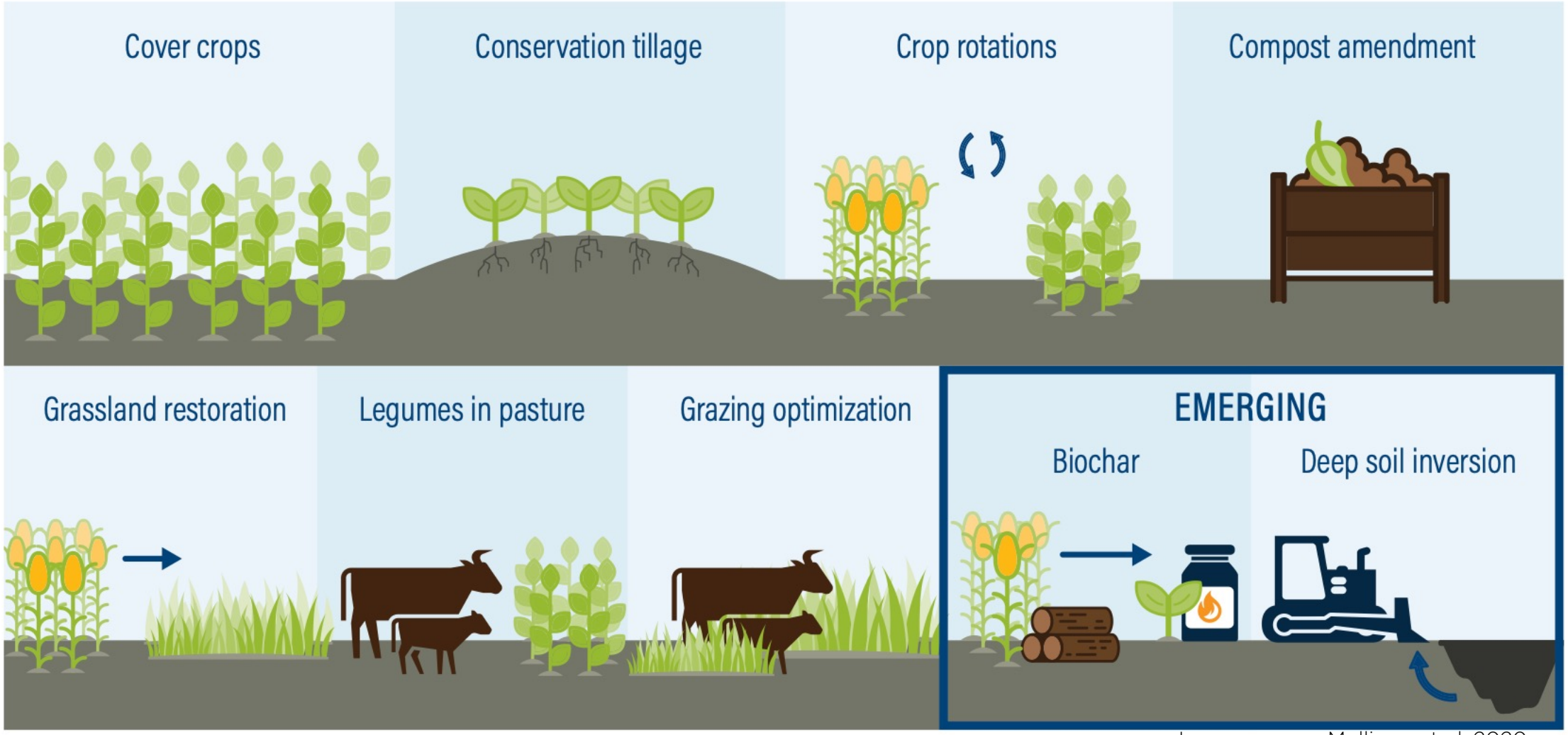
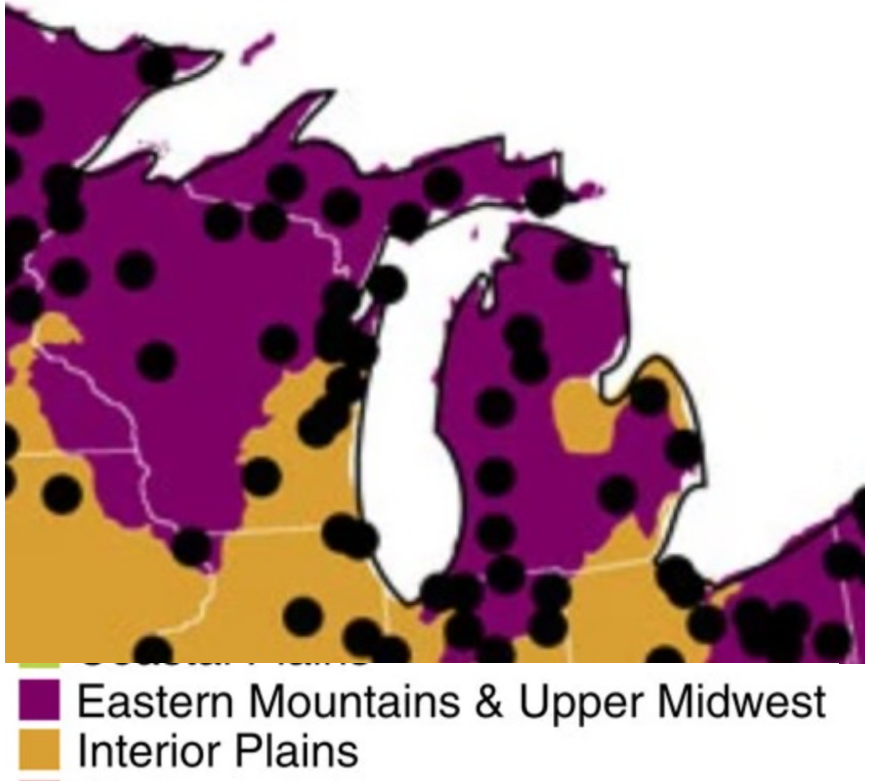


Image source: Mulligan et al. 2020

Wetlands and waterways

- Wetlands contain a disproportionate amount of the earth's total soil carbon; holding between 20 and 30% of the estimated 1,500 Pg of global soil carbon despite occupying 5–8% of its land surface (Nahlik and Fennessy, 2016)
- Conditions characteristic of wetland soils slow decomposition and lead to the accumulation of organic matter
- In Michigan we have swamps, bogs, marshes, and fens

Map of the distribution of wetland probability sites



Nahlik and Fennessy, 2016

NE Regional Overview

Forests, carbon, and climate-oriented management in this region

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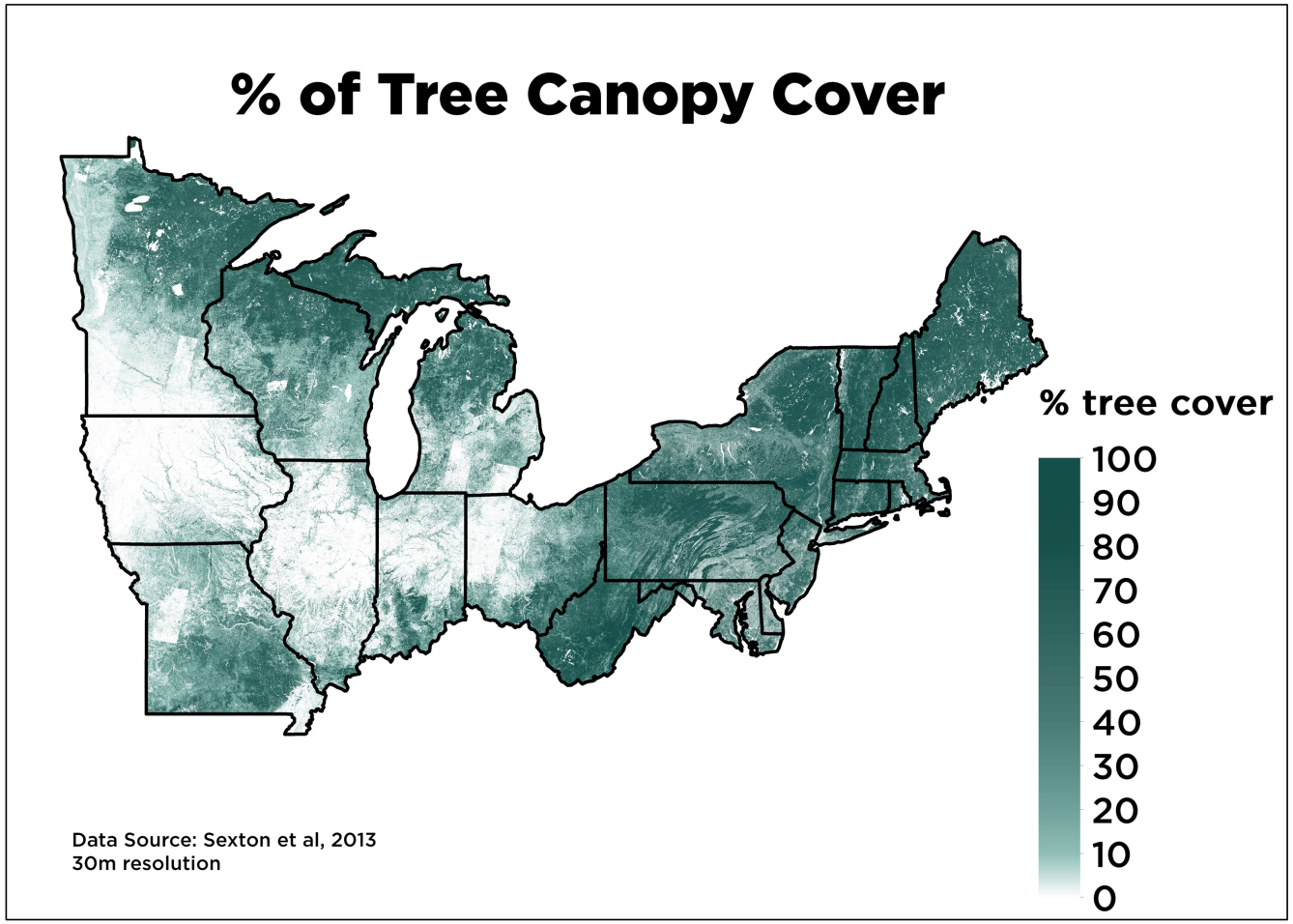
Forest Overview

- One of the most highly forested regions in the US
  - >40% total land area forested (68.8 million hectares)[1]
- Home to >40% of U.S. population[2]
- Large variation in forest types
  - Stretching from the Mississippi river to the Atlantic coast
  - High biodiversity and climatic variation present

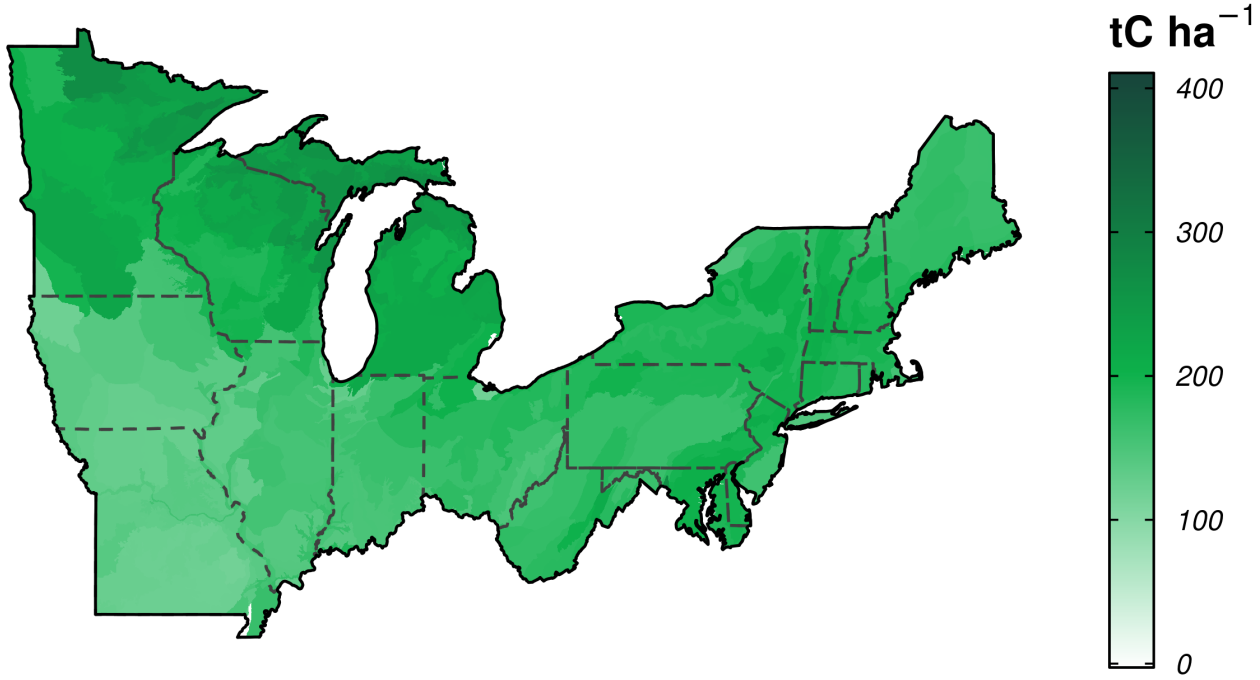


1. USDA Forest Service 2005
2. Shifley et al. 2016

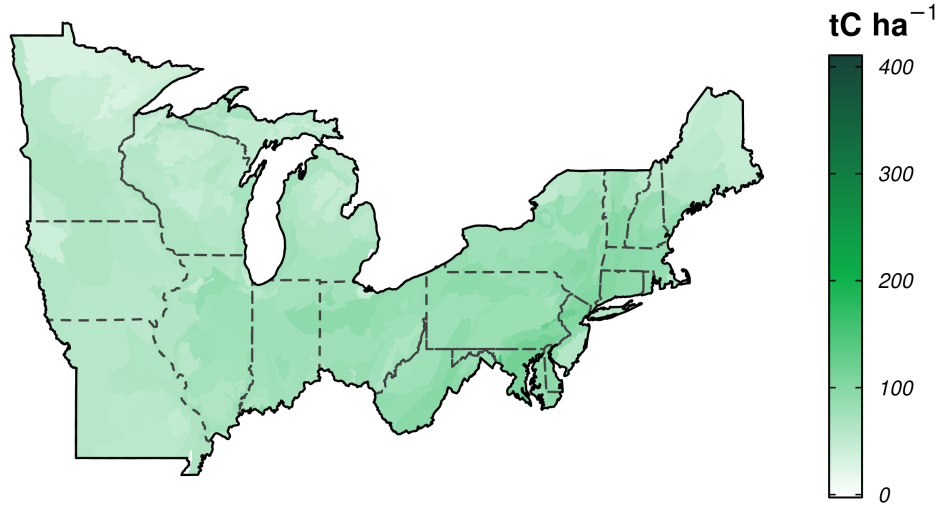
Figure: FCCP 2021

Carbon Storage

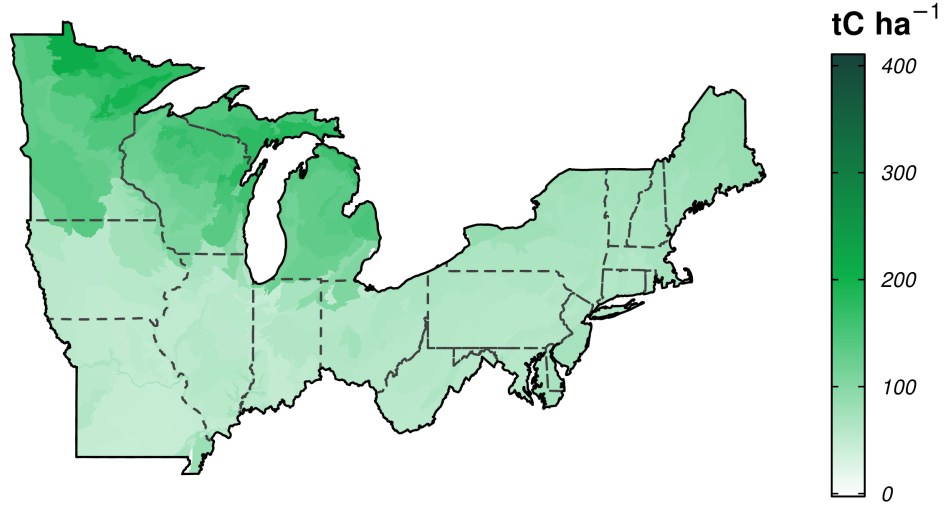
Forest Carbon Density: Total carbon



Forest Carbon Density: AG Live & Dead



Forest Carbon Density: Soil organic



Forest Background

Figures: FCCP 2021, using USFS FIA data

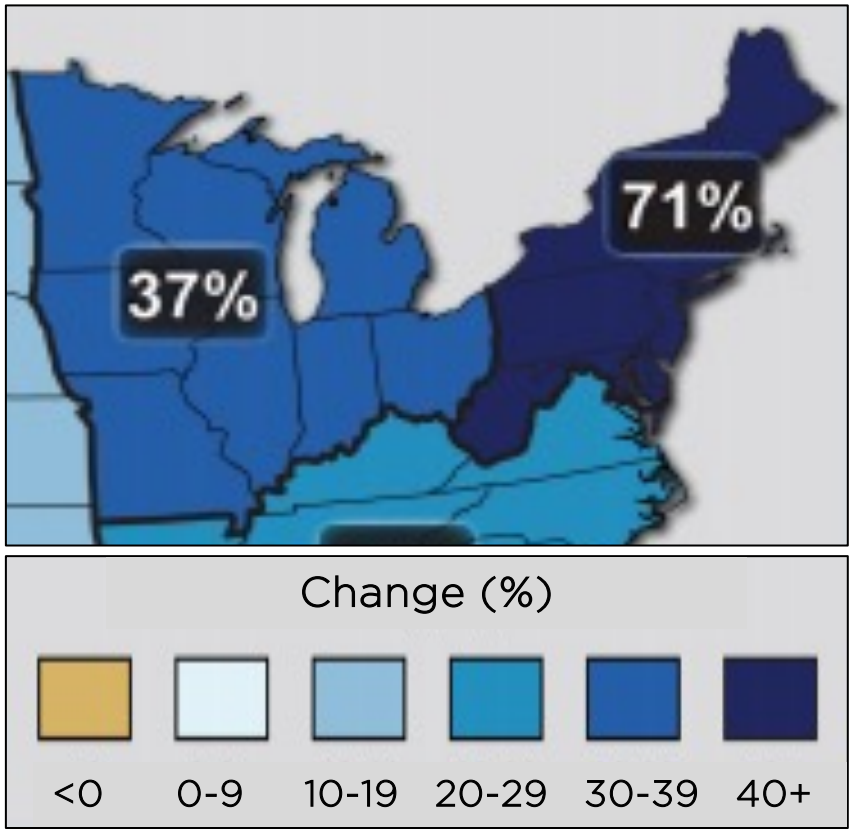
Changing Precipitation Regimes

Climate Change & Forest Disturbance

- More heavy precipitation with increasing storm events & extreme weather
  - More water goes into runoff instead of groundwater recharge
  - Increased soil & streambank erosion

Risk may be greatest:
- Traditionally dry sites with species that aren't adapted to significant precipitation or standing water
- Riparian sites & buffer zones where erosion from severe precipitation can cause mortality and limit regeneration

Observed change in very heavy precipitation 1958-2012



1. Walsh et al. 2014

Figure: Walsh et al., 2014

Shifts in Temporal Dynamics

Climate Change & Forest Disturbance

- Earlier springs and longer growing seasons
- Freeze-thaw cycles can damage tissues and alter soil processes
  - Bud damage with increased potential for "late" spring frosts
  - Conifers are particularly susceptible
- Increased evapotranspiration
  - Drought stress

Projected change in final spring, and first fall, frost dates from 1994 to 2055.

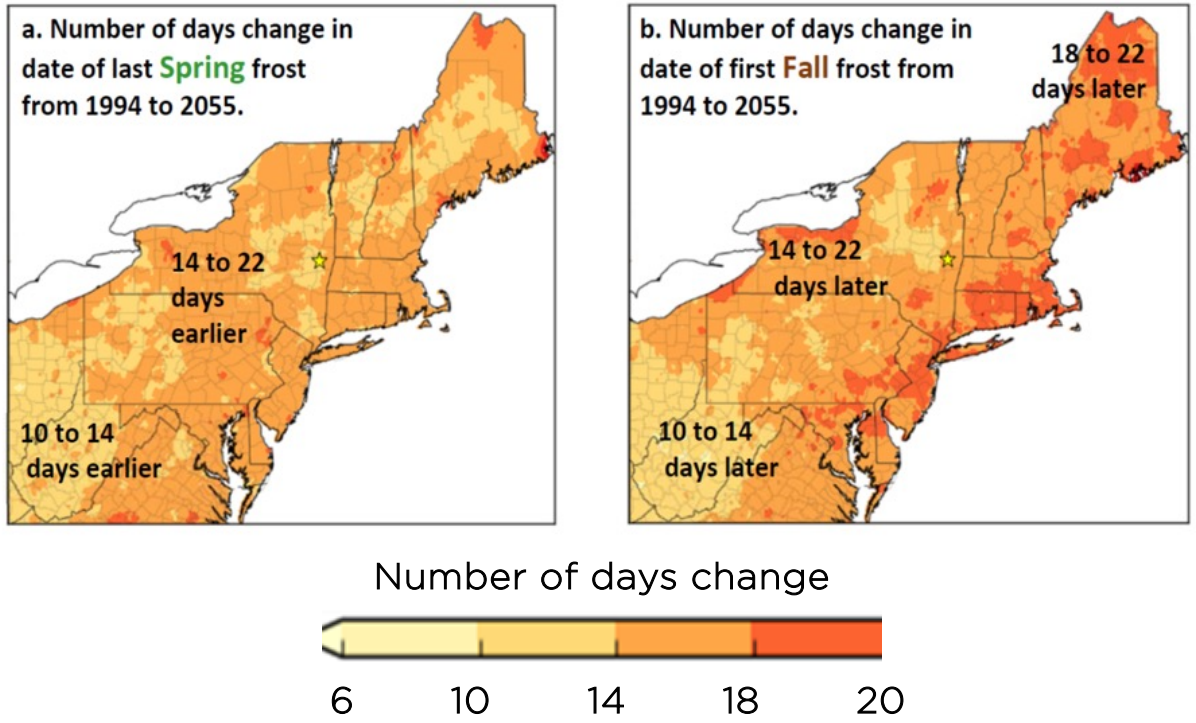


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Figure: Wolfe et al. 2018 in Koehler 2018

Climate Change as a "Threat Multiplier"

Climate Change & Forest Disturbance

Interactions between climate change impacts increase disturbance likelihood & severity

- Drought
  - Causes moisture stress in trees and reduces their resistance to other disturbances (i.e., pests & diseases)
- Pests
  - Warming winters provide better conditions for insect outbreaks
  - Forests with high levels of insect-induced mortality have increased wildfire risk
- Fire
  - Burned stands have reduced soil moisture and provide shelter to forest pests

Example: Oak decline has been widely observed across the Northeast and is believed to be caused by a suite of concurrent stressors acting on the trees. Invasive pests, drought, fire suppression, and soil compaction are all believed to contribute to decline and together, can cause mortality.

1. Oak Decline (U.S. National Park Service), n.d.
2. Brandt et al. 2014

Image: Joseph OBrien, USDA Forest Service, Bugwood.org

Ecological Concerns for Forest Management

- Appropriate restoration of heterogeneity in vegetation
- Promoting resilient ecosystems
- Adapting to changing climate conditions
- Supporting biodiversity goals
- Water protection

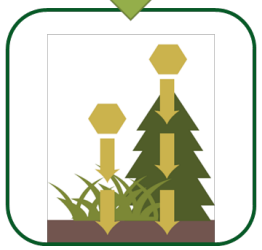
Active management involves social and ecological tradeoffs, including tradeoffs for carbon goals.

Helpful approaches include:

- Assessment of risks
- Monitoring
- Cross-boundary collaboration

Image: T. Ontl, USDA Forest Service

Increase carbon inputs

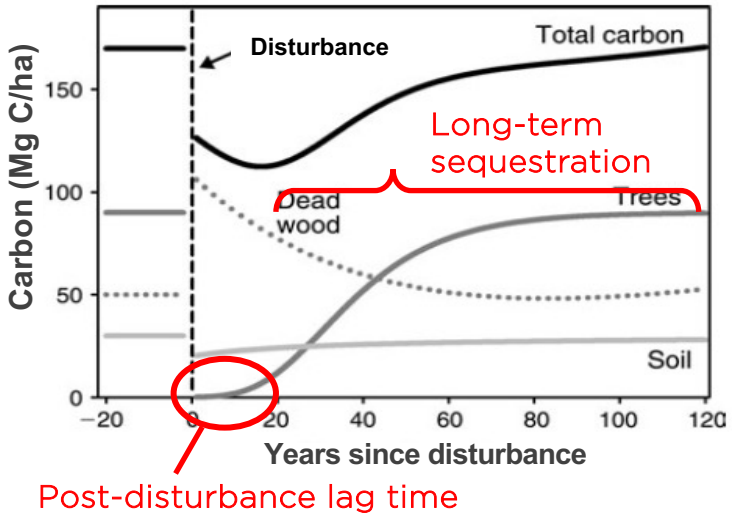


Carbon Implications of Common Forestry Practices:

Afforestation & reforestation

Adaptive Management

- Both practices benefit carbon sequestration by increasing the density of trees, increasing site productivity as trees establish and grow larger.
- Sequestration benefits from reforestation are typically highest on sites where natural regeneration is low or unpredictable



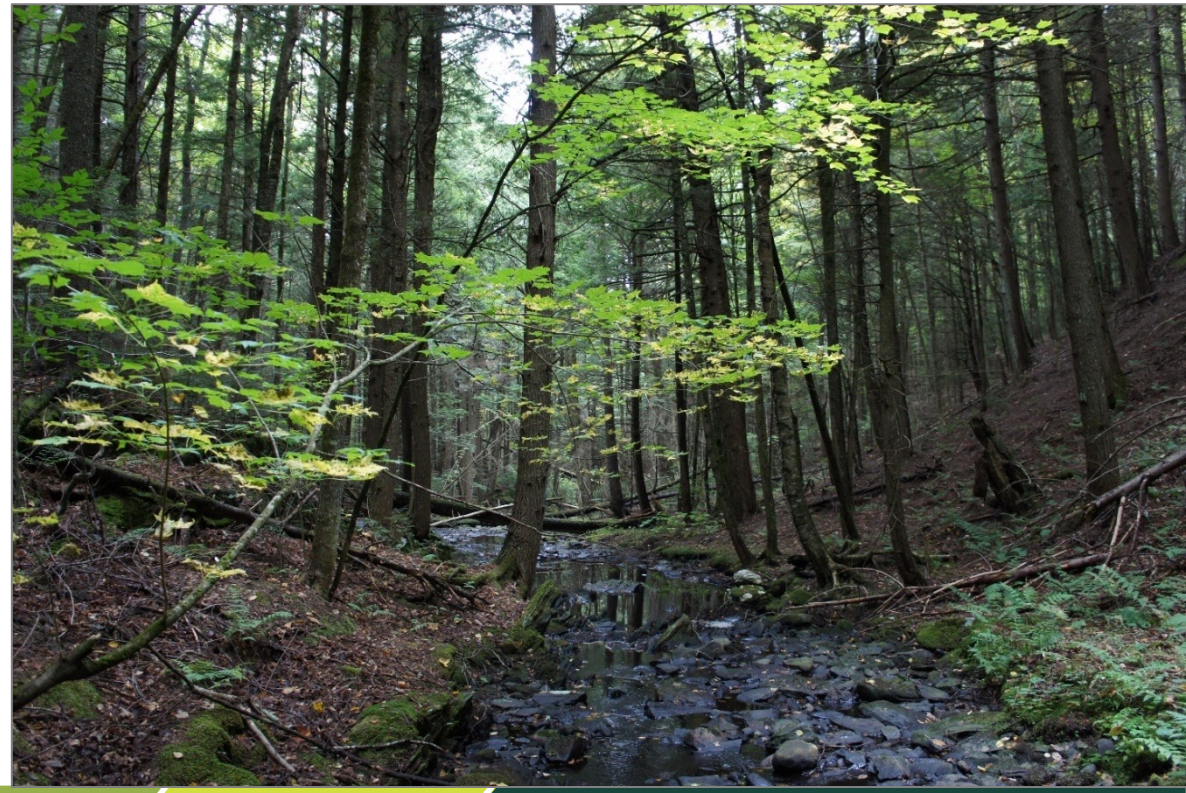
Carbon Management in the Northeast

Adaptive Management

APPROACH: Increase carbon stocking on well-stocked or understocked forest lands

Example TACTICS:

- Increase retention when harvesting, including during commercial thinning and regeneration harvests
- Protect forests through creating or enhancing reserves, especially in high carbon density areas or sites with low vulnerability
- Extend buffer zones around wetlands and riparian zones when conducting harvests



Best suited for:

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NIACS
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Michigan NCS in Action

Forest Carbon and Climate Program
Department of Forestry
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State of Michigan

UNITED STATES CLIMATE ALLIANCE

STATES UNITED FOR CLIMATE ACTION

- Climate Alliance Regional Learning Labs in NWL
  - FCCP was the state facilitator for MI
  - Created interactive spreadsheet used by states
  - Pre- and post- team meetings on the Climate Alliance, NWLs, and the
- Output: NWL Pathways Document

USCA Regional Learning Lab Pre-Work: New States

Q12 How important is each general Pathway to your state's overall Natural and Working Lands strategy? We recognize that many states may be early in the process and this could change!

Reforestation	**High**
Forest management/Restocking	**High**
Agroforestry/Silvopasture	**Not sure**
Fire management	**High**
Avoided forest conversion	**High**
Urban reforestation	**High**
Avoided grassland conversion	**High**
Grassland restoration	**High**
Soil health management	**High**
Cropland nutrient management	**Not sure**
Cover crops	**Not sure**
No till/Conservation till	**Not sure**
Improved manure management	**Not sure**
Tidal wetland restoration	**N/A (pathway not applicable)**
Others (please specify)	**These are aspirational. They are importance for a future revision, and do not reflect the 2009 action plan.**

Q13 Priority pathways: Of the 12 pathways in the Opportunity Assessment, please list up to three that you would like to focus on at the Regional Learning Lab.

Pathway:	**Forest management/restocking - on private and public lands**
Pathway:	**Grassland restoration - primarily on private lands**
Pathway:	**Urban forestry**

Identifying priorities, opportunities, and barriers with the State of Michigan at the regional USCA meeting in St. Paul, MN , fall 2019

Michigan Emission Targets and Carbon Neutrality

Governor signed Executive Order Sept 2020 committing to carbon neutrality by 2050

- Economy will lower emissions in line with state targets and Paris Agreement
- Carbon neutrality further indicates ongoing emissions will need to be offset

- Michigan 10th state to commit to 100% economic carbon neutrality
- Points to potential need to offset emissions in the land sector
- Executive Order also created an advisory Council on Climate Solutions
  - Cooper appointed to co-chair NWL working group

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Governor Whitmer Announces Bold Action to Protect Public Health and Create Clean Energy Jobs by Making Michigan Carbon-Neutral by 2050

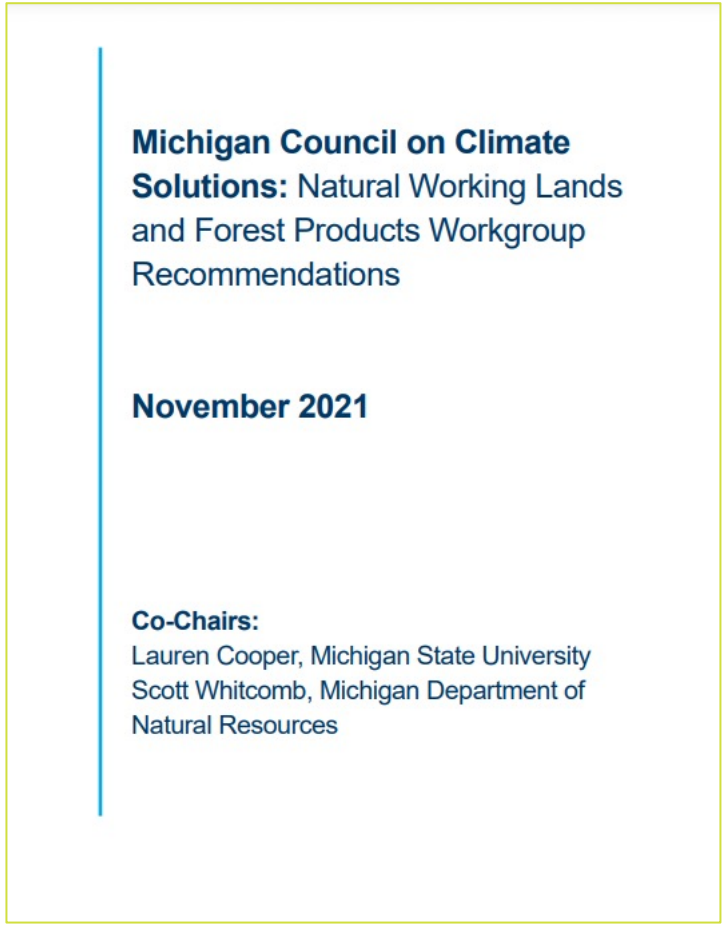
FOR IMMEDIATE RELEASE
September 23, 2020
Contact: press@michigan.gov

Governor Whitmer Announces Bold Action to Protect Public Health and Create Clean Energy Jobs by Making Michigan Carbon-Neutral by 2050

With the MI Healthy Climate Plan, Michigan becomes the ninth state to commit to 100% economic carbon neutrality

Council on Climate Solutions

- Cooper appointed co-lead of Natural and Working Lands Group by Governor Whitmer in 2020
  - with Scott Whitcomb (MDNR)
- Over 1 year, lead ~130 diverse individuals into recommendations
- Reporting the Council and continuing engagement as expert



Michigan Department of Agriculture & Rural Development

Department of Natural Resources DNR Michigan

EGLE Michigan Department of Environment, Great Lakes, and Energy

Workgroups and Co-Chairs

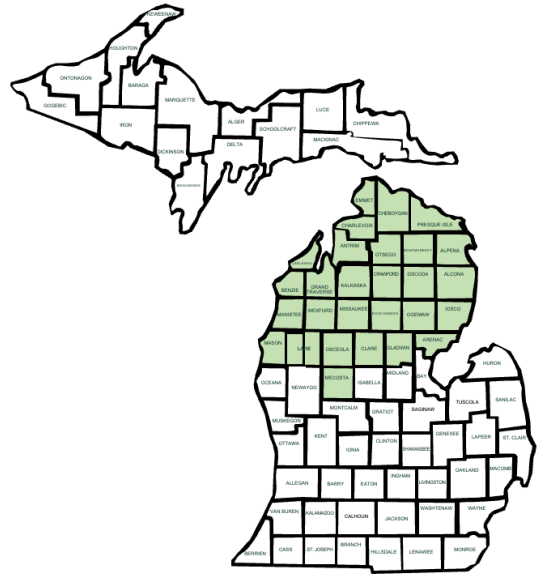
Energy Production, Transmission, Distribution, and Storage	Buildings and Housing	Transportation and Mobility	Energy Intensive Industries	Natural Working Lands & Forest Products
Douglas Jester, 5 Lakes Energy	Charlotte Jameson, Michigan Environmental Council	Charles Griffith, Ecology Center	Steven Holty, Hemlock Semiconductor	Lauren Cooper, MSU
Katherine Peretick, Commissioner	Karen Gould, MPSC	Judson Herzer, LEO	Robert Jackson, EGLE	Scott Whitcomb, DNR

Natural Working Lands and Forest Products Workgroup

Council on Climate Solutions: Workgroup Recommendations

1. Maintain and develop healthy forests across public and private land.
2. **Implement a Healthy Soils Act for Michigan** in which the Legislature and Governor can set a floor for future funding and attract additional funding for soil, water, and habitat conservation by recognizing that protecting and enhancing the state's soils have a direct impact for climate solutions.
3. **Protect existing wetlands and waterways, create new and restore wetlands** where appropriate, and increase carbon storage in waterway green infrastructure in increase both mitigation and adaptation benefits.
4. **Enhance and develop a transformative bioeconomy** that:
    1. implements and promotes natural, sustainable, and low-emission materials production and use
    2. reduces emissions across all NWL commodities (agricultural and forest products)
    3. reduces waste and increases efficiency, and 4) promotes sustainable land use planning
5. **Promote climate initiatives and ensure multi-level action for mitigation and adaption** across natural and working lands by acting in a leadership capacity, fostering enabling conditions, promoting knowledge transfer, and increasing access to needed data and information.

NRCS Regional Conservation Partnership Program



- Reforestation Project: **Climate Action and Reforestation in Northern MI**
- Partnership with MDARD, MI DNR, TNC, WRI, Huron Pines, Arbor Day Foundation, USDA NRCS
- Project: $5,393,506 to plant trees on 16,400 acres in 27 counties in the Northern Lower Peninsula

WORLD RESOURCES INSTITUTE

Huron Pines

DEPARTMENT OF NATURAL RESOURCES · DNR · MICHIGAN

USDA Natural Resources Conservation Service

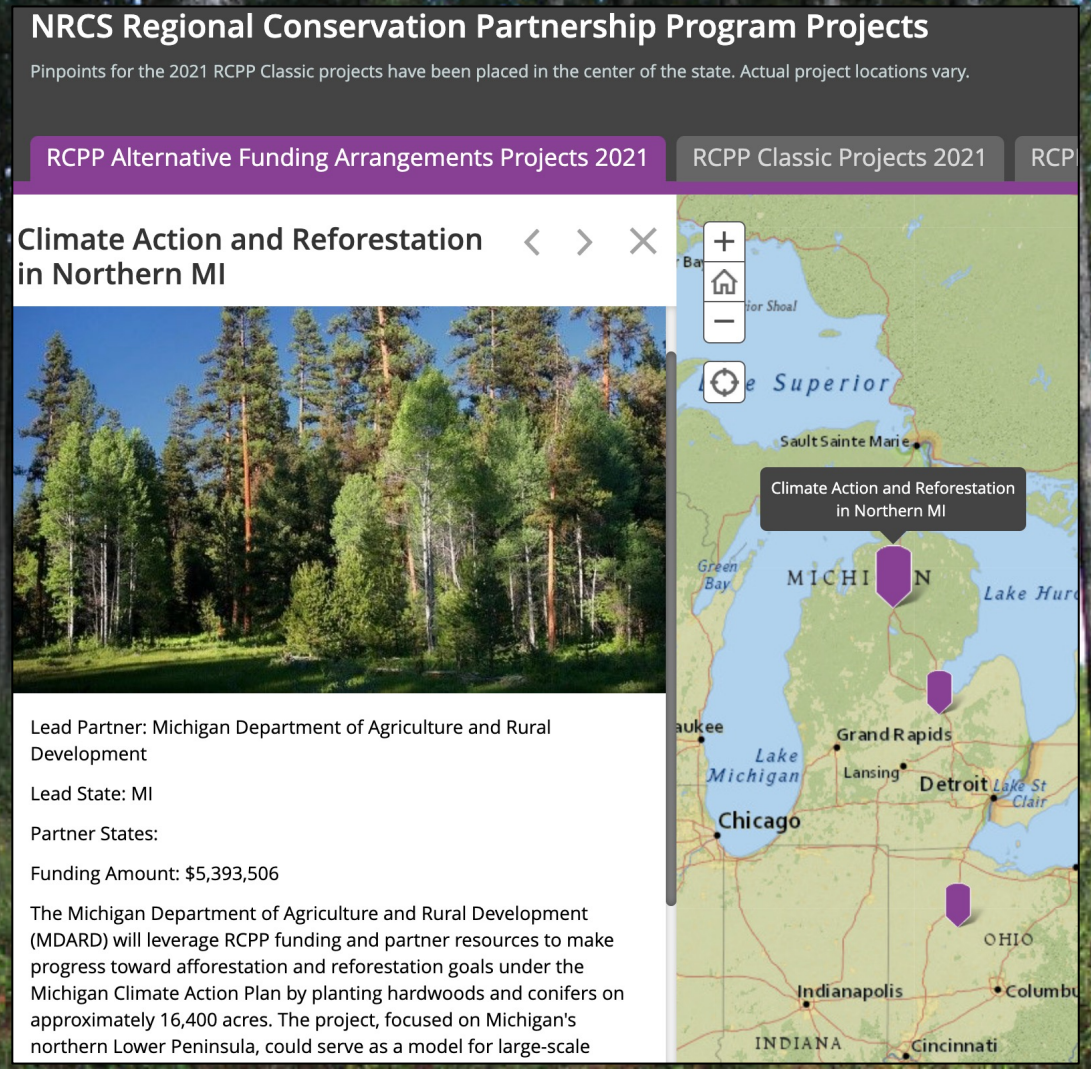
The Nature Conservancy

Michigan Department of AGRICULTURE & Rural Development

Arbor Day Foundation®

Overall project aims

1. Develop new forested areas and keep them that way
   - Influence the economics that drive land use decisions
   - Minimize incentives to develop/ agricultural conversion
2. Make restocking and reforestation more attractive to landowners
3. Increasing emphasis on carbon storage and climate in programs and communication
4. Boost capacity to engage in dialogue and incentives around carbon values for forests



RCPP Reforestation Project

Partnership with MI MDARD, MI DNR, TNC, WRI, Huron Pines, Arbor Day Foundation, USDA NRCS

FCCP Activities

- Research:
  - Carbon: assess sequestration benefits using a forest planning and analytics model (Remsoft) using site-specific inputs
  - Social and Economic Impacts: topics include potential future revenue generated from forest harvest and potential tax benefits.
  - Assessment of landowner likelihood of new practice adoption/ effectiveness of knowledge transfer materials
- Outreach/ Knowledge Transfer
  - Supporting knowledge gaps among landowners
  - Implement 'train the trainers' learning session for implementing partners focusing on carbon storage and management, carbon measurements, and emerging carbon incentive programs

Thank you!

Contact

Forest Carbon and Climate Program

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