Indiana forests, carbon, and climate

View from the top of the Morgan-Monroe State Forest Flux Tower

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Three questions:

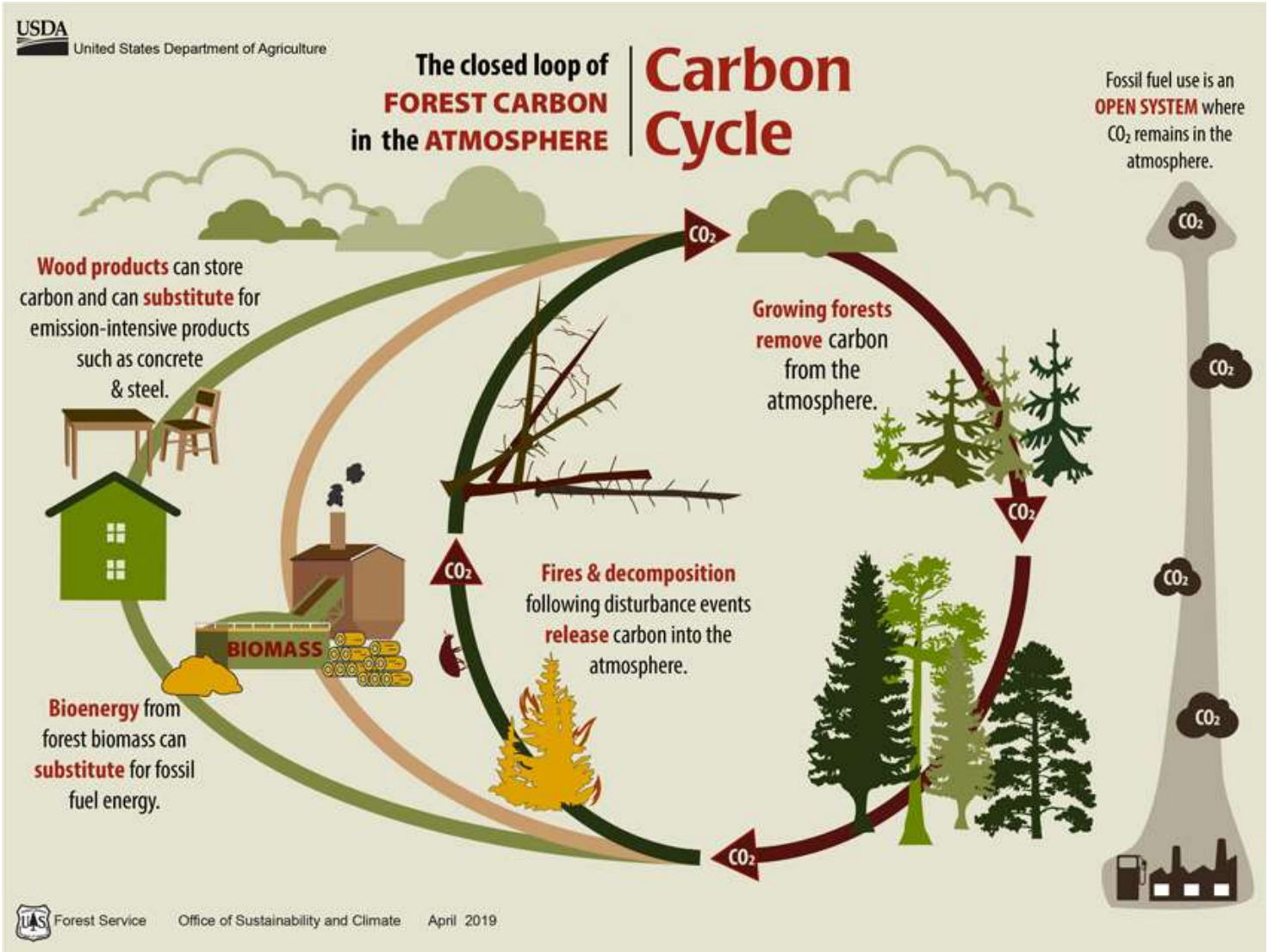
1. In what ways can forests affect climate…locally and globally?

2. What have we learned specifically about these processes in Indiana, and the Eastern United States?

1. How does this knowledge inform our understanding of the usefulness of forests as tools for slow climate change?

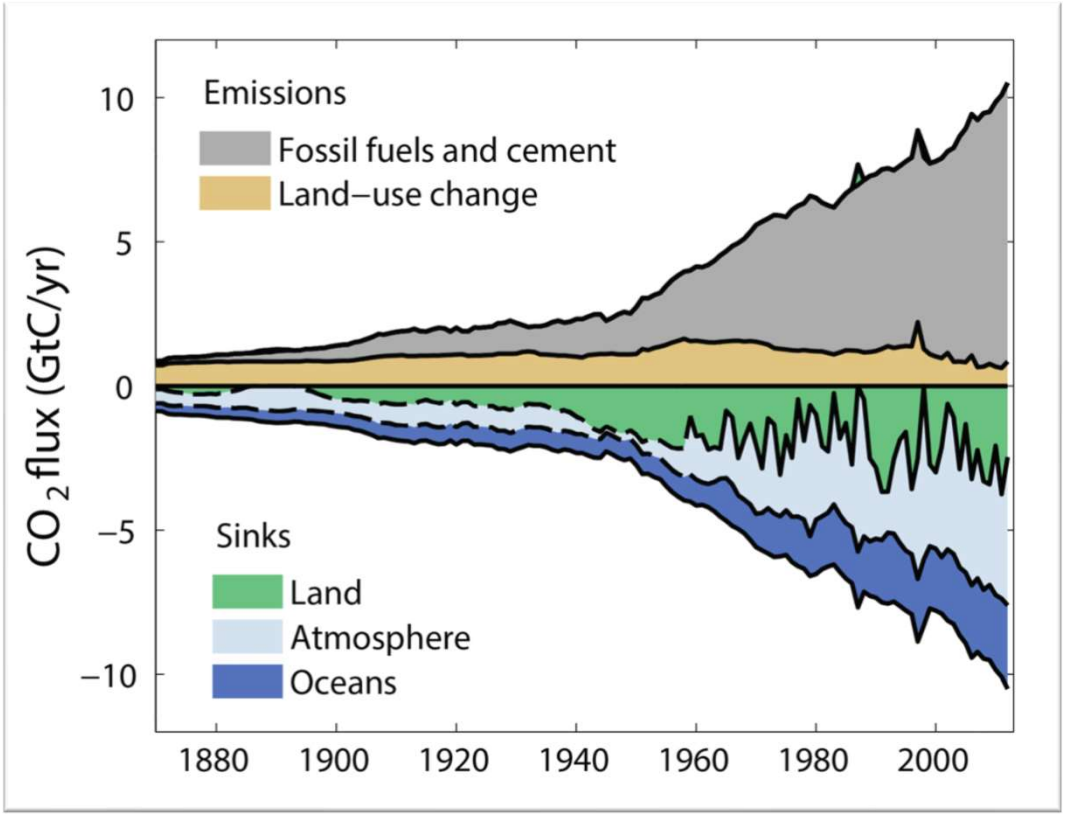
In what ways forests affect climate…locally and globally?

Forests are carbon sinks…



In what ways forests affect climate…locally and globally?

Forests are carbon sinks…

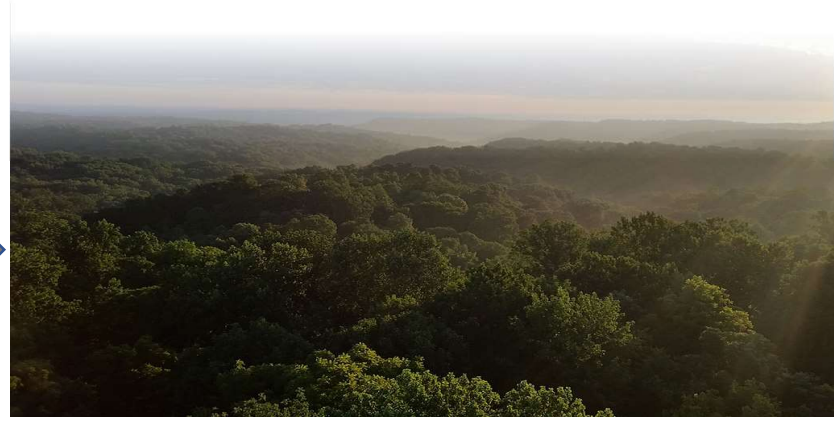


Carbon uptake and storage is a global benefit….”climate mitigation”

In what ways forests affect climate…locally and globally?

Forests can affect surface and air temperature regimes….

Grass field



Forest

Forests are darker → warming

Forests evaporate more water → cooling

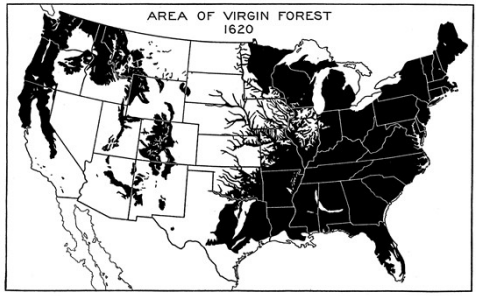
Forests are efficient "mixers" of heat energy → cooling

Land surface cooling is a local benefit…."climate adaptation"

What have we learned specifically about these processes in Indiana, and the Eastern US?

Before 1800 **1850** **1900** **1950** **2000**

Forests dominated



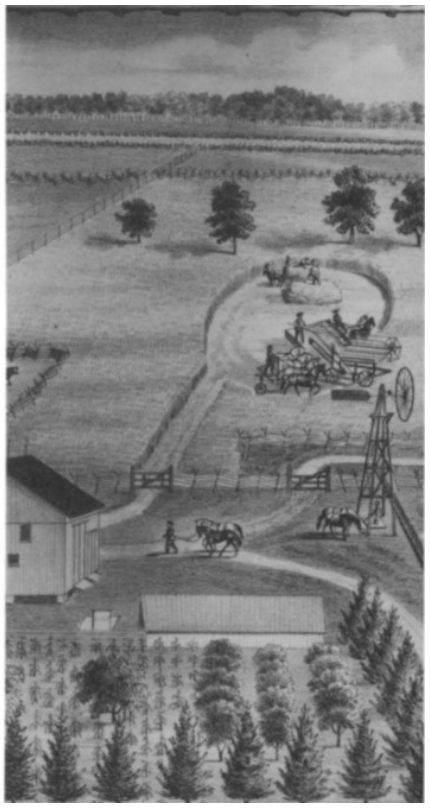
ECONOMIC GEOGRAPHY

Vol. I MARCH, 1925 No. 1

THE RELATION OF GEOGRAPHY TO TIMBER SUPPLY

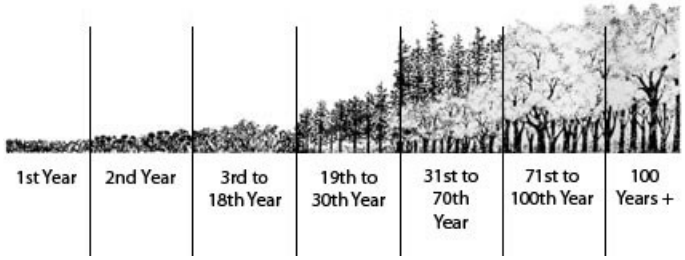
W. B. Greeley, Chief
U. S. Forest Service

Widespread land clearing, farming, clearcutting



From Steinson, 1994: “Rural life in Indiana 1800-1950”

Reforestation



What have we learned specifically about these processes in Indiana, and the Eastern US?

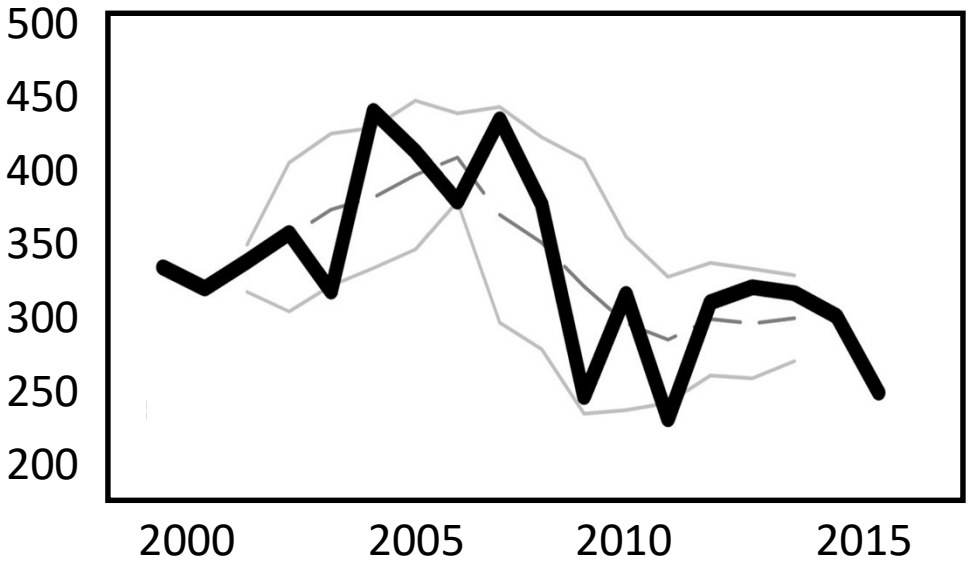
We have tools ("Flux towers") that can allow us to measure ecosystem carbon uptake

Crossett Experimental Forest, AR

Morgan-Monroe State Forest, IN

Rabun Gap, GA

Annual carbon uptake in Morgan-Monroe ($gC/m^2/yr$)



stronger sink

weaker sink

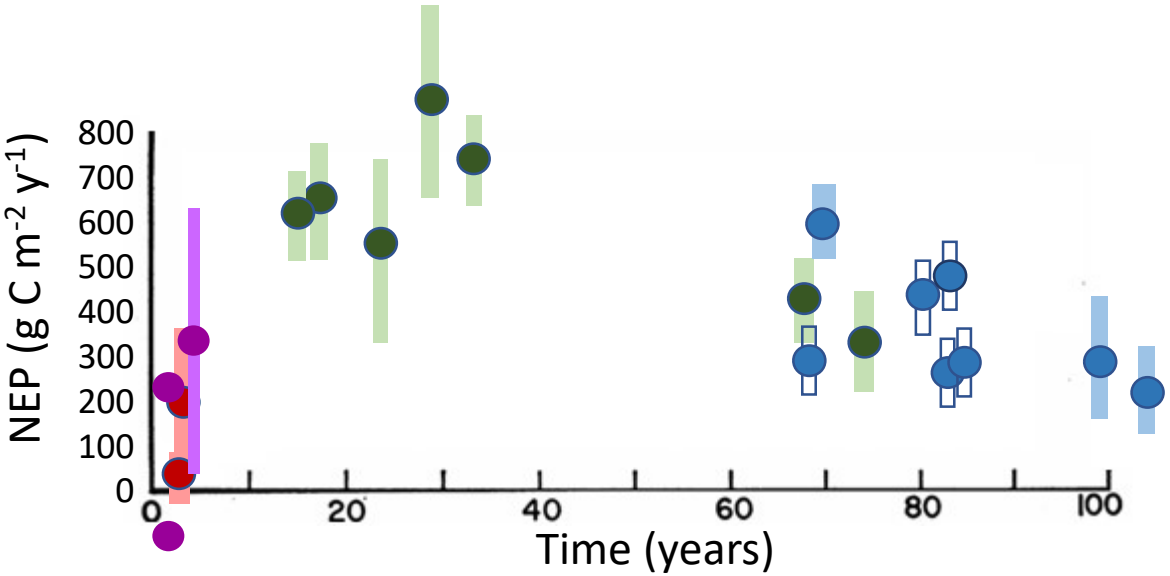
~300 $gC/m^2/yr$

~4.5 metric tonnes CO_2/acre

$90/acre if carbon price is $20/tonne

What have we learned specifically about these processes in Indiana, and the Eastern US?

Leveraging a network of towers in the Eastern United States…

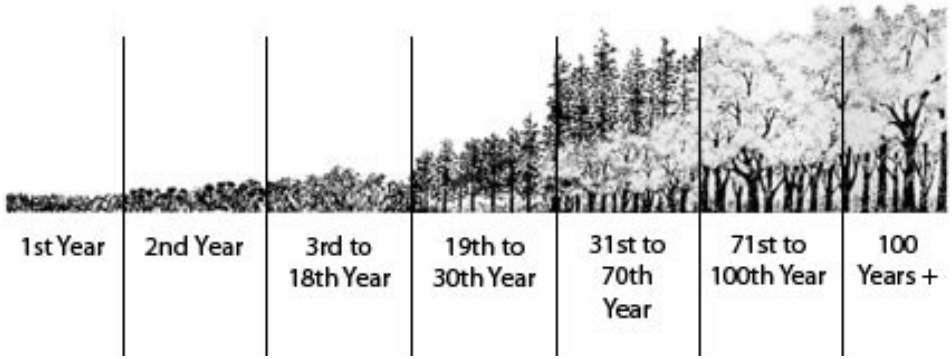


Grassland

Pine Forest

Hardwood Forest

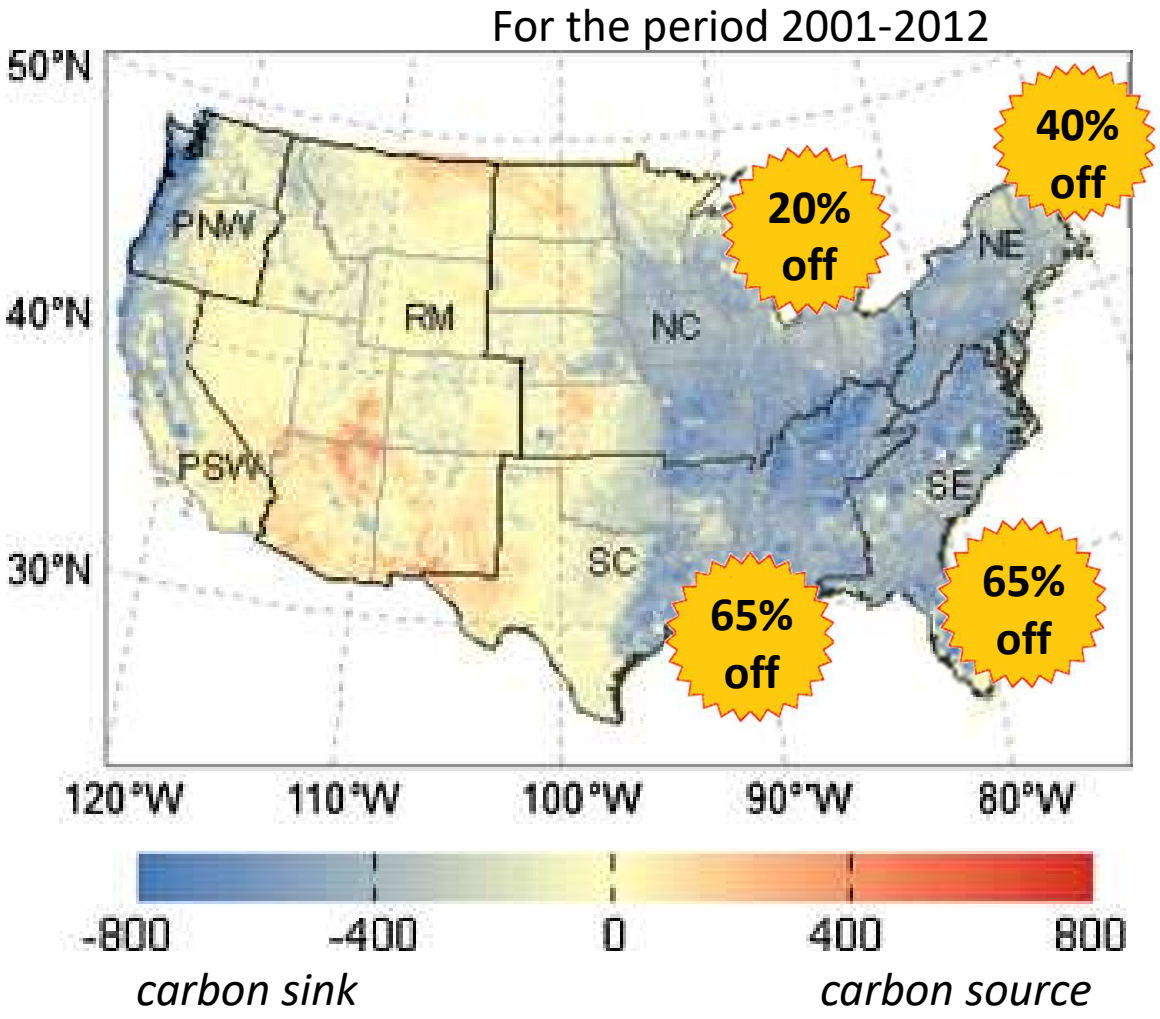
Crops



Results from Morgan-Monroe are representative of other maturing hardwood forests

What have we learned specifically about these processes in Indiana, and the Eastern US?

What can we learn when we blend flux tower data with satellites information?

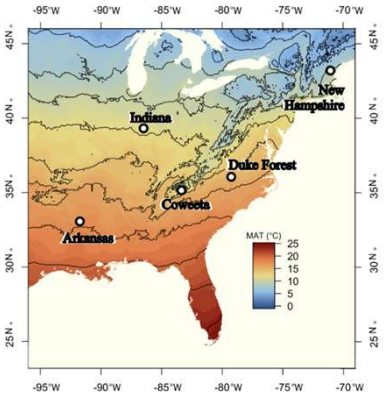


Xiao et al. 2011

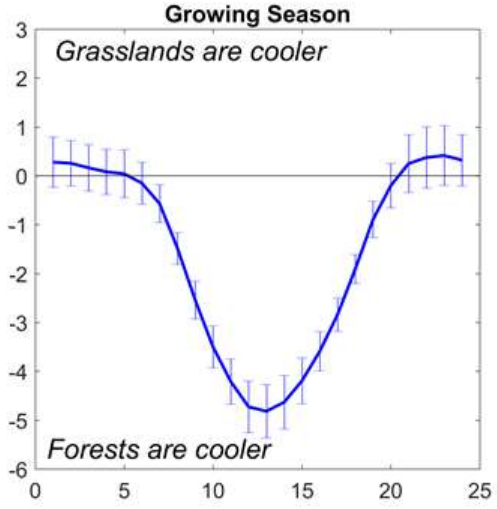
What have we learned specifically about these processes in Indiana, and the Eastern US?

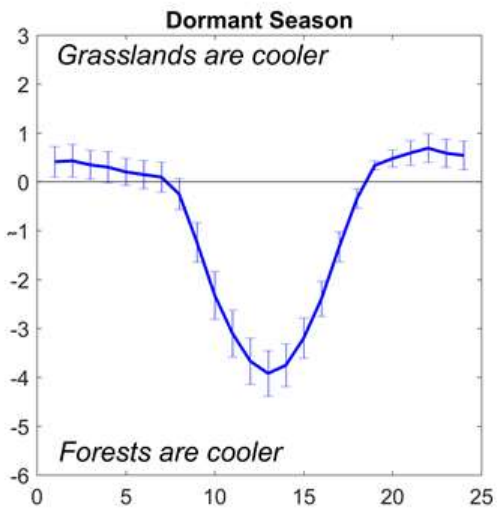
In the Eastern US…forests keep us cool!

paired flux towers



Surface Temp Difference (forests – grasslands, deg C)

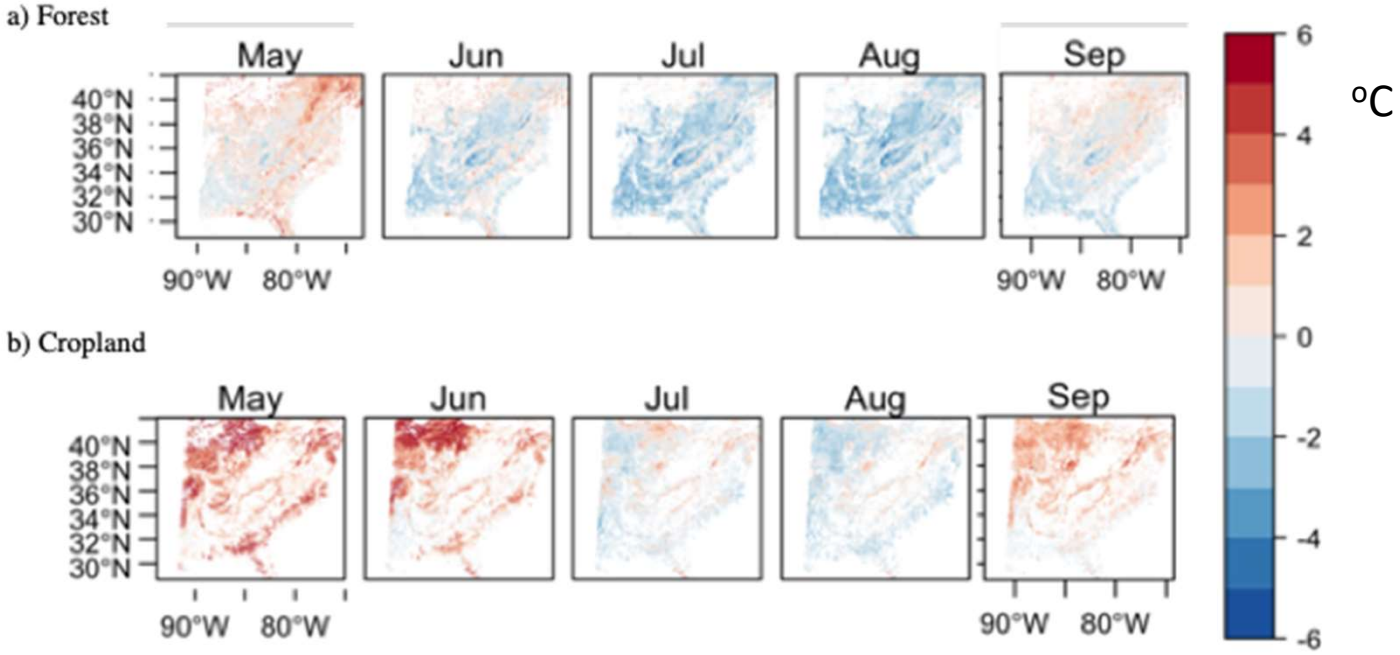




What have we learned specifically about these processes in Indiana, and the Eastern US?

Satellite data confirm the result….forests keep us cool

Surface temperature minus interpolated air temereature



What have we learned specifically about these processes in Indiana, and the Eastern US?

BIG QUESTION: Will these benefits persist into the future? Are they **permanent**?

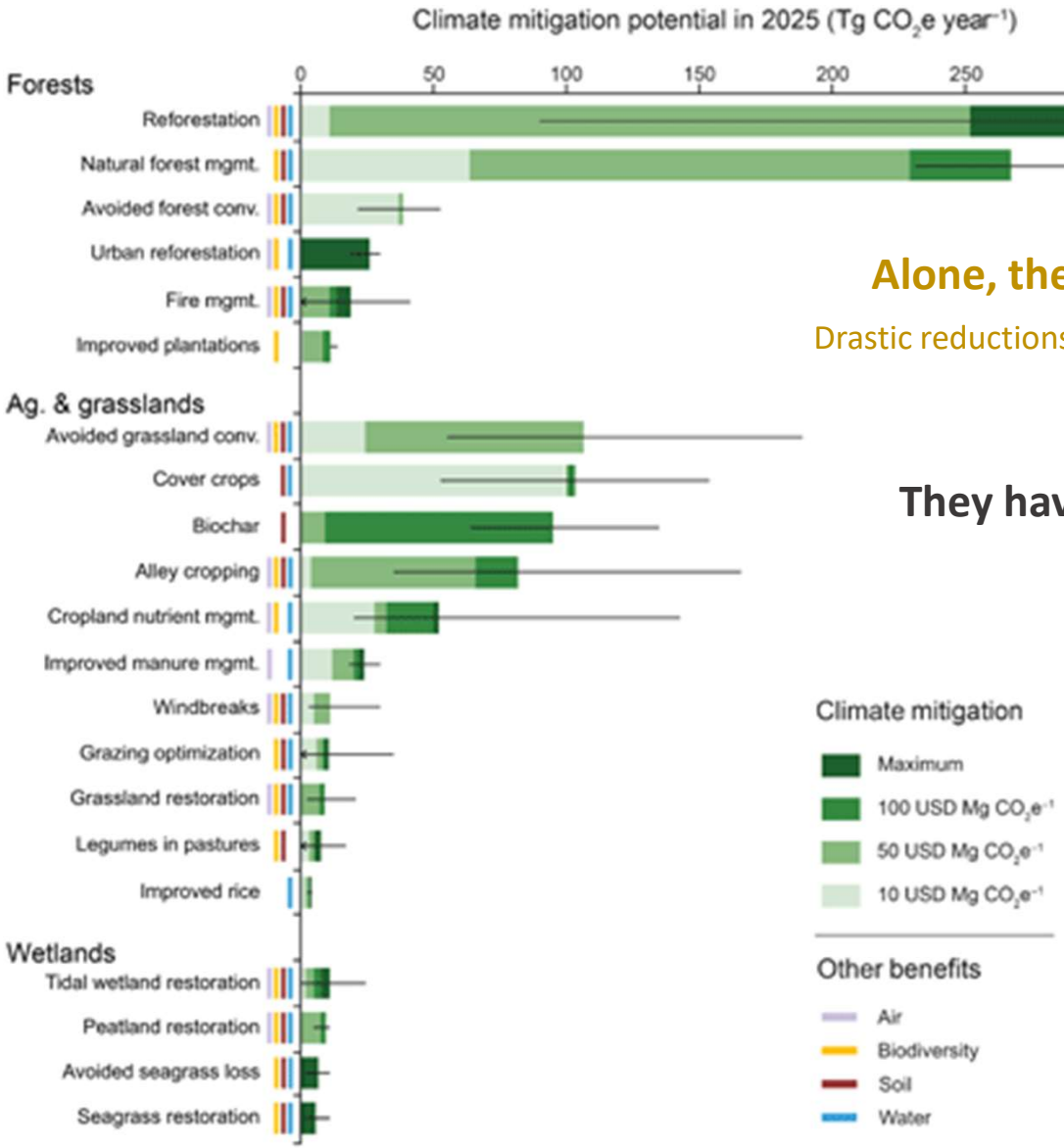
CO2 is rising, and growing seasons are becoming longer….more CO_2 uptake in forests

but

Droughts, wildfire, insects are becoming increasingly problematic….less CO_2 uptake in forests

On the usefulness of forests as tools for slowing climate change….

Natural Climate Solutions



From Fargione et al. 2018

Alone, they are not a panacea!

Drastic reductions to GHG emissions must happen.

They have some co-benefits.

The uncertainty is big!

On the usefulness of forests as tools for slowing climate change….

There is quite a bit of momentum for Natural Climate Solutions….

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Create “carbon markets” connecting investors/industry to land managers….

The process:

Establish baseline C uptake rates (usually through biomass inventories for forests)
Demonstrate “additionality” (project wouldn’t have happened anyways)
Use models to estimate the projected CO_2 sequestrations gains
Long-term monitoring and verification (2-5 year return intervals)

On the usefulness of forests as tools for slowing climate change….

“The Growing Climate Solutions Act”

Introduced in the senate by Mike Braun

To authorize the Secretary of Agriculture to develop a program to reduce barriers to entry for farmers, ranchers, and private forest landowners in certain private markets, and for other purposes

Stoops, Glick, Lehe (on the house side)

SB 373: Amends the law concerning the Harrison Conservation Trust Fund, giving it power to:

1) Receive $ from investors

2) Deposit the $ in the “INpact forest carbon account”

1) Use $ to purchase property that will generate carbon offsets

2) Sell or facilitate the sale of these offsets

On the usefulness of forests as tools for slowing climate change….

Research Summary….

- Eastern US forests, even maturing ones, are substantial carbon sinks that give us a discount on our CO_2 emissions
- Forests in the Eastern US keep us cool…a local benefit…climate adaptation
- We have tools (flux towers, satellites) that can help us quantify C uptake and temperature benefits over landscape to regional scales.

On the usefulness of forests as "Natural Climate Solutions"

- Sustaining and growing tree cover in places where forests once dominated → good idea
- We need to reduce the uncertainty, especially linked to age/management effects
- Do we want to leave the job of baselining/monitoring/verification to "third parties"?
- Forests should be managed for a range of benefits….

Thank you!

Questions?

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