Plantation Carbon Storage: Distribution and Management Effects

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PINEMAP

USDA United States Department of Agriculture

National Institute of Food and Agriculture

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Overview of Tier II Network

- 123 distinct sites pulled from the experimental designs of coops
  - Forest Biology Research Cooperative
  - Forest Modeling Research Cooperative
  - Forest Productivity Cooperative
  - Pine Management Research Cooperative
- 322 plots sampled. Usually one representative treatment plot per site.

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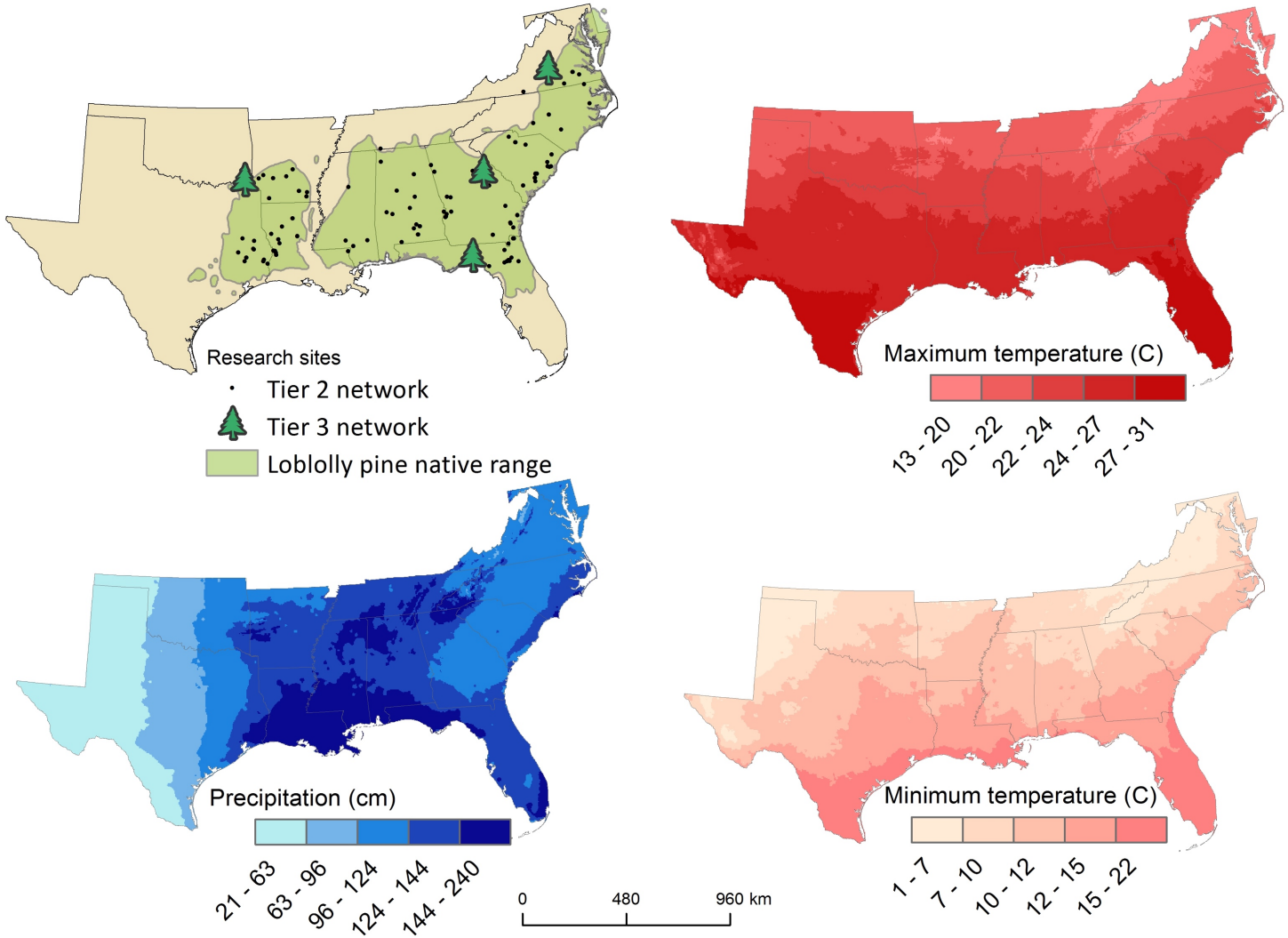
Network of sites and climate



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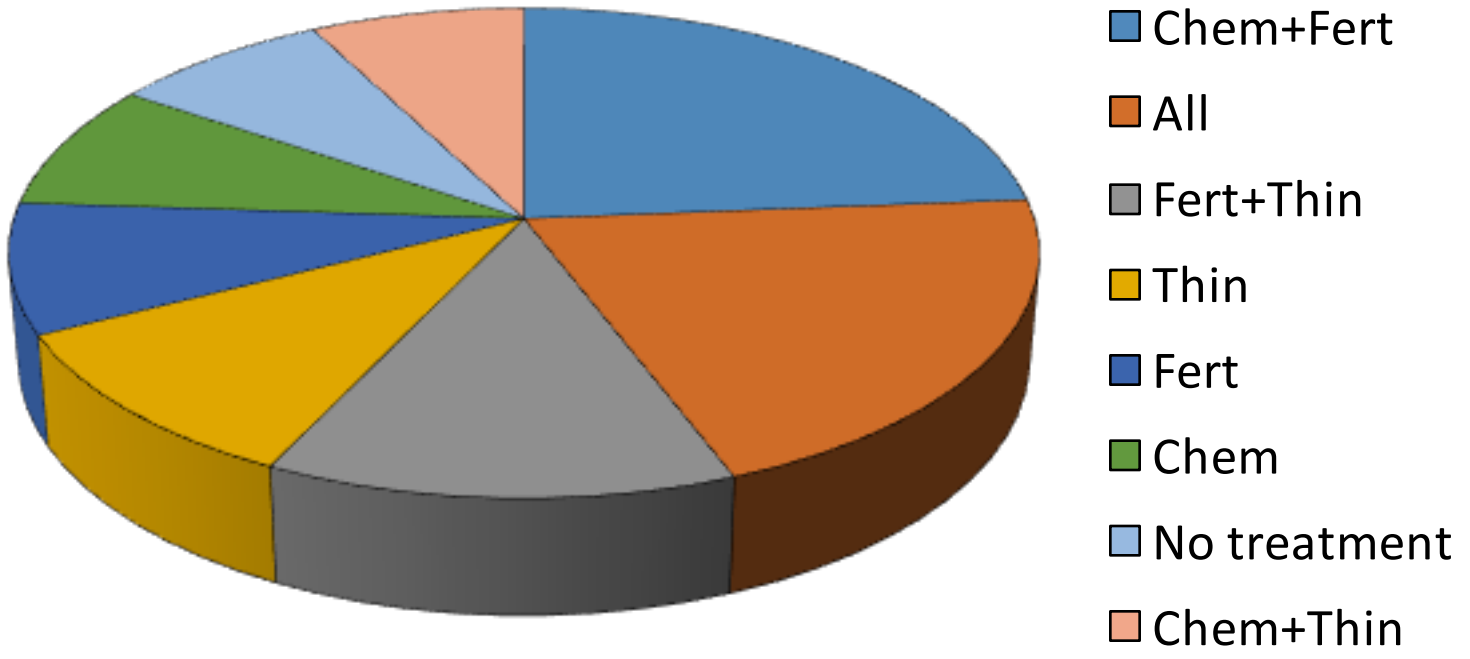
Silvicultural Treatments in Tier II Network



322 distinct treatments

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Carbon Sampling Protocol

- Aboveground biomass and coarse roots
  - Cooperative mensurative data and allometry
- Soil Samples
  - 0-10 cm, 10-20 cm, 20-50 cm, 50-100 cm
  - Roots and woody debris at all depths
- Forest Floor
  - Litter and Duff (Oi and Oe+Oa)
  - Fine roots <2 mm are included in this estimate
- Understory
- Coarse woody debris and stumps

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Carbon Distribution

Ave. Total=192 Mg C ha^{-1}
Ave. Age= 17 years
N=132

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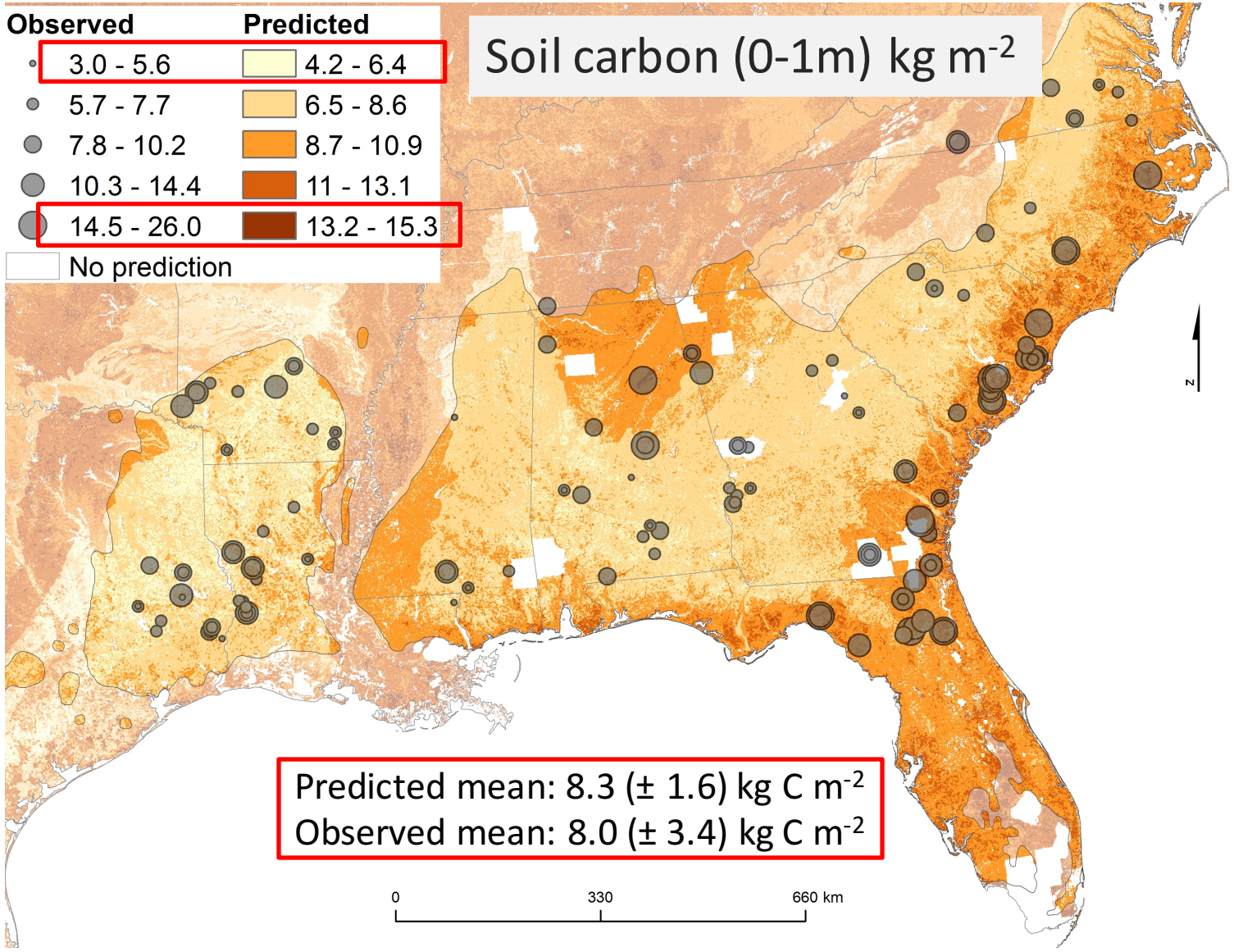

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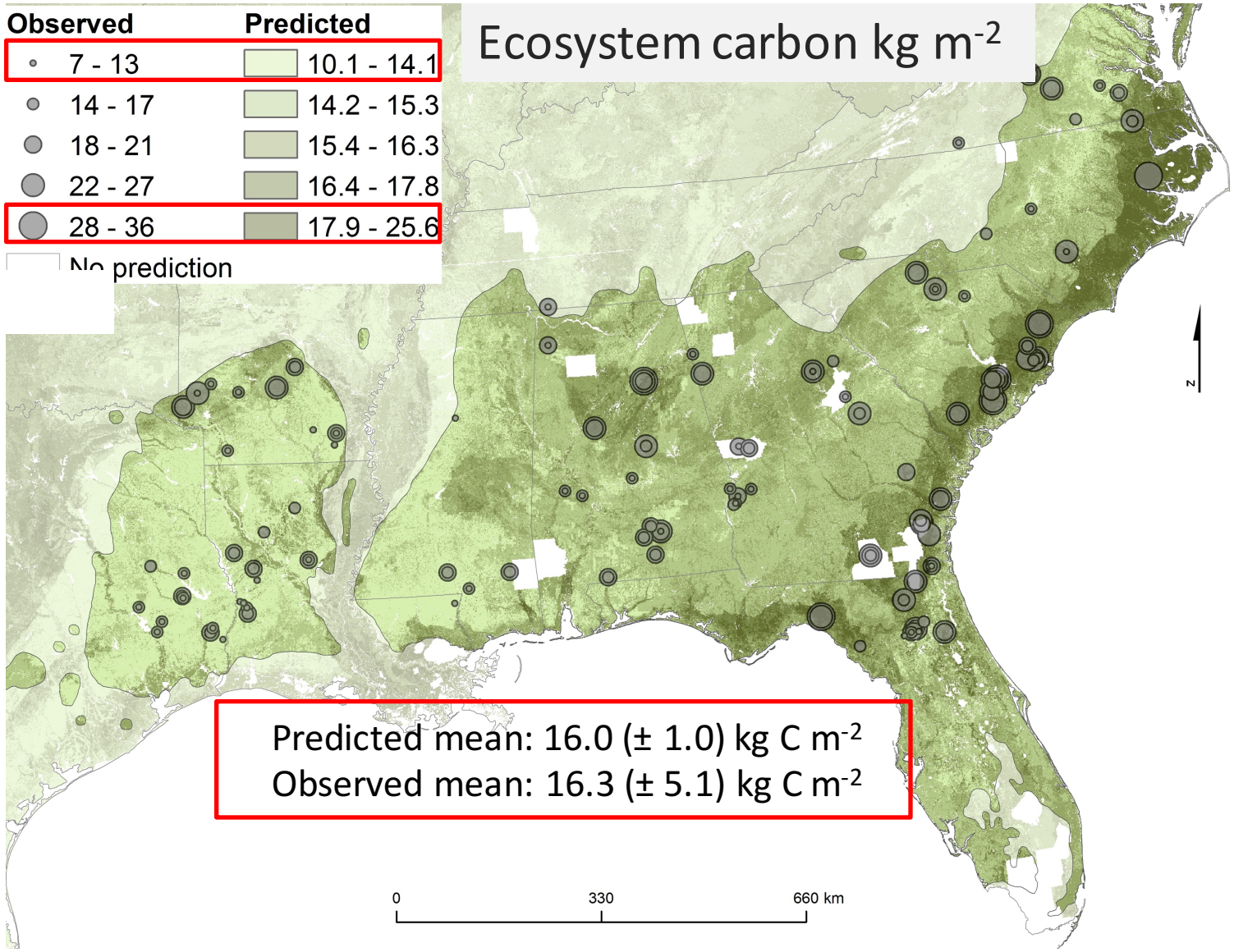

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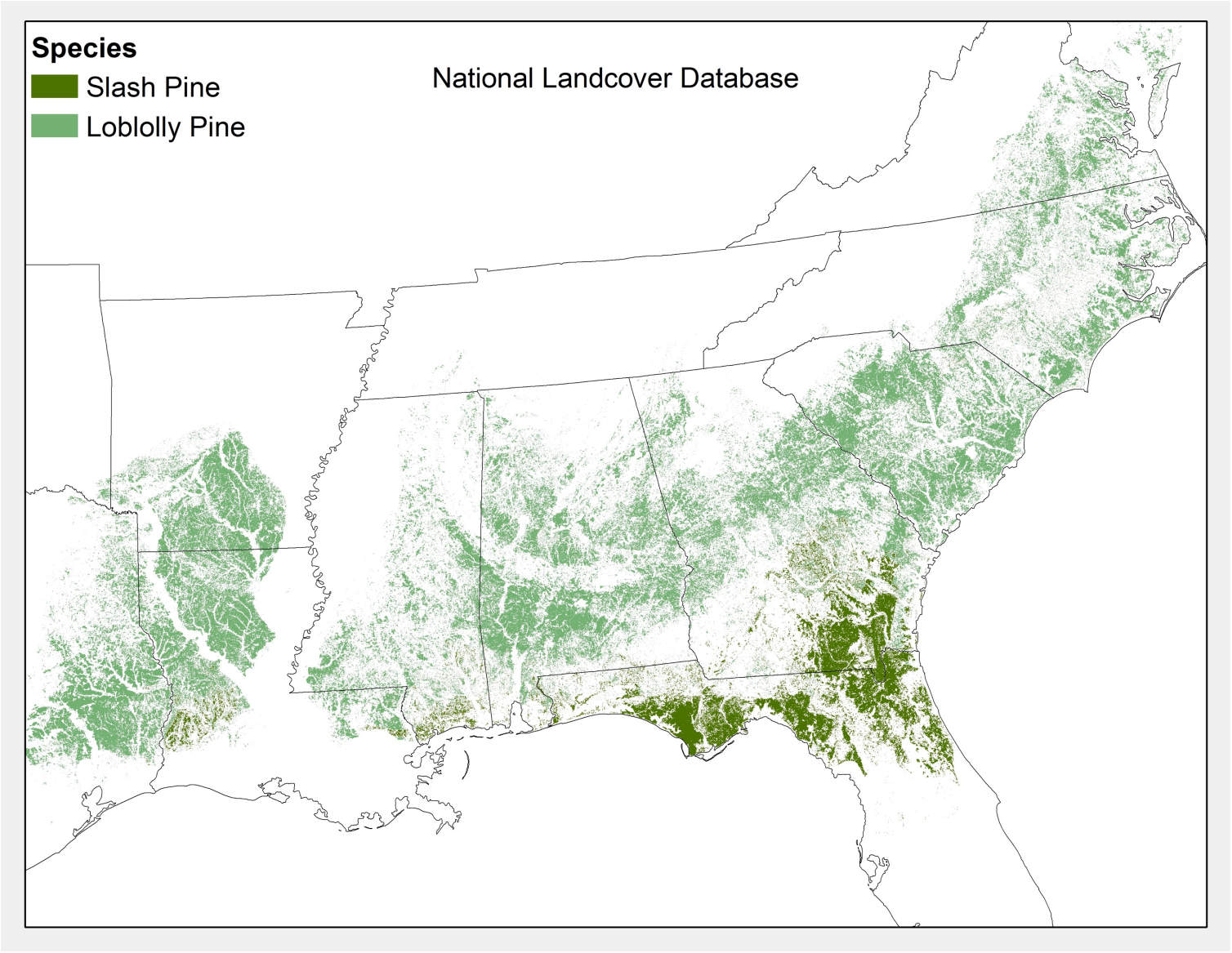
Across the Southern US states
~ 13.3 to 19.1 Pg soil carbon
~ 26.1 to 29.1 Pg ecosystem carbon

In loblolly and slash pine forests
~ 1.4 to 2.2 Pg soil carbon
~ 2.8 to 3.8 Pg ecosystem carbon



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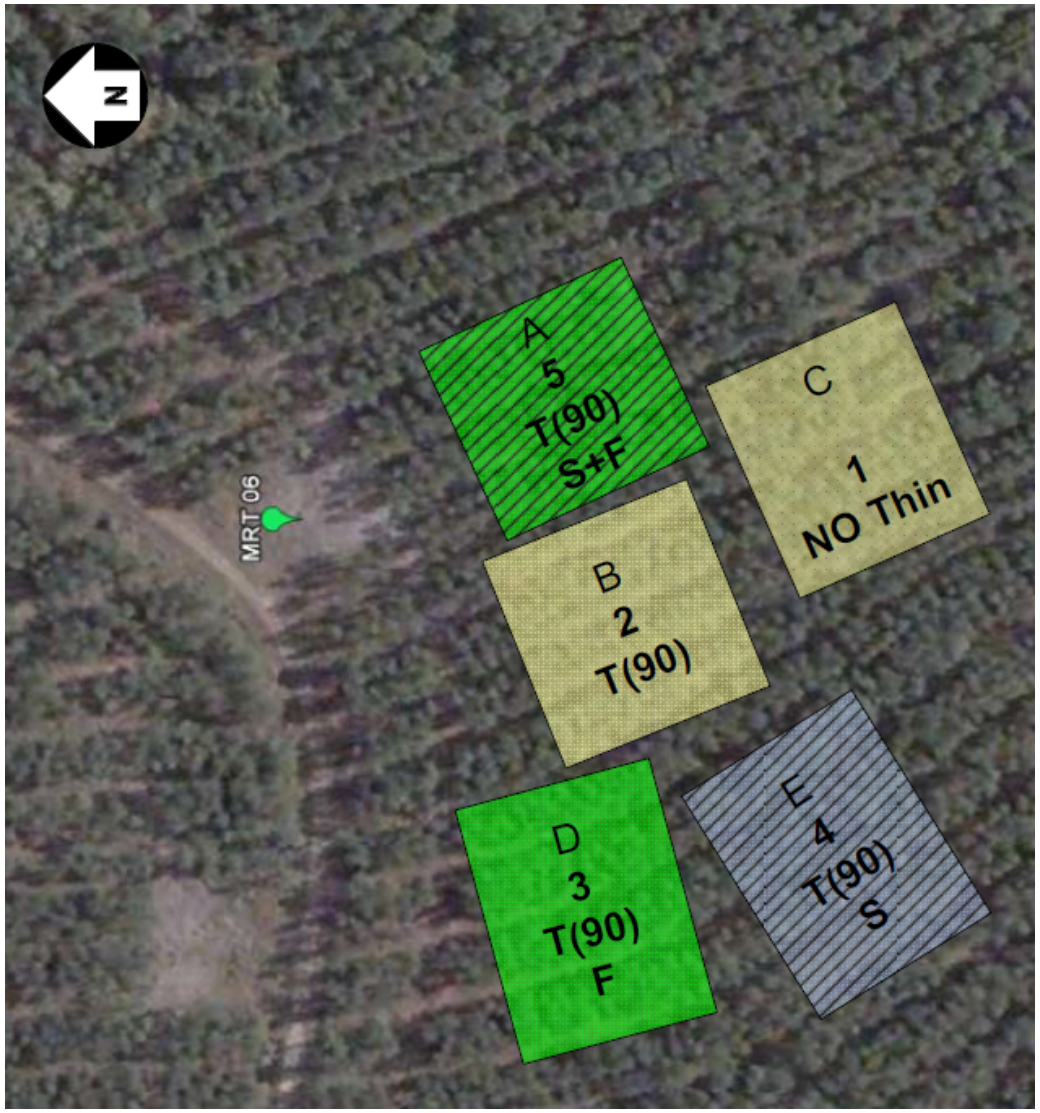
Pair plot and simple correlation approach



Each site treated as replicate in paired plot analysis.

Does a change in tree biomass correspond to a change in another pool?

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Pairings

Thinning

Thin	Chem	Fert		Thin	Chem	Fert	N
1	0	0		0	0	0	7
1	1	0		0	1	0	14
1	1	1		0	1	1	24
1	0	1		0	0	1	8

Chemical Control

Thin	Chem	Fert		Thin	Chem	Fert	N
0	1	0		0	0	0	1
1	1	0		1	0	0	9
0	1	1		0	0	1	4
1	1	1		1	0	1	4

Fertilization

Thin	Chem	Fert		Thin	Chem	Fert	N
0	0	1		0	0	0	1
1	0	1		1	0	0	7
0	1	1		0	1	0	10
1	1	1		1	1	0	32

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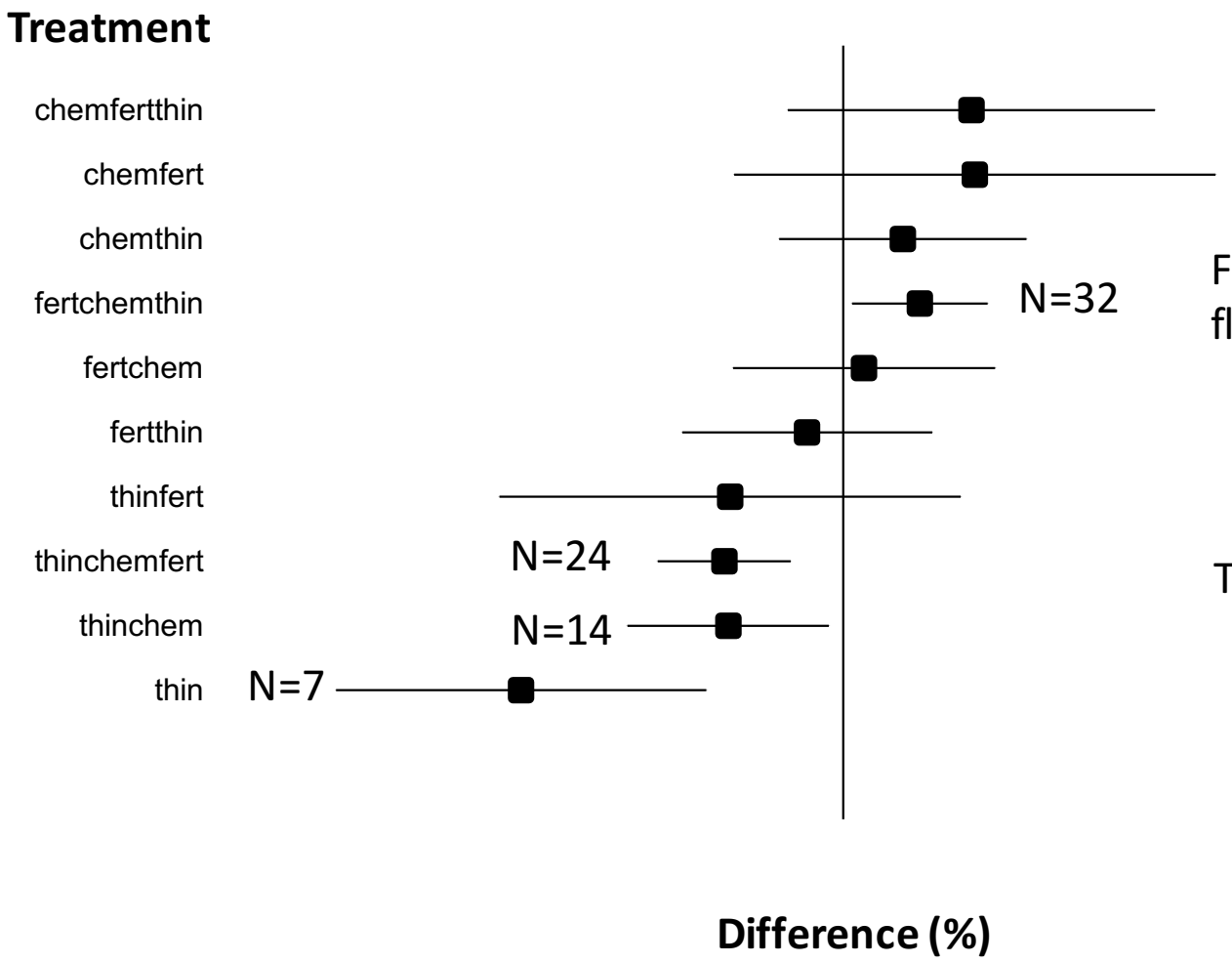
Forest Floor Carbon



Fertilization increases the forest floor (with chem and thin trt)

Thinning decreases the forest floor

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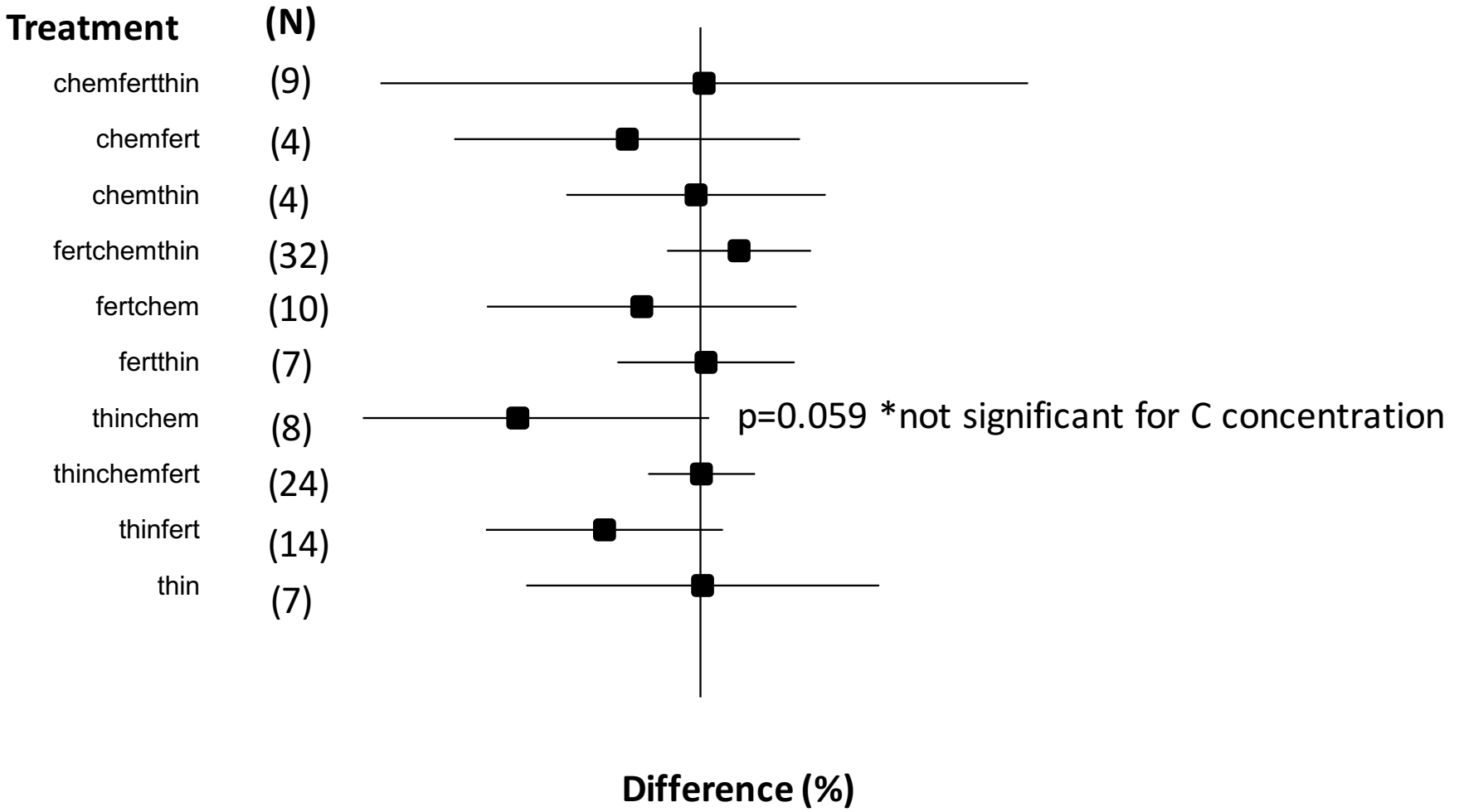
Soil Carbon (Mg C ha^{-1}) to 1 meter



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Does soil or forest floor carbon vary with biomass?

- Paired plot analysis leaves out 80 plots with no in-site contrast, because based on binaries, they are the same (e.g. High vs. Low fertilization)
- Varying levels of replication across treatment combinations
- Different types of forest (e.g. drainage class) can obscure magnitude of effect in soils

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Biomass Change vs. Soil or Forest Floor Change

r=0.25
P<0.001

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Summary

- Soil and tree biomass store 75% of ecosystem C (for soils to 1 meter).
- ~10-12% of stored C in the region is in loblolly pine and slash pine forests.
- Forest management can affect the forest floor and aboveground C pools but has no discernible effect on soil C.

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