PINEMAP

Thinning, fertilization and weed control effects on soil, detrital, and biomass carbon pools: A regional assessment

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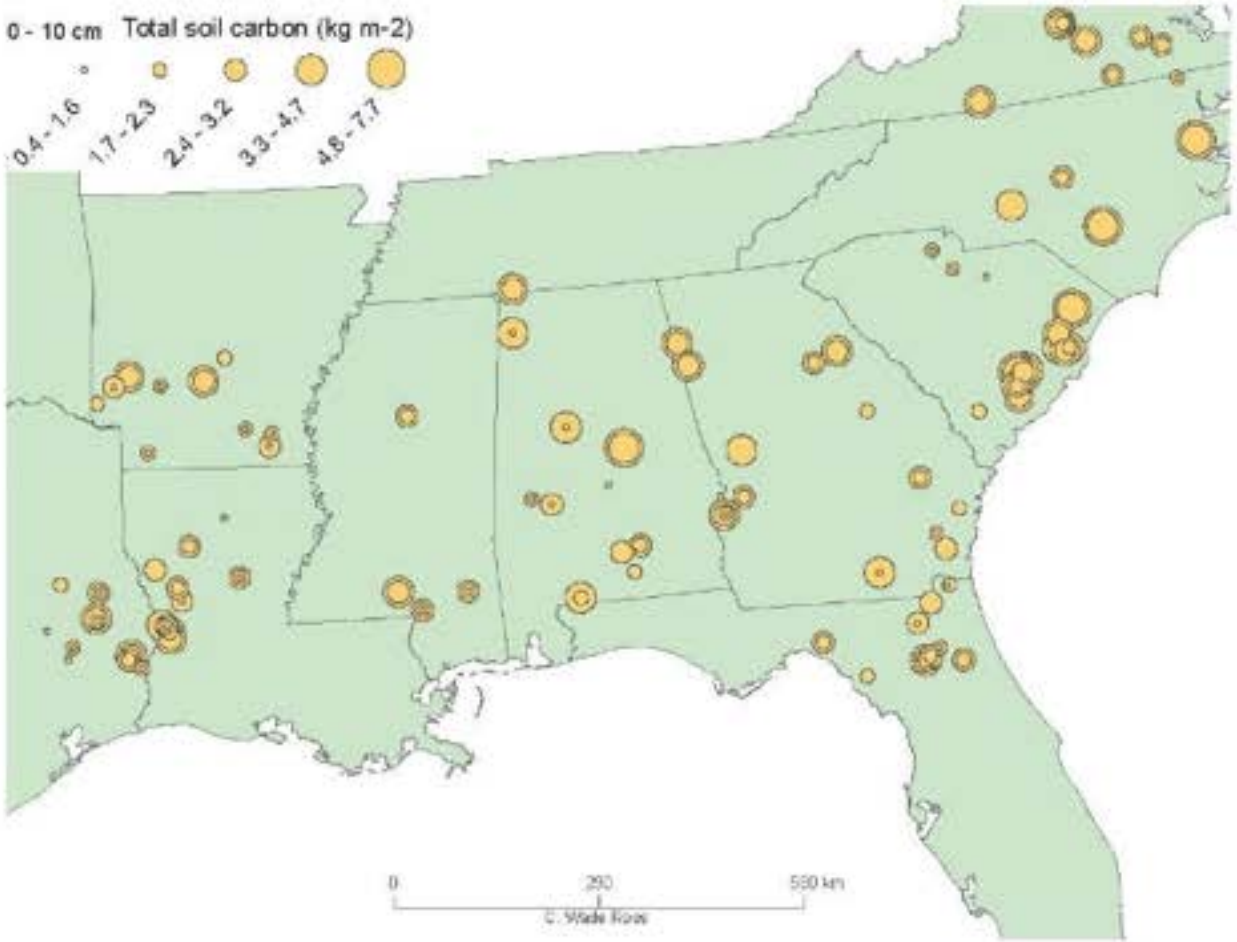
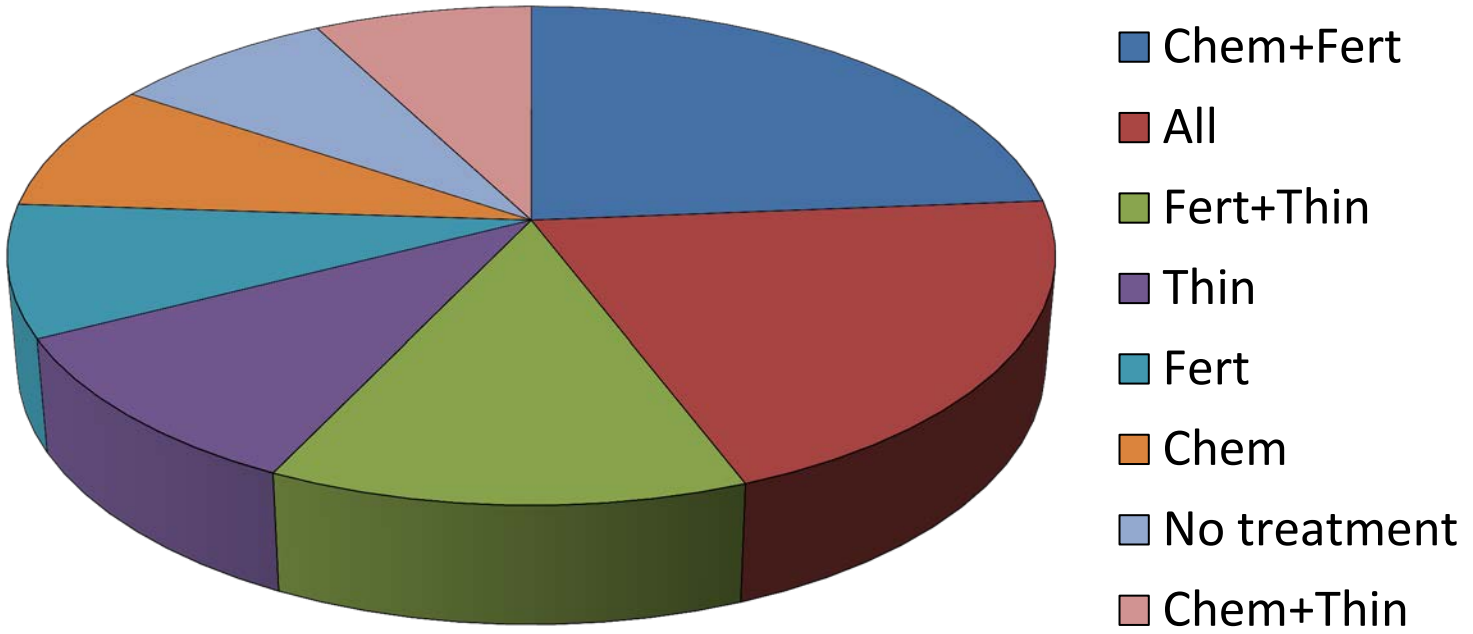
Tier II Site Distribution

126 sites
450 plots



Wade Ross

Silvicultural Treatments in Tier II Network

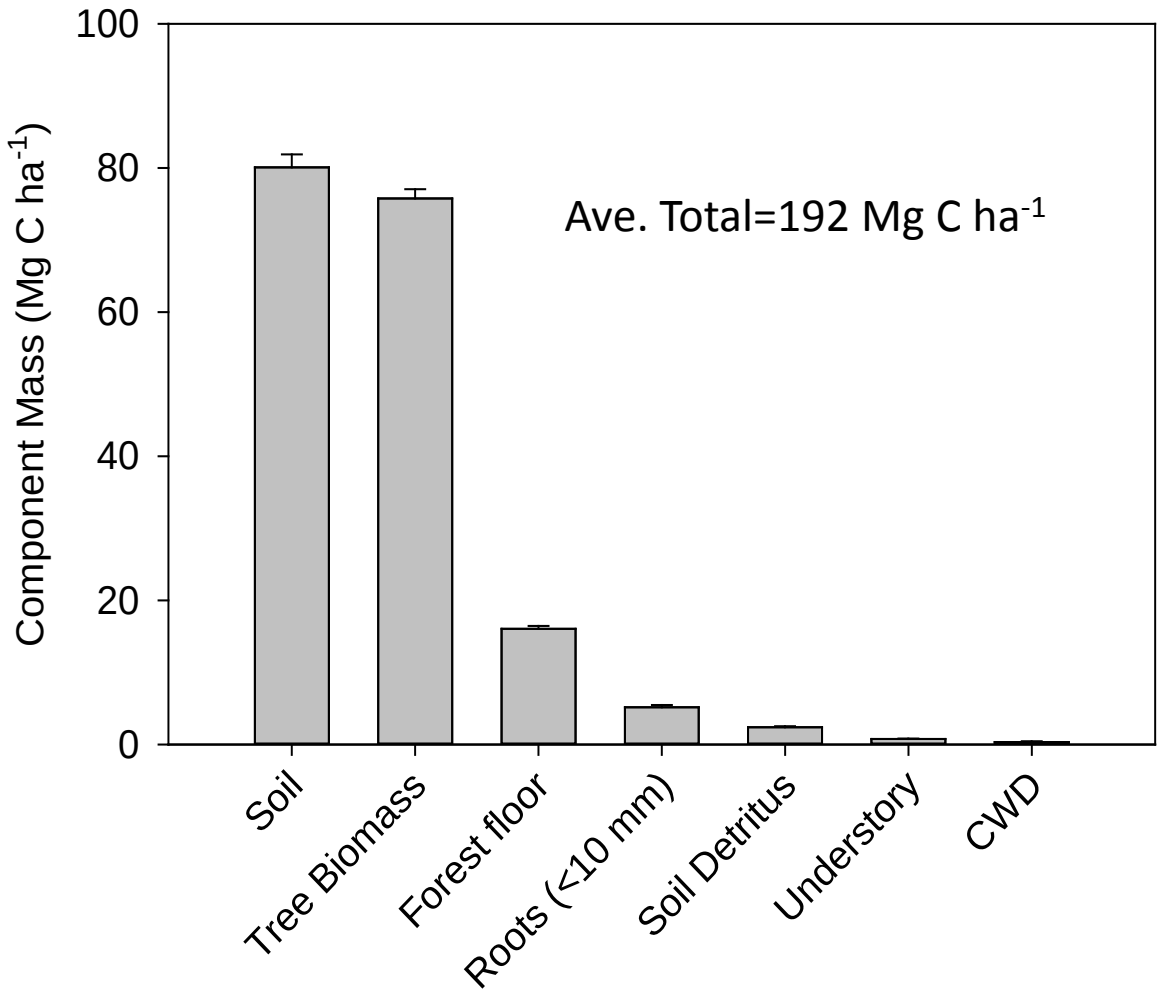


322 distinct treatments

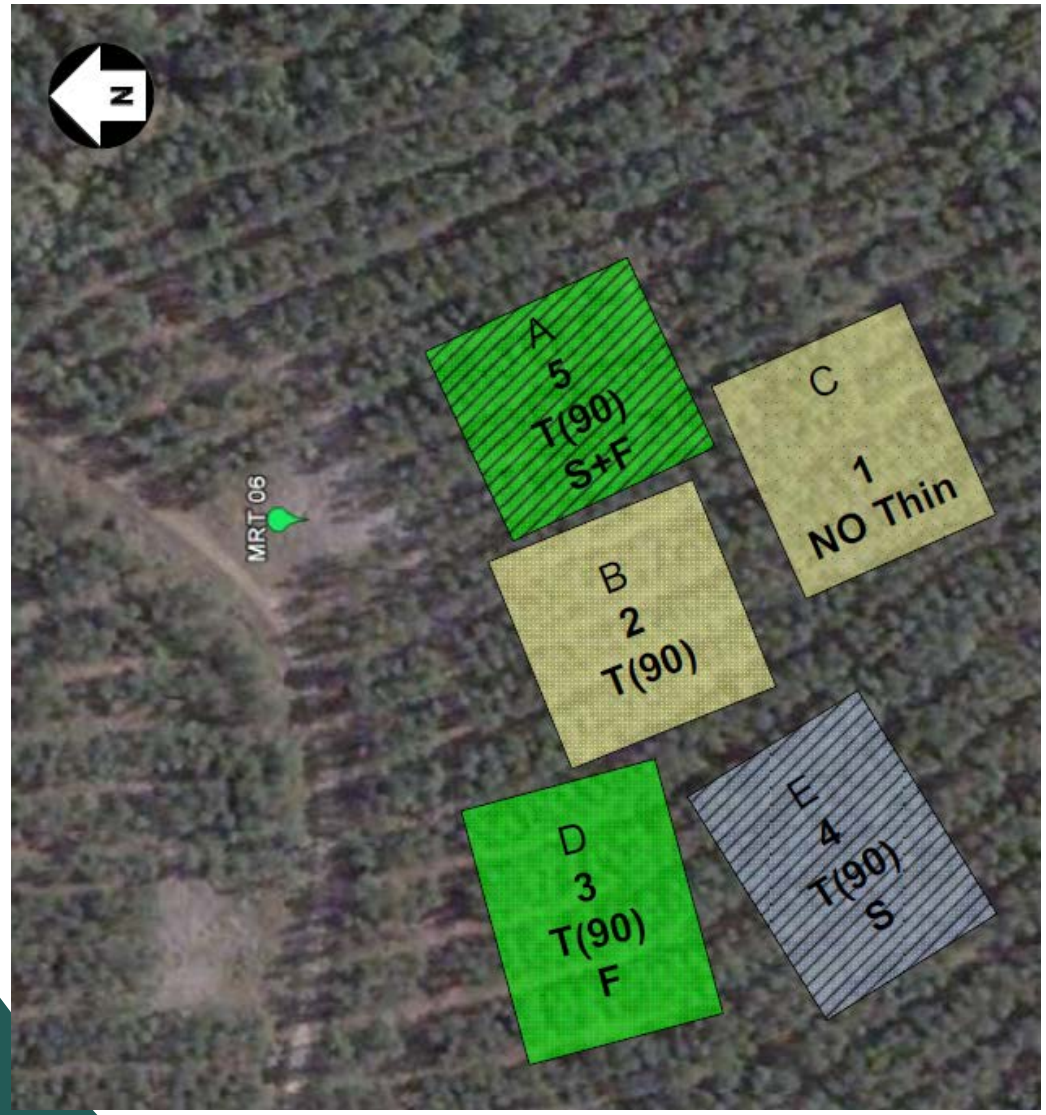
Carbon Sampling Protocol

- 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

Carbon Distribution Across 110 Sites



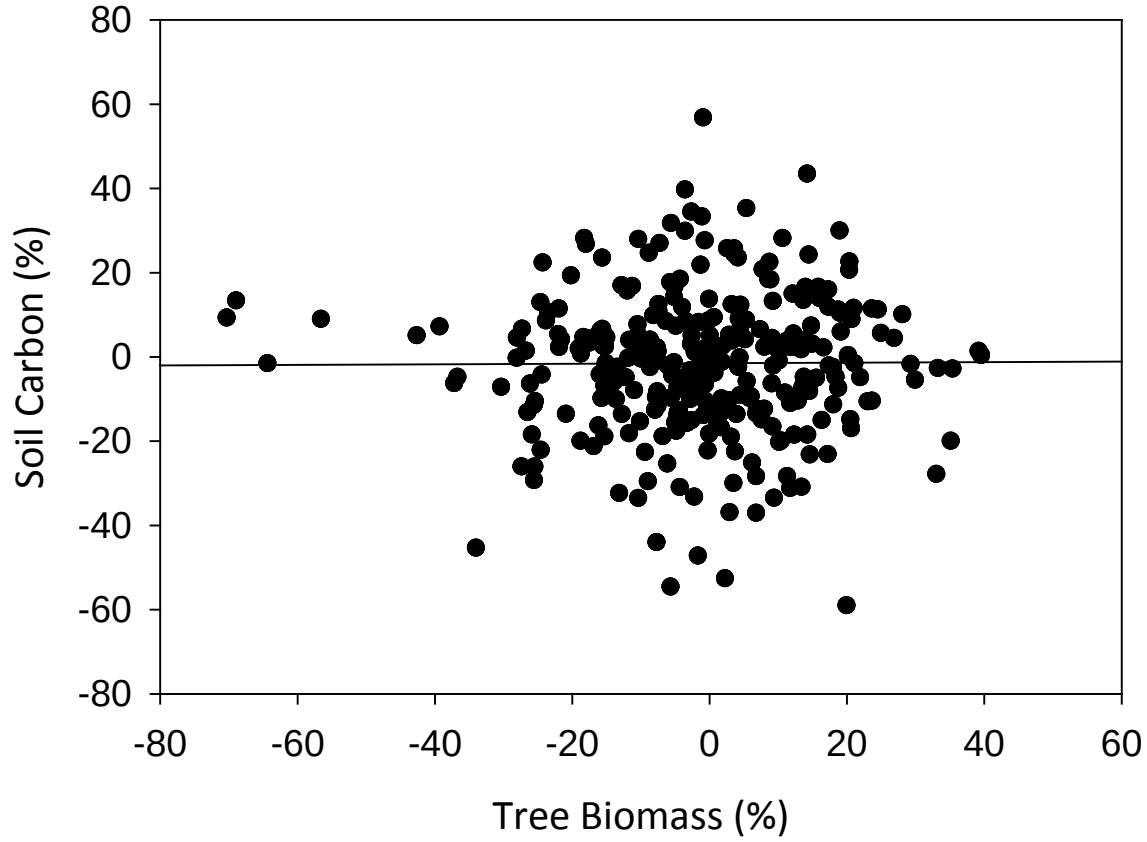
Response Normalized to Site Average

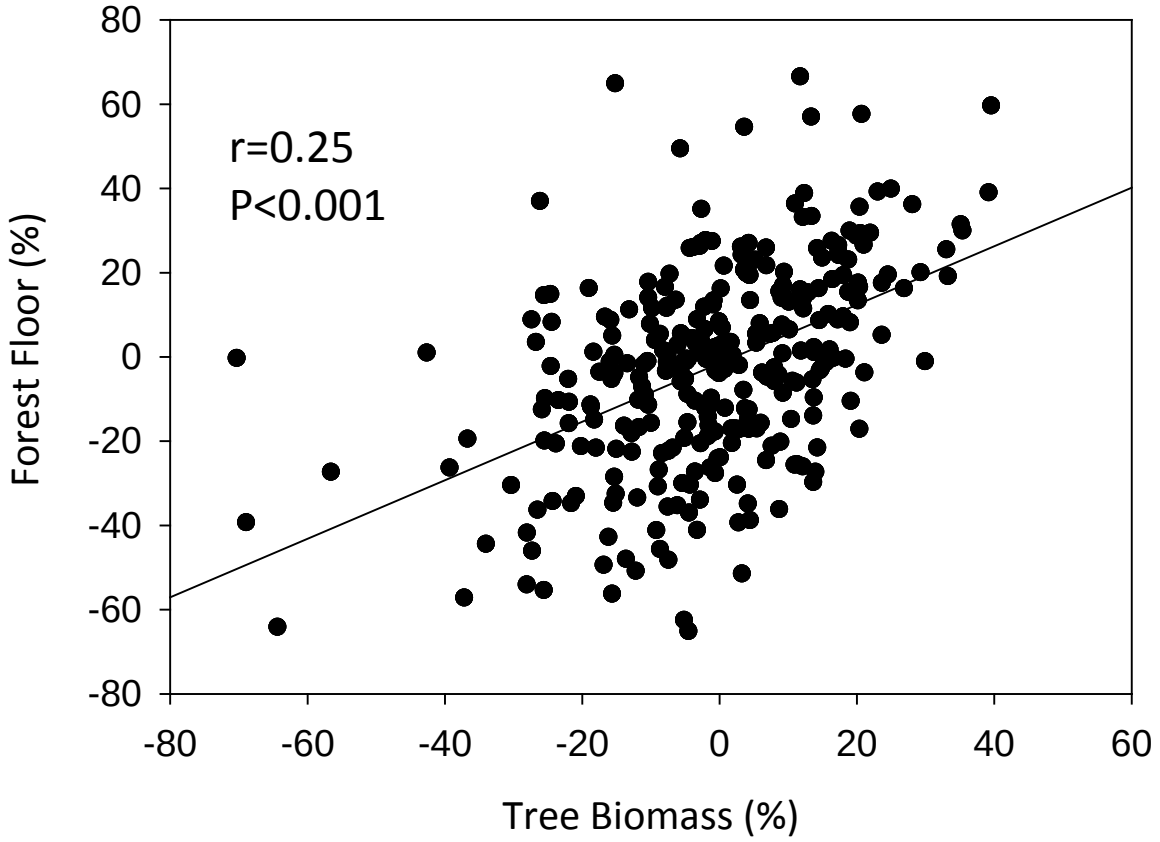


$$Y_{B,S,FF} = \frac{(\mu_i - Xij)}{\mu_i} * 100$$

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

Biomass Change vs. Soil or Forest Floor Change





Analysis 1: Paired Plots

Thinning

Thin	Chem	Fert		Thin	Chem	Fert	N
A			-	B			
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	6

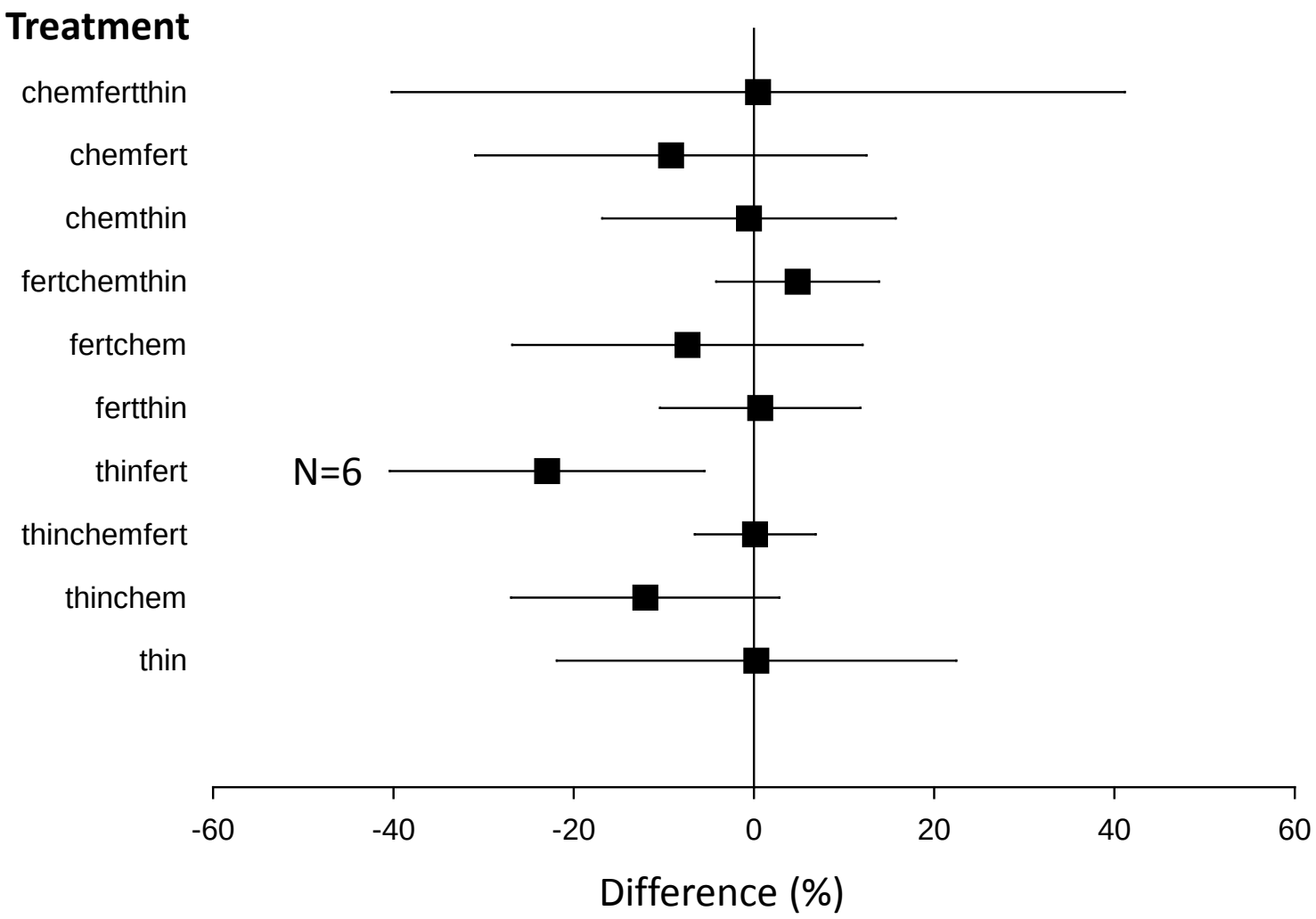
Fertilization

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

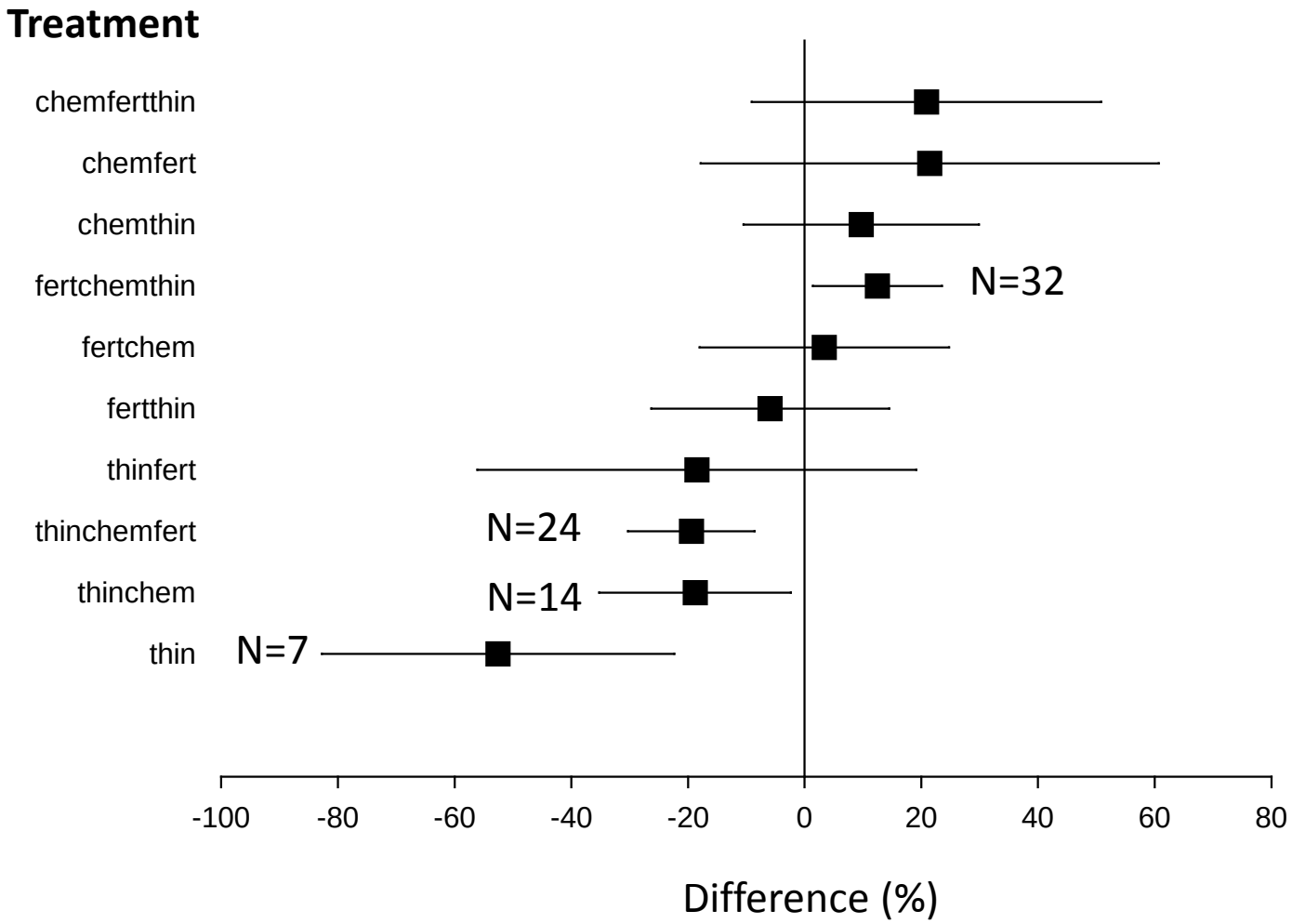
Chemical Control

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

Soil Carbon


Treatment
chemfertthin
chemfert
chemthin
fertchemthin
fertchem
fertthin
thinfert
thinchemfert
thinchem
thin
N=6
-60
-40
-20
0
20
40
60
Difference (%)

Forest Floor Carbon



Positives

- Best fits our design
- Simple to interpret

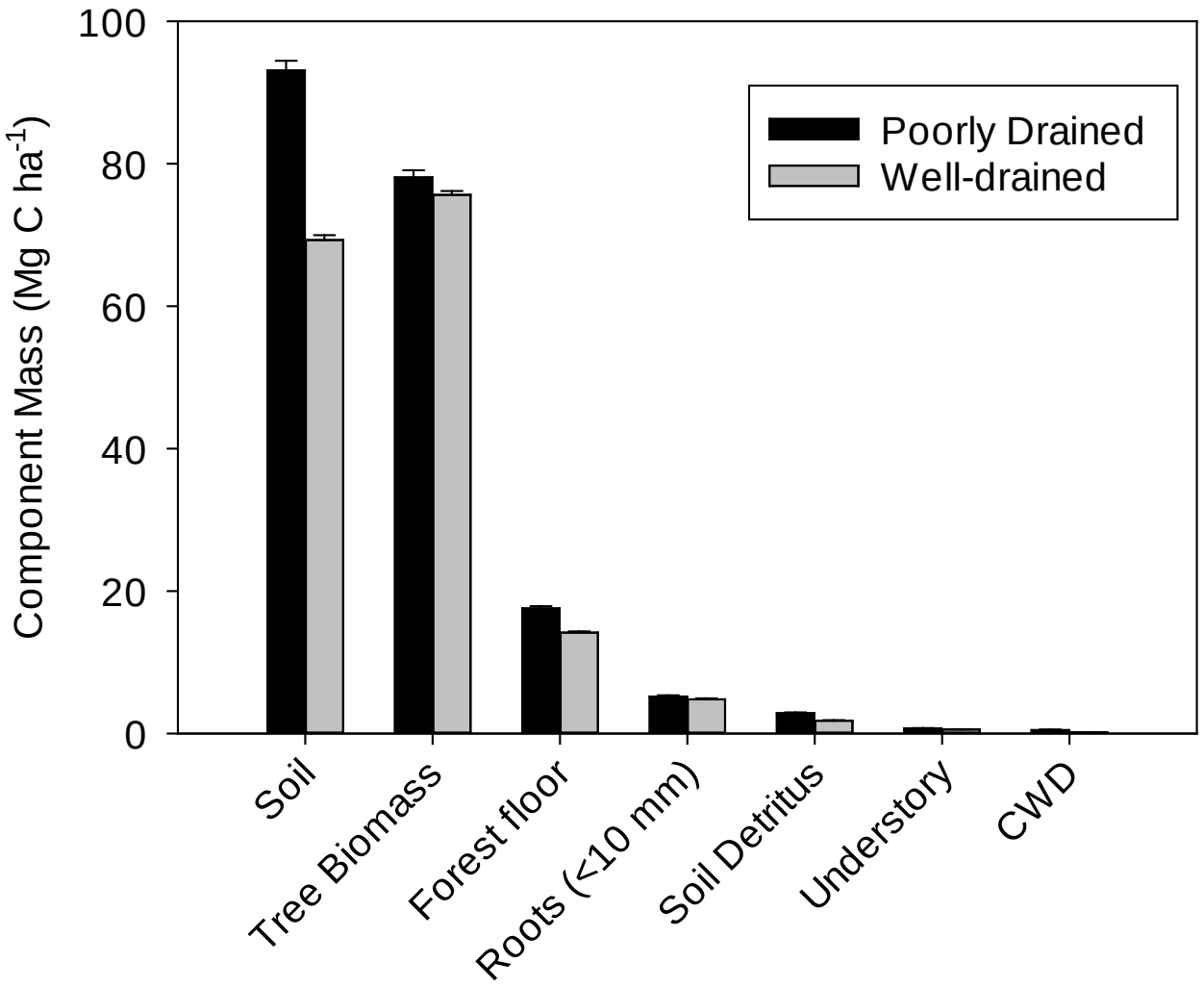
Negatives

- 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

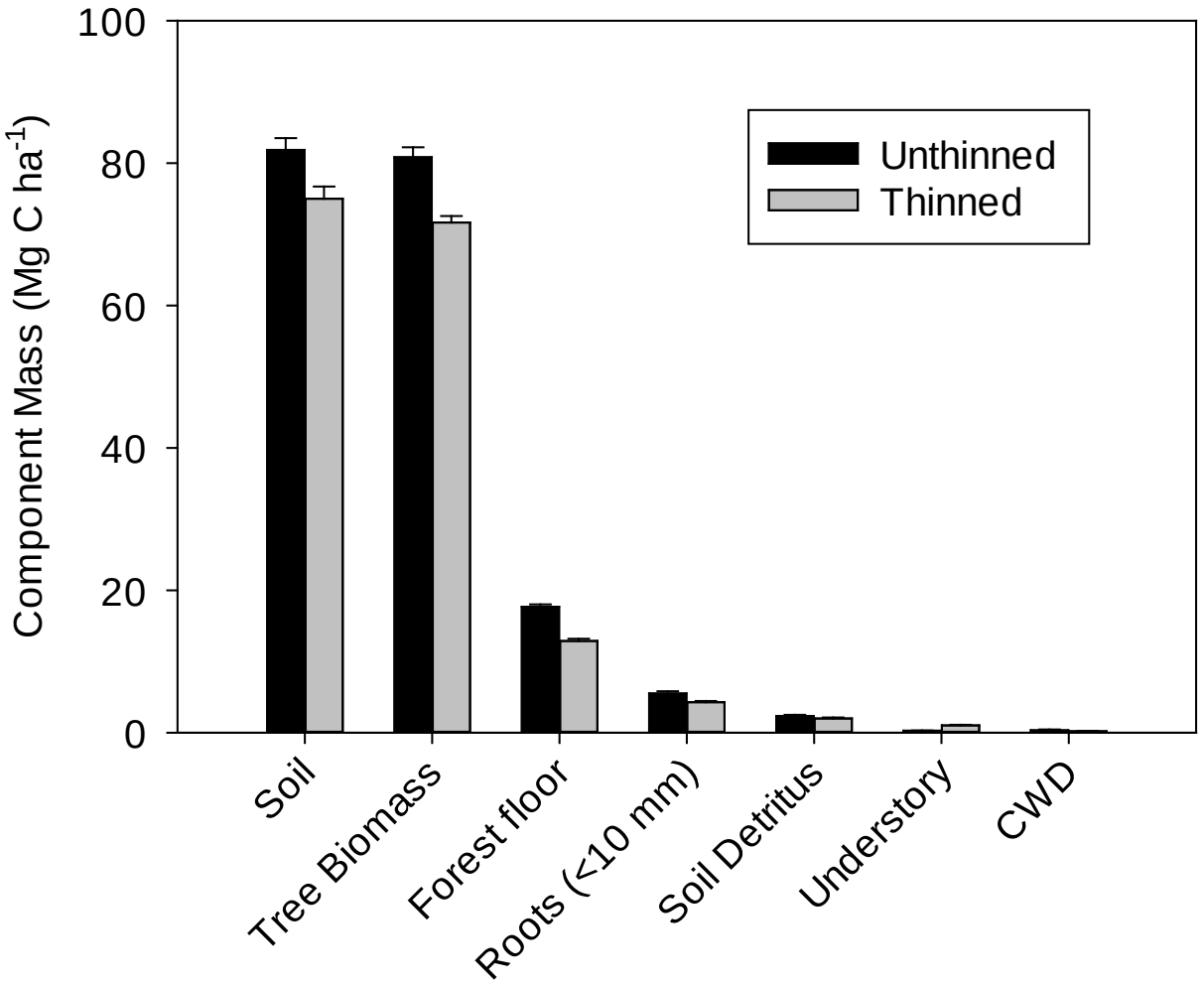
Analysis 2: Incorporate Drainage and Drop, Reclassify Treatments

- For soil carbon, drainage determines a large amount of the variation across region
  - Drainage added
- Chemical control has no clear effect in older forests
  - Chem dropped as treatment
- Fertilization levels used to classify management intensity
  - N fertilization rate used to create High, Med, and Low intensity

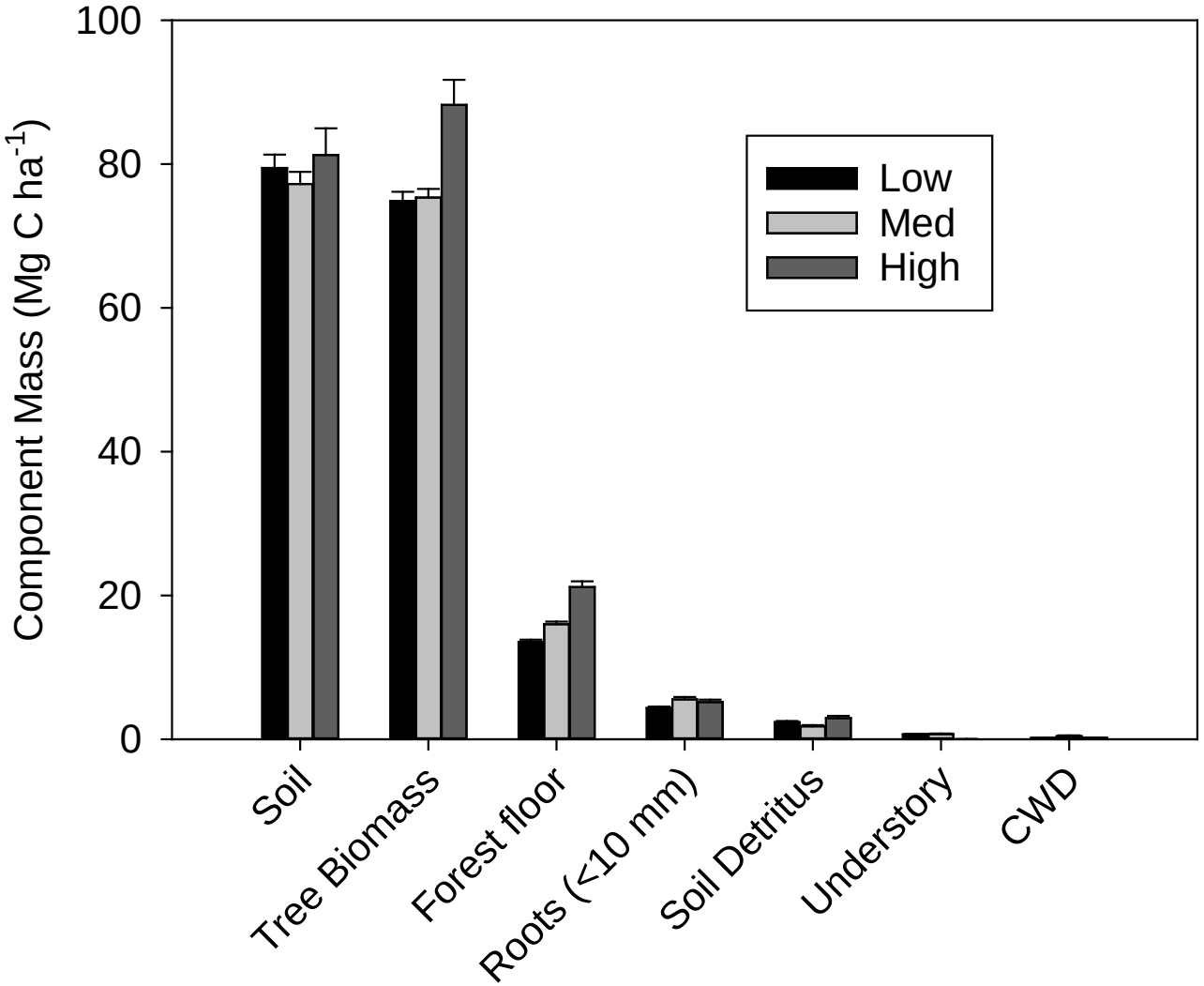
Soil Drainage



Thinning


100
80
60
40
20
0
Component Mass (Mg C ha-1)
Unthinned
Thinned
Soil
Tree Biomass
Forest floor
Roots (<10 mm)
Soil Detritus
Understory
CWD

Fertilization Level



Low: 0-200 kg N ha^{-1}

Med: >200 – 650 kg N ha^{-1}

High: >650 kg N ha^{-1}

Summary

- Analysis 1
  - Thinning decreases forest floor C for multiple treatment combinations
  - Potential soil C decrease in fertilized stands that are thinned
- Analysis 2
  - Reconfigured treatment designations create more balanced design and brings in sites that were unexamined in Analysis 1

Ongoing Analysis

- Soil Drainage, Relative Fertilization and Thinning are being incorporated into pairwise analysis approach.
- Soil carbon separated by horizon.
- Non-parametric analysis of soil carbon (W. Ross, S. Grunwald)