SPECIES AND DENSITY EFFECTS ON WOODY BIOMASS PRODUCTION ON MINED LANDS:

ESTABLISHMENT AND TWO YEAR RESULTS

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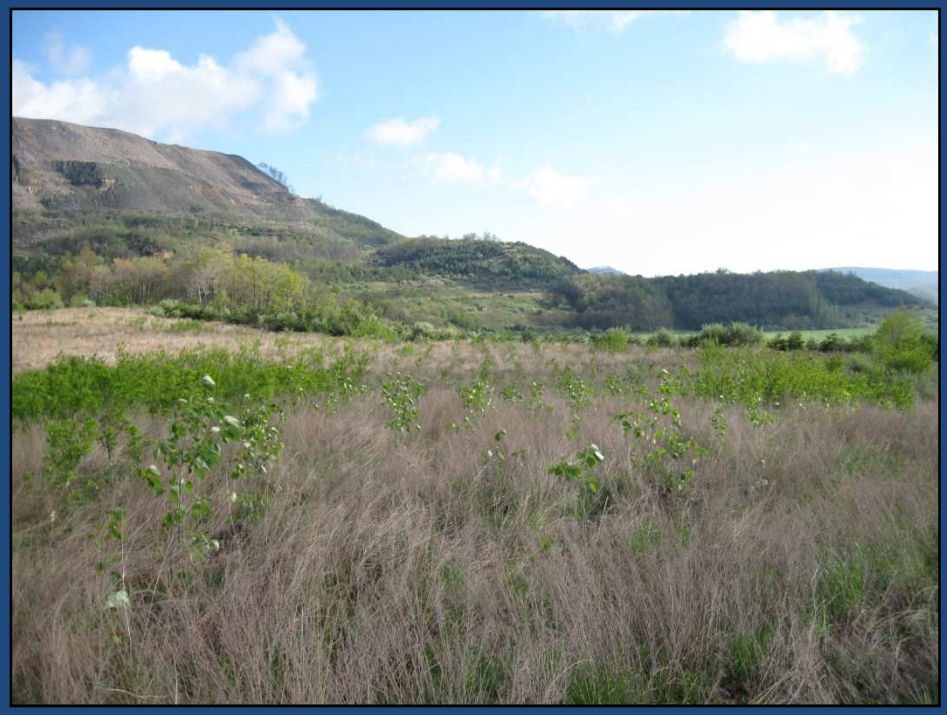

Why grow woody biomass?

- Harvest for power plant fuel
- Carbon sequestration
- Cellulosic ethanol
- Other benefits
  - Soil stability
  - Infiltration
  - Evapotranspiration

New ‘hybrid’ power plants

- Up to 20% non-coal materials
- Local forests must provide biomass for fuel mix


Buchanan
Letcher
Dickenson
Wise
Russell
Norton
Virginia City, VA
Washington
Scott
81
23
Bristol
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Google
36°55'05.37" N 82°20'40.03" W
Eye alt 65.64 mi

Why grow biomass in past mined lands?

- Lower transportation costs
- Less impact to native forests

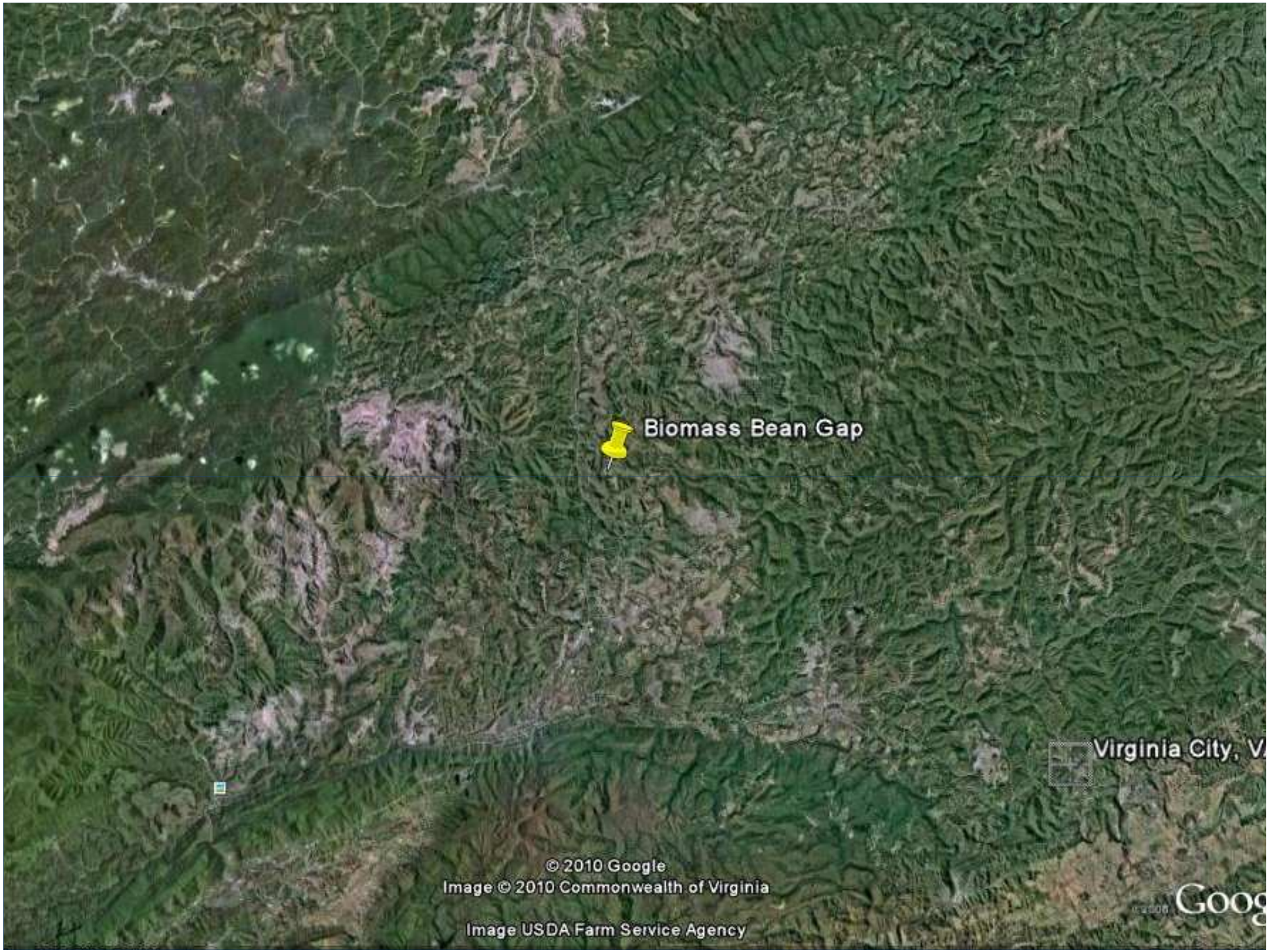
Biomass Bean Gap
Virginia City, V
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Image © 2010 Commonwealth of Virginia
Image USDA Farm Service Agency


State Route 634
Birchfield Rd
Starling Rd
Biomass Bean Gap
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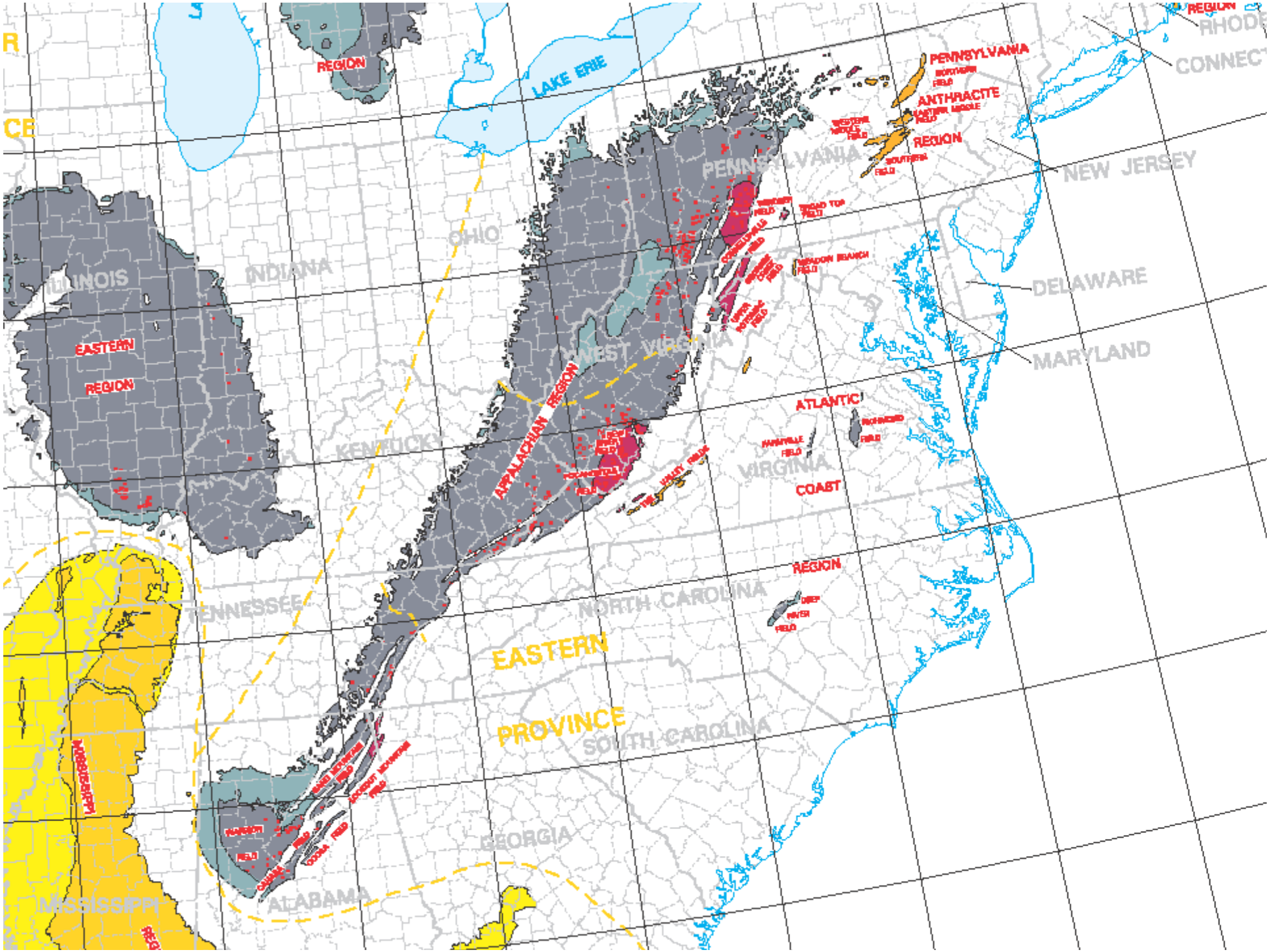
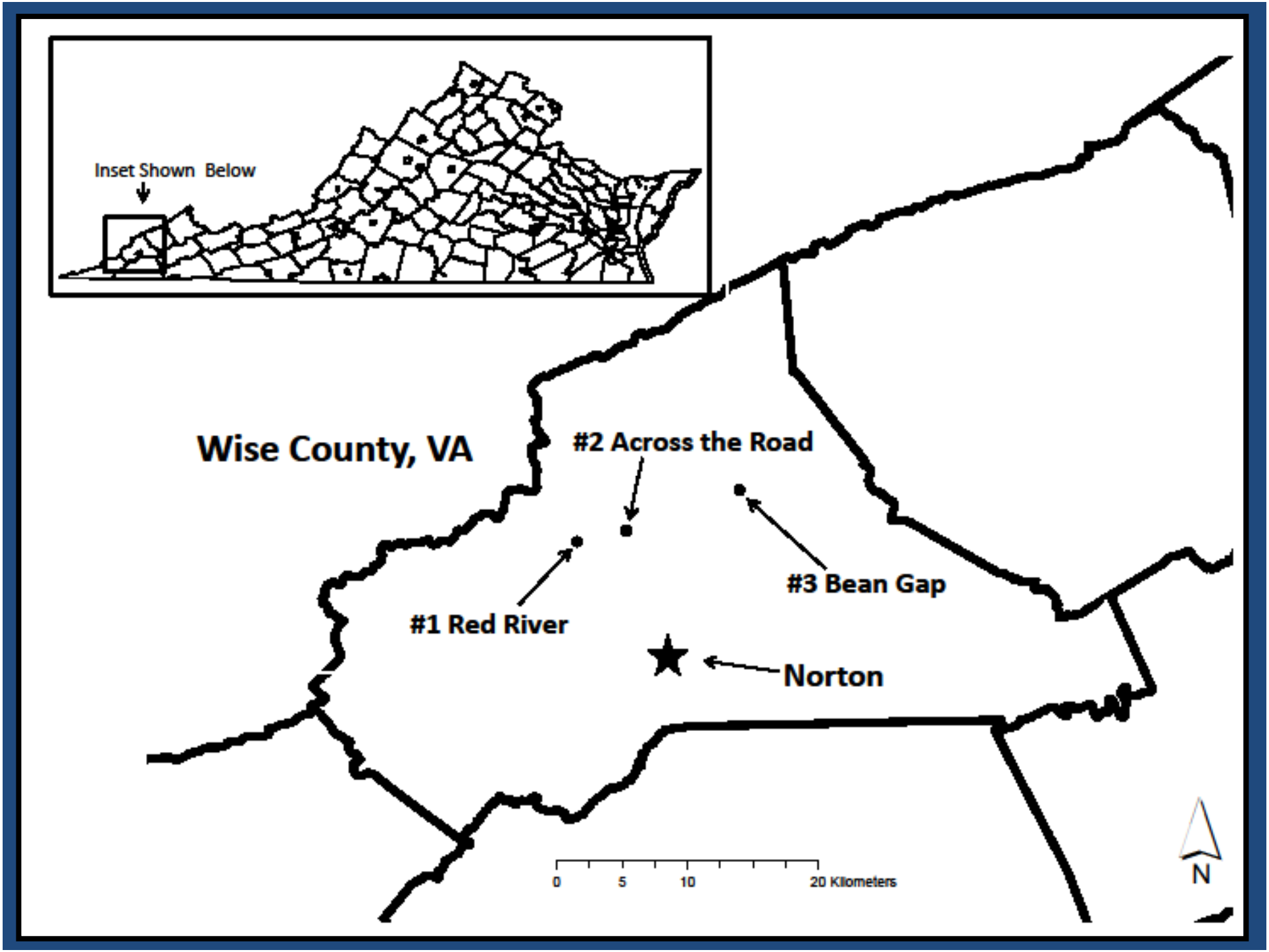
Land base is out there for biomass production

Past research has shown that properly reclaimed mined lands can grow trees quickly…FRA

Objectives

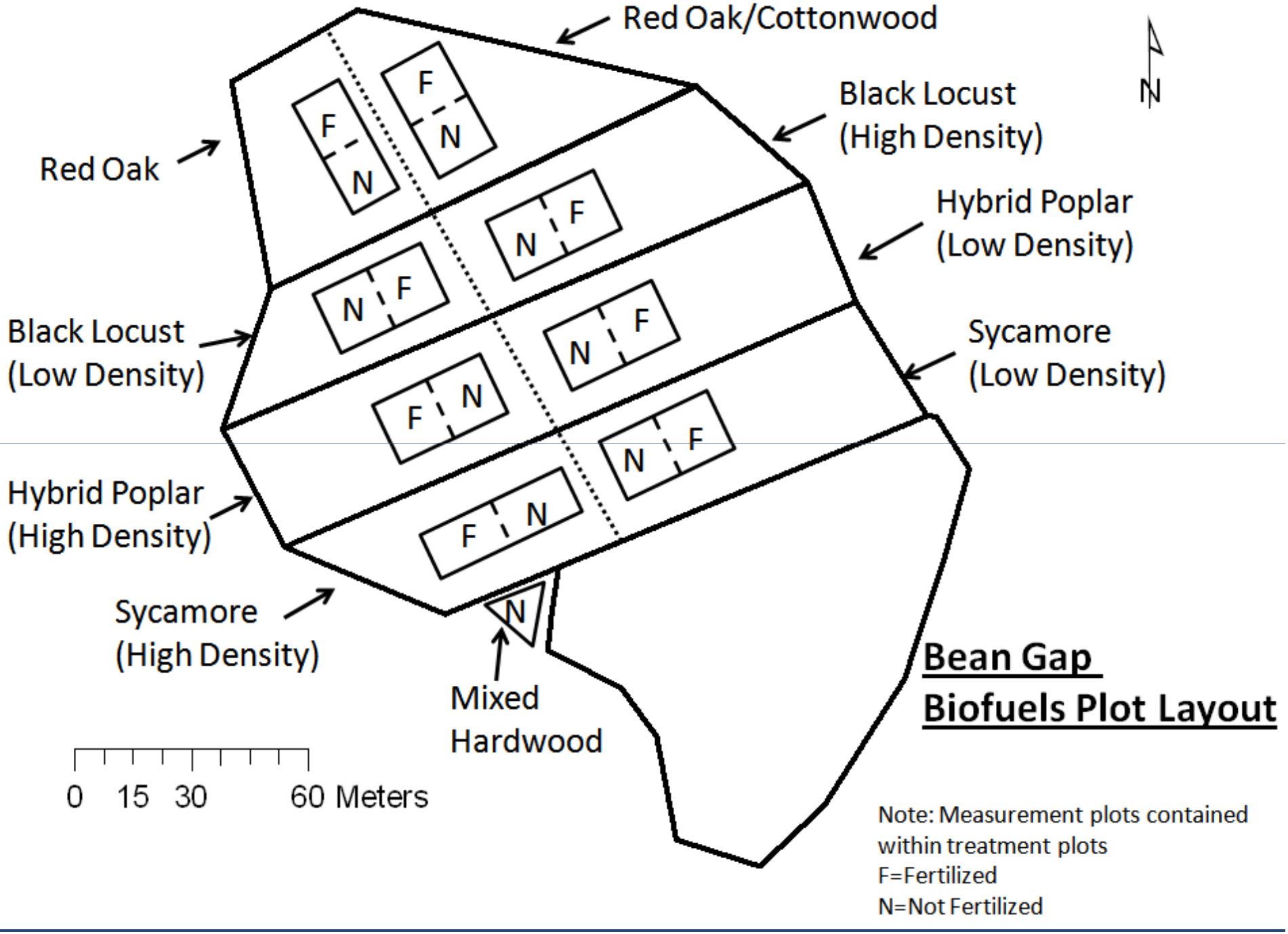
- 1. Develop and describe a method for preparing mine sites that have been reclaimed in previous years and are currently unused for biofuels production.
- 2. Measure and compare production of woody biomass crops on mined lands using various species and planting densities.
- 3. Measure and compare optimum harvest cycles of woody crops on mined land.
- 4. Determine the potential of woody biomass, growing under optimal soil conditions, to sequester atmospheric carbon in above and below-ground forms.

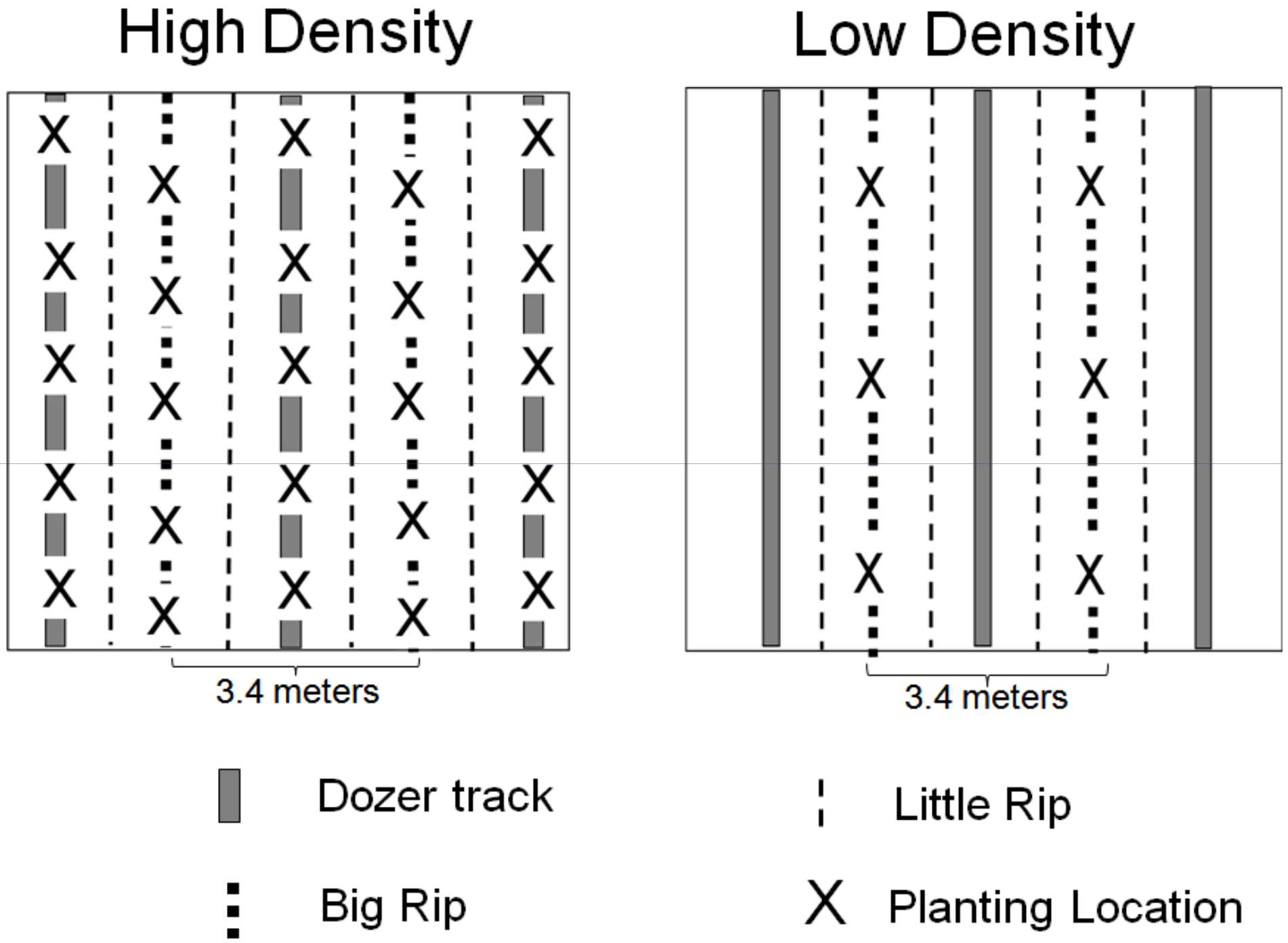

LAKE ERIE
REGION
PENNSYLVANIA
ANTHRACITE
REGION
NEW JERSEY
DELAWARE
MARYLAND
OHIO
INDIANA
ILLINOIS
EASTERN
REGION
WEST VIRGINIA
APPALACHIAN REGION
KENTUCKY
VIRGINIA
ATLANTIC
COAST
REGION
TENNESSEE
NORTH CAROLINA
EASTERN
PROVINCE
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI


Inset Shown Below
Wise County, VA
#2 Across the Road
#3 Bean Gap
#1 Red River
Norton
0
5
10
20 Kilometers
N

December 2007

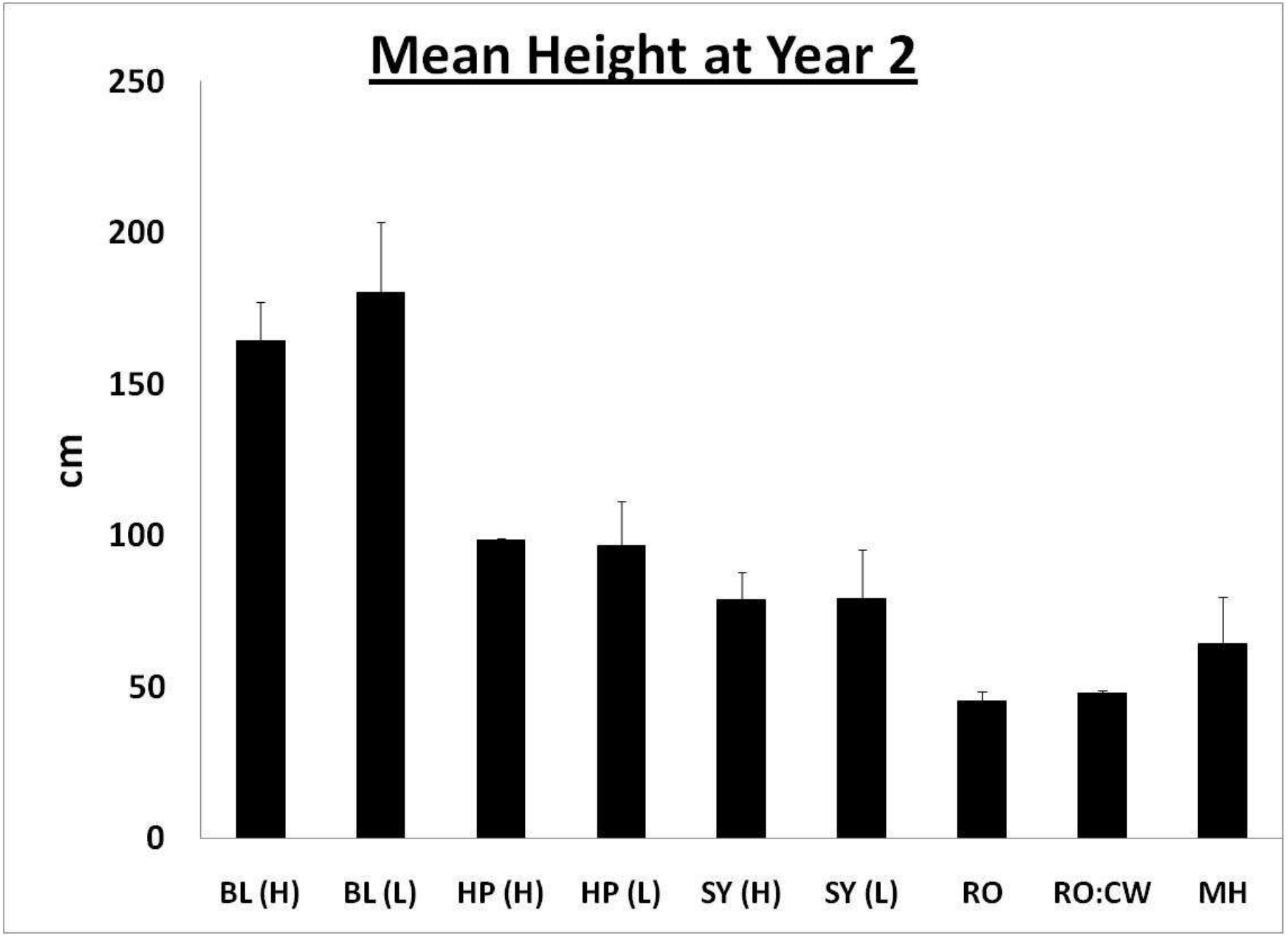

UNION CONC
647-3376

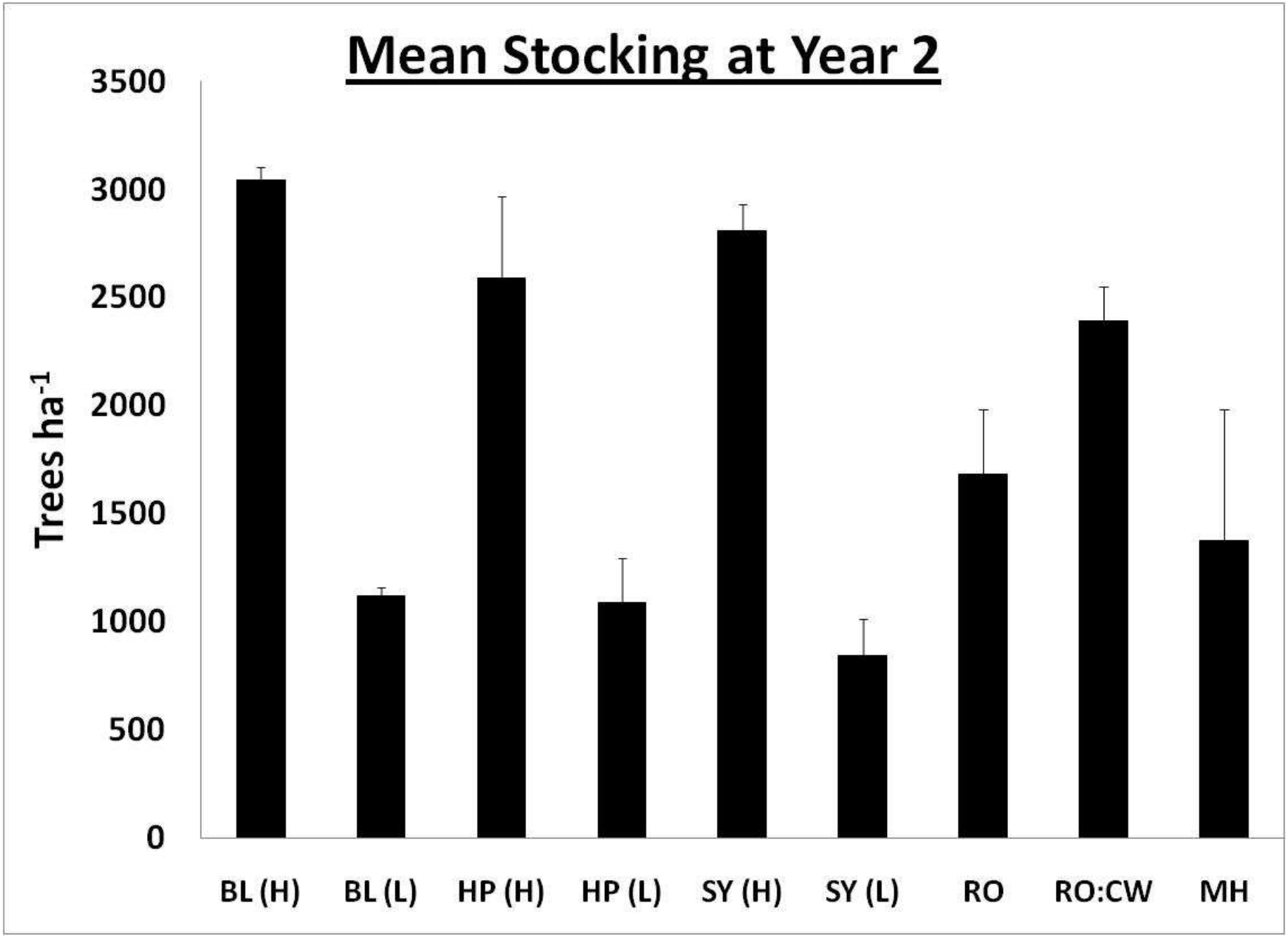

Red Oak/Cottonwood
Black Locust
(High Density)
Hybrid Poplar
(Low Density)
Sycamore
(Low Density)
Red Oak
Black Locust
(Low Density)
Hybrid Poplar
(High Density)
Sycamore
(High Density)
Mixed
Hardwood
N
F
N
0 15 30 60 Meters
Bean Gap
Biofuels Plot Layout
Note: Measurement plots contained within treatment plots
F=Fertilized
N=Not Fertilized

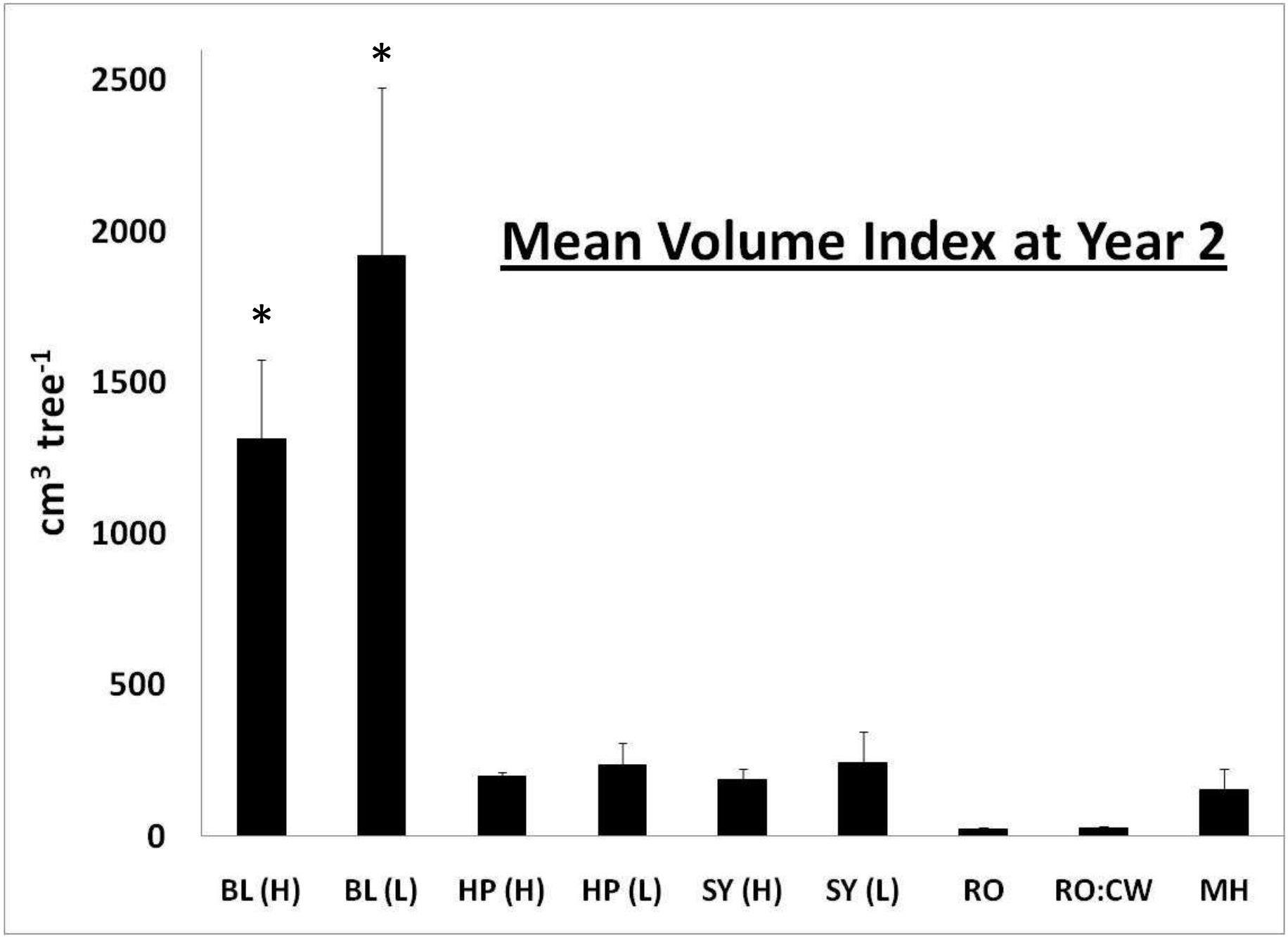

High Density
Low Density
3.4 meters
3.4 meters
Dozer track
Little Rip
Big Rip
Planting Location

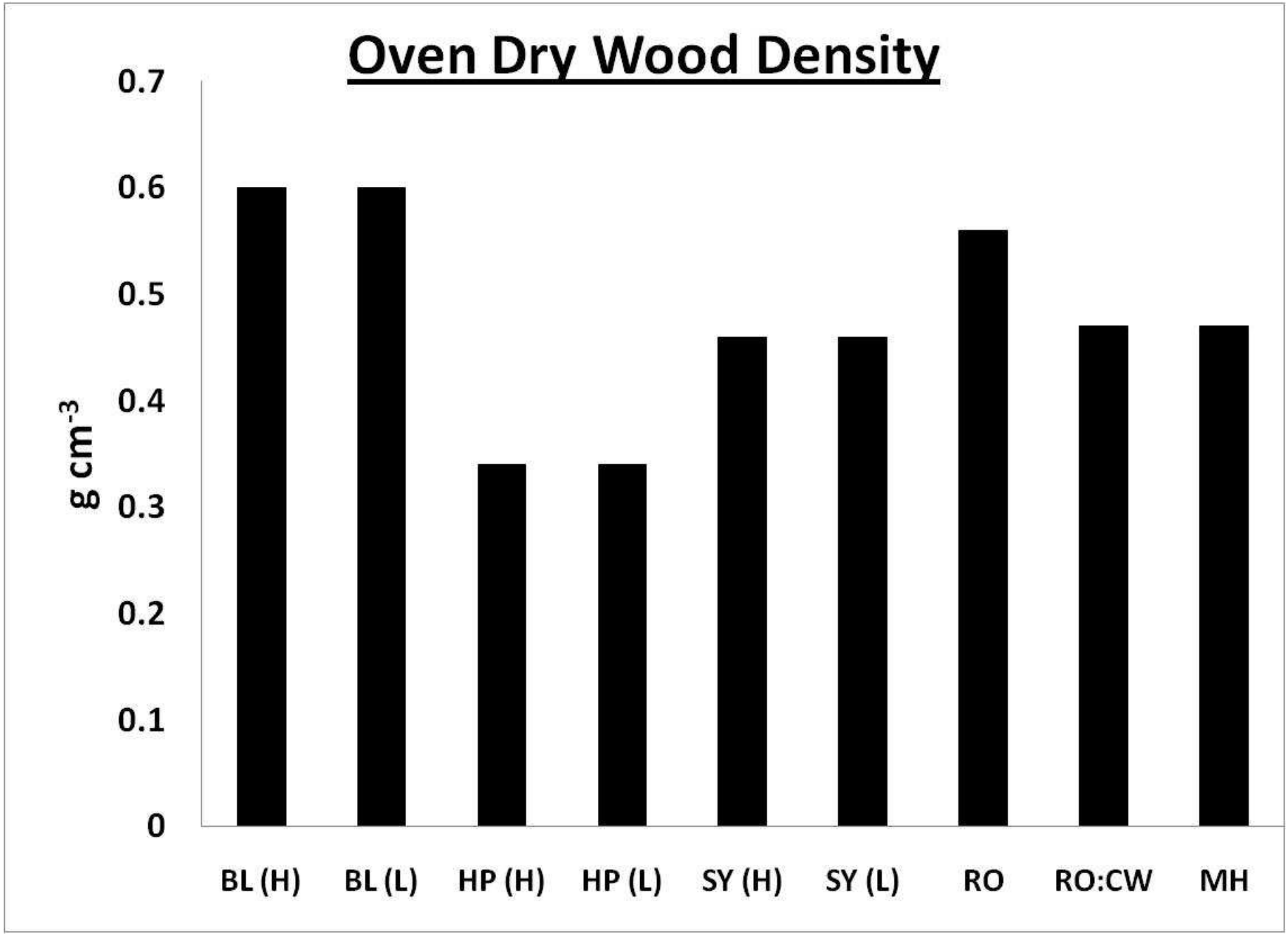
Management

- Planted winter 2007/2008
- Sprayed with glyphosate spring 2008 & 2009
- Measured December 2009
- Fertilized in winter 2009/2010
  - 118 ml of granular 19:19:19
  - Fertilizer treatment will not have effect until this growing season, not in this analysis

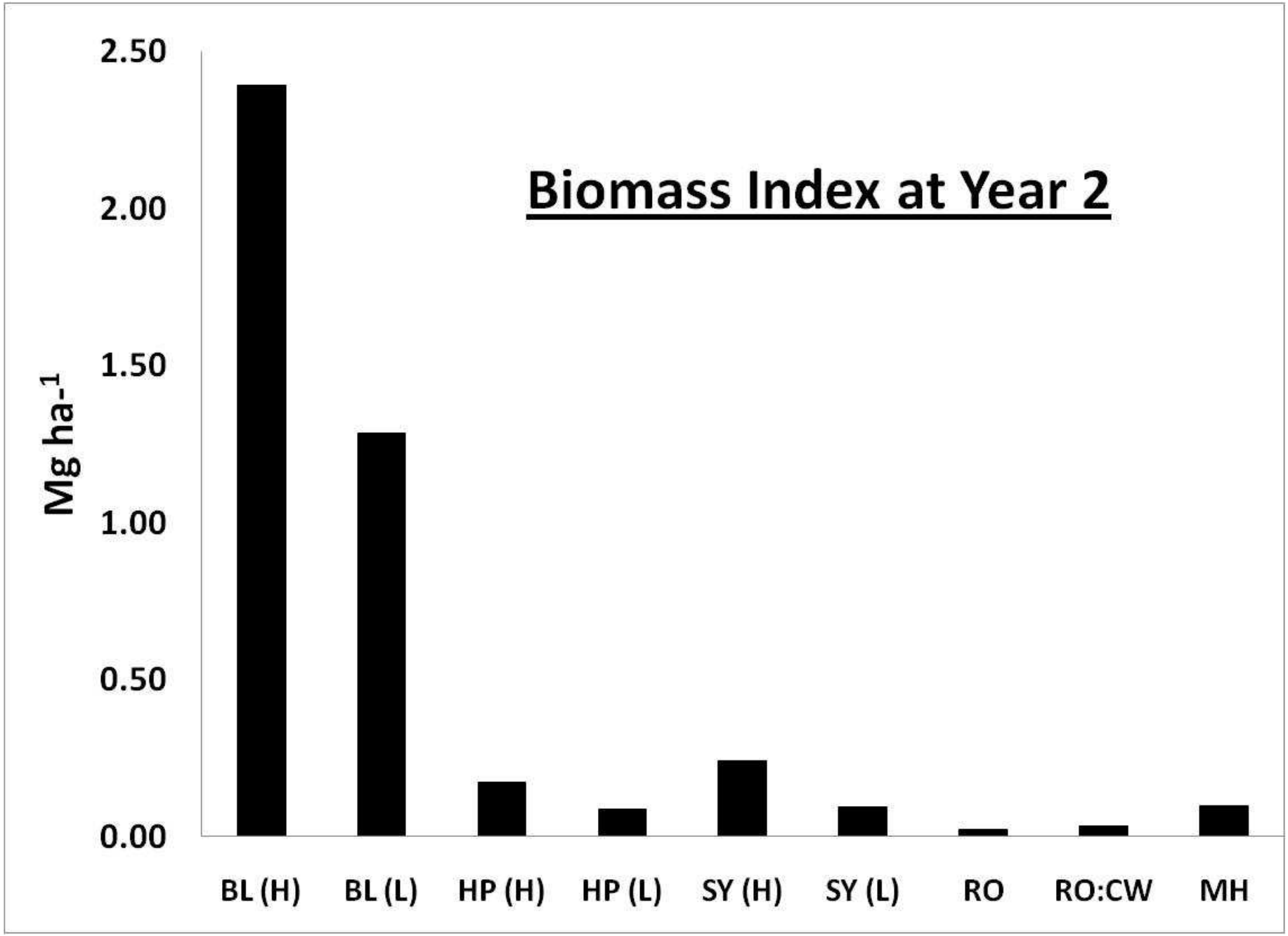

Mean Height at Year 2
250
200
150
100
50
0
cm
BL (H)
BL (L)
HP (H)
HP (L)
SY (H)
SY (L)
RO
RO:CW
MH


Mean Stocking at Year 2
Trees ha-1
3500
3000
2500
2000
1500
1000
500
0
BL (H)
BL (L)
HP (H)
HP (L)
SY (H)
SY (L)
RO
RO:CW
MH


Mean Volume Index at Year 2
cm3 tree-1
2500
2000
1500
1000
500
0
*
*
BL (H)
BL (L)
HP (H)
HP (L)
SY (H)
SY (L)
RO
RO:CW
MH



From: Global Wood Density Database (Zanne et al. 2009)


Biomass Index at Year 2
Mg ha-1
2.50
2.00
1.50
1.00
0.50
0.00
BL (H)
BL (L)
HP (H)
HP (L)
SY (H)
SY (L)
RO
RO:CW
MH

Mixed Model Analysis
-per tree volume

Source	Degrees of Freedom	Sum of Square	Mean Square Error	F statistic	Pr>F
Block	2	675317	337658	2.05	0.1797
Species	2	9017009	4508504	27.34	<.0001
Density	1	209239	209239	1.27	0.2863
Species x Density	2	343932	171966	1.04	0.3878
Model	7	10245499	1463642	8.88	0.0013
Error	10	1648805	164880		
Total	17	11894304			

Summary at Year 2

- Black Locust is clearly producing the most biomass at year 2
- Hybrid Poplar and Sycamore
- Red Oak/Cottonwood and Red Oak
- High Density looks best at year 2

Future Questions

- Locust borer?
- Fertilizer effects?
- Will the high density treatment produce more biomass at year 5, year 10?
- Harvesting/delivery?

Suggestions for Success

- Quality tree planters/ tree stock
- Time ripping/herbaceous plantings to give trees a head start
- Control weeds
- Hire a forester with experience

Thanks To:

- Alpha Natural Resources
- Powell River Project
- Forestland Group, Penn Virginia Resource Partners, and Red River Coal
- Amy Villamagna and Chris Jackson