

Changes in vegetative structure in the first decade of restoration management in an old growth Mountain Longleaf Pine forest



Martin Cipollini, Berry College
North GA Rx Fire Conference, June 4, 2020



Mountains in NE Alabama and NW Georgia harbor Mountain or “Montane” Longleaf Pine



**Most longleaf is in the
Coastal Plain**



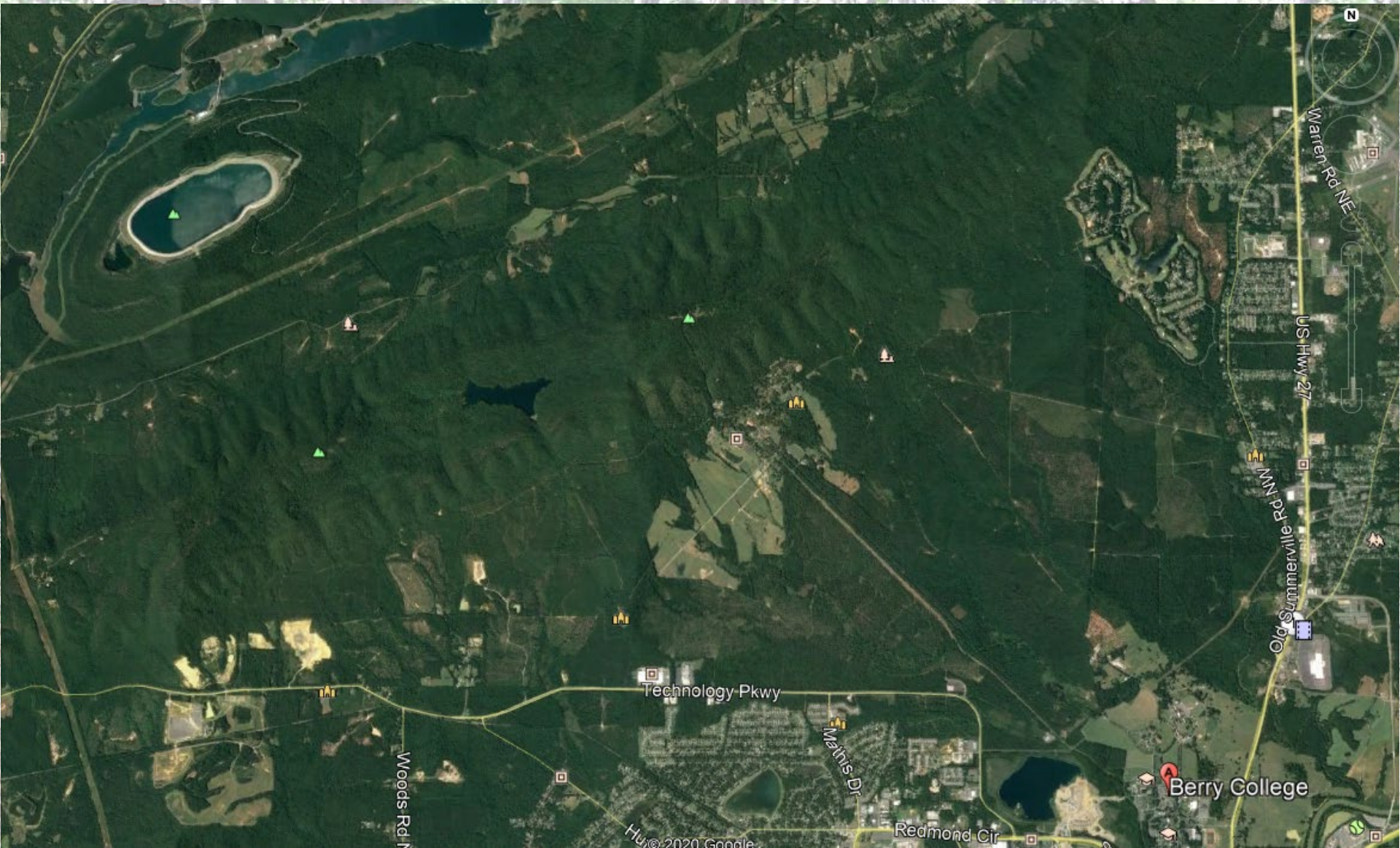
**Longleaf on Berry's
Lavender Mountain**

LEGEND.

- BOUNDARY LINES OF BOTANICAL DISTRIBUTION
 - - - - - BOUNDARY LINES OF REGIONAL ECONOMIC DISTRIBUTION
 - - - - - BOUNDARY LINE OF REGION OF MIXED GROWTH
 - - - - - NORTHERN LIMIT OF *PINUS CUBENSIS*.
 * * * * * AREAS ON WHICH THE SPECIES OCCURS SCATTERED.
 I YIELD 1000 TO 2000 FEET B.M. PER ACRE.
 II YIELD 2000 TO 4000 FEET B.M. PER ACRE.
 III YIELD 3000 TO 4000 FEET B.M. AND OVER PER ACRE.



Berry College's "27,000 acre Outdoor Laboratory" -- the "World's Largest College Campus"



Why develop a management plan?

- Old trees, and historical accounts and maps suggested a widespread longleaf forest on Lavender Mountain.**
- Burning had been restricted for decades, resulting in hardwood encroachment, fuel buildup, and near total loss of understory.**
- Little longleaf recruitment since ~1930s; population was in decline.**
- Most of mountain was never plowed, suggesting that recovery of historical understory plant community was possible.**
- Southern Pine Beetle (SPB) and wildfires were problems with pine plantations on campus.**



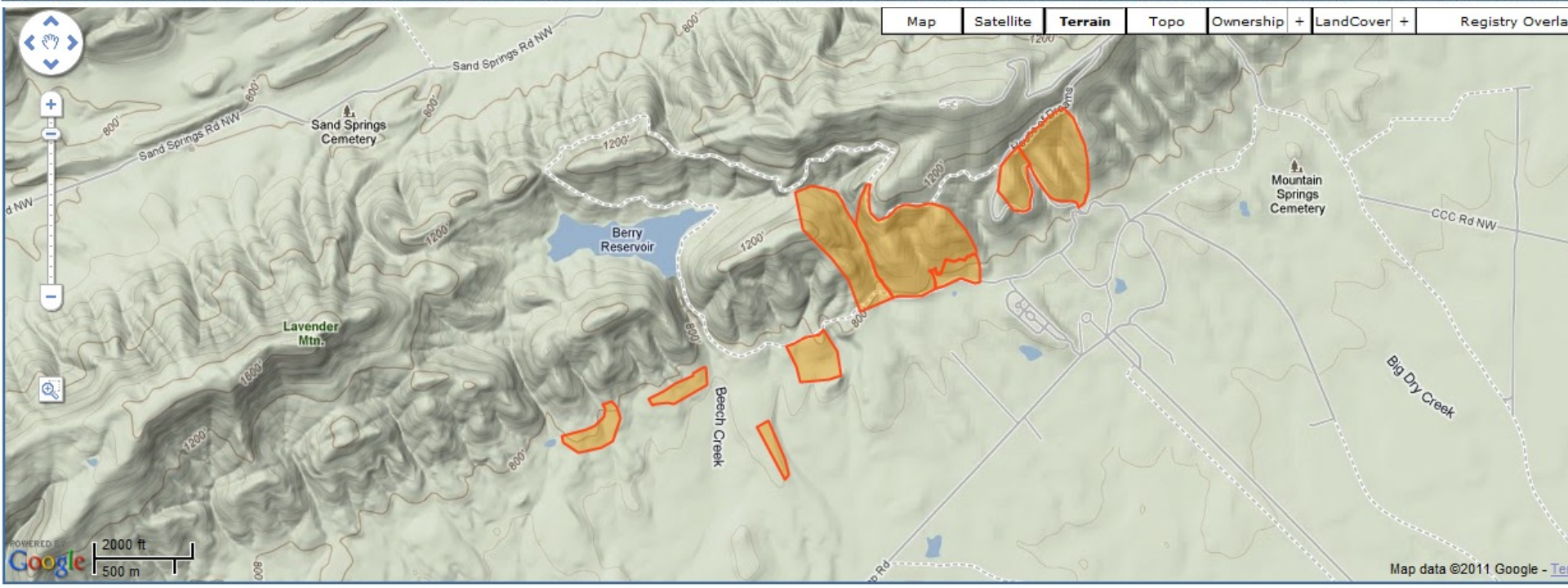
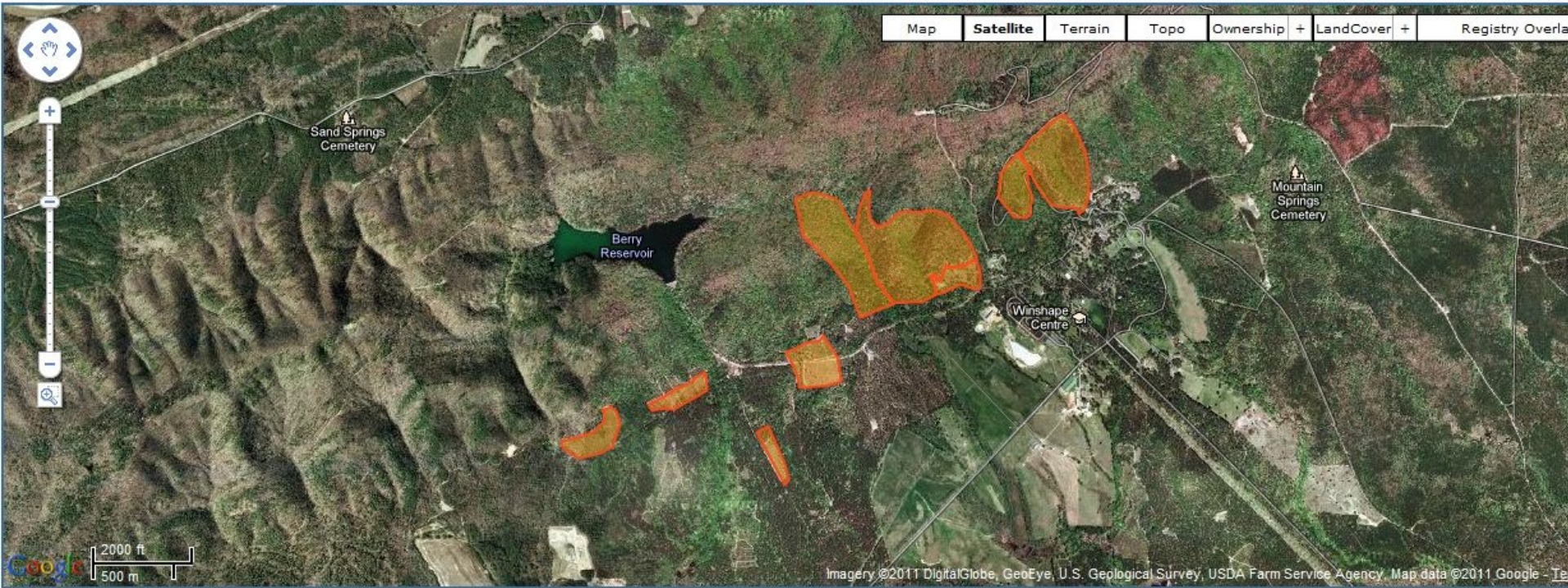
Management: Goals

- **Open pine-dominated canopy; longleaf pine highest in importance.**
- **Stable longleaf pine population.**
- **Reduction of duff, litter, and woody fuels.**
- **Increase in abundance and diversity of understory herbs and grasses.**
- **Ancillary positive impacts on faunal diversity.**
- **Vegetation composition similar to frequently burned old-growth mountain longleaf pine forest (e.g., Mountain Longleaf Pine National Refuge [MLL] of AL).**

Restoration management of old growth areas

- **2003 – began restoring a burning regime on a planned 3-5 year return interval**
- **2005 - began controlling hardwoods primarily via herbicide application**
- **Along the way - research, education, and outreach**
- **Help from Berry's Forestry and Land Resources, Student Work and Volunteer Services, Berry Longleaf Network, Interagency Burn Team**





Prescribed Burning (+/- 60 ha)

- Restoration burns done in “old growth” areas – most areas burned three or four times since 2003
- Raking to control effects of duff smoldering.



Direct Hardwood Control (+/- 25 ha)

- “Hack/squirt” injection for hardwood control in old growth areas: Arsenal AC™
- Targeted non-fire tolerant hardwoods with DBH <14 inches.





Tree Community Sampling



Point-Centered Quarter Method

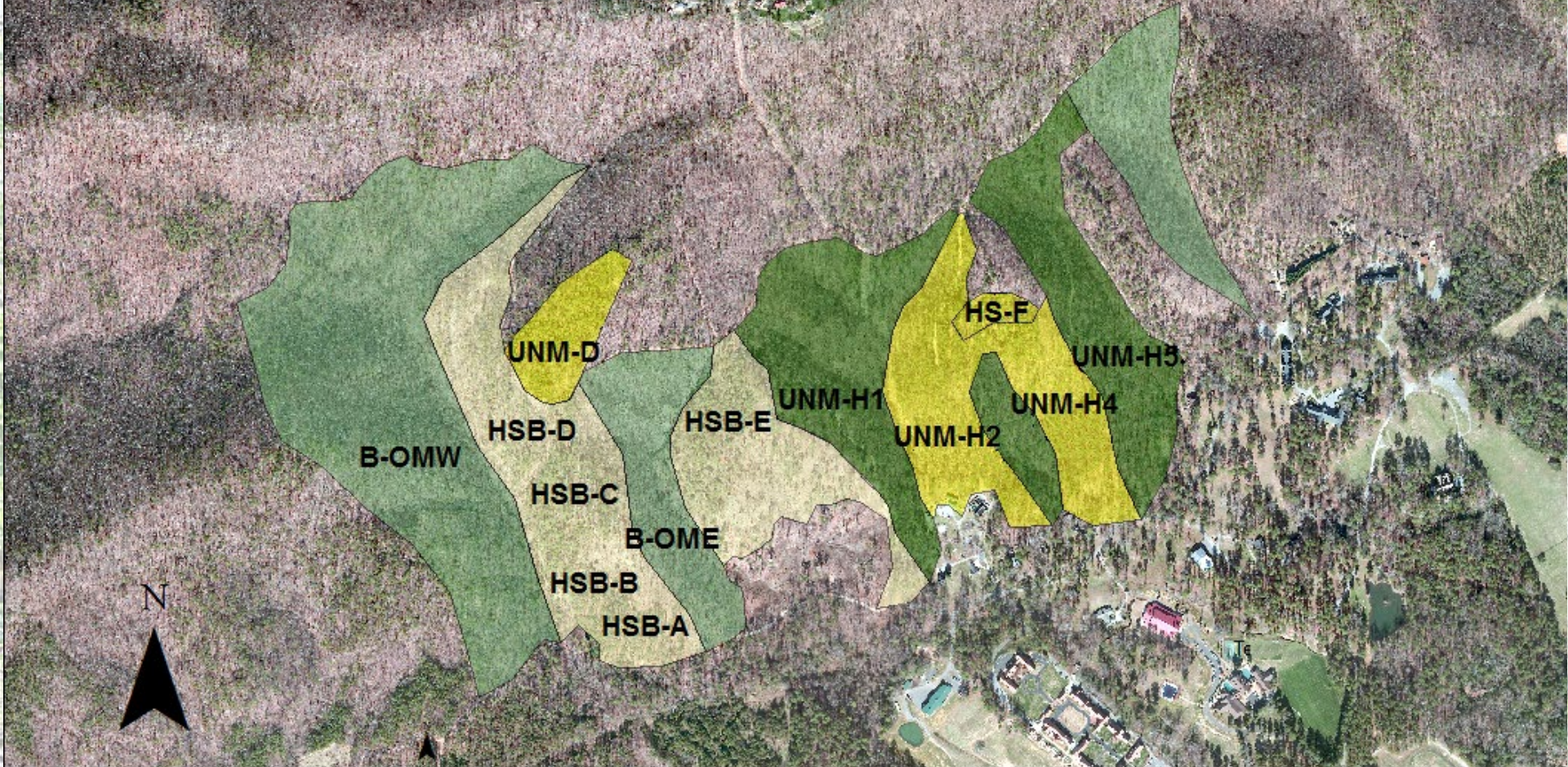
D = Density (#/ha)

C = Cover (BA; m²/ha)

**F = # points/total #
points**

IV = RD + RC + RF

**(for comparisons including
Mountain Longleaf Wildlife
Refuge, IV = RD + RC)**



0 100 200 400 600 800 1,000 Meters

Coordinate System: NAD 1983 UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -87.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Legend

-  Mature Longleaf Unburned
-  Mature Longleaf Burned
-  Mature Hardwood Unburned
-  Mature Hardwood Burned

Mountain Longleaf Pine NWR Reference Sites

Caffey Hill (MLL-CH) and Red-tail Ridge (MLL-RTR)



Tree community data from Varner et al. 2003.

Talladega NF Reference Sites

Fire-suppressed Horn Mountain (TNF-HM)



Coleman Lake RCW Project (TNF-RCW)



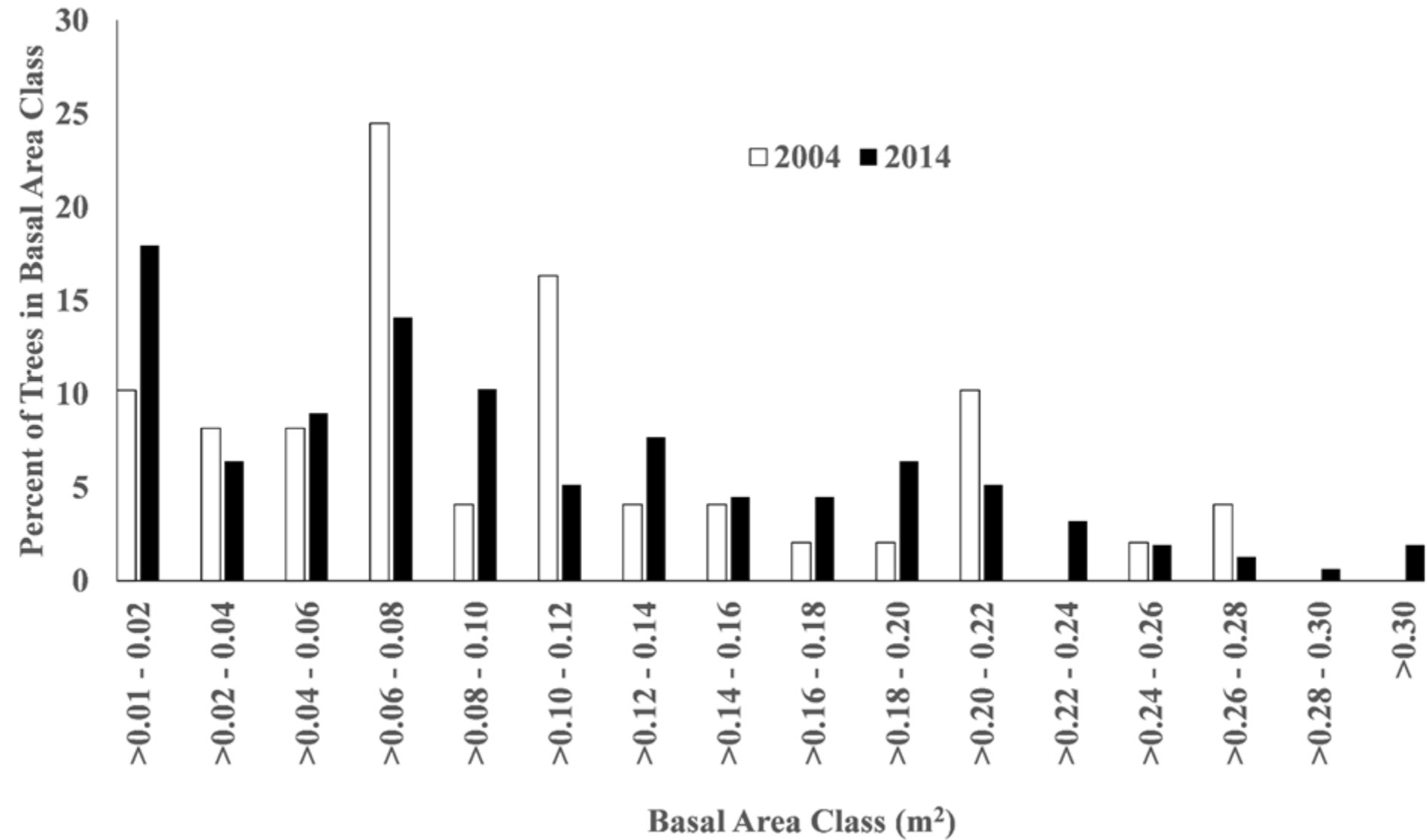
Tree community data from Kush et al. 2005

Canopy Tree Importance Values 2014

Importance values of the top 10 tree species in the Berry College Longleaf Pine Management Area, sorted by overall importance. Data are means and standard deviations across all stands within each management class (HSB = hack/squirt herbicide and burned, B = burned only, HS = hack/squirt herbicide only, and UMN = unmanaged reference areas).

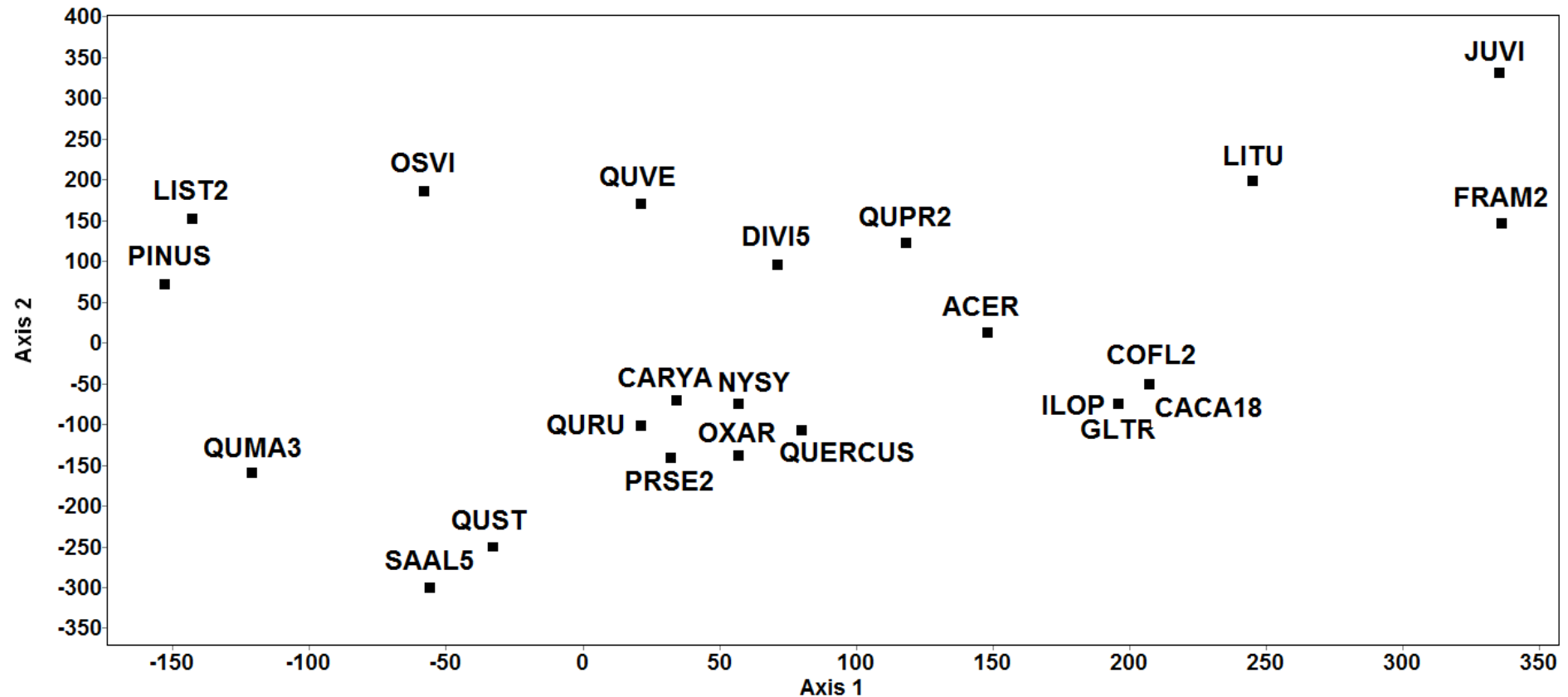
Scientific Name	HSB Longleaf (N = 5) Mean (S.D.)	UNM Longleaf (N = 3) Mean (S.D.)	B Hardwoods (N = 2) Mean (S.D.)	UNM Hardwoods (N = 2) Mean (S.D.)	HS Longleaf (N = 1) Mean
<i>Quercus prinus</i> L. (QUPR2)	0.29 (0.26)	0.51 (0.04)	0.93 (0.31)	0.92 (0.07)	0.25
<i>Pinus palustris</i> P. Mill. (PIPA2)	0.65 (0.37)	0.16 (0.01)	0.02 (0.00)	0.01 (0.01)	0.31
<i>Pinus echinata</i> P. Mill. (PIEC2)	0.37 (0.14)	0.23 (0.20)	0.13 (0.16)	0.10 (0.00)	1.04
<i>Pinus taeda</i> L. (PITA)	0.21 (0.13)	0.08 (0.11)	0.00 (0.00)	0.00 (0.00)	0.00
<i>Nyssa sylvatica</i> Marsh. (NYSY)	0.07 (0.05)	0.14 (0.10)	0.12 (0.06)	0.13 (0.00)	0.03
<i>Acer rubrum</i> L. (ACRU)	0.02 (0.02)	0.16 (0.08)	0.17 (0.10)	0.17 (0.03)	0.02
<i>Carya pallida</i> (Ashe) Engl. & Gra. (CAPA24)	0.05 (0.05)	0.10 (0.03)	0.07 (0.07)	0.10 (0.04)	0.02
<i>Oxydendrum arboreum</i> (L.) DC. (OXAR)	0.03 (0.02)	0.12 (0.03)	0.05 (0.05)	0.04 (0.02)	0.00
<i>Vaccinium arboreum</i> Marsh. (VAAR)	0.05 (0.07)	0.03 (0.04)	0.00 (0.00)	0.05 (0.07)	0.18
<i>Carya tomentosa</i> (Lam.) Nutt. (CATO6)	0.04 (0.08)	0.07 (0.06)	0.03 (0.01)	0.03 (0.02)	0.03
All other trees	0.25 (0.02)	0.24 (0.01)	0.27 (0.01)	0.34 (0.01)	0.20
Pines	1.24	0.47	0.15	0.11	1.42
Hardwoods	0.80	1.36	1.64	1.76	0.65

Longleaf Pine Size Distribution



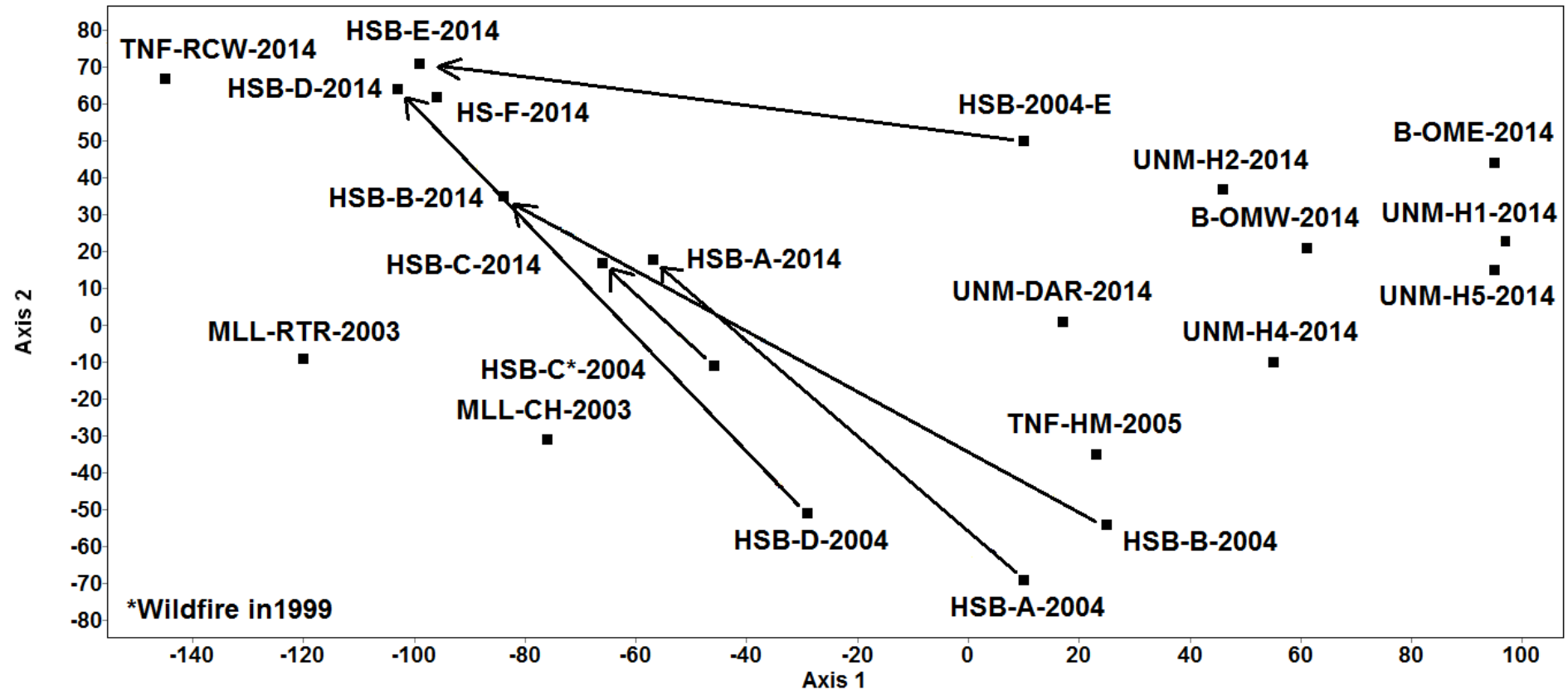
Canopy Tree Ordination – Density

RA Ordination Plot - Density

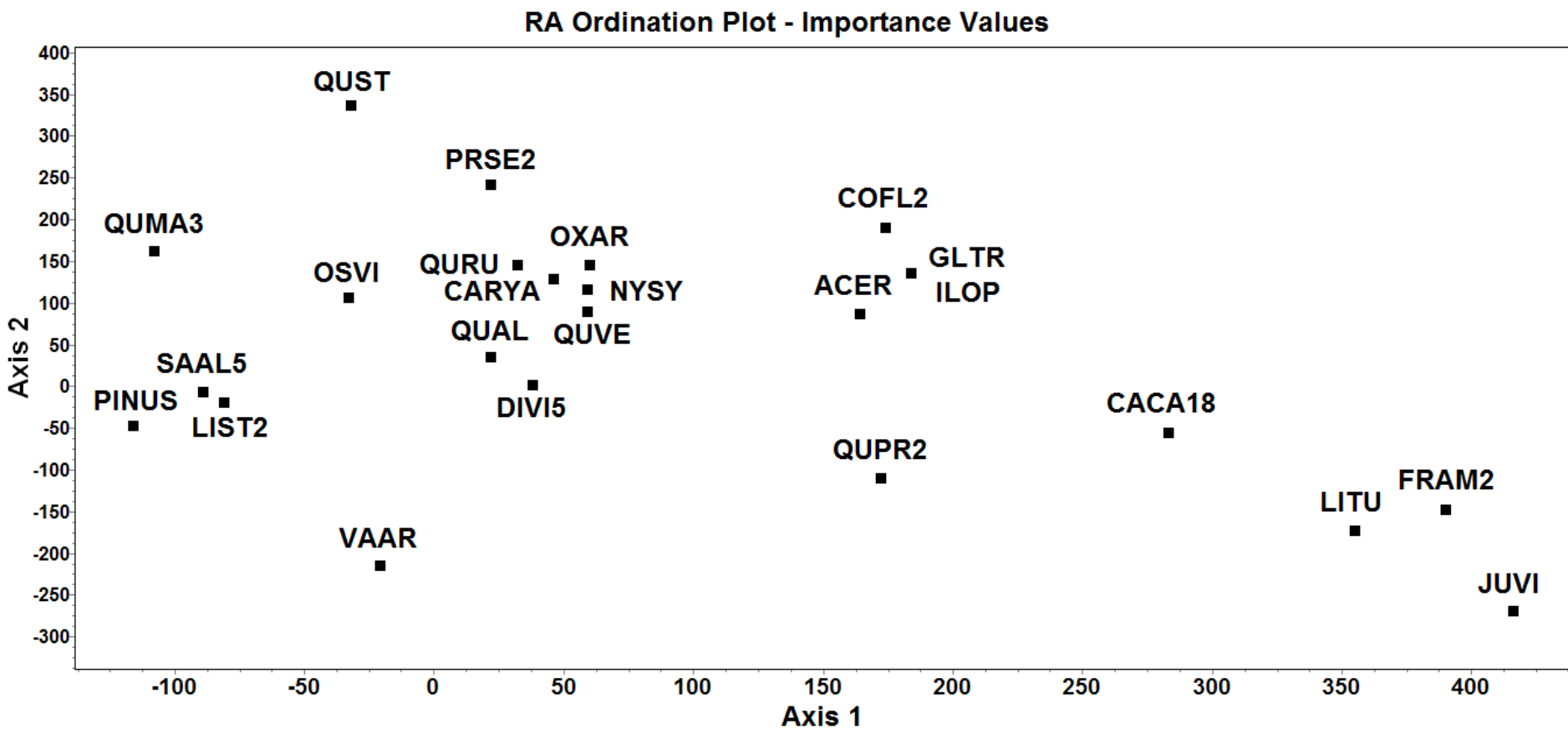


Canopy Tree Ordination – Density

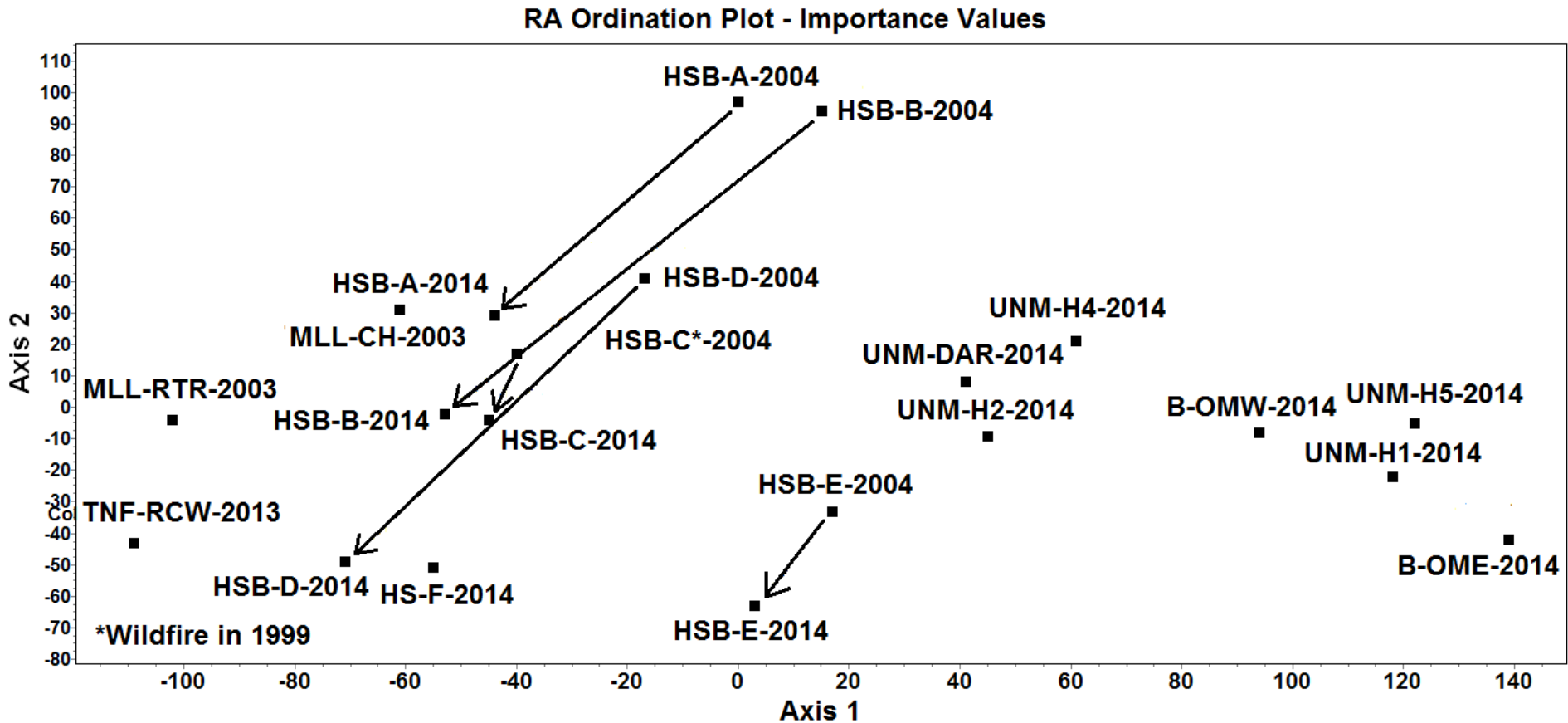
RA Ordination Plot - Density



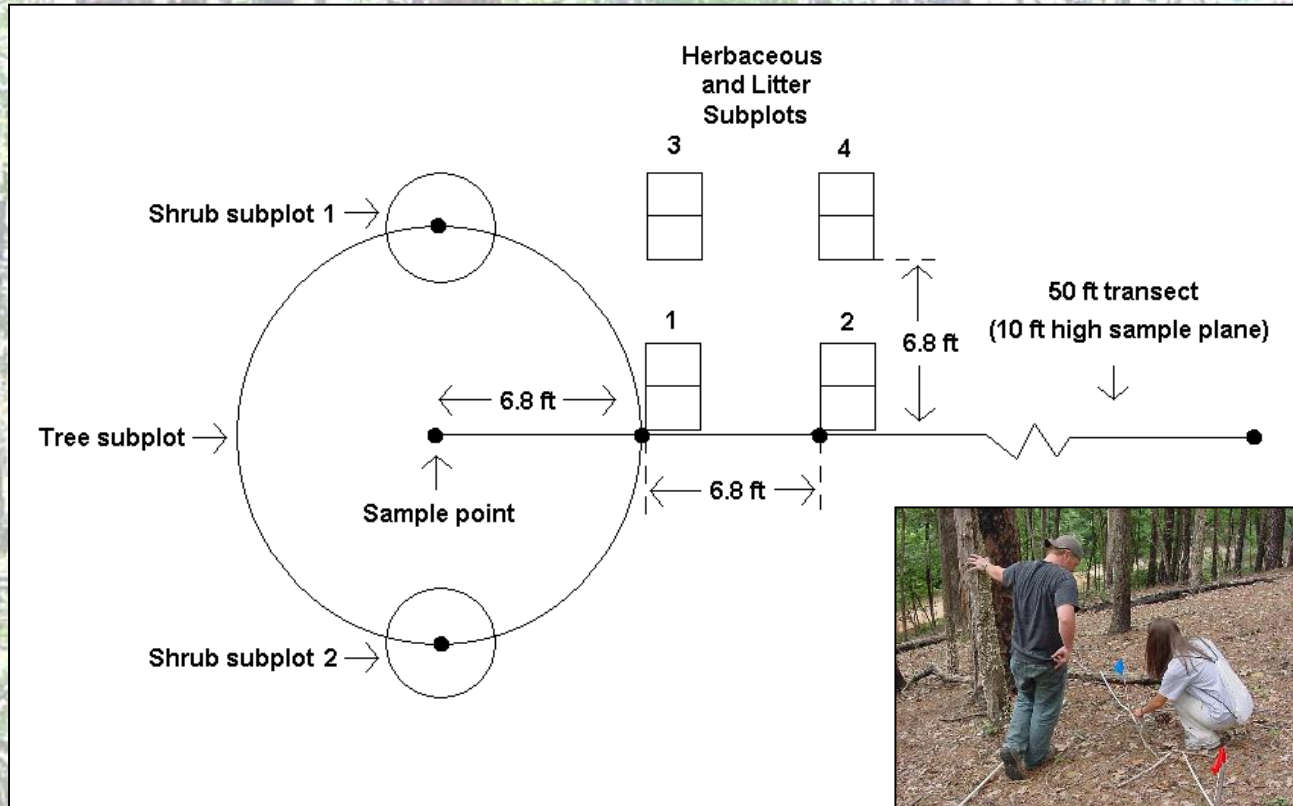
Canopy Tree Ordination – Importance



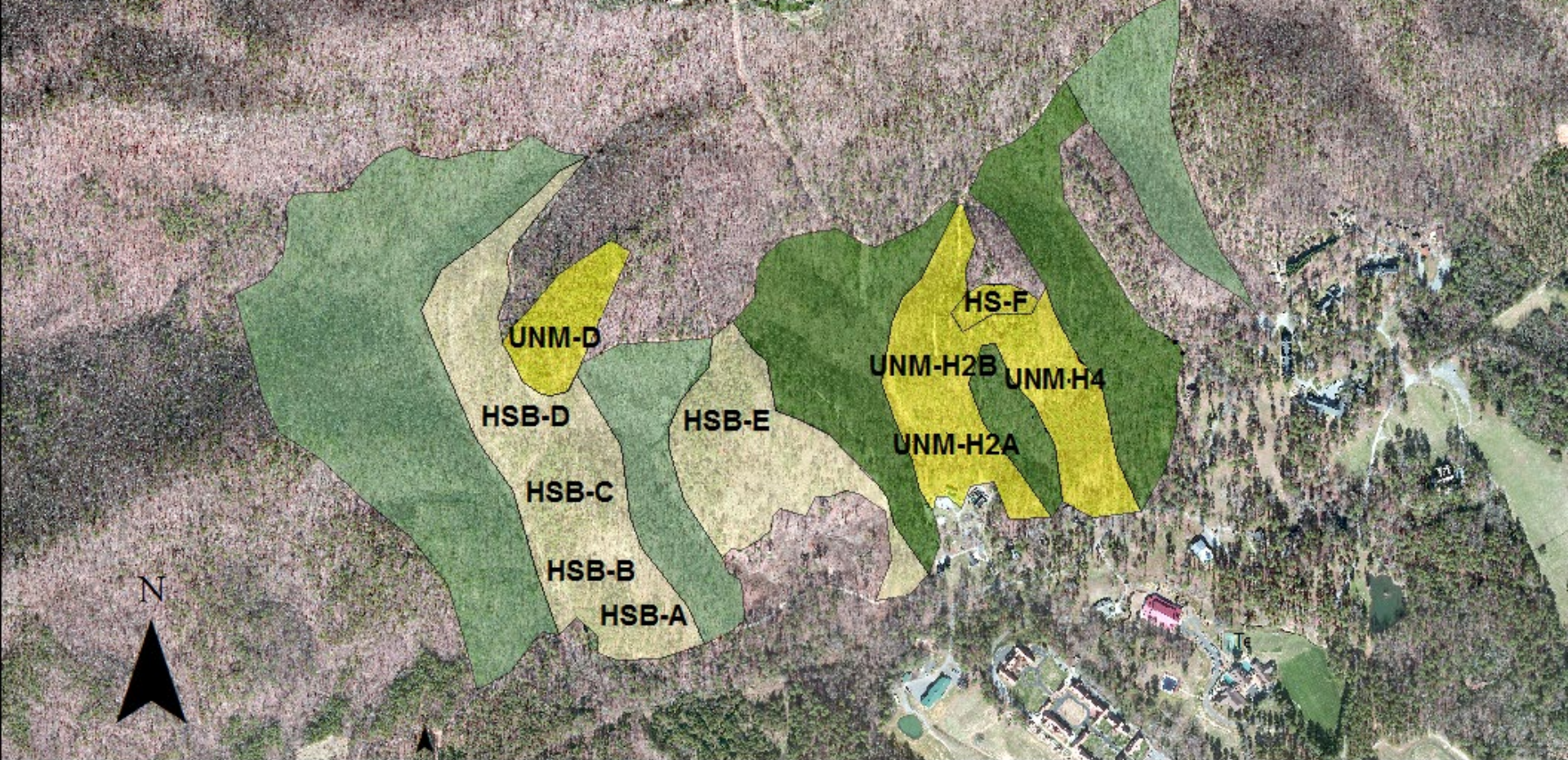
Canopy Tree Ordination – Importance



Fuel Sampling Spring/Summer 2015



**Brown, et al. 1974.
Handbook for Inventorying
Surface Fuels and Biomass
in the Interior West . USDA
Forest Service.**



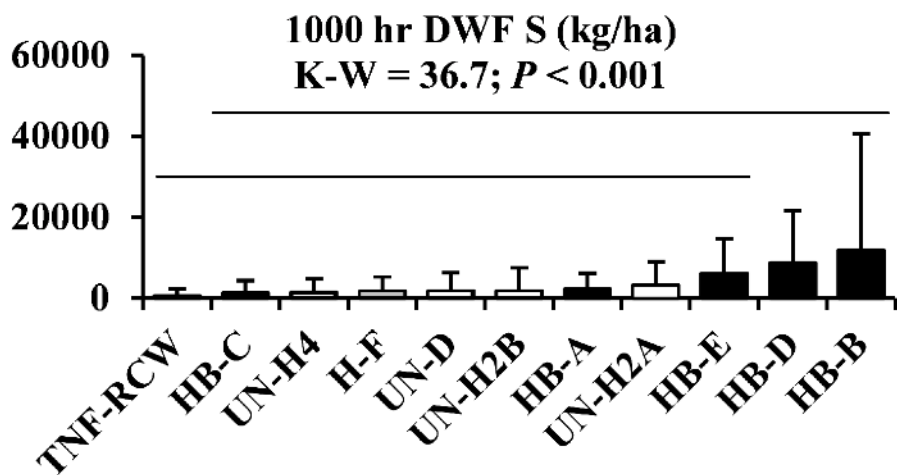
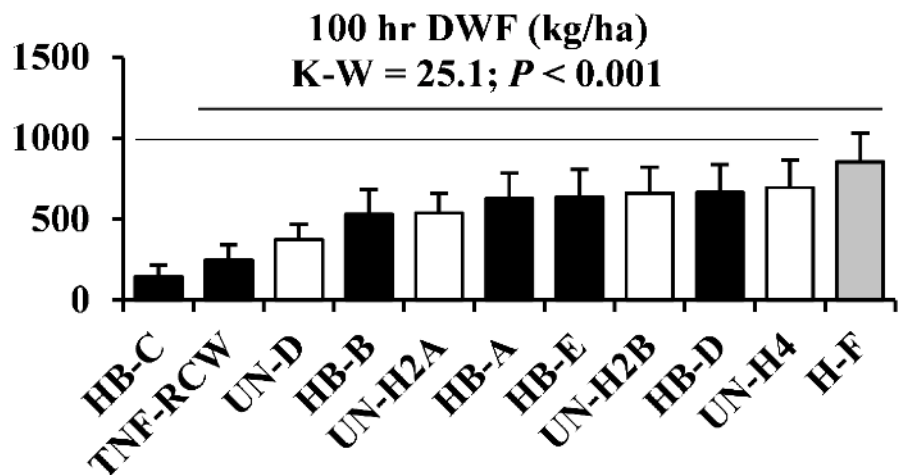
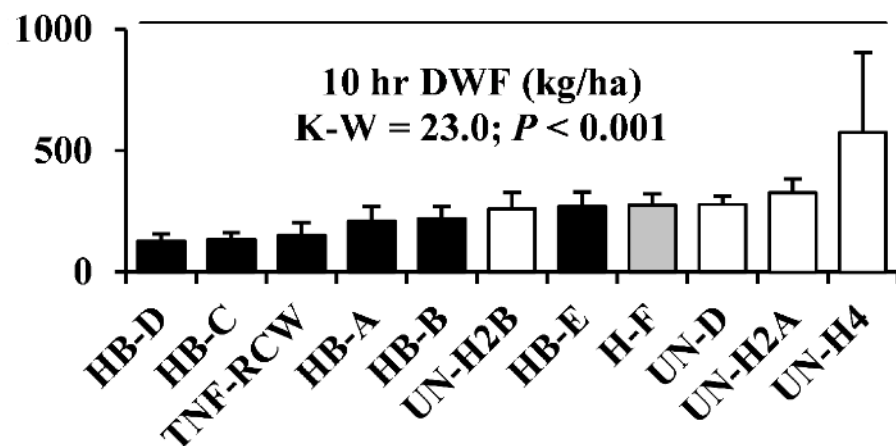
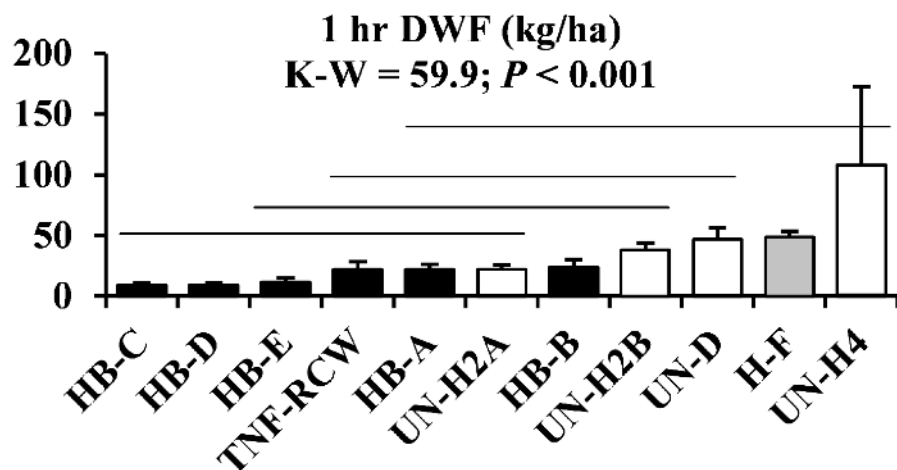
0 100 200 400 600 800 1,000 Meters

Coordinate System: NAD 1983 UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -87.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

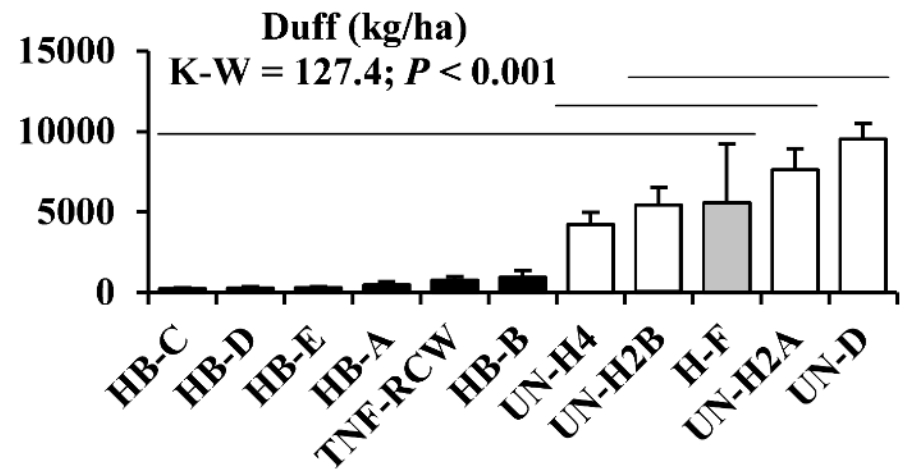
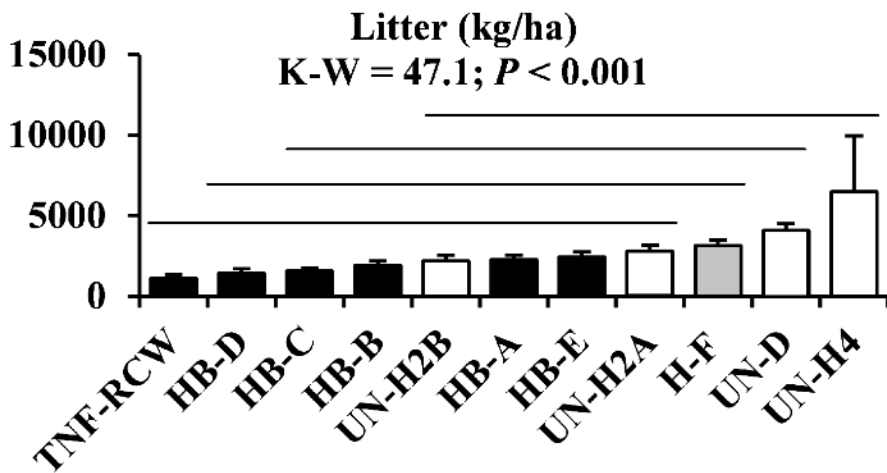
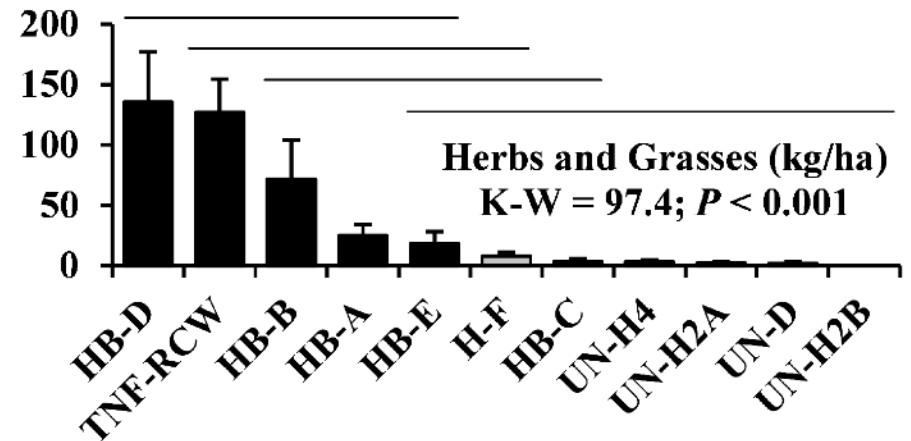
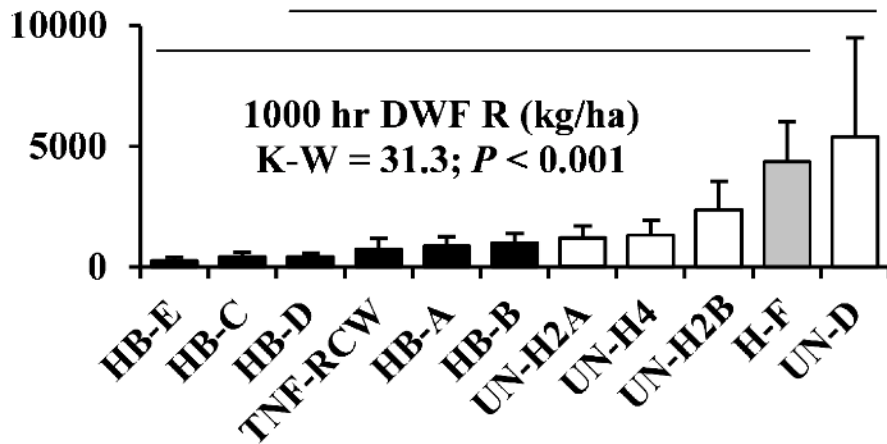
Legend

-  Mature Longleaf Unburned
-  Mature Longleaf Burned
-  Mature Hardwood Unburned
-  Mature Hardwood Burned

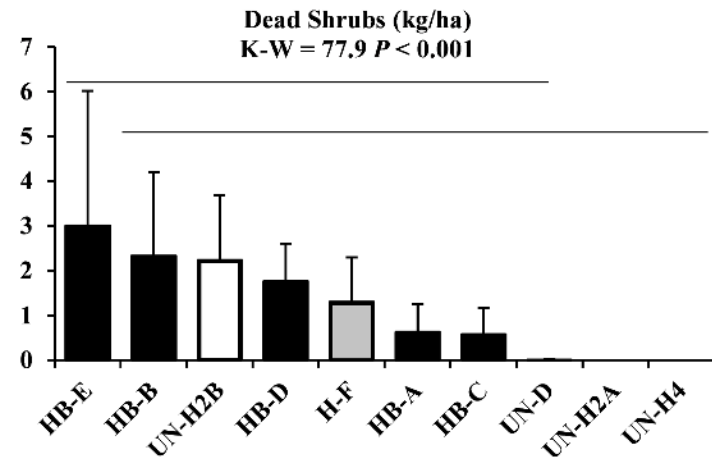
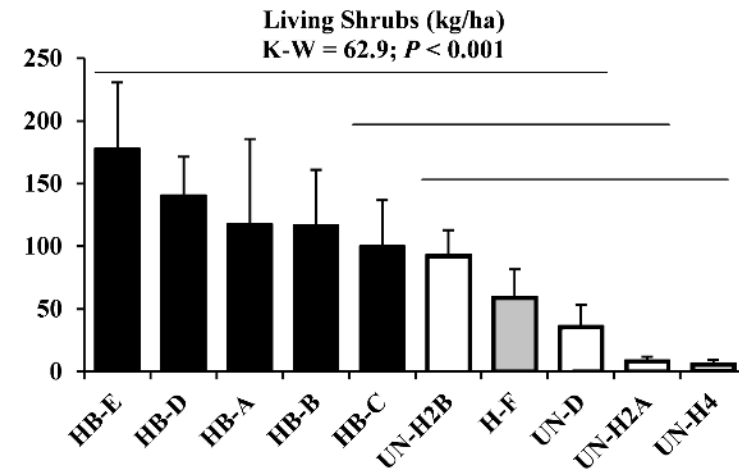
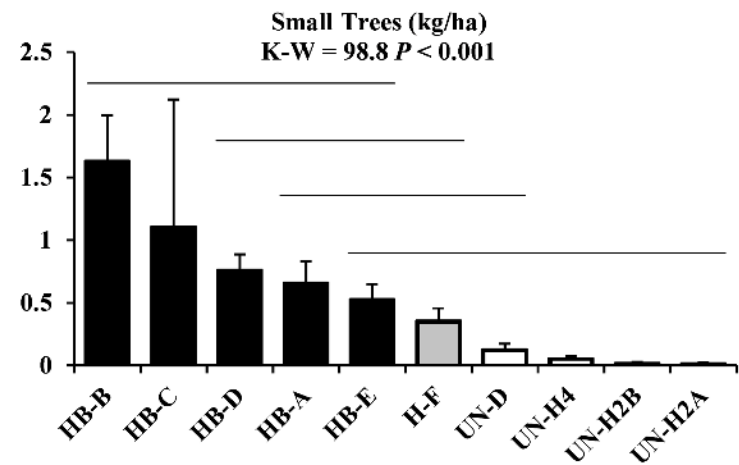
Downed Woody Fuels - 2015



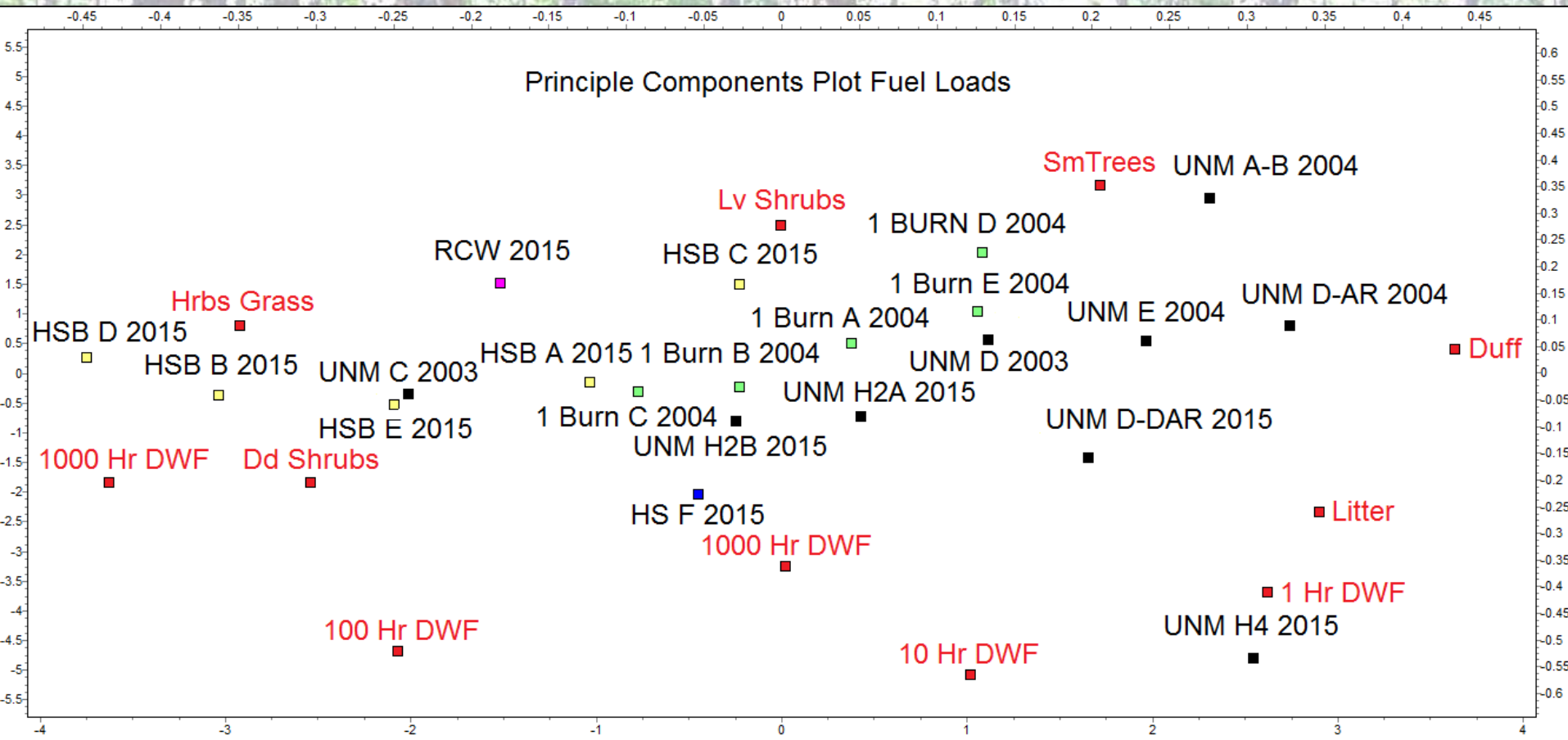
Downed Woody and Other Fuels - 2015



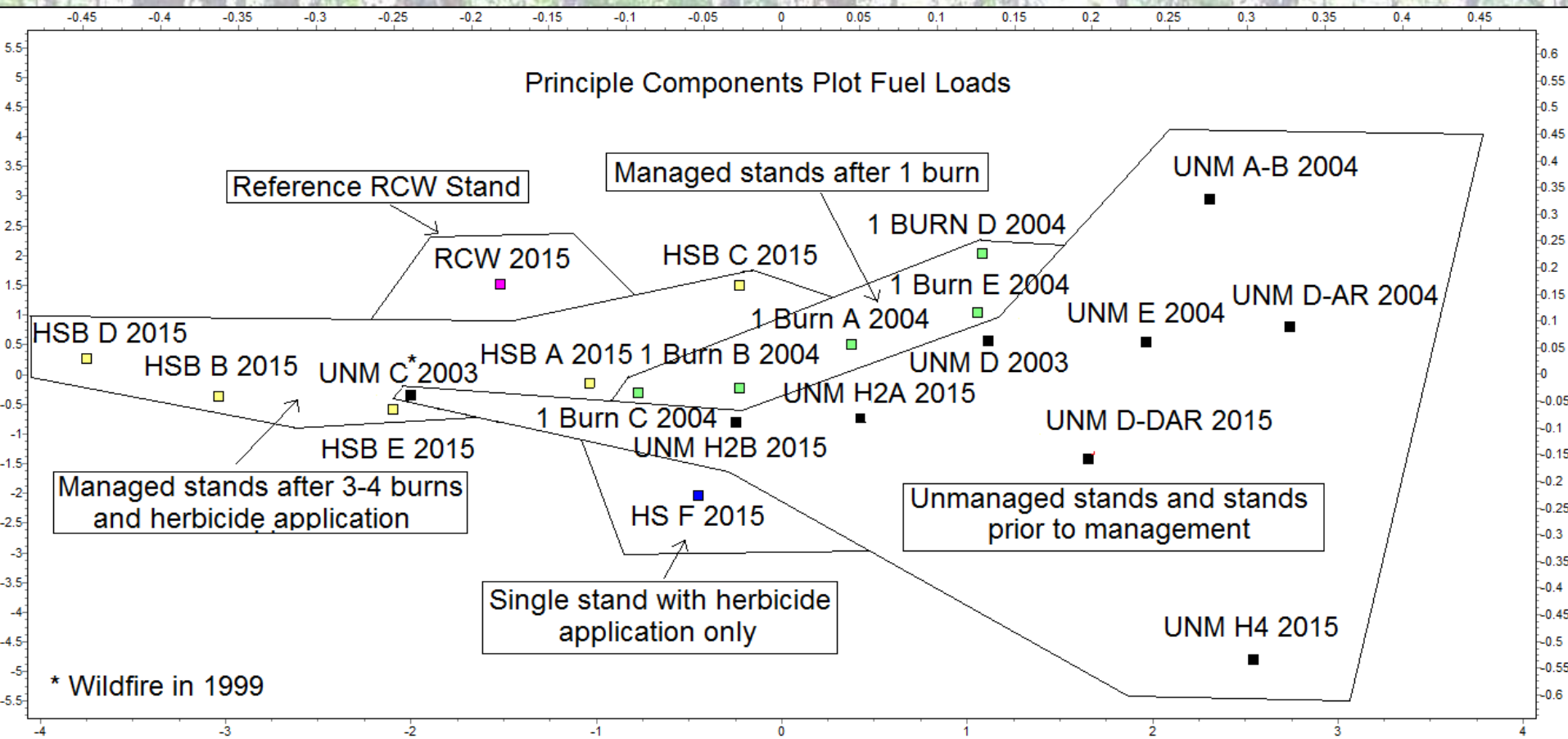
Small Trees and Shrubs - 2015

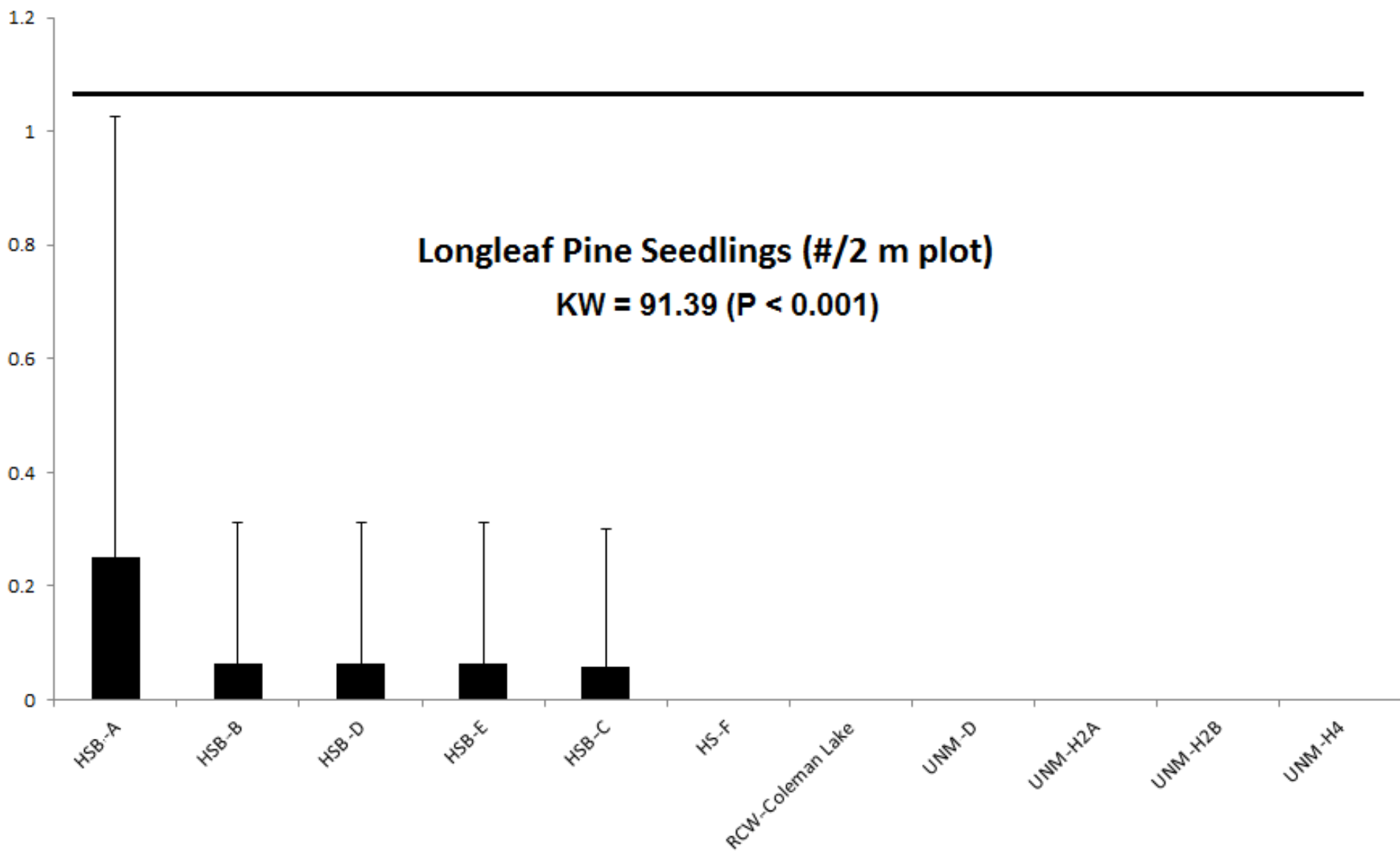


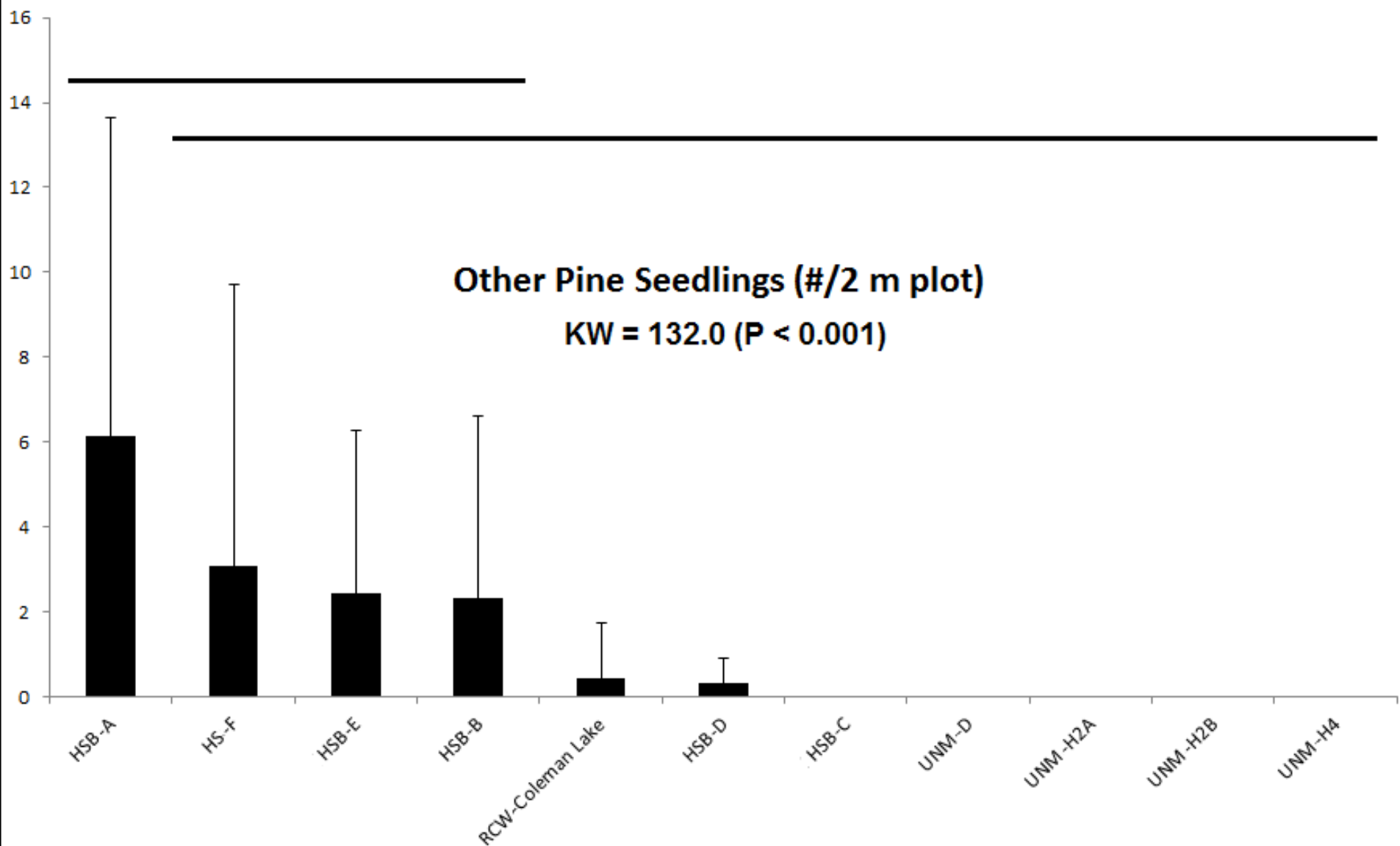
Ordination Fuel Loads - 2015



Ordination Fuel Loads - 2015







Other Early Results

- **Herbaceous plants/grasses increased from 14 spp. (mostly shade-tolerant) to 130-170 spp. (mostly perennials with affinities for dry, sunny, acidic sites); tentative list of “Mountain Longleaf Pine Forest” herbaceous plants and grasses developed via a comparative study.**
- **Bird diversity increased about 50%; community shifted from ground-feeding, canopy-nesting omnivores to foliage-feeding, ground- and shrub-nesting insectivores or seed/fruit-eaters.**
- **Reptiles and amphibian diversity much higher in managed areas (15 species) vs. unmanaged areas (6 species); community shifted toward species adapted to dry, sunny conditions.**

Acknowledgements

- **Berry College Students!**
- **Dr. S. Briggs (President of Berry College)**
- **Dr. D. B. Conn (Dean of MNS and Chair of ELM Committee)**
- **W. Yeomans, M. Huffman, T. Chesnut (Land Resources)**
- **G. Gallagher (Animal Science)**
- **A. Jones (Horticultural Services)**
- **Members of the Berry Longleaf Network**
- **Members of the Interagency Burn Team**
- **Berry Volunteer Services and Freshman Service Day Program**
- **Physical Plant, Historic Berry, and Campus Security Departments**
- **National Science Foundation**
- **Southern Company-National Fish & Wildlife Foundation**
- **Georgia Forestry Commission and U.S. Forest Service**
- **J. Buffington and M. Miller (MNS Secretaries)**
- **E. Elsberry (Science Building Manager)**
- **D. Davin (Research and Sponsored Programs)**
- **Volunteers too numerous to mention individually: Thanks!**

