

Mapping forest structure along the southern Blue Ridge Parkway from LiDAR



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Blue Ridge Parkway
Research and Science Symposium
Folk Arts Center, Asheville, NC
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Focus

(1) Motivating questions:

- How different is the BRP from surrounding lands?
- Can we see *edge effects* to structure that are important for management?

(2) The all-lands dataset: mid-2000s North Carolina LiDAR (13 counties of Western NC; roughly 14.5 million 60 foot grid cells (~1,800 mi²))

(3) LiDAR products used in analysis:

- Maximum vegetation height
- A full above-ground structural classification

NC Airborne LiDAR dataset and processing

Phase III data collected for flood hazard mapping (Feb-Apr, Dec 2003)
Use of above ground aspects (veg.), an after thought

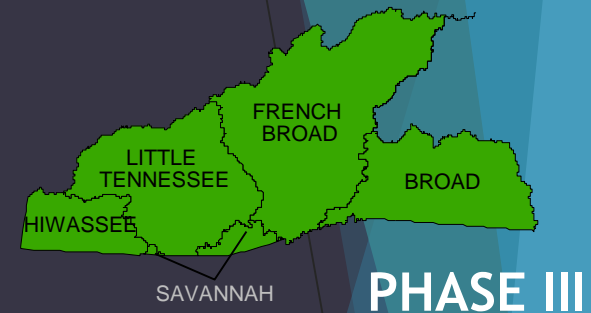
Max canopy height at 60' grid resolution was calculated from a LiDAR-based DEM from same effort

Typology of vertical structures:

- (1) Point height calculated from high res DEM
- (2) Extreme values removed
- (3) Density calculated across 5 ft. height bands
- (4) Density recalculated as % of above ground points in each band
- (5) Non-hierarchical K-means clustering used to reiteratively identify 10, 20, 40, 75 and 200 unique structural types

The processing was conducted using a supercomputer at Oak Ridge NL

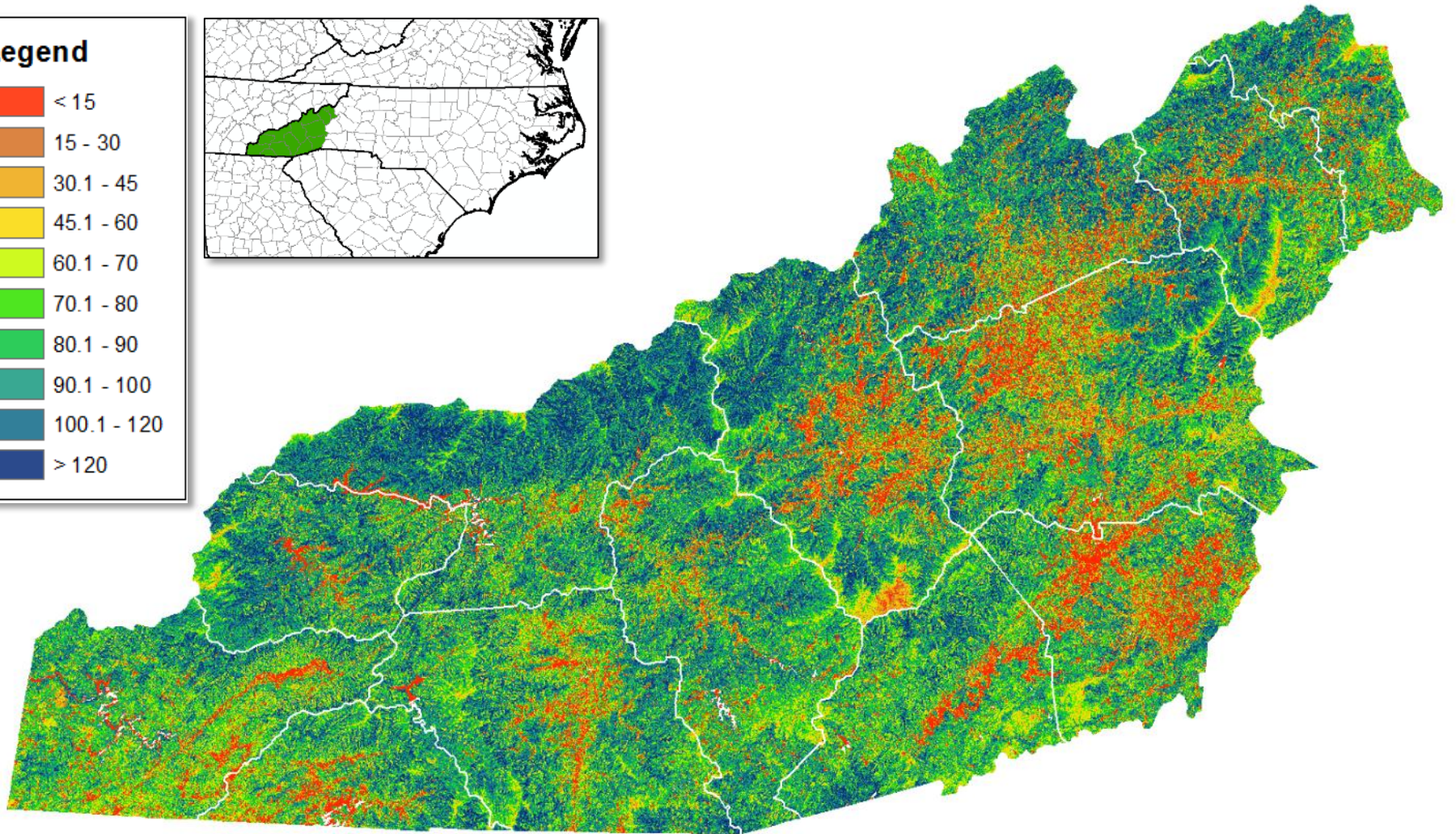
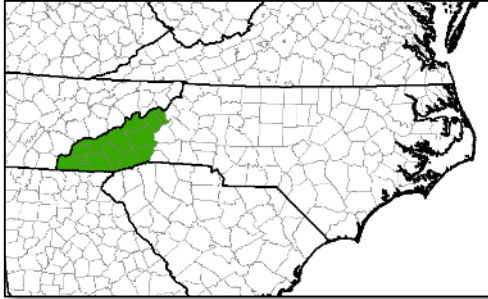
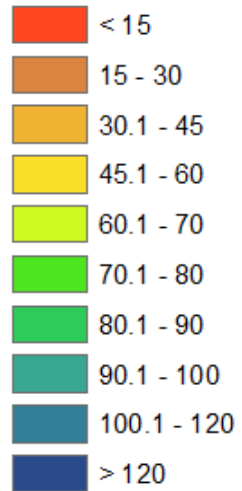
Subsequent landscape analysis was conducted using a 250,000 random point sample of various rasters for jurisdictional, land use history, vegetation compositional and topographic gradient analysis.



Maximum vegetation height from LiDAR

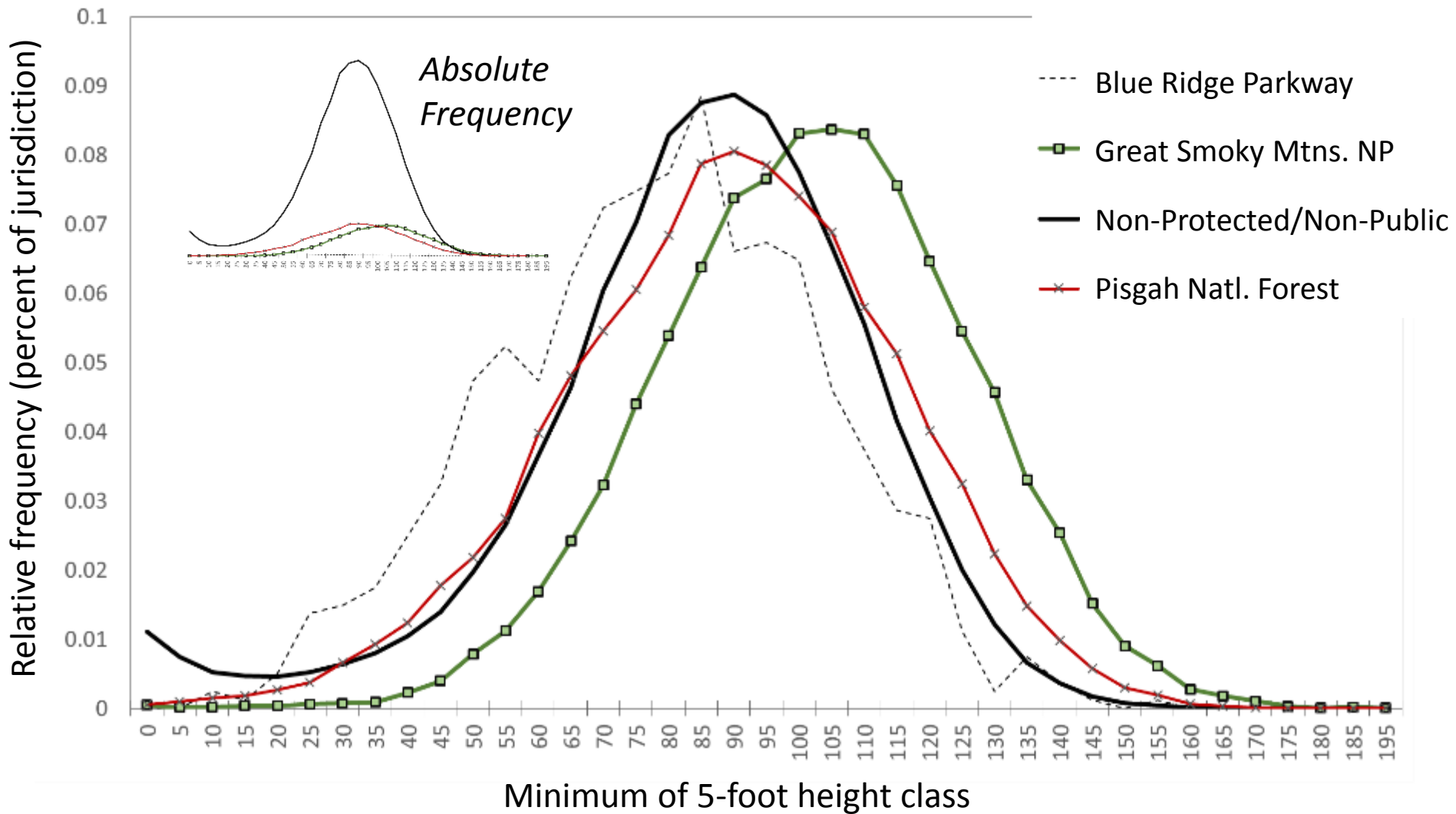
Across a 13-county area of western NC

Legend



Distributions of maximum height by jurisdiction

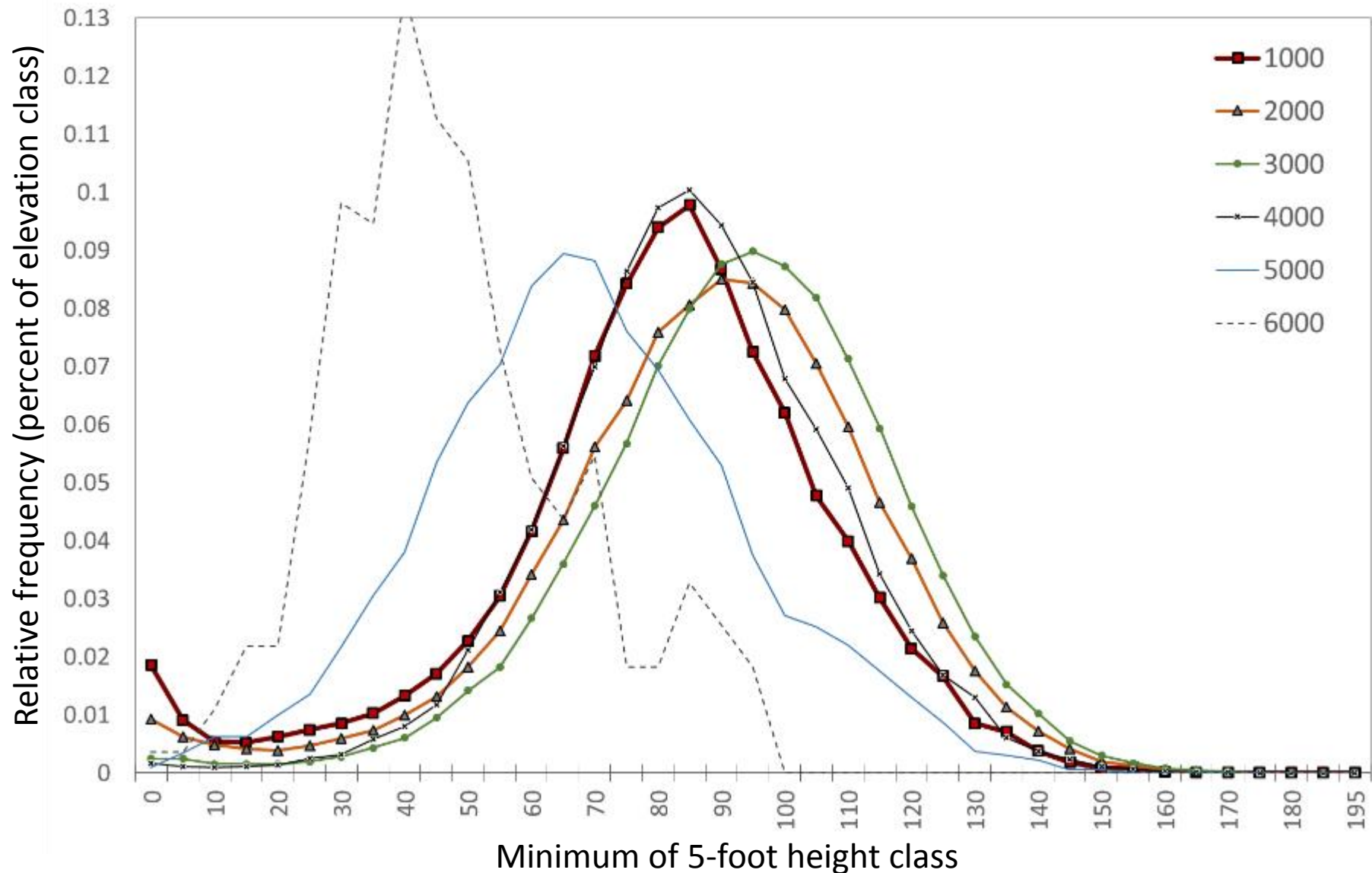
Regional pattern of natural types



N= BRP: 802; GSMNP: 19,839; Non: 120,514; Pisgah NF: 21,991 (Sum: 163,146)

Distributions of max. height by elevation

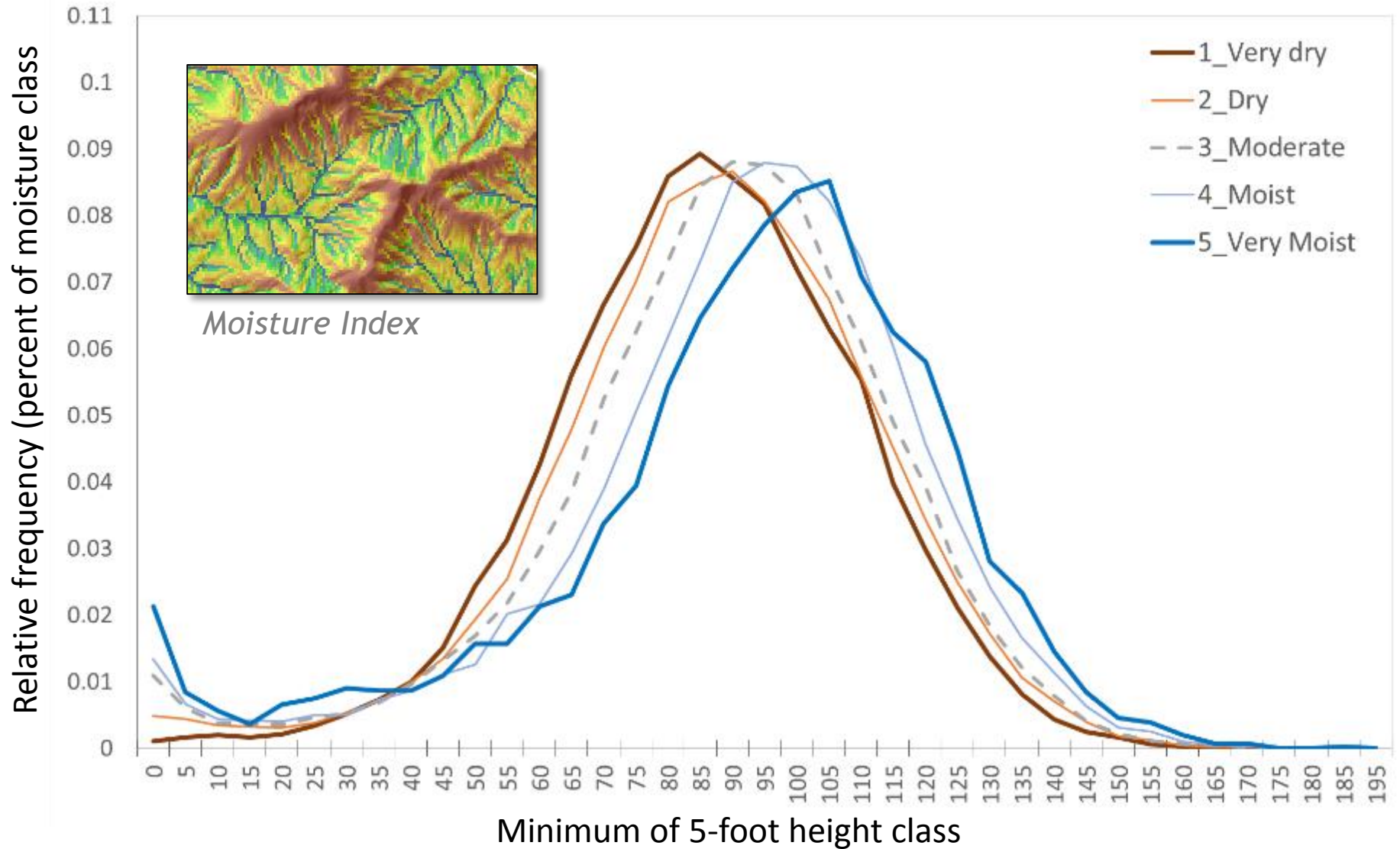
Regional pattern of natural types



N=210,248 randomly sampled 20x20m LiDAR grid cells

Distributions of max. height by moisture index

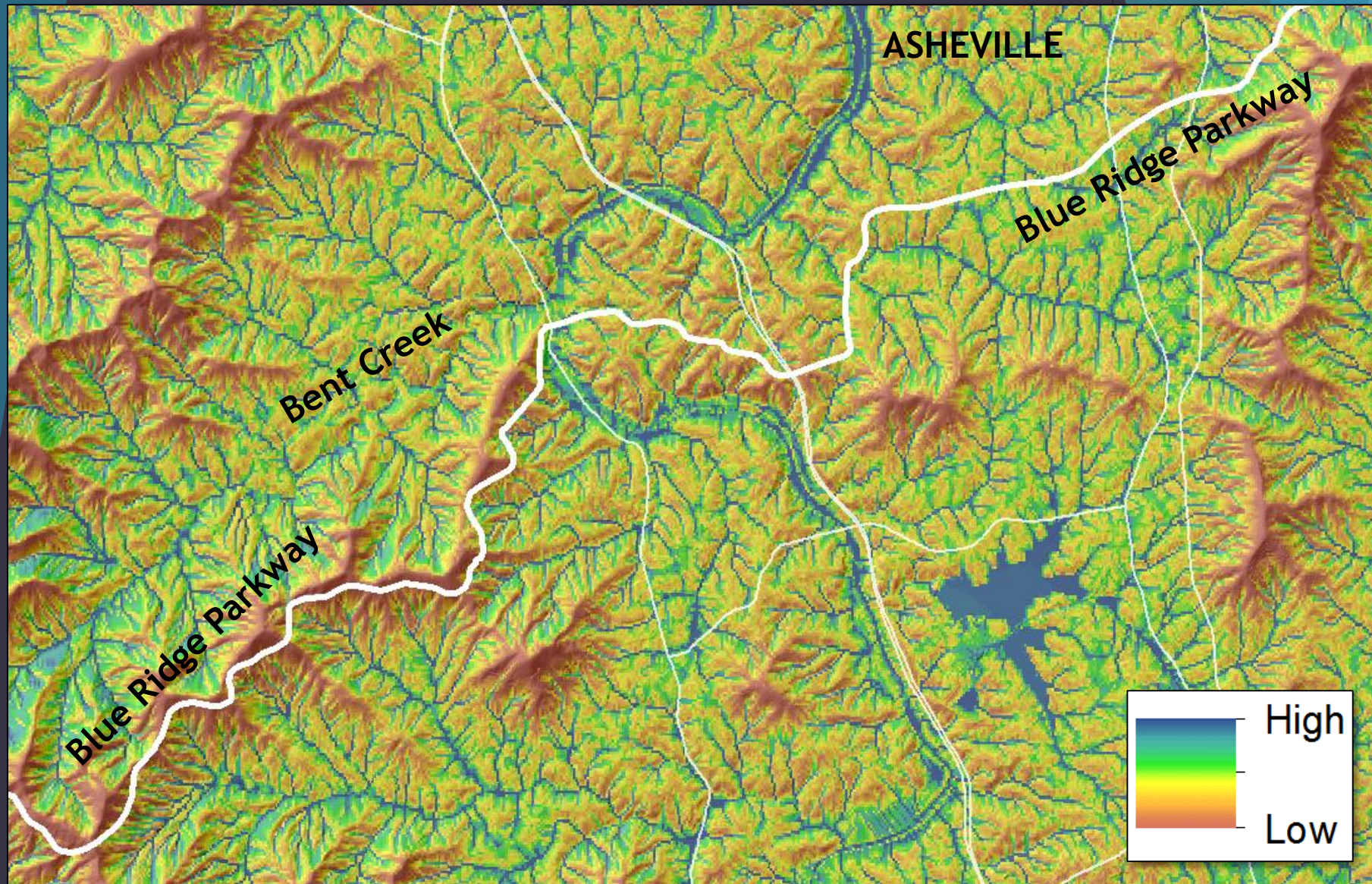
Regional pattern of natural types



N=210,248 randomly sampled 20x20m LiDAR grid cells

The Parkway's preference for high and dry sites

Topographic Moisture Index (TIMI)

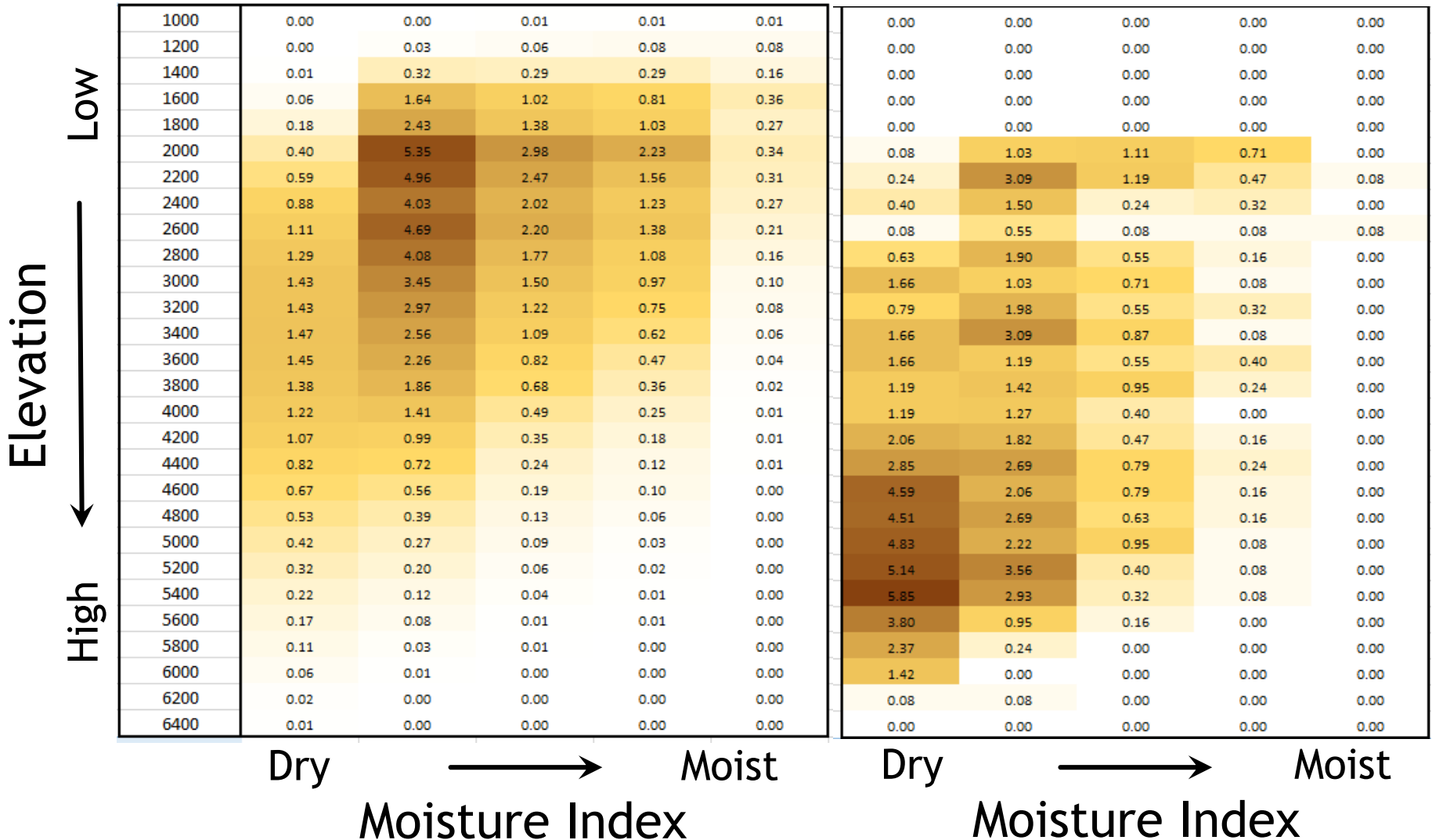


The NC Blue Ridge Parkway's “topographic niches”

As compared to “Natural” lands of the surrounding region

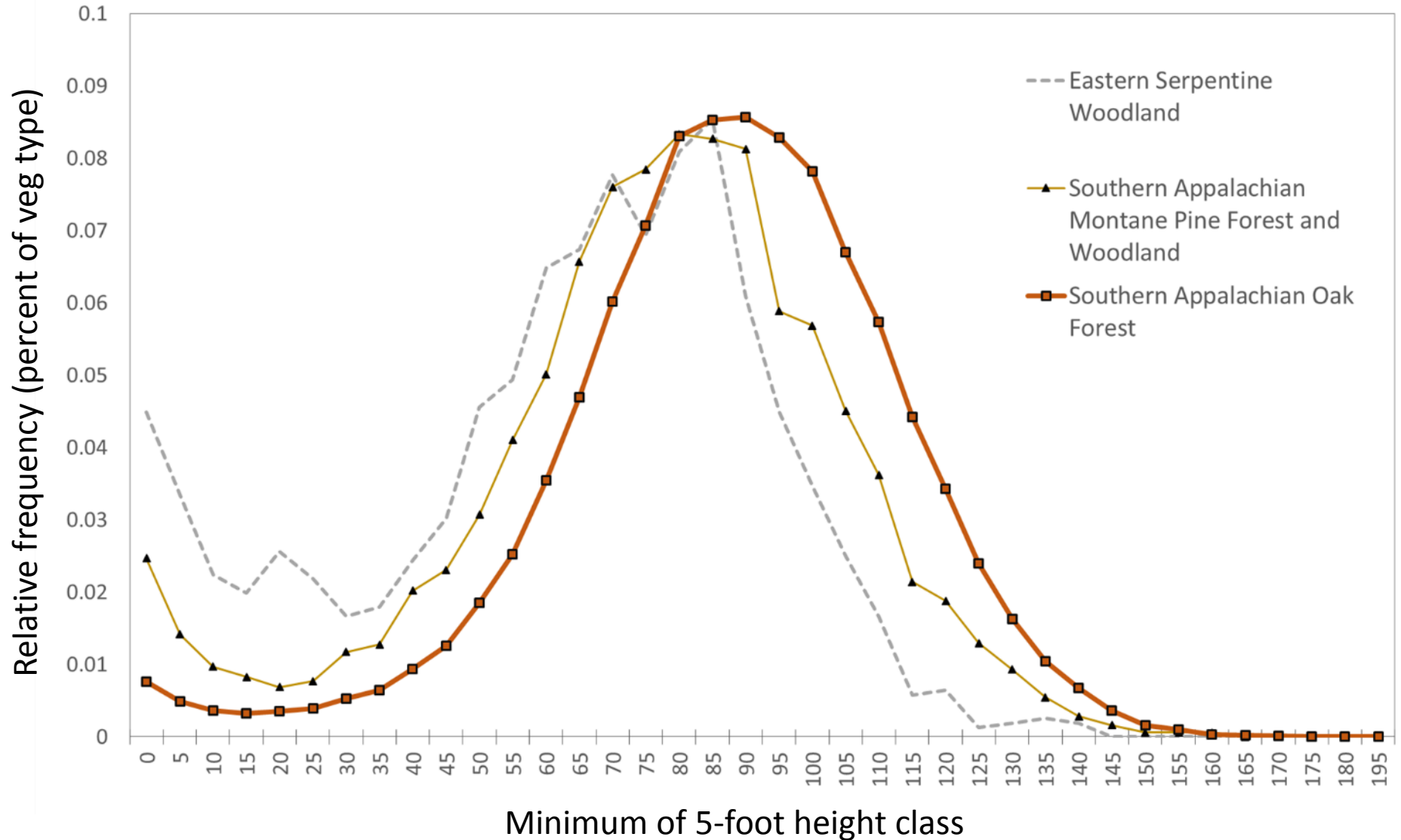
13 Western NC Counties

Blue Ridge Parkway



Distributions of max. height by vegetation type

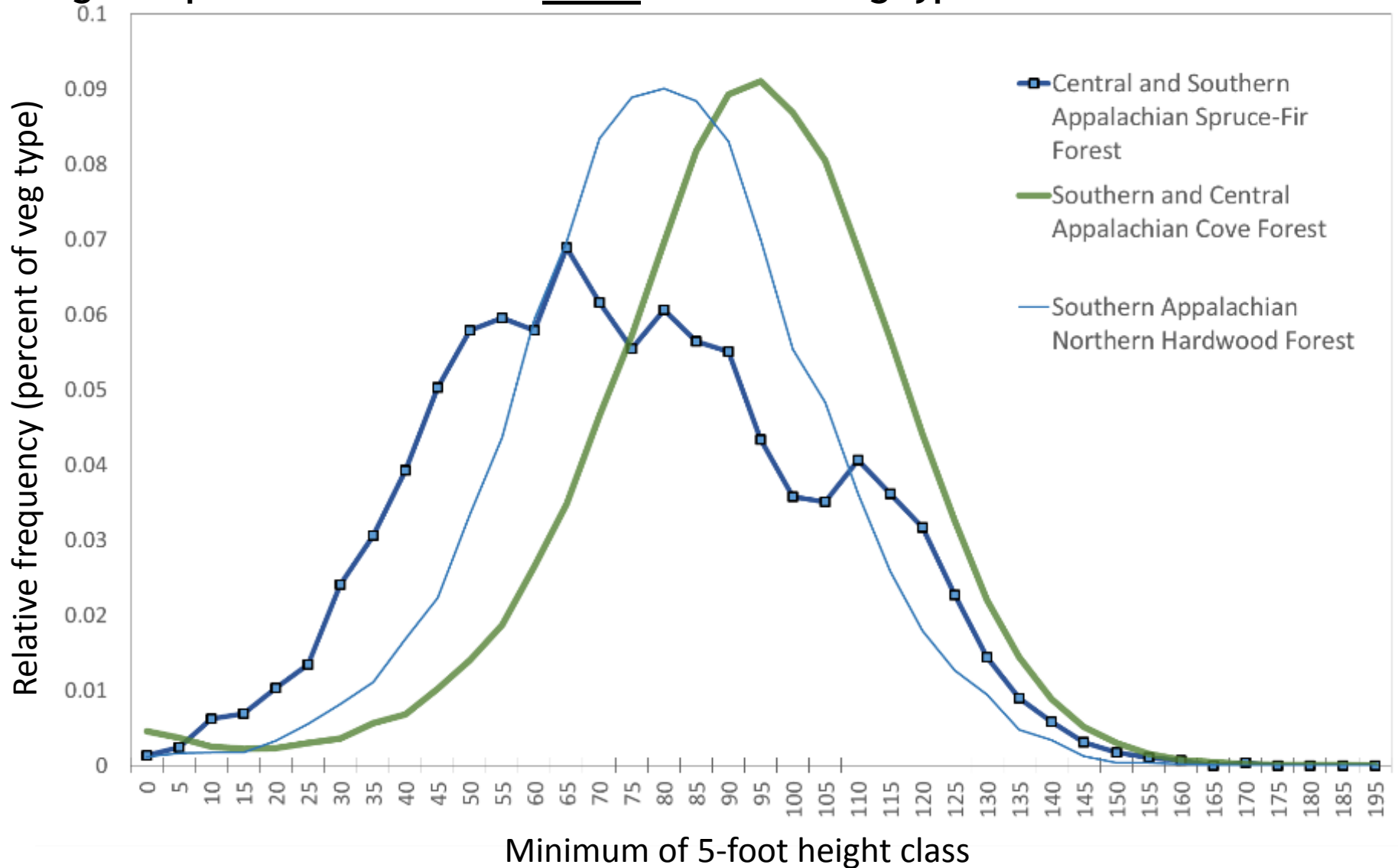
Regional pattern for selected xeric Landfire eVeg types



N = Serpentine woodland: 1,558; Pine forest-woodland: 4,945; Oak forest: 81,786

Distributions of max. height by vegetation type

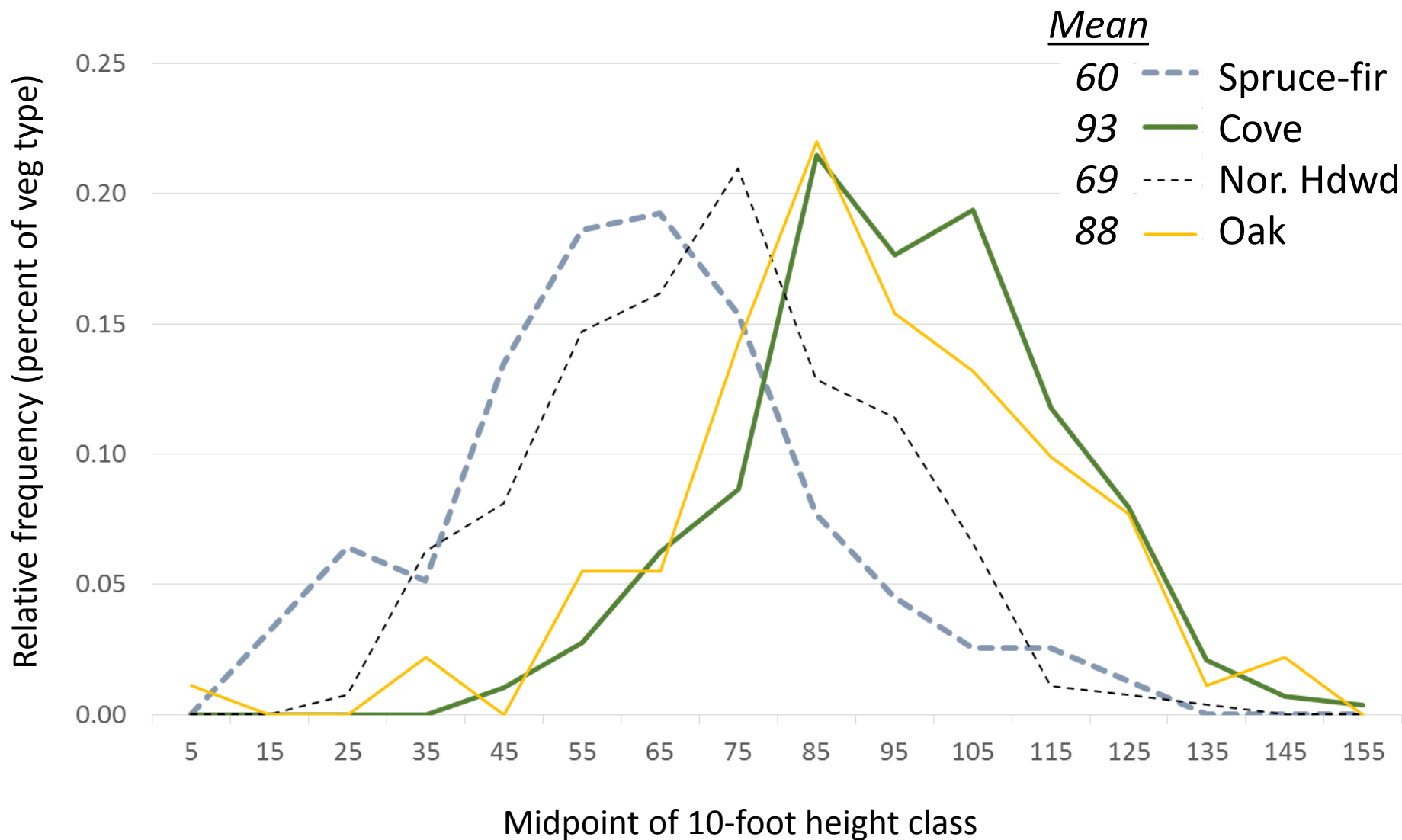
Regional pattern for selected mesic Landfire eVeg types



N= Spruce-fir forests: 2,904; Cove forests: 77,956; Northern Hardwood: 11,802

Distributions of max. height by vegetation type

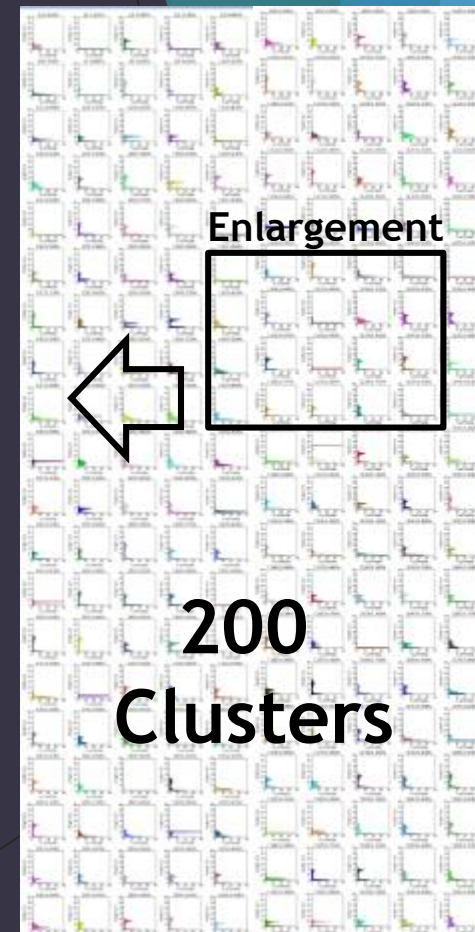
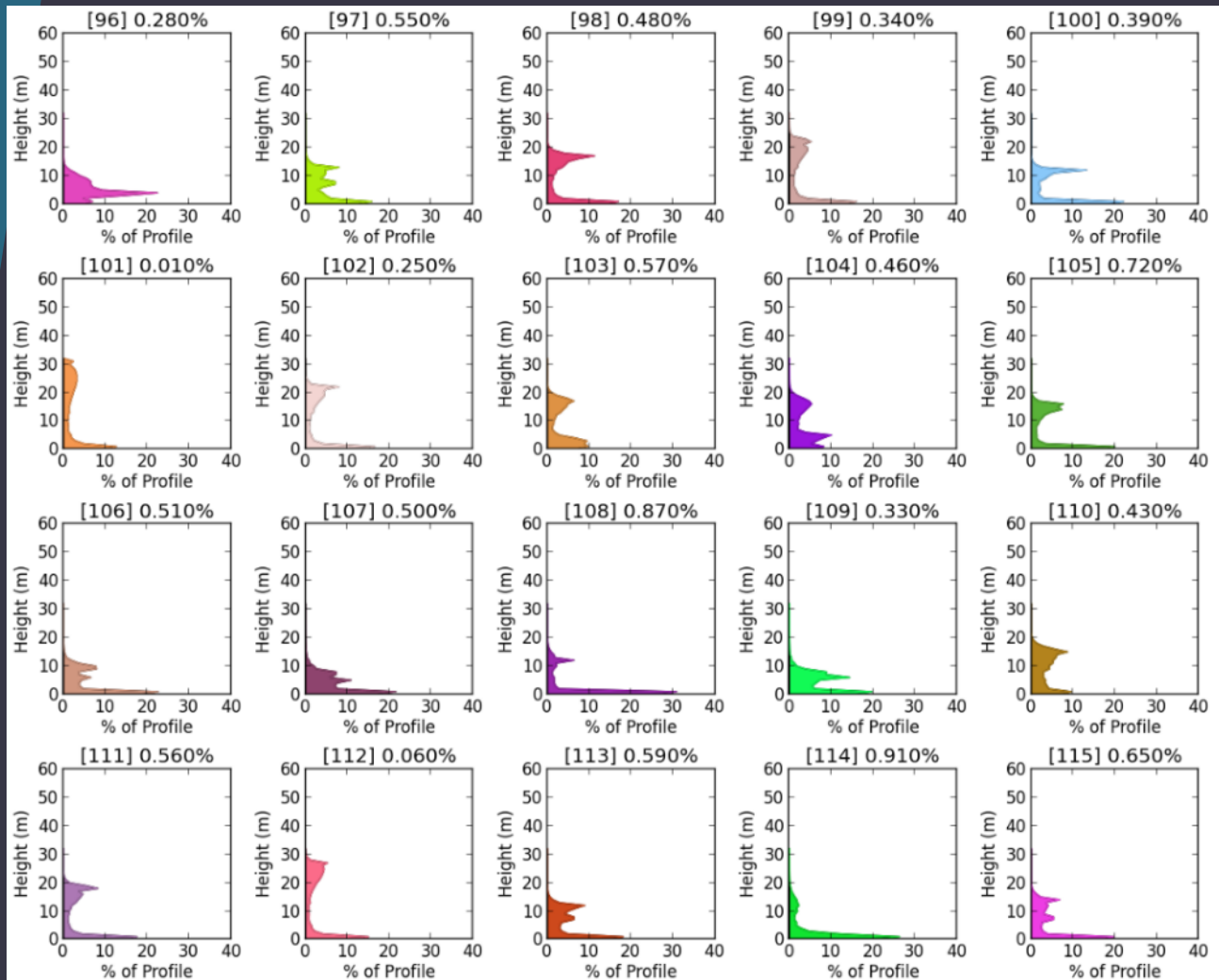
Blue Ridge Parkway for selected Landfire eVeg types



N= Spruce-fir: 156; Cove: 289; Northern Hardwood: 272; Oak: 91

The Structural Classification

LiDAR relative density profiles for clusters



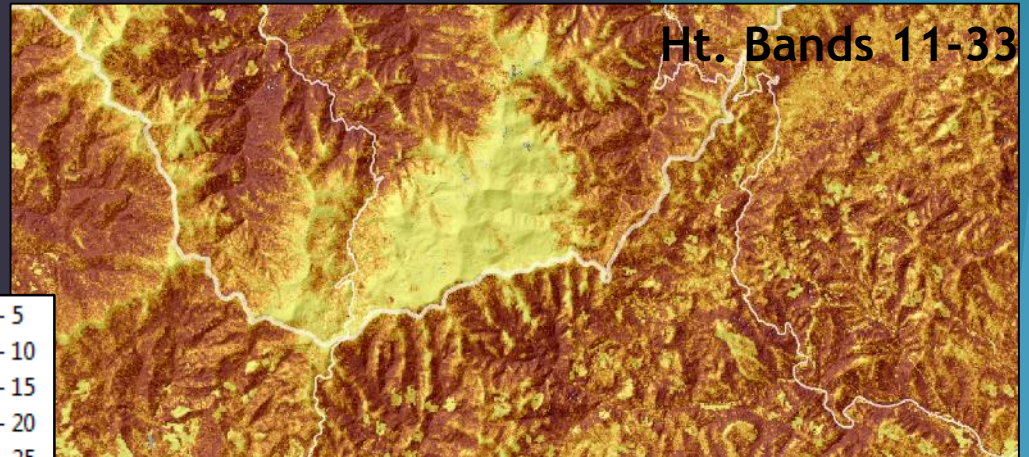
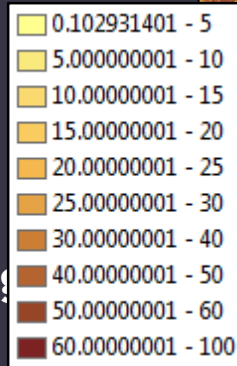
5-foot height band's percent of profile

Height

The Structural Classification

Relative proportion of LiDAR returns in Upper (bands 11-33), mid (6-10) and lower (1-5) fixed height bands for the Greater Shining Rock Wilderness Area, Pisgah NF and Blue Ridge Parkway

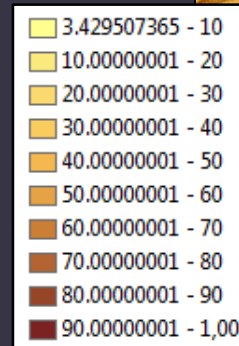
Percent



Ht. Bands 6-10

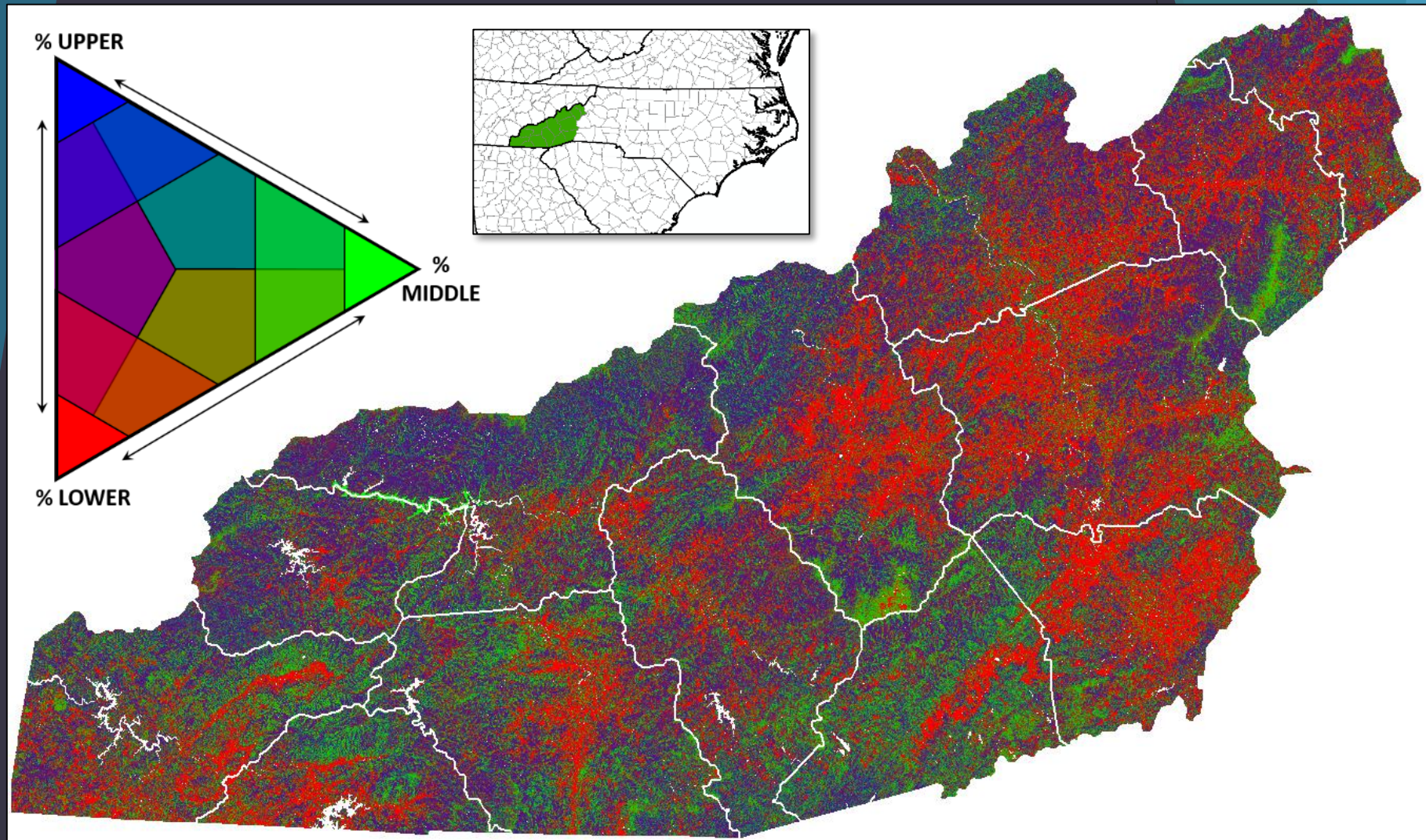


Percent



The Structural Classification

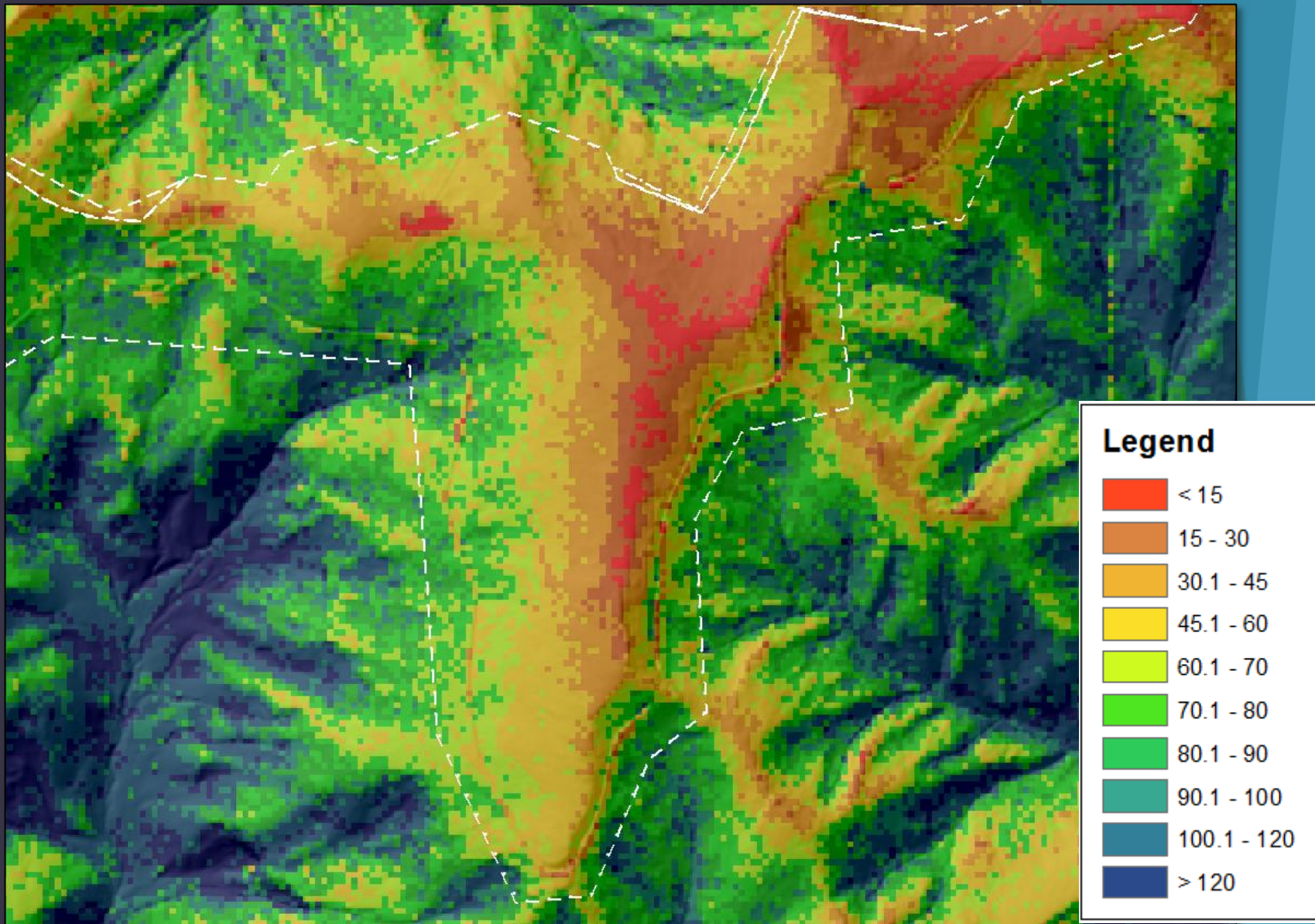
Tri-polar (R-G-B) colors on three height zones



Edge effects along the Blue Ridge Parkway

Craggy Mountains: Structural impacts of Parkway fragmentation

MAX. HEIGHT



Edge effects along the Blue Ridge Parkway

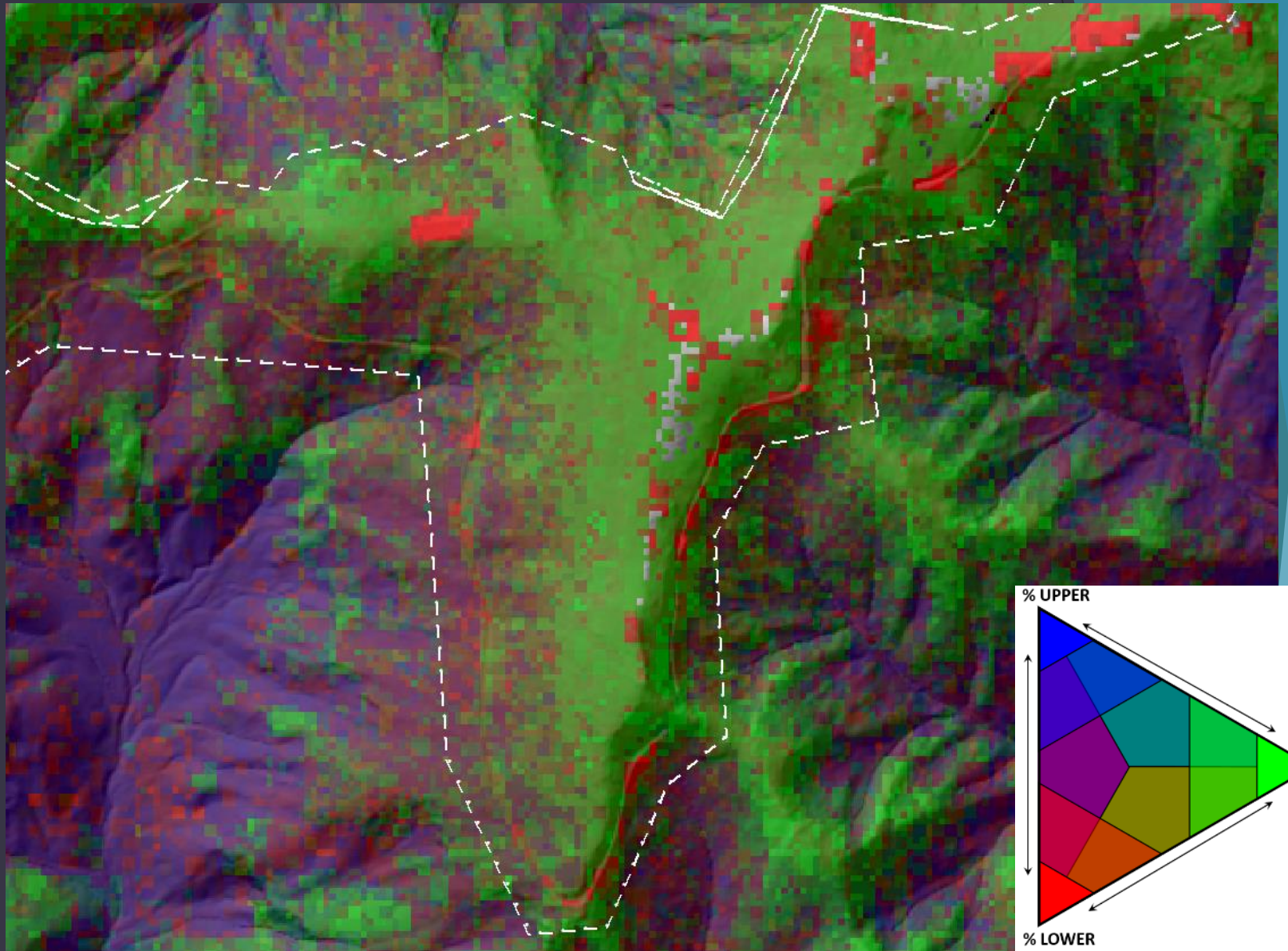
Craggy Mountains: Structural impacts of Parkway fragmentation



Edge effects along the Blue Ridge Parkway

Craggy Mountains: Structural impacts of Parkway fragmentation

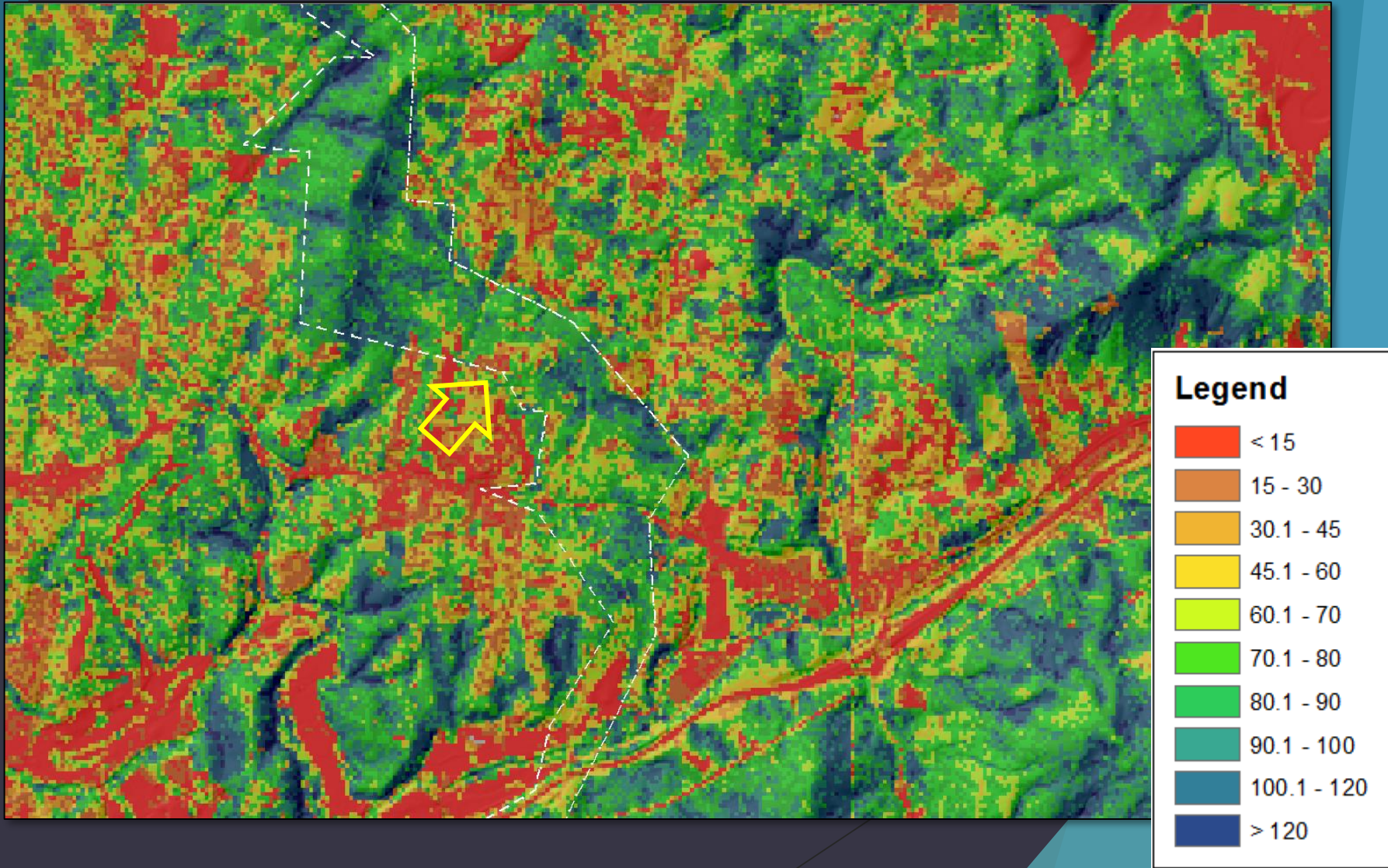
STRUCTURAL CLASSIFICATION



Edge effects along the Blue Ridge Parkway

Folk Arts Center: Structural condition when surrounded by private lots

MAX. HEIGHT



Edge effects along the Blue Ridge Parkway

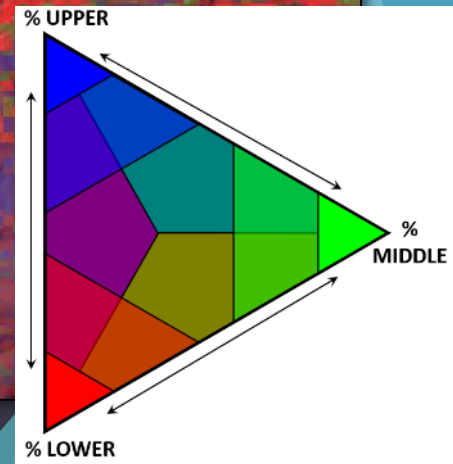
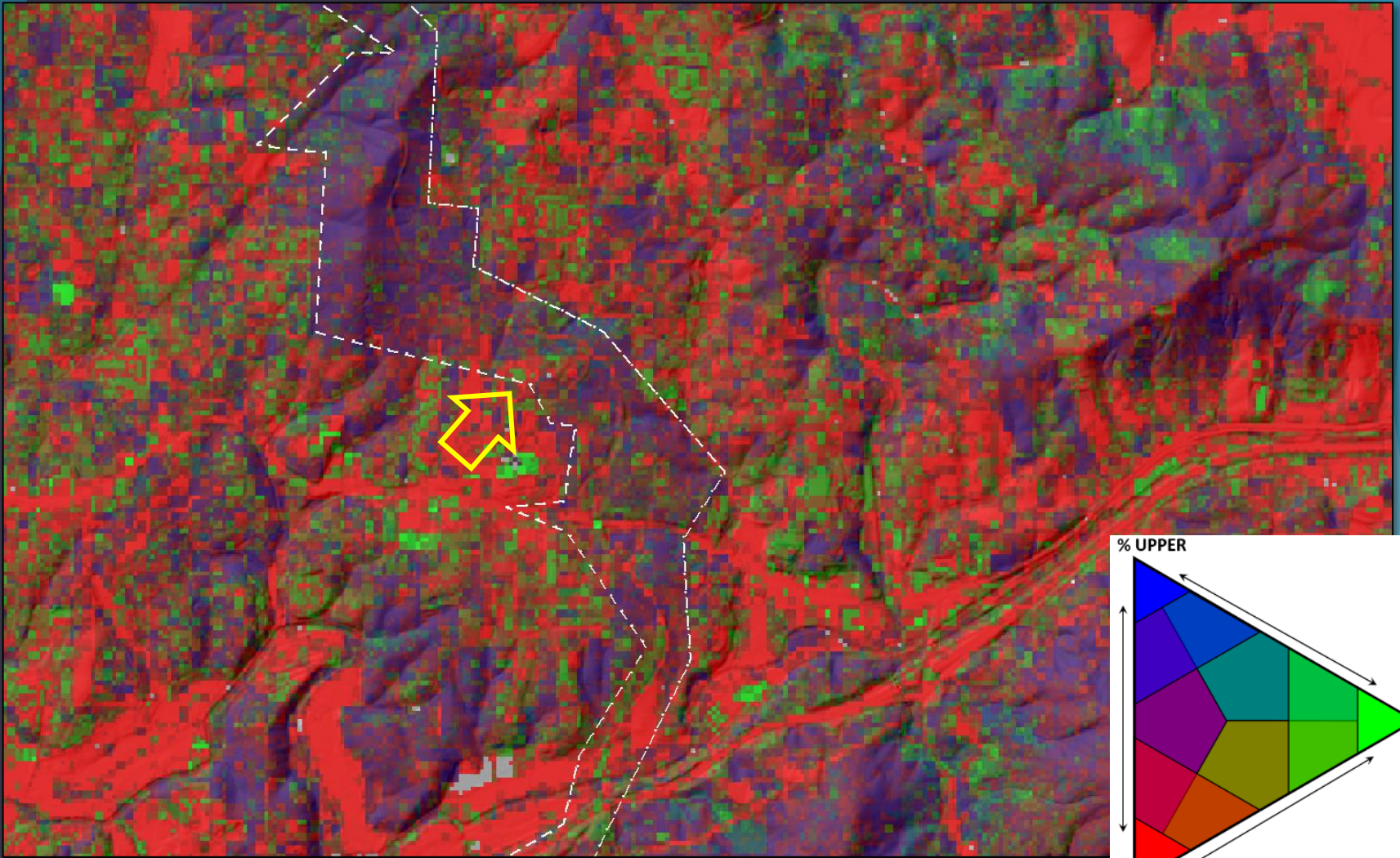
Folk Arts Center: Structural condition when surrounded by private lots



Edge effects along the Blue Ridge Parkway

Folk Arts Center: Structural condition when surrounded by private lots

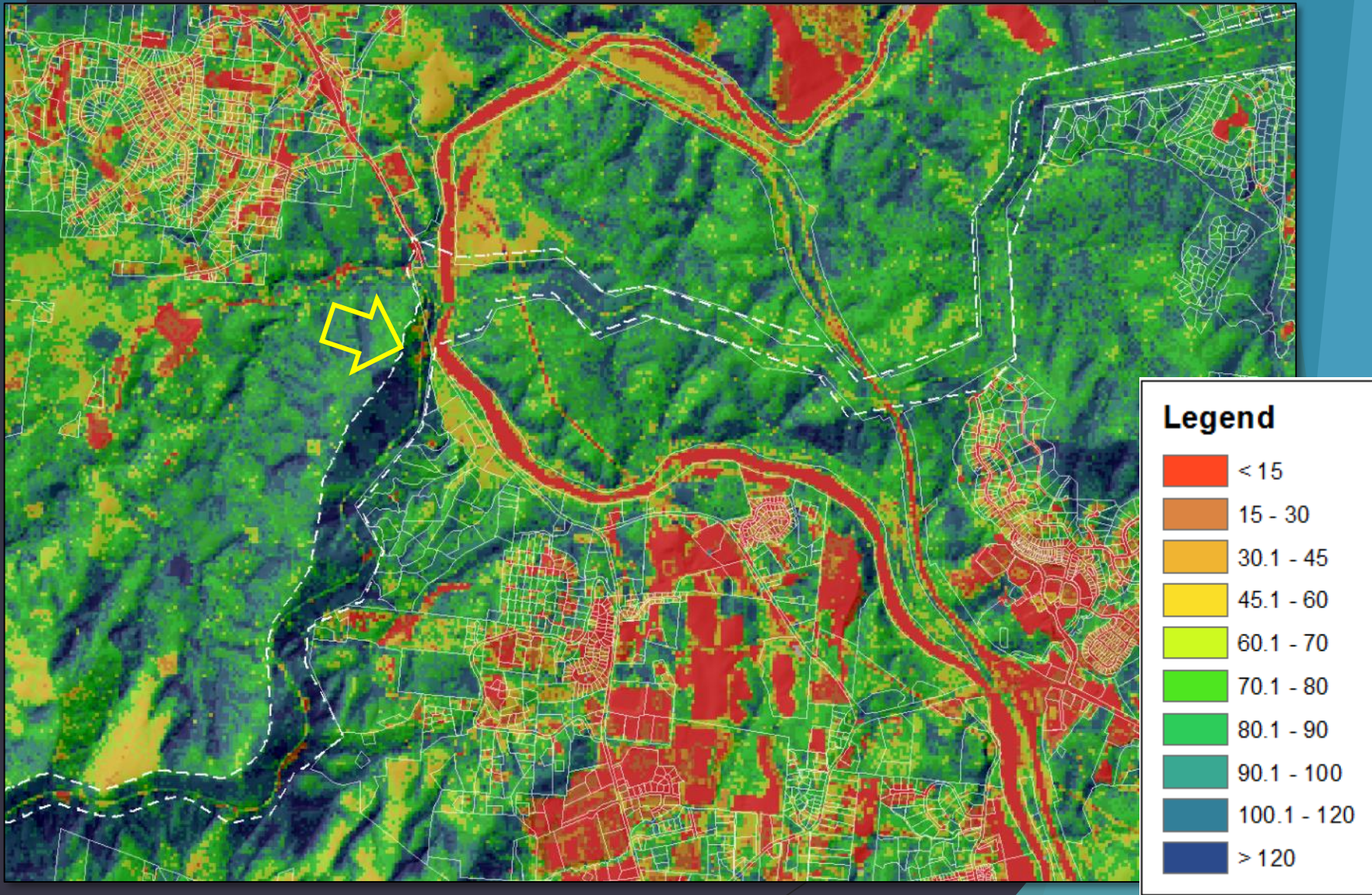
STRUCTURAL CLASSIFICATION



Edge effects along the Blue Ridge Parkway

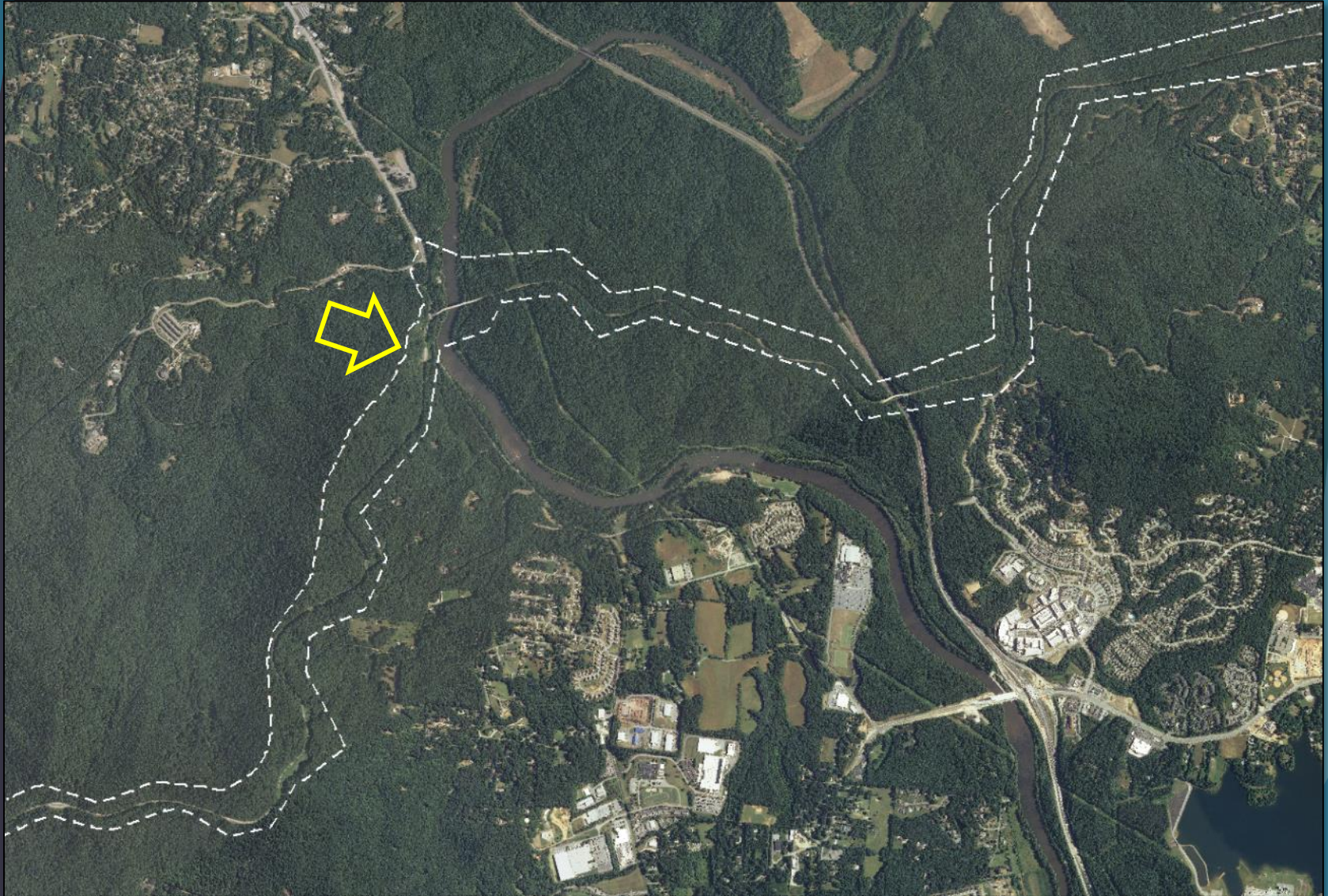
French Broad Overlook: Structural impacts at the Wildland-Urban Interface (WUI)

MAX. HEIGHT



Edge effects along the Blue Ridge Parkway

French Broad Overlook: Structural impacts at the Wildland-Urban Interface (WUI)



Edge effects along the Blue Ridge Parkway

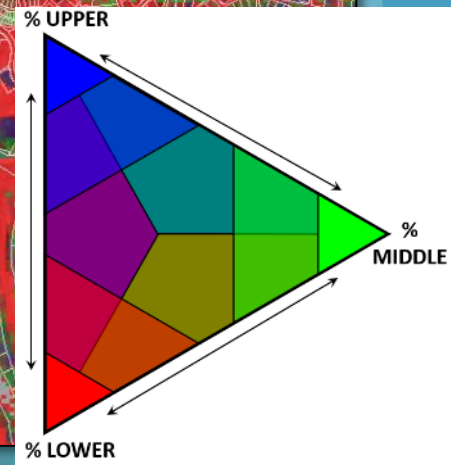
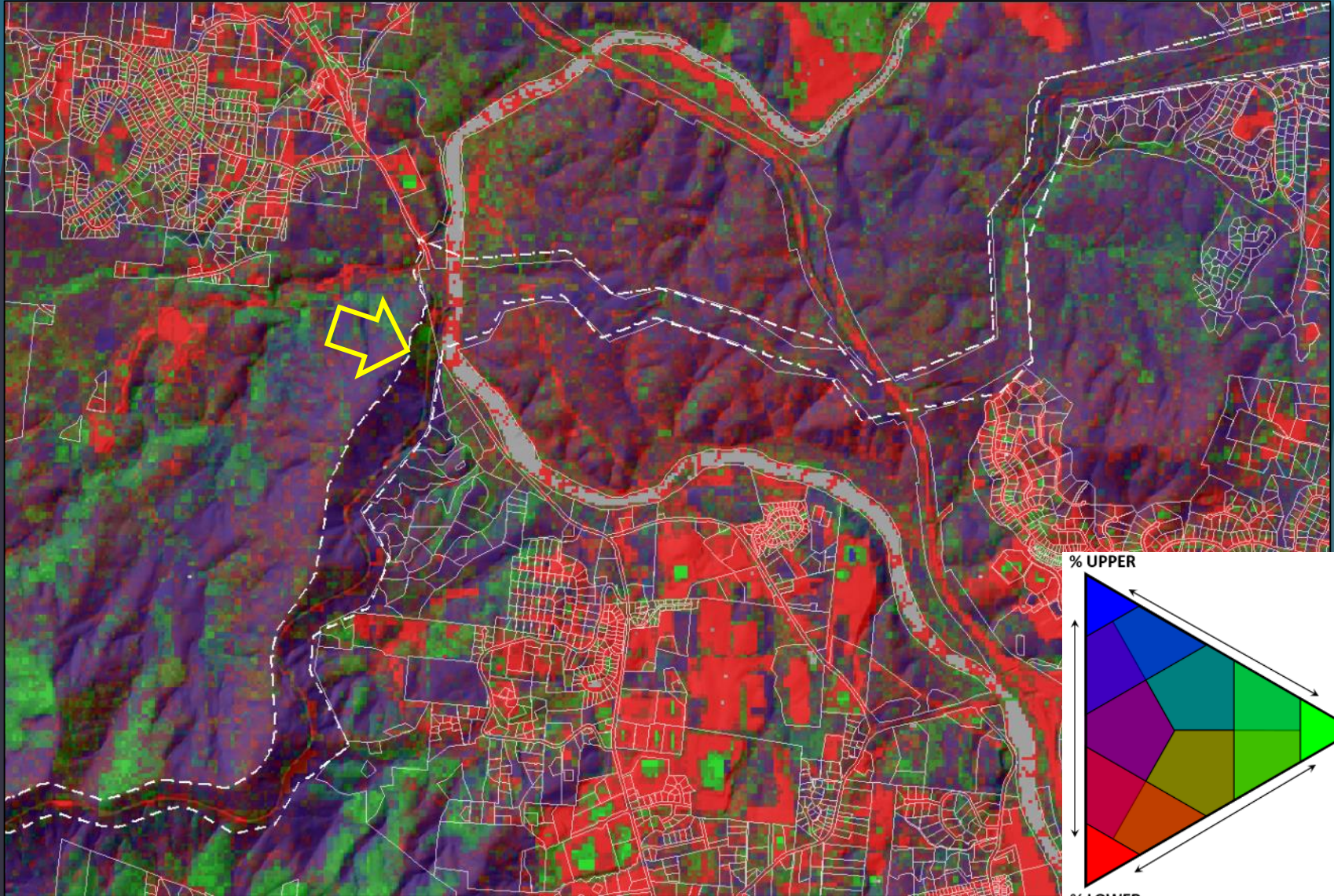
French Broad Overlook: Structural impacts at the Wildland-Urban Interface (WUI)



Edge effects along the Blue Ridge Parkway

French Broad Overlook: Structural impacts at the Wildland-Urban Interface (WUI)

STRUCTURAL CLASSIFICATION



Summary

- (1) Across North Carolina's Appalachians, vegetation height is predominantly explained by elevation and moisture gradients, with disturbance history of local significance.
- (2) The NC Blue Ridge Parkway's forests are of lower stature than surrounding jurisdictions due to the Parkway's preference for higher and dry slopes. This "niche" may present different management challenges and opportunities.
- (3) Casual inspection of the Parkway's edge effects using both max canopy and the full classification finds complex and ambiguous patterns. While hard roadside edges are common, the Parkway's natural structure is highly variable, and this nuances impacts along the Parkway's course.

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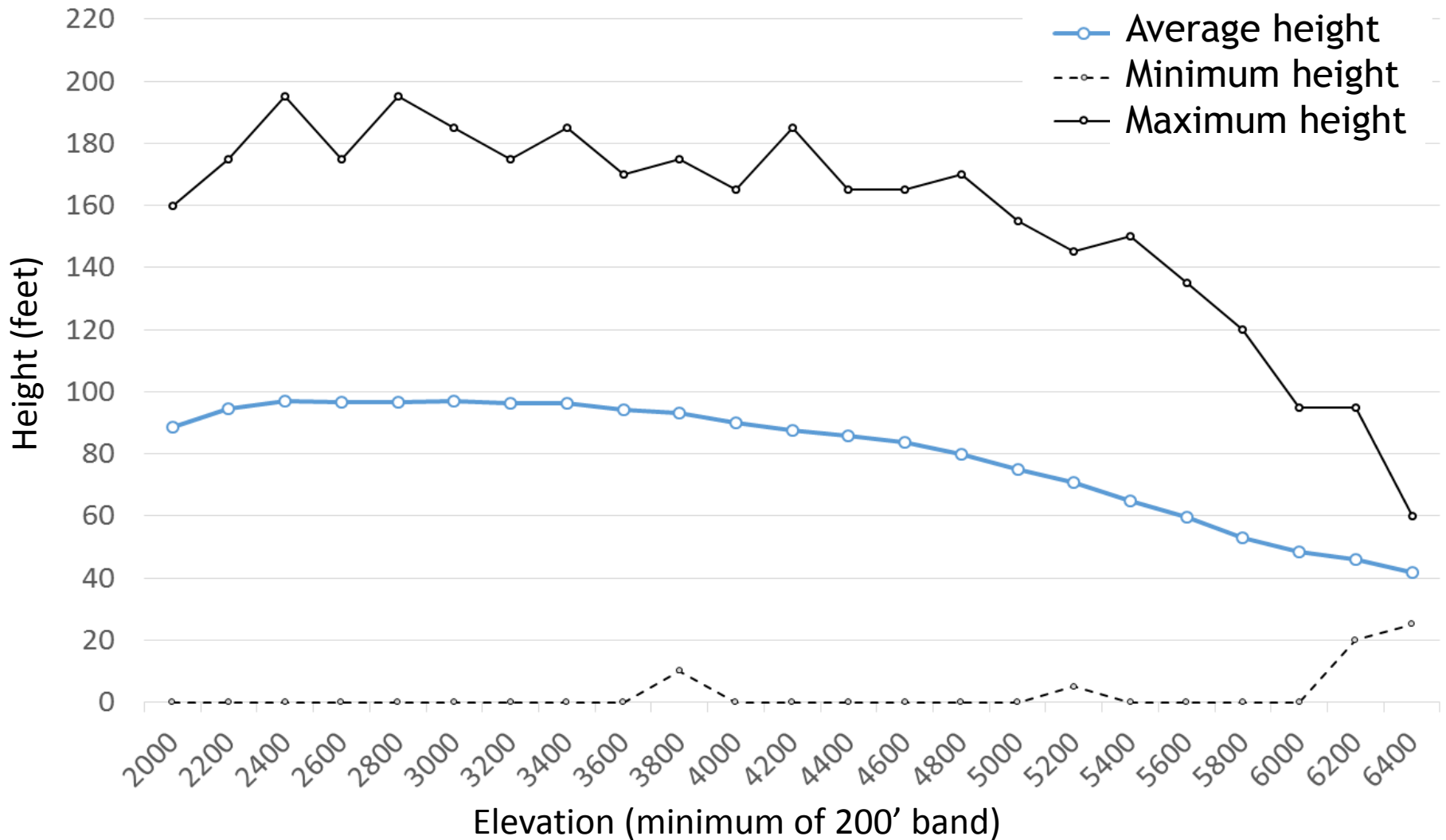
Steven P Norman (US Forest Service)
stevenorman@fs.fed.us

Thank You



Change in vegetation height by elevation

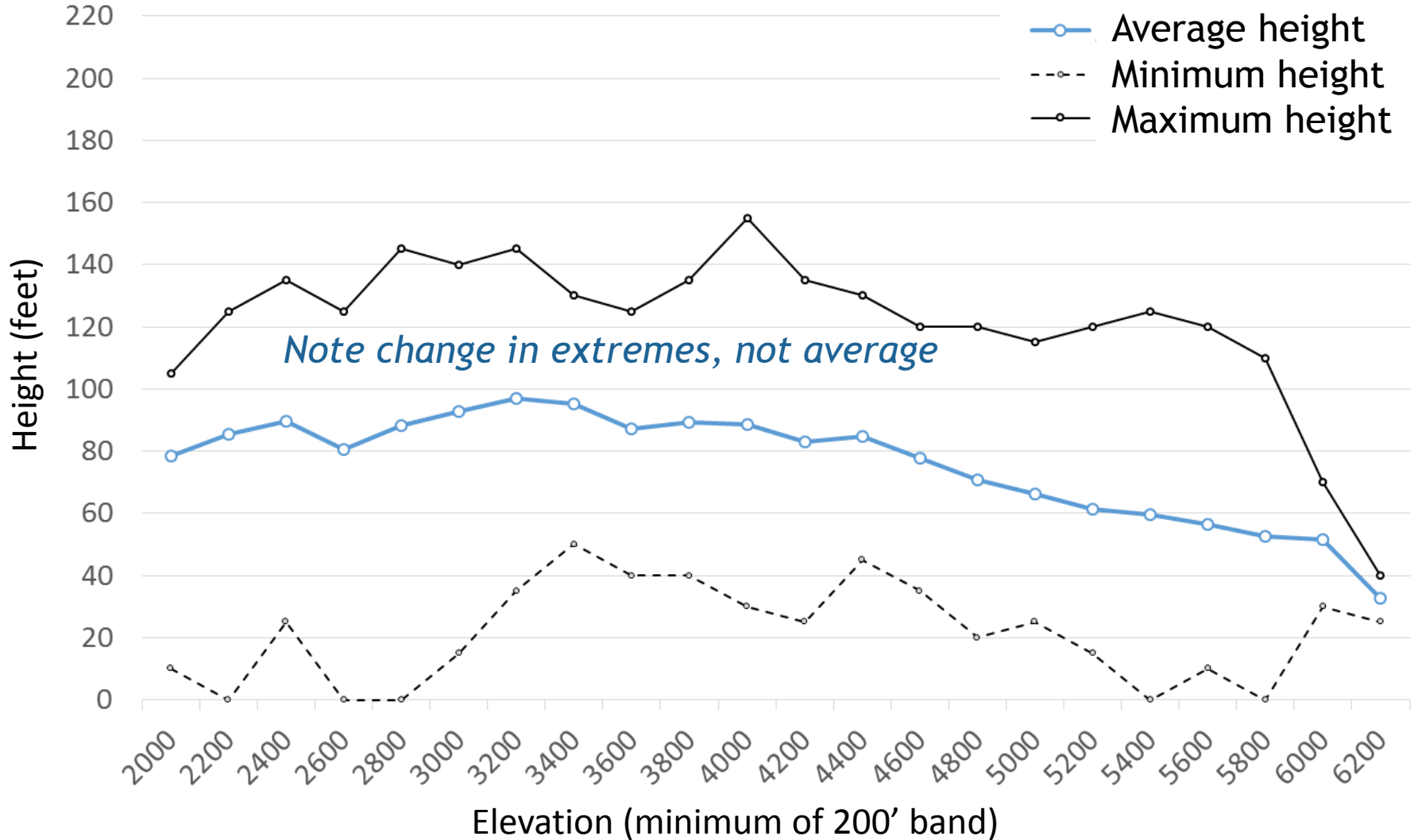
Regional relationship across all public lands



N=84,773 random points

Change in vegetation height by elevation

Blue Ridge Parkway relationship only



N=1,274 random points