Visualizing Spruce in a GIS

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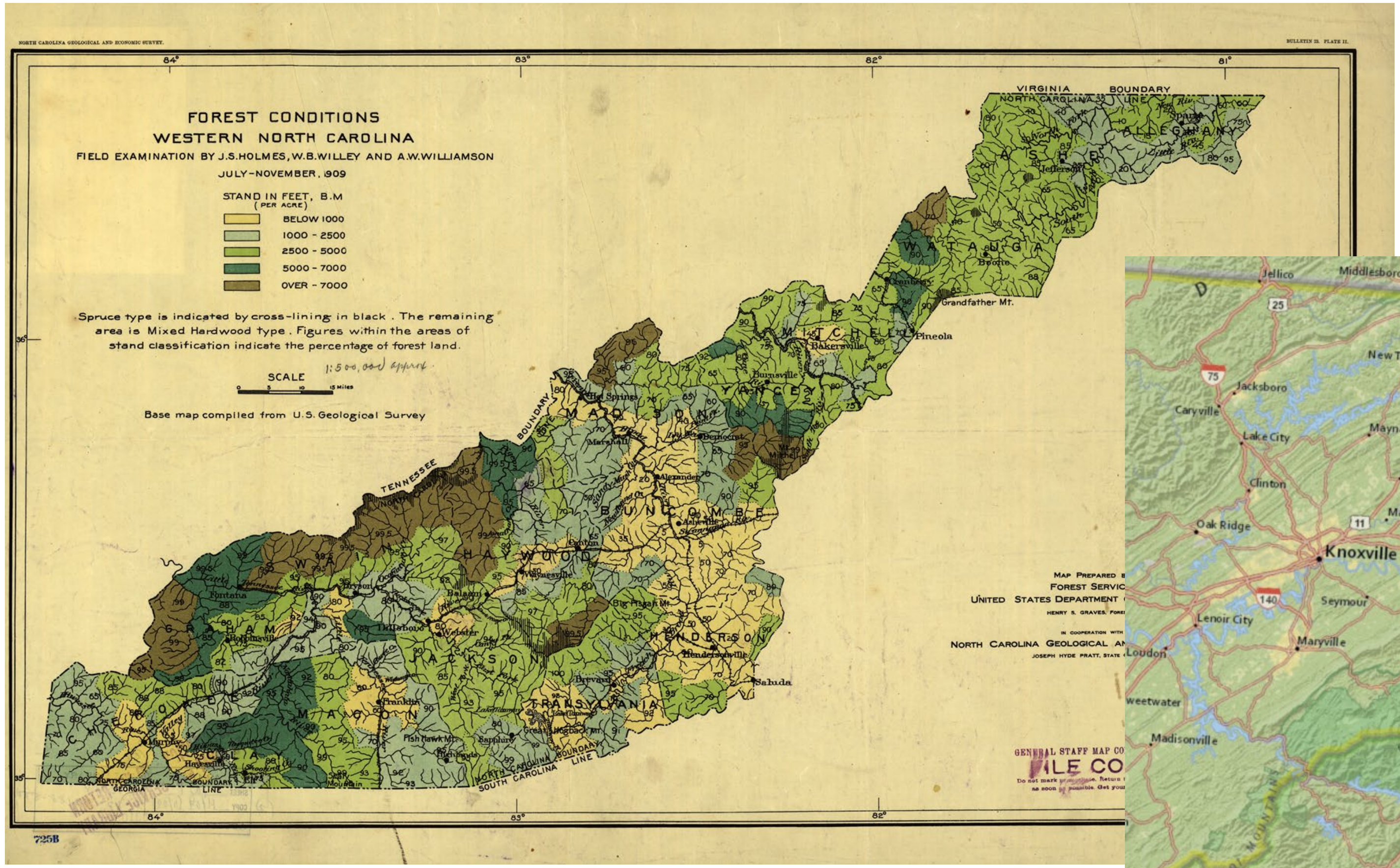
Existing Spruce Datasets

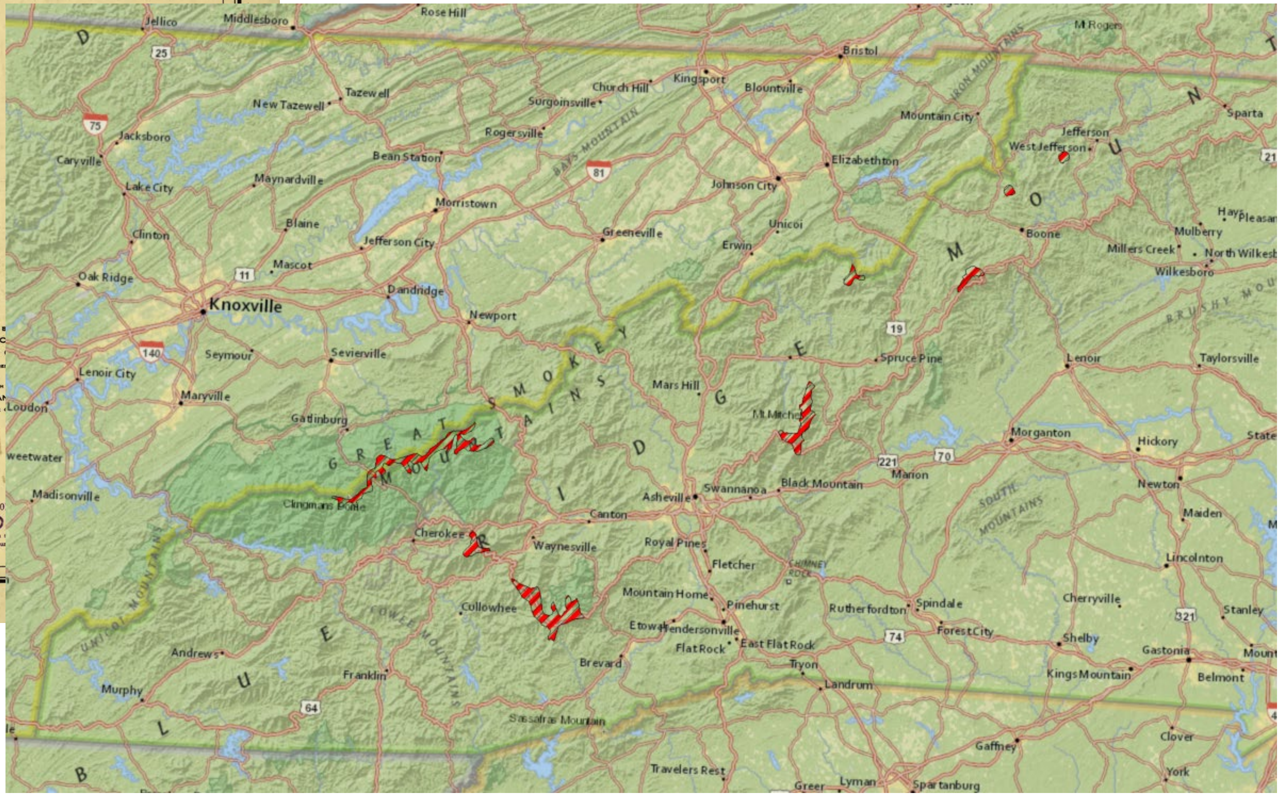
- Pre-Digital Data
  - Holmes et al. 1909
  - Pyle and Schafale 1985
  - Dull et al. 1988
- Digital Datasets
  - SAMAB Southern Appalachian Assessment 1996
  - USFS Ecological Zones
  - GAP Landcover datasets
    - USGS GAP – 2011
    - SEGAP – 2001 and 2011
    - NCGAP
  - SASRI Spruce Units 2016
  - SASRI Spruce Restoration Prioritization

Holmes et al. 1909

- Map showing forest conditions in Western North Carolina circa 1909
  - Map accompanied a forest service report
    - Logging including forest response to it
    - Fire
    - Railroads
- Extent exclusive to Western North Carolina
- Spruce-Fir
  - Single class

Holmes et al. 1909 – Forest Conditions, WNC





Pyle and Schafale 1985

- Map showing forest disturbance history in a portion of the Black Mountains and Mount Rogers
  - A report to Southern Appalachian spruce-fir ecosystem assessment program
- Calculated the percent of historic disturbance each spruce restoration unit contained

Pyle and Schafale 1985

FIGURE 1

DISTURBANCE HISTORY OF THE SPRUCE-FIR ZONE OF MT. ROGERS NATIONAL RECREATION AREA

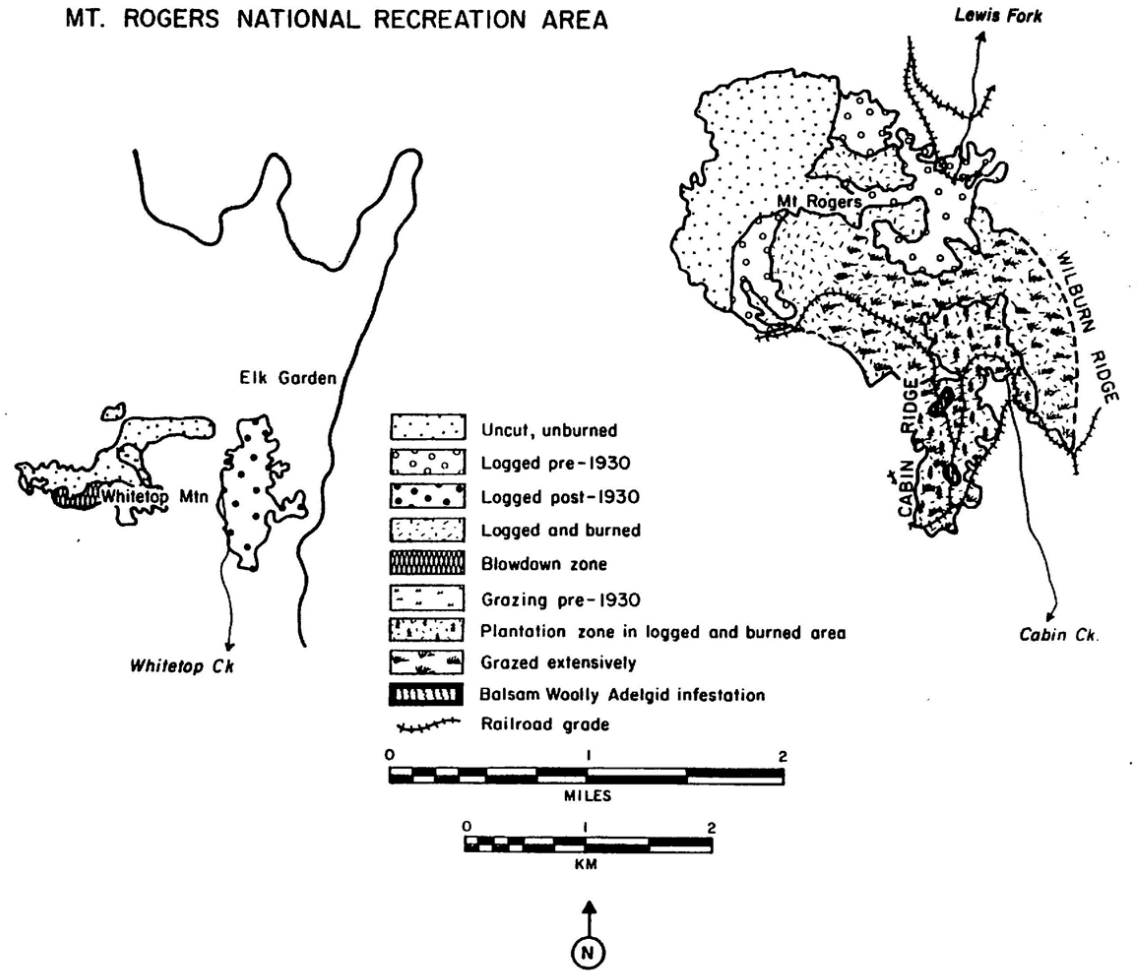


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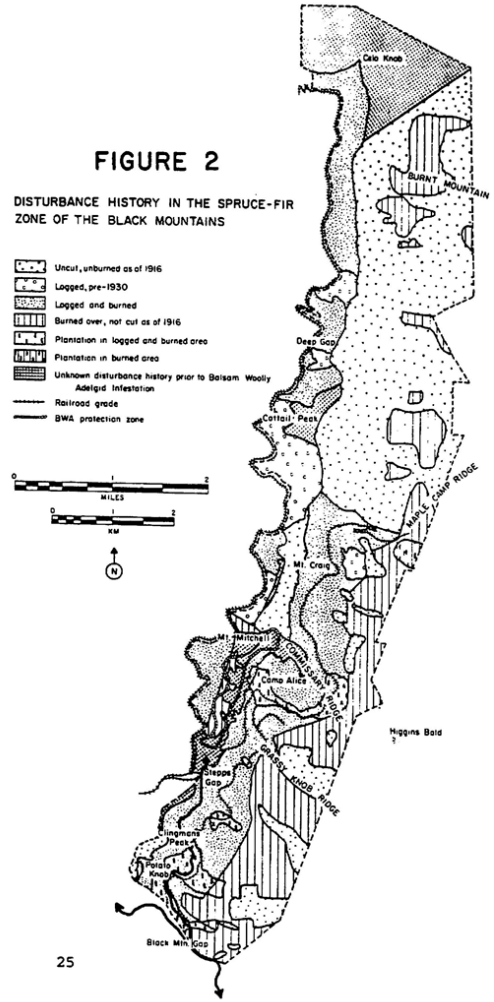
FIGURE 2

DISTURBANCE HISTORY IN THE SPRUCE-FIR ZONE OF THE BLACK MOUNTAINS



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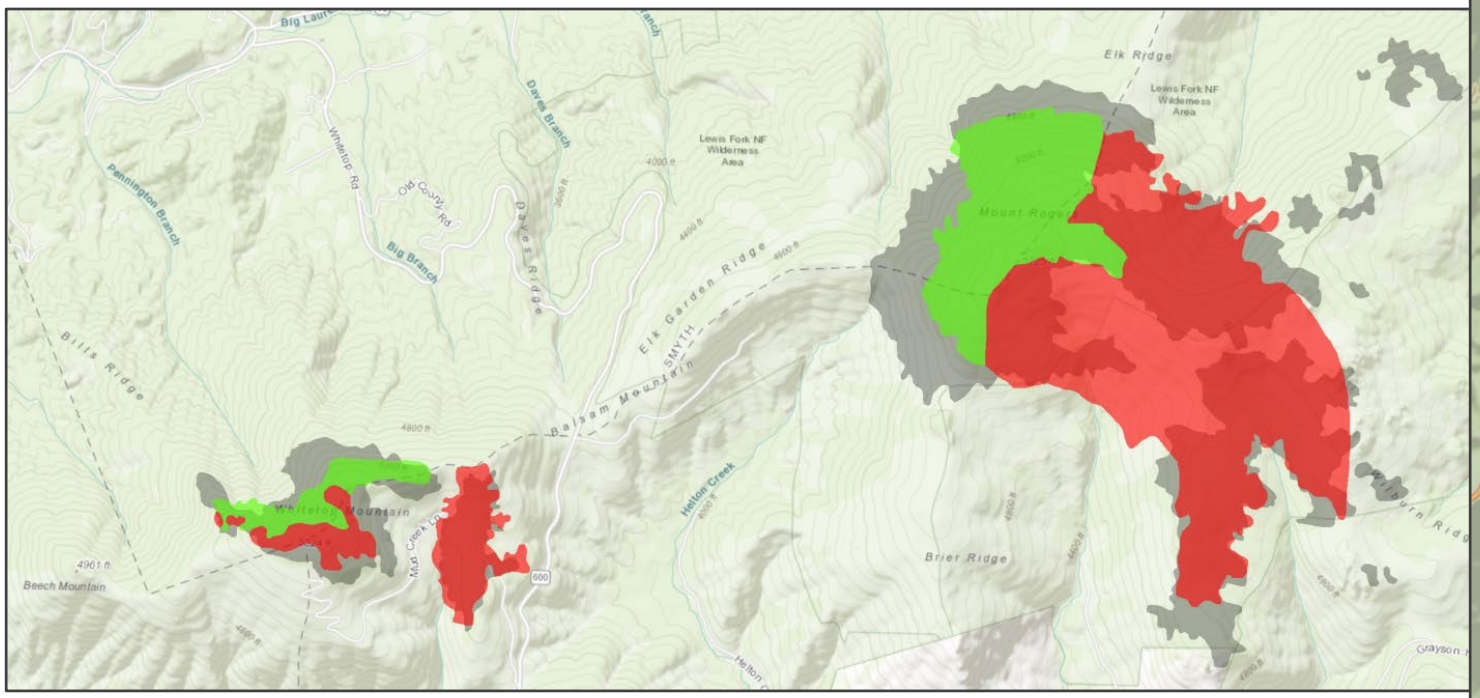
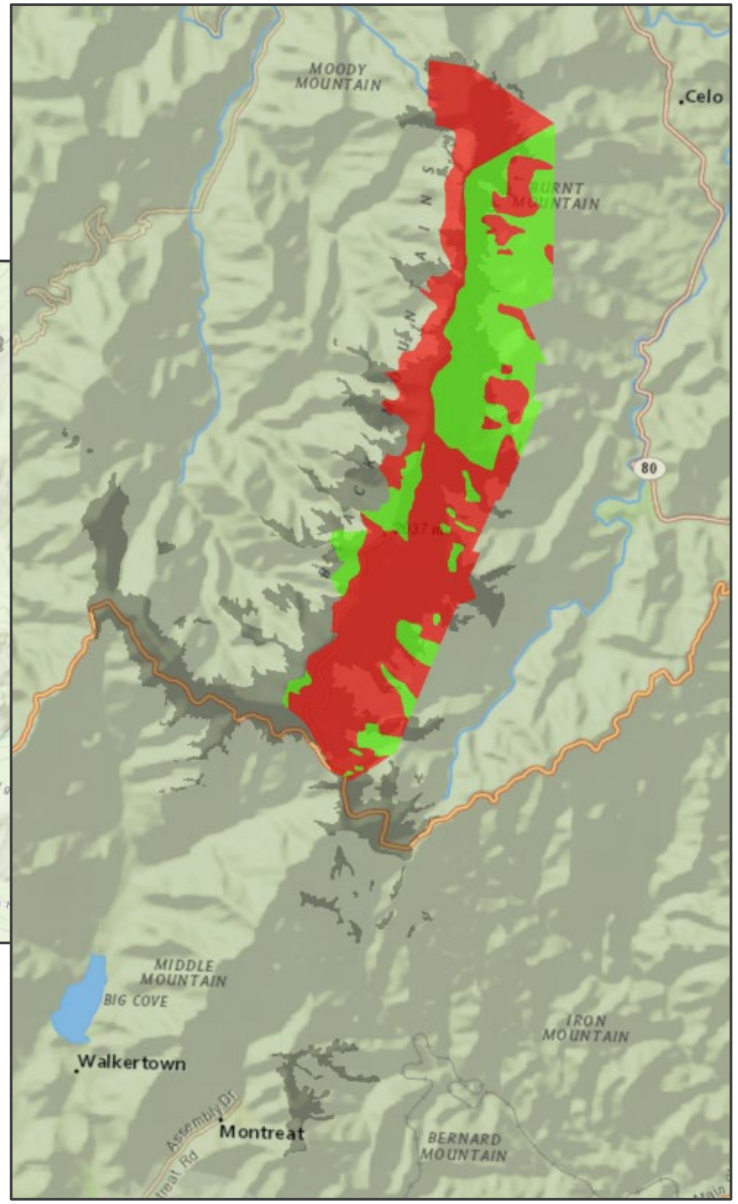
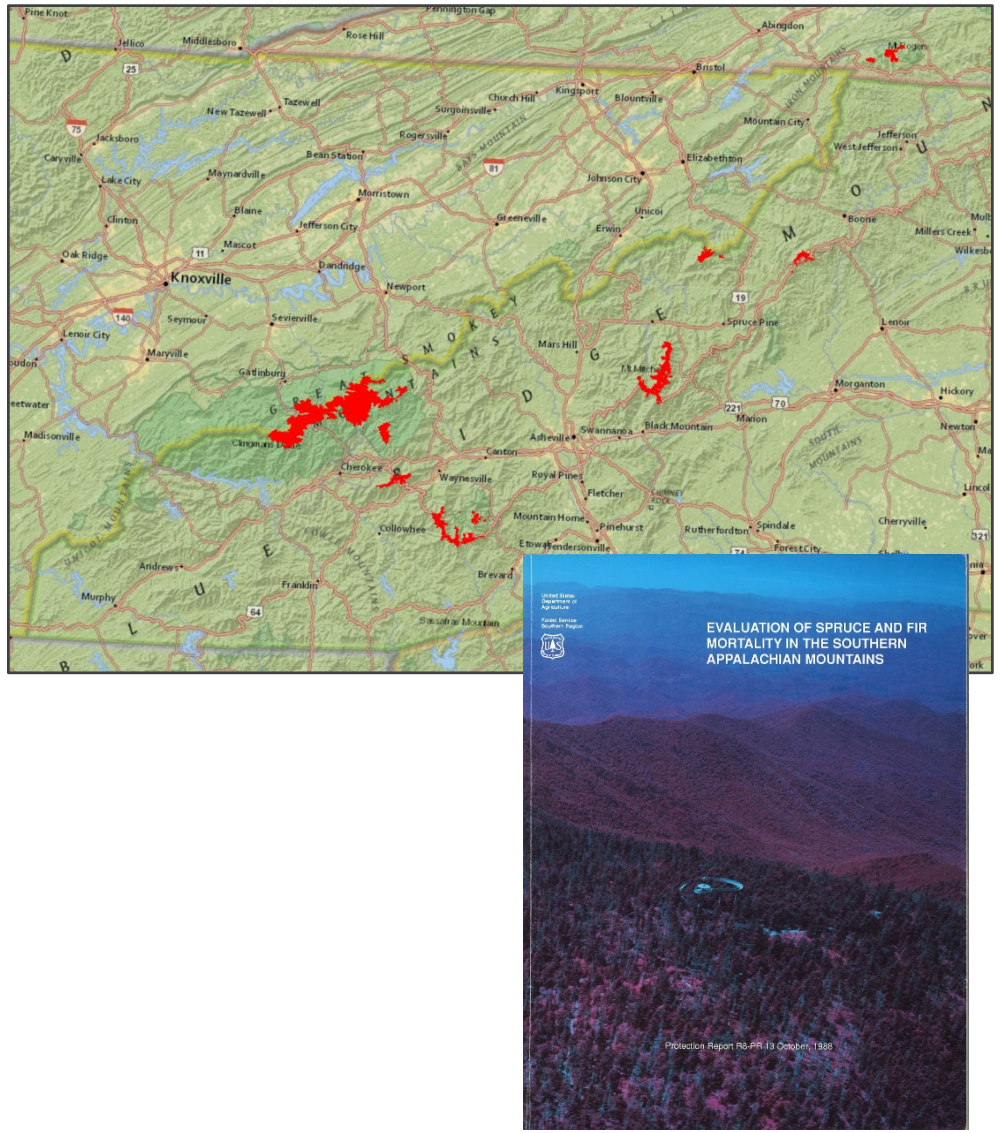
Pyle and Schafale 1985





Dull et al. 1988

- Forest Service report - Evaluation of spruce and fir mortality in the Southern Appalachians
  - Black Mtns
  - Great Smoky Mountains NP
  - Roan Mountain
  - Balsam Mtns
  - Grandfather Mountain
  - Mount Rogers and White Top Mountain



Dull et al. 1988

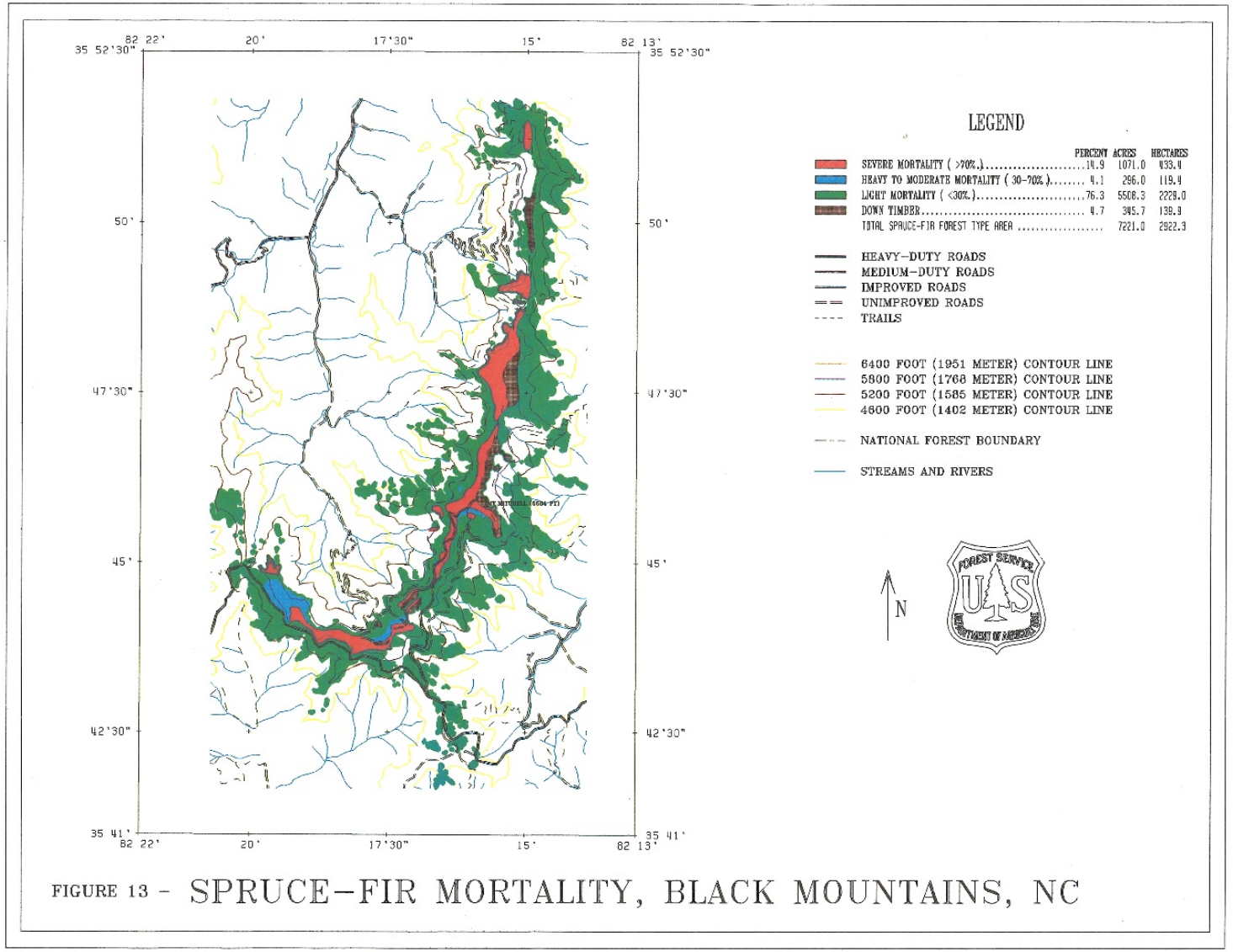
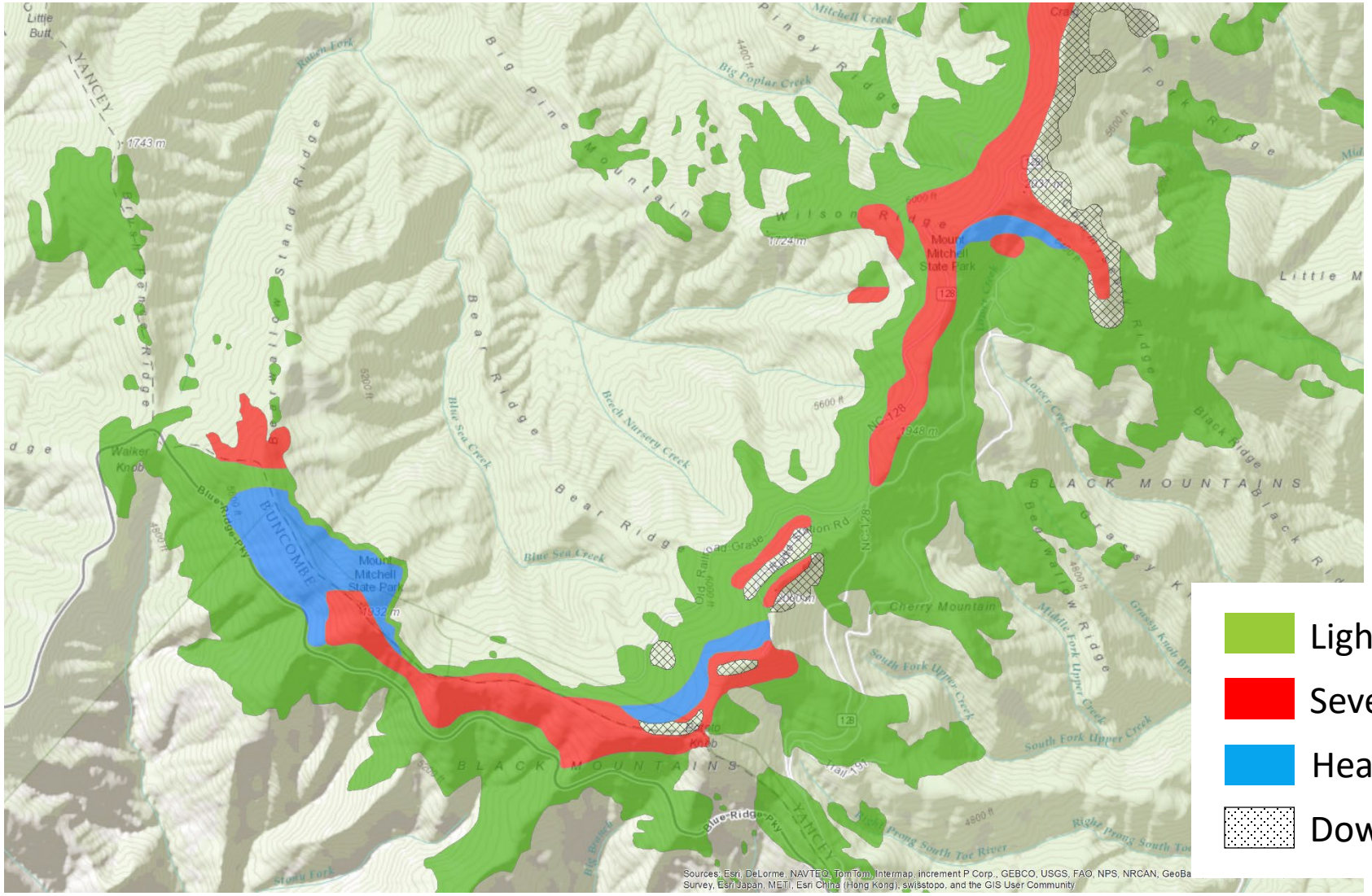


FIGURE 13 - SPRUCE-FIR MORTALITY, BLACK MOUNTAINS, NC

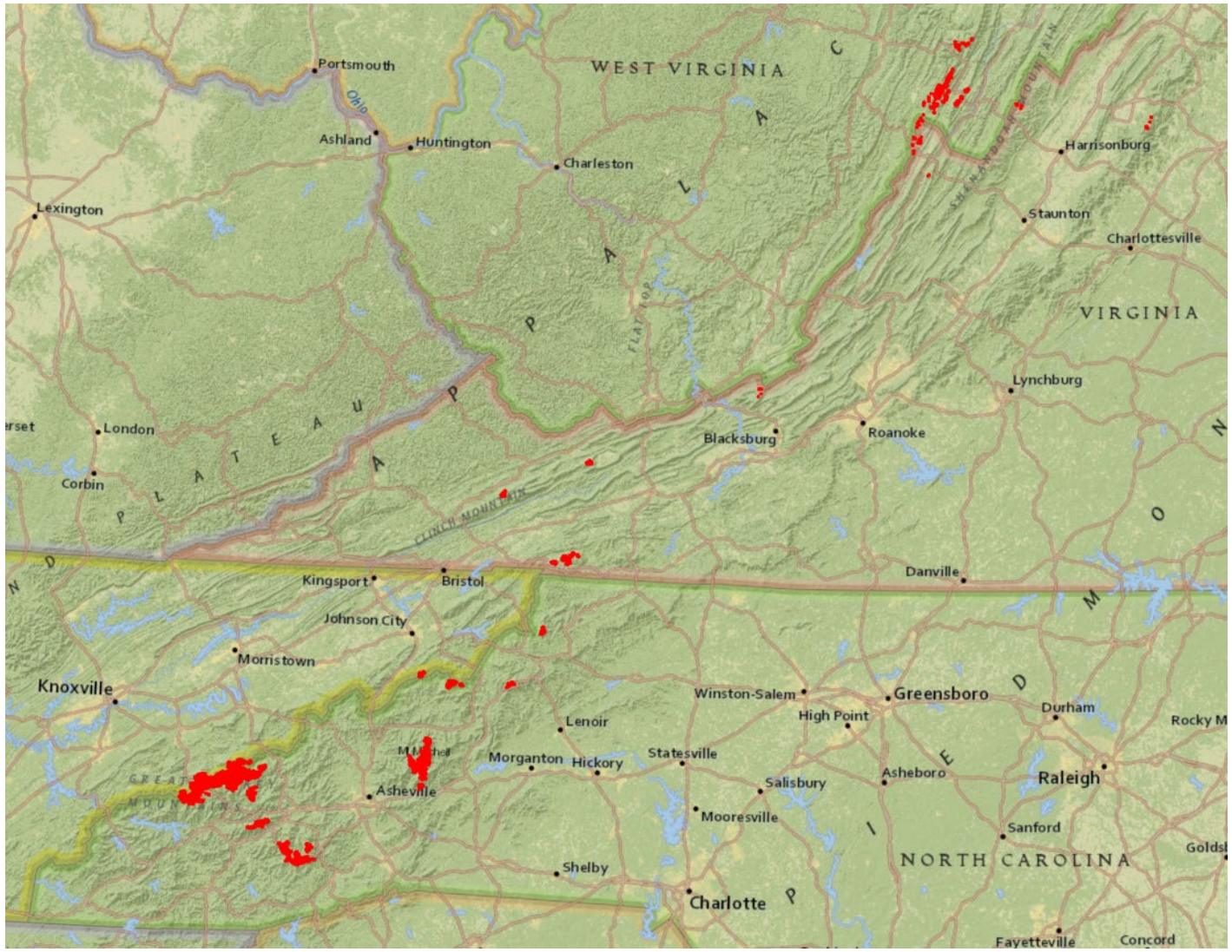
Dull et al. 1988



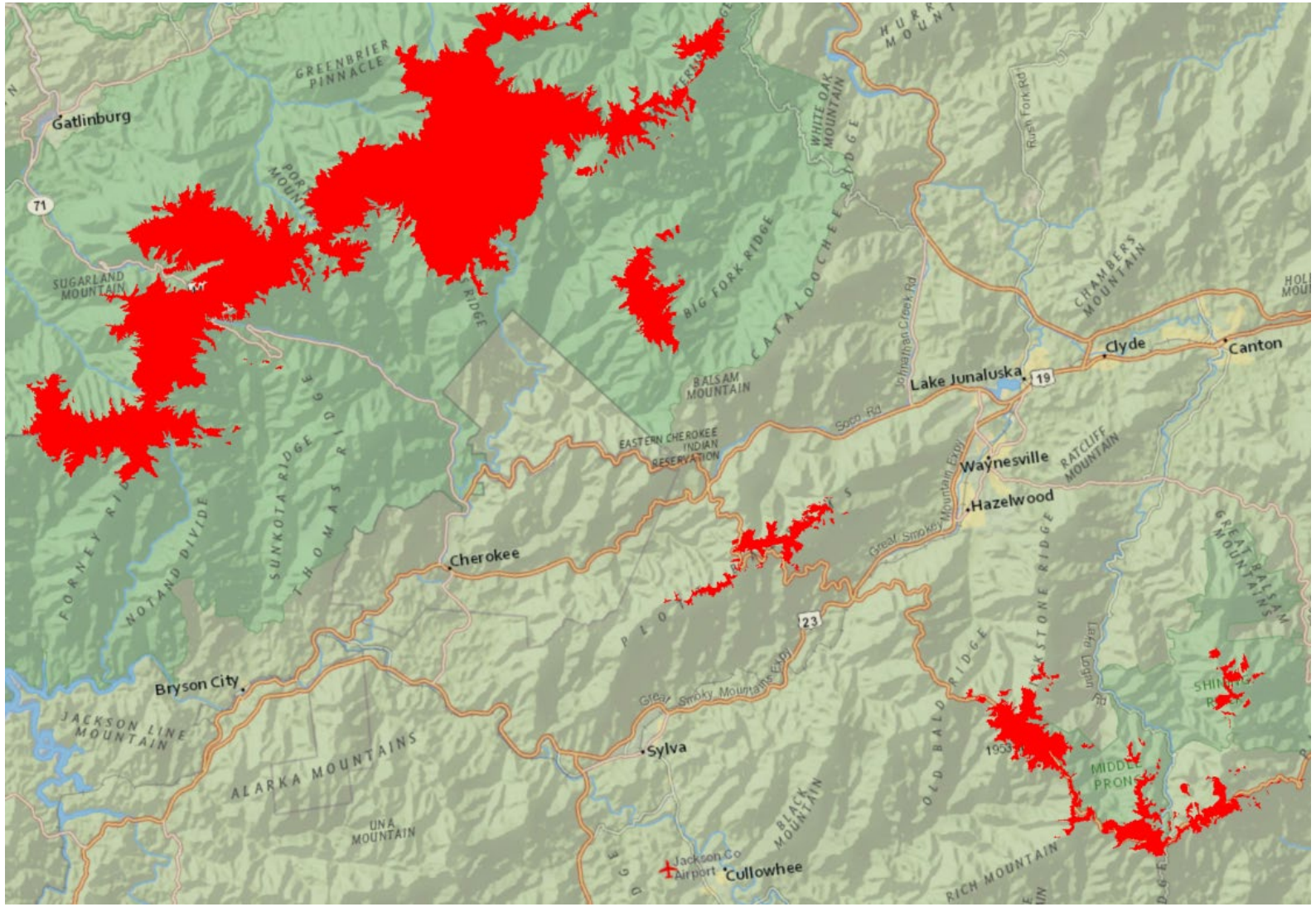
SAMAB Southern Appalachian Assessment 1996

- Southern Appalachian Extent
  - Maybe just areas in and around National Forests
- Coverage derived from delineations of photointerpretation of 1:24,000 color infrared photography. (Photography - 1985)
  - USDA Forest Service data and TVA data were appended to combine a complete coverage for the Great Smoky Mountains National Park, Cherokee National Forest, Jefferson National Forest, and Shenandoah National Park
- Single Spruce-Fir class

So. App. Assessment 1996



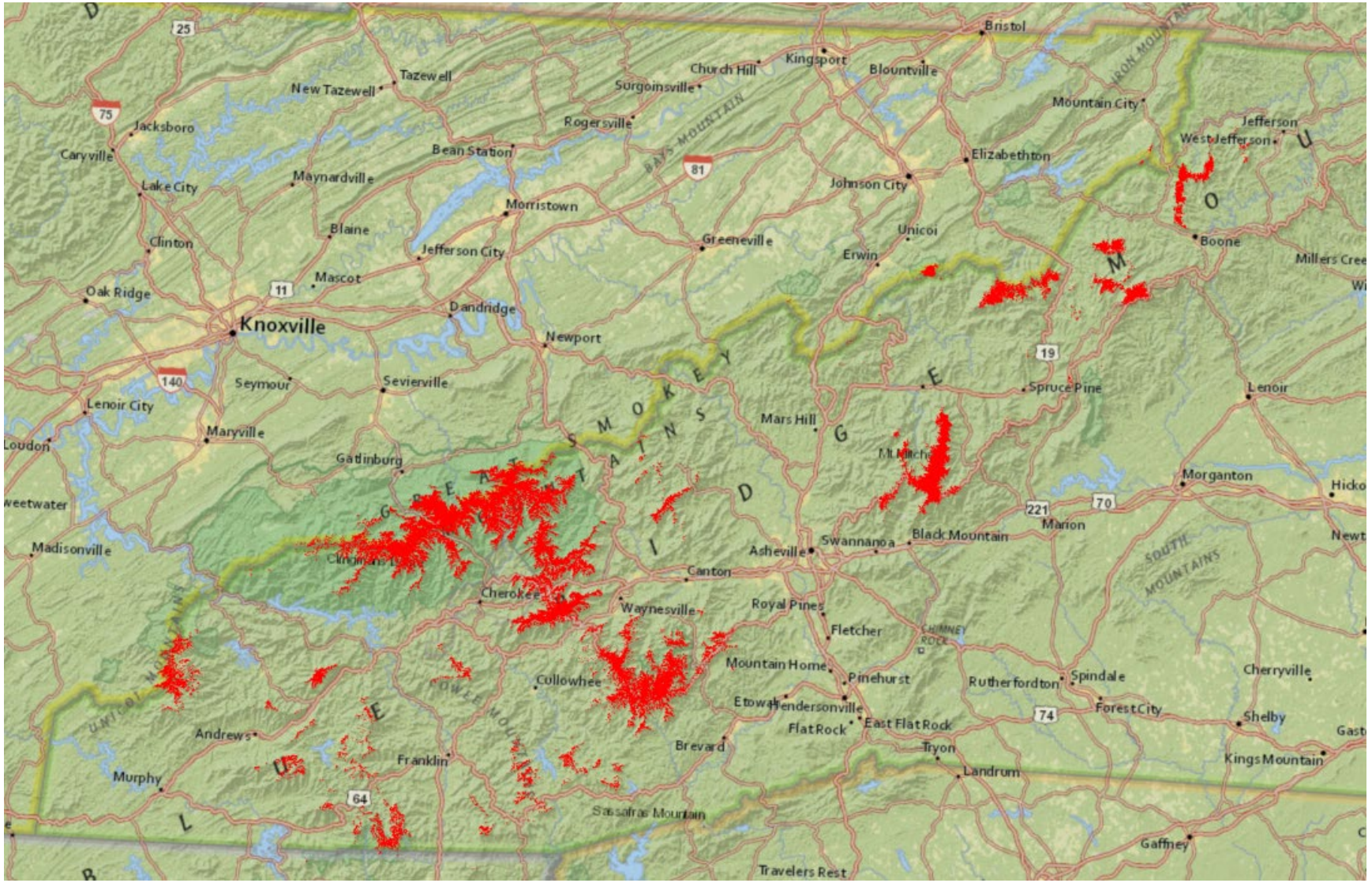
So. App. Assessment 1996



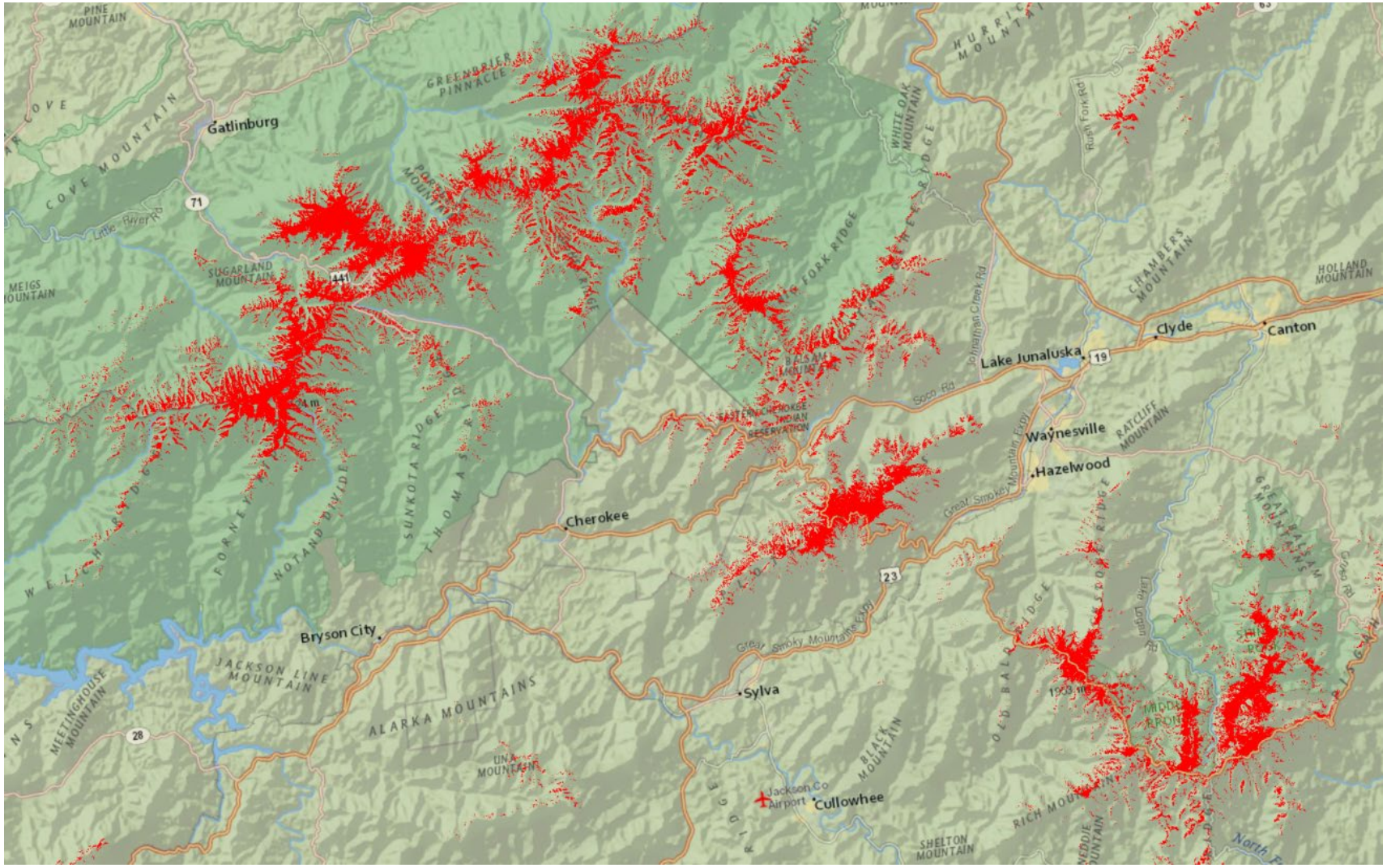
USFS Ecological Zones

- Southern Appalachian Extent
- Predicted distribution of 11 principal forested ecological zones in the Southern Appalachian Mountains. The extent of ecosystems was predicted by mathematical models based on environmental variables (climate, geologic, topographic, and others)
- 3 approximations, most recent 2011

Ecological Zones



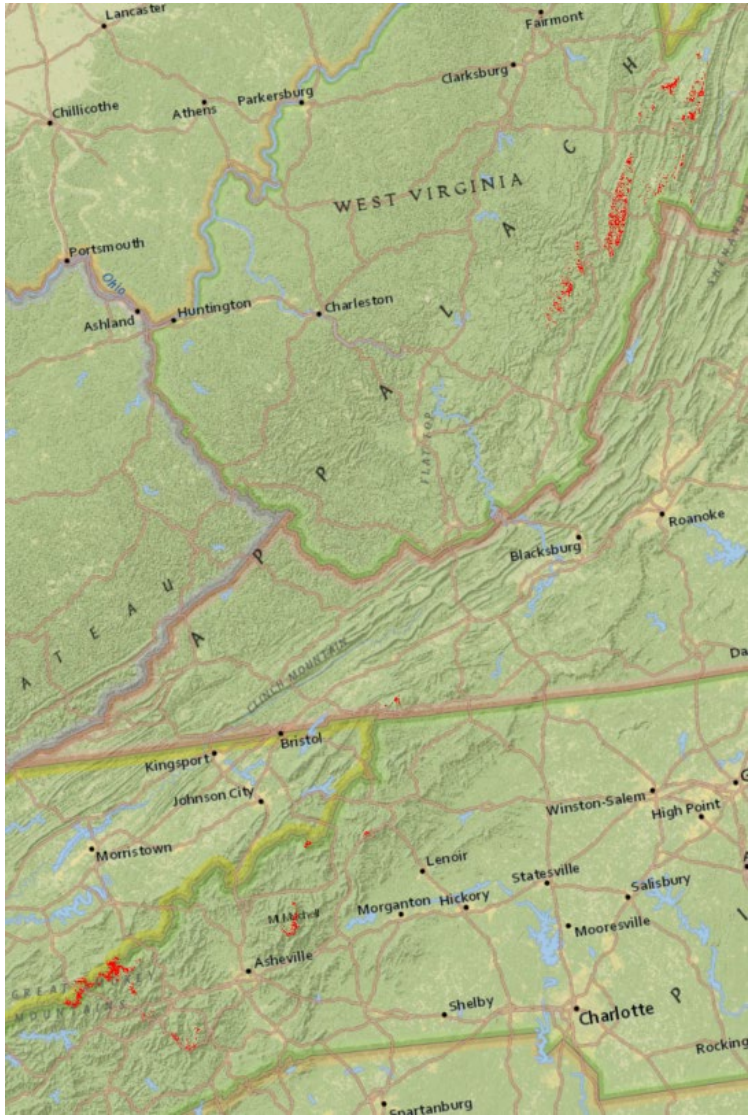
Ecological Zones

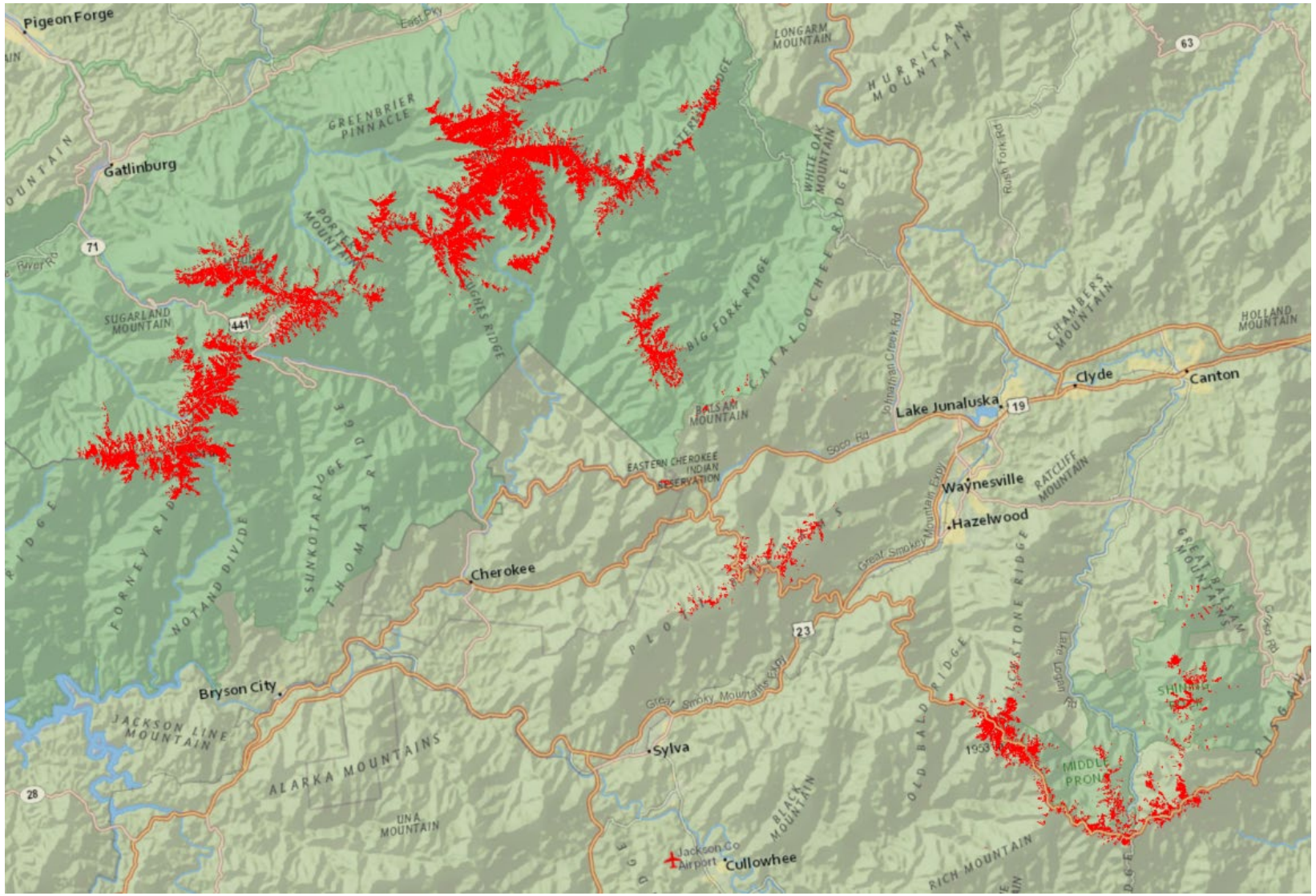


GAP Landcover datasets

- North Carolina GAP
  - Landsat thematic mapper (TM) imagery acquired in 1991 and 1992
  - North Carolina Extent
- Southeast GAP Landcover
  - Landsat thematic mapper (TM) imagery acquired in 1999 and 2001
  - North Carolina and Virginia Extent
- USGS National GAP Landcover – 2011
  - Seamless dataset for lower 48 states
  - North Carolina, Virginia, West Virginia

National GAP 2011



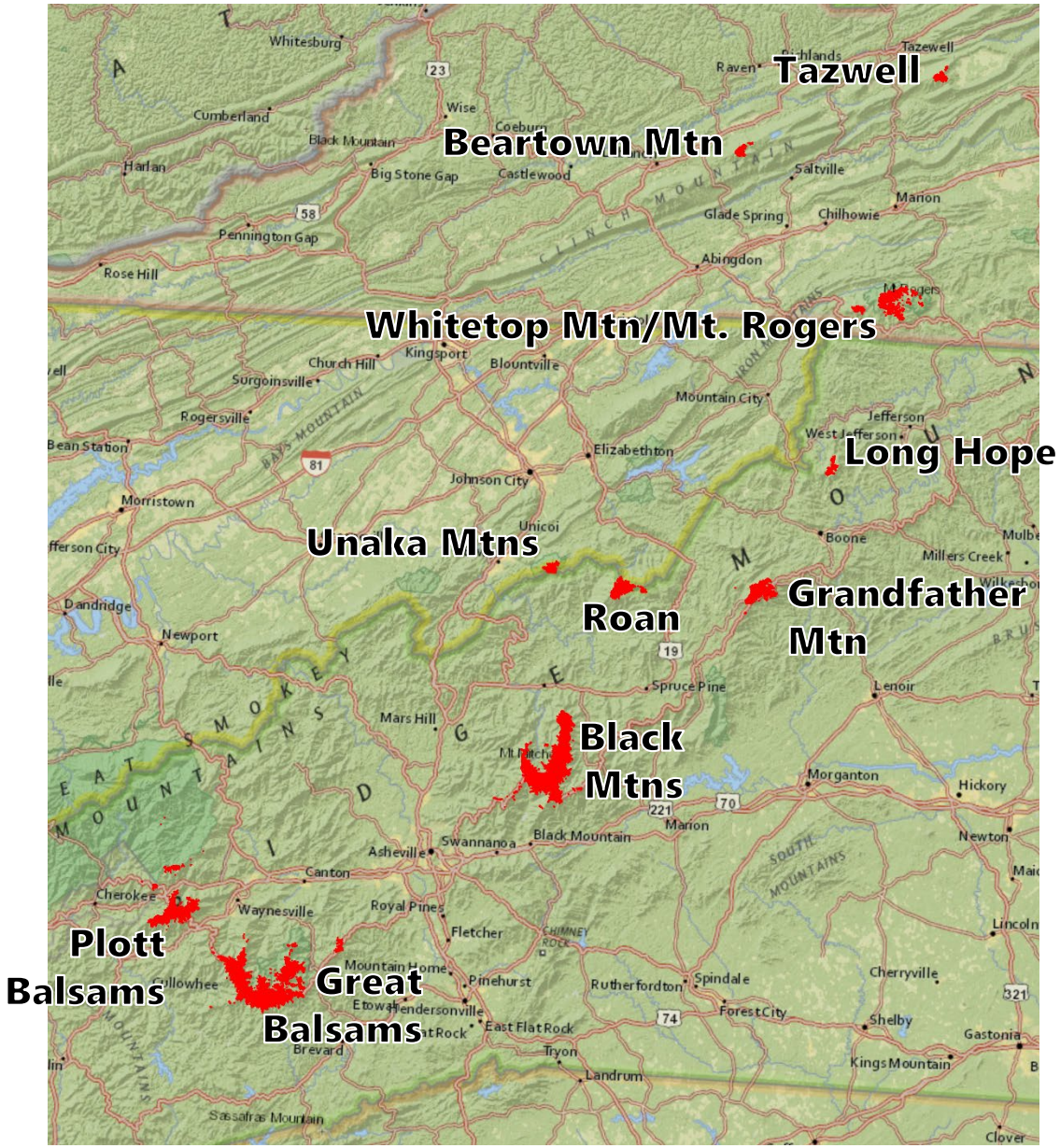


SASRI Spruce Units

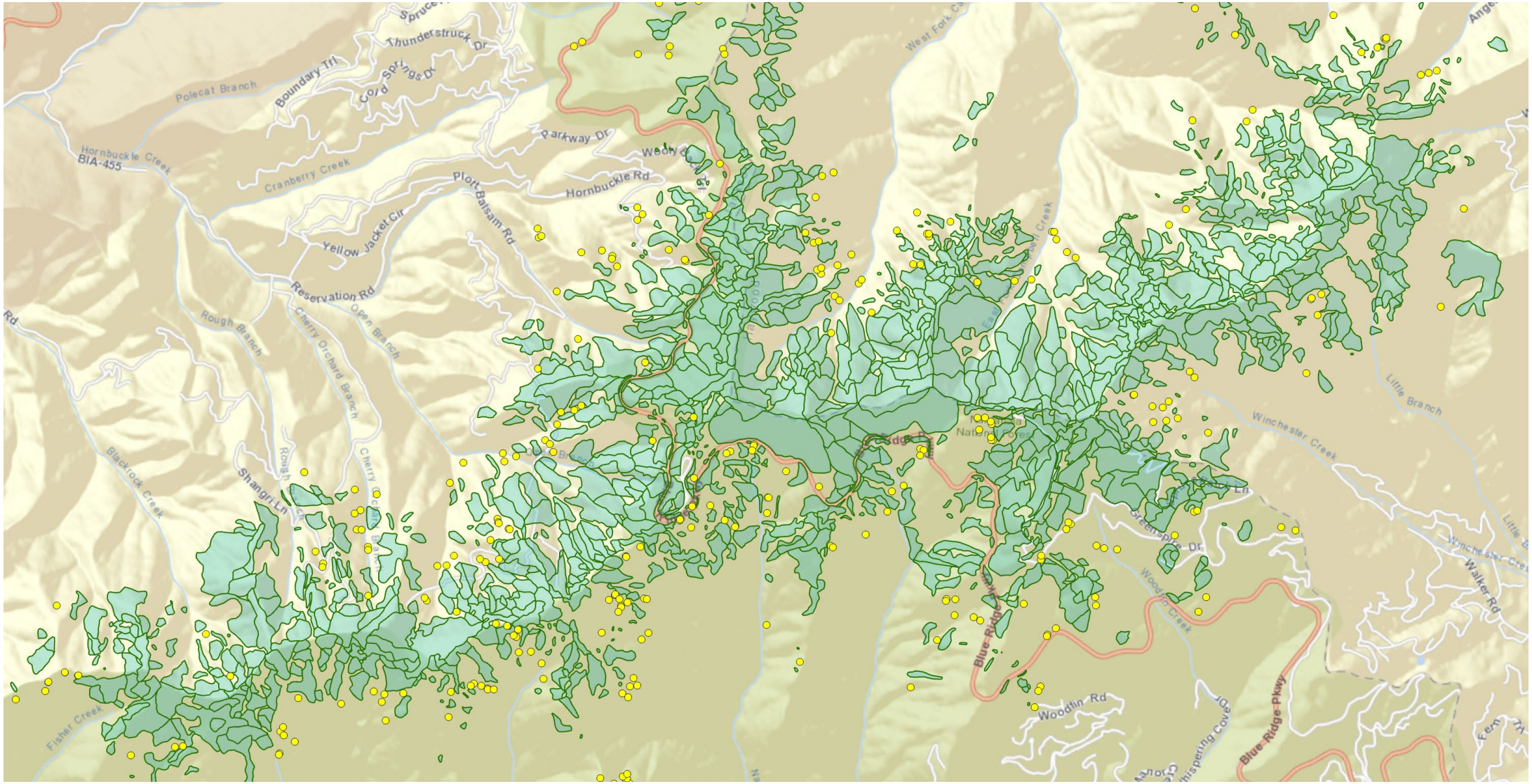
- Polygon data drawn around current spruce “patches” based on overstory and understory density of spruce
  - Digitized from aerial imagery
- Entire So. Appalachian coverage except GSMNP
- Attribute Data:
  - Spruce overstory class and structure
  - Overstory condition and composition
  - Hemlock overstory
  - Spruce Understory
  - Non-spruce Understory

SASRI Spruce Units

- 11,174 polygons
  - Size ranged from 0.003 Ha to 95.6 Ha in size
  - Mean size was 1.2 Ha
- Additionally **7,080** point locations of individual trees were identified
  - Locales where trees were too sparse to represent a polygon.



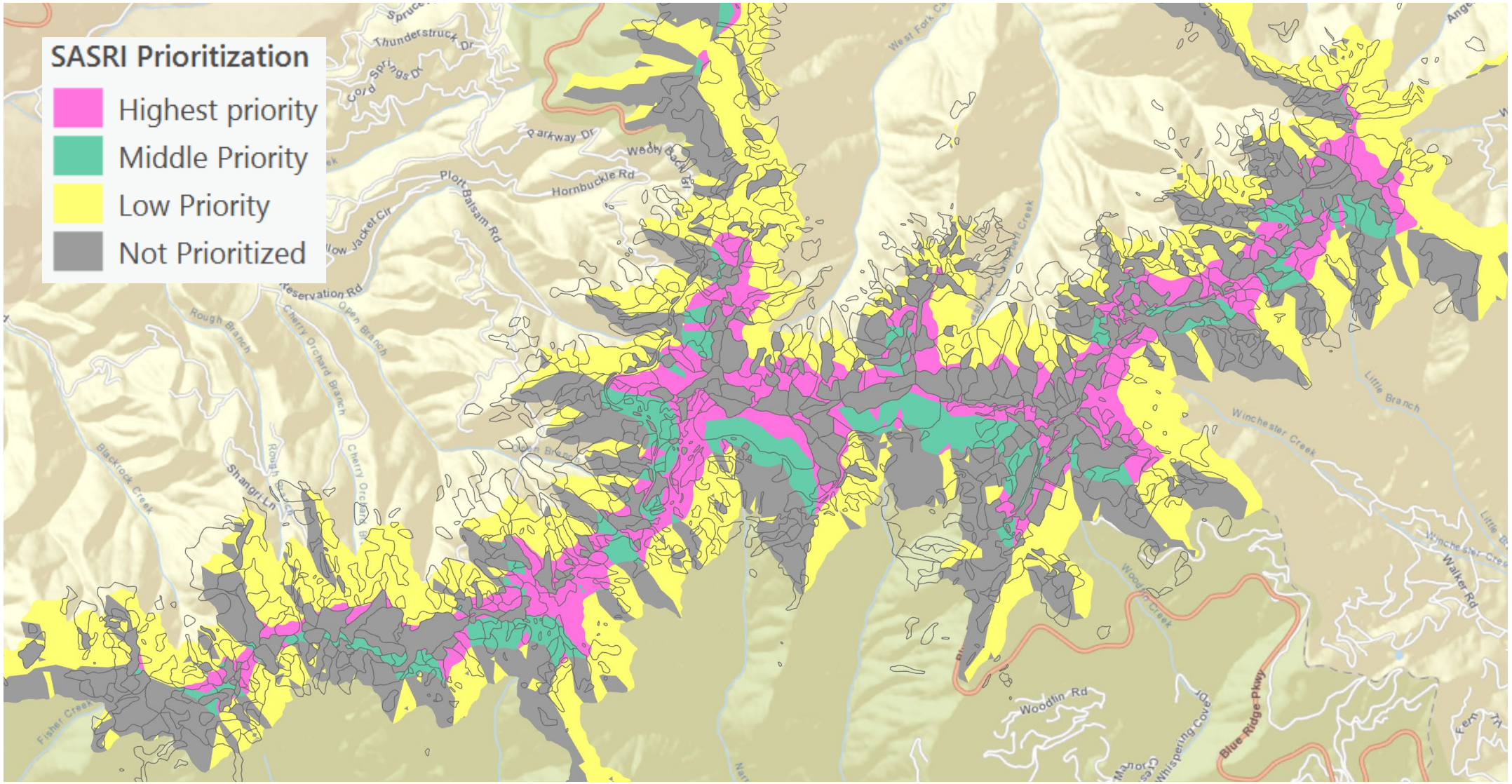
SASRI Spruce Units



SASRI Spruce Restoration Prioritization

- Prioritized areas based upon **Elevation, Aspect, Spruce Density, and Disturbance History**
- Southern Appalachian extent
- Prioritization considerations
  - Higher elevations given higher priority
  - Mesic aspects given higher priority
  - Areas known to have been logged given higher priority
  - Areas with less than 25% spruce density

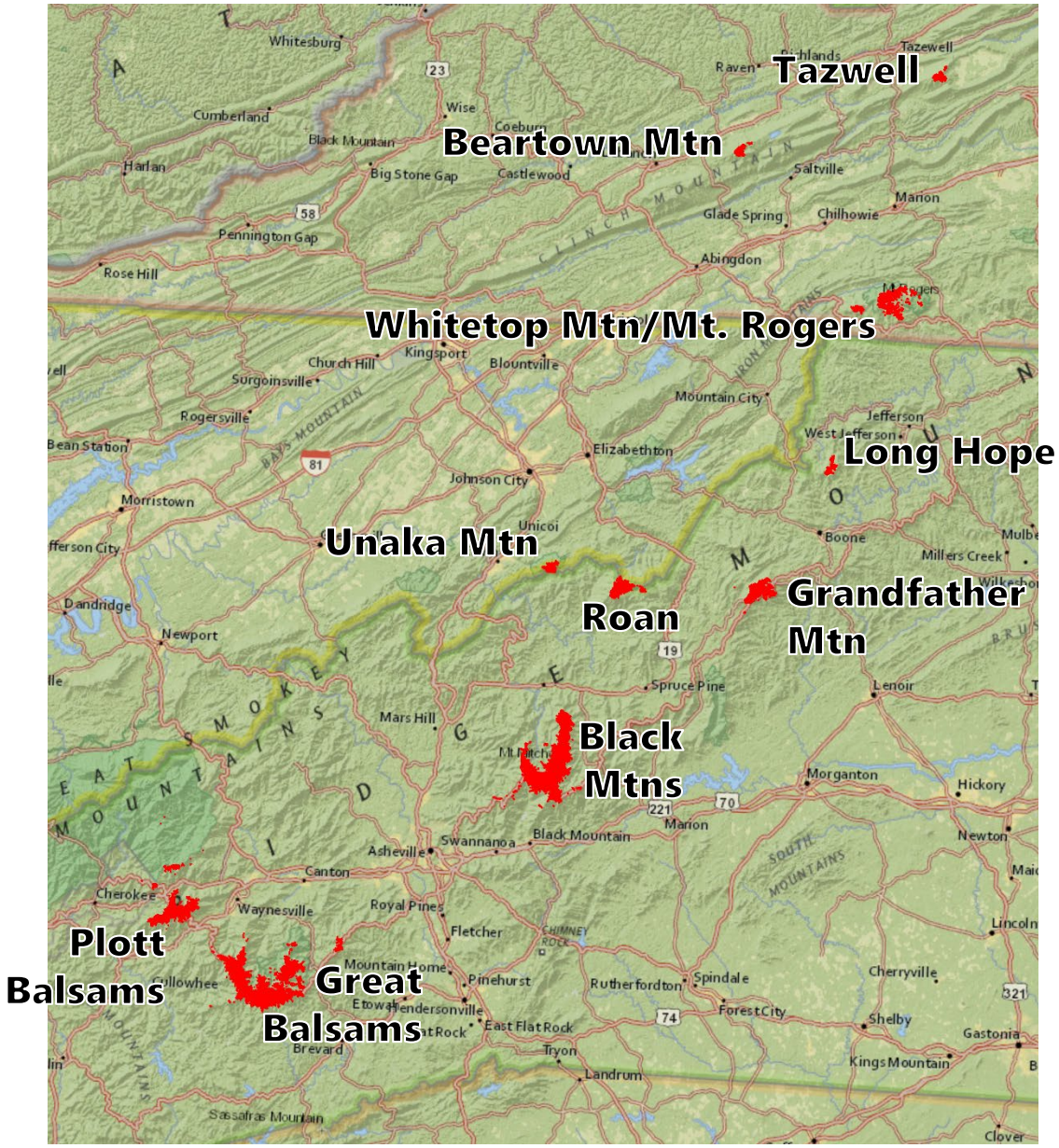
SASRI Spruce Units



Spruce Unit Accuracy Assessment

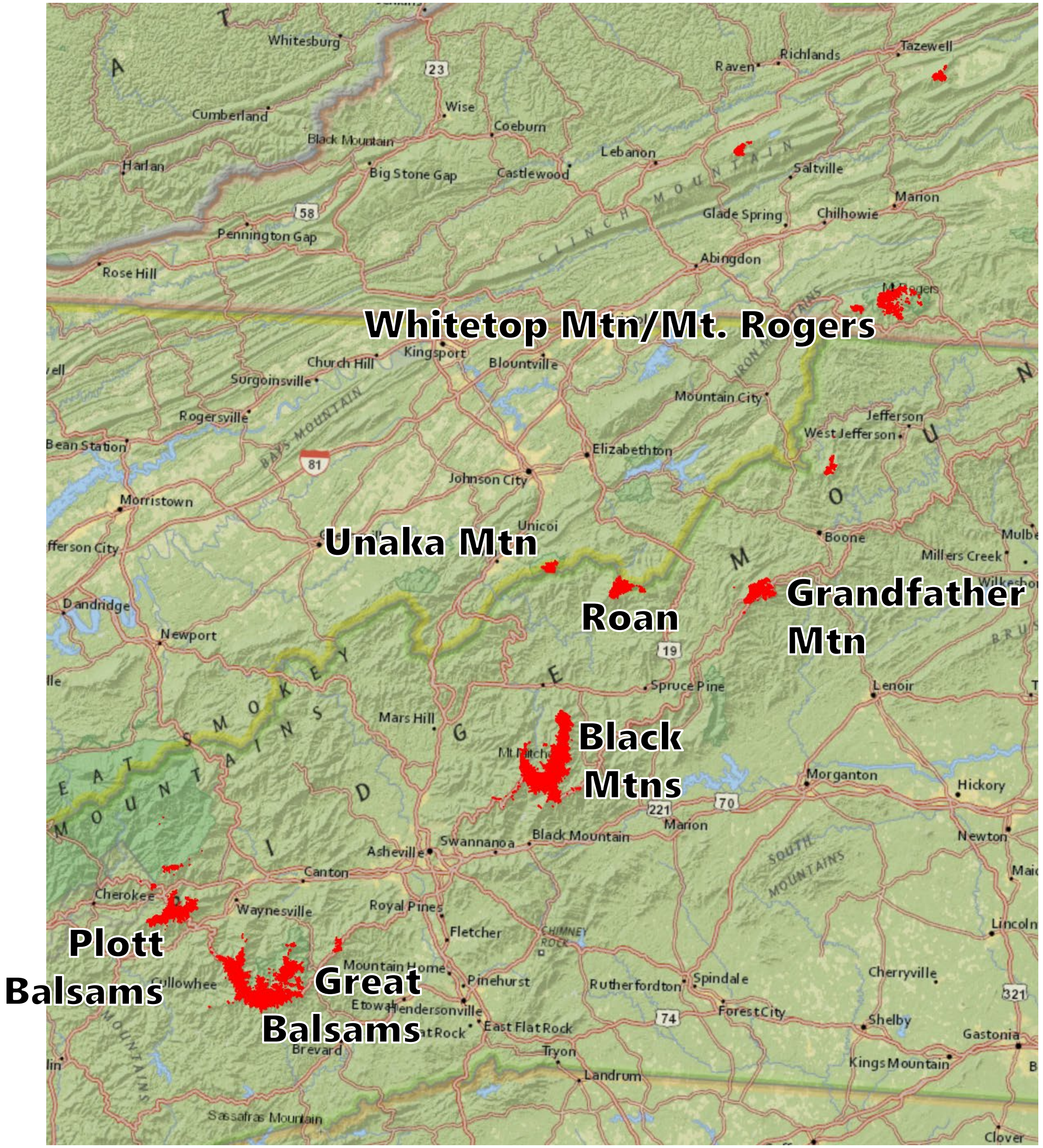
Accuracy Assessment

- Field collected accuracy assessment data on the Spruce Unit dataset
- Field Apps created
  - ArcGIS Collector – The map part
  - Survey123 – The data form part
- Collects point locale and attribute data on the Spruce units



Accuracy Assessment

- Collected data on:
  - Spruce Overstory Density
  - All Coniferous Overstory Density
  - Understory Spruce Presence
  - Hemlock Present
  - Fir Present
  - Overstory Tree Composition
  - Polygon Correct



Results – Spruce Overstory

All Points

	No	One Off	Yes
Count	55	126	170
Percent	15.7%	35.9%	48.4%

n = 351

Mark Collected

	No	One Off	Yes
Count	26	62	117
Percent	12.7%	30.2	57.1%

n = 205

Results – Spruce Overstory - Split

Black Mountain n = 80

	No	One Off	Yes
Count	23	17	40
Percent	28.8%	21.3%	50%

Grandfather Mtn n = 27

	No	One Off	Yes
Count	3	16	8
Percent	11.1%	59.3%	29.6%

Great Balsams n = 56

	No	One Off	Yes
Count	2	20	34
Percent	3.6%	35.7%	60.7%

Plott Balsams n = 48

	No	One Off	Yes
Count	3	21	24
Percent	6.3%	43.8%	50%

Results – Spruce Overstory - Split

Roan Mountain n = 46

	No	One Off	Yes
Count	16	21	9
Percent	34.8%	45.7%	19.6%

Unaka Mtn n = 30

	No	One Off	Yes
Count	3	11	16
Percent	10%	36.7%	53.3%

Whitetop/Mt. Rogers n = 52

	No	One Off	Yes
Count	5	17	30
Percent	9.6%	32.7%	57.7%

Results – All Coniferous Overstory

		No	One Off	Yes
All Points	Count	5	53	61
	Percent	4.2%	44.5%	51.3%

n = 119

Results – Spruce Understory

All Points

	No	Yes
Count	149	202
Percent	42.5%	57.5%

n = 351

Mark Collected

	No	Yes
Count	79	126
Percent	38.5%	61.5%

n = 205

Results – Spruce Understory - Split

Black Mountain n = 80

	No	Yes
Count	33	47
Percent	21.3%	58.7%

Grandfather Mtn n = 27

	No	Yes
Count	11	16
Percent	40.7%	59.3%

Great Balsams n = 56

	No	Yes
Count	27	29
Percent	48.2%	51.8%

Plott Balsams n = 48

	No	Yes
Count	20	28
Percent	41.7%	58.3%

Results – Spruce Understory - Split

Roan Mountain n = 46

	No	Yes
Count	20	26
Percent	43.5%	56.5%

Unaka Mtn n = 30

	No	Yes
Count	12	18
Percent	40%	60%

Whitetop/Mt. Rogers n = 52

	No	Yes
Count	20	32
Percent	38.5%	61.5%

Assessment Results – Polygon Correct?

All Points

	No	Yes
Count	15	336
Percent	3.9%	96.1%

n = 351

80 – TBTA, 2 no

Mark Collected

	No	Yes
Count	6	199
Percent	2.9%	97.1%

n = 205

34 – TBTA, 1 no

Thanks!

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