

# The Flat Laurel Spruce Collaborative

Putting SASRI partners and products together to restore flying squirrel habitat

**Process** and **tools** used to identify a candidate site and to design a suitable prescription.

**Logistics** and **extras** – community involvement, education and research

Chris Kelly, Mountain Wildlife Diversity Biologist, NC Wildlife Resources Commission

# 2017 Spruce Restoration Project



**GOAL:** Restore the conifer component to improve habitat for Carolina Northern Flying Squirrel by planting Red Spruce in an area altered by historic logging and wildfires.

# Problem and need:

## Northern flying squirrel

Most of their habitat was logged. Some burned.

The **composition** of the forest *changed* after logging and fires to a more **hardwood-dominated** mix.



**Our high elevation forests became dominated by hardwood species.**

# Desired Future Condition: mixed conifer-hardwood stands

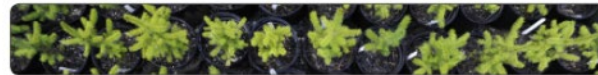
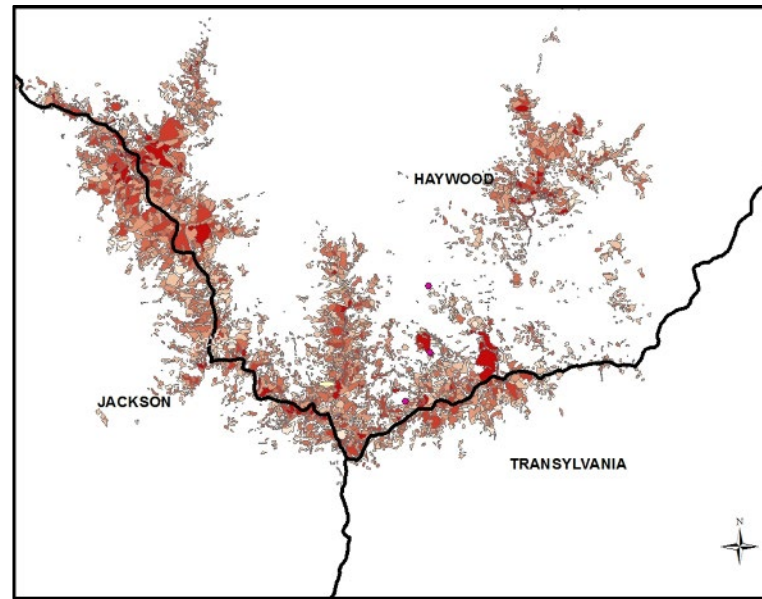


Smoky Mountains as a reference condition

≥30% of  
overstory in  
conifers

# SASRI products

- Map of current spruce
- Restoration Plan & criteria
- Fact sheet
- Draft charter
- Unicois planting
- Nov 2017 workshop



## Restoring Red Spruce in the Southern Blue Ridge



### Islands in the Sky: Our Natural Heritage

The high elevation spruce-fir forests found in eastern Tennessee, western North Carolina and southwest Virginia are islands in the sky. Found only on the highest mountaintops, this ecosystem is characterized by high moisture and is often immersed in cloud cover. At one time, they covered vast expanses of the mountain landscape, but are now only found sparsely in some areas.

Today, these forests face increasing pressures from pollution, climate change and exotic insect pests. These high-elevation forests are home to federally-endangered species like the spruce-fir moss spider and Carolina northern flying squirrel. Other species of conservation concern such as the northern saw-whet owl, black-capped chickadee, and several salamander species also call these forests home.

### Why are Spruce-Fir Forests Endangered?

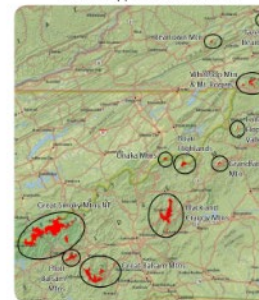
Spruce-fir forests of the Southern Blue Ridge ecoregion, have been in decline for more than 100 years primarily due to past logging practices and the resulting wildfires that compounded their ability to recover from human disturbance.

In addition, acid deposition and the mortality of the Fraser fir from the Balsam Woolly Adelgid have impacted our precious spruce-fir forests. Today, these high-elevation "cloud forests" are considered the second-most endangered ecosystems in the United States.



Northern Flying Squirrels

### Populations of Red Spruce in the Southern Appalachian Mountains



[www.RestoreRedSpruce.org](http://www.RestoreRedSpruce.org)



## Southern Appalachian Spruce Restoration Plan

The Southern Appalachian Spruce Restoration Initiative (SASRI) has set forth the following plan for interagency communication and cooperation toward the goal of restoring the spruce-fir forests throughout the Southern Blue Ridge ecoregion.



# So... how do we actually restore spruce?

- Release existing
- Plant new



# Flat Laurel Collaborative Spruce Restoration Project



# Planning a spruce project

## Assess PROBLEM AND NEED

IMPROVE QUALITY (↑ spruce in a forest patch)

CONNECT isolated patches of spruce forest

## Evaluate APPROPRIATENES S

- Current Spruce Unit
- SASRI Plan criteria
- Rare species records or models
- Field visits to determine if planting is needed

## Consider LOGISTICS

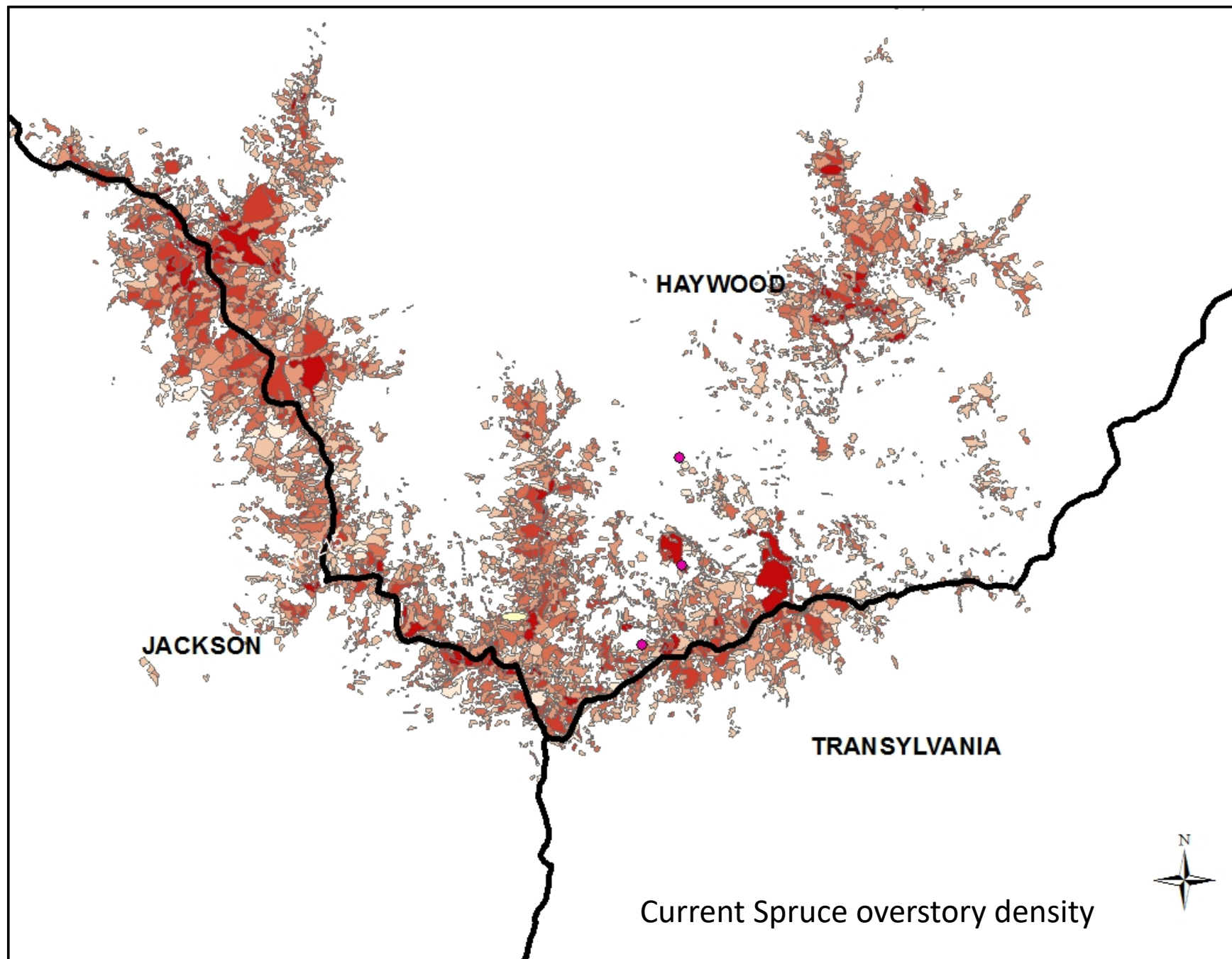
- Seedling propagation needs
- Access via roads, trails

## COORDINATION and IMPLEMENTATION

Landowner, regulations, compliance  
Partners and outreach  
Funding  
Planting and Management  
Monitoring

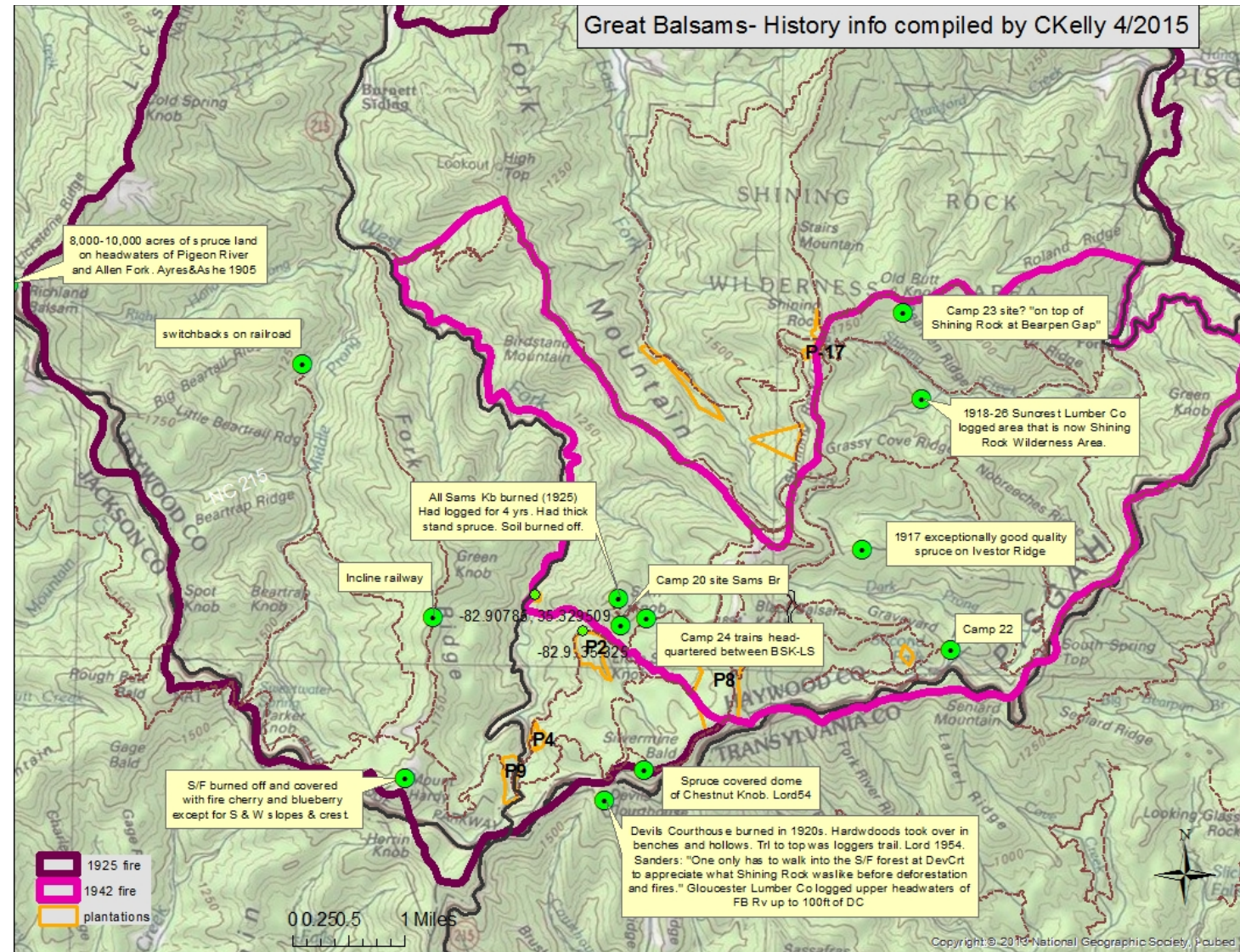


Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community



# Site history

- Logged 1905-1925
- Logging camps
- 1925 fire
- 1942 fire
- Plantations 1938+

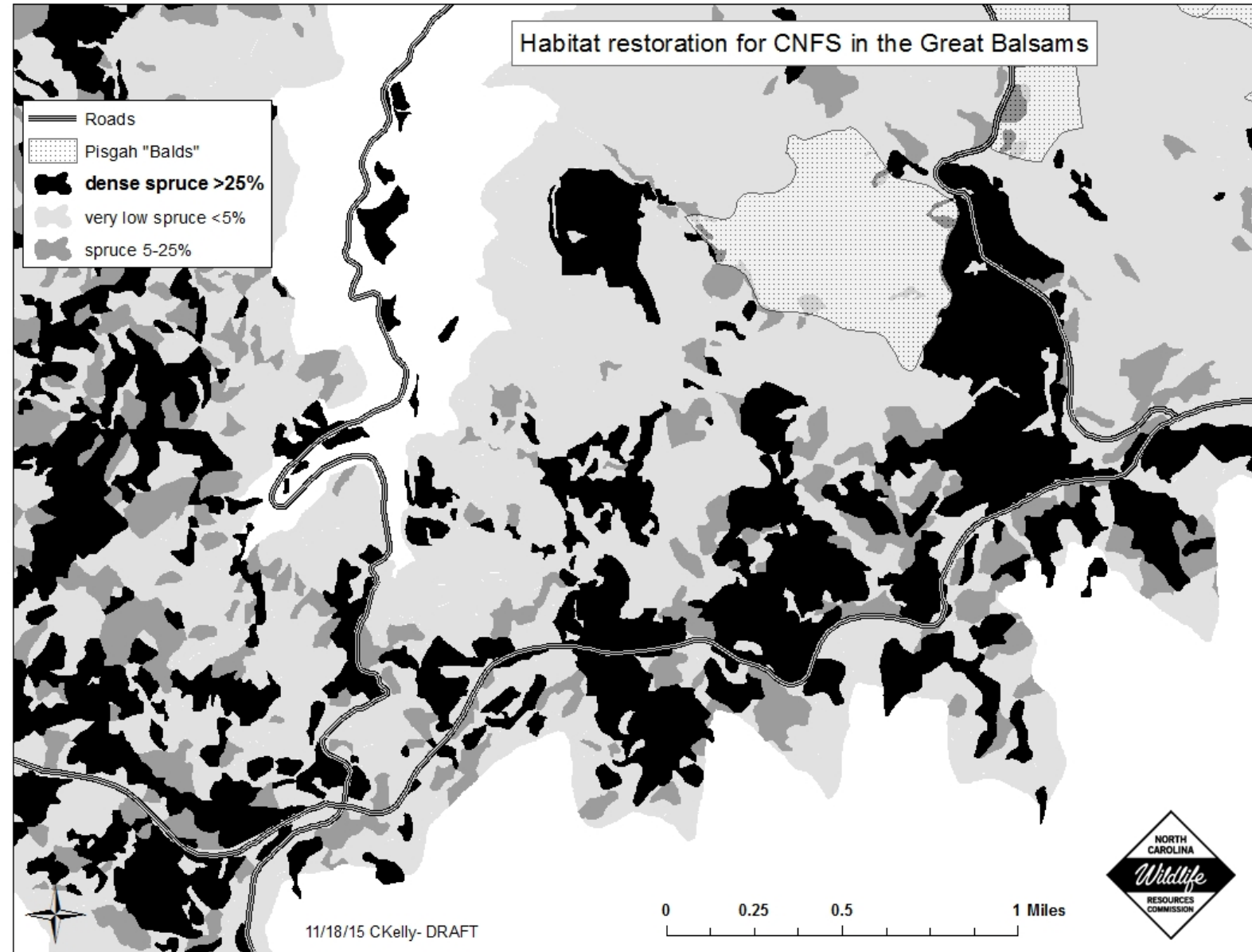


# Flying squirrel habitat restoration

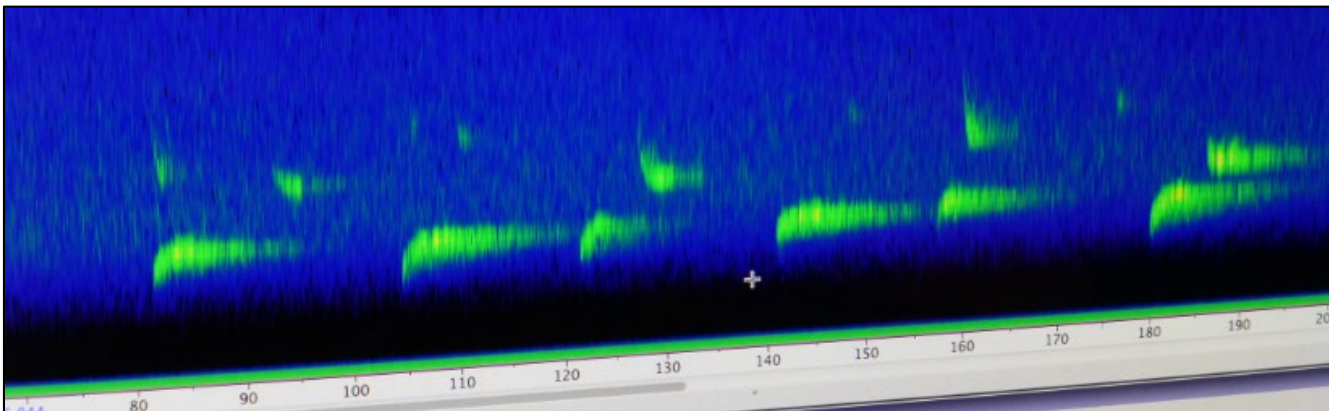
Increase  
spruce  
component

Connect  
habitat for  
CNFS

Squirrel  
model and  
surveys

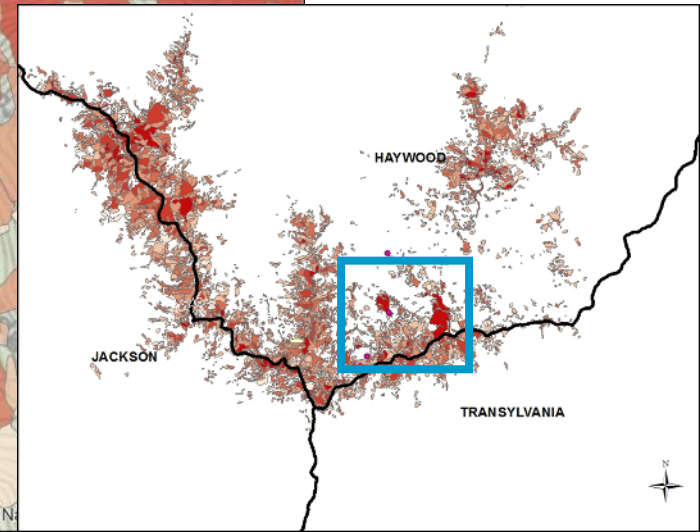
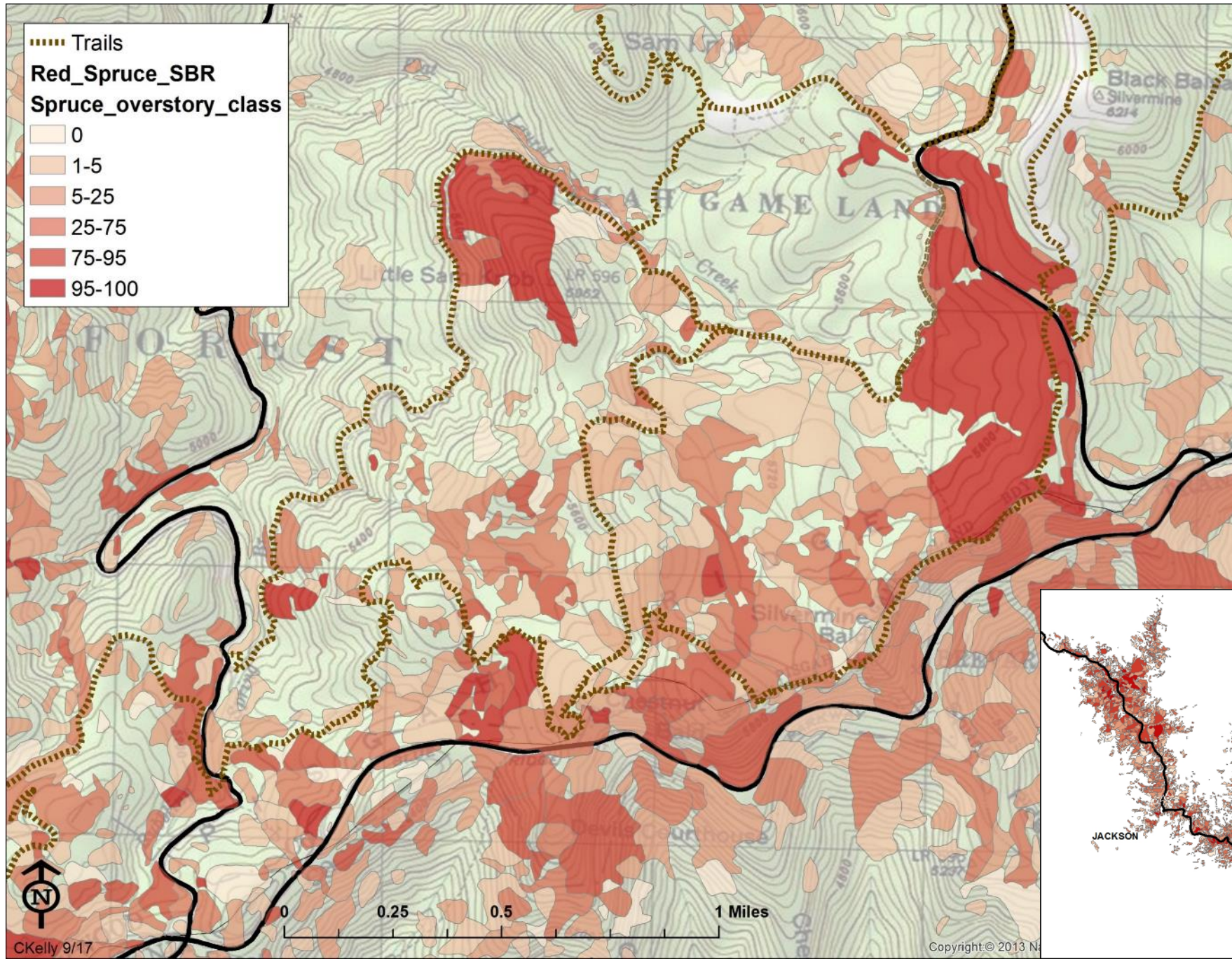


# Flying squirrel and bird surveys

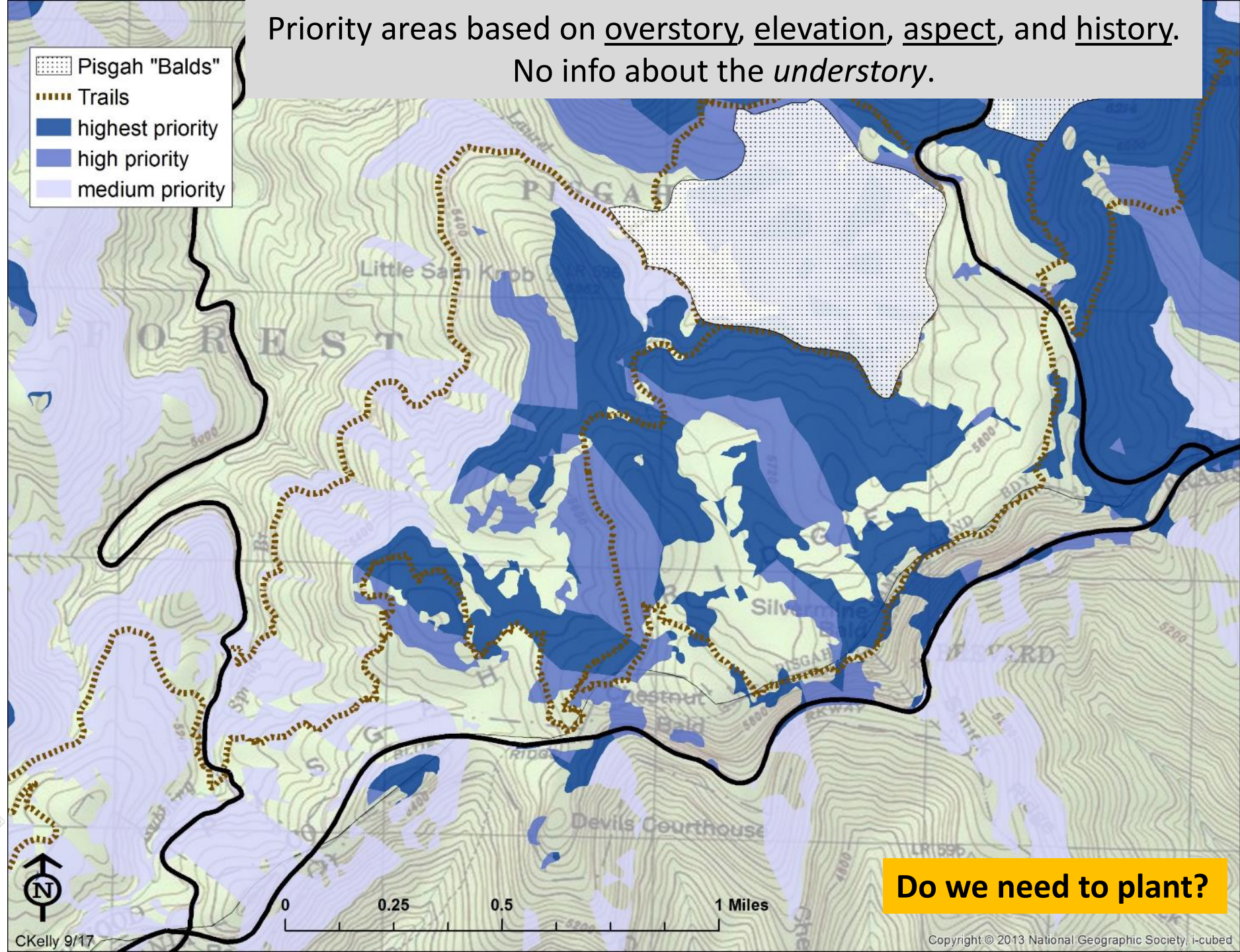


Location		Need		Appropriateness		Logistics		Coordination		
Massif	Area	Improve habitat quality (↑ spruce component)	Connect isolated patches	SASRI Plan --- CSUs	Flying Squirrel info	Access	Seedling Propagation	Project leader	Landowner --- Regulations compliance	Partners outreach --- Funding
Great Balsams	Flat Laurel, east of LSK	North slope along Flat Laurel Creek Trail (planted 2017)	Small isolated open areas between forest and plantation	SASRI: highest priority --- CSU: 0 and 1-5% overstory spruce	Model: >50% chance present  Surveys: confirmed with acoustics (NCWRC)	Flat Laurel Creek Trail from Black Balsam parking lot	1,000-1,500 from GB seed stock	NCWRC (CKelly)	USFS --- NEPA	NCWRC, USFS, TPC, HCC, etc --- PR funds,

# Current Spruce Units



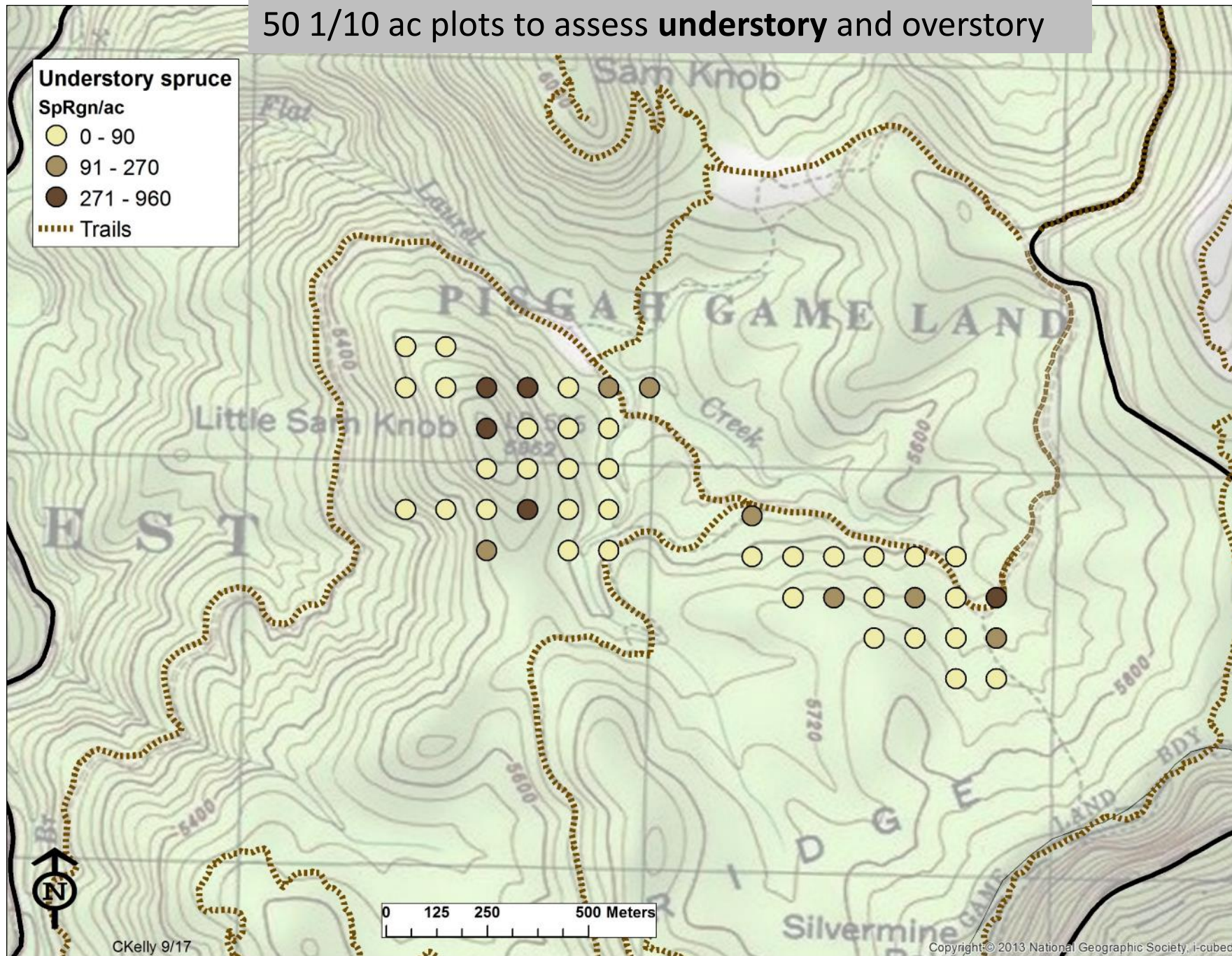
Priority areas based on overstory, elevation, aspect, and history.  
No info about the *understory*.



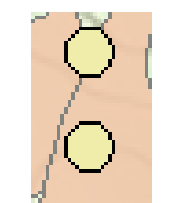
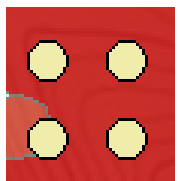
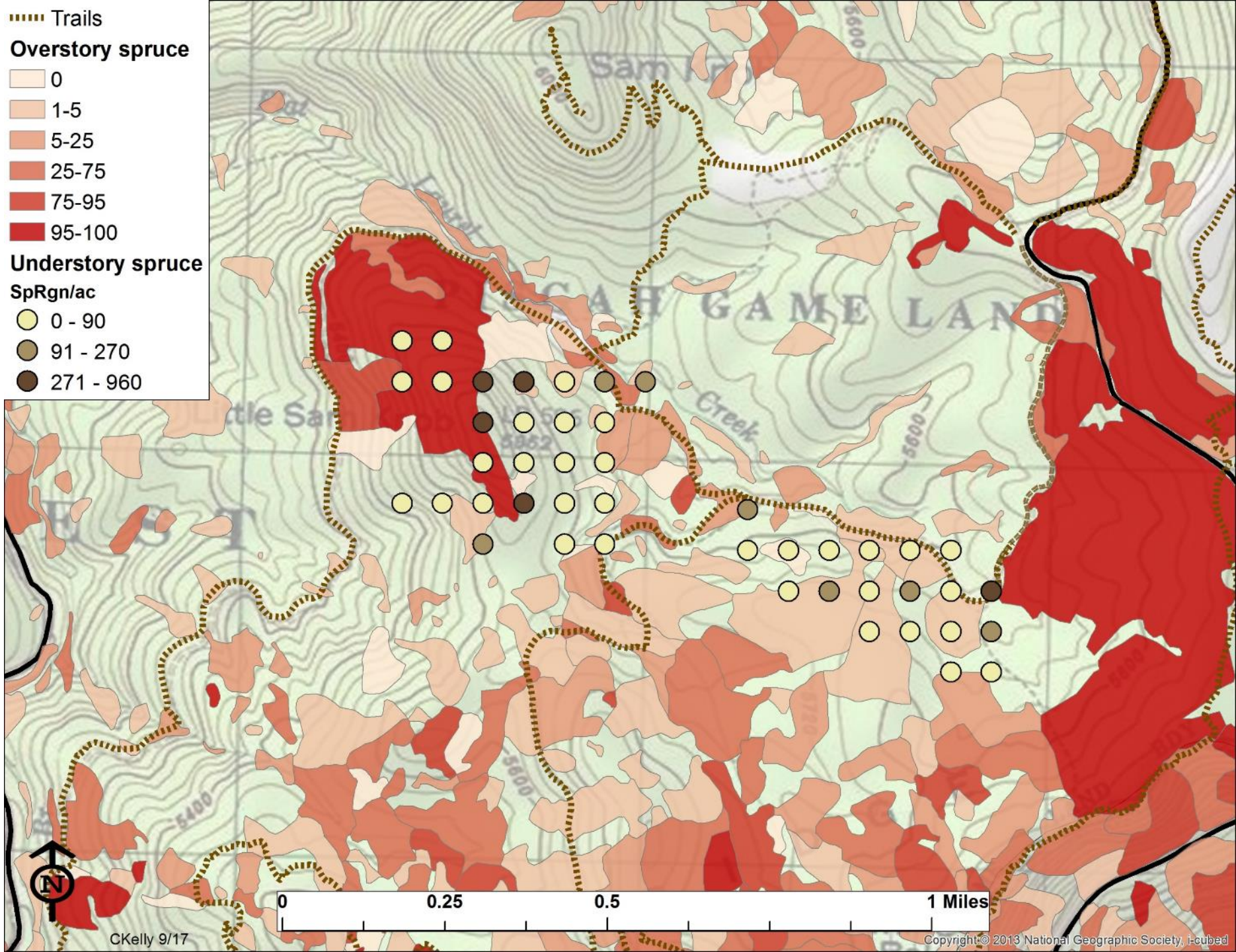
Do we need to plant?



50 1/10 ac plots to assess **understory** and overstory

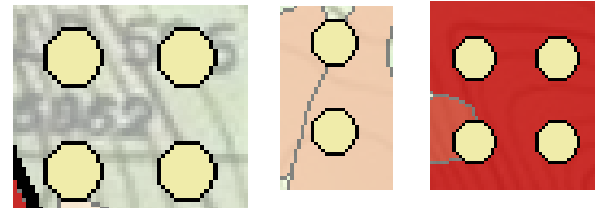
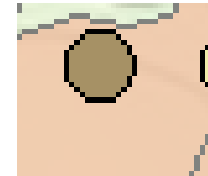


- Trails
- Overstory spruce
  - 0
  - 1-5
  - 5-25
  - 25-75
  - 75-95
  - 95-100
- Understory spruce
  - 0 - 90
  - 91 - 270
  - 271 - 960



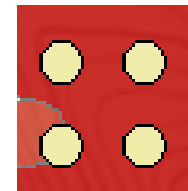
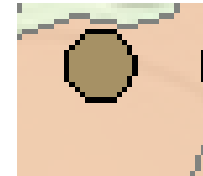
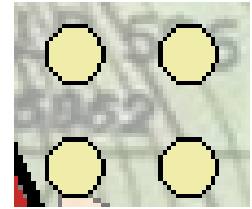
# Decision process for treatments

- ~~If acceptable level of advanced regeneration and overstory spruce >25%, then **no action**.~~
- If advanced regeneration is at acceptable level but spruce basal area is <25%, then **release suppressed spruce trees**.
- If advanced regeneration is low/absent, then **plant seedlings**.

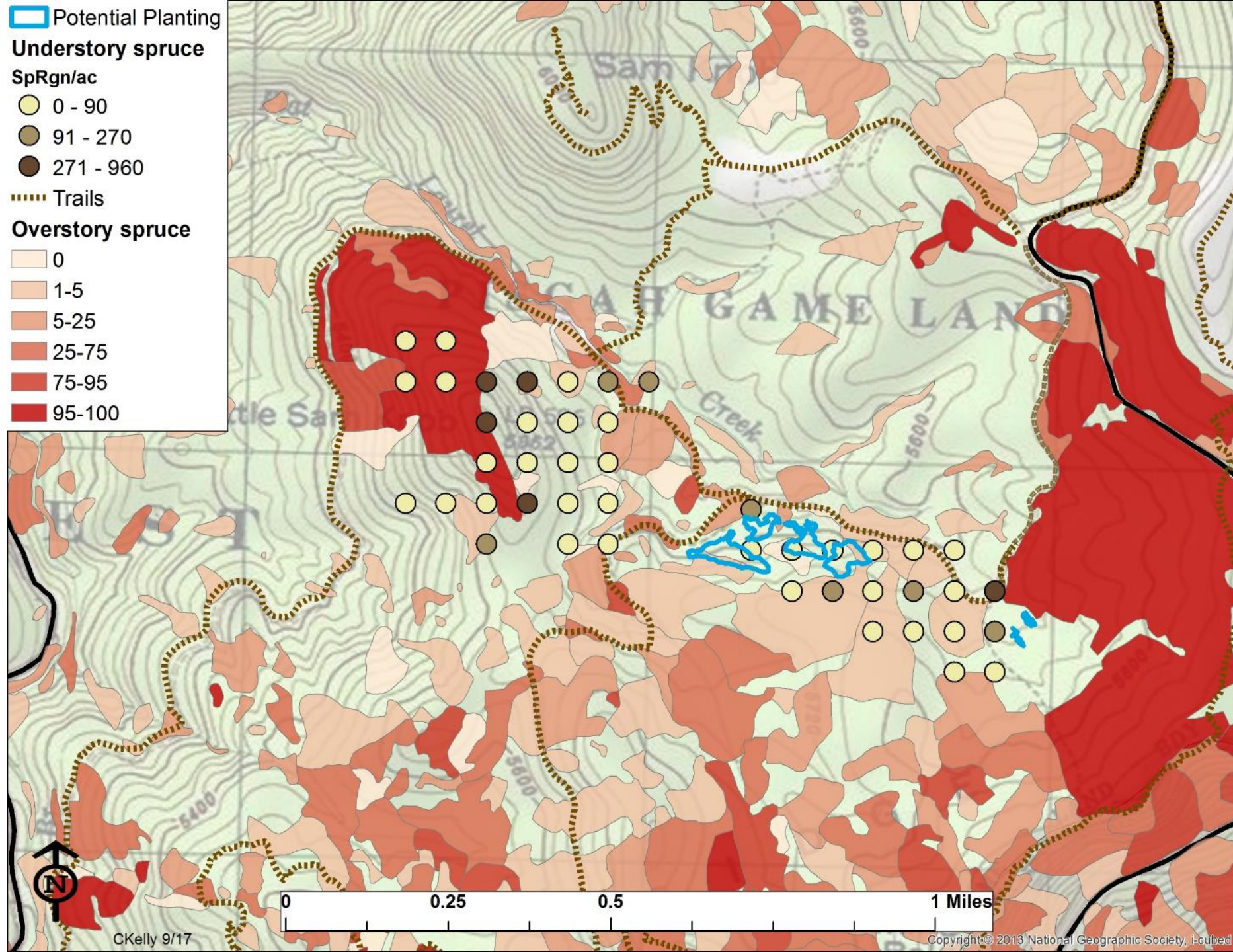
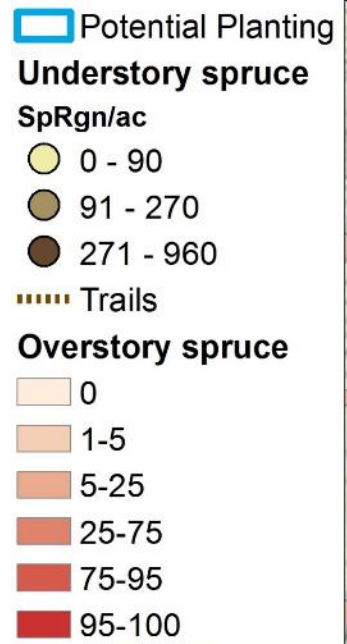


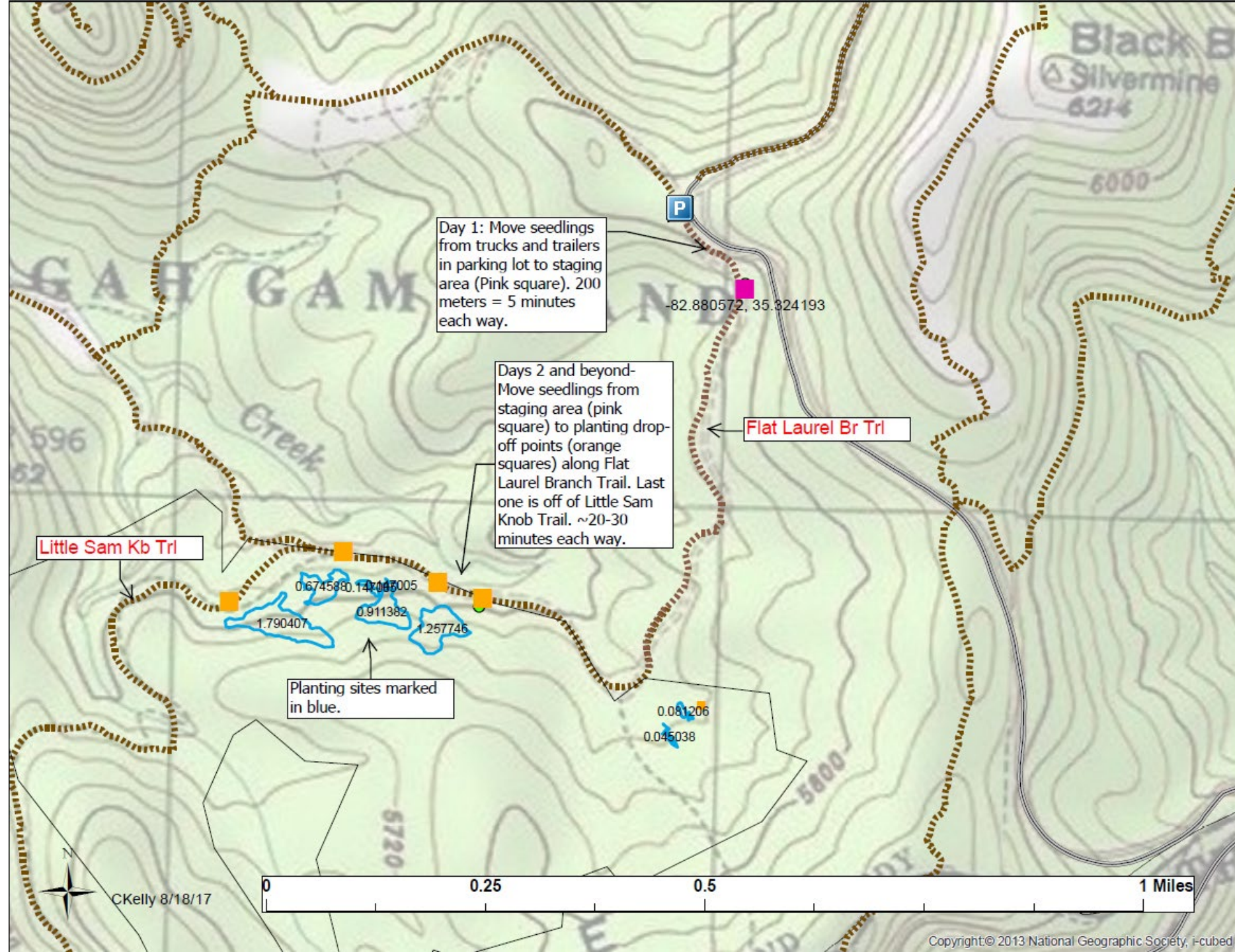
# Treatments

- **Planting** (in areas with low advanced regeneration):
  - Existing openings – release from herbaceous competition?
  - Low density overstory hardwoods – future release potential
  - Closed canopy hardwoods – with release
- **Release** (planted spruce or existing volunteers):
  - Mechanical only (cut or girdle)
  - Chemical only
  - Chemical/mechanical
- **Thinning** Plantation Spruce (create structure)











# Flat Laurel Spruce Collaborative Project

September 2017

The N.C. Wildlife Resources Commission, along with partners, is planting red spruce trees on the Pisgah National Forest to help speed recovery of this high-elevation forest. They will be planting spruce trees in an area of the forest located in Haywood County, north off the Blue Ridge Parkway. Prior to its acquisition by the U.S. Forest Service, the forest here was impacted by historic logging and wildfires in the early 1900s. Hardwood trees recovered faster than spruce in burned areas. Planting spruce trees will benefit many rare species of wildlife, including the Carolina northern flying squirrel, red crossbill, brown creeper and northern saw-whet owl. The Carolina northern flying squirrel eats truffles, the fruiting bodies of mycorrhizal fungi associated with the roots of red spruce trees. The red crossbill, a stocky red or greenish finch, eats spruce seed and has a specialized bill that pries open cones to extract seed. More projects of this nature will be conducted across other parts of the Southern Appalachians.

## Project Objectives:

- Plant red spruce trees to boost the conifer component and resiliency of high-elevation forest within Pisgah National Forest, in Haywood County.
- Benefit the federally endangered Carolina northern flying squirrel, and rare bird species such as the red crossbill, brown creeper and northern saw-whet owl.

## Partners:

- This project was initiated by the N.C. Wildlife Resources Commission and developed with the U.S. Forest Service and Warren Wilson College.
- Valuable input was provided by members of the Southern Appalachian Spruce Restoration Initiative (SASRI) and other partners in the conservation community including Southern Highlands Reserve, Southern Appalachian Highlands Conservancy, The Nature Conservancy, NC Natural Heritage Program, MountainTrue, The Wilderness Society, and Defenders of Wildlife. This restoration project is the first for SASRI.

## Methods:

- The source of these seedlings is seed collected from red spruce cones in North Carolina by SASRI partners.



U.S. Fish and Wildlife Service



The green circle indicates the site of restoration, which is located in Haywood County.



Carolina northern flying squirrel (Clifton Avery)



Haywood Community College student planting spruce seedlings (U.S. Fish and Wildlife Service)

## Flat Laurel Spruce Collaborative Project

### Methods (continued):

- Seedlings are grown at the Southern Highlands Reserve, a native plant arboretum and research center in Transylvania County. Their staff and volunteers extract, clean, and germinate seeds, and pot the seedlings. The gallon-potted seedlings being planted are 12 to 18 inches tall.
- The restoration site is 1 mile down the Flat Laurel Branch Trail. One-thousand seedlings will be carried in, on foot, by Wildlife Commission personnel, SASRI partners, and volunteers from organizations such as The Pisgah Conservancy, The Climate Times, and Southern Appalachian Wilderness Stewards
- Forestry, Wildlife and Conservation Biology students from Haywood Community College and Warren Wilson College are planting the seedlings using a technique called "underplanting," which means the seedlings will be planted under the hardwood canopy. Ensuring seedlings survive being planted under a hardwood canopy means they need tall stems and well-developed roots. They will be left to recover from the shock of transplant for a few years. After a few years, selected, small hardwood trees will be girdled to provide more sunlight to the growing seedlings.

### What's next?:

- Wildlife Commission staff and SASRI members will monitor the effect of the restoration project by conducting surveys on birds and flying squirrel populations. Forestry students will help monitor seedling growth and survival.
- SASRI is holding a Spruce Workshop in Gatlinburg, Tenn., on Nov. 14-16, 2017 that will bring together researchers, land managers, horticulturalists, and species experts to share information and experiences and identify needs and gaps that will advance the restoration of spruce forests in the central and southern Appalachians.

### For more information, please contact:

Christine Kelly, Mountain Wildlife Diversity Biologist  
North Carolina Wildlife Resources Commission  
828-230-1320, christine.kelly@ncwildlife.org



Juvenile (top) and adult male red crossbill (A. Lenk)



Brown creeper (Francesco Veronesi)





# Monitoring Growth and Survival







## Carolina Vegetation Survey: Level 1

- Height
- Diameter

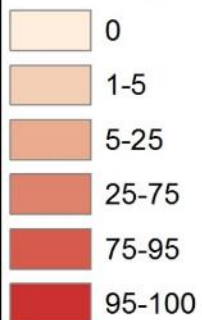




Flying squirrel dens in canopy hardwoods

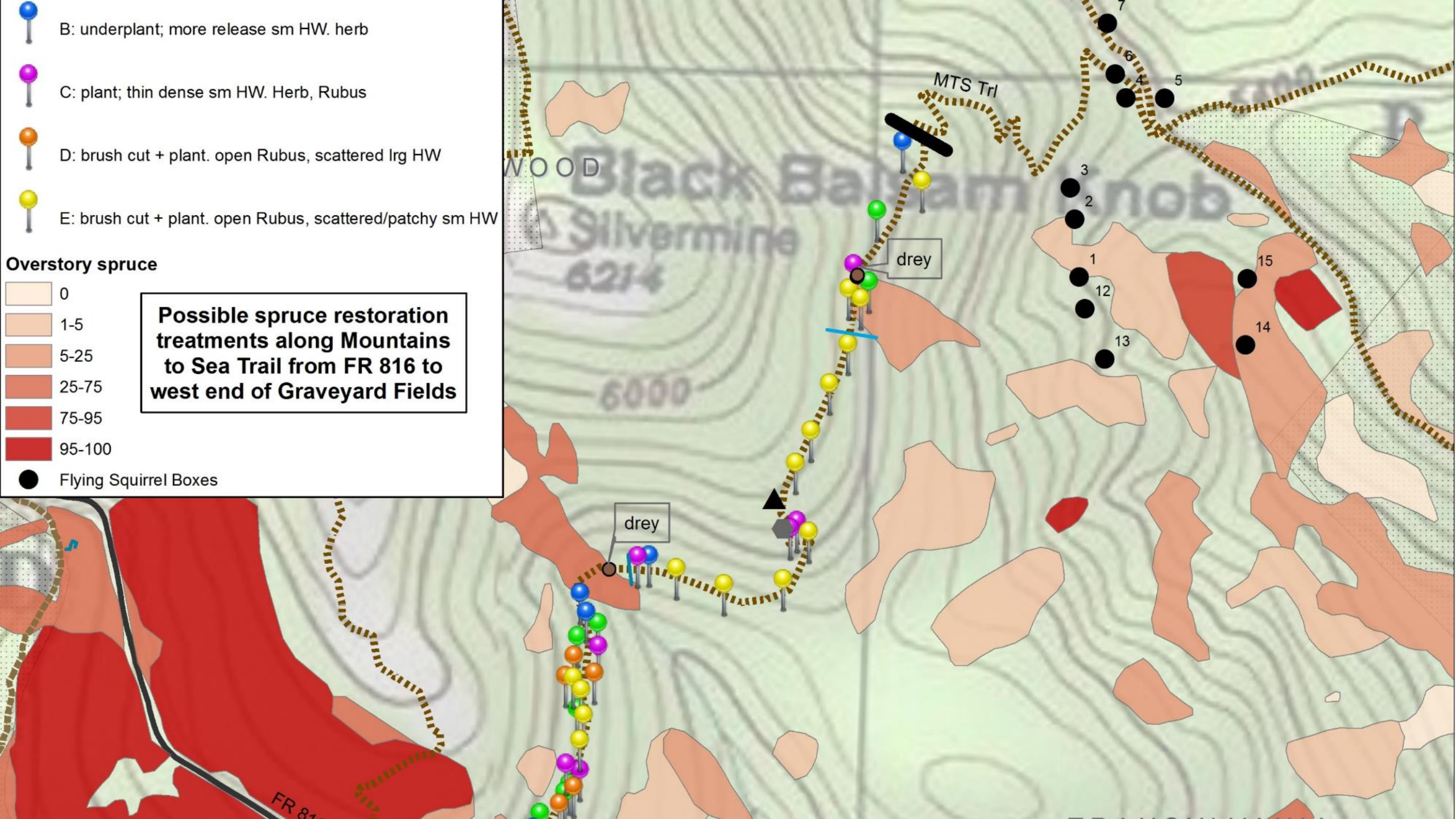
-  B: underplant; more release sm HW. herb
-  C: plant; thin dense sm HW. Herb, Rubus
-  D: brush cut + plant. open Rubus, scattered lrg HW
-  E: brush cut + plant. open Rubus, scattered/patchy sm HW

#### Overstory spruce



**Possible spruce restoration  
treatments along Mountains  
to Sea Trail from FR 816 to  
west end of Graveyard Fields**

 Flying Squirrel Boxes



Location		Need		Appropriateness		Logistics		Coordination		
Massif	Area	Improve habitat quality (↑ spruce component)	Connect isolated patches	SASRI Plan --- CSUs	Flying Squirrel info	Access	Seedling Propagation	Project leader	Landowner --- Regulations compliance	Partners outreach --- Funding
Great Balsams	Graveyard west end	Along MTS Trail, vicinity of intersection of MTS Trail and Graveyard Ridge Trail	Vicinity of MTS Trail	SASRI: medium --- CSU: 0 and 1-5% overstory spruce	Squirrel box captures and dreys (NCWRC)	MTS Trail from FR 816. Graveyard Ridge Trail from Parkway	2,000 from GB seed stock	NCWRC (CKelly)	USFS --- NEPA	NCWRC, USFS, <b>TPC</b> , HCC, etc --- PR funds, other

# Thank you!

- U.S Forest Service
- U.S. Fish and Wildlife Service
- Southern Highlands Reserve
- The Pisgah Conservancy
- Carolina Mountain Club
- Backcountry Horsemen of Pisgah
- Southern Appalachian Wilderness Stewards
- Daughters of the American Revolution
- The Climate Times of Boone
- NCWRC Mills River crew
- [christine.kelly@ncwildlife.org](mailto:christine.kelly@ncwildlife.org) 828-230-1320



Location		Need		Appropriateness		Logistics		Coordination		
Massif	Area	Improve habitat quality (↑ spruce component)	Connect isolated patches	SASRI Plan --- CSUs	Flying Squirrel info	Access	Seedling Propagation	Project leader	Landowner --- Regulations compliance	Partners outreach --- Funding
Black Mtns	North of Parkway between Walker Knob and Potato Knob (5400ft contour)	Northern hardwood forest along Wilson Boundary Road	Uncertain  Need to study map. GIS analysis	SASRI: highest priority --- CSU: 0 and 1-5% overstory spruce	Model: >50% chance present  Surveys: confirmed with acoustics (NCWRC)	Wilson Boundary Road	Uncertain  Need to conduct field surveys	Any takers?	USFS and Cane River Club --- NEPA	NCWRC, USFS, NC State Parks, etc --- PR funds, partner funds

Location		Need		Appropriateness		Logistics		Coordination		
Massif	Area	Improve habitat quality (↑ spruce component)	Connect isolated patches	SASRI Plan --- CSUs	Flying Squirrel info	Access	Seedling Propagation	Project leader	Landowner --- Regulations compliance	Partners outreach --- Funding
Roan Mtn	East along NC 261 from Carvers Gap	Northern hardwood forest	Uncertain	SASRI: medium to low priority --- CSU: 0 and 1-5% overstory spruce	Model: >50% chance present  Surveys needed. Confirmed at Carvers Gap and western slopes of Grassy Ridge	NC 261	Uncertain	Any takers?	USFS --- NEPA	NCWRC, USFS, SAHC --- PR funds,