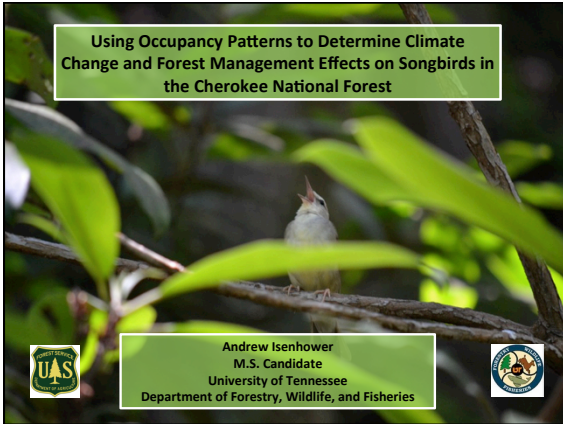




Using Occupancy Patterns to Determine Climate Change and Forest Management Effects on Songbirds in the Cherokee National Forest



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Outline:

- Introduction/Justification**  
(Birds as Indicators, Climate Change, Forest Management, and Study Area)
- Research Objectives**  
(Relating Occupancy to Forest Management and Climate Change)
- Data Collection Methods**  
(Point Counts, Forest Measurements, and Climate Change Data)
- Analysis Methods**  
(Occupancy, Focal Species, and Statistical Analysis)
- Implications/Questions**

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Birds make great indicators for many aspects of natural resource management.



(Carignan and Villard 2002)

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**Many species have strong ties to specific habitat components**

(Hamel 1992)(Kremen 1992)

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**Birds may be the first indicators of climate change effects on wildlife.**

(Crick 2004) (McCarty 2001) (NABCI 2014)

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**The USFS required under the National Forest Management Act to sustain wildlife species which are present during the beginning of the planning period.**

**Many other species depend on more mature forest areas with relatively low disturbance.**

(USDA 1979)

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**Study Area**  
**Cherokee National Forest (CNF)**

- 259,000 ha. on eastern border of Tennessee
- Largest tract of public land in TN.
- Part of a large chain of public land from GA to VA.
- Location and landscape diversity make the CNF a great case study for forest management and climate change effects.
  - The Appalachian Mountains are critical stopover and breeding site for many avian species.
  - Forest has been actively managed
  - Management has changed over time
  - Elevation changes

**Volume of Timber Harvested on CNF Between 1992 and 2006**

(C. USDA 2014. 009)

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**Objectives**

1. Determine occupancy trends for 17 priority species on the CNF.
2. Use multivariate analysis to determine correlations between occupancy data and forest management practices on CNF.
3. Use multivariate analysis to determine correlations between occupancy data and regional temperature and precipitation changes.
4. Use BBS data in a similar manner to determine if trends shown on the CNF parallel trends shown around the region.




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**Data Collection Methods**  
 Objective 1  
 For the last 22 years point count data has been gathered on the Cherokee National Forest

**Point Counts**

- ~200 points surveyed each year
- Randomly stratified across all districts and stands of the CNF
- All are at least 100m from stand border
- Each site is GPS marked
- Auditory and visual identification of birds
- Conducted during the breeding season (May-July)




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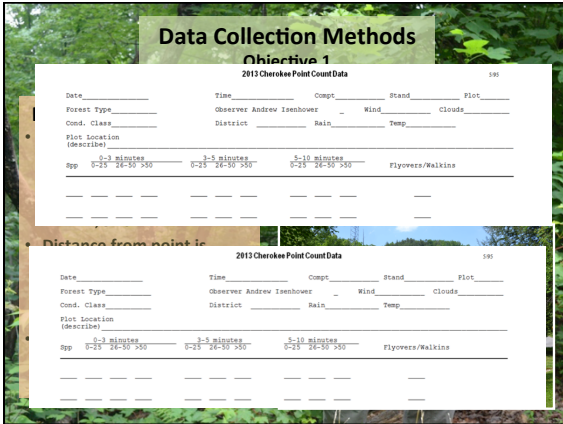
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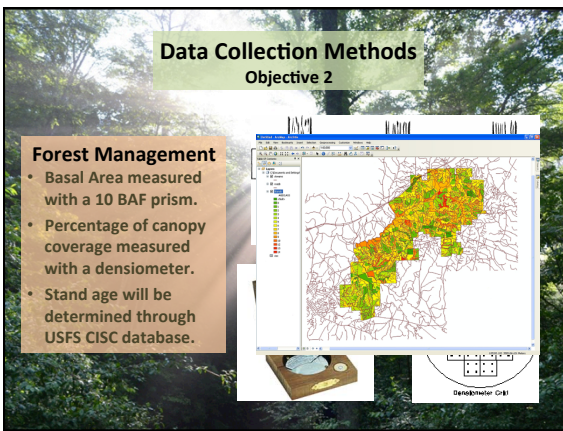
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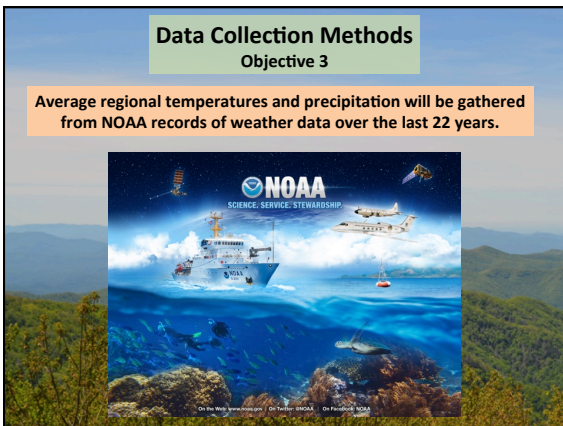
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**Data Collection Methods**  
**Objective 4**

Data from the BBS will be downloaded from the USGS site: <https://www.pwrc.usgs.gov/bbs/RawData/>

(USGS 2014)

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**Analytical Methods**  
**Objective 1**

Present!

**Occupancy**

- Occupancy ( $\Psi$ ) will be calculated for all species detected within 50 m of a point using:  $\Psi = S_D / (S(1 - (1 - p)^K))$ 
  - S= Total # of sites
  - S<sub>D</sub>= # of sites sp. was detected
  - p= Probability of detection
  - K= # of times site was counted

(Baumgardt et al. 2014)

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**Analytical Methods**  
**Objective 2**

**Secondary Succession**

Fire	Annual plants	Grasses and perennials	Grasses, shrubs, pines, young oak and hickory
0 years	1-2 years	3-4 years	5-150 years
			Mature oak and hickory forest
			150+ years

© 2006 Encyclopædia Britannica, Inc.

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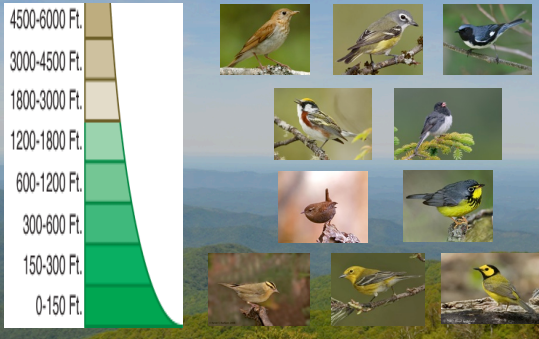
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### Analytical Methods

#### Objective 3



4500-6000 Ft.  
3000-4500 Ft.  
1800-3000 Ft.  
1200-1800 Ft.  
600-1200 Ft.  
300-600 Ft.  
150-300 Ft.  
0-150 Ft.



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### Analytical Methods

#### Objective 4

#### BBS Data

- Occupancy data will be calculated using the same methods as before.
- 20 routes that border CNF in both TN and NC will be used.
  - 1 route = 1 point



(USGS 2014)

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### Analytical Methods

#### All Objectives

#### Statistical Analysis

- Occupancy calculations done with program Presence.
- Multivariate statistical analysis done in SAS.
  - Using covariates:
    - Stand Age
    - Canopy Coverage
    - Basal Area
    - Temperature
    - Elevation
- Detection probabilities calculated using Farnsworth et al. methods to account for:
  - Species Variability, Observer, Time of Day, Weather, Duration, and Distance



This is Dataaaaal!

(Farnsworth et al. 2002)

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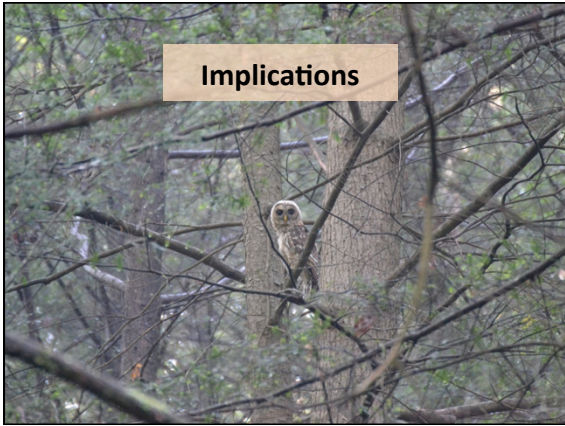
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Implications

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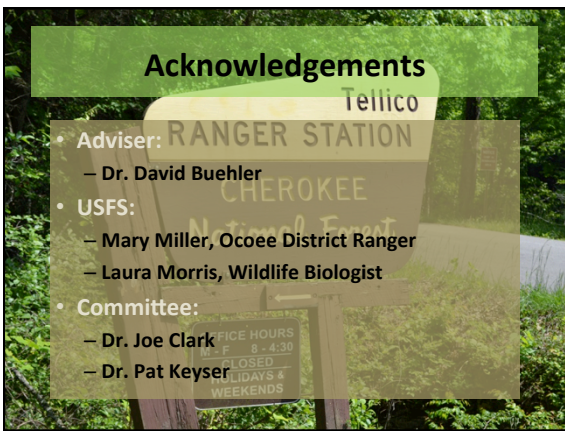
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- Committee:
  - Dr. Joe Clark
  - Dr. Pat Keyser

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Photo Credits

- [http://www.nrs.fs.fed.us/news/release/resources/gallery/stoleson\\_forest\\_interior\\_birds/](http://www.nrs.fs.fed.us/news/release/resources/gallery/stoleson_forest_interior_birds/)
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