

The Box Turtle Connection

Mark-Recapture Study of Box Turtles

Study Design and Population Estimation

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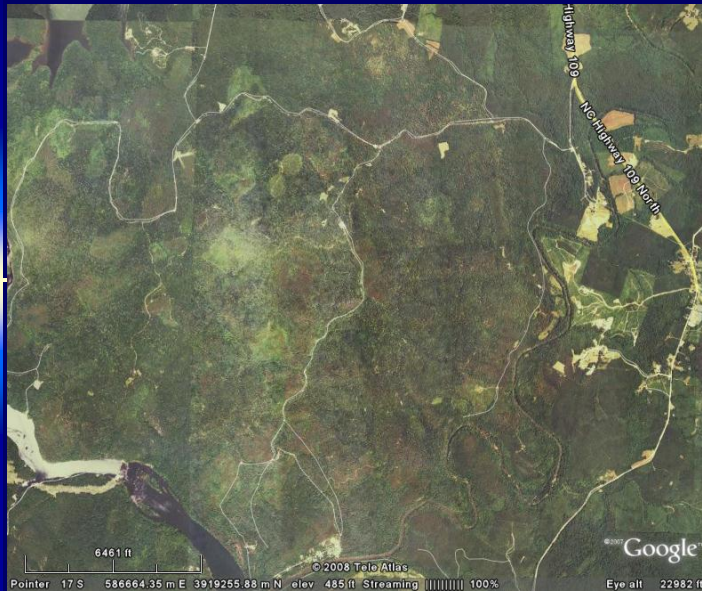
The first state-wide study of box turtles!



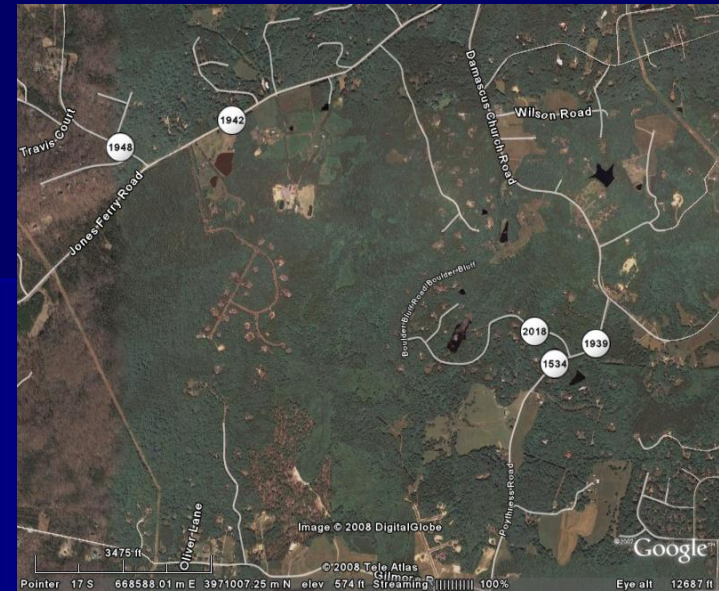
Objectives of Study

- Determine the status of box turtles in NC, and get a sense of how turtle populations differ across the state
- Gather baseline information on population size and structure
 - Long-term monitoring
 - Knowledge for reintroductions (if ever needed)
- Determine factors that limit box turtle populations
 - e.g., patch size, road density, forest type

Uwharrie National Forest



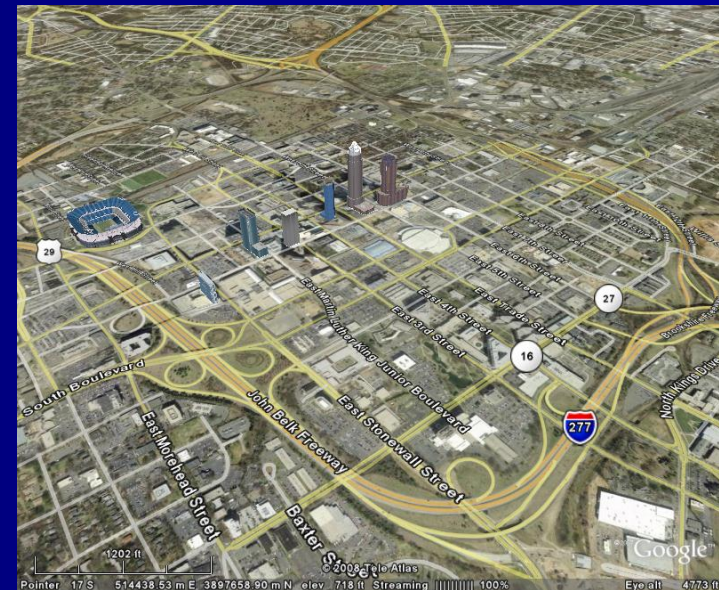
Chapel Hill Rural Neighborhood



My Neighborhood



Downtown Charlotte



What does marking animals tell us?

- Population size
- Population density
- Survival
- Sex ratios
- Age structure
- Growth
- Movement
- and the results can be surprising...



Why do we want to know how many turtles live in an area?

- Box turtles seem common, but is just because they're easy to see? (e.g., on roads)
- What's a "natural" population size?
- Minimum viable population size?
 - Inbreeding depression
 - How much unfragmented land do box turtles need to maintain "good enough" populations
- Prioritize protection of the best populations?
- Plan development to maintain large enough forests?



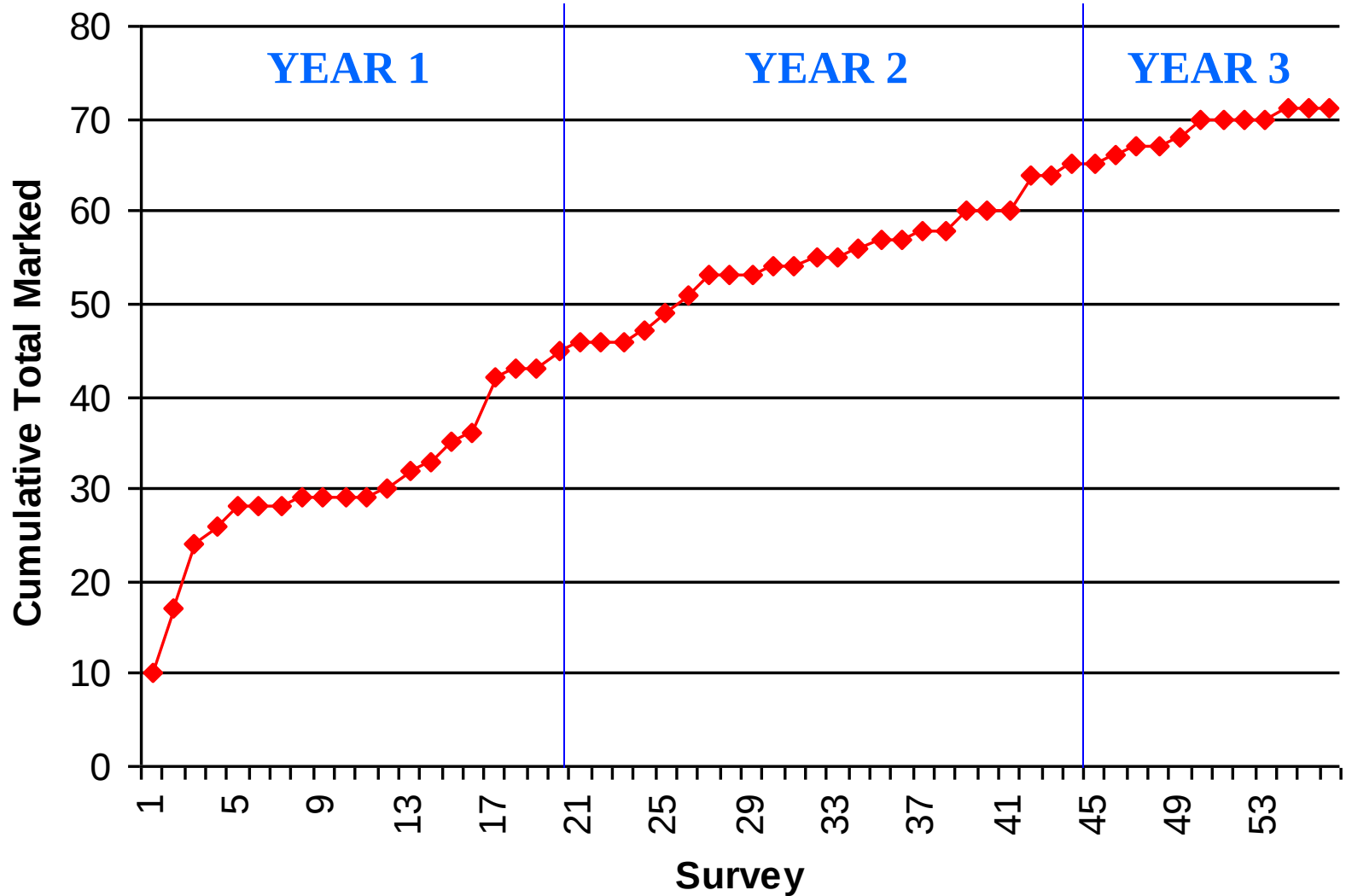
Hellbenders in North Carolina



~ 150 - 200 / km of stream!!!!



Adult Green Salamanders Marked Over Time at Eastatoee Creek, SC, 2002-04





~ 100 adults in the population in any given year



Spotted Turtles in West Virginia



~ 15 per acre!!!!

51

300 yds

Spotted Turtles at Hemlock Bluffs



~ 5 adult turtles in the whole preserve!!!

Population Estimation

3 major methods of pop. estimation

- Count the whole population at once
 - e.g., Galapagos tortoises on an island
- Removal method
 - Remove animals until no more captures
 - Not terribly compatible with conservation...
- Mark-recapture
 - Mark animals over time and estimate population
 - Accuracy increases with more recaptures



Tercar
LQX
11-14-07



Simple Mark-Recap Equation

$$N = \frac{nM}{R}$$

N= total population size

M= number of animals marked in 1st sample

n = total animals captured in 2nd sample (marked and unmarked)

R = number of recaptures in 2nd sample

Simple Mark-Recap Equation

$$N = \frac{nM}{R}$$

M = In 2009, 45 turtles are captured and marked in an area

n = In 2010, 67 turtles are captured in the same area

R = Of the turtles captured in 2009, 37 were previously marked

$$N = \frac{(67)(45)}{37} = \frac{3,015}{37} = 81 \text{ turtles in population}$$

Developed by Gary White – Colorado State

- Powerful program for estimating population size
- Survival estimates
 - By age, sex, etc.

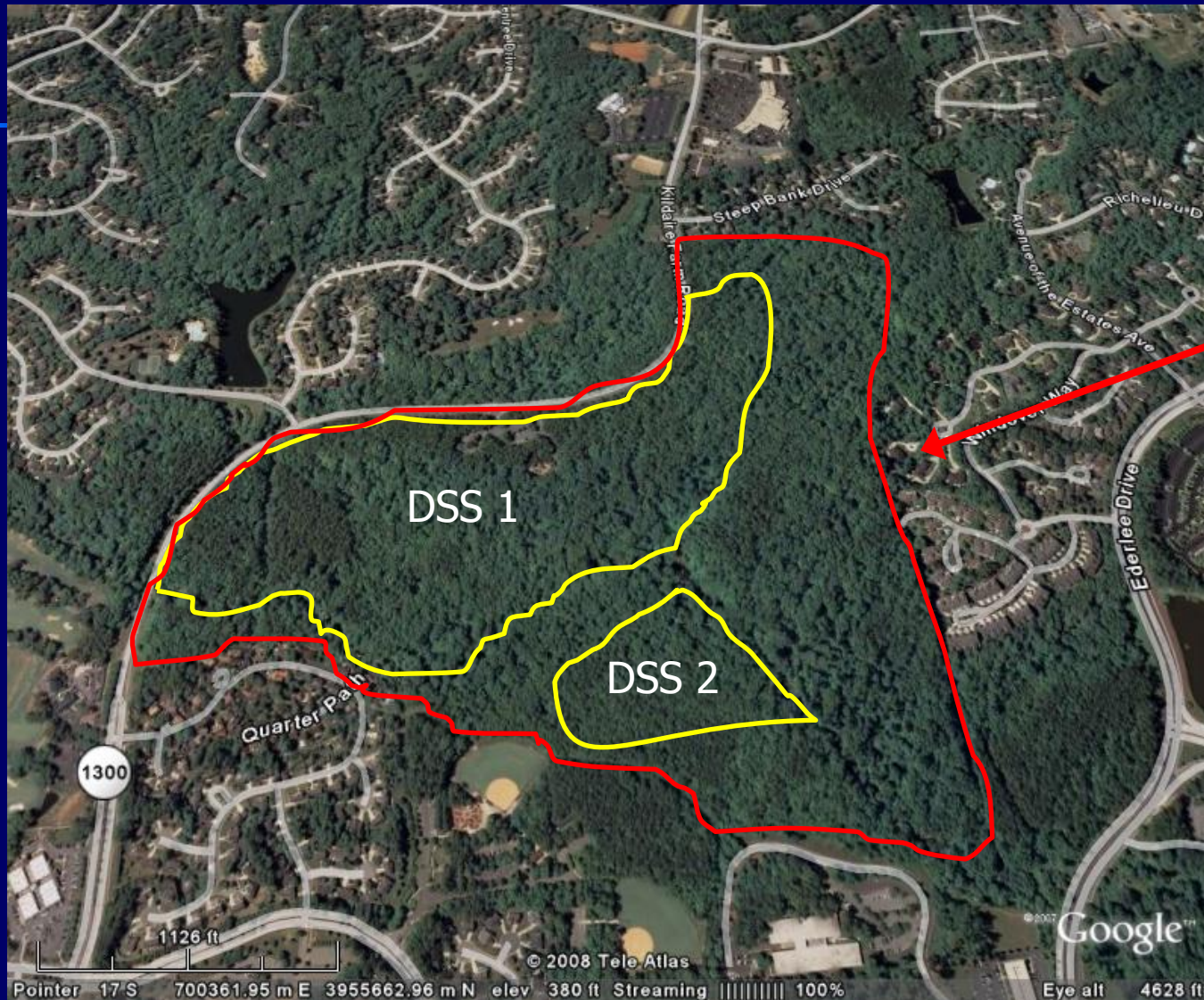
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Density estimates of box turtles in various places

Subspecies	Locality	Year	Density (No./hectare)	Estimate of variance	Reference
<i>carolina</i>	Indiana	1960–1967	4.4–5.7	No	Williams and Parker, 1987
		1970	3.7		
		1983	2.7		
<i>carolina</i>	Maryland	1950	9.9–12.4	No	Stickel, 1950
<i>bauri</i>	Florida	1993	14.9	Yes	This study
			(adults only)		
			16.4		
			(adults + juveniles)		
<i>carolina</i>	Tennessee	1968	18.8–22.7	No	Dolbeer, 1969
<i>triunguis</i>	Missouri	1966–1979	18.4–26.9	Yes	Schwartz et al., 1984

Langtimm, Dodd, and Franz. Herpetologica 52(4):1996

Defined study area is important!



**Hemlock
Bluffs
Study
Area**

Avoid Biasing Data

- Try to survey entire area evenly
 - If possible, take different paths during hikes or outings
- Try to keep surveys relatively random
 - ie., if you know of a place where a certain turtle always hangs out, don't just keep going back and catching that turtle
- Make sure you mark every turtle

Thank you!!



This project would
not be possible without
your work!

