




## Mark-Recapture of White-Tailed Deer Using DNA Sampling from Scat

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## Introduction

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- **Population Estimates**
- **Why Are They Important?**
  - Prerequisite for many wildlife management endeavors
    - Threatened and Endangered Species
    - Conservation Policy
    - Game Species
      - Harvest Strategies
  - Population size is the currency by which success of many management programs is ultimately judged



(Leopold 1933)

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## Introduction

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- **Population Estimates**
- **Optimal Estimators**
  - Reliable
  - Unbiased
  - Cost effective
  - Easy to conduct
- **Which One?**
  - Total/Incomplete Counts, Indirect Counts, Mark-Recapture
    - Well-established statistical techniques that deal with imperfect detectability are preferred to uncorrected counts
      - Mark-Recapture and Distance-Sampling

White 2005

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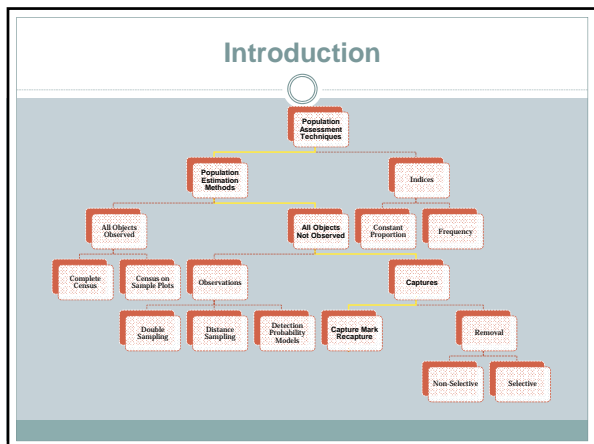
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### Introduction

- **Mark-Recapture**
  - General Assumptions
    - Population is closed to additions and deletions
    - Marked and Unmarked animals are equally vulnerable to capture
    - Marks are not lost or overlooked
- **Non-Invasive vs. Invasive**
  - Marker
  - Behavior

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### Introduction

- Population Estimates
- Why White-Tailed Deer?
  - Keystone Species
    - Competition
    - Altering Habitat
  - Most economically important big-game mammal in North America
    - Pittman-Robertson Act
    - Crop Damage
    - Deer-Vehicle Collisions
  - Game Species



(Schaefer and Main 2001)

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### Justification

- Economic and Environmental Importance of White-Tailed Deer
- Population Estimates are the basis for most management protocols
- Managers need reliable techniques that minimize assumptions and biases
  - Lost Marks
  - Equal Catchability
  - Closed Population
  - Scat
    - Randomly Dispersed

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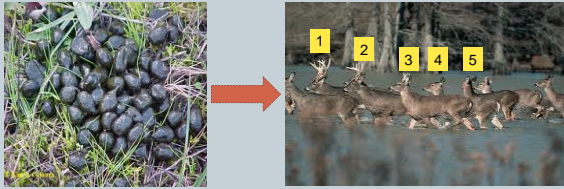
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### Goal

- Determine if genetic markers from scat can give reliable population estimates



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### Goal: Can genetic markers from scat produce population estimates

**OBJECTIVE 1-DENSITY**  
Evaluate the potential for genetic markers from scat to estimate density

**OBJECTIVE 2-SEX RATIOS**  
Evaluate the potential for genetic markers from scat to estimate sex ratios

**OBJECTIVE 3-HOME RANGES**  
Evaluate the potential for genetic markers from scat to estimate home ranges

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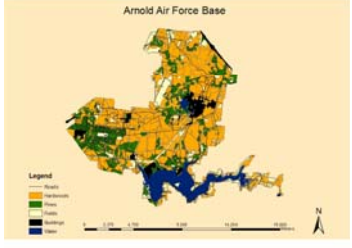
**Study Area**

Arnold Air Force Base  
AEDC WMA  
Coffee and Franklin  
County, Tennessee

- ~16,000 hectares
- ~8,500 ha Hardwoods
- ~3,000 ha Pines
- ~1,500 ha Open Fields



Arnold Air Force Base



Legend

- Plots
- Hardwoods
- Pines
- Open Fields

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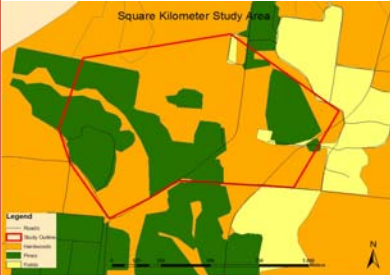
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**Study Area**

1 km<sup>2</sup> Area

- ~50 ha Hardwoods
- ~40 ha Pines
- ~10 ha Fields



Square Kilometer Study Area

Legend

- Plots
- Study Outline
- Hardwoods
- Pines
- Open Fields

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**Scat Sampling  
Capture Events**

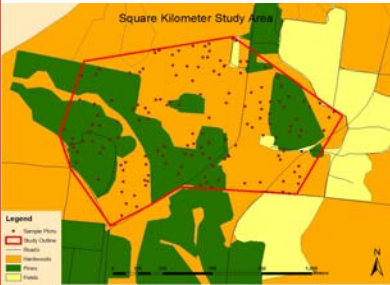
5 Capture Events

Capture Event=2 days

150 random plots per  
capture event

750 Total Plots

Plots were sampled:  
Jan 11, 2010-Jan 21, 2010



Square Kilometer Study Area

Legend

- Orange Plots
- Study Outline
- Hardwoods
- Pines
- Open Fields

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### Scat Sampling Why 150 Plots?

- **Recapture**
  - Need at least 20%
- **Preliminary**
  - 20% success
- ~8 deer/km<sup>2</sup>
- ~10 pellet groups/deer/day
- ~160 pellets groups/capture event

- **Need for 20% Recapture**
  - ~30 pellet groups/capture event
  - 20% success

**150 Plots/ Capture Event**

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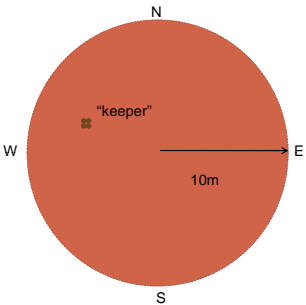
### Scat Sampling Plots

Plots were generated in Arc Map and located using GPS

10 m radius circle plots

Flagged at center point and at cardinal directions

Pellets 0.1m<sup>2</sup> from center of group will not be collected



The diagram shows a red circle representing a 10m radius plot. The cardinal directions are labeled: N (North) at the top, S (South) at the bottom, E (East) on the right, and W (West) on the left. A horizontal line from the center to the right edge is labeled '10m'. A small square labeled 'keeper' is located inside the circle, slightly to the left of the center.

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### Scat Sampling Collection

Latex Gloves

Placed in Paper Bags

Labeled:  
Date, Plot #, Sample #, and Ranking

Stored:  
Open Air Containers

Desiccant added

Sent to Wildlife Genetics International to be analyzed



The photograph shows a brown paper bag with handwritten text in blue ink. The text reads: 'Jan. 12, 2010', 'Day 2 Site 1-12A', 'N 35.22.681', 'W 086.09.974', and '# Pellets=10 + Recapt'.

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### Genotyping

Wildlife Genetics International  
QIAGEN's Dneasy Blood and Tissue Kits  
ATL digest buffer  
Individual Genetic Profiles  
6 microsatellites  
Gender Determination  
ZFX/ZFY gender marker



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### Analysis

- **Program DENSITY**
  - Uses encounter histories similar to Program MARK but also incorporates spatially explicit mark-recapture locations
  - Allow us to obtain estimates of home ranges and population density unbiased by edge effects and incomplete detection

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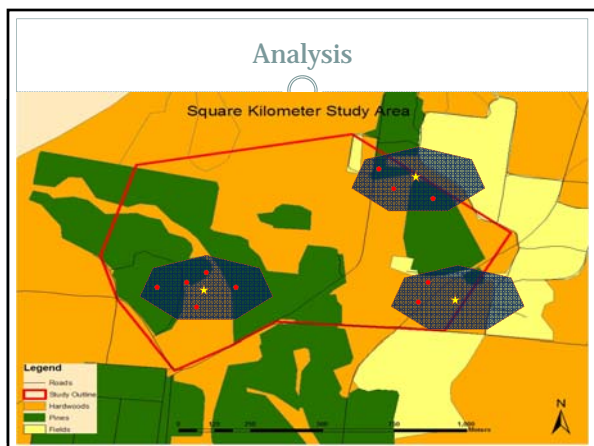
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### Aknowledgements

- **Committee members:**
  - Drs. Lisa Muller, Craig Harper, Joe Clark, Frank van Manen
- **Funding Agencies**
  - FWF, UTIA Ag Innovation, DoD, USFWS
- **Rick McWhite, AAFB Natural Resource Manager**
- **Wes Winton, AEDC WMA Manager**
- **Jared Beaver, Fellow Grad Student**
- **Technicians**
  - Ashley Unger, Marcus Mustain, Sandra Nash, Shane McKenzie

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### Questions?



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