Linking White-tailed Deer Density, Nutrition, and Vegetation in a Stochastic Environment: Population Dynamics

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THIRD OF 3 PART SERIES
DENSITY DEPENDENCE

- Widely documented in ungulates

- Especially in temperate, relatively stable environments

- In stochastic environments, density dependence has been controversial
Stochastic Environment

(CV annual precipitation >30%)

Density Dependent (DD) responses variable and site specific?
Stochastic Environment

Hypotheses:

- DD always operating (but sometimes undetectable)
- DD acting sometimes, but not always
- DD not expressed (Density Independent)
Deer foraging and nutrition

Vegetation

Deer morphology and demography

Diet composition, quality, intake rate

Diet quality

Intake rate

Percent forbs

Percent grass

Percent shrubs

Cover, richness, diversity, evenness

Percent grass

Percent forbs richness, diversity, evenness

Ratio, rate, or mass

Deer density

Hypothesized

Alternative
Experimental Design

- 3 deer densities x 2 ranch replicates
- 81 ha enclosures
9 Years of data
2004-20012

Central water source

Densities adjusted twice/year
Population monitoring

Most deer tagged

Populations monitored by camera survey and estimated by RECONSTRUCTION

\[ \hat{Y} = 0 + 0.99X \]
Detecting Density Dependence

- Fawn/doe ratio
- Growth rate of fawns and yearlings
- Survival of deer 6-14 months of age
- Survival of deer >14 months of age
- Adult body mass (buck 4-10 yrs, does 2-10 yrs)
- Population growth rate
Fawn/Doe ratio

• Reconstruction used to estimate does present in July

• Reconstruction also used to estimate number of fawns in December

• December approximate time of weaning
Daily Growth Rate

- We weighed fawns and yearlings harvested in population adjustments
- Subtracted birth mass
- Calculated days since assumed July 18 birth
- Calculated kg/day growth rate
Survival—Older fawns and adults

- Used camera records of tagged deer
- PROGRAM MARK
- Estimated survival
Adult body mass

All captured and harvested deer were weighed

Platform scale
Population Growth Rate

- We calculated lambda apparent ($\lambda_{\text{APP}}$) accounting for deer added and/or removed from enclosures
Statistical Analysis

- Mixed models
- Repeated measures
- One-tailed tests for density effect
RESULTS

• No density dependence ($P > 0.10$):
  • Growth rate of fawns and yearlings
  • Survival of deer 6-14 months of age
  • Survival of deer >14 months of age
RESULTS
Fawn/doe ratio ($P = 0.04$)
RESULTS

Adult body mass ($P = 0.10$ does, $<0.01$ bucks)
RESULTS

Population growth rate \((P = 0.04)\)
Question

• Only minor density effects on diets (Dave Hewitt) and vegetation composition (Tim Fulbright)

• Yet density effects on fawn/ewe ratio, adult body mass, and population growth rate

• WHY?
Home range size declined significantly as density increased.
Some deer in low quality patches?
SIX PUBLISHED POPULATION ESTIMATES FOR SOUTH TEXAS

Density Dependence?

Deer/Kilometer squared

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- 
- 
- 

Unlikely

May be

Likely

Medium

Low

11
13
16
18
36
40

High
Difficult for STX Deer to increase to level where DD apparent
Stochastic Environment

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