Dissertation Chapter Outline

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## Chapter 1: Conceptual Synthesis and Perspectives on Population Modeling Tools and Decision Frameworks in Wildlife Management

**Objective**:

* Provide a synthesis of how wildlife population models have evolved, what analytic advances have emerged, and what limitations still exisespecially in the context of deer management in the Southeast.

**Main Points**:

* Population models are central to setting harvest regulations and answering core management questions, but most agencies rely on a narrow range of tools.
* Review of traditional methods like SAK and SPR, matrix-based approaches, and recent growth in Bayesian state-space models and agent-based models (ABMs).
* Comparative summary across key factors like data needs, interpretability, cost, and adaptability.
* Overview of how newer platforms (e.g., R, GitHub, NetLogo, Shiny) and tools (e.g., ArcGIS Field Maps, Survey123) are changing what’s possible (e.g., cloud computing)
* Gaps remain in reproducibility, flexibility, accessibility, applicability
* Introduce the need for pluralistic, modular frameworks - Ani’s “Rule of 3” as a rationale for using multiple tools instead of relying on a single model - a ‘bouquet’ or ‘toolbox’

**Alternatives and Additions**:

* Consider including qualitative feedback from biologists or analysts across multiple states to capture operational constraints and design preferences.

## Chapter 2: Building a Modeling Framework for Deer Management

**Objective**:

* Build an adaptable population modeling framework using Alabama as the initial focus, centered around an ABM and designed for eventual transferability to other states or contexts.

**Main Points**:

* Outline of available harvest data, cooperator check station records, and decision workflows currently used by Alabama DWFF.
* ABM built using ODD protocol as the foundation using available data in AL representing spatial harvest dynamics, deer life-history, and hunter behavior.
* Integrate other modeling and methods (e.g., spreadsheet deterministic models can help initialize or calibrate the ABM)
* Scenario-based evaluation: simulate the impact of regulatory changes (e.g., season length, bag limits, spatial scale, demographic ratios) on deer population structure and harvest outcomes.
* Use trade-off analysis to visualize how decisions might perform across multiple agency objectives (e.g., age structure, harvest numbers, effort).

**Alternatives and Additions**:

* Demonstrate generalizability by applying model structure to a second southeastern state using their data templates. (motivation for participatory effort from DWFF)
* Include scenarios with a decline in hunting participation and explore alternative approaches (e.g., landowner incentives, recruitment-focused efforts).

## Chapter 3

## Option A: Integrating Evaluating Nontraditional Data for Modeling and Monitoring

**Objective**:

* Assess the potential to incorporate and validate wildlife population models using existing data sources that are publicly available

**Main Points**:

* Categorize data by structure: traditional (cooperator harvest), semi-structured (camera projects), and unstructured (e.g., social media, opportunistic sightings).
* Test how these data could validate model predictions or refine parameter estimates.
* Build feedback loops where outputs from simulations inform priorities for new data collection, and vice versa.
* Consider implementation challenges such as standardization, storage, legal concerns.
* Highlight automation opportunities (e.g., ML image classification), and future surveillance systems that enable more responsive management.

**Alternatives and Additions**:

* Focus in on trail cameras as a case study—building off recent applications in avian monitoring (e.g., Jonathon’s bird point work).

## Option B: Designing Modeling Tools and Data Systems with State Agencies and Stakeholders

**Objective**:

* Work directly with Alabama DWFF and other stakeholders to co-develop usable, trusted, and streamlined data systems and modeling interfaces.

**Main Points**:

* Identify what data is already collected (e.g., antler points, age estimates) and evaluate how it could feed into a modeling workflow.
* Propose centralized workflows to reduce archived or inconsistent data collection (e.g., digital entry from the field, real-time dashboards).
* Conduct interviews or surveys with hunters, landowners, and agency staff to understand trust in models, desired outputs, and transparency needs.

## Option C: Modeling Stressor Interactions and Regulatory Trade-Offs in Southeastern Deer Populations

**Objective**:

* Extend the ABM to simulate how interacting population stressors such as disease outbreaks, habitat degradation, and invasive species—could shape management outcomes and risk-based decision-making.

**Main Points**:

* Overview of stressors: CWD, EHD, tick-borne burdens, drought effects, competition with pigs.
* Link stressor events to modeled dynamics (e.g., how reduced forage + high density = higher disease prevalence).
* Simulate compounding scenarios (e.g., drought year + reduced hunter effort + EHD outbreak).
* Evaluate cross-boundary impacts from local disturbances.
* Model surveillance strategies and adaptive regulation
* Include uncertainty analysis: how risk tolerance and unknowns could shift decision thresholds.