

# Traffic Noise Impact on Bird Migration: Predictive Analysis Framework

## Project Overview

This capstone project will develop a predictive tool to analyze how traffic noise along the I-95 corridor affects bird migration patterns. By integrating transportation data with bird observation records, the project will quantify relationships between traffic patterns, vehicle characteristics, pavement conditions, and changes in bird migration timing.

## Research Questions

1. How has bird migration timing changed along the I-95 corridor over the past two decades?
2. What is the relationship between traffic noise (influenced by vehicle weight, pavement condition, and volume) and these migration timing shifts?
3. How might future changes in traffic patterns and vehicle fleet composition impact bird migration?

## Methodology

### 1. Data Integration

- Collect and align bird observation data with traffic pattern information
- Develop corridor segmentation framework for consistent spatial analysis
- Create temporal standardization protocols for cross-dataset comparison

### 2. Historical Analysis

- Analyze historical trends in migration timing metrics for indicator species
- Correlate with traffic volume, vehicle weight profiles, and pavement condition data
- Develop statistical models to quantify relationships while controlling for confounding variables

### 3. Predictive Model Development

- Implement ensemble modeling approach to handle component weight uncertainty
- Validate using historical data with appropriate train/test splits
- Create scenario generator for exploring future conditions

#### 4. Visualization and Reporting

- Develop interactive dashboard for exploring results
- Generate maps of critical "acoustic conflict zones"
- Prepare final report with policy recommendations

### Expected Outcomes

1. A validated model showing relationships between traffic noise components and bird migration timing
2. Projection tool for forecasting impacts under different traffic and vehicle fleet scenarios
3. Identification of priority areas for noise mitigation or conservation efforts
4. Evidence-based recommendations for transportation planning and conservation policy

### Technical Approach

- SQL/Presto for data integration and cleaning
- R/Python for statistical modeling and machine learning analysis
- Bayesian hierarchical models to handle uncertainty in component weights
- Sensitivity analysis to identify critical thresholds and intervention points
- Predictive modeling of bird resting points around highways
- Predicting detour routes
- How are xyz species specifically affected?

### Project Significance

This research addresses an important knowledge gap at the intersection of transportation planning and conservation biology. By quantifying how traffic noise affects migratory birds, the project will inform both infrastructure decisions and wildlife management practices along one of North America's most critical migration corridors.

Existing Literature:

<https://www.nature.com/articles/s41467-020-16899-x>

<https://www.sciencedirect.com/science/article/pii/S2351989421001049>

<https://www.pnas.org/doi/10.1073/pnas.1504710112>

<https://abcbirds.org/blog/north-american-bird-flyways/>