The Economic Value of Biodiversity in India

Running Notes

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Project Description

This project aims to produce the first measure of willingness to pay (WTP) for biodiversity. This provides a monetary measure to value biodiversity which can be applied to a wide variety of applications in environmental economics and natural captial accounting. The data relies on E-bird observations of diverse bird species observations. The sample is limited to local, long-time users who are residents (not tourists) in India. The methodology to calculate WTP relies on a revealed preference throughh the random utility model (RUM). The RUM determines the value of seeking out diverse species of birds by comparing the value of alternative counterfactual bird siting locations and the cost to go to these counterfactuals. Monetary value is determined through the RUM by estimating the travel cost of the reveal preference compared to counterfactual locations.

Notes

For notes, we present the most recent first so that notes are chronologically most recent.

9/12/2025

Raahil, Matt, Ryan, Jovin

TODO:

- **Matt**: Diagnositics for missing species richness
- **Matt/Jovin**: Migration component for Shift-share
- **Ryan/Jovin**: Computing Shift-Share

- **All**: Review new working paper (has new IV)

Agenda

1. Missing information for species richness by season
- Core issue coming from the imputation with BirdLife data leading to negative coefficient
- Several hotspot clusters are missing seasonal information
  - Means that noone is visiting these hotspots previously (e.g., rarely visited)
- Diagnostic: Number of trips per hotspot (confirm they are hotspots)
  - Number of distinct time periods with observations for each hotspot
2. Migration for Shift-share
- Classify birds are migratory or not
- Remove species with missing migratory classification
- Keep migratory species to determine migration connections to regions
- Jovin has successfully matched a lot of these (fuzzy matching)

8/27/2025

Ryan, Jovin

TODO:

- **Matt**: We need to meet with you to discuss working on this with MSI
- **Jovin**: Responsible for Shift
- **Ryan**: Responsible for Share

Plan to Estimate Shift-Share

1. Merge the Species range data with the migratory species data
   - Species range data: base-data/species/BOTW_2024_2.gpkg
   - Migratory species data: base-data/species/species_list_categorized.csv
   - Merge by: scientific_name
   - Result: species level data with range map and classifier for migratory
2. For each country j, calculate γ_j

$$\gamma_j = \sum_{s=\text{total num of species in j}}^{S} \frac{\text{species range overlap India}_{sj}}{S_j}$$

- Count the number of species s in j
  - Species range data: base-data/species/BOTW_2024_2.gpkg
  - India Borders: data/shp/district-2011
  - Need to make one shape (spatial union) so any intersection with India shape
  - Indicator for each species if any overlap of species with India borders
- Spatial overlap of species s range over the country border of India. This will create some fraction.
  - Calculate sqkm for India shapefile one time (part 1)
  - Spatial inner join of range s on India.
  - Calculate sqkm for the inner join (part 2)
  - Divide part 2 by part 1 to get the fraction of overlap for species range over India borders
- Combine to make γ_j using the weighted sum $\sum_s$
  - Spatial intersection of species range s with countries in the flu dataset
  - Create the weight S_j by counting the number of indicators for intersecting ranges with j
  - Create γ_j for each j by summing fractions in (2) divided by weight S_j
  - Country j Shapefiles: TODO.

1. Create the shift by merging γ_j with the flu data - Flu Data: data/clean/flu-data.csv - Result is time series by t

$$Shift_t = \sum_{j=country}^{J} flu_{jt} \times \gamma_j$$

2. Create the share for each hotspot t

$$Share_d = \sum_s \frac{\text{Indicator for migratory}_{sd}}{S_d}$$

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1. Start with e-bird data. For each hotspot $d$ get the number of unique species observed
    - e-bird data: Ask Matt what is the best way to do this given the current workflow.
2. Merge in the migratory data on these species for each hotspot $d$
    - Migratory species data: base-data/species/species_list_categorized.csv
    - Merge by: scientific_name
3. Create the share variable as weighted sum for hotspot $d$
    - For hotspot $d$, count indicator for migratory.
    - For hotspot $d$, get count of unique species $S_d$
    - Then construct sum of the fractions.
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