Camper Travel Patterns: What Do State-Level Data Tell Us?

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Background

• I work on spatial and temporal aspects of invasions, typically at broad scales
  – Focus on human-mediated pathways
• At last year’s Continental Dialogue meeting
  – I presented analyses of National Recreation Reservation Service data (NRRS)
    • Patterns of camper travel (and presumably firewood movement)
  – As a group, we discussed need for additional analyses
• Opportunity arose via TNC to work with North Carolina State Parks data
  – Margaret Fields and Markus Le deserve lots of credit!
NRRS data vs. NC State Parks data

• NRRS
  – 7.2 million reservations over ≈5-year period
  – > 2500 campgrounds

• NC State Parks
  – 65,520 reservations over 1 year (Oct 2013-Sept 2014)
  – 29 parks
  – Fields: park location, camper origin ZIP code, date of reservation, number of people, number of days
  – Calculated (straight-line) travel distance between origin and park
  – Unlike NRRS, information on how reservation was made: Web, Telephone, or On-Site ("Field Manager")

• Neither provides information on camper firewood usage
Histograms of camper travel distances

**NRSS**

Mean distance: 236 km
Median: 93 km
Maximum: 5566 km

**NC State Parks**

Mean distance: 162 km
Median: 75 km
Maximum: 3908 km
NC State Parks, histograms by reservation type

- **All reservations**
  - Mean: 162 km
  - Med: 75 km
  - Max: 3908 km
  - N = 49264

- **Web reservations**
  - Mean: 161 km
  - Med: 80 km
  - Max: 3908 km
  - N = 49264

- **Phone reservations**
  - Mean: 169 km
  - Med: 80 km
  - Max: 3865 km
  - N = 9973

- **On-site reservations**
  - Mean: 161 km
  - Med: 45 km
  - Max: 3795 km
  - N = 6463
Number of camper reservations broken down by type

- **Piedmont region**
  - Jordan Lake State Recreation Area
  - Kerr Lake State Recreation Area
  - Falls Lake State Recreation Area
  - Hanging Rock State Park
  - Morrow Mountain State Park
  - Lake Norman State Park
  - Pilot Mountain State Park
  - William B. Umstead State Park
  - Medoc Mountain State Park
  - Eno River State Park
  - Raven Rock State Park
  - Crowders Mountain State Park
  - Stone Mountain State Park
  - New River State Park
  - South Mountains State Park
  - Lake James State Park
  - Mount Mitchell State Park
  - Gorges State Park
  - Mount Jefferson State Natural Area
  - Carolina Beach State Park
  - Hammocks Beach State Park
  - Merchants Millpond State Park
  - Cliffs of the Neuse State Park
  - Goose Creek State Park
  - Jones Lake State Park
  - Pettigrew State Park
  - Lumber River State Park
  - Lake Waccamaw State Park
  - Jockey's Ridge State Park

- **Mountains region**
  - Piedmont region
  - Coastal region

- **Coastal region**
  - Piedmont region

Legend:
- Web
- Telephone
- On-Site
## In-state vs. out-of-state camper origin

<table>
<thead>
<tr>
<th>Region / Park</th>
<th># Res</th>
<th>In State (%)</th>
<th>Out of State (%)</th>
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<tbody>
<tr>
<td><strong>Coastal</strong></td>
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<tr>
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<td>3788</td>
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<td>73.2</td>
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<tr>
<td>William B. Umstead State Park</td>
<td>1202</td>
<td>87.3</td>
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Regional differences in travel distances

Carolina Beach State Park
Cliffs of the Neuse State Park
Goose Creek State Park
Hammocks Beach State Park
Jones Lake State Park
Lake Waccamaw State Park
Lumber River State Park
Merchants Millpond State Park
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Mount Mitchell State Park
New River State Park
South Mountains State Park
Stone Mountain State Park
Network Modeling

- At last year’s meeting, presented results of analyses completed with network model using NRRS data
- Similar network model built for NC State Parks data
  - Programmed in R (by Markus)
  - Bidirectional network
  - Key assumption: 15% of campers bring firewood home with them
Network Modeling

• Two main objectives
  – Origin risk
    • Focusing on out-of-state origins
  – Park risk
    • Again, out-of-state origins
Number of reservations

- 1
- 2 - 3
- 4 or more

△ State park
● Visitor origin (ZIP)

NC State Parks Network
Out-of-State Origin Risk, NRMR Network Model

Origin Probability, $\varphi_{ij}$

- < 0.000001
- 0.000001 - 0.00001
- 0.00001 - 0.0001
- 0.01 - 0.1
- 0.1 - 1
- 0.0001 - 0.01
- 0.001 - 1

North Carolina
Summary Points

• Similarities and differences between national-level and state-level camper reservations data
• Implications for firewood regulation and management (including messaging)
• State-level network model enables nuanced analyses
• Now analyze data from other states?
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