PPGIS for Environmental Planning & Design

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Outline of Talk

- Background
- Proposed PPGIS projects
- Case Study: WNC NF Planning
  - Data and Methods
  - Results
  - Conclusions
- NC Projects, Methods and Outcomes
  - WMPO
  - Washington

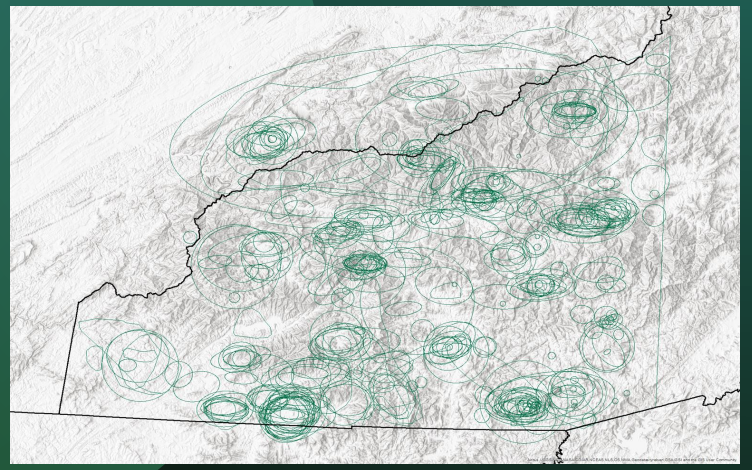
What is PPGIS?

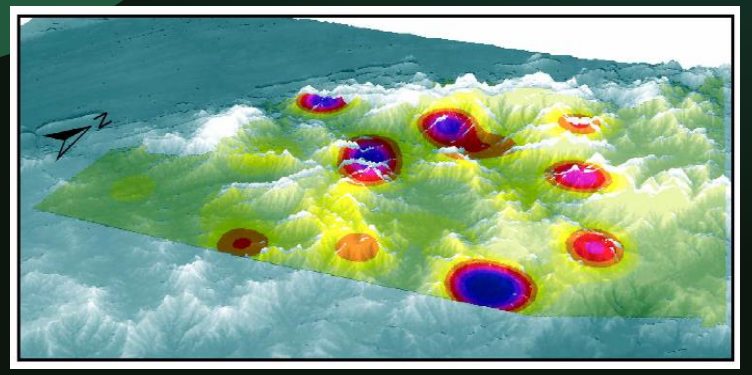
Public participatory GIS (PPGIS) is defined as a field within geographic information science that focuses on the public uses of various forms of geospatial technologies to participate in public processes, such as planning and decision making.

Source: Tulloch, D., 2008, Is VGI Participation? From Vernal Pools to Video Games, GeoJournal, 72:161-171.

How Does PPGIS Work?

- Builds on the ideas of spatial attribute mapping
- Respondents draw features (i.e., points, lines, or polygons) on a map of a designated landscape and assign values to those places
- Data can be digitized and spatially analyzed to show how values are distributed across the landscape



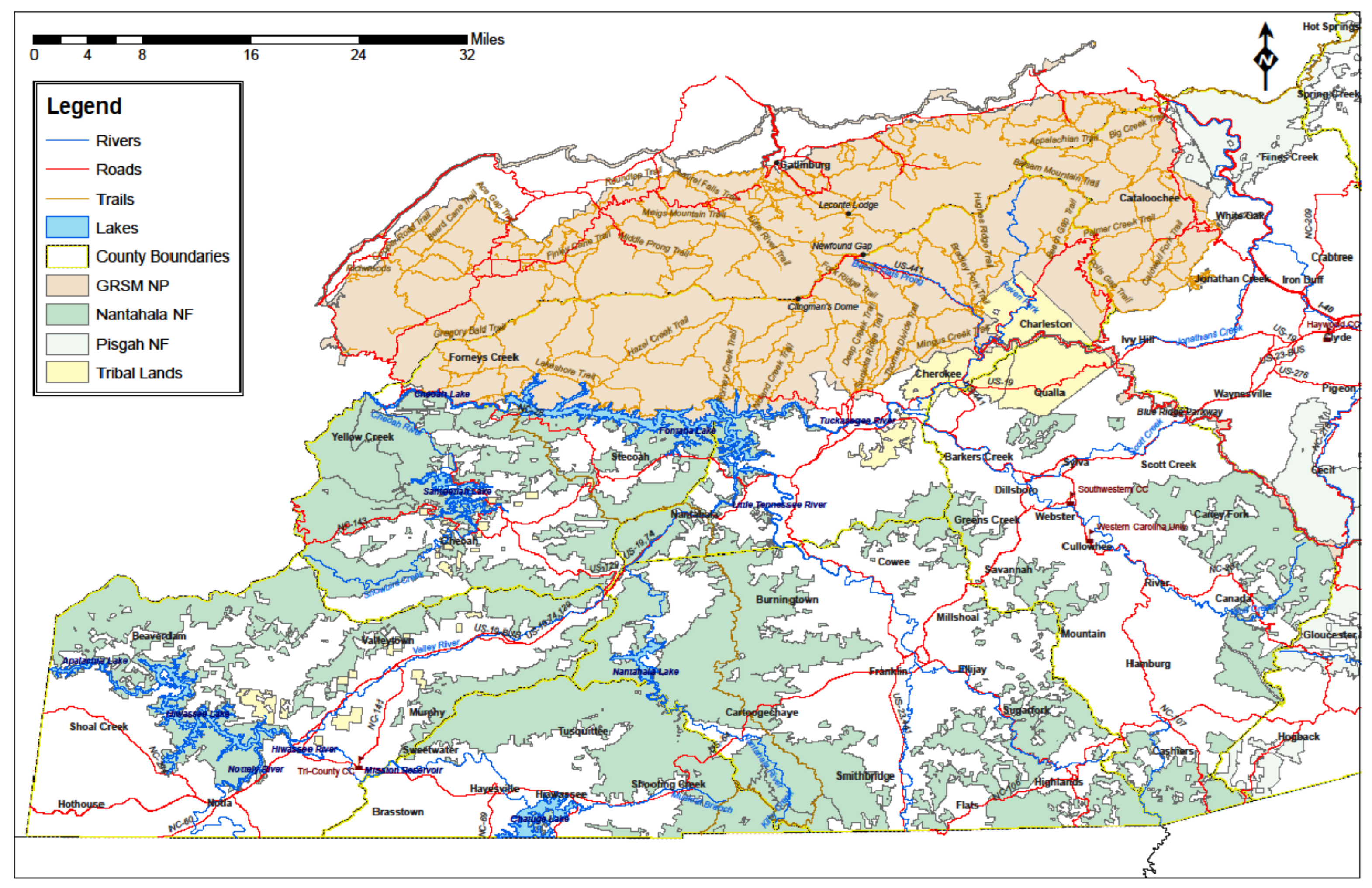


Proposed PPGIS Projects

- *Using public participatory GIS to enhance climate adaptation and resilience in Puerto Rico*, National Oceanic and Atmospheric Administration, Climate Program Office, Adaptation Sciences Division; D.M. Styers, K. Rogers, and G. Dobson, co-PIs
- *Using public participatory GIS to enhance climate adaptation and resilience in North Carolina*, University of North Carolina System, Research Opportunities Initiative; D.M. Styers, K. Rogers, G. Dobson, and N. Pricope, co-PIs
- *Engaging underserved communities in designing nature-based solutions for coastal flooding in NC*, National Fish and Wildlife Foundation, National Coastal Resilience Fund; D.M. Styers, K. Rogers, G. Dobson, and N. Pricope, co-PIs

Case Study: WNC NF Planning

- 7 rural counties
- Public lands (NF, NPS)
- Tribal lands
- 8,025 km^2 of land area
- Home to 194,102 people (US Census Bureau, 2010)
- ~25 people/km^2



Data and Methods

Sampling

Events with good accessibility to public across region

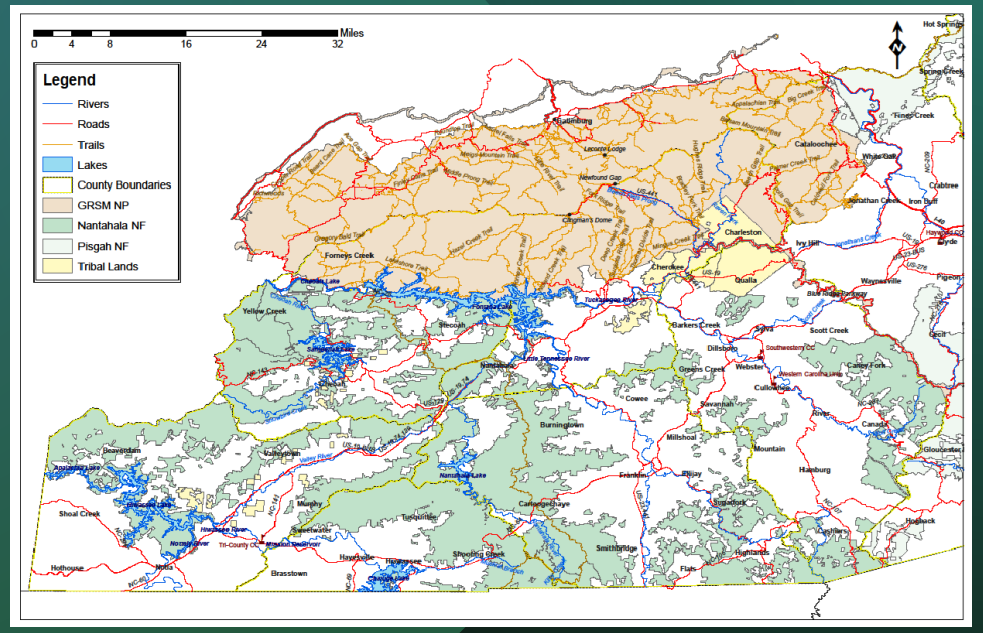
Selected 5 WNC communities with fall festivals (popular among locals and tourists)

Label in Figure 1	Location name	Respondents	Polygons
B	Brasstown	36	111
C	Cullowhee	42	150
F	Franklin	10	40
H	Highlands	13	55
S	Stecoah	15	63
Total		116	419

Data and Methods

Survey Instrument

- 11” x 17” color paper map of WNC
- Short survey, included questions about participant’s:
  - resident or visitor status
  - zip code
  - frequency and length of stay of visits
  - gender
  - race/ethnicity
  - age
  - education
  - household income
- Identify up to 5 places in WNC that are important to you
- For each location, list all activities you do there, and up to 3 values you have for those places



Survey Participant Information

For each question, please fill in the blank or mark the box that most closely resembles your situation.

1) **zip code** or **country** of your primary address _____

2) Do you consider yourself a resident of or a visitor to western North Carolina? ***Circle only one.***

Resident Visitor

3) In the past 5 years, how often have you visited western North Carolina?

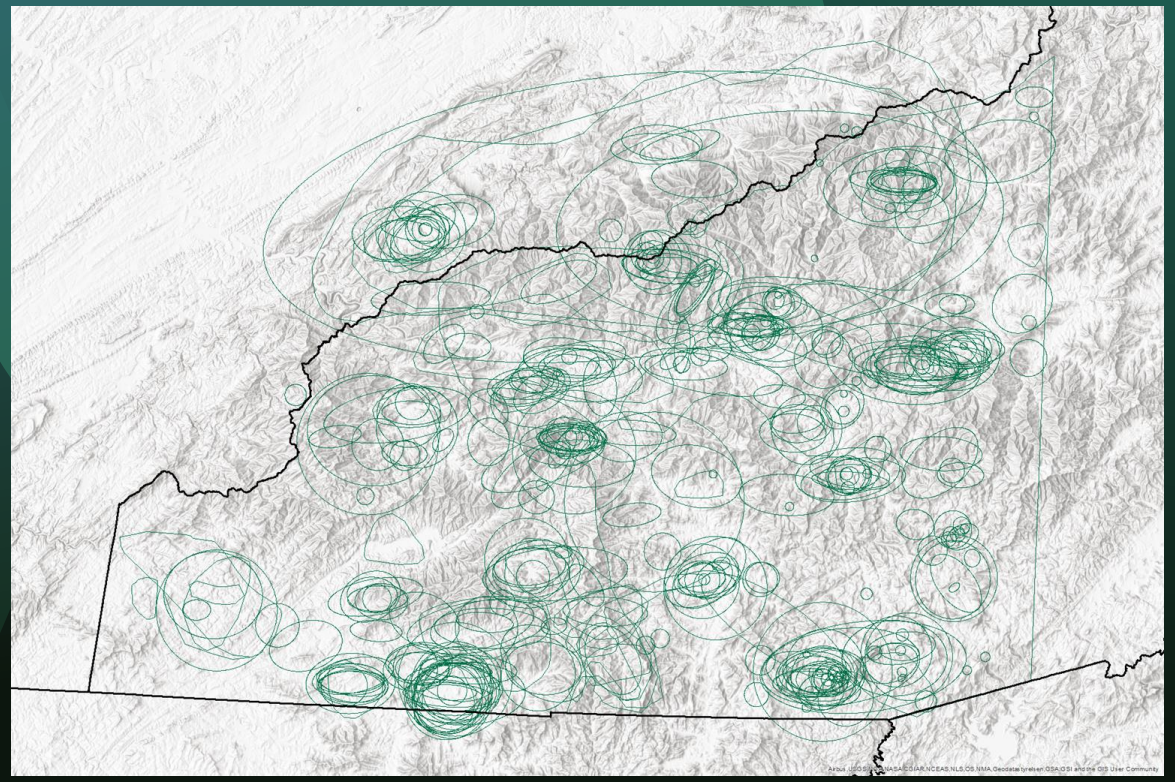
☐ I live here # years _____ *Skip Question 4*
☐ First time
☐ Once or twice
☐ Occasionally (1-2 times per year)
☐ Often (many times each year)

Data and Methods

Digitizing and Data Entry

- All activity polygons created by the survey respondents were digitized in ArcGIS
  - 419 shapes total

- Tabular survey data were entered into a spreadsheet and then linked to a merged shapefile of all 419 activity locations

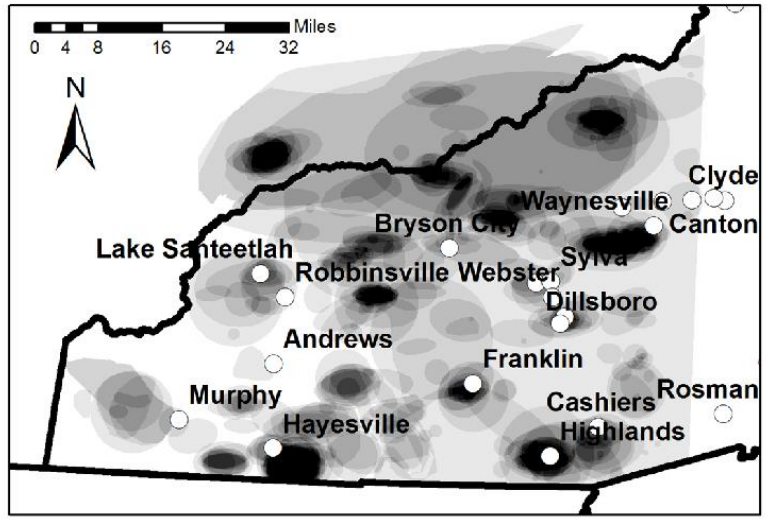


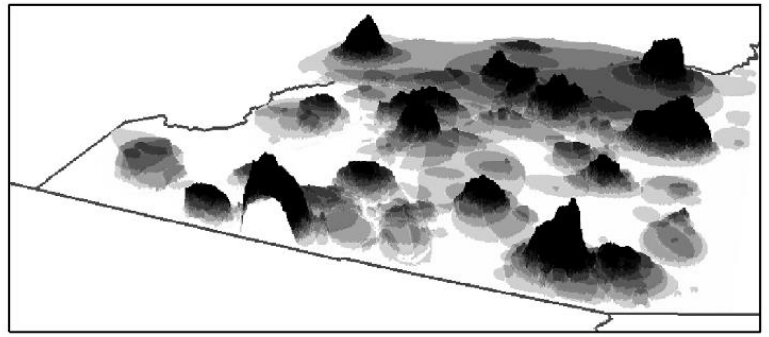
Data and Methods

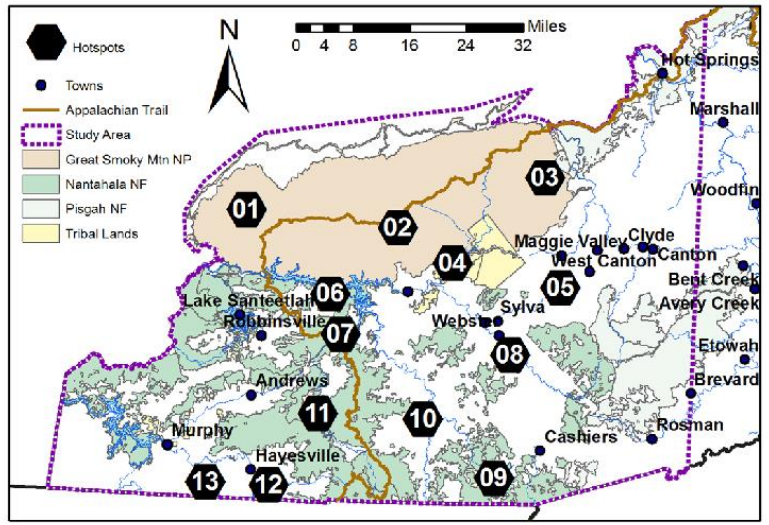
Rasterization Process

- Rasterized each polygon individually, and then summed the number of times each pixel across the study area was included in a polygon

- Identified 13 “hotspots” of high intensity use and other patterns outside of high-density locations



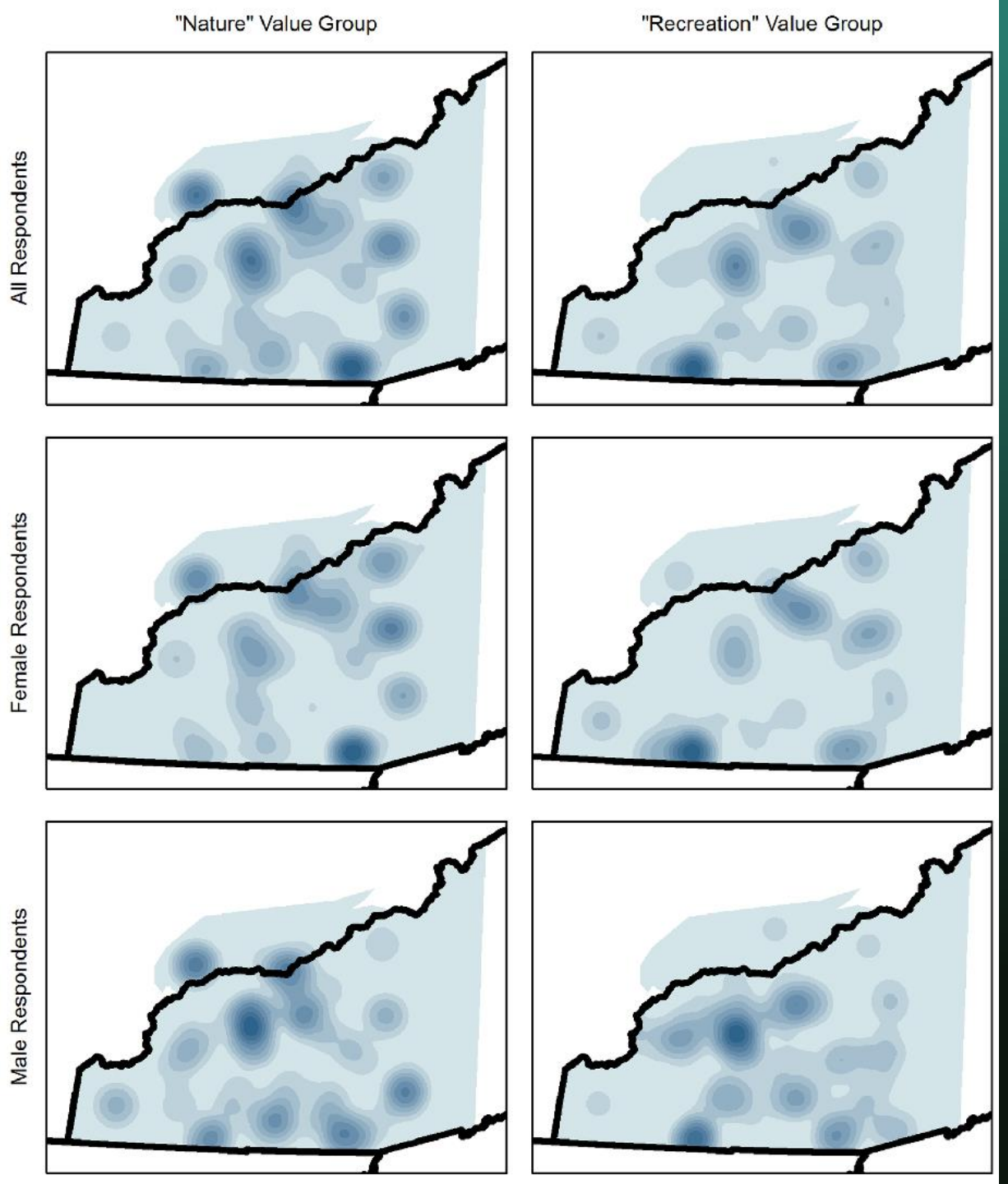




Results

Kernel Density Patterns

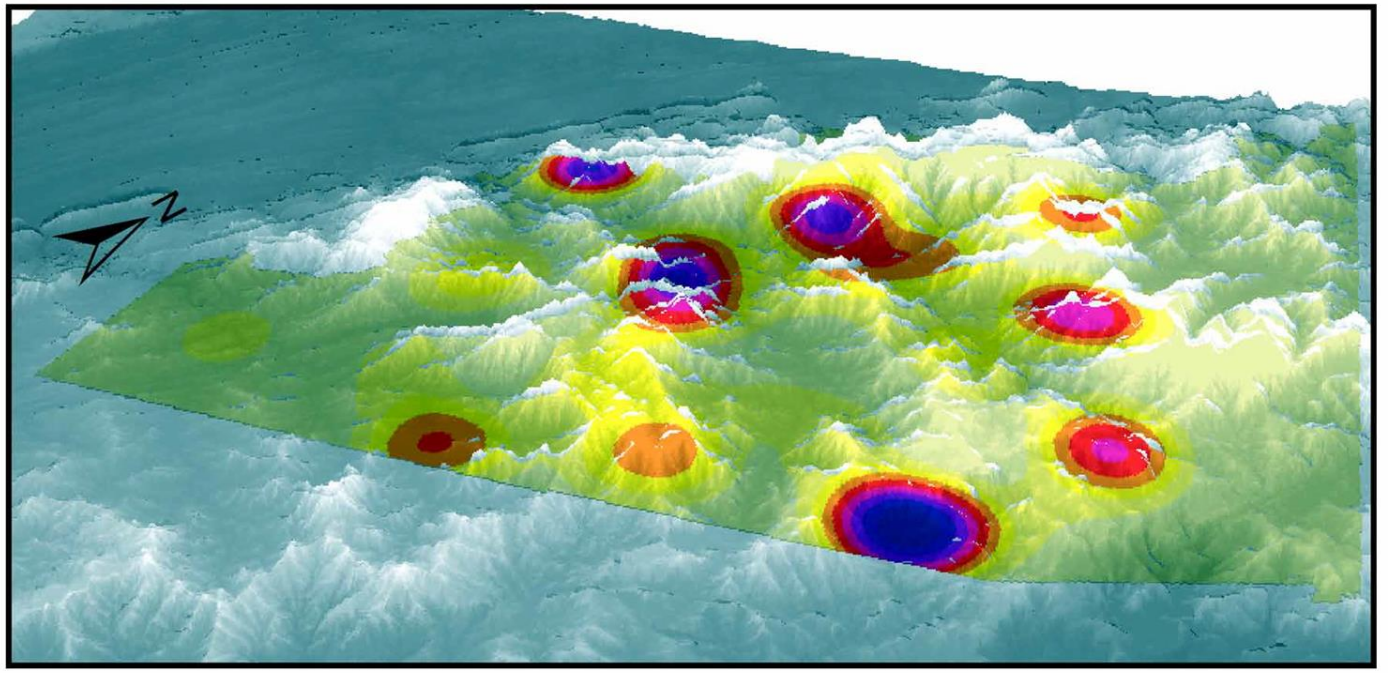
- Constructed by creating centroids for each polygon, which inherited all attribute data
- This process is much quicker to set up and run than the rasterization process discussed before and can produce a number of analysis surfaces in a short amount of time
- Spatial patterns result (at right)



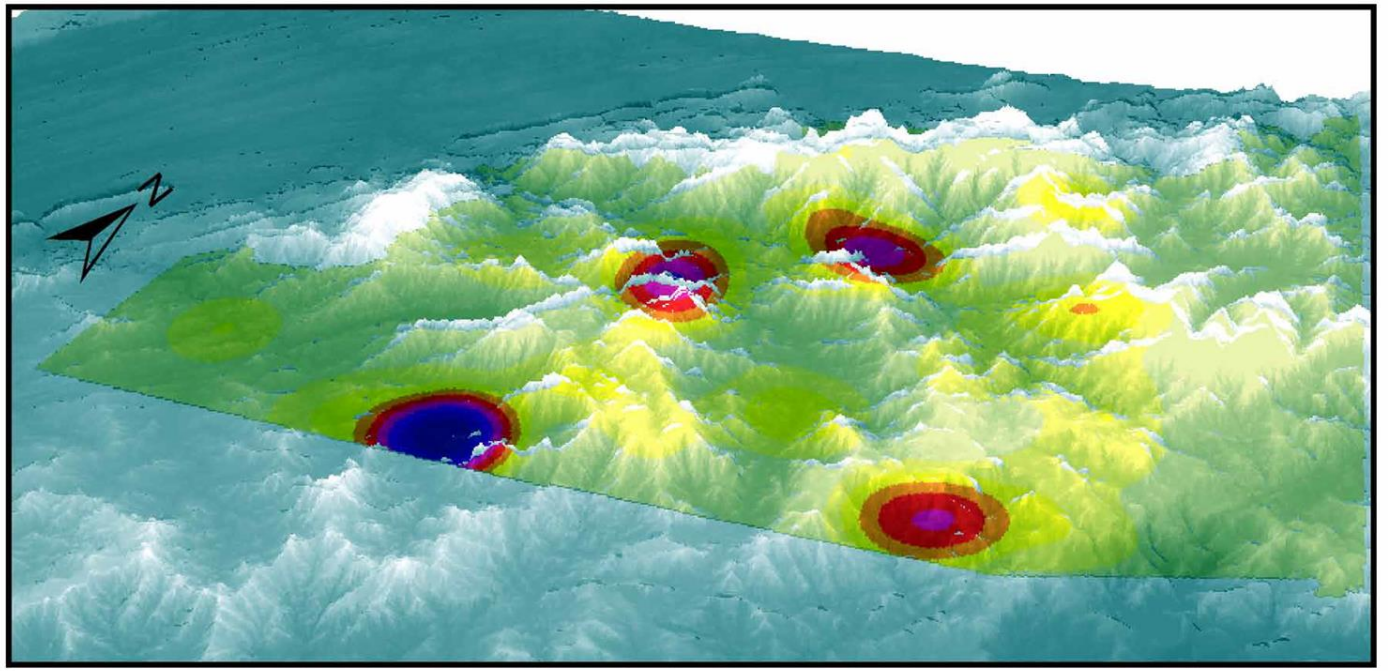
Results

Kernel Density

- In images at right, we draped kernel density surfaces over mountain and valley topography to illuminate role of terrain for each of our value groupings



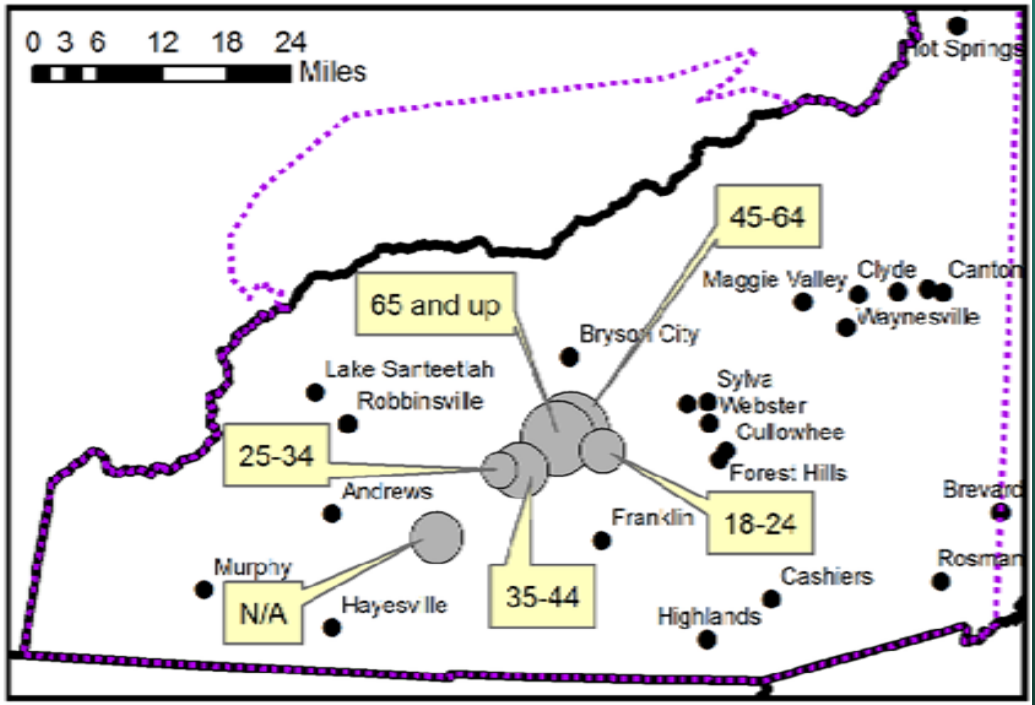
Top: “Nature” and Bottom: “Recreation” kernel density surfaces

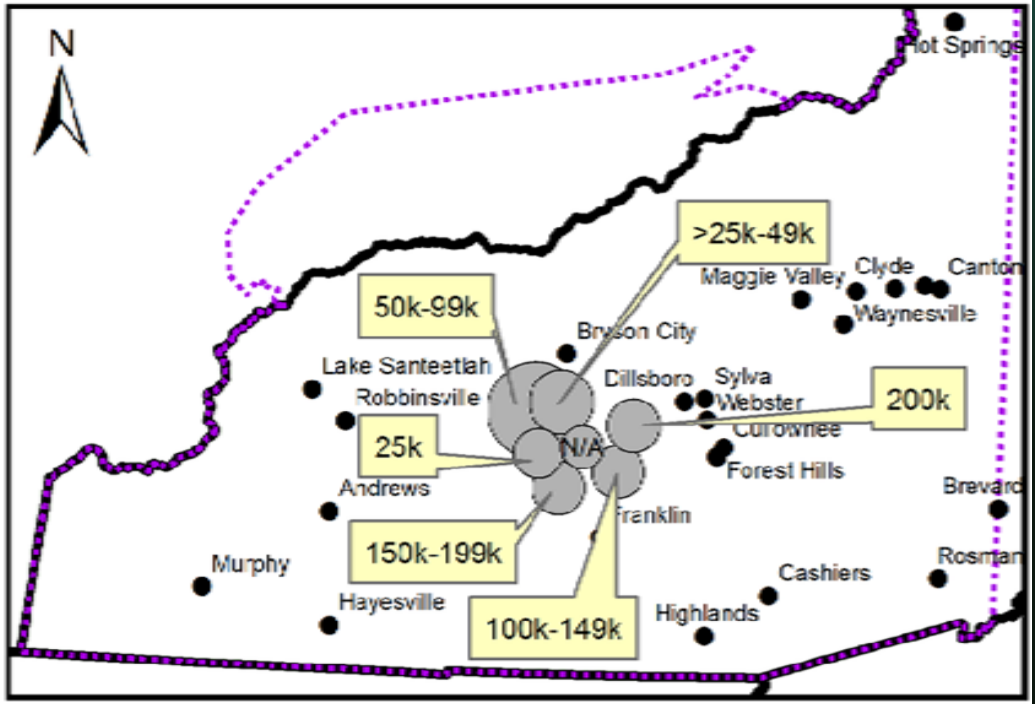


Results

Descriptive Spatial Statistics

- Upper: by age
  - Older age groups utilize more of the area than younger age groups, as shown by size of circle
- Lower: by household income
  - 3 lowest income categories trend to the west and north
  - 3 highest categories trend to the south and east of that line
  - This puts the lower incomes deeper into mountainous areas and farther from major settlements.

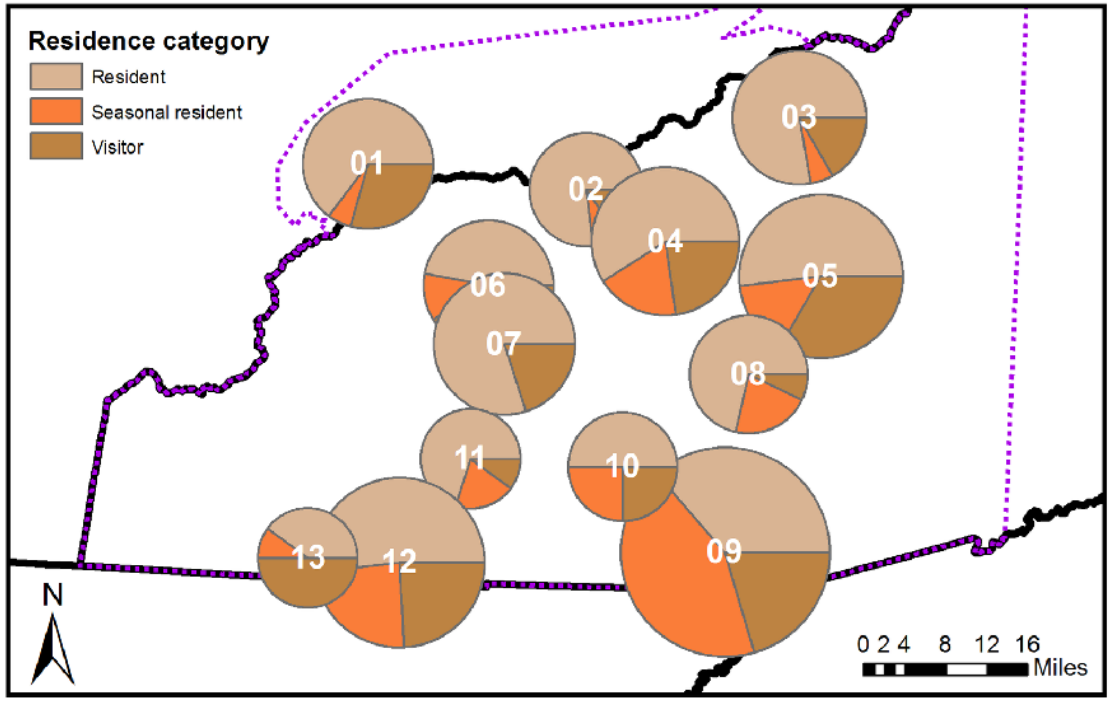


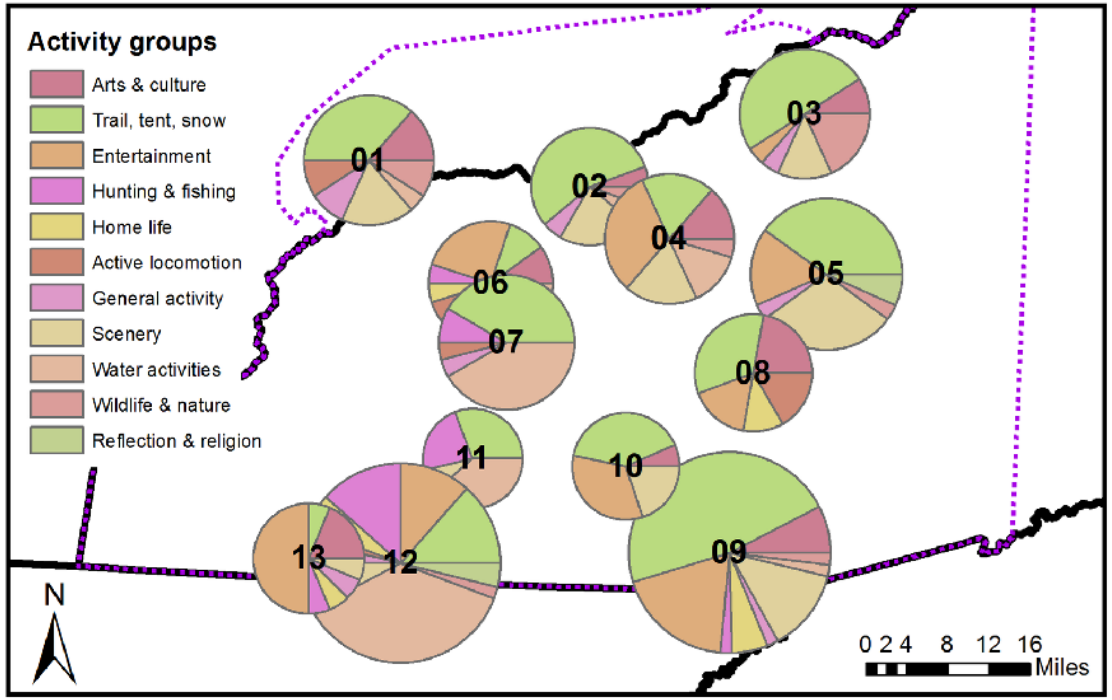


Results

Graduated Pie Charts

- Allow us to visualize two attribute dimensions plus location
- Upper: Seasonal residents are strongly represented in the Highlands area (Hotspot 9) and to the south and east
- Lower: We can see the dominance of one-two primary activities at each of hotspots, and that the dominant activity varies from site to site

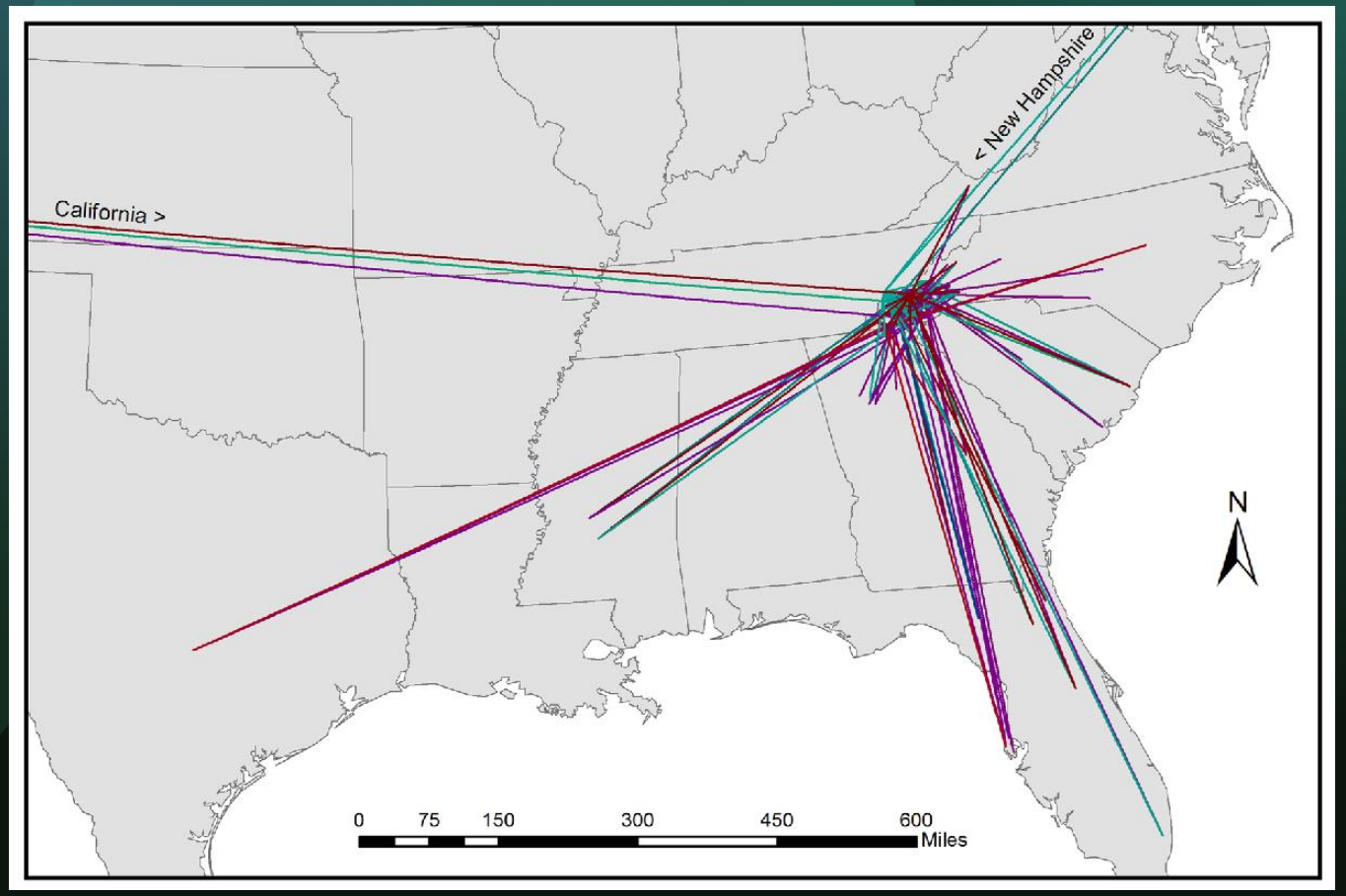




Results

Origin-Destination Lines

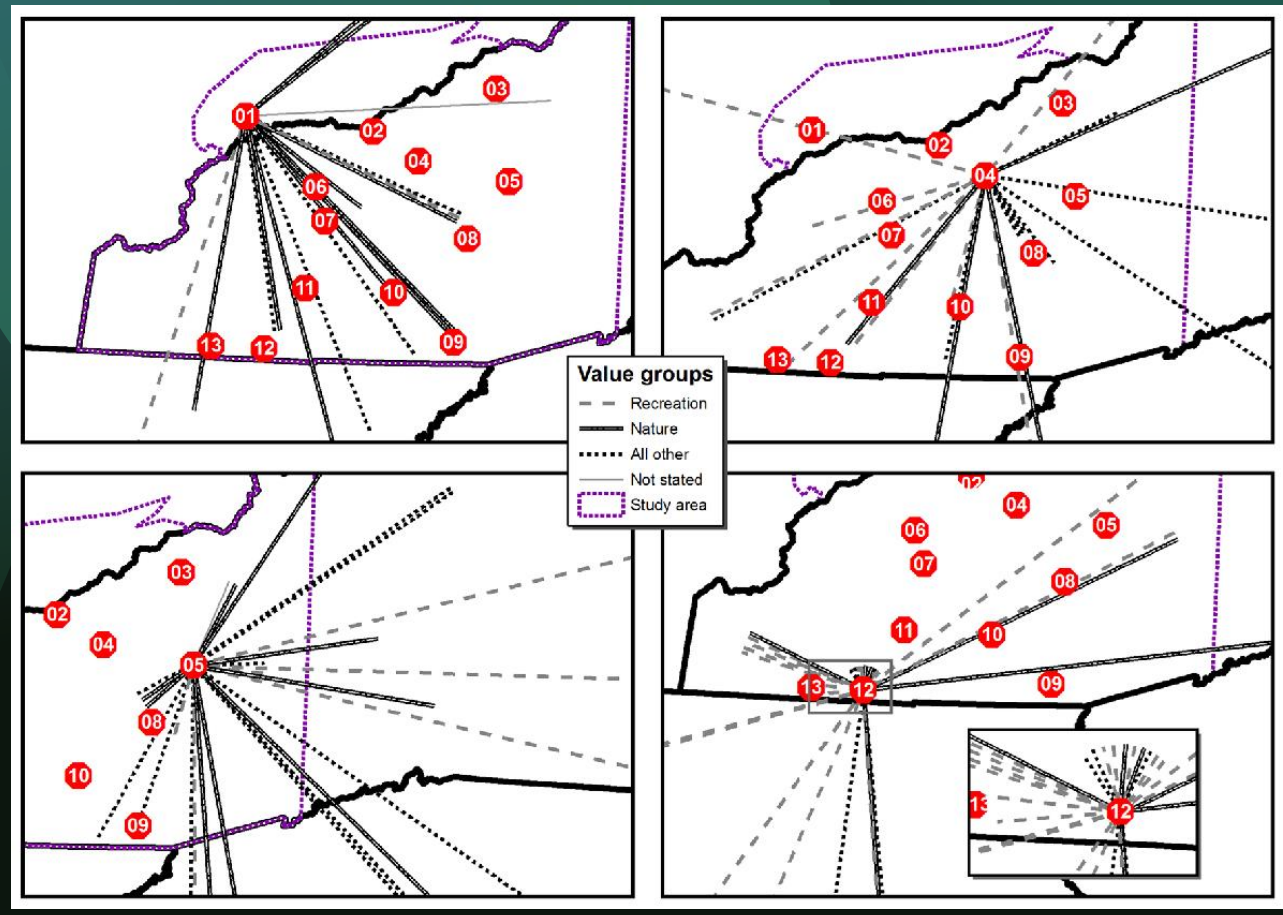
- Where people travel from to each hotspot, and why
- Most people using the hotspots come from within or near the western North Carolina region, while a number come from other parts of the Southeast, and a few from farther afield



Results

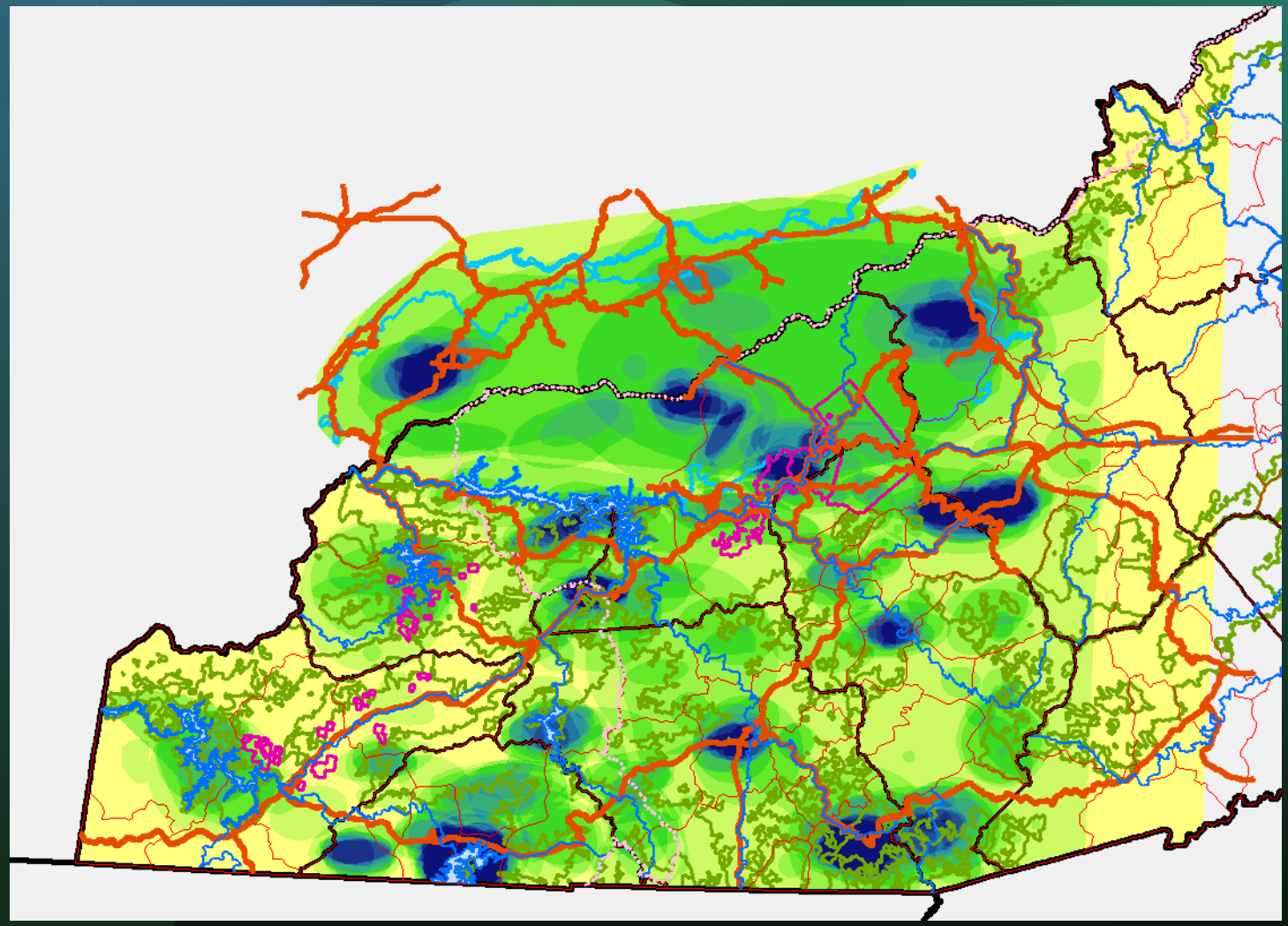
Origin-Destination Lines

- Cades Cove (Hotspot 1; UL) draws people who assign it a "Nature" value and a variety of "other" values, but appears to have little attraction for "Recreation" values uses. People visit there from within the region but not the immediate vicinity, and also from farther away.
- Cherokee (Hotspot 4; UR) has visitors from a wide radius and varied distances, and is associated with a greater diversity of values ("Nature," "Recreation," and "other").
- The Blue Ridge Parkway at Balsam (Hotspot 5; LL) again draws people identifying a range of values, and from close by, around the region, and far afield.
- Chatuge Lake (Hotspot 12; LR) stands out among all the hotspots for the dominance of the "Recreation" values group, even though "Nature" and "other" are present, and also for the large number of very local users as shown in the inset.



Conclusions

These four approaches and the resulting visualizations are illustrative of the many ways that GIS can be used in the analysis of spatialized qualitative survey data. Each example here has things to tell us about how the region is used, by whom, and why, that could not have been gleaned from a non-spatial analysis of the survey data.



Styers, D.M., G.R. Dobbs, L. Cerveny, and I. Hayes. 2018. Geovisualization of Socio-Spatial Data on Outdoor Activities and Values in the Southern Appalachians. *International Journal of Applied Geospatial Research* 9(3):55-80. doi:10.4018/IJAGR.2018070104 (Free copy on ResearchGate)

NC Project 1: WMPO

Using public participatory GIS to enhance climate adaptation and resilience in coastal NC

Goal: to develop a PPGIS process for mapping and analyzing the uses, values, and perceptions of people who frequent locations across coastal NC as part of their routine daily lives, as well as those visited for specific, less frequent activities.

2 rounds of workshops, in 5 public locations (Leland, Navassa, Rocky Point/Burgaw, two locations in DT Wilmington) in the spring/summer of 2024 and 2025, hosting up to 20 participants.

Workshop activities will include presentations and individual and group mapping exercises in multiple formats (digital and paper). Populations from underserved communities will be recruited.

NC Project 1: WMPO

Using public participatory GIS to enhance climate adaptation and resilience in coastal NC

1. On a map of WMPO, stakeholders will mark areas of outdoor activity using points, lines, and polygons. At each location marked, stakeholders will rank activities by frequency of occurrence.
2. Through an accompanying survey, stakeholders will indicate:
    a. The landscape values they hold for each of the areas they marked on the map, ranked by order of importance.
    b. The perceived climate change risks for each of the areas they marked on the map, ranked in order of highest perceived risk.
    c. The potential climate adaptation strategies for each of the areas they marked on the map, ranked in order of perceived success.
3. Stakeholder mapped areas will be assessed for patterns and trends by demographic groups.

NC Project 1: WMPO

Using public participatory GIS to enhance climate adaptation and resilience in coastal NC

Unoccupied Aerial Systems (UAS) Site-Level Data Collection

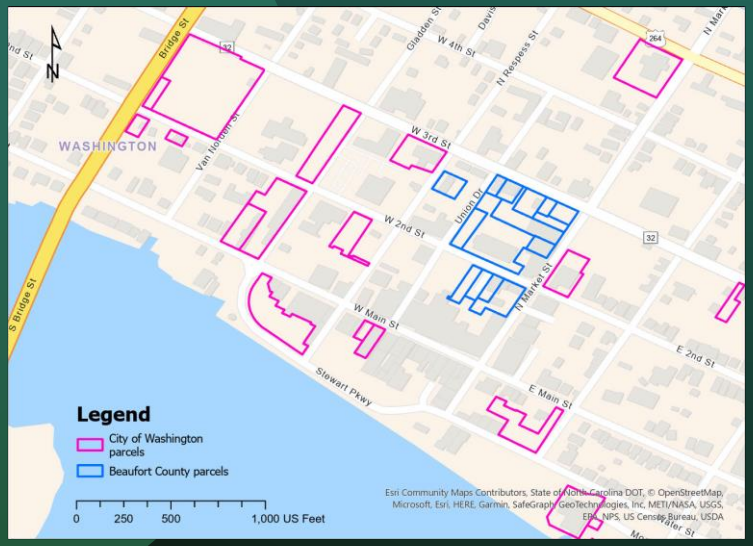
- UNCW's newly established UAS Observatory for Coastal Mapping – *learn more from Dr. Narcisa Pricope later today!*

Conceptual Designs

- CPE will work with research team to develop conceptual designs for five specific locations. Designs will provide sufficient detail to inform regulatory agencies, resource agencies, and other stakeholders involved in the permitting and implementation of the alternatives. Designs will include a written description of each concept and permit drawings and/or conceptual sketches.

NC Project 2: Washington

Engaging underserved communities in designing nature-based solutions for coastal flooding in NC



<u>Goal</u>: to continue Washington's resilience progress by utilizing a PPGIS approach to engage stakeholders and citizens in the design process for one of their highly prioritized projects, the Green Infrastructure Pilot Project.

Several nature-based solutions (NBS) will be explored through the PPGIS workshops. Potential solutions will be vetted by workshop participants, which will include stakeholder groups and citizens of the Washington area. Workshop participants will be asked to map locations where they would like to see different types of UGI implemented in their city, as well as their values for such spaces and features. Targeted properties are those in DT Washington owned by the city and county.

NC Project 2: Washington

Engaging underserved communities in designing nature-based solutions for coastal flooding in NC

The idea is to have participants select features of public spaces that they will use and value having in their neighborhood/city.

What survey questions would YOU ask??

We would then utilize UNCW's UAS Observatory for Coastal Mapping to collect data to be used by Moffat & Nichol to develop conceptual renderings based on a combination of what NBS are feasible for the site(s) and features selected by workshop participants.

Acknowledgements

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I would like to thank my WNC project co-authors, Drs. Lee K. Cerveny and G. Rebecca Dobbs.

I would also like to thank the many WCU undergraduate students who contributed to the success of this project.

Lastly, I would like to thank my grant proposal co-investigators, Karin Rogers, Greg Dobson, and Dr. Narcisa Pricope.


Thank you!
Questions?