

Title: Ensuring equitable access to outdoor recreation: Evaluating spatiotemporal patterns and trends in campground use on federal public lands

Student Authors:

Clarissa Boyajian
Master of Environmental Data Science
Student
Bren School of Environmental Science &
Management
cboyajian@bren.ucsb.edu

Halina Do-Linh
Master of Environmental Data Science
Student
Bren School of Environmental Science &
Management
halina@bren.ucsb.edu

Client Authors:

Kaitlyn Gaynor (UCSB-based advisor)
Postdoctoral fellow
National Center for Ecological Analysis and
Synthesis
gaynor@nceas.ucsb.edu

Will Rice
Assistant Professor
University of Montana
will.rice@mso.umt.edu

Other Clients:

Rick DeLappe
National Parks Service
Program Manager, Recreation One Stop
Rick_Delappe@nps.gov

Eric Levine
Sehlke Consulting
Data Security and Privacy Officer,
Recreation One Stop
eric.levine@sehlkeconsulting.com

Jason Smurthwaite
United States Forest Service
Data Manager, Recreation One Stop
jason.smurthwaite@usda.gov

Objectives

Federal lands in the United States provide important recreation opportunities to the public, but there is a **growing need to understand and mitigate inequities in access to outdoor recreation**. This project will address this need by creating an **interactive platform** for summarizing and visualizing park-specific patterns and trends in visitation volume, demand, and visitors' location of origin. The platform will integrate nationwide Recreation.gov reservation data with U.S. census data to:

1. Gain insights into **demand for reservations** across different types of recreation areas.
2. Analyze access to federal public lands among **historically underserved groups** in relation to recreation **activity type, cost, location, and demand**.

To accompany this online platform, the MEDS student group will also:

3. Develop a report detailing experience and findings to inform Recreation One Stop staff of **opportunities to reach equity goals** through Recreation.gov design and policies, maintenance of the public Recreation Information Database (RIDB), and further research.

Given sufficient time, the student group will:

4. Expand the web platform to analyze the **impact of the COVID-19 pandemic** on equitable recreational access, drawing on 2019, 2020, and 2021 data.

Significance

Outdoor recreation provides critical health and wellbeing benefits to communities, and in the United States, federal public lands play an important role in providing access to nature. However, access is not equal for all people (Ewert & Hollenhorst 1990; Flores et al. 2018), which has been recognized as an environmental injustice (Floyd & Johnson 2002). At present, park visitation and camping are seeing a surge in popularity, heightened even more by the COVID-19 pandemic, and this rapid increase in demand for recreation opportunities may only further these inequities.

The challenge now facing public land management agencies is how to allocate quality visitor experiences to a more diverse user base. Simply increasing recreation opportunities on public land is not a viable solution to this rising demand. Many land management agencies in the U.S. are tasked with the dual mandate of providing recreational opportunities for visitors while also preserving and conserving natural resources and places (Sharta & Suter 2020). For over a century, striking the balance necessary to uphold this mandate has proven a challenge for agencies like the National Parks Service (Meinecke 1937, Sax 1980), and the recent growth of recreation (Figure 1) has renewed concerns about its potential negative environmental impacts and changes to the visitor experience (Hammitt et al. 2015; Timmons, 2019).

While managers seek to allocate existing resources (e.g. campsites) through the fairest means possible, including reservation systems, equal opportunities do not translate to equitable access (Shelby et al. 1989). Due to historical exclusion and current realities (related to access to technology, ability to plan vacations in advance, knowledge of reservation systems, cost), current reservation and fee systems for accessing the outdoors in our public federal lands may privilege certain groups of people (e.g., white, wealthy; Shelby et al. 1989; Nyaupane et al. 2007). In this capstone project, the student group will explore patterns of recreation reservations to understand and mitigate these barriers.

As described in the client support letter, this project is of great interest to our clients on the Recreation One Stop team, which manages all reservation systems on federal land and is concerned with equity in access to recreation. Based on our conversations, we expect that this work will be of high interest to a wide range of agency leaders, protected area managers, and

operators of campgrounds, as these parties are responsible for setting reservation policies, communicating and advertising to users, and assessing the effectiveness of allocation systems. We also expect that our product (an interactive web platform) will be used for data exploration by the research community, and will guide future research on equity in recreation in federal land. Finally, we anticipate that the product will be of interest to the general public (specifically, outdoor recreators), and can serve as a tool for increasing awareness of recreation opportunities and reservation procedures and timing. While the reservation data that we will use are publicly available, they are not currently presented in an accessible format.

Background

Currently, much of our understanding about trends in recreation on public lands comes from the Integrated Resource Management Applications (IRMA) Portal, which the National Parks Service uses to monitor visitor counts over time (Bergstrom et al. 2020). However, these data lack information on where visitors are coming from. This project will leverage the Recreation Information Database (RIDB), managed by Recreation One Stop, an interagency partnership that provides reservation services and trip-planning tools on Recreation.gov. The RIDB is far more robust, including data from other land management agencies, and information on visitor zip codes, costs, group sizes, and dates of both reservations and recreation activities. While it is available for public download, there is no way for park managers or users to easily summarize or visualize the data, and we propose to fill that gap.

Previous research has demonstrated the value of RIDB data in forecasting future recreation demand for single park units (Rice et al. 2019) and analyzing preferential characteristics for popular recreational facilities (Rice & Park 2021). A recent study summarizing RIDB data from national parks (Walls et al. 2018) also identified broad patterns in reservations. For example, campsite reservations are made far in advance, but many are canceled last minute (Figure 2); visitors tend to visit national parks near their homes (Figure 3); and the distribution of incomes of campers appears to be similar to the U.S. population as a whole (Figure 4). However, overall, the vast RIDB data has received limited system-level research attention to date, and this work will be the first to explore issues of equity with RIDB data.

Furthermore, much of the existing research on outdoor recreation focuses on National Park Service lands (e.g., Walls & Akney 2018), which is only a small percentage of all federal land used by the public. The other land management agencies, including US Forest Service, Bureau of Land Management, and Army Corps of Engineers, often lack the capacity and funding to process reservation data, and are less frequently the subjects of outside research. Little is known about how patterns of access and demand vary across land management types. The RIDB includes data from all federal land management agencies, and therefore has tremendous promise to inform our understanding of patterns and trends in recreation across space and time and to inform policies for more equitable campground access for all federal public lands.

Equity

Equity issues are central to this proposal, as described throughout. This work on access to recreation reservations will build on previous work highlighting barriers to outdoor recreation for members of historically underrepresented groups, including economic constraints, cultural factors, and a long history of exclusionary and discriminatory practices (Scott et al. 2018).

Data

This project will draw on the extensive [Recreation Information Database \(RIDB\)](#), which includes detailed information on all recreation reservations (e.g., backcountry permits, campsite reservations, guided tour tickets, etc.) from 106 federal public lands from 2006-2020, including zip code or country of origin. In January 2022, data from 2021 will be available. From 2019 alone, the RIDB database includes over 1.2 million records. The managers of RIDB have agreed to be regularly accessible to students (see more in client support letter).

This project will also use [ZIP Code Tabulation Areas \(ZCTAs\) census data](#) as a proxy for socio-economic status and demographic data (which has precedent in other social science studies) to explore equity with regard to outdoor recreation access.

Possible approaches

The clients will work closely with the MEDS capstone student group to develop an approach for meeting the deliverables and objectives, which may include the following steps:

Data cleaning: The students will first develop a reproducible workflow for cleaning and standardizing the RIDB data, which is in .csv format and includes multiple data types: numeric, character, date/time, spatial. They will perform quality checks on the data, possibly using R packages like dplyr for data summary and cleaning, and report data inconsistencies to clients.

Spatial analysis: The students will georeference the locations of a) the recreation activity (from latitude and longitude in RIDB) and b) home of individuals making the reservation (from ZIP code) for mapping and spatial analysis. The students will also join data on individual reservations with socioeconomic data from the US census, using ZIP codes.

Data analysis & visualization: The students will perform basic calculations on RIDB data to achieve objectives 1 and 2. First, to quantify demand for reservations across different types of recreation areas, they will calculate and summarize (a) the elapsed time between the reservation and the recreation activity (for each reservation), and (b) the percentage of available activities that are reserved (for each campground/unit on each day). Second, to assess drivers of access to federal public lands, students will calculate, summarize, and visualize mean income and racial demographics in the ZIP codes of users, in relation to (a) land management agency, (b) recreation activity type (from RIDB), (c) cost of reservation (from RIDB), (d) reservation policies (from Recreation One Stop), (e) distance of activity from home (calculated by students), (f) demand (as measured above).

Web platform: We anticipate that the students will produce an R Shiny dashboard application, with interactive maps (e.g., using Leaflet), plots (e.g., using Plotly), and tables, which include key data summaries and visualizations from above. Potential features of this platform may include the ability to (a) select and compare different units and time periods of interest, and (b) generate and download a report for a given management area of interest.

Deliverables

In addition to the requirements, final deliverables for the client will include:

- Interactive platform that allows users to easily visualize park-specific patterns in visitation demand and access, as described above (for example, it may resemble [this platform](#) by the Trust for Public Land)
- A report detailing experience and findings to inform Recreation One Stop staff of opportunities to reach equity goals through Recreation.gov design and policies, maintenance of the public Recreation Information Database (RIDB), and further research.

Citations

- Bergstrom, J. C., Stowers, M., & Shonkwiler, J. S. (2020). What does the future hold for U.S. national park visitation? Estimation and assessment of demand determinants and new projections. *Journal of Agricultural and Resource Economics*, 45(1), 38–55.
- Ewert, A., & Hollenhorst, S. (1990). Resource Allocation: Inequities in Wildland Recreation. *Journal of Physical Education, Recreation & Dance*, 61(8), 32–36.
- Flores, D., Falco, G., Roberts, N. S., & Valenzuela III, F. P. (2018). Recreation Equity: Is the Forest Service Serving Its Diverse Publics? *Journal of Forestry*, 116(3), 266–272.
- Floyd, M. F., & Johnson, C. Y. (2002). Coming to Terms with Environmental Justice in Outdoor Recreation: A Conceptual Discussion with Research Implications. *Leisure Sciences*, 24(1), 59–77.
- Hammit, W. E., Cole, D. N. & Monz, C. A. (2015). *Wildland recreation: Ecology and management*. Oxford, UK: John Wiley & Sons.
- Meinecke, E. P. M. (1937). Recreation planning: A discussion. *Journal of Forestry*, 35(12), 1120–1128.
- Nyaupane, G. P., Graefe, A. R., & Burns, R. C. (2007). Understanding Equity in the Recreation User Fee Context. *Leisure Sciences*, 29(5), 425–442.
- Rice, W. L., Park, S. Y., Pan, B., & Newman, P. (2019). Forecasting campground demand in US national parks. *Annals of Tourism Research*, 75, 424–438.
- Rice, W. L., & Park, S. (2021). Big data spatial analysis of campers' landscape preferences: Examining demand for amenities. *Journal of Environmental Management*, 292, 112773.
- Sax, J. L. (1980). *Mountains without handrails, reflections on the national parks*. Ann Arbor, MI: University of Michigan Press.
- Scott, D., & Lee, K. J. (2018). People of Color and Their Constraints to National Parks Visitation. *The George Wright Forum*, 35(1), 82.
- Shartaj, M., & Suter, J. F. (2020). Exploring the Local Determinants of Campground Utilization on National Forest Land. *Western Economics Forum*, 18(2), 114–128.
- Shelby, B., Whittaker, D., & Danley, M. (1989). Idealism versus pragmatism in user evaluations of allocation systems. *Leisure Sciences*, 11(1), 61–70.
- Timmons, A. L. (2019). Too much of a good thing: Overcrowding at America's national parks. *Notre Dame Law Review*, 94(2), 985–1017.
- Walls, M., Wichman, C., & Ankney, K. (2018). Nature-Based Recreation: Understanding Campsite Reservations in National Parks. *Resources for the Future*.



September 23, 2021

Group Project Committee
Bren School of Environmental Science & Management
2400 Bren Hall
UC Santa Barbara, CA 93106

Dear Group Project Committee:

We enthusiastically support the MEDS Group Project proposal, “Ensuring equitable access to outdoor recreation: Evaluating spatiotemporal patterns and trends in campground use on federal public lands.” The proposal was written in partnership with Clarissa Boyajian and Halina Do-Linh, students in the inaugural MEDS cohort. We are writing this letter on behalf of the entire client team, which includes the leadership of Recreation One Stop (R1S), the federal interagency partnership that manages reservation services (the Recreation.gov website), reservation data, and trip-planning tools for all federal lands in the United States.

This project will leverage an underutilized R1S dataset, the Recreation Information Database (RIDB), which includes all information on reservations for recreation opportunities on federal lands, made on the Recreation.gov website. These data include detailed information on reservation dates, costs, and home zip codes, but are not currently presented in a format that is accessible to the public or to managers and have not yet been used to explore issues of equity in access to outdoor recreation in the United States. The student project will summarize, visualize, and analyze these data across federal recreation sites, and integrate information on visitor ZIP codes with census data and reservation policies to better understand patterns of access to recreation opportunities. The resulting web platform will provide an important tool for recreation managers and the general public, with the aim of reducing barriers to access to the outdoors and increasing equity in outdoor recreation. Importantly, the insights gained from this project will be used by Recreation One Stop (R1S) to inform the design of more equitable systems for booking campsites.

As the clients for this project, we commit to provide consultation and supervision for the student group. Dr. Gaynor is based at NCEAS through June 2022, and will serve as the on-site supervisor, meeting regularly with the student team to provide guidance on project management, data science, and client coordination. Dr. Rice is the head of the Wildland and Recreation Management Research Lab at the University of Montana, and as an expert in the field, will advise students on project design, connect them to relevant literature, and introduce them to other managers and scientists for additional consultation.

The proposed project also has the full, enthusiastic support of R1S leadership, including Program Manager Rick DeLappe (National Parks Service), Data Manager Jason Smurthwaite (US Forest Service), and Data Security and Privacy Officer Eric Levine (Sehlike Consulting). We have already had two meetings with the R1S leadership team along with the student proposal authors, and there was agreement that this project will fill an important data science gap and serve management agency objectives. Eric Levine and Jason Smurthwaite have agreed to hold

a standing meeting with the student group every two weeks for the six months of the capstone project, to ensure clear, open communication. They will provide access to and answer student questions about data and metadata needed to complete the project, beyond what is publicly available on RIDB. R1S leadership recognizes facilitation of this capstone project as aligned with their mission to support research using public data from public lands. Furthermore, they expressed that receiving feedback from the student capstone group with regard to the ease of use of their data and the equity of their public reservation system is of utmost importance.

All of the data necessary to complete this project are publicly-available on RIDB (in the form of .csv files) at <https://ridb.recreation.gov/landing> and the US Census website at <https://data.census.gov>. RIDB data include detailed information on reservation dates, costs, and home zip codes, but will not include confidential information and will therefore have no need for non-disclosure agreements or restrictions for publication. Data for 2021 will be available in January of 2022. Any additional data or metadata will be provided to students by Data Security and Privacy Officer Eric Levine.

If there is any additional information that we can provide, please contact us. We are very interested in pursuing this collaboration with the Bren School, as are the R1S clients.

Best wishes,



Kaitlyn Gaynor
Postdoctoral researcher
National Center for Ecological Analysis and Synthesis
University of California - Santa Barbara
gaynor@nceas.ucsb.edu



Will Rice
Assistant Professor
Parks, Tourism, and Recreation Management Program
Department of Society & Conservation
University of Montana
will.rice@mso.umt.edu

Budget and justification

This project requires no additional funding for software, data, or tools. All data are freely available, and objectives can be completed with open-source software. We anticipate that the \$200 provided by the Bren School will be sufficient. In the long-term, after completion of the capstone, the clients commit to seeking funding for maintenance, development, and hosting of the web platform if necessary.

Supplemental Figures

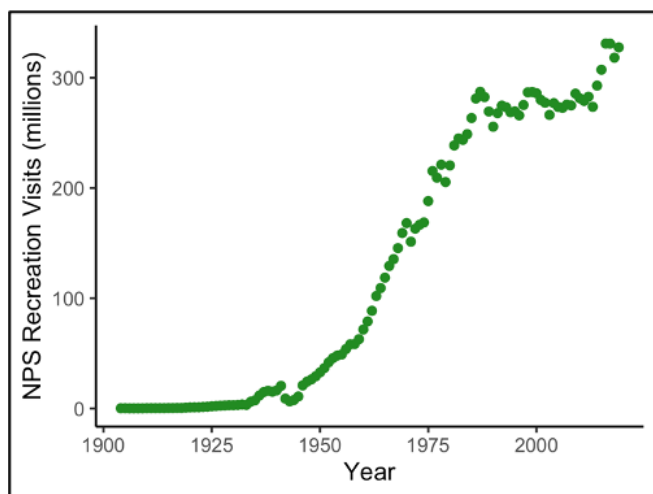


Figure 1. Total annual visitors to the National Park Service system, since its inception through 2020. Visitation has been rapidly increasing, particularly within the last decade. (Source: IRMA)

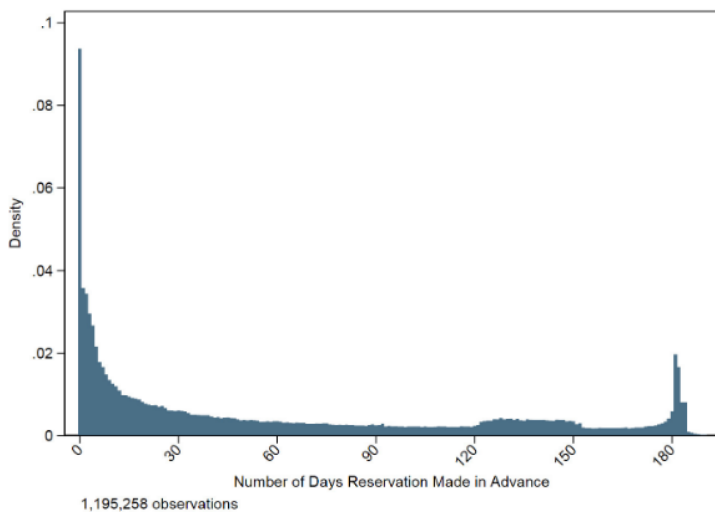


Figure 2 - Reproduced from Walls & Akney 2018. Days in advance that National Park campsite reservations are made from 2014 to 2016. Reservations are made far in advance, but many reservations are canceled at the last minute.

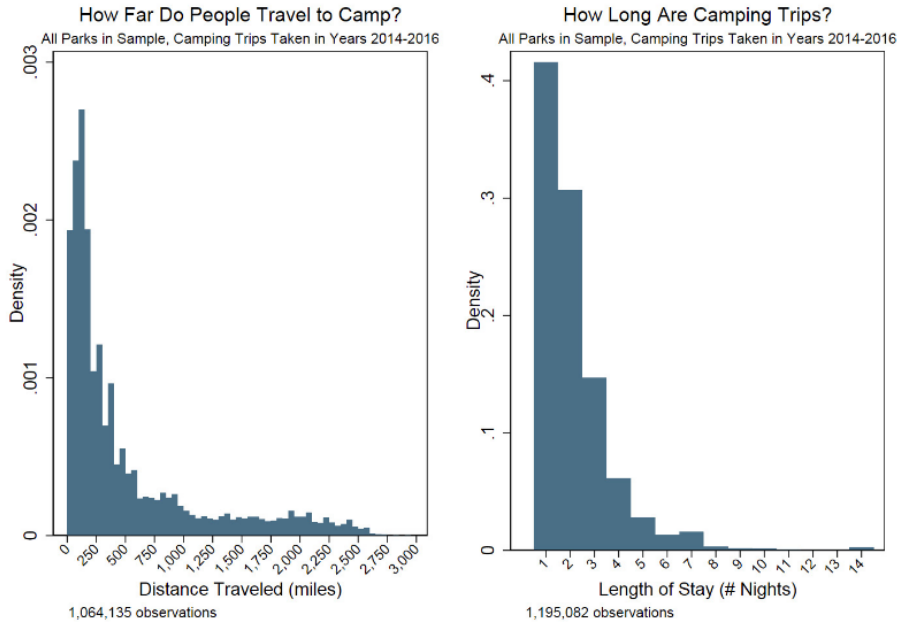


Figure 3 - Reproduced from Walls & Akney 2018. Distance traveled and duration of stay for National Park camping visits from 2014 to 2016. Visitors tend to visit national parks near their homes and stay only two nights, and longer trips are rare.

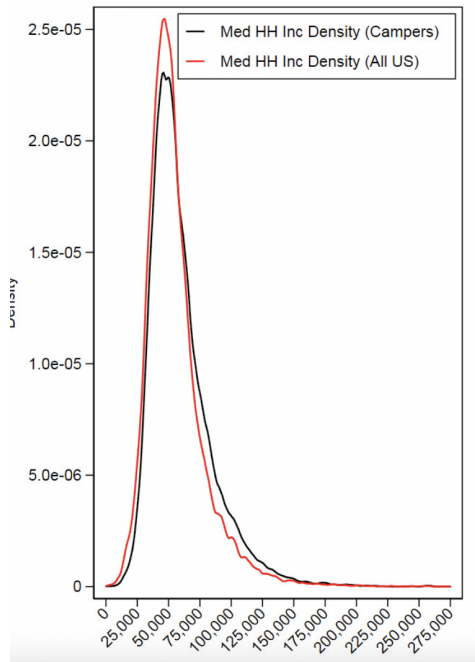


Figure 4 - Reproduced from Walls & Akney 2018. Median household income (by zip code) for National Park campers and for US Population. The black line estimates the distribution of median household (HH) income of campers from 2014 to 2016. The red line estimates the distribution of median household for all zip codes in the U.S. using average median household income from 2014 to 2016 where each zip code is an observation.