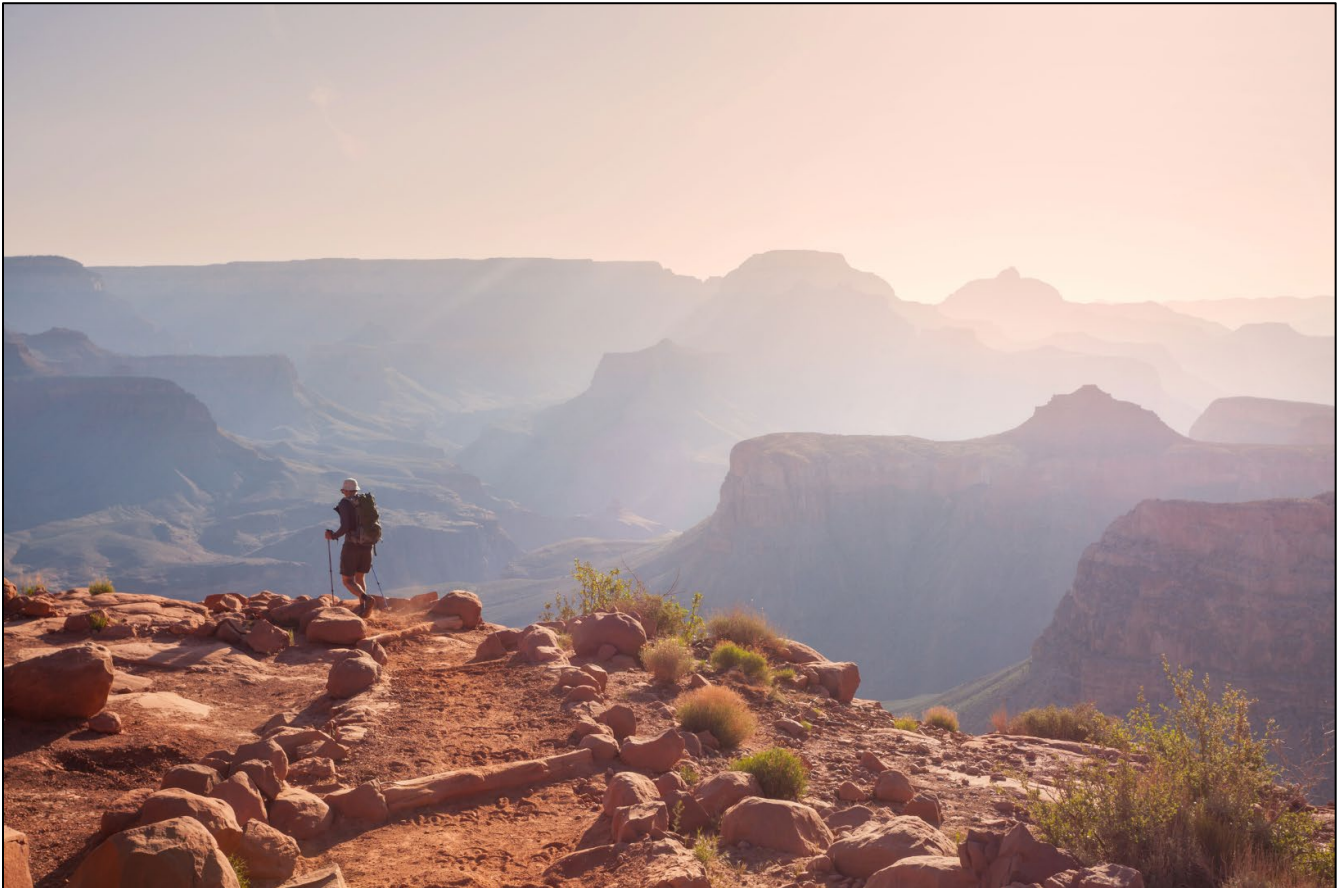


Final Report—September 2024

Socioeconomic Data Needs Assessment

**Visitor Use Estimation for National Trails and
National Wild and Scenic Rivers Systems**



ON THE COVER

Visitor Use in Grand Canyon National Park, Arizona
Photo by Kamchatka

Socioeconomic Data Needs Assessment: Visitor Use Estimation for National Trails and National Wild and Scenic Rivers Systems

Final Report—September 2024

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Prepared for:

National Park Service, National Trails System & Wild and Scenic Rivers System and Social
Science Program

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Introduction

The National Trails System (NTS) and the National Wild and Scenic Rivers System (NWSRS) are characterized by being porous, multijurisdictional, remote, and of significant length, creating ample challenge for the National Park Service (NPS) and other federal, state, and local jurisdictions when creating accurate counts of visitor use. Currently, there are not established methods for visitor use estimations for many of these long-distance corridors. As such, visitor use estimation is not regularly reported for many of these systems. This has led the NPS, in partnership with other agencies, to seek science-based and cost-effective methods of determining visitor counts through this Data Needs Assessment. This project outlines preliminary recommendations for counting visitors and estimating visitation.

After an extensive literature review covering both conventional and emerging methods, the study team identified a variety of strategies, assumptions, limitations, and sitewide considerations to begin to identify the feasibility of estimating use. Because river and trail systems are typically much different in spatial layout and geographic complexity than a traditional national park, unique factors are needed to estimate use. A brief synopsis of the literature review is provided at the end of this section to highlight key findings and how they fed into this Data Needs Assessment.

In addition to outlining specific data needs, the assessment includes high-level method descriptions for three sites (one national scenic trail, one national river, and one national historic trail) to estimate use. While the details are still somewhat hypothetical, these three examples can be used for building a framework for future studies in estimating use along these long-distance systems.

The following sections provide high-level detail and feasibility for various methods to estimate visitor usage that could provide credible results for future pilot projects throughout the NTS and NWSRS. Each location has unique specifications that need to be considered, which is characterized by the differences between the described methods for the three hypothetical studies and addressed through the adaptable and modular process developed in this report. Overall, the goal of this report is to provide a framework to begin thinking of the needs, challenges, and logistics which can be built upon for future studies.

Literature Review Synopsis

The literature review that guided the development of this Data Needs Assessment aimed to document the methods used by researchers to measure use, demographics, profiles, and more from visitor studies on trails and rivers. Both conventional and emerging methods were documented in order to help provide guidance on future studies. This information was sourced from a variety of studies conducted by the NPS, U.S. Forest Service, municipal parks, recreation managers, non-profits, and other managing agencies.

Throughout the literature review, a few key topics were highlighted in regard to measuring visitor use:

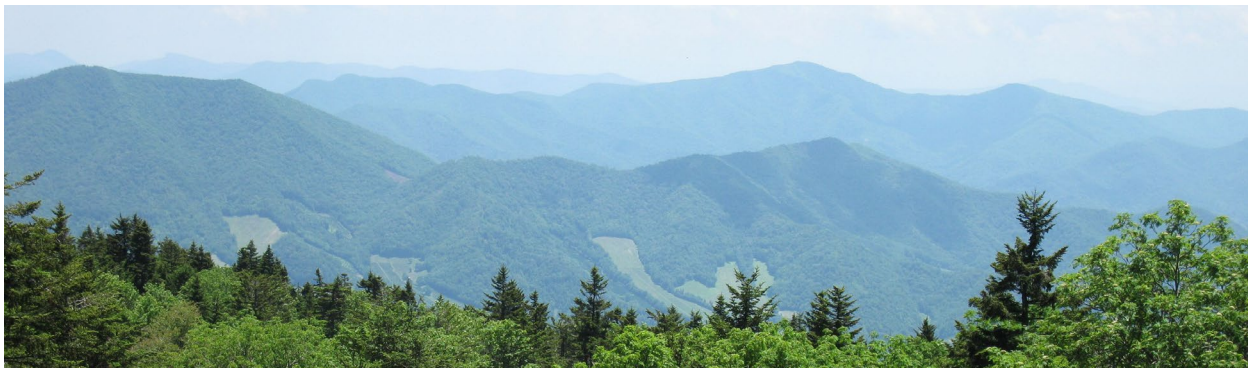
What is a “Trail”?

There is no universal definition of a trail in the United States, but one of the best definitions used for national recreation trails is: “...a travel way established either through construction or use which is passable by at least one or more of the following, including but not limited to: foot traffic, stock (e.g., equestrian), watercraft, bicycles, in-line skates, wheelchairs, cross-country skis, off-road recreation vehicles such as motorcycles, snowmobiles, ATVs, and 4-wheel drive vehicles.”

The National Park Service

- 1) Conventional methods (e.g., traffic counters, trail counters, observations) have generally been the most used method to estimate use; however, the success rate of such methods can vary depending on site layout. Multi-jurisdiction sites, long trail/river lengths, and a porous boundary can make traditional counting techniques difficult. Accuracy of such a system can be challenging to understand and assumptions are needed.
- 2) Emerging methods such as geo-tagged photo density and mobile location data have been used in certain scenarios to help estimate use. Mobile location data appears to be the most promising new technology, but it cannot be the only data source possible to measure use. Other conventional methods are likely still required because there is a need to understand on-the-ground realities in conjunction with big data sources. Equipment like physical counters are still important to validate emerging data sources with real-world checks and balances.
- 3) Overall, visitor use estimation for rivers and trails is still fluid. While some studies have attempted ways to estimate visitor numbers, there is not a consensus on which approach is optimal. Additionally, each site requires unique assumptions based on the management backgrounds and available data. Thus, this Data Needs Assessment will be one of the first higher level approaches to outline methods to estimate use.

Outside of these key points, the literature review documented many studies' approaches to economic valuation, visitor profiling, and other benefits to communities. While these studies are useful to consider, they are not as relevant to visitor use estimation. Therefore, these aspects are included in the literature review but are not summarized in this Data Needs Assessment further.



Appalachian National Scenic Trail
Source: www.nps.gov

Socioeconomic Data Needs Assessment

This section of the report is organized into four subsections according to the relevant topic areas of the study:

1. Priority data needs for estimating visitor use
2. Primary purposes of data
3. Challenges
4. Opportunities

The consulting team (including members from Otak and RRC Associates) hosted a virtual workshop with the Technical Guidance Team (TGT) in January 2023 to better understand socioeconomic issues associated with administering and managing porous, often multijurisdictional, long-distance linear systems that are part of the National Trails System (NTS) and the National Wild and Scenic Rivers System (NWSRS). As part of this workshop, the TGT was asked to share priority data needs for complex linear travel corridors within the NTS and NWSRS, as well as purposes for, challenges associated with, and existing and future opportunities related to collecting and evaluating these data. Themes and findings from this discussion were compiled and later presented back to the TGT for validation and are reported in the following subsections. Findings from this discussion also served as a key step in helping the consulting team develop recommended methods to estimate visitor use along complex linear travel corridors of the NTS and the NWSRS, as documented in the third section of this report.

Priority Socioeconomic Data Needs

Four priority socioeconomic data needs for complex linear travel corridors of the NTS and the NWSRS were identified. First is the need for visitation statistics, including annual, monthly, and daily levels, for both day use and overnight use. Second is the need for visitor use mobility pattern data, which can help facilitate the understanding of sites visited, routes used, itineraries traveled, and relative use levels within travel corridors (e.g., heatmaps). A third priority data need identified is for visitor group and trip characteristics (e.g., day, overnight, long-distance, private, commercial, etc.) information, which can facilitate the understanding of visitor group sizes and types, demographic information (e.g., race, ethnicity, age, etc.), trip-based expenditures, and primary trip purposes. A final priority data need identified is monitoring the benefits offered by designated rivers and trails, especially as they relate to local and national economies and physical and mental health.

Primary Purposes of Socioeconomic Data Needs

The data needs listed in the previous subsection are important to the NTS and NWSRS managing agencies for a variety of reasons. First, these data are needed to support planning efforts. For example, understanding use levels and patterns is necessary to help inform (1) infrastructure investments, such as building new or increasing current capacities of parking areas, campgrounds, or bathrooms; (2) staffing-related decisions, such as the need to hire temporary staff to support onsite parking management, emergency services, or trail maintenance; and (3) improvements to visitor services, such as expanding or reducing capacities of ranger tour or shuttle program schedules.



Appalachian Trail Conservancy at Appalachian National Scenic Trail
Source: www.nps.gov

Implementing planning concepts generally requires funding. Using socioeconomic data to demonstrate the need for and calculated effects of implementing planning concepts is an effective way to justify funding amongst limited resources. Furthermore, socioeconomic data plays a key role in communication and outreach efforts to agency leadership, stakeholders, and the general public with regards to the value, relevancy, and impacts of the NTS and the NWSRS. For example, as part of Government Performance and Results Act (GRPA) reporting, these data help demonstrate progress towards annual and long-term goals. Within reports to Congress and during stakeholder and public meetings, data-driven summaries of economic and social impacts of designated rivers and trails can be shared to elevate the status of the NTS and NWSRS.

Socioeconomic data, especially as they relate to visitor use levels and patterns, also inform visitor use and resource management. User capacity analyses, for example, are primarily driven by visitor use estimates and visitor use patterns data. Furthermore, visitor use data help inform long-term monitoring schedules (e.g., optimal seasons, months, days, and hours for ongoing monitoring efforts), which ultimately allow managers to identify changes in use patterns and/or resource degradation and manage adaptively.

Challenges of Addressing Socioeconomic Data Needs

There are a variety of challenges associated with collecting socioeconomic data along travel corridors within the NTS and the NWSRS. As previously mentioned, many designated rivers and trails are relatively long-distance, linear systems passing through both urban and remote settings, with porous boundaries and with many points of entry and exit. As a result, these travel corridors are comprised of multiple use types (e.g., hiking, fishing, boating, etc.), user types (e.g., locals vs. tourists, day vs. overnight vs. through-trip travelers, private vs. commercial users, etc.), and jurisdictions, which creates layers of complexity to developing data collection and analysis methodologies. Researchers must consider whether data vendors and/or data collection equipment can distinguish between these heterogenous use and user types, and if not, how to account for the differences they present within the data. It is also necessary to consider the suitability and

limitations of alternative data types and methods, including passive mobile data, visitor surveys, observation-based methods, and other techniques.



Pacific Crest National Scenic Trail in Yosemite National Park (USGS Trails Sustainability/Leave No Trace Program)
Source: USGS Trails Sustainability/Leave No Trace Program

Additional methodological challenges for collecting socioeconomic data along complex long-distance travel corridors include (1) equipment deployment and maintenance in vast systems in remote areas, (2) selecting representative site-level sampling areas that can be applied to estimate overall use within a system, and (3) distinguishing between visits and visitors.

It's also important to note that there are limited resources to support data collection and ongoing monitoring. Staffing limitations, a lack of funding, and ongoing financial costs to sustain long-term data collection cycles all present challenges to collecting data in these systems.

Opportunities to Help Address Socioeconomic Data Needs

While there are a number of challenges related to collecting socioeconomic data along travel corridors within the NTS and the NWSRS, as listed in the previous subsection, there are also a number of opportunities to help address these challenges. First, internal and external capacity to address the challenges of collecting socioeconomic data is greater than ever before. Historically, the agencies managing the NTS and the NWSRS (i.e., the Bureau of Land Management (BLM), the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Forest Service (USFS)) have had relatively few internal staff and leadership with training in social science disciplines. More recently, however, a growing number of agency staff have been trained in the social sciences and with the knowledge, skills, and abilities required for

socioeconomic monitoring and visitor use research. Paired with external consulting and academic partners trained in social sciences, there is a large pool of skilled professionals who recognize that the need to understand visitor use along long-distance travel corridors is real, and that applying resources to produce well-grounded estimates of visitor use is important for the NTS's and the NWSRS's long-term management goals.

In fact, companion efforts of this nature are already underway. For example, the Appalachian Trail Conservancy and American Trails are conducting pilot studies that explore the feasibility of applying anonymized mobility data to examine visitor use at popular and porous parks and trails, including the Appalachian National Scenic Trail (APPA). Similarly, journal articles of this nature have been published in recent years. In 2019, for example, passive mobile data were used to estimate visitation levels across several high-use, multi-use, porous, and urban-proximate parks and trails within the Nature Reserve of Orange County, California (Monz et al., 2019). In 2023, an assessment of the current state of passive mobile data, including suggestions about how to evaluate the suitability of these data for parks and protected area applications, was published (Lawson et al., 2023). The researchers contributing to these existing and ongoing efforts, and their published literature, can be leveraged as resources to improve socioeconomic data collection and/or estimation methodologies for designated rivers and trails.

Another opportunity to note is that those committed to addressing the challenges of estimating visitor use levels for complex linear travel corridors are developing pragmatic objectives. For example, it is recognized that, in most cases, estimating hourly and daily visitor use levels along long-distance rivers and trails could overstate the level of precision offered by the data sources available and for the challenges of estimating visitation in these complex systems. Instead, it is acknowledged that estimates of monthly and annual visitor use, while less granular, will be more accurate, reliable, and feasible. Socioeconomic data collection efforts could also be positioned for success by leveraging a system of typologies to recognize that not all river and/or trail segments are the same and to help develop methods that are best suited to the varying contexts of these systems. This topic will be addressed in further detail later in this report.

Lastly, it is important to note that visitor use data already being collected along subsegments of the NTS and the NWSRS can be leveraged as a potential basis for and an opportunity to improve count estimates. For example, the Pacific Crest National Scenic Trail (PCT) passes through several national park units that utilize visitor use counting equipment and robust counting procedures. Ridge Runners collect observation-based counts of visitors along popular segments of the Appalachian Trail during peak use periods. The Middle Fork of the Salmon River, for example, requires commercial and non-commercial boating permits year-round, which provide a record of the number of groups and individuals accessing the area, by day, for select use types. Inventorying what, where, and how existing visitor use counts are being collected will help facilitate and enhance the design and implementation of approaches for estimating visitor use along long-distance travel corridors within the NTS and the NWSRS. This topic is discussed in more detail later in this report.



Middle Fork of the Salmon River
Source: www.nps.gov

Recommendations for Counting Visitors and Estimating Visitation

This section of the report is organized into three subsections according to the relevant topic areas of the study:

1. Recommended Typology System
2. Existing Data Sources
3. Methods for Pilot Studies

Each subsection consists of further relevant sections and analysis that provide more granular detail to the above topics.

Recommended Typology System

Rivers and trails can be categorized according to specific typologies to assist in counting method procedure development. Potential typologies are further described below in this subsection.

Physical Characteristics

The NTS and the NWSRS (“rivers and trails”) are both designations given by the Congress or Secretary of the Interior in the United States to highlight exceptional natural and recreational resources. While both designations promote the appreciation and conservation of natural resources, rivers prioritize water-based environments, whereas trails emphasize land-based routes and the exploration of surrounding landscapes.



Merced River
Source: www.nps.gov

Rivers primarily focus on the protection and preservation of rivers and their surrounding landscapes, emphasizing the importance of free-flow, water quality, and outstandingly remarkable values such as fish, wildlife, recreation, scenic, or cultural resources.. They often provide opportunities for recreational activities such as boating, fishing, and wildlife viewing.

On the other hand, **trails** encompass designated land routes that showcase outstanding natural, historical, or cultural features. These trails can be used for hiking, backpacking, horseback riding, or other non-motorized activities, allowing visitors to experience the diverse landscapes and cultural heritage along the trail corridors.

Geographic Setting

Rural settings, rivers and trails often traverse natural and less-developed areas, showcasing pristine environments and offering opportunities for outdoor recreation. Rivers in rural areas may flow through forests, fields, and agricultural lands, providing scenic beauty and habitat for diverse wildlife. Trails in rural settings may wind through mountains, forests, or open countryside, offering hikers and nature enthusiasts a chance to immerse themselves in unspoiled natural landscapes.

Urban settings present unique challenges for rivers and trails. Rivers in urban areas often face issues such as pollution, altered flow patterns, and encroaching development. However, efforts are made to restore and revitalize urban rivers, creating green spaces and recreational opportunities for local communities. Urban trails can be found in parks, along waterfronts, or converted rail lines, providing residents and visitors with accessible options for walking, biking, and enjoying outdoor activities within city limits.

Suburban settings typically lie between rural and urban areas, characterized by a mix of residential, commercial, and open spaces. Rivers in suburban regions may be influenced by both natural and anthropogenic factors. They might traverse residential neighborhoods, commercial areas, or parks, providing opportunities for recreation and relaxation. Suburban trails often connect neighborhoods, parks, and local amenities, offering residents convenient access to nature and opportunities for active lifestyles.



Pacific Crest National Scenic Trail
Source: www.nps.gov

Length

A short to medium river or trail is one that can be managed by a limited number of physical counts but is typically 100 miles or less in length. These rivers and trails offer a compact and accessible outdoor experience, ideal for day trips or short excursions. Visitors can explore the cultural heritage or enjoy the picturesque landscapes within a relatively short distance.

A medium to long river or trail is one that typically would require five to ten physical counts or locations that require more complex decisions, this river or trail length of 101 to 200 miles may offer more involved experiences for outdoor enthusiasts. It would typically allow visitors to delve deeper into the historical or scenic wonders of the area, providing ample opportunities for multi-day trips and exploration of diverse landscapes along the route.

The longest typology of river or trail is one that typically requires over ten physical count locations, is over 200 miles in length, and typically presents an extensive and immersive outdoor adventure. It encompasses a substantial stretch of historical or scenic significance, often spanning across different landscapes and regions. Visitors embarking on this long-distance journey will encounter a variety of cultural landmarks and breathtaking vistas, requiring careful planning and endurance to complete the entire route.

“National scenic trails are 100 miles or longer, continuous, primary non-motorized routes of outstanding recreation opportunity, established by an Act of Congress.” So national scenic trails could fit into any of the three typologies of “short to medium,” “medium to long,” or “longest”.

The National Park Service

Intensity of Use

Given the current lack of accurate visitations estimates across rivers and trails, intensity of use estimates will largely be based on the river or trail’s level of crowding and infrastructure capacity on a given day during peak season. It is important to note that these intensity of use descriptions are approximate and vary depending on the specific river or trail, the time of year, and other factors.

Rivers and trails characterized as having a **low intensity of use** experience minimal crowding and have ample capacity to accommodate visitors. These areas are often less popular or lesser known, resulting in fewer people accessing them during peak season. Visitors can expect a tranquil and remote experience, with plenty of space to enjoy the natural surroundings. Infrastructure such as parking, restrooms, and facilities are typically sufficient to accommodate the relatively small number of visitors.

Rivers and trails categorized as having a **moderate intensity of use** experience a moderate level of crowding and have infrastructure that may approach or occasionally reach capacity during peak season. These areas are relatively popular and attract a moderate number of visitors. While visitors can still enjoy the natural beauty and recreational opportunities, they may encounter some congestion at popular viewpoints, trailheads, or access points. Infrastructure may experience occasional strain, particularly during weekends or peak periods, but overall, it remains functional.

Rivers and trails characterized as having a **high intensity of use** are subject to significant crowding and often exceed the capacity of their infrastructure during peak season. These areas are very popular and attract a large number of visitors, resulting in potential congestion and limited space at key locations. Visitors should expect crowded parking lots, congested trails, and limited availability of amenities. Additional measures such as timed entry permits, shuttle systems, or crowd management strategies may be implemented to mitigate overcrowding and protected resources.



New England National Scenic Trail
Source: www.nps.gov

Seasonality of Use

The amount of time that a river or trail is open, or the length of its peak season are important in understanding overall use. Rivers or trails that are open seasonally will, by design, likely be used less than a river or trail that is open throughout the year with an extended peak season. It is important to note that the specific seasonality and availability of rivers and trails may vary depending on factors such as location, climate, and resource management practices.

Rivers or trails categorized as **seasonally limited** are only open for a portion of the year, typically during a specific season. These areas may be closed or inaccessible during the off-season due to factors such as weather conditions, wildlife concerns, or resource management practices. Seasonally limited rivers or trails often have a shorter peak season and may experience lower overall use due to the limited availability.

Rivers or trails with an **extended peak season** are open for a significant portion of the year, providing visitors with ample opportunity to explore and enjoy the area. These areas typically have a longer period of visitation, spanning multiple seasons or months. The extended peak season allows for increased flexibility in planning visits, as visitors can choose to experience the river or trail during different times of the year. Infrastructure and services are generally available for a more extended duration, accommodating the higher demand throughout the extended peak season.

Rivers or trails with **year-round availability** offer access to visitors throughout the entire year, regardless of the season. These areas are open and accessible in all seasons, providing opportunities for outdoor recreation and exploration regardless of the time of year. Year-round availability allows visitors to experience the river or trail in different seasons, each offering its unique beauty and recreational opportunities. Infrastructure and services, such as parking, facilities, and visitor centers, are typically maintained and operational throughout the year to accommodate visitors' needs.

Entry Point Characteristics

Rivers or trails with a **single point of access** have a clearly defined entry point or trailhead that serves as the primary access point for visitors. These areas typically have a more concentrated visitor presence, as all visitors must enter through the same access point. The single point of access typically makes it easier to estimate and manage visitor flow.

Rivers or trails with **multiple points of entry** offer visitors various access points along their length. These areas may have several designated trailheads or entry points distributed throughout the river or trail system. Multiple points of entry increase the flexibility and accessibility for visitors, allowing them to access different sections or segments of the river or trail. However, estimating visitor numbers becomes more challenging due to the dispersed entry points. Managing and monitoring visitor use may require a broader approach, including visitor surveys, trail counters, and other data collection methods.

Rivers or trails with **porous access** have numerous entry points or access options, often without clearly defined trailheads or designated entry points. These areas may allow visitors to enter the river or trail system from various locations, such as different road crossings, intersections, or unmarked access points. Porous access makes it particularly challenging to estimate visitor numbers accurately. Monitoring and managing visitor use in porous areas requires more comprehensive approaches.

Data Availability and Accessibility

Rivers and trails will vary in the variety and comprehensiveness of data available internally and from other third parties. Generally, the data that is readily available and easily accessible, the easier it becomes in understanding visitor use.



Westfield River

Source: www.nps.gov

Hiking, Rafting, or Other Type of Permitting

A river or trail permitting system can impact the understanding of visitor use to the area. Through pre-established permitting systems visitor profiles and duration of visits can aid in better understanding overall use of the area. A river or trail that has access to a comprehensive database of their permitting system can help in understanding the total use of the river or trail.

Third-Party Guides / Shuttle Services

The availability data from third-party guides or shuttle services can aid in understanding visitor use of the river or trail. If readily available, these services can provide valuable insights into visitor patterns and preferences, as they often collect data on the number of visitors they transport, trip durations, and the locations they frequent. Guide services may also record visitor demographics and preferences through customer feedback and surveys.

Cell Phone Service

Access to cell phone service plays an important role in understanding visitor use on rivers and trails through the use of mobility data. When visitors have reliable cell phone coverage along the entire length of a river or trail, it allows for the collection of comprehensive and real-time mobility data. This data can provide valuable insights into visitor behavior, movement patterns, and usage trends.

With cell phone coverage, visitors' mobile devices can serve as tracking tools, generating data on their movement and location. Analyzing this mobility data can offer a better understanding of popular access points, trail segments, and areas of high visitor concentration. Furthermore, mobility data can help identify visitor preferences, such as popular stops, scenic viewpoints, or recreational activities along the river or trail. It can also reveal visitor flows and peak usage times, which can guide the development of targeted visitor education programs or infrastructure improvements.

However, it is important to note that reliance on mobility data from cell phones has limitations. Not all visitors may have access to or use cell phones while exploring rivers and trails, and some may intentionally limit their phone usage for various reasons.

Additional Amenities

The availability of additional amenities and infrastructure along rivers and trails can contribute to understanding visitor use. These amenities, which can include campgrounds, visitor centers, interpretive signage, picnic areas, restrooms, etc. serve as important points of interaction and opportunities for data collection.

Campgrounds

Campgrounds provide a central location for visitors to stay overnight, allowing for data to be gathered on the number of campers, their length of stay, their demographics, etc. By monitoring campground occupancy and reservation data, insight can be gained on visitor demand, peak seasons, and camping preferences.

Visitor Centers

Visitor centers serve as hubs for information, orientation, and interpretation. They often collect visitor data through registration systems, surveys, and feedback. Visitor centers can capture visitor profiles, geographic origins, and trip characteristics. Visitor centers provide opportunities for on-site visitor surveys and interviews, allowing for more detailed insights into visitor use patterns and behaviors.



Bering Land Bridge National Preserve near the Serpentine Hot Springs
Source: www.nps.gov NPS Photo/Dev Dharm Khalsa

Feasibility

When considering how to estimate visitor use for a river or trail, there are certain criteria that are more critical than others in understanding overall feasibility.

Characteristics that are **critical** in understanding how feasible it is to collect data of a river or trail are data availability, porousness of the river or trail, and overall length.

Data availability is critical, as it provides crucial information on visitor use, trends, and preferences. This includes data provided either directly through the river or trail, as well as data that might be accessible through a third-party guide or shuttle service. If no to little data is available, the approach for designing a counting methodology becomes more labor intensive due to the requirement of equipment installation or in-depth studies to begin the process.

The porousness of a river or trail is another critical factor. A river or trail with multiple entry points or a more porous nature allows for greater access and dispersal of visitors. This can impact visitor flow and allow for more opportunities for visitors to access the river or trail without being counted. Additionally, the likelihood of double counting becomes more evident as people may be traveling in various directions.

The overall length of a river or trail is also critical to consider. The length determines the scale and scope of efforts required. Longer rivers or trails may have varying characteristics, visitor use patterns, and resource considerations along their length. Understanding visitor use across the entire length of a river or trail necessitates different approaches compared to shorter, more localized sections.

Characteristics that are of **secondary** importance in understanding how feasible it is to collect data of a river or trail are geographic setting and seasonality of use.

The geographic setting of a river or trail, such as rural, urban, or suburban, is of secondary importance in understanding feasibility. While it can influence visitor access, transportation options, and other factors, it does not directly impact the fundamental understanding of visitor use. However, it can affect visitor demographics, preferences, and the overall visitor experience, which are relevant considerations for managing and planning the river or trail.

The seasonality of use is a secondary characteristic as it primarily affects the length and timing of the river or trail's peak season. An understanding of the length and timing of a river or trail's peak season allows for a more nuanced understanding of visitor use and the time of year in which peak use should be expected. Ultimately, this information is more anecdotal, but would allow more comprehensive visitor use data to be validated when compared seasonally or month-to-month.

Characteristics that are of **tertiary** importance in understanding how feasible it is to collect data of a river or trail are intensity of use and additional amenities. Intensity of use is one characteristic of tertiary importance. While an understanding of the intensity of use at a river or trail provides insights into visitor crowding, this type of information is largely anecdotal and offers less opportunities for grounded visitor use characteristics.

Additional amenities, such as campgrounds, visitor centers, or other facilities, are also of tertiary importance. These amenities may not be directly involved in understanding visitor use on a river or trail but should be considered as visitors to these amenities are either adding to or a part of the total visitation estimates.

The decision to pursue visitor use estimate efforts for any given river or trail is likely to involve a number of decisions based on the above characteristics. Rivers or trails that have access to more data, are less porous in nature, or are shorter in length will generally be the most feasible for visitation estimates. Conversely, a river or trail that lacks access to data, is in a remote location, is lengthy, and/or has multiple points of entry would be among the least feasible or cost-effective characteristics for visitation estimates.

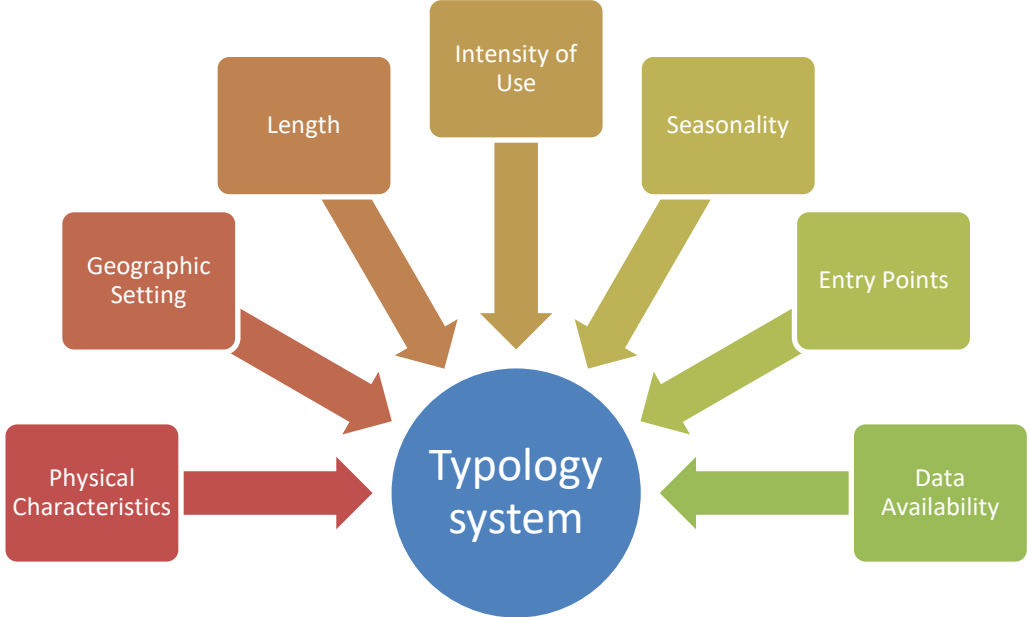


Figure 1: Typology Factors

Data Collection and Estimation Options

The data collection methods that can be used by rivers and trails to better understand visitation.

Conventional Counting Procedures

Conventional counting techniques generally include actual counts of visitors, proxy counts, and statistical estimates for estimating visitor numbers. Actual counts involve tallying individual visitors as they enter the managed area in some form. Staff can be stationed at entrances using handheld counters or by using automated counters like those on doorways. Another option is analyzing individual-level administrative data on visits. Actual counts provide a straightforward method of counting visitors, but it is labor intensive.

Proxy counts are the most used method for estimating visitation. Instead of counting visitors directly, proxy counts involve counting a "proxy" item, like vehicles. The counts of these proxy items are then translated into visitation estimates using multipliers, such as the Person Per Vehicle (PPV) factor. While proxy counts can be useful for estimating visitor use, they require an initial investment of time and resources to install equipment and invest in schedules for monitoring. These multipliers should be periodically reassessed as conditions change over time. Additionally, counting visitors using multiple modes of transportation can be challenging as automated counters typically focus on a single transportation mode, either vehicles or bikes/pedestrians.

Actual counts and proxy counts can be used at rivers or trails of any geographic setting but would be most effective in use on those rivers or trails that are shorter in length with lower levels of use intensity, less seasonal use, and have fewer points of access. These shorter, less porous rivers and trails allow for an accurate count of visitors without the need to station staff or counters at multiple locations throughout the river or trail. For instances where the river or trail is longer, has multiple points of entry, or has high levels of use it is expected to be more effective to use statistical estimates.

Statistical Estimates

In cases where actual counts or proxy counts are not feasible for capturing all visitors, other estimates can be developed by quantifying relationships between areas where visitation can be measured and areas where it is difficult to measure (e.g., using models to estimate how counts at one location would likely change at another). This approach takes advantage of the correlation in visitation between different areas of the same managed area. By measuring visitation in some areas and using statistical models, estimates can be made for areas where direct measurement is not possible or easy.

Generally paired with conventional counting techniques, statistical estimates are a way to use models to predict visitation changes when it can't be measured easily or often. This method works well for motorized trails such as parkways because travel patterns are predictable and typically related. Using regression models, counts at a single counter can be modeled for areas further along the same stretch of trail that cannot be measured. While this method typically involves an in-depth study, it reduces the number of physical counts that need to be permanently installed. However, these models require in-depth studies to update and rely on a large-scale effort to first develop. Additionally, areas with very porous boundaries can be difficult to infeasible to implement models.

Visitor Survey

Aside from conventional counting techniques, visitor surveys are needed in many cases to help refine and understand count estimates. Duplicate counts are an issue for NPS counting procedures as visitors may cross multiple counters on their visit, inflating actual visitation statistics. To help correct duplicate counting

methods, visitor surveys can be used to ask visitors which locations they plan on visiting that day. Managing agency personnel can understand the percentage of visitors that are expected to cross more than one counter in a day and use a correction factor to eliminate some duplicate counting procedures. Visitor surveys can also be useful to explore visitor movement behavior that is not easily captured through observational or other traditional count metrics.

Like actual and proxy counts, visitor surveys can be used widely across rivers and trails of any geographic setting any geographic setting but would be most effective in use on those rivers or trails that are shorter in length with lower levels of use intensity, less seasonal use, and have fewer points of access. Additionally, visitor surveys can offer valuable insights in situations where there is higher use intensity by asking about group size; more porous access by inquiring about the method of entry; or year-round accessibility by gathering information on anticipated repeat visitation.

Secondary Data Analysis

Secondary analysis of similar locations with count procedures can be a valuable tool for estimating visitation. By studying and analyzing data from comparable areas or sites where count procedures have been implemented, valuable insights can be gained. The patterns and relationships observed in these similar locations can be used as a basis for estimating visitation at the target site. This approach leverages the assumption that visitation behaviors and factors influencing visitor numbers are often similar across comparable sites. By applying statistical techniques and models to the data from these similar locations, visitation estimates can be generated for the target area, even if direct count procedures are not feasible or available. This method allows for a more informed estimation of visitation, enhancing planning and resource allocation decisions to support management.

While cost effective, secondary data analysis can only be used in instances where a site has access to data from comparable areas or sites where count procedures have already been implemented, limiting the opportunity for use of this estimation option. Furthermore, there are many assumptions that need to be made to use this methodology. Overall, the methodology is not preferred to most other options presented, especially traditional counts.

Mobile Location Data

Mobile location data has emerged as a valuable resource for estimating visitation by comparing sample sizes to on-the-ground counters. With the proliferation of smartphones and location-tracking technologies, anonymized mobile data can provide insights into visitor movement and behavior. By leveraging this data, it becomes possible to estimate visitation patterns in real-time and over extended periods.

To estimate visitation using mobile location data, a sample of mobile users within the target area or vicinity is collected, generally through third-party data providers. This sample can be correlated to the counts obtained from on-the-ground counters, such as entrance gate tallies or automated counters. By carefully selecting representative samples and applying statistical techniques, it is possible to derive accurate estimates of visitor numbers. This approach offers several advantages over traditional counting methods. Firstly, mobile location data can provide a more comprehensive and continuous view of visitor flows throughout an area, capturing both popular and less-frequented areas. Secondly, this type of data can allow for real-time monitoring and analysis, enabling managers to make timely decisions based on current visitation trends. Lastly, the scalability of mobile data analysis can allow for monitoring visitation across multiple areas or regions simultaneously, providing a broader perspective on visitor trends and behaviors.

However, it is important to note that mobile location data has its limitations. The sample size of mobile users may not be fully representative of all visitors, as not everyone carries a smartphone or actively uses location-tracking services. Variations in demographics, smartphone usage patterns, and privacy concerns can introduce biases in the data. Additionally, accurate calibration and validation of the mobile data against on-the-ground counters are crucial to ensure reliable estimates. Sample sizes from data providers on mobile location data fluctuates. As applications fall in/out of their ecosystem for data collection, the sample size varies. This makes it critical to calibrate and normalize device counts on a rolling basis if population estimates are the main purpose for the data. Despite these challenges, mobile location data analysis offers a promising avenue for estimating visitation, providing valuable insights for management and planning.

Given its flexibility in use, mobile location data can be applied to rivers or trails across their typology characteristics. A key limiting factor for mobile location data is the geographic setting of the river or trail due to the need for a reliable mobile network to collect the data. As such, more rural rivers or trails may have a harder time collecting this data than an urban area with greater mobile network access. Additionally, due to the costliness of mobile location data, rivers, or trails with less funding for visitor estimation efforts may find that this is not a feasible estimation option.

Methods for Pilot Studies

The following discussion of methods and metrics relates to the typologies identified in the *Recommended Typology System* section, allowing managers to easily go down the rubric and identify what characteristics the corridor has within the typology system. Table 1, the *Example Typology Rubric* presented on the next page first identifies the critical, secondary, and tertiary typologies, as discussed in the *Feasibility* subsection. These critical typologies should be considered first with the greatest weight on the type of visitor estimation research to be prescribed, secondary and tertiary typologies should then be considered as needed. Once the site has been characterized within the typology system, a prescription of the ideal data collection and estimation option can be identified.

The remainder of this section is dedicated to three hypothetical scenarios to illustrate how the typology rubric would be used on a given river or trail. For the following scenarios, the definitions and units of measurement are provided below.

The primary metrics proposed to be used in measuring visitor use are similar to those used at other park units and management areas across the country. While there may be challenges on rivers and trails to directly convert certain metrics per site, it's intended for the proposed metrics to match as closely as possible with standard NPS Visitor Use Statistics measurements. The following metrics are proposed for measurement and defined by the NPS Visitor Use Statistics Program (<https://www.nps.gov/subjects/socialscience/nps-visitor-use-statistics-definitions.htm>):

1) Visits

- a. Defined by the NPS Visitor Use Statistics Program as the entry of any person, except NPS and service personnel, onto lands or waters administrated by the NPS. Visits are only counted as one per day, no matter if the visitor leaves the site boundaries and returns that same day.

2) Visitor Hours

- a. Defined by the NPS Visitor Use Statistics Program as the presence of one or more persons, excluding NPS personnel, in a managed area or park for continuous, intermittent, or simultaneous periods of time aggregating one hour.

3) Overnight stays

- a. Defined by the NPS Visitor Use Statistics Program as one night within a managed area or park by a visitor, excluding employees, NPS personnel, or their families.

Table 1: Example Typology Rubric

Critical	Entry Point Characteristics	<i>Numerous entry points or access options</i>	<i>Various access points along their length</i>	<i>Single point of access</i>
	Length	<i>Short to Medium</i>	<i>Medium to Long</i>	<i>Longest</i>
	Data Availability and Accessibility	<i>Existing count data</i>	<i>Permitting/ secondary data</i>	<i>Cell Service</i>
Secondary	Geographic Setting	<i>Rural</i>	<i>Urban</i>	<i>Suburban</i>
	Seasonality of Use	<i>Seasonally Limited</i>	<i>Extended Peak</i>	<i>Year-Round</i>
Tertiary	Intensity of Use	<i>Low</i>	<i>Moderate</i>	<i>High</i>
	Additional Amenities	<i>Campgrounds</i>	<i>Visitor Centers</i>	<i>Other Visitor Services</i>

Based on the typology of each site, the decision on which data source and approach to use would be determined by the river or trail staff and/or a research team.

Scenario 1: National historic or scenic trail in the longest length category (over 200 miles) with auto tour or drivable components.

This hypothetical trail possesses several key characteristics:

- 1) Multiple points of entry,
- 2) Reliable cellphone service coverage,
- 3) A suburban setting,
- 4) An extended peak season,
- 5) High intensity of use, and
- 6) Campgrounds with associated registration or permitting data.

Given the trail's considerable length (over 200 miles) and multiple points of entry, segmentation and the use of physical counters will be necessary. The use of physical counters could then be used as an anchor point for statistical estimates and mobile location data. In this case, an approach would include:

- 1) Segmenting the trail into manageable areas by logical access points or based on mileage. Depending on the site, either option may be feasible.
- 2) Installing permanent counters to use as an anchor point for estimates. Because the trail is mostly drivable, permanent traffic counters are likely the most appropriate method to collect count data.
- 3) Generate statistical estimates to eliminate the need for a large volume of traffic counters as drivable trails are well positioned to use statistical estimates due to the linear nature of travel.
- 4) If necessary, collect mobile location data for calibration and trip patterning. Though due to the lack of current count metrics, temporary counters may be necessary at least once to calibrate mobile location device sample size.

The secondary and tertiary typologies reveal that the trail experiences a high intensity of use and provides access to campgrounds. The significant level of trail usage and the length makes it challenging to rely solely on proxy or actual counts, further underscoring the suitability of statistical estimates and/or mobile location data as preferred methodologies in addition to conventional methods.

Multiple points of entry make this specific example prone to double counting and a high rate of re-entry. To help correct double counting, a study may need to employ at least a one-time survey of users to gauge rates of reentry or estimated using mobile location data. Because proxy counts are necessary for this type of trail, conducting a one-time study to develop metrics such as reentry rates and multiple count corrections is necessary. Statistical estimates can be developed at this time and paired with the corrections found in the study. Eventually, these metrics would need to be updated (every 10+ years for instance), but the count procedure could run with assumptions built in from the original study.

In summary, an effective approach to comprehensively understanding visitation to this trail involves combining statistical estimates, mobile location data, and conventional counts to best predict relationships across the trail system. This drivable trail resembles other similar locations managed by the National Park Service such as Blue Ridge Parkway and the Lewis and Clark National Historic Trail. This example study

would be moderately difficult to conduct due to the length and lack of permanent counters. However, estimates could be made if error is acceptable in the overall projection.

Table 2: Example Long Historic Trail Typologies

Critical	Entry Point Characteristics	Numerous entry points or access options	Various access points along their length	Single point of access
	Length	Short to Medium	Medium to Long	Longest
	Data Availability and Accessibility	Existing count data	Permitting/ secondary data	Cell Service
Secondary	Geographic Setting	Rural	Urban	Suburban
	Seasonality of Use	Seasonally Limited	Extended Peak	Year-Round
Tertiary	Intensity of Use	Low	Moderate	High
	Additional Amenities	Campgrounds	Visitor Centers	Other Visitor Services

Scenario 2: A medium length national historic or scenic trail

This hypothetical scenic trail possesses several key characteristics:

- 1) Various access points,
- 2) Lack of existing data,
- 3) A suburban setting, a year-round season,
- 4) Moderate intensity of use, and
- 5) No additional amenities.

Given the trail's length ranging from 101 to 200 miles and the presence of various points of entry, segmentation of the site is likely preferred, but may not be fully necessary if counters can be set up at realistic intervals. However, due to the absence of cell service in the area, the preferred approach would likely not prioritize using mobile location data due to the potential lack of data to make confident conclusions. In this case, an approach would include:

- 1) Installing at least one permanent counter to use as an anchor point for estimates.
- 2) Relying on statistical estimates for areas that are not feasible for counter installation.
- 3) Using a one-time study to best create reasonable assumptions that are unable to be answered by statistical estimates.
- 4) Secondary analysis could be beneficial due to the lack of any current data collection techniques.

The secondary and tertiary typologies reveal that the trail experiences moderate year-round usage but lacks facilities that could provide a source of secondary data. Without access to secondary data, the available options for analysis are narrowed down to statistical estimates using either a one-time study with temporary counters or a select number of permanent counters to use into the future. A variety of assumptions would need to be made since continuous updating of count procedures would be difficult due to the lack of data and cellular service.

Since there is no secondary data available to be fed into a statistical model for estimation, primary data collection becomes essential. The choice of primary data collection method will depend on the desired level of depth and budget of the trail. An in-depth visitor survey would offer a more costly and in-depth option, while proxy counts represent a lower-cost and less detailed option. Actual counts fall between these two options. Once the primary data is collected, it can be incorporated into a statistical model to generate estimates of visits beyond the areas where the primary data was initially collected.

In summary, an effective approach to comprehensively understanding visitation to this trail involves combining statistical estimates, secondary data sources, conventional counts, and a one-time study to best predict relationships across the trail system. This trail resembles other similar locations managed by the National Park Service such as the Natchez Trace Scenic Trail. With trails like the Ala Kahakai National Historic Trail and the Selma to Montgomery National Historic Trail being similar in size and use but find themselves in more urban settings. This example study would be moderately difficult to conduct due to the lack of permanent counters or other types of primary data available. Though overall costs for an initial study

to collect primary data as a baseline to build off of would be less substantial as compared to those trails that are 200 miles or longer.

Table 3: Example Medium Scenic Trail Typology

Critical	Entry Point Characteristics	<i>Numerous entry points or access options</i>	<i>Various access points along their length</i>	<i>Single point of access</i>
	Length	<i>Short to Medium</i>	<i>Medium to Long</i>	<i>Longest</i>
	Data Availability and Accessibility	<i>Existing count data</i>	<i>Permitting/ secondary data</i>	<i>Cell Service</i>
Secondary	Geographic Setting	<i>Rural</i>	<i>Urban</i>	<i>Suburban</i>
	Seasonality of Use	<i>Seasonally Limited</i>	<i>Extended Peak</i>	<i>Year-Round</i>
Tertiary	Intensity of Use	<i>Low</i>	<i>Moderate</i>	<i>High</i>
	Additional Amenities	<i>Campgrounds</i>	<i>Visitor Centers</i>	<i>Other Visitor Services</i>

Scenario 3: A short to medium length wild and scenic river

This hypothetical river possesses several key characteristics:

- 1) Single point of entry through a main put-in location,
- 2) Access to data from their own internal raft permitting and third-party data from a commercial rafting group,
- 3) A rural setting,
- 4) Seasonally limited access to the river, and
- 5) Moderate intensity of use.

Given the river's length of less than 100 miles and the presence of a single access point at a primary put-in location, it is advisable to employ actual counts or proxy counts at the location with the possibility of adding permit data as an additional variable. Mobile location data may be used in future updates based on availability of permanent count solutions, but it's likely not needed unless for measuring other metrics of interest and more frequent updates. The availability of data through river raft permitting and commercial rafting guides also allows for the utilization of secondary data analysis to supplement or replace these conventional counting or surveying methods. A general approach could include:

- 1) Installing one permanent counter at the access point or obtaining a long-term observational count to use as a baseline.
- 2) Collect permit data and use as a proxy for shifts in visitation.
- 3) If necessary, collect mobile location data for calibration and trip patterning, though this is not likely a priority for the study.

The secondary and tertiary typologies indicate that the river experiences moderate usage, but with seasonally limited access. These characteristics further emphasize the need for traditional count methods as the timeframe for implementing these methods is shorter, and therefore less costly, as compared to other locations. Moreover, since the river has only one point of access through the visitor center, a small team of counters or surveyors would be sufficient to ensure an accurate count of visitors to the river. Considering the characteristics of this river, the most effective approach for understanding visitation patterns is likely to involve a combination of conventional counting methods, supplemented by secondary data analysis to validate the obtained counts.

In summary, given the characteristics of this river, the most effective approach for understanding visitation patterns entails a combination of conventional counting methods or surveys, complemented by secondary data analysis of permit data for validation. Alternatively, with their access to robust permitting data, the river can bypass the need for more costly primary data collection and estimate visitor use directly from the permitting data. While this is a rare case scenario due to rivers typically having more than one point of entry, it is not dissimilar to The River Styx, which, due to it being an underground river, has limited points of access with access to permitting/secondary data.

Table 4: Example Short River Typology

Critical	Entry Point Characteristics	<i>Numerous entry points or access options</i>	<i>Various access points along their length</i>	<i>Single point of access</i>
	Length	<i>Short to Medium</i>	<i>Medium to Long</i>	<i>Longest</i>
	Data Availability and Accessibility	<i>Existing count data</i>	<i>Permitting/secondary data</i>	<i>Cell Service</i>
Secondary	Geographic Setting	<i>Rural</i>	<i>Urban</i>	<i>Suburban</i>
	Seasonality of Use	<i>Seasonally Limited</i>	<i>Extended Peak</i>	<i>Year-Round</i>
Tertiary	Intensity of Use	<i>Low</i>	<i>Moderate</i>	<i>High</i>
	Additional Amenities	<i>Campgrounds</i>	<i>Visitor Centers</i>	<i>Other Visitor Services</i>

Conclusions

Throughout this Data Needs Assessment, we have presented various possible approaches for estimating visitor use. Estimating visitor numbers in rivers and trails poses particular challenges due to their length, complexity, and unique characteristics. To obtain the best estimate of use in these areas, it is necessary to employ multiple counting methods. However, it's important to note that even with these methods, some level of error is inevitable. The complexity of these sites makes it difficult to capture all visitor activity compared to other managed areas, including other National Park Service locations with gate counts or simple access points. Nevertheless, there are ways to potentially arrive at a reasonable estimate using the various sources identified.

It is crucial to implement conventional count methodologies in some form at almost every site. Physical counts, whether through traffic monitoring, trail observation, or other means, are essential for calibration and accurate estimation. Without reliable on-the-ground counters, too many assumptions are required, compromising the reliability of the estimates. While emerging methods like mobile location data or statistical estimates can help reduce some assumptions, they do not eliminate them entirely.

The examples provided for potential approaches are intentionally broad and flexible. Each river or trail has unique characteristics that must be taken into consideration when developing a counting approach. Using the recommended typologies system as a starting point provides guidance on the level of difficulty and feasibility for a specific river or trail. For example, a long trail without current count data or installed equipment will inherently be more complex and challenging than one with a limited number of access points and existing counters. Rivers and trails managers can utilize this approach to assess the feasibility of implementing a long-term counting procedure on a site-by-site basis.

Citations

Lawson, S., Monz, C., & Larkin, A. (2023). Passive Mobile Data Analysis of Visitor Use in Parks and Protected Areas: Prospects and Challenges. *Journal of Park and Recreation Administration*.

Monz, C., Mitrovich, M., D'Antonio, A., & Sisneros-Kidd, A. (2019). Using mobile device data to estimate visitation in parks and protected areas: an example from the nature reserve of orange County, California. *Journal of Park and Recreation Administration*, 37(4), 92-109.

Ziesler, PS, Pettebone, D 2018 Counting on Visitors: A Review of Methods and Applications for the National Park Service's Visitor Use Statistics Program. *Journal of Park and Recreation Administration*, 36(1): 39-55.

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