



Oregon State University



Visitor Use Management Fact Sheet

Data Collection & Constraints

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Sampling Decisions

Collecting data requires financial and staff resources. To be efficient with these resources, ensure that your sampling strategy is appropriate for the indicator(s) you are measuring.

Will you monitor year-round or during a specific season of the year?

An important consideration when making this decision is that you want to **ensure that the data you collect are representative of the time period for which you plan to make management decisions.** For example, you might choose to sample only during your high use season, as this is the time when certain visitor use issues would be most likely to occur. Alternatively, you might be interested in differences throughout the year.



Figure 1. A research technician collects data from a trail counter. Photo: Madeline Aberg.

Will you use random sampling or convenience sampling to schedule dates of data collection?

Random Sampling

- All dates within the sampling time period have an equal probability of being sampled.
- Ensures a higher level of confidence when making conclusions about trends over time.
- Necessary for statistical analysis.
- Requires more staff resources.
- Randomly sampled dates need to be chosen ahead of the monitoring season.

Convenience Sampling

- Sample based on staff availability.
- Easier to combine with other tasks and staff schedules.
- Not appropriate for statistical comparisons or tracking trends over time.

Probability Proportional to Use Sampling

- The probability of a date or time being selected is proportional to the amount of use at that time

Do you want to make conclusions about specific park units or zones?

Management concerns might vary from one unit of the park to another and may be addressed differently in separate park units. Therefore, it may be useful to sample each site independently. You can aggregate data for analysis across sites if needed, but you cannot make conclusions for individual sites using data that was collected as an aggregate.

Do you want to stratify your data by any variable?

Some of the behaviors you are monitoring may differ depending on other variables, such as weekdays versus weekends and holidays, or time of day. In these cases, it is useful to sample from each of the strata of interest, so that you are able to make comparisons.

Example: Not stratified

Su	M	T	W	R	F	Sa

Example: Stratified by weekday vs. weekend/holiday

Su	M	T	W	R	F	Sa

How many samples do you need?

There are tradeoffs between the cost of obtaining large samples and the benefit of making valid and precise estimates. We recommend considering the following:

- How **controversial** is the visitor use issue you are monitoring? Controversial issues may benefit from higher sample sizes that allow for more confidence in statistical comparisons.
- How much **variation** is there in the data? If variation is high, more samples will be needed than when variation is low. You may be able to estimate variation based on professional judgement, but in many cases, you will need pilot data to make this decision.
- What is your desired level of **confidence** in your conclusion? Additional samples will increase your confidence when your sample size is small but will have less impact when your sample size is large.
- How many **comparison units** are you monitoring? Examples of comparison units are locations, seasons, days of the week, or times of day. Your sample size requirement will generally double if you want to compare two groups, compared to analyzing the population as a whole.



Figure 2. Seals on the beach with recreational users in the distance. Photo credit Parks California.

Sampling Tips

- Drawing **sample dates randomly from each week** ensures that the data points will be spread throughout the season of interest, which is not guaranteed in a simple random sample.
- Following the **sliding scale** recommendation from the Interagency Visitor Use Management Council (IVUMC 2019), data from a monitoring program can be used to identify whether more intensive monitoring is needed in subsequent years. Examples of this would include high amounts of variations in the data or conditions that are near or over a threshold.
- We recommend including **backup dates** in your sample, in the event that data collection cannot occur on the originally sampled dates.
- **Document your sampling strategy thoroughly!** This is necessary to ensure that monitoring can be repeated each year using the same approach, which allows for a comparison of trends over time.
- **Staff availability** may impact your ability to sample.
- If you are monitoring multiple indicators (e.g., parking lot counts and people at one time counts) or park units, consider **bundling** sites or monitoring to facilitate logistics and transportation.
- Data may not need to be collected annually. If you make the decision to increase the yearly interval, for example a five-year interval, options for scheduling would be:
 - Collect all monitoring data in one year, every five years.
 - Stagger data collection so that some portion of monitoring (e.g., certain sites) occurs each year



Figure 3. A redwood seedling growing from the base of a burned tree in Big Basin Redwoods State Park.

Managing Changes to Monitoring

Monitoring protocols must be implemented the same way each year to be valid for monitoring trends over time. Consistent training and well-documented protocols can help to avoid differences in the interpretation of the protocol. **We strongly recommend that protocols not be altered**, with three exceptions:

- 1) An existing measure may be subdivided into more refined measures, so long as future data can be reaggreated into a form comparable to earlier years of data.
- 2) Additional fields may be added to existing measures or new measures may be created, so long as the original measures continue to be collected.
- 3) Sampling intensity may be increased to obtain more data points than the minimum, so long as the sampling approach remains consistent. If data collection is added outside of the original monitoring period (e.g., the high use season), only observations within the original monitoring period should be compared when assessing long term trends.

If a protocol is updated, it should be updated to reflect the change. For example, from “BBRSP Parking Lot Protocol, Version 1” to “BBRSP Parking Lot Protocol, Version 2.” The protocol and version used to collect data should be noted in any reports or products.

Using the VUM Framework with Limited Resources

The following strategies for using the VUM Framework with limited time, money, and personnel are guided by the sliding scale principle of the framework. Using the sliding scale, we decide what level of data collection we need based on:

- The level of **controversy** and potential for litigation.
- The **risk of an impact** to resource conditions and/or the visitor experience. For example, could this visitor use issue negatively affect an endangered species?
- The amount of **uncertainty** surrounding the issue.
- The level of **stakeholder involvement**.

Based on these factors, you can scale your level of effort, data collection, and analysis.

Strategies

- 1) Use partnerships to increase capacity for visitor use monitoring.

These partnerships could include:

- Academic institutions
- Non-profit organizations
- Youth Conservation Corps Crews
- Volunteers

- 2) Tailor the monitoring program to fit into existing staff duties.

- If you are monitoring within multiple sites, bundle nearby sites for data collection.
- Start with a small number of samples, then conduct more intensive data collection later if conditions are met.
- Select key locations within the park that can serve as “indicator locations.”
- Collect data during key dates and times of day. For example, collecting data during the high use season may be most informative.
- Consider if less precise data can be used to answer the same question. For example, if you are counting the number of cars in a parking lot, could an estimate of the percentage of the parking lot that is full be an adequate measure, or do you need to count the precise number of cars.

- 3) Use convenience sampling approach but collect ancillary data. This allows you to discuss the approximate representativeness of your sample when presenting data. For example, if your sampled dates are spread throughout the high use season and contain a similar number of weekdays and weekends, you would have more confidence in the representativeness of the data than if all of your samples occurred on weekdays in the early season.

Example: Yellowstone National Park

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A partnership with the Yellowstone Youth Conservation Corps was used to conduct visitor use monitoring with limited resources. Key takeaways:

- Hiring a consistent intern for the summer ensured high quality and consistent data collection.
- Using automated trail counters helped to collect data outside of the crews’ working hours.
- Data collection techniques were adapted to fit the skills of the technicians, ensuring that reliable data were collected.

Plan for Data Analysis

Planning for data analysis at the start of data collection can help to streamline data analysis. Some key tips:

- Set up the worksheet where you will enter data in a manner that is conducive to data analysis.
 - Use consistency when naming variables. Choose short but meaningful names.
 - Be consistent when entering data (e.g., Write the site name the same way each time.).
 - Use a consistent indicator of missing data. If you plan to use software for data analysis, check the default for missing data in the software. For example, R statistical software uses “NA,” and SPSS uses “999.”
 - Avoid using spaces in names and values.
 - Use consistent case rules.
 - Include a worksheet with metadata for the dataset, including:
 - The name and full citation of the protocols used, as well as the permanent file location.
 - The structure of each worksheet in the workbook.
 - The name and full citation of protocols used, as well as the permanent file location.
 - The structure of each worksheet in the workbook.
 - Field naming conventions for each element in the database (i.e., a data dictionary).
 - Lists of valid values for each measure and the required format for field types.
 - Units for each type of measure.
 - Value used for missing data.
 - The relationship of the file to other monitoring files

Table 1. An illustration of the metadata worksheet for monitoring data.

Field Name	Variable	Data Type	Values
Unit	unit	Text (abbreviation)	MD = Main Day Use Area RDO = Rancho del Oso
Parking Lot	lot	Text	Reservation FCFS = first-come, first-served
Date	date	Date (MM/DD/YYYY)	

- Plan your comparisons ahead of time and ensure that you have adequate samples for each group. For example, if you plan to compare the number of encounters on a hiking trail on weekends to weekdays, stratify your sample to obtain data on both types of days.
- Consider how you will identify outliers versus errors in the dataset.
- If applicable, plan how you will use multiple sources of data together.
 - Example: Assess the relationship between the number of encounters on a hiking trail and the number of vehicles in the parking lot.

RESOURCES

Visitor Use Management Framework.

Interagency Visitor Use Management Council. Framework & Guidebooks

<https://visitorusemanagement.nps.gov/VUM/Framework>

Designing a Monitoring Program

Reynolds, J. H., M. G. Knutson, K. B. Newman, E. D. Silverman, & W. L. Thompson, W. L. 2016. A road map for designing and implementing a biological monitoring program. *Environmental Monitoring and Assessment*, 188, 1-25

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Data Management

Borer, E. T., E. W. Seabloom, M. B. Jones, & M. Schildhauer. 2009. Some Simple Guidelines for Effective Data Management. *Bulletin of the Ecological Society of America* 90, 205-214.

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Borman, K. W., & K. H. Woo. 2018. Data Organization in Spreadsheets. *The American Statistician* 72, 2-10.

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McCord, S. E., N. P. Webb, J. W. Van Zee, S. H. Burnett, E. M. Christensen, E. M. Courtright, & C. Tweedie. 2021. Provoking a Cultural Shift in Data Quality. *BioScience* 71, 17-28. <https://doi.org/10.1093/biosci/biab020>

SUGGESTED FACT SHEET CITATION

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