

Science

FINDINGS

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“Science affects the way we think together.”
Lewis Thomas

Using Social Media as Data to Better Understand Recreation on Public Lands



USDA Forest Service

Hikers in Mount Baker-Snoqualmie National Forest, Washington. Measuring recreation use is challenging, but social media data can be used to supplement traditional monitoring approaches and provide more timely information for recreation managers.

“If bread is the first necessity of life, recreation is a close second.”

—Edward Bellamy, author and activist

The Snow Lake Trail is one of the most popular hiking trails on the Mount Baker-Snoqualmie National Forest. Less than an hour from downtown Seattle, the trek into the Alpine Lakes Wilderness provides spectacular views of waterfalls and a lake. The splendid scenery provides the perfect backdrop for photographing and posting wilderness experiences on Instagram, Twitter, and other social media platforms.

A few years ago, outdoor recreation planner Sarah Lange and recreation program manager Dave Redman, both with the Mount Baker-

Snoqualmie National Forest, were frustrated by the scarcity of information on how specific trails or sites in the forest were being used.

Lange was familiar with work by researchers at the University of Washington, who were using social media to track visits to national parks. She wondered if the Mount Baker-Snoqualmie National Forest could use social media posts by visitors, such as hikers on the Snow Lake Trail, to track visitation.

National forest managers expend a great deal of resources to count and map different trees or wildlife species, but the number and distribution of human visitors to the forest is harder to nail down. Recreation managers often have to make management decisions on trail and facility development without knowing basic information, such

IN SUMMARY

More people visit public lands for recreation than for any other reason, which makes providing opportunities for sustainable recreation a key service that national forests can provide. Recreation managers, however, frequently lack basic information on the amount and extent of recreation use. Traditional approaches that rely on visitor traffic counts and in-person interviews to measure visits and recreation can be costly and may not provide needed information in a timely way.

A team of scientists with the USDA Forest Service, Pacific Northwest Research Station and the University of Washington, along with recreation managers from the Mount Baker-Snoqualmie National Forest, developed a method to use social media, such as Twitter and Instagram posts, to provide land managers with useful measures of recreational use. They tested it in the heavily visited forest an hour outside the Seattle metropolitan area, and on more rural, less visited public lands in northern New Mexico.

The team found that social media can be used to measure visits to trails and sites on public lands with more detail than traditional recreation monitoring systems. These data can improve visitation estimates and the ability to assess rapid changes in recreation use. However, social media appears to complement, rather than replace, traditional monitoring systems, which can provide valuable information on types of use, visitor attitudes, and perceptions of recreational experiences.

as how many people are visiting, where they are going, and how that changes over the seasons.

“Visitation trends and projections of future visitation should inform what we do in recreation management, from designing a parking lot or planning for facilities,” Lange says. “Unfortunately, we just haven’t had an accurate way of tracking that information unless we’re out maintaining a trail count, which is very time intensive.”

Recreation managers mostly rely on visitor surveys conducted as part of the National Visitor Use Monitoring (NVUM) Program—a national effort to document the number of people using national forests. NVUM also collects data on visitor activities, demographics, and satisfaction. The survey gives information about forest-wide usage, but it doesn’t provide details at the level of specific trails, or even across ranger districts. Also, the survey rotates among forests, collecting visitation data for each individual forest every five years, leaving a gap in visit estimates.

Redman and Lange reached out to Eric White and Dale Blahna, research social scientists with the USDA Forest Service, Pacific Northwest (PNW) Research Station, along with Spencer Wood, a University of Washington research scientist, with the seed of an idea: could they use social media platforms, such as Twitter, Instagram, Flickr, and “trip report” posts to a popular hiking website, to describe visitation across the vast Mount Baker-Snoqualmie National Forest?

Following the Posts

The Mount Baker-Snoqualmie National Forest stretches about 140 miles across the western slopes of the Cascade Range, from Mount Rainier National Park to the Canadian border. The national forest includes nine wilderness areas, four ski areas, and hundreds of miles of hiking, biking, and off-road trails that are popular with users from the Seattle metropolitan area. In 2015, NVUM estimated the forest received about 2.2 million visits per year, making it one of the most-visited national forests in the country.

The research team selected 16 trails, representing a range in popularity, for the study. They started by exploring the feasibility of using social media—in this case, geotagged photos shared publicly on Flickr (www.flickr.com)

and trip reports posted to a website maintained by the Washington Trails Association. They then compared the number of social media posts to counts from more traditional methods, such as time-lapse cameras, infrared sensors, and trailhead parking counts, to find out how many people were on the trails.

The researchers found that counts of both Flickr posts and trip report posts to the Washington Trails Association website correlated with counts using traditional methods of monitoring visitor use at sites and trails throughout the forest. This showed that social media data could help managers identify which trails were most visited.

“That doesn’t actually tell us the number of visits at a place—it just tells us that this trail is

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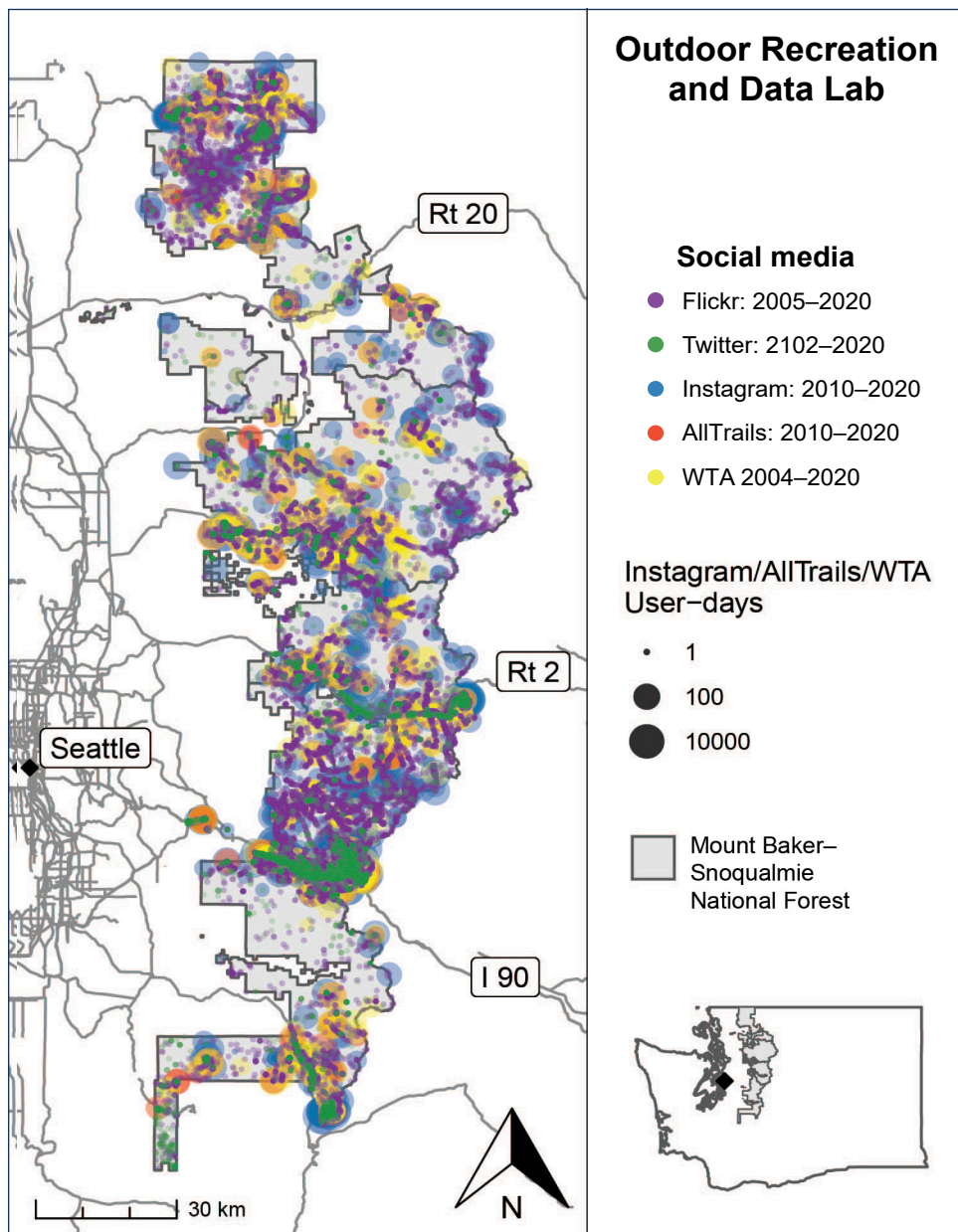
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Locations of geotagged social media posts from visitors to the Mount Baker-Snoqualmie National Forest. Scientists developed a statistical model that uses social media data to predict weekly visits to recreation sites in this region. WTA = Washington Trails Association.

busier than that other trail, because it has more posts,” said White. “The second question was, ‘Can we take the counts of the number of posts on this trail and actually translate it into an estimate of the number of visits at that trail?’”

Answering the second question involved developing statistical models that use the number of social media posts and incorporate variables accounting for holidays and local weather. The researchers found that social media data can be applied to estimate visits to sites that are unmonitored or otherwise lack onsite counts.

“The primary goal is to help a manager who’s sitting at their desk wanting to know how many people were at any given trail last week, because that would tell them a lot about what they’re managing for and what they need to be doing in the coming week,” Wood says. “The primary goal is to map and measure the popularity of sites at places where we otherwise didn’t collect information.”

Putting the Model to the Test

Next, the team wanted to know if the model they developed for the Mount Baker-Snoqualmie National Forest, a heavily visited national forest near a major metro area, could be used to estimate visits to sites in northern New Mexico, a more remote area with public lands that receive much lighter use. Partnering with the U.S. Department of the Interior, the New Mexico study focused on the Santa Fe National Forest and land managed by the Bureau of Land Management and National Park Service.

The researchers put the same methodology into place, using traffic counters and infrared sensors on the ground, while also collecting several sources of social media, including Twitter, Instagram, and Flickr posts on a sample of trails within the study area.

The research team expected to detect regional differences in social media use given differences in climate, land management, population density, mobile phone signal coverage, and visitor demographics. They found, however, that the use of social media was relatively similar in both New Mexico and Washington.

“Surprisingly, people post the same amount per visit in northern New Mexico as they do in western Washington,” White says. “We found that about 3 percent of visits in both places results in an Instagram post, for instance. That told us we can use social media data to understand that correlation between posts and visits, and that correlation still holds in both places.”

The researchers also learned that visitation estimates were further improved when the models integrated traditional data sources. This suggested that social media data complements, rather than replaces, traditional monitoring systems.

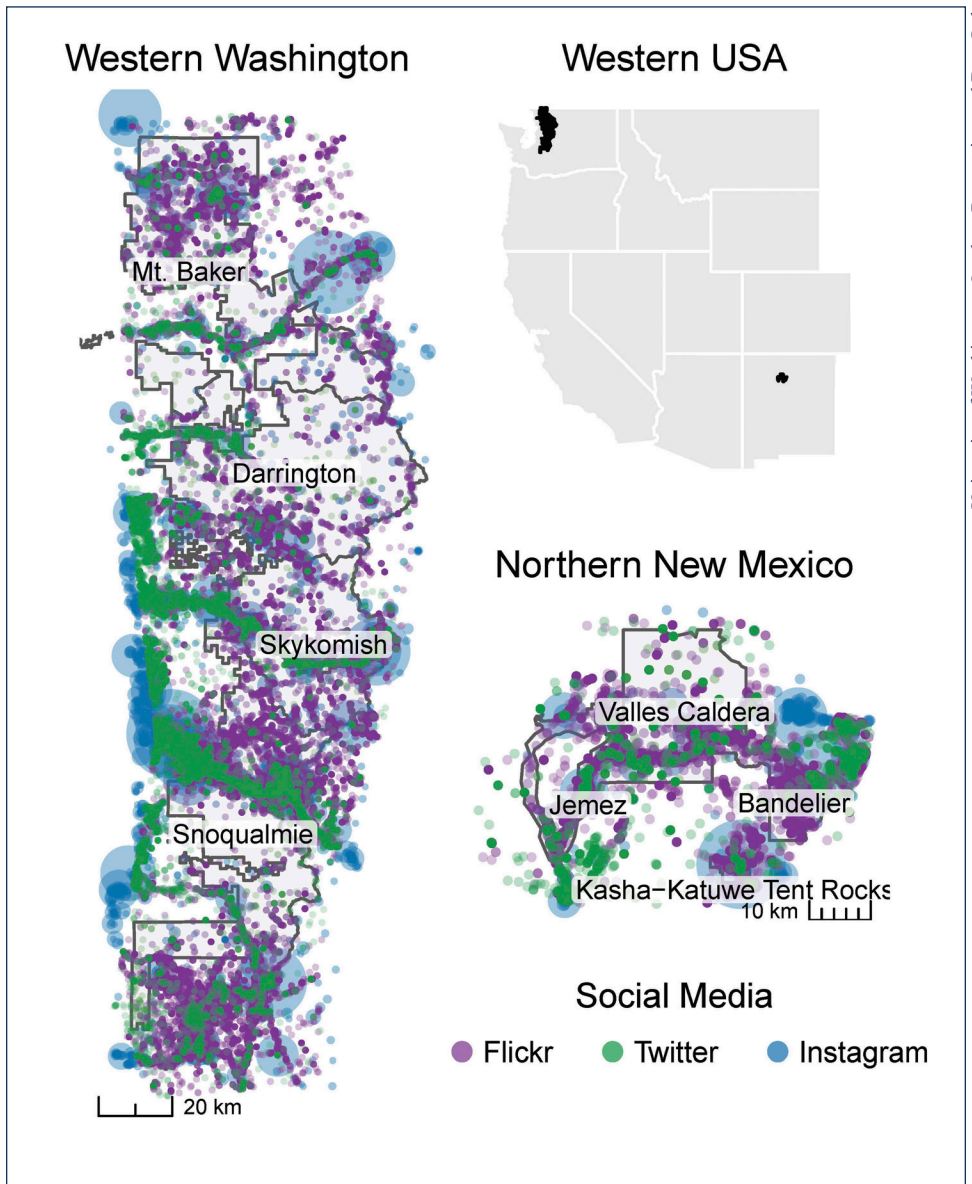
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KEY FINDINGS

- Weekly number of visits to individual trails on the Mount Baker-Snoqualmie National Forest can be derived from statistical models that use the number of social media posts and variables that account for holidays and local weather.

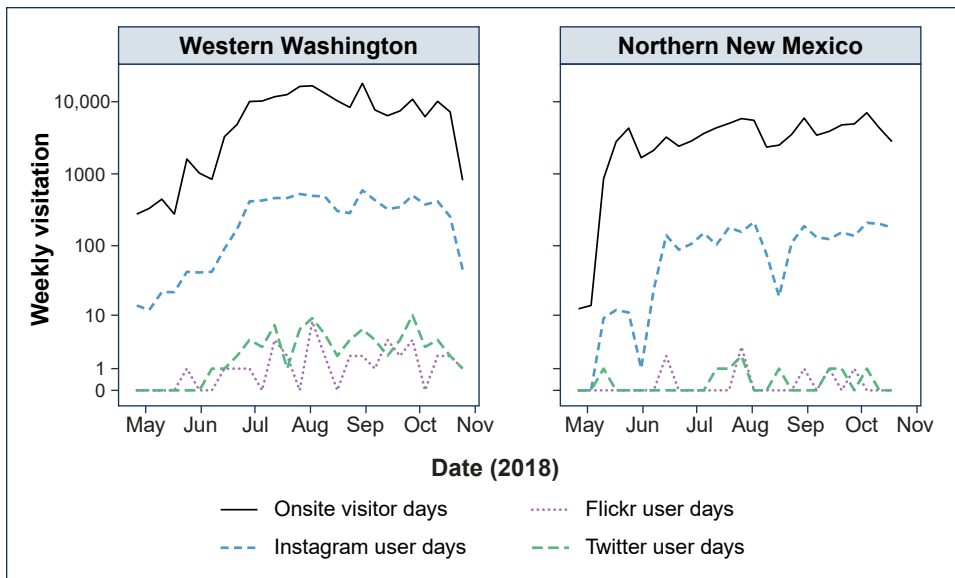
- Social media can be used to estimate recreation use at smaller scales than is typically available with the National Visitor Use Monitoring Program, which estimates visitation at the forest level.

- Models developed for estimating recreation use in a national forest near an urban area in Washington also performed well when applied to public lands in rural New Mexico. This highlights the potential to use social media-based models to estimate visitation in places without traditional onsite recreation counts.



Scientists successfully counted recreational visits by using social media posts from a national forest just an hour outside the Seattle metropolitan area and in a rural setting in northern New Mexico. Points represent the latitude and longitude where a Flickr photograph (purple) or tweet (green) was created. For Instagram, points represent places to which images were assigned by users (blue). Larger points represent a greater number of Instagram posts from the location.

University of Washington, Outdoor Recreation and Data Lab



Total weekly recreational visits for 26 sites in western Washington and 13 sites in northern New Mexico. Visits were recorded between April 27 and October 24, 2018, and measured by onsite counts and social media sources.

The New Mexico work confirmed the potential to expand use of the model in other parts of the country. It also demonstrated an easier, less costly way to estimate visitation.

Serving People

Blahna explains that the social media techniques for estimating the number of visits provide new opportunities for land managers to focus on the second half of the Forest Service motto, “Caring for the land and serving people.”

“When I see the clusters of dots on the social media maps, I see opportunities to continue serving people,” Blahna says. “It lets managers know where they might need to go in and harden sites so they can continue providing recreational opportunities while protecting the resource.”

The team has already shown what this might look like by constructing a data visualization dashboard called TrailTrends. The dashboard gives managers a near real-time depiction of visitation to different sites over time and is already being used for recreation planning and management.

The dashboard can help managers identify sites within a forest that are experiencing increased visitation and greater demand for certain recreational activities. Lange says the dashboard can help managers respond to new visit patterns or issues more quickly.

“It helps us kind of get our arms around visitation and not just the areas of concern,” Lange says. “It actually could be a tool that we can use to understand what’s happening on the ground.”

Monika Derrien, a research social scientist with PNW Research Station, has started a parallel branch of the project to understand the qualities (and not just the quantity) of visits through the content of social media posts. “We want to learn about the social space of trails. How are people describing their experiences? How are they describing themselves and others that they encounter on the trails?” says Derrien.

Derrien and colleagues from Western Colorado University and the University of Washington are focusing specifically on the trip reports posted to the Washington Trails Association website to begin answering these questions. “By systematically reading and coding these trip reports, we’ll be able to characterize and understand these dynamics and patterns within the trip report data,” she says.

Facilitating Better Experiences

During the summer of 2020, visits to the Mount Baker-Snoqualmie National Forest surged as nearby Seattle-area residents fled the city for campgrounds, trails, and waterways. Visitors looking to escape the city heat swamped Eagle Falls, a popular swimming spot on the South Fork of the Skykomish River and the location of several viral video posts. Forest officials estimated that 1,000 people a day were visiting the falls over the summer; most were parking illegally on the side of the state highway that passes through the forest, creating traffic backups and safety problems. At the trailhead for the Snow Lake Trail on Snoqualmie Pass, officials counted 650 cars in the parking lot and 1,500 hikers on the trail.

Redman envisions a future where real-time social media models of visitation could offer alerts through websites or mobile applications to forest visitors who are looking to avoid areas with lots of visitors and congestion, such as Eagle Falls, and suggest alternative destinations.

“We’re certainly not there, or not even close, but the ultimate management scenario might be direct, real-time influence on how and where people are recreating,” says Redman.

These new data sources are creating new opportunities for managers to track visits to more dispersed locations. By integrating traditional counting and monitoring methods, a more detailed picture of use emerges. This can help national forest managers fill in gaps between NVUM surveys, and reduce costs for collecting forest- or site-level visitor use data.

Redman says the ultimate aim is to create a better user experience. And it may just be the visitors themselves who produce the data that will be key to unlocking that management challenge.



Hiking in the Columbia River Gorge, Oregon. Recreation managers need information about visitor use and preferences for effective planning.

Eric White

Community Scientists Team Up With “Vic the Chatbot”

The team has created a community of volunteer scientists who contribute crowd-sourced data for estimating visits to trailheads on the Mount Baker-Snoqualmie National Forest. As part of the Visitors Count! Program, signs at trailheads across the national forest ask hikers to send a text message reporting the number of vehicles in the parking lot. When the hiker sends the text, they're connected to an automated “chatbot” named Vic that asks the user if they're willing to answer more questions: How many people are in your group? What time did you arrive? What time did you leave the trailhead?

People have taken part enthusiastically, and this has become one of the program's best sources for on-the-ground information.

“I think it appeals to people's sense of altruism,” Derrien says. “People are hiking these trails, and they want to help, even if that is simply telling us how many cars are in the parking lot at that moment. It's a low barrier. And people are happy to provide that information. There's a lot of opportunity there.”

Other national forests are using the Visitors Count! Program as well.

For more information, visit: <https://www.outdoorrd.org/community/visitorscount/>.

Dealing With Limitations

There are several caveats to using social media for estimating recreation usage. Social media users are not a random sample of the public, just as they aren't representative of visitors to national forests.

“Social media users tend to be younger, and they tend to be more affluent,” Derrien says. “It's already a subset of the population that's visiting national forests to begin with. And then it's another subset of visitors who make posts on social media. So, we have to be careful [to ensure] we understand who the data represent and how we extrapolate from that.”

Social media also changes rapidly, and platforms rise and fall in popularity with cultural changes and technology developments. Concerns with privacy and data access present ethical and financial challenges to working with these datasets. Wood says it requires



- Social media provide information that can be used to more efficiently select locations for conducting traditional visitor counting and surveys through the USDA Forest Service's National Visitor Use Monitoring Program
- Social media and crowd-sourced data appear to complement, rather than replace, traditional monitoring systems. These data can help improve the estimates and the ability to assess rapid and unforeseen changes in use, such as in response to a pandemic.
- A data visualization dashboard depicts estimated recreation use at trails based on social media posts on the Mount Baker-Snoqualmie National Forest. The TrailTrends dashboard helps users visualize recent changes in use levels and the effects of management actions.

periodic recalibration to account for the differences in popularity among platforms as user groups shift from platform to platform.

“We know that the popularity of these different platforms changes over time,” Wood says. “So, when we first started doing this work, Flickr was really popular. Now it's not. And we've watched the popularity of Instagram increase over the years. I'm sure that sometime in the future, it won't be popular and something else will replace it.”

Some platforms allow users to have open access to the information available on their platform. Other platforms sell their information, and some are not selling but have restricted availability. These policies change regularly and are a serious challenge to the researchers.

“Going forward, one thing that I worry about is that, increasingly, platforms are restricting access to their data, or they're selling data,” White says. “Presently, we're not buying any data in this project, and it would be cost prohibitive if we had to buy the data we needed to implement this across the country.”

Another issue is opacity in how the different social media platforms produce data and whether companies are limiting data availability.

“The programs on the company side of the API (application programming interface) are often a black box, so we don't fully know if they're restricting or promoting certain information,” Wood says. “When we send a query to an API and ask for all photos taken in Rainier National Park, for example, is the platform promoting certain content by certain users? Are they returning all the photographs? Sometimes the answers to those questions are totally unknown.”

So far, the team's strategy has been to compare information from several social media platforms and calibrate the social media data with traditional onsite data sources, such as surveys

and trail user counts. Using multiple platforms and data sources helps dilute the biases in each. For now, the researchers are confident in their approach to using these data, but they suggest future research will have to adjust to a shifting social media landscape with newly emerging platforms, policies, and barriers.

“Distracted from distraction by distraction.”

—T.S. Eliot

Further Reading

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