Chapter 17: Using Social Media for Research and Monitoring the Changing Landscape of Public Land Use

Sonya Sachdeva[1]

> And the choice we face…isn't whether or not that is the [social] media environment we want to operate in. That's the media environment we've got. The question we all face now is, 'How can we make best use of this media? Even though it means changing the way we've always done it.'
>
> —Clay Shirky, TED talk

Purpose

In chapter 7 of this report, Francisco Valenzuela discussed how digital technology is changing the character of recreational experiences on public lands. Chapter 17 highlights the potential and pitfalls of using social media in research and monitoring on public lands. Recent research has revealed that social media can be a powerful tool in quantifying visitor use and utility on public lands. It can also provide managers with rich qualitative information about visitor experiences, satisfaction, and engagement that can be leveraged to achieve a more enjoyable recreation experience while creating more resilient ecosystems. In this chapter, we also highlight some challenges that the use of social media data entails, such as the need to validate models relying on "noisy" data. Managers may also need to become better versed with a wide variety of social media technology, as well as to understand how social media use varies with visitor goals and backgrounds. We end with a reflection on how this technology is transforming the management of public lands and enhancing the relationship between people and the outdoors.

Problem Statement

The rapid pace of technological innovation has affected virtually every facet of 21st-century society. The management of our public lands and shared natural resources is no exception. Although these technologies have been adopted more gradually within public lands management, it seems clear that innovations such as mobile applications on smart devices, autonomous vehicles, and social media are fundamentally affecting how we make decisions about our public lands. The latter, in particular, is most relevant to the study and practice of outdoor recreation, as social media appears to be changing human interactions as well as ways that people relate

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to and engage with the natural world (Büscher 2016). This bidirectional flow of information implies that social media can be used not only to inform management decisions but also by public land managers to inform and guide visitor behavior. Informal observations suggest that record-high rates of visitation to national parks can be attributed, in part, to the desire of visitors to post images of themselves framed by scenic vistas (Egan and Egan 2016). This has clear implications for public land managers. Although record attendance boosts revenues to some public lands, it can also create traffic congestion, ecological disturbance, and safety issues, and can otherwise overwhelm available resources and diminish visitor experiences. However, the proliferation of social media use and users on public lands can also be a valuable resource for adaptive land management, providing much-needed insight into such factors as visitor demand, characteristics, and motivations.

One of the most common ways in which social media data can be used to inform outdoor recreation policies is by measuring visitation rates and assessing overall user counts. These measures are of paramount importance to managers as they help aid decisions as to where resources should be allocated to improve visitor experiences, and where interventions are most critical to sustaining landscapes. Traditionally, user counts are collected either by installing physical counters (infrared or pressure) or by conducting visitor surveys at trailheads, both of which may entail substantial cost (Cessford and Muhar 2003, Ryus et al. 2014). Automated traffic counters must be installed correctly and be regularly maintained, and, depending on the type of counter used, may not be effective at distinguishing between type or modality of use (e.g., bicyclist versus pedestrian versus a group of pedestrians) (Lindsey et al. 2014). Manual counts may provide more precision but fewer data points without an extensive group of dedicated data collectors (Fisher et al. 2018). Other measures have been developed to address issues of the breadth of data. For instance, the Forest Service's National Visitor Use Monitoring (NVUM) program provides forestwide estimates, as well as descriptive information about what activities forest visitors are most likely to engage in, activity duration, visitor demographics, and overall satisfaction (English et al. 2002). These data, while providing an extensive snapshot of public use of the national forests, comes at the expense of specificity of information that might be useful to managers of a specific forest. For instance, which trails or campsites might entail specific management problems, or when are gridlocks more likely to occur at a specific location within a specific forest?

Social media data can operate at both national and local scales. The vast amounts of geolocated data generated by posts on Twitter, Flickr, and Instagram[2]

[2] The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

can effectively and accurately provide a broad, national-level perspective on visitor demand and estimates of overall use of public lands (Wood et al. 2013). But these data can also provide information at a more local fine-grained temporal and geographic scale. Unlike NVUM, which samples each forest within the National Forest System once in 5 years, social media data can be collected continuously over time and across the entire system concurrently (Fisher et al. 2018). Clusters of activity at particular spots can help identify trail systems, watersheds, and landscapes where management problems are currently present or can arise (Sonter et al. 2016) (fig. 17.1). In addition to providing simple use estimates, social media posts can also be used to infer descriptive information about how

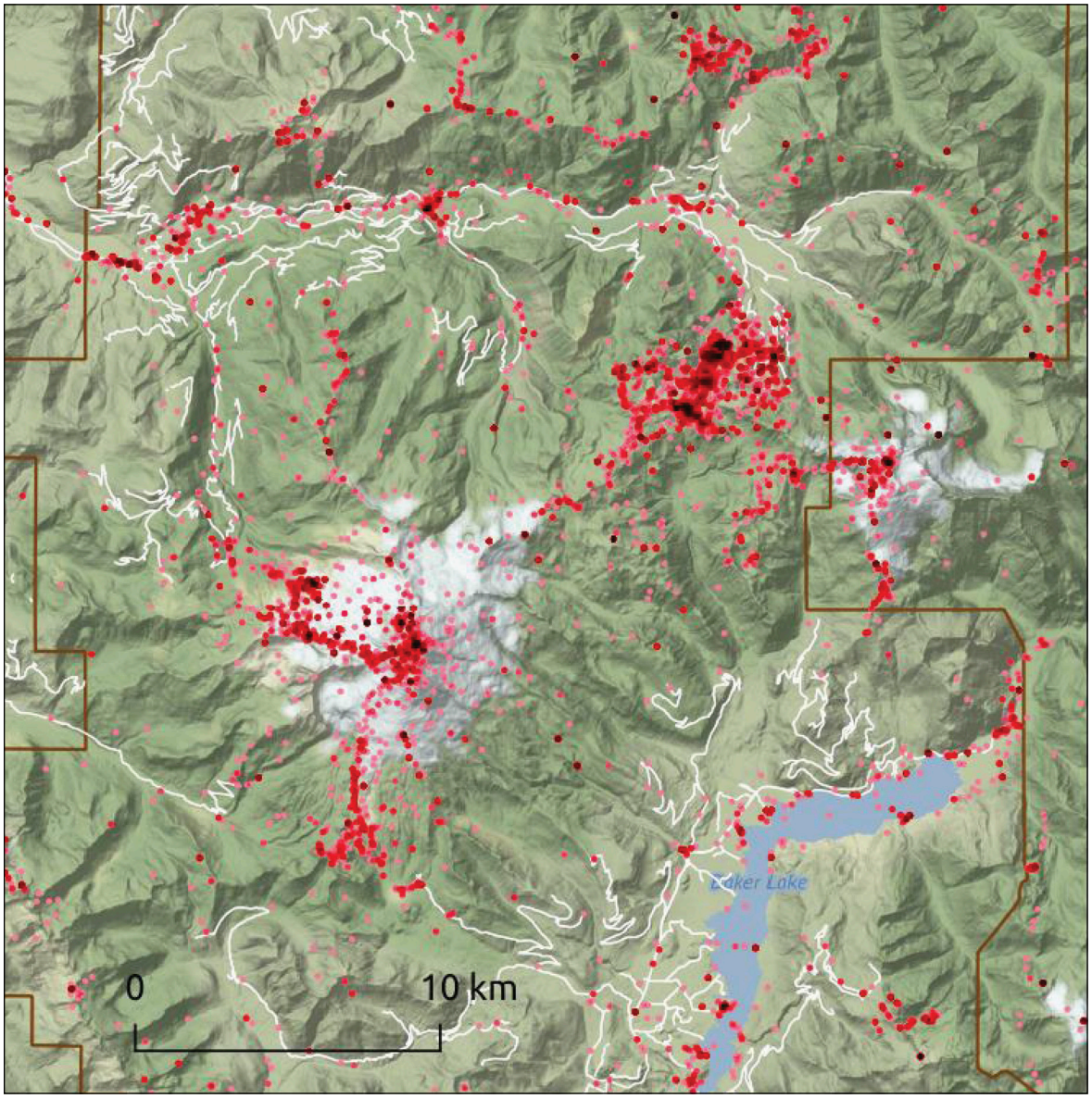

Figure 17.1—Photo postings to Flickr® of the Mount Baker area on the Mount Baker–Snoqualmie National Forest, Washington.

visitors are using the land by delving deeper into the text and images that accompany users' posts. Image classification, for example, can show whether bicycling is more popular than jogging among social media users on a particular trail, or what scenes are more likely to draw in visitors (Somasundaram et al. 2009). Semantic content analysis of the text can reveal user demographics, interests, and even the experiences that people are having and sharing at particular sites (Schertz et al. 2018).

Social media data may also be more suited than traditional counting methods to address participation and equity issues in the use of public lands. A large body of research has previously documented that racial and ethnic minorities tend to visit national parks and forests at a lower rate than other groups (Johnson 1998, Scott and Lee 2018) even as the national population has become more diverse (Colby and Ortman 2014). Social media platforms, and the social networks formed within them, may help reach visitor groups that may not be learning about public lands and outdoor recreation through other forms of media (Aydın and Arslan 2016, Flores and Kuhn 2018), as racial disparities in social media use tend to be less profound than in other forms of media (Hargittai 2007, Hargittai and Jennrich 2016, Jackson et al. 2008). Younger people are also less likely to engage in outdoor recreation overall. But, just as young people are often more comfortable with technology than their older counterparts, social media data can be helpful in facilitating communication with previously unreached or underserved visitor groups. These data can also give managers insight into which facilities and public spaces are being underutilized by younger visitors or minority groups (Hamstead et al. 2018).

Social media has the potential to be a transformative tool to measure use of public lands across a broad spectrum of visitors with different motivations and goals, as well as a means of fostering rich relationships between people and their environments.

Managers' understanding of why people visit public lands and why they engage in nature-based outdoor recreation has shifted dramatically in recent decades. As noted by McCool et al. (2020) and Blahna et al. (2020), the paradigm has shifted—from a belief that visitors come to our national parks and forests to seek solitude and a "wilderness experience" to the understanding that motivations to recreate are as diverse as our populace (Winter et al. 2004). Public land managers' communication and messaging appears not to have co-evolved with this shift in paradigm. As noted in a recent report, many of the National Park Service's external communications and publicity materials perpetuate an individualistic ideal of spending time in nature (Wells 2018). Not only is this ideal not reflective of broader public sentiment and trends, but it may also be untenable in some areas with increased rates of visitation. Social media has the potential to be a transformative tool to measure use of public lands across a broad spectrum of visitors with different motivations and goals, as well as a means of fostering rich relationships between people and their environments.

Barriers and Challenges

Before this potential can be fully realized, researchers have a responsibility to clearly outline the possible drawbacks and limitations of social media in visitor use monitoring and recognize the continuously evolving nature of how social media is being used by visitors to public lands. Anyone with even the most basic experience with social media from either a consumer or modeling standpoint can most likely attest to the noisiness of social media data (i.e., unusable or irrelevant data). Posts vary in quality of content, often needing to be extensively edited to provide usable data, and user location information is not always reliable or even available. For instance, in many remote locations, cellular signals may be weak or absent and users may not be able to post content that could be particularly helpful to outdoor recreation managers.

Furthermore, owing to increased regulatory scrutiny and (justifiably) increasing privacy concerns on the part of users, social media data of all types may become more challenging for researchers to access (Beninger et al. 2014, Boyd and Crawford 2012). In recent months, Facebook, Instagram, and Twitter have all restricted the means and quantity of data they provide—not only to private companies but also to researchers. Third-party resellers of social media data are virtually extinct, so researchers and managers who wish to use this sort of data might have to capture it through increasingly limited APIs (application programming interfaces) offered by the social media platforms themselves, or form partnerships with social media analytic companies. Although these efforts most likely will be more cost-effective than other data collection means (i.e., trail counters, field intercept surveys), depending on the approach used, access to social media data could cost several thousand dollars per request.

Thus, researchers, while building estimates of use for various trails or inferring visitor motivations to recreate outdoors, face at least two distinct conceptual barriers to overcome. First, they must be attentive to signal-to-noise ratios within social media data and be able to independently ground-truth their model estimates (Wood et al. 2013). Social media data can be plentiful but can also contain a substantial amount of spurious information. Second, researchers (and managers) should proactively address the potential ethical issues arising from using secondary data, such as those collected from private social media companies. Social media companies are increasingly restricting access to their users' data, and researchers should also ensure that user privacy is protected and that data are maintained securely (Moreno et al. 2013).

Managers, too, must view these data not as substitutes for traditional use estimation methodologies but rather as complementary tools for observing visitation in realtime, attaining descriptive information through fairly low-cost means, and

improving communication with customers and visitors. This requires an increased level of technological prowess on the part of many land managers, for whom this may be a new mode of communication, to enable them to monitor social media feeds across platforms. Note that this does not imply that managers need to be adept at programmatically collecting and analyzing social media content. Rather, it could be as basic as managers becoming more fluent in the tasks of ensuring that social media sites belonging to their organization, forest, or park provide current and up-to-date information. They may also need to adjust how they communicate necessary information; analyses of social media content have shown that the types of information people seek differ by social media platform. For instance, visitors often use Twitter and Instagram for weather and closure-related information (i.e., information that changes more rapidly), whereas they might use Facebook and Google for more stable information such as park hours (Garrison and Li 2014). Being well-versed across a diverse array of social media platforms will allow managers to more effectively communicate with visitors.

Finally, as noted above, social media data can potentially be used to bridge historical and current inequities in the use of public spaces. But it is important to be mindful that these tools are not used in a way that serves to reinforce those same disparities. Although overall social media use does not vary as a function of race, different groups may differ in how they use social media and in which media outlets they most prefer (Hargittai 2007). Outreach and community engagement are still critical, even as more communication occurs online. Bolstering these traditional outlets will also help managers better understand customers' needs and, as negative feedback arises, address those concerns more productively (Schenck 2018).

New Conceptual Directions

Insights from visitors' social media conversations can provide close to real-time management feedback.

The wide availability of social media data has led to a transformation in how social scientists think about data and, as this chapter has argued, created new opportunities for more effective land and natural resource management. Insights from visitors' social media conversations can provide close to real-time management feedback—revealing when bottlenecks are most likely to occur, where visitors feel most versus least satisfied, what provisions are lacking on certain trails, what interpretive and informational messages visitors are accessing, and, from an ecological standpoint, whether certain natural systems are more likely to be disturbed than others. Although headway has been made toward answering these questions, researchers can create models that better integrate visitor flow/use estimates with descriptive and experiential information, and also incorporate ecological and landscape characteristics (Beeco and Brown 2013). Managers have long been aware of the need for balance in manag-

ing for recreation and natural resources (Lynn and Brown 2003), and the analysis of social media may provide them with another powerful tool to do so effectively.

Recent evidence also suggests that social media use may increasingly present a safety concern on public lands. Visitors to national parks and forests may be engaging in riskier behaviors in recent years, resulting in part from their desire to create popular social media posts. Although the evidence, at this point, is primarily observational and anecdotal, land managers have seen an increase in social-media-related accidents (Bain 2018, Tory 2018). The danger is twofold: not only do social media users engage in risky behavior to create noteworthy posts, but secondary viewers of these posts may then underestimate the risk involved when they emulate these behaviors (Isaak 2016). The preponderance of information available online may also lead some novice visitors to believe that certain trails and climbing routes are more accessible and easier to navigate than they really are. These safety concerns may be successfully addressed by further research on social media trends. For instance, by measuring trends in online conversations or posted images with geotagged locations, researchers might be able to predict which sites may become visitor hotspots and consequently at increased risk for accidents. Managers can then proactively intervene in these areas to prevent visitors from engaging in risky behaviors.

Despite the Internet content that can best be described as unproductive or downright frivolous, it is difficult to deny that social media is providing many people with a new platform to engage with civic issues (Waters and Feneley 2013). Many conservation and environmental organizations already offer specialized applications that raise awareness, disseminate information, and solicit donations (Büscher 2016, Nah and Saxton 2013). Most public land management agencies also have social media accounts that they use to communicate with visitors, creating a much more interactive visitor experience (Keane 2016). However, this also presents an opportunity to transform visitors from tourists to active stewards of our public lands (Francis et al. 2017). Land managers can enlist visitors to actively seek and report sites that require cleanup (see, for example, this Forest Service story map at https://usfs.maps.arcgis.com/apps/StoryMapCrowdsource/index.html?appid=71260d441cfc4305851c739d148fc23d) and perhaps even tap into influencer networks on social media to draw visitors for that explicit purpose. These initiatives to promote ecological behaviors and awareness of social-ecological systems may become even more effective if they move beyond the typical social media sources (e.g., Facebook, Twitter, and Instagram) and take advantage of more specialized social networks. These may include Strava, a popular social network for athletes that displays running and biking routes, or the Washington Trails Association, which allows hikers to post reviews and advice about trails across the state.

Compelling Questions

As a new tool in the arsenal of natural resource managers and environmental scientists alike, the analysis of social media data allows us to pose and answer several compelling research questions:

9. Can social media provide accurate and usable estimates of visitor flow that are more fine grained and spatially explicit than traditional use estimation methodologies? Who is using social media? Who is missing from this data set? How do we integrate social media data with traditional data?
10. Can these new tools also provide rich descriptive data about visitor experience and engagement?
11. Can these estimates function at various temporal and geographic time scales?
12. Can social media data provide real-time management feedback that is actionable? For instance, can users alert managers to safety issues, points of natural disturbances, and traffic gridlock?
13. Can social media allow for a more interactive experience between managers and visitors?
14. How can these platforms be used to tailor visitor experience and address the diverse motivations underlying outdoor recreation, as well as the socioeconomic, racial, and age-based diversity of visitor groups?
15. Can social media be used to engage the public in land management issues and provide a pathway to inspire a new generation of environmental stewards?

Conclusions

As with any new tool or technological innovation, the use of social media data requires a balance. Managers and scientists can understand what type of insights these data can provide from a visitor experience and natural resource management perspective while overly relying on this data source at the expense of traditional monitoring methodologies. It seems clear, on the basis of current and ongoing research, that social media data can be effectively used to understand how many visitors are using public lands, in which ways, and to what end. As yet unknown, but remaining as a tantalizing possibility, is whether these newly emerging tools can help develop a cohort of environmentally knowledgeable and engaged visitors who recreate conscientiously and share stewardship responsibilities with public land managers.

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