

Using social media to quantify forest-based tourism in the Northern Forest

Principal Investigator: Diane Kuehn

Affiliation/Institution: SUNY ESF

Email: dmkuehn@esf.edu

Mailing address: 1 Forestry Dr., 320 Bray Hall, Syracuse, NY 13210

Co-Principal Investigator: James Gibbs

Affiliations/Institutions: SUNY ESF

Emails: jpgibbs@esf.edu

Collaborators and Affiliations: Alden Sampson and Marshall Moutenout

Upstream PBC

Completion date: August 31, 2019

Social media data can be useful for studying visitor use of parks in the Northern Forest Region, but have cost and time limitations.

Funding support for this project was provided by the Northeastern States Research Cooperative (NSRC), a partnership of Northern Forest states (New Hampshire, Vermont, Maine, and New York), in coordination with the USDA Forest Service.

<http://www.nsrcforest.org>

Project Summary

Project Goal: to use social media data to quantify forest-based tourism in the NFR.

Parks throughout the Northern Forest Region currently rely on the collection of visitor information from park admissions and visitor surveys -- techniques that can be time consuming and costly to implement. By utilizing data from images posted online through Flickr, we explore the feasibility of using social media data for the study objectives shown on the following slide.

Objectives

1. To identify the potential uses of social media data for tourism promoters and managers.
2. To evaluate the utility of automated image classification for quantifying visitor experiences.
3. To identify the hotspots of outdoor recreation use in the NFR.
4. To identify major visitor movement traces (i.e., itineraries) in the NFR.
5. To examine the seasonality and diurnality of visitor activity in the NFR.
6. To identify the forest landscape contexts and visual targets that trigger engagement by visitors.
7. To determine if the density of images posted by the public can be used to estimate visitor attendance in parks.
8. To contrast the utility of different social media platforms for the above purposes.

Background and Justification

- Forest-based recreation and tourism account for nearly 73,000 jobs in the northeastern US, contributing an estimated \$14.3 billion to the economy (NEFA, 2013).
- Tourism promotion agencies, forest managers, and academics rely on visitor use information to guide recreation and tourism planning efforts.
- Current methods of obtaining visitor information are time consuming and expensive. Can social media data be used to obtain visitor information instead?

Methods

- Needs assessment conducted by interviewing forest managers and tourism promoters in each state.
- Social media data downloaded from Flickr.
 - “Tags” (image descriptions) were generated and image density was identified using Clarifai software.
 - Tags were analyzed for:
 - Type of experience reflected in the image.
 - Consistency with actual image content.
 - Visitor itineraries identified from multiple postings by photographers.
 - Visitor density obtained from number of images posted for each park.
 - Regression analysis conducted to identify significant relationships among visitor attendance and social media data.

Results/Project outcomes

Objective 1. To identify the potential uses of social media data for tourism promoters and managers.

- 9 interviews were conducted in NY, VT, NH, & ME

Potential uses identified	Percentage of managers indicating use (n = 9)
To identify visitor hotspots	67%
To determine types of recreational activities	56%
To collect information on visitors' location of residence	56%
To estimate visitor use of forest areas	44%
To identify visitor perceptions about sites	33%

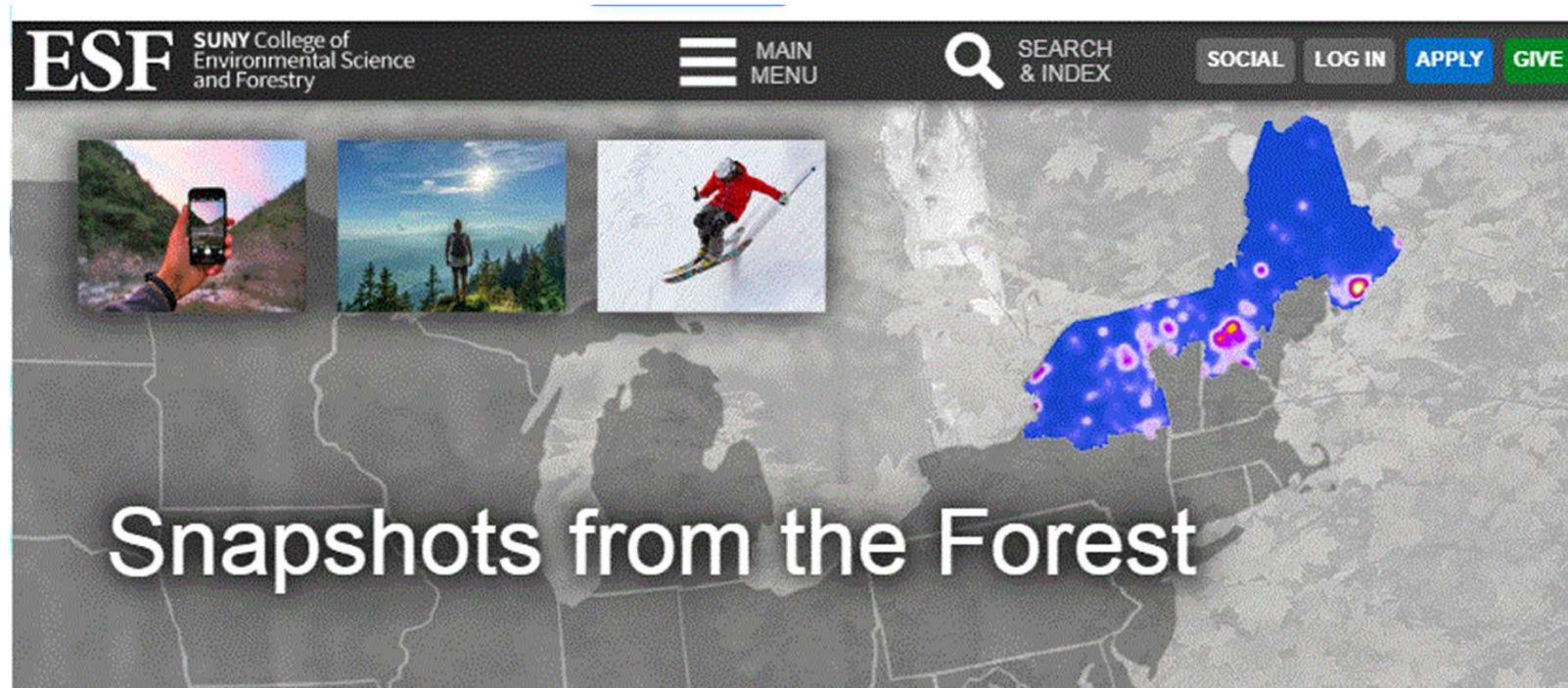
Detailed results from the interviews can be found at:

<https://www.esf.edu/socialmediastudy/documents/Summary-of-Needs-Assessment.pdf>

Results/Project outcomes

Detailed results of this study can be found on the following slides in this presentation and on the study website:

<https://www.esf.edu/socialmediastudy/>



Results/Project outcomes

Objective 2. To evaluate the utility of automated image classification for quantifying visitor experiences.

- Images taken in designated parks and forests from 2012 through 2016 were “tagged” using Clarifai software. Examples of tags are below.



GENERAL-V1.3



Results/Project outcomes

Objective 2. To evaluate the utility of automated image classification for quantifying visitor experiences.

To complete this objective, we asked two questions:

Question 1: Are the images selected using Clarifai tags related to visitor experiences in parks?

- A sample of 198 images was selected randomly from all of the images obtained using Clarifai (N = 116,360).
- Two recreation researchers viewed each image and classified them as related to recreation or not.
- 85% of the images in the sample were identified on average as related to recreation.

Results/Project outcomes

Objective 2. To evaluate the utility of automated image classification for quantifying visitor experiences.

Question 2: Do the tags provided by Clarifai accurately describe the images?

- A convenience sample of 91 students in an ESF class was used to identify if the tags accurately described the 198 images.
- According to the students, 64% of the images on average were tagged accurately by Clarifai.

Results/Project outcomes

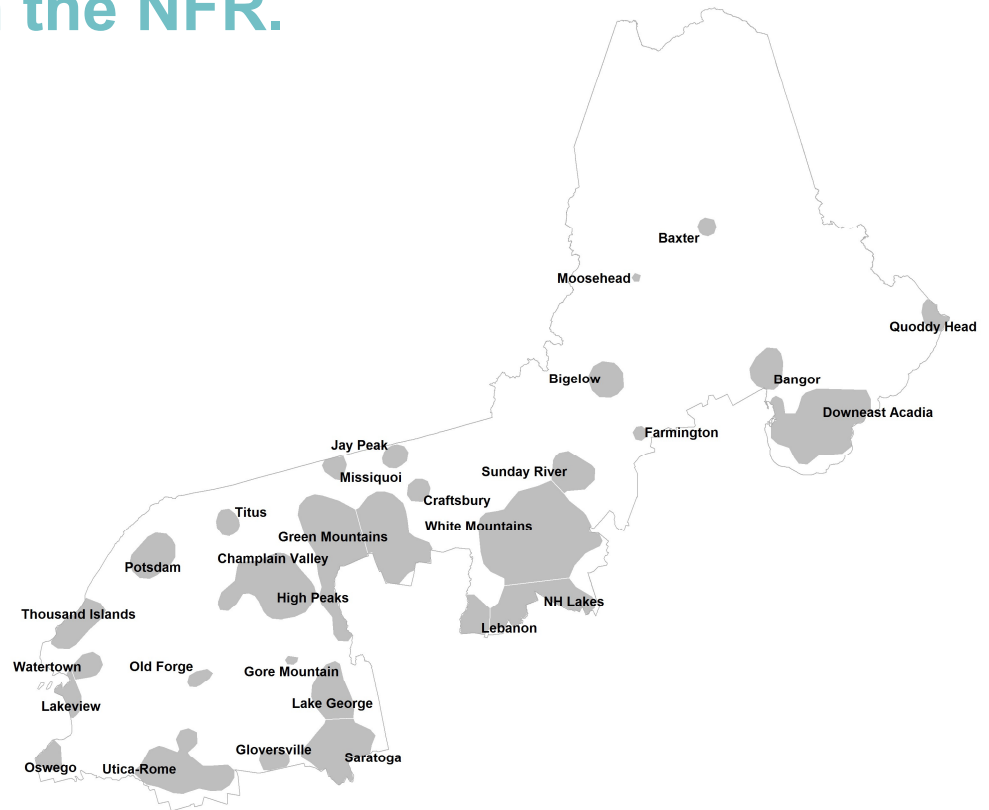
Objective 3. To identify the hotspots of outdoor recreation use in the NFR.

Visitor hotspots were identified according to the number of images found per square kilometer.

The map to the right shows the sites within the NFR having the highest density of images.

The complete set of maps can be accessed at:

https://www.esf.edu/socialmediastudy/Flickr_hotspot_mapping.html



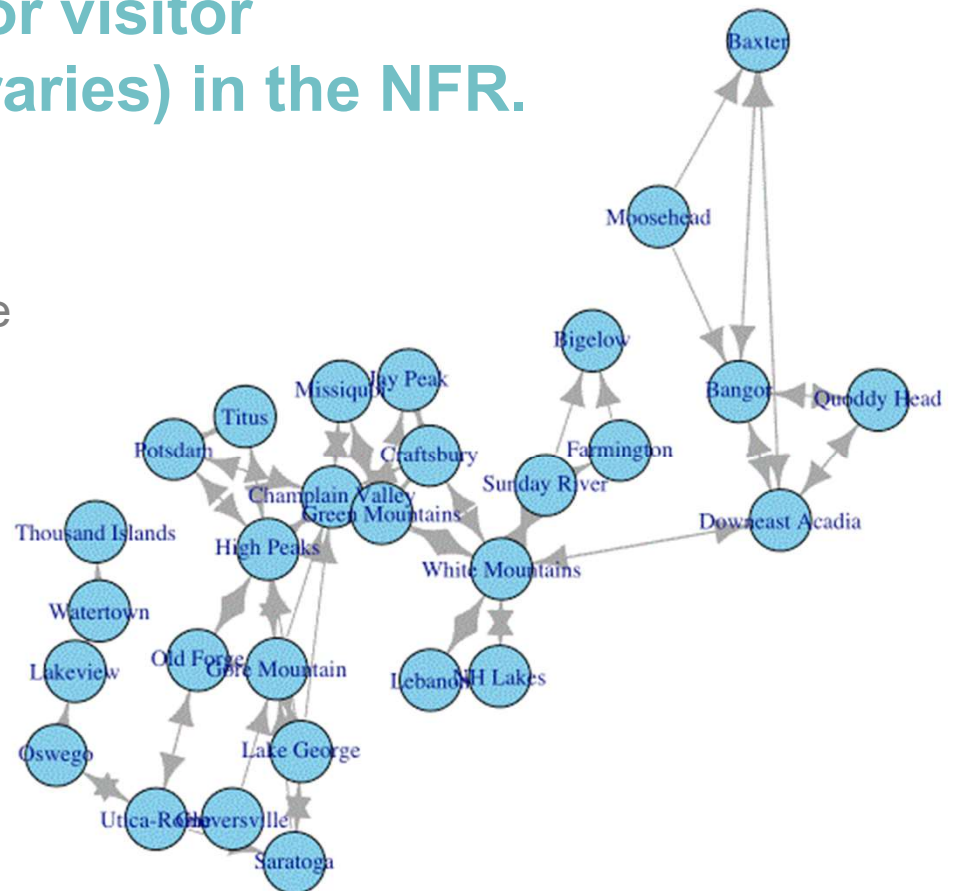
Results/Project outcomes

Objective 4. To identify major visitor movement traces (i.e., itineraries) in the NFR.

Connections between destinations in the NFR were mapped by identifying the locations of consecutive photos taken by visitors.

These “traces” indicate the patterns of movement of visitors between destinations.

“Clickable” trace maps are at: <https://www.esf.edu/socialmediastudy/trace%20diagrams/flickr.trace.network.html>



Results/Project outcomes

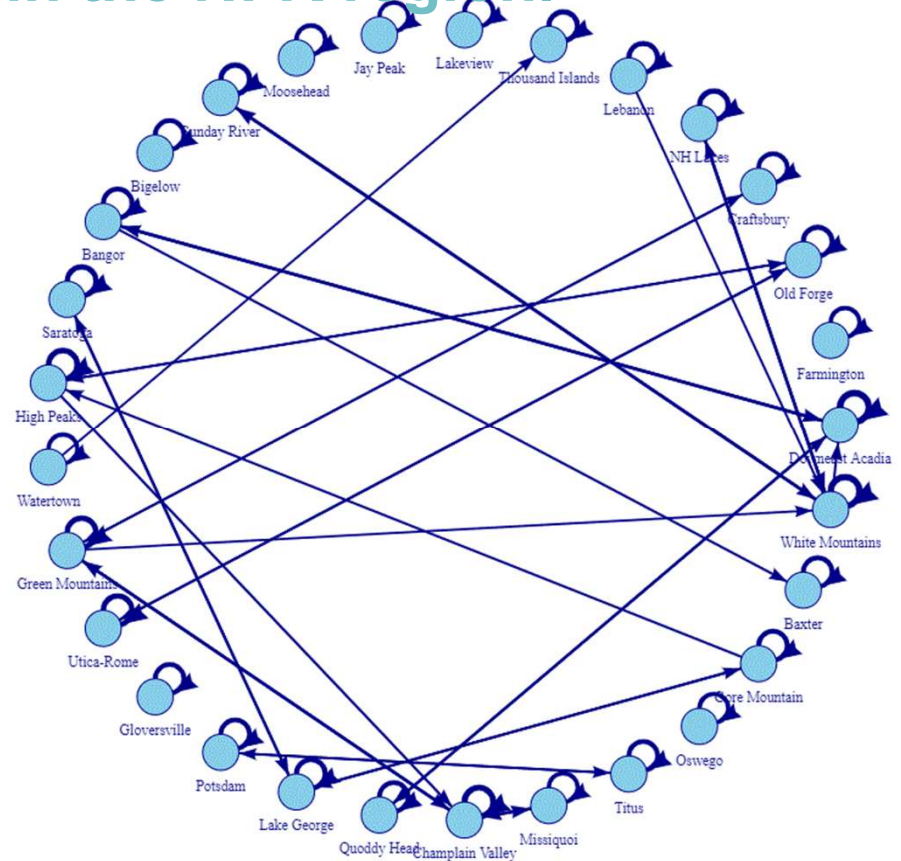
Objective 5. To examine the seasonality and dirunality of visitor activity in the NFR region.

Seasonal trace diagrams of visitor itineraries were created.

The figure to the right shows the movement of visitors between destinations during the summer.

Click on a specific destination on each diagram at:

<https://www.esf.edu/socialmedia/study/trace%20diagrams/flickr.trace.network.html>

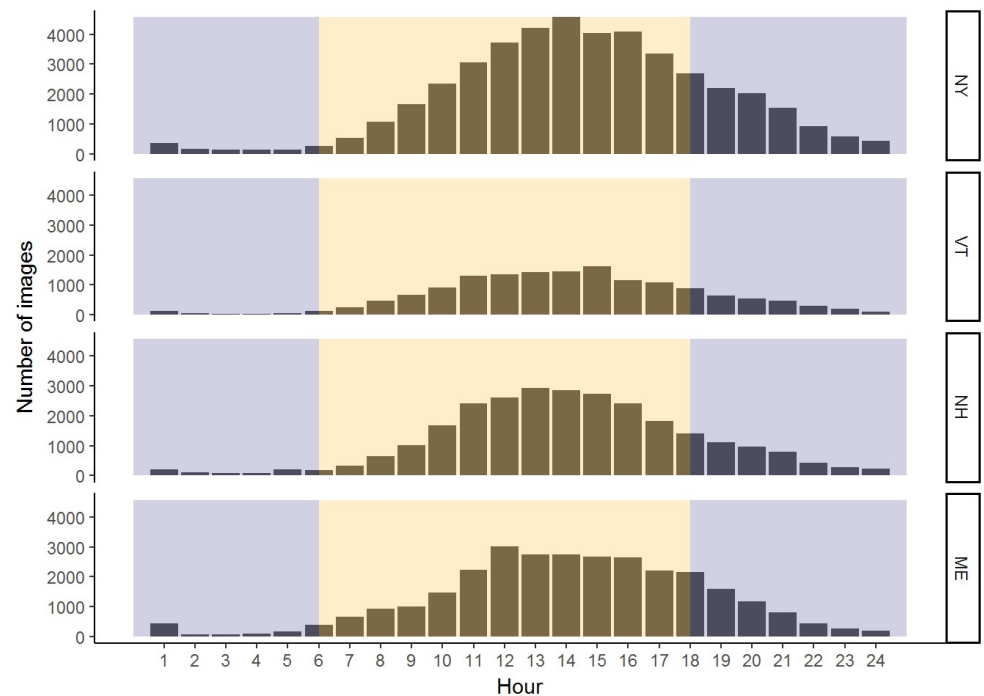


Results/Project outcomes

Objective 5. To examine the seasonality and diurnality of visitor activity in the NFR region.

Diurnality was examined by identifying from the time stamp on images when images were taken.

The graph to the right shows that most images are taken mid-day in each of the states.



Results/Project outcomes

Objective 6. To identify the forest landscape contexts and visual targets that trigger engagement by visitors.

Most of the images photographed by visitors were related to the natural and/or scenic aspects of their experiences such as trees (45% of the images had a tag related to trees), sky (40%), water (27%), and wilderness (20%).

Images were also often focused on the recreational aspects of the visitors' experiences (e.g., hiking, skiing), seasons, and wildlife observations.

Detailed results are available at:

https://www.esf.edu/socialmediastudy/Flickr_tag_mapping_website.html

Results/Project outcomes

Objective 7. To determine if the density of images posted by the public can be used to estimate visitor attendance in parks.

State Park attendance data for 2012-2016 were obtained from each state's park agency (ME, NH, VT, NY); data for Acadia National Park was obtained from the National Park Service website.

The following were identified for each state park:

- Road access vs. boat-only access
- Number of amenities (0 to 9; includes restrooms, campgrounds, trails, boat launch, nature programs, fishing, picnic areas, location on a scenic byway, historic site in park)
- Type of destination (primary, secondary, service hub)
- Park size (in square kilometers)
- Number of images posted on Flickr on each day (2012-2016)
- Number of photographers (i.e., visitors) posting images on Flickr on each day (2012-2016)

Results/Project outcomes

Objective 7. To determine if the density of images posted by the public can be used to estimate visitor attendance in parks (continued).

Regression analysis was used to identify significant relationships among park attendance data and the access, amenities, destination level, size, and social media data.

The best regression model fit was obtained for each state (except VT) when “mean images per summer day” was included in the regressions.

The detailed results of this analysis can be found at:

<https://www.esf.edu/socialmediastudy/reports.htm>

Results/Project outcomes

Objective 8. To contrast the utility of different social media platforms for these purposes.

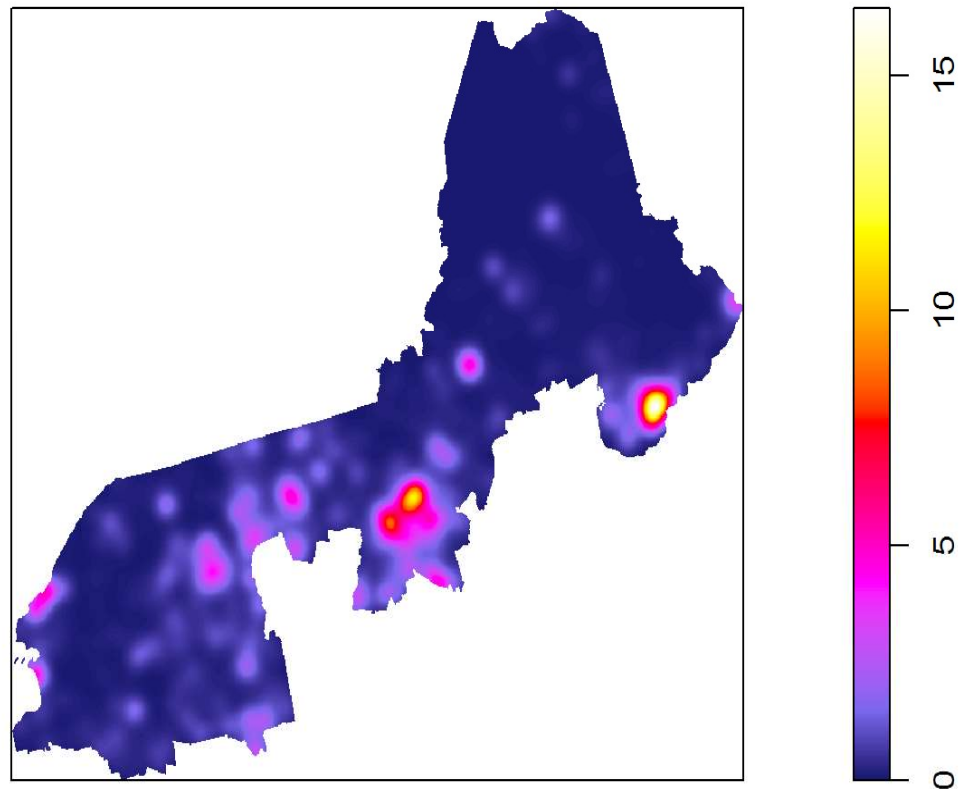
Instagram, Flickr, Facebook, and Twitter were assessed.

Due to privacy restrictions (Instagram and Facebook) and high data purchasing costs (Twitter), only Flickr was possible to use for the purposes of this study; comparisons between platforms could not be made.

Implications and applications in the Northern Forest region

- Study results indicate that social media data can be used to:
 - identify hotspots of visitor use
 - trace itineraries of visitor travel
 - better understand the perceptions of visitors toward parks and outdoor recreation experiences in general.

Rural image density



Implications and applications in the Northern Forest region

- Significant relationships were identified between social media data and park admissions data.
- However, it is likely not feasible for most park agencies to use social media data for the purpose of estimating park attendance at this time due to the extensive costs and time involved in the analysis.
- Strategies for simplifying access to and use of social media data for park management purposes are needed in the future.

Future directions

Continued research is needed to:

- Improve access to social media data for park management purposes;
- Apply this data collection protocol to other resource settings.

List of products

Project website:

- Snapshots from the Forest. (2019). SUNY ESF. Accessed online at: <https://www.esf.edu/socialmediastudy/>

Peer-reviewed journal articles:

- Kuehn, D., Gibbs, J., Goldspiel, H., Barr, B., Sampson, A., Moutenot, M., Badding, J., & Stradtman, L. (2019). **Using social media data and park characteristics to understand park visitation.** *Journal of Park and Recreation Administration*. doi: 10.18666/JPRA-2019-10035
- H. Goldspiel, J. Gibbs, D. Kuehn, B. Barr, A. Sampson, M. Moutenot, and J. Badding. (2019). **Using automated image classification of social media data to assess spatial, temporal, and thematic patterns in nature-based tourism.** *Journal of Environmental Management*. In progress.

List of products (continued)

Conference presentations:

- D. Kuehn, J. Gibbs, A. Sampson, M. Moutenot, & L. Stradtman. (2019). **Using Social Media Data to Understand Park Visitation**. Poster presentation at the National Environment and Recreation Research Symposium, April 7, 2019, Annapolis, MD.
- Badding, J., D. Kuehn, J. Gibbs, A. Sampson, and M. Moutenot. (2018). **A Needs Assessment for Using Social Media Data for Recreation Management in the Northern Forest**. Poster presentation at the National Environment and Recreation Research Symposium, April 8, 2018, Annapolis, MD.
- Kuehn, D., J. Gibbs, A. Sampson, M. Moutenot, J. Badding, & W. Burgess. (2017). **Using social media to quantify forest-based tourism in the Northern Forest**. Poster presentation at the 2017 Northeast Recreation Research Symposium, Annapolis, MD. April 2, 2017.

Acknowledgements

We wish to thank the many individuals who made this research possible:

- Harrison Goldspiel, SUNY ESF
- Brannon Barr, SUNY ESF
- Joshua Badding, SUNY ESF
- Wendy Burgess, SUNY ESF
- Lilly Stradtman, SUNY ESF
- Diana Carter, NYS Office of Parks, Recreation, and Historic Preservation
- Jessica Savage, VT Department of Forests, Parks, and Recreation
- Charlene J. Daniels, ME Bureau of Parks and Lands
- Dee Dee Hanson, NH Division of Parks and Recreation
- Paul Otteson, SUNY ESF (study website developer)

This project was supported by the Northeastern States Research Cooperative through funding made available by the USDA Forest Service. The conclusions and opinions in this paper are those of the authors and not the NSRC, the Forest Service, or the USDA.