Talking Points: Tapping the Potential for Large-Scale Resource Planning and Monitoring

Talking Points Collaborative Mapping (TPCM)
USDA Forest Service Participatory GIS Tool

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Abstract: Site-level participatory GIS data results have untapped potential for improving large-scale resource planning. Results could be more profitable if adapted for two additional purposes: A frame of reference for interpreting and comparing the results of a single site with other sites as well as a comprehensive database of comments across all sites for large-scale monitoring. We introduce a proposed framework for Talking Points Collaborative Mapping capable of addressing these uses.

Web-based “crowdsourcing” applications are a welcomed addition to enhanced public participation in land and resource planning among federal, state, and local governments and nongovernmental organizations. Such applications have been most typically used during early stages of planning proposed actions and provide new and additional opportunities to hear the public’s voice. More recently, crowdsourcing applications are being employed in the service of “citizen science,” or engaging the public to help provide needed baseline information, monitoring and unstructured feedback. However, most of the applications appear to be geared to providing a proverbial “snapshot in time” of information and/or opinion.

In this presentation we briefly explore the untapped potential for a specific crowdsourcing application used by the US Forest Service—Talking Points Collaborative Mapping (TPCM)—for large-scale resource planning and monitoring. In addition, we briefly explore a basic framework for systematically extracting and compiling information from individual site applications of TPCM in the creation of a large-scale tool for planning and periodic monitoring of public participation and content across for the National Forest System.

Talking Points Collaborative Mapping Tool

In response to the 2009 Open Government Initiative, 2012 FS Planning Rule directives, 2016-20 FS Strategic Plan, and evolving social media opportunities, the Forest Service employs the Talking Points Collaborative Mapping (TPCM) to bring a new dimension to its public participation toolkit.

TPCM’s origins as a dedicated Forest Service crowdsourcing web application began with the cooperation of the US Geological Survey in 2010 and was used in a range of more than 80 separate planning applications including national forest plan revisions, project implementation, and special designations planning, among other uses. In 2016 the Forest Service began to work with Esri on a second-generation of TPCM utilizing Esri modular Crowdsource Reporter/Manager applications. Both versions of TPCM collect spatially linked public comments, photographs, and other information and store them in exportable databases.
Newly configured and now part of Esri’s ArcGIS Online (AGOL) platform, TPCM is an internet-based, dynamic mapping, public commenting site that is accessible on all personal computers, including mobile devices. It remains an easy-to-use, highly configurable, web-based public participatory GIS tool and now is compatible with Story Maps and other ArcGIS online products.

TPCM provides unique spatial and learning capabilities for receiving, analyzing, reporting and integrating public comments and photos. It meets the public commenting needs in support of Forest Planning, Wilderness, NEPA, Developed Recreation and much more. To date, multiple National Forests in every region have created over 80 projects to meet their public commenting needs, with more in the planning stages as we now move forward with the new TPCM-Esri application.

A partial list of TPCM features include:

- *Explicit spatial and time-stamped referencing of unlimited public comments, especially with regard to other available national forest data layers as points, lines or polygons. Zoom and pan capabilities.*
- *True collaborative capabilities allowing public commenters to communicate with each other as well as with Forest Service staff in “real time” discussion as opposed to collection (with contact information optional and confidential).*
- *Automatic documentation and display of comments and spatial locations.*
- *Easy integration of photos, documents and links to other documents.*
- *Ability to export data & GIS in multiple formats*
- *Potential for forest & NFS-wide comparisons of public comment themes and trends.*
- *New configuration compatible with standard GIS, online or mobile devices.*

The latest version of TPCM can collect more than 25 fields of information including respondent comments, Forest Service content analysis categorizations, and data on usage characteristics—however, some of that total is provided at the option of the respondent, especially protected private information.

TPCM results are similar to traditional public “scoping” comments as referenced in the 1970 National Environmental Policy Act (NEPA). The Forest Service is able to use this information to better understand what issues matter to the public and where in the national forest those comments are linked to. However, to date the Forest Service has not developed a companion analytic system that would facilitate a true means of compiling, comparing, and monitoring public issues across both time and space.

**Why TPCM’s General Function is Important**

TPCM is important because it fills a need that is more or less specific to the Forest Service. Here’s why:

1. The FS has long been involved in seeking public participation in National Forest planning, most formally as directed through the 1970 NEPA process of “scoping” and 1976 NFMA:
“For an environmental impact statement, bureaus must use scoping to engage State, local and tribal governments and the public in the early identification of concerns, potential impacts, relevant effects of past actions and possible alternative actions. Scoping is an opportunity to introduce and explain the interdisciplinary approach and solicit information as to additional disciplines that should be included. Scoping also provides an opportunity to bring agencies and applicants together to lay the groundwork for setting time limits, expediting reviews where possible, integrating other environmental reviews, and identifying any major obstacles that could delay the process.” 43 CFR 46.235 

NEPA Scoping Process

But, scoping as traditionally practiced, that is, as written comments, has its limits. For example, they usually are not spatially defined outside of common official or unofficial names—rather they refer to a general area which may or may not be adequate. Comments are typically sent in independently and not made available until after the scoping period has ended, meaning that no “collaborative learning” or sharing of information is taking place. That is, the input of others has no opportunity to inform others. Also, comments are rarely linked to ongoing temporal events.

This certainly reduces the amount of real-time analyses of many public participation comments and ability of the forest to evaluate or monitor and adaptively manage its public participation plan.

2. As a result, 36 CFR 219.4, Requirements for public participation, in the 2012 Planning Rule, encourages new approaches to public participation:

“When developing opportunities for public participation, the responsible official shall take into account the discrete and diverse roles, jurisdictions, responsibilities, and skills of interested and affected parties; the accessibility of the process, opportunities, and information; and the cost, time, and available staffing. The responsible official should be proactive and use contemporary tools, such as the internet, to engage the public, and should share information in an open way with interested parties.”

3. Another relevant section of the Rule, 36 CFR 219.3, Role of science in planning, requires the use of best science in national forest plan revisions, and that this applies to monitoring:

“The responsible official shall use the best available scientific information to information the planning process required by this subpart.”

4. Current commercially available dedicated crowd-sourcing software is not necessarily optimized for use by the Forest Service or other federal agencies. Majority of available commercial crowd-sourcing products are not built for federal land managers—and more for local government and NGO uses. Various issues include use of survey capacity, lack of protection of sensitive information, poor ADA Section 508 compliant, lack of full range of necessary manager options, etc.

5. TPCM has gone through two iterations (originally in partnership with the USGS and now Esri) to address these issues as best it can. It has been specifically designed to meet the needs of the FS and
therefore does not need to sacrifice capabilities essential to our agency directives for public participa-
tion in all 3 phases of planning and associated project work not found in other commercial products
built without cooperation of the Forest Service.

Crowdsourcing Commenting versus Monitoring

We’ve noted that as a crowdsourcing tool TPCM is useful in all stages of planning but in this presenta-
tion we focus on its potential for role in “large-scale monitoring.” By large-scale monitoring we are refer-
ing to its use in collating individual site applications over different geographies and years to provide the
following functions:

- Provide a frame of reference for succeeding individual national forests by allowing them to com-
pare their results to all other sites in order to identify unique patterns of use or possible errors
in the implementation of the application.
- Identify and track regional differences in public issues.
- Identify and track trends in public issues over time.

Before we move on to discussing TPCM’s potential for large-scale monitoring let’s first describe several
general scenarios of how crowdsourcing can be implemented and the effect on the usefulness of the in-
formation collected.

We generally think of crowd sourcing investigations as the public commenting on current events or ac-
tions, existing conditions, and opinions to public officials and others in the general public—or, in other
words, on things that have immediately and readily noticeable changes in progress. Such observations
tend to be isolated in time and place, that is, the here and now.

![Figure 1 - One time, simultaneous and independent information collection and analysis.](image)

For example, in figure 1 above, three national forests, “A”, “B” and “C”, located across the American
Southwest might simultaneously but independently host a crowdsourcing application in year x only in
order to learn about public issues and/or desired conditions for each forest. Typically, the comments of
each of the three forests are considered separately in terms of respondent characteristics, participation, issues and implications. They may not be.

Analysis of the comment information is rather simple and descriptive in nature. There is little if any monitoring value in this situation and consequently no “big data” processes are implemented.

A slightly more robust crowdsourcing investigation might be to conduct several or many crowdsourcing applications in the three separate forests “A”, “B”, and “C” simultaneously in year x only—but to also attempt to compile the results into a single, larger dataset (Figure 2 below).

![Figure 2 - One time, simultaneous and coordinated information collection and analysis.](image)

Opportunities to cross reference and compare forest results become an added opportunity. Nevertheless, while more organized in became a little more organized in application and analysis, traditional concepts of monitoring are not necessarily occurring. As described in 36 CFR 219.19, “monitoring” is “the systematic process of collecting information to evaluate effects of actions or changes in conditions or relationships.”

Under this scenario analysis gets a little more complicated and opportunities extend to analysis of variance and correlations among national forest populations and results.
Figure 3 - Repeated, isolated information collection.

Figure 3 above illustrates another more robust crowdsource application where a single national forest repeatedly applies the same process over time but does not compare those results to other national forests. This permits better trend analysis, at least for a single national forest. The previous 36 CFR 219.19 citation also applies to this situation. Analysis in the above scenario promotes trend analysis to better detect degrees of change over time.

Finally, Figure 4 below depicts a scenario where multiple national forests pool their information over time, permitting all the benefits of the previous scenarios, as well as much extended opportunities for analysis. This figure also generally represents the scenario assumption underlying the discussion of TPCM’s potential for large-scale monitoring.

Figure 4 - Repeated, simultaneous and coordinated information collection and analysis.
Why TPCM’S Monitoring Capabilities are Important

As we’ve said, in addition to its role in facilitating dialogues, it is important to also consider TPCM’s capabilities with regard to monitoring at both the (1) national forest and the (2) National Forest System levels:

- First, let’s note a few things about the state of adaptive management monitoring of social and cultural environments as they are affected by national forests. More rigorous study of social and cultural influences on public land management is hampered in several vital aspects:
  - Lack of consistent, available and relevant “secondary” SCE secondary data for analyses and modeling.
  - Lack of ability to collect consistent, reliable and relevant “primary” SCE data for analyses and modeling (largely a result of Paperwork Reduction Act)

Not surprisingly, lack of reliable predictive models for public land management (analogous to economic input/output models).

FS and other agencies have only recently begun to enter into spatial linkage of scoping comments and ability to (1) let public engage each other as well as (2) provide real time feedback.

Assuming that we have said enough about the value of collecting spatially linked comments, some of which are informed by dialogue and access to information available through TPCM—as well as the information we’d really like—let’s focus first on what TPCM can do in terms of expanded value to individual forests:

- For individual forest, deriving feedback from the public on various issues allows planners to understand the concerns and suggestions first-hand.
- Because of the spatial referencing of each comment, comments can quickly be associated with locations on a map.
- Word Sentiment by location can quickly give planners an idea of how the public feels about these geographic areas.
- These comments can be part of the public record and referenced as part of the justifications for decisions that have been made.

As we move forward with more automated business intelligence and content analysis, using algorithms provided by experts in social science, economics, and other areas, quick scenarios could be derived, that can provide planners with the tools they need to help with make important land-use decision.
**Basic TPCM Statistics**

The majority of the basic statistics cited below will benefit each forest directly in monitoring the progress of the project use as well as summarizing knowledge of participants and participation. That is, they tell the picture about local participation and issues. Results would most likely be of interest to the ROs and NFs.

When the results of each individual forests are combined within a “big data” set then they can begin to tell a story about public participation and issues across the NFS in general, and whether there are observable trends geographically and/or temporally. Also, it would be a good indicator and/or record of the attempts and success the agency has in reaching out to the public, and in turn the public’s response to that effort. Results would most likely be of interest to the WO.

1. **Participation Rates** (For individual forest projects and grand means for all forest projects)

   These metrics can provide *frames of reference* for individual forests to help judge the participation in their own uses. They may signal problems in the set-up of TPCM or unusual participation characteristics—both worth watching and addressing as appropriate.

   i) Standard “self-contained” use metrics (sortable by category, issues or key words) would include:

   - Number of total comments and distribution over project time.
   - Number of total replies to comments and distribution over project time.
   - Mean number of comments per day for project time.
   - Mean number of replies per day for project time.
   - Mean number of replies to comments.
   - Ratio of total comments to total replies to comments and distribution over project time.
   - Proportion of repeat commenters and distribution over project time.
   - Proportion of repeat repliers and distribution over project time.
   - Ratio of repeat commenters to repeat repliers and distribution over project time.
   - Residence of commenters and distribution over project time.
   - Residence of replies to comments and distribution over project time.

   ii) Demographic related use metrics would include:

   - Population and key demographics (e.g. age, race, income, education, employment, length of residence) of project influence area.
   - Participation rate of assumed population base for comments.
   - Participation rate of assumed population base for replies.
2. **Identification** (For individual forest projects and means for all forest projects)

These metrics (also sortable by category, or issues or key words) can provide information on the assumed level of interest on the part of participants in as far as they are willing to provide identity and contact information—prerequisites for NEPA standing as well as to place on simple mailing lists for information.

- Number of comments providing identification information *and distribution over project time*.
- Number of replies providing identification information *and distribution over project time*.
- Proportion of total comments to total replies to comments providing identification *and distribution over project time*.

3. **Key Issues** (For individual forest projects and means for all forest projects)

These metrics can provide information on the assumed relative importance of different project issues as far as they may be identified with key words or free user-specified text string searches.

i) Standard “self-contained” use metrics (sortable by category, or issues or key words) would include:

- Proportion of comments using key words or issues *and distribution over project time*.
- Proportion of replies using key words or issues *and distribution over project time*.
- Proportion of comments using key words or issues supplying identification *and distribution over project time*.
- Proportion of replies using key words or issues supplying identification *and distribution over project time*.
- Cross-tabulation of key words or issues used in comments and replies *and distribution over project time*.

ii) Demographic related use metrics would include:

- Cross-tabulation of key words or issues with population and key demographics (e.g. age, race, income, education, employment, length of residence) of project influence area.
4. **Attachments** *(For individual forest projects and means for all forest projects)*

These metrics (also sortable by category, or key words or issues) can provide information on the assumed level of interest on the part of participants in as far as they are willing to provide identity and contact information—prerequisites for NEPA standing as well as to place on simple mailing lists for information.

- Proportion of comments providing photographs or URLs and distribution over project time.
- Proportion of replies providing photographs or URLs and distribution over project time.
- Proportion of total comments to total replies to comments providing photographs or URLs and distribution over project time.
- Cross-tabulation of comments providing photographs or URLs and key words or issues and distribution over project time.
- Cross-tabulation of replies providing photographs or URLs and key words or issues and distribution over project time.

5. **Forest Service Handbook (FSH) 1909 Reference and Other Classifications** *(For individual forest projects and means for all forest projects)*

Not only is it possible to provide analysis of the direct comments of replies but also to allow project managers to assign additional useful classifications to the comments and replies. Public respondents can voluntarily choose to assign descriptive classification “categories” to their comments. Project managers can subsequently assign further descriptive classification sub-categories, applicable sections of FSH 1909, inventory activity, and program content.

These metrics (also sortable by category, or key words or issues) can provide useful information on how the forest can sort the comments in connection with one or more of 15 section of FSH 1909 components.

- Proportion of comments associated with FSH section and distribution over project time.
- Proportion of replies associated with FSH section and distribution over project time.
- Proportion of comments associated with FSH section and distribution over project time.
- Proportion of replies associated with plan component and distribution over project time.
- Cross-tabulation of key words or issues used in comments and FSH section and distribution over project time.
- Cross-tabulation of key words or issues used in replies and FSH section and distribution over project time.
Collected Data

With the data we have already collected from our USGS version of TPCM, we’ve below are a few examples and scenarios of how the data might be used. We are still exploring these questions and realize there is much more potential as we move forward. Before we get into the statistics derived from our multiple projects, let’s look a few visual representations of comment made across the National Forest Service. Of course, as we move ahead, we hope to derive much more spatial statistics as well. Below you is a quick representations of comments left by the public on multiple efforts throughout our National Forest System.

The illustration below reveals a heat map based upon the spatial point density of comments received. Without knowing what the issue(s) of topic are, it is quick to notice where the areas of most concern might be.
Below is a representation of the type of comments left during the Flathead National Forest public commenting effort:

Figure 6 - Flathead National Forest heat map based on point density of comments.

Figure 7 - Type of comments left during the Flathead NF effort.
TPCM responses are being compiled on an ongoing basis in order to develop an ever-expanding database from which we intend to learn and share information regarding (1) the messages the public is giving us, (2) if and how those messages vary by topic most often used for comments regarding travel management, (3) their value as a frame of reference for other subsequent users, and (4) how well the TPCM tool is performing as a communication. Database information will contain fields directly collected by the applications, as well as derived fields contributed by analysts for additional insight through statistical analysis. Database information will be accessible to all levels for administrative and research purposes. The graph below quickly illustrates the variability of data received and how it might be analyzed.

Being able to query individual comments, in even a very low-level content analysis, is useful in confirming or refuting commonly accepted assumptions. A question one could ask is how can we take advantage of the power of relational databases to add increased comprehension of respondent comments? Using the same data as the example above, we can see from the graphic below where the user is able to query all comments to find those that match only specific content search strings through mostly simple and automated procedures.
Data from several Forest Service public commenting efforts looks at how the importance of Contact and Commenting data. This information is helpful in being able to establish communication links with public. Also, for standing in NEPA appeals. For example, what accounts for the differences in (1) whether a National Forest is a repeat TPCM user and (2) why one Forest gets hundreds of responses while others get few? Is it a result of user engagement in the process or respondent engagement in the process? TPCM has most often been used for comments regarding travel management, wilderness suitability, and general planning comments. The number of comments ranges greatly from 2 to 912 responses, with the latter two topics showing the greatest number of responses. However, could this be due to phrasing or other artifacts of the NF TPCM preparation or articulation of desired?

Figure 9 – In this example, author queries all comments to find those that match only specific content search strings.

Figure 10 - Response rate based on the Topic of the Public Commenting Effort.
What does this information tell us about the people responding? For example, in the following figures below showing response rate patterns over time by three different National Forest public commenting efforts for Wilderness. It would be interesting to see if other topics vary as much.

![Figure 11 - Response rate patterns over time for the Flathead, Nantahala & Pisgah, and Ashley NFs](image)

Some other examples of contact and commenting information, such as the amounts of feedback measures, e.g., length of comment in number of characters, or use of geometries in association with comments—ask the question, are they somehow correlated with either or both (1) interest in the topic or (2) need for specifics?

Illustrated by the images below, though entirely consistent, it appears that recreation comments are the more lengthy comments and use geometries more frequently than those for other comments. Looking at the figure below, it seems Restoration comments are most lengthy yet also least likely to use geometries. Why is this? Does it represent a fundamentally different way of discussing the two? Why do wild and scenic rivers appear to show markedly less length and geometries than the other preservation oriented land use of wilderness? Are there any other implications to these results? Perhaps through either or both (1) additional statistical analysis or (2) reviewing the results with the NF staff.
For all topics and NFs: What topics elicit the most and least verbose feedback? Because restoration is more a concept, is that reason commenters are not leaving long comments? Are roles and contributions for “a-spatial” concepts or policies than directly tied to particular areas?

Figure 13 - Because restoration is more a concept, is that reason commenters are not leaving long comments?
Another question we could ask is do different topics of TPCM Public Commenting efforts show different behavior by the public? From the image below, we can certainly hypothesize that respondents in TPCM uses regarding both generic planning and for wilderness show a markedly different willingness (3x that of other topics) to attach contact information to their comments. Why is this? Is it because respondents for these topics are more likely to be thinking about the need to establish standing when dealing with these topics, and that requires providing contact information? Why do recreation respondents appear less willing when recreation has consistently been a high participation topic? Are there any other implications to these results? Perhaps through either or both (1) additional statistical analysis or (2) reviewing the results with the NF staff.

![Figure 14 – Do Different Topics of the TPCM Application show different behavior by the Public?](image)

Offering social media capabilities, the Talking Points application also allows commenters to reply (anonymously) to other’s comments. The graph below looks at the collective National Forest Public Commenting Effort Topic and number of comments received in relation to the replies given by other members of the public. Are top topic groups more into “engagement” over issues? (Of course we don’t yet know whether replies are affirming or disputing original comment.)
Another subject we could look at and theorize about is whether the topic for which the National Forest public commenting effort elicits an “emotionally involved” in response? The graph below asks us to consider the question why does a certain topic have more comments containing the word “I” than other topics?

Based on the illustration below, a question we might ask is, for all topics and NFs: Are the top topic groups more interested in establishing standing for NEPA (National Environmental Policy Act) efforts?
Figure 17 - Might the data show that the Top Topics are related to NEPA efforts?

As stated above, being able to query individual comments, in even a very low-level content analysis, is useful in confirming or refuting commonly accepted assumptions. How can we take advantage of the power of relational databases to add increased comprehension of respondent comments? TPCM should be able to perform low-level content analysis for comments as well as to examine individual comments for patterns based upon their text. TPCM data analysis could allow for any combination of National Forests Efforts, and search strings and to seek out different ways data can be analyzed, as illustrated below.
The above illustrations show but a handful of examples of the rich information that can be derived from National Forest Service public commenting data.

The Road Ahead

As we move forward, we look forward to a multitude of tools and methodologies that will be available to National Forest System planners and decision-makers. We will easily be able including the public in important land management planning, whether through public meetings, mail in responses, emails, and now the ability to use computers and mobile devices with Talking Points Collaborative Mapping application. While we continue to collect public commenting data from numerous projects, forests, regions nationwide, there is much potential for exhaustive and automated analyses. We can us latest business intelligence, analytics, and spatial analysis tools available today while provide the Forest Service and the general public tools they need to make informed decisions.

We believe the future of Talking Points Collaborative Mapping (TPCM) will rely on synergistic relationships between all the branches and program areas within the Forest Service, including a strong working partnership with Esri. Each program will cooperatively work together to provide valuable input, application, and participate in collecting, and analyzing their unique areas of expertise. The continued TPCM effort, which goes beyond an online mapping, public commenting venue, can also include automated data collection and management, business intelligence, analysis and reporting. It can be a model for cohesive collaboration between the multiple program areas in the Forest Service. With Esri as a strong partner as well, we believe we can accomplish our goals more time efficiently and cost effectively.
Data collected with TPCM can become part of a larger data set which would include other data derived via crowdsourcing and citizen science applications. It could be integrated further with other data sets for analysis and reporting, such as data derived from the National Visitor Use Monitoring (NVUM) Program, the Rec Fee Program, EMC’s NEPA Comment Analysis and Response Application Comment Analysis and Response Application (CARA), many more. This could be all be done in Forest Service’s Enterprise Data Warehouse (EDW) using Extract, Transform, Load (ETL) applications. In the EDW, online Dashboard tools can be housed that leadership and invested personnel can easily access for a variety of information and reports. This could include an interactive map tool whereby one could select an area, region, or forest, and automatically pull reports, analysis and related data.

In this new digital era, automated data collection and storage is the norm. Working with Esri to achieve this goal, the Forest Service will have less need to depend so heavily on National Data Requests, which have relied on manual efforts from staff to gather data from multiple sources, and often require considerable time and personnel resources, and often remain incomplete. We look forward to working with Esri to help us employ state-of-the-art tools to provide automated data collection, analysis and reporting, not only to satisfy forest-level projects, but collectively as well for Regional and National Forest Service analysis and reporting needs.