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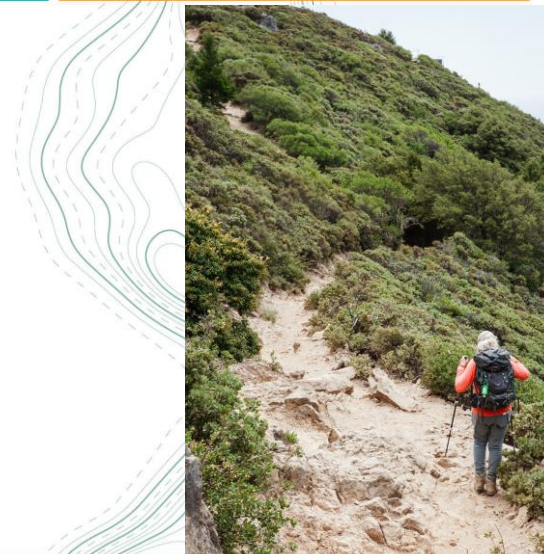


Visitor Use Management Protocol

Social Trail Monitoring

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Overview

This protocol is used for monitoring ***social trails***¹ (also called “user trails”). Most social trails are non-system, informal, trails created by trampling that were not installed and/or are not maintained by managers. Social trails are inclusive of all types of user trails, from short segments between campsites to longer cross-country routes. Monitoring social trails can be useful to park managers for various reasons. For immediate management decisions, an inventory can provide a comprehensive picture of where resource issues may exist. This can be useful for project planning and to support decisions about appropriate management actions related to resource protection. Monitoring is also useful for long-term management, to indicate how conditions are improving or degrading over time.

This protocol is adapted from D'Antonio, A. & Hall, T. (2016). *US Forest Service Minimum Protocol for Social Trail Monitoring in Wilderness*. Corvallis, OR: Oregon State University.

Considerations

- ***Determine the Monitoring Area:*** Before field data collection, park staff should review maps and local knowledge of attraction sites to identify locations where most social trails are expected to occur. It is also helpful to review what data have been collected in the past related to social trails, current system-trail inventories, and campsite assessments (if relevant). These data can help identify which areas should be searched for social trails. Carefully document any decisions about areas that will not be monitored. For instance, you might decide not to monitor areas in steep, inaccessible terrain where you know use is low, or you may intentionally exclude abandoned system trails that are still evident in the landscape but no longer in use.
- ***Create a Trail Naming Convention:*** If you are using a recreation-grade GPS and recording social trail attributes on paper (see next section about choosing appropriate technology), choosing a clear and meaningful naming convention will be critical for ensuring consistency across different personnel and matching characteristics to the

¹ Terms in bold italicized text are included in the Glossary

spatial data. This should be clearly documented before fieldwork begins. Do not use spaces in your naming if possible.

- **Choose Appropriate Technology for Monitoring:** All technological options should be considered and weighed. Some things to consider are the following:
 - Technology type available
 - The number of people who will be collecting data at one time (which affects the number of devices needed)
 - Skills of individuals collecting data
 - Battery life needed during data collection

This protocol can be implemented using various types and levels of technology, but some form of GPS device is required to map social trails (Table 1). There are two key components to the protocol:

- First, the geographic length of each social trail and the location of each **social trail spur** must be recorded.
- Second, selected characteristics about the level of impact of the social trail (width, **condition class**, and presence of human waste) must also be documented and associated with the geospatial data on the extent of the trail for later analysis.
 - An optional, third component is identifying the primary use for the social trail. If the primary use of the social trail can be confidently identified (e.g., climbing access, viewpoint, etc.) this activity can and should be documented. If the primary use cannot be identified, the social trail can be labeled as “general visitor use” and other information can be entered in the comments sections during data collection to provide context for the social trail.
 - Specific park units may opt to collect additional characteristics. Those listed in this protocol are the minimum characteristics typically collected when monitoring social trails.

GPS-based devices make mapping the extent of social trails very quick and easy. Lower cost and less accurate recreation-grade GPS units, like handheld Garmin units or similar devices, can be used to map the length and location of the social trails and the location of social trail spurs, but information on trail impact characteristics will need to be recorded on a separate, paper data sheet and entered manually into a spreadsheet. The GPS data from recreational, handheld units will have to be later cross-referenced with the data on trail impact characteristics for analysis and reporting.

Mapping-grade GPS units - like those made by Trimble, Juniper Systems, or similar companies - are more accurate in their mapping capabilities but also more expensive and slightly harder to learn to use. The benefit of many mapping-grade GPS units is that they often contain applications that allow for data collection of trail characteristics within the program. Therefore, the characteristics data are automatically linked to the spatial data (location and length) of the social trail. This makes post-processing of the data much easier and does not require any data entry after field protocols are completed.

Finally, smartphone and tablet applications, such as Field Maps by ESRI, can be an alternative to stand-alone GPS units. Smartphones and tablets have built-in GPS capabilities, and mapping apps provide the same ability to enter characteristics data that are automatically attached to the spatial data of the social trails. The GPS units in smartphones and tablets are less accurate than mapping-grade GPS units but are generally easier to use and less expensive. These devices can also be paired with external antennas, which increases spatial accuracy; in ideal conditions, a smartphone or tablet paired with an external antenna can map to sub-meter accuracy.

Table 1. Options for collecting data on social trails.

	Trail length	Condition data	Linking data	Examples
Recreation-grade GPS	GPS unit	Paper/tablet	Manual entry of condition data and linking to trails in GIS	Garmin handheld unit + paper
Mapping-grade GPS*	GPS unit	Data logger	Automatically linked	Trimble GeoXT
Smartphone or Tablet and App*^	Internal GPS	Data logger	Automatically linked	FieldMaps by ESRI

*A pre-written and set-up data dictionary of the characteristics (i.e., condition class, presence of human waste) will need to be created for use with this technological option.

Protocol

Before Heading into the Field:

Load any basemaps that may be helpful in locating social trails and review what data have already been collected.

Some examples of useful basemaps include (but are not limited to) the following:

- Administrative boundaries
- Roads
- System trails
- Social trails that have previously been mapped
- Water layers with the locations of lakes and rivers
- Topographic maps
- Campsite maps

When choosing which and how many basemaps to include, be conscious of the memory space available on devices. In addition to preparing basemaps and loading these onto the GPS-based device, be sure that all technology is fully charged prior to heading into the field for data collection. Prepare and pack extra batteries or other means of charging the batteries of your devices (such as portable solar panels or a portable, external battery charger).

Using Foot Searches for Locating Social Trails:

Locations searched for social trails should be carefully mapped to ensure that future monitoring can be done within the same locations.

Likely locations for social trails include the following:

- Areas near trailheads where there may be “toilet” trails or shortcuts from parking areas to system trails
- Trail junctions
- Water bodies near a system trail (generally within ¼ mile of the trail in forested environments) or that are visible from a system trail
- Access to climbing routes
- Scenic viewpoints
- Places where off-trail travel is facilitated by topography and vegetation (e.g., subalpine areas with open views)
- Camping areas
- Features named on maps
- Abandoned system trails, if they are actively being used by visitors

- Approved non-compliant structures and historic structures/features of interest (e.g., lookouts, cabins)
- Areas adjacent to high-use locations outside park boundaries that don’t have trailhead facilities or designated trails (e.g., youth camps, private residences)
- River corridors where access is by boat

When searching an area for social trails, the following process should be used:

- Within the search area, walk the length of all system trails, looking carefully for social trails.
- In areas with dense networks of social trails, it will be helpful to scope the area out to understand where the different segments and spurs are, so you can have a plan for monitoring all of them. (See “special considerations – networks of trails.”)
- At lakes or along rivers, travel around the shoreline or riparian area to the extent possible given vegetation and topography.
- Where lakes are relatively near each other, explore for user trails connecting one lake to another.
- In locations where trails are close to lakes or rivers, look for user trails providing short-cuts to water access.
- In areas with resistant or resilient meadow vegetation, look for user trails where the meadow and forest meet.

Spatial Mapping of Social Trails:

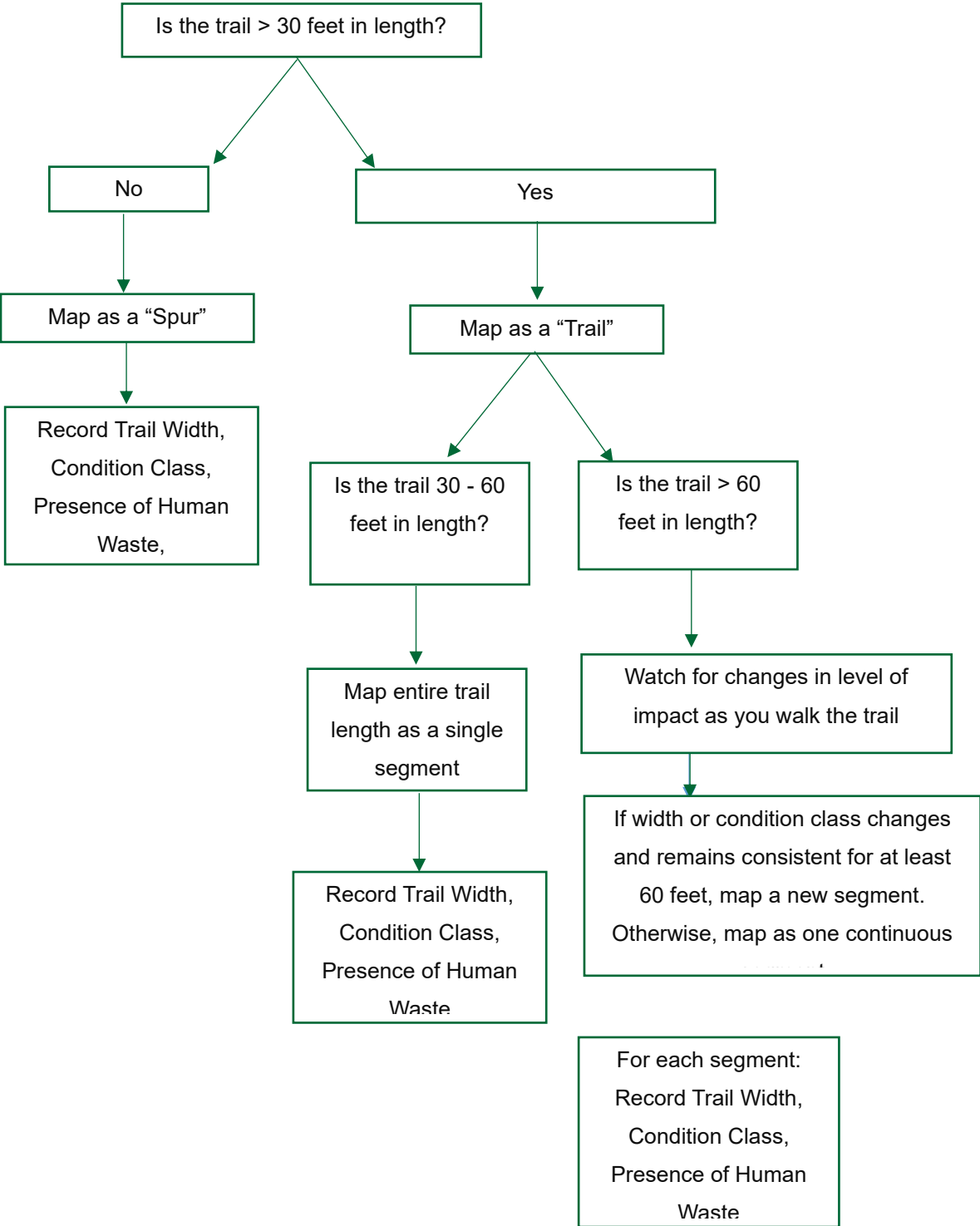
Once a social trail has been located, **determine if the segment is at least 30 feet in length** – this will determine whether to map it as a trail or as a spur (see Figure 1).

For trails, the lineal extent will be mapped using a GPS unit or GPS-enabled phone or tablet.

- 1) Starting at the location where the social trail intersects with an organizing feature (designated system trail, another social trail, campsite, etc.), **record a few (2-3) points to mark the start of the trail accurately.**
- 2) While recording with the GPS unit or GPS-enabled phone or tablet, **walk the extent of the social trail (at an average hiking pace) to its completion.**
 - a. If the trail takes any sharp curves, be sure to pause at these changes in direction to ensure accurate mapping.
- 3) Once you reach the end of the social trail, **record a few points (2-3) with the GPS or GPS-enabled phone or tablet unit to ensure the end-point of the social trail is recorded accurately.**

For trail spurs, the only GPS data that will be recorded are the points where the spur leaves an organizing feature.

Figure 1. Decision tree for monitoring social trails and spurs.



Assess the Level of Impact:

- 1) While hiking the social trail – or visually scanning trail spurs -- note all instances of human waste (such as the presence of toilet paper) that are observed while mapping the extent of the trail.

- 2) Also, make note of the level of impact in preparation for assigning impact categories and ratings to the social trail or spur. **The observations related to impacts to vegetation and soil should be made in relation to nearby, undisturbed locations.** In other words, consider how much vegetation loss and soil impact there is on the social trail/spur when compared to nearby areas that visitors do not use.
 - a. Specifically, make a mental note of the **average level of vegetation loss and mineral soil exposure/erosion in the social trail tread, as well as the width of the trail or spur.**
 - b. The start of a social trail or social trail spur may be wider or have more soil impact than the rest of that social trail or spur. Be sure to scope the social trail or social trail spur without mapping for a few feet *before* thinking about assigning a width category or **condition class** rating so that you are not unduly biased by what you see at the beginning of the trail or spur.
 - c. For social trails, you should wait to assign impact characteristics until after you have mapped the length of the trail and observed the level of impact for the entire extent of the social trail.
 - d. Although conditions and widths will almost always vary somewhat within a trail, you will assign the condition class and width categories that are most typical of that segment or spur (the average width or condition class).
 - e. **If a social trail's condition or width class changes and remains different for at least 60 feet, then this will be recorded as a new trail segment.** (See Figure 2 for a hypothetical illustration.)

- 3) Once the lineal extent of the trail has been mapped, then the level of impact to the social trail will be recorded. Each trail/spur will be assigned a specific category for each type of impact – when assigning the categories of trail width and condition class consider the average impact to the entire social trail that was just mapped.
 - a. Assign the average trail width of the social trail/spur into one of three categories:
 - Category 1: < 12 inches in width
 - Category 2: 12 inches – 24 inches in width
 - Category 3: > 24 inches in width

 - b. Assign the social trail/spur to one of **three average condition class ratings as described below in Table 2** (See Appendix B for photographs illustrating condition classes).
 - When assigning condition class ratings, be sure to compare social trail/spur conditions to the surrounding vegetation community and soil type.

- These condition classes are meant to document the level of *change* from undisturbed conditions. Some ecological communities may naturally be sparse in terms of vegetation.
- Higher condition class values represent an increasing level of disturbance to the natural community (1 = very little disturbance to 3 = highly disturbed).

Table 2: Description of condition class ratings

Condition Class Rating	Description
Class 1	Slight loss of vegetation relative to undisturbed adjacent areas; no soil disturbance or erosion. Lowest level of ecological impact for this ecosystem.
Class 2	Significant vegetation loss compared to undisturbed adjacent areas, but some vegetation remaining in tread; no soil disturbance or erosion. Moderate amount of ecological impact for this ecosystem.
Class 3	Complete loss of vegetation compared to surroundings, and/or soil disturbance or erosion obvious and significant . Highest amount of ecological impact for this ecosystem.

Note about areas with little natural vegetation:

It can be difficult to assign condition classes in areas with naturally little vegetation. Therefore, this protocol provides different guidelines for areas with ≥10% vegetation in the surrounding area and areas with 1-10% vegetation. Condition Class Rating for trails and spurs **in areas with at least 10% vegetation cover** should follow these rules: In areas with 1-10% surrounding vegetation cover, trails/spurs should be assigned Class 1 for minimal soil disturbance and Class 2 for moderate to significant soil disturbance/erosion. Class 3 is not appropriate in these areas, because of the lack of vegetation during undisturbed conditions. Also, in these areas, enter 'B' for barren in the comments (such as a cinder cone or sandy trail) and "A" for alpine areas.

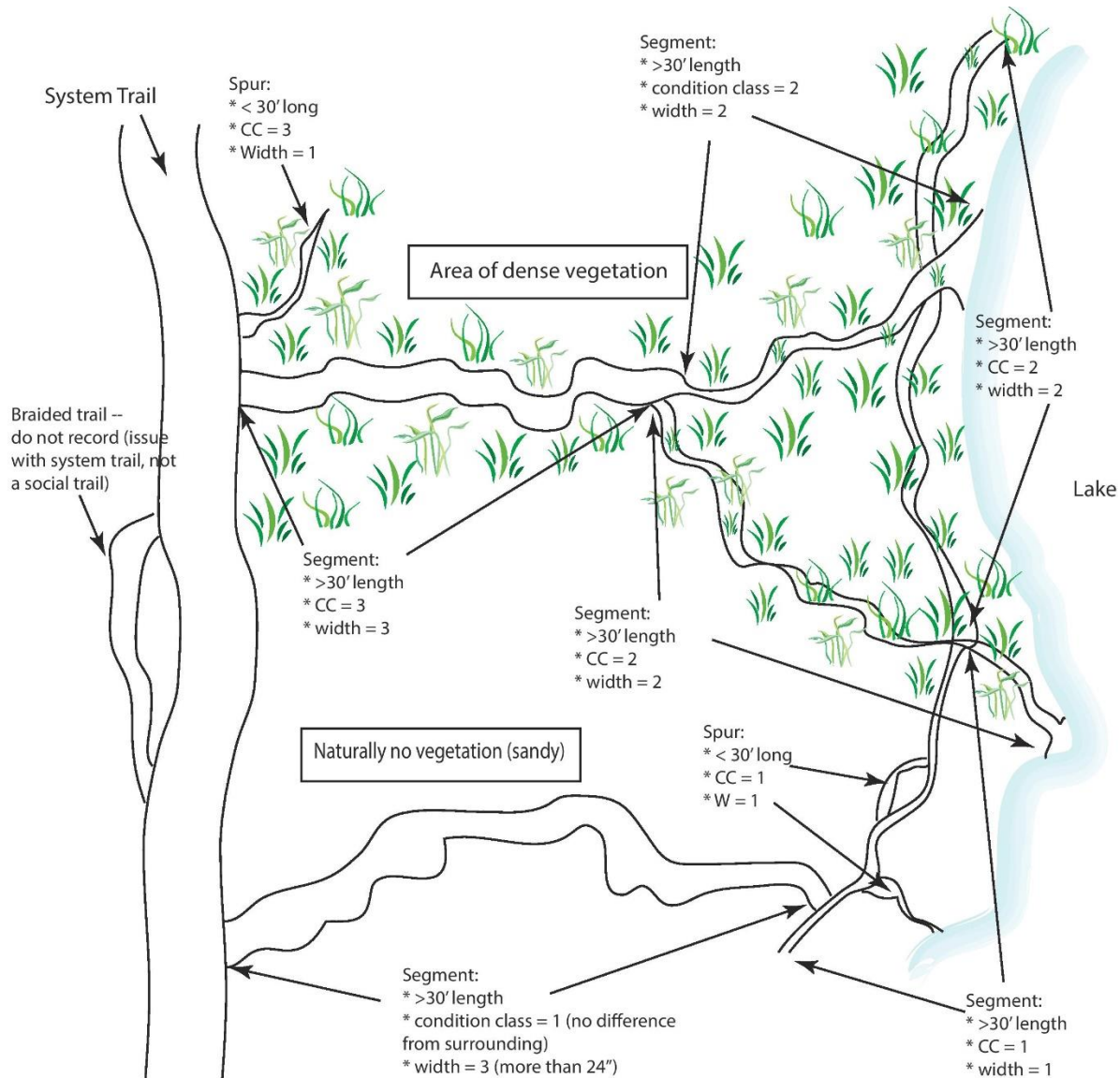
- 1) Assign the social trail to one of four categories of human waste presence.
 - Category 0: No human waste or toilet paper observed
 - Category 1: 1 instance of human waste/toilet paper observed
 - Category 2: 2 – 3 instances of human waste/toilet paper observed
 - Category 3: >3 instances of human waste/toilet paper observed.

- 2) Optional, but recommended: If a primary use of the social trail can be determined, that information can be recorded under the comments section of the data sheet or data dictionary. Examples of specific types of use that might be assigned to a social trail/spur include, but are not limited to the following:
 - Stock use
 - Fishing
 - Mountain biking
 - Hiking
 - Climbing access
 - Viewpoint access
 - Camping access
 - Toilet use
 - Accessing water

- 3) Use a “Comments” section in the data dictionary/mapping interface to provide any additional detail that may be useful to managers or may provide context about the social trail. If you are unsure if the information might be useful, record it anyway. Examples of things that might be important to note in the comments include (but are not limited to):
 - If visitors are actively maintaining the social trail
 - If the social trail leads to known cultural or historical resources
 - If built structures are found on or near the social trail
 - If the trail is an abandoned/decommissioned system trail that is still receiving use
 - If there are special considerations about the environment, such as barren area or alpine environment

See Appendix C for a pocket-sized field card that can be printed and used for quick reference for the category descriptions for the level of impact characteristics.

Figure 2. Example Map of Social Trails, Illustrating Segmenting, Spurs, and Conditions



- Condition Class 1: Slight loss of vegetation relative to undisturbed adjacent areas, no soil disturbance or erosion. Lowest level of ecological impact for this ecosystem.
- Condition Class 2: Significant vegetation loss compared to undisturbed adjacent areas, no soil disturbance or erosion. Moderate amount of ecological impact for this ecosystem.
- Condition Class 3: Complete loss of vegetation compared to surroundings, soil
- Width Category 1: < 12 inches
- Width Category 2: 12 inches – 24 inches
- Width Category 3: > 24 inches

Situations with Special Considerations

Long social trails with varying conditions:

There is no maximum length for a social trail – some social trails may be extremely long, such as those circling a lake or following the path of a river. Often, a single social trail may change drastically in terms of the level of impact to the trail from visitor use. For instance, vegetation loss may be much higher where a trail is within a forest than where it crosses a meadow. When this happens, a single trail should be mapped as multiple segments. Specifically, if the width or condition of the trail changes from one class to another and remains in that new width or condition class for more than 60 feet, then a new segment of trail should be mapped (see Figure 1 and Figure 2). To do this, stop at the point where impact changes from one category to another and map a few (2-3) points where those conditions end. This will be the end of the social trail segment. Record the average width category, condition class rating, and instances of human waste for that social trail segment. Then, start mapping the lineal extent of a new social trail segment at the same location where you ended the previous trail segment. Continue by following the protocol outlined above.

Social trail networks where multiple social trails and spurs emanate from each other:

It is often efficient to begin by mapping the main social trail that appears to have the highest level of impact. (Map this social trail in segments, as appropriate, if its width or condition class changes, per guidelines above.) Then, re-walk the social trail that was just mapped, mapping and assessing each social trail and spur that originates off of this main social trail. This type of situation may be common around lakes, along rivers, at campsite clusters, and at viewpoints.

Very short (<30 feet) social trails:

These social trail “spurs” should be mapped as points instead of linear features. A waypoint can be recorded with the GPS unit or GPS-enabled phone or tablet at the location where the trail intersects with the designated trail, another social trail, or campsite. Information about the level of impact will still be recorded (average width category, condition class rating, and instances of human waste) for the social trail spur as described in the *Assessment of Level of Impact* section.

Re-routes of system trails and abandoned trails: In many parks, historic trails ran directly through meadows or up slopes. Where trails have been re-routed, the original trail tread may still be in use. Where this is the case, the abandoned trails should be monitored as long as there are signs of active use by visitors. Abandoned trails that are no longer used by visitors are not required to be mapped and assessed as part of this protocol. (However, if a local unit decides to monitor such trails, they may do so.)

Social trails within campsites or campsite clusters:

Campsites typically have social trails or spurs linking them to system trails, access to water, or other campsites. These trails should be monitored under this protocol. However, short social trails *within* a single campsite (e.g., connecting a tent pad to the fire area) should not be monitored.

Animal “Game” trails:

Animal trails can sometimes be confused with social trails. Animal trails should not be monitored, unless it is clear that they are being used by recreational visitors. Social trails generally head towards a destination, following topography, and go through vegetation that is easy for human travel. Animal trails may meander or be found on steep grades; watch for signs of wildlife, such as wildlife prints or scat, that may indicate a game trail.

Unsafe trails:

Occasionally, you may come across a social trail that is too steep, too eroded, or too close to the edge of a cliff or waterbody to map safely. In such cases, use your best judgment to keep you and your group safe. If you deem it too dangerous to map a social trail, mark the location where the social trail starts, following the procedures for mapping a social trail spur. In the comments section, make note of why you were unable to map the social trail.

Social trails in restricted areas: Social trails are sometimes closed off for safety reasons or restoration. If closing the trails has worked to prevent visitors from using the social trail, this protocol does not require mapping the social trail. However, some units may wish to include such trails in their monitoring, and that decision must be made locally.

Technical Directions

Note: These are just board, general technical directions that can be used. These technologies, apps, and software are constantly being updated. Please refer to the most current manuals and technical guides for the technology you will be using to monitor social trails and follow those specific instructions.

Data Collection

Recreation-grade GPS unit (e.g., Garmin) & Paper Data Collection:

Depending on the brand and model of the recreation-grade GPS unit, the specifics of how to record a track or waypoint vary. Please refer to the user guide of your specific recreation-grade GPS unit to determine how to record a trail and mark a waypoint before beginning the monitoring protocol. The steps listed below are meant to be general guidelines.

NOTE: when using a handheld GPS, once you start recording a trail segment, you may need to complete that track; depending on the unit, there may not be an ability to “pause” like there is with other technology. Therefore, it may be useful to explore an area and develop a plan before beginning to collect data.

Once a social trail or social trail spur has been located:

- 1) Clear any data that may have been recorded while locating the social trail.
- 2) Walk the length of the trail or trail segment with the GPS unit and save the track, giving it a Unique Trail ID. If it is a social trail spur (<30 feet in length), create a new waypoint and give it a Unique Trail ID.
- 3) Write the Unique Trail ID on the data sheet provided in Appendix D (be sure this ID matches the ID you have given the track or waypoint).

- 4) Continue to fill in the remaining columns according to the “Procedures” section of the protocol (above).
- 5) Repeat from step 1 for all new social trails/spurs or for new segments of longer social trails.

Note: Using a consistent naming convention is extremely important to enable pairing spatial data from the recreation-grade GPS units with the data collected on the paper data sheets. Be sure that a consistent naming convention is used and that the name given to the track or way point perfectly matches the name on the data sheet (and also the name entered in Excel during data entry). Names must match in all aspects, including use of upper/lower case, spaces, and symbols.

Mapping-Grade GPS Units (E.g., Trimble GeoXT or Juno) and TerraSync Data Collection:

At the beginning of data collection:

- 1) Open TerraSync (or alternative mapping software pre-loaded onto the GPS unit)
- 2) Create a new data file and enter a unique name (E.g., monitoringsite_date).
- 3) Select the data dictionary (which will need to be created ahead of time) associated with the social trails protocol
- 4) The mapping interface should be set up to map both linear features (for social trails) and point features (for social trail spurs)

Once a social trail or social trail spur has been located:

- 1) Select the “Social Trail” feature when mapping a social trail (this will map as a linear feature). Select “Spur” when mapping a social trail spur (will map as a point feature).
- 2) Follow the “Procedures” section to map the linear extent of the social trail or mark a spur as a waypoint.
- 3) After mapping the location of the social trail, fill in the data dictionary using the drop-down menus or fill in data where appropriate. Refer to the “Procedures” section for a description of the categories for each attribute in the data dictionary.
- 4) Close the feature when the data dictionary has been completely filled out.

Mapping App for Smart Phones and Tablets:

At the beginning of data collection **while connected to Wi-Fi** (otherwise, the data will not be downloaded and saved):

- 1) Open the “Field Maps” (or similar mapping) app on your smartphone or tablet.
- 2) Sign in to the appropriate organizational account using your username and password.
- 3) Download the features and basemap for your project area.
- 4) Open Social Trail map (this map for field data collection will need to be set up ahead of time)

Once a social trail or a social trail spur has been located:

Note: The specifics of these steps may change as apps are updated, these are just general guidelines to follow based on the current interface in Field Maps.

- 1) While standing at the start of the social trail or the social trail spur, tap the “Collect New” or “+” button in the Social Trail Monitoring map.
- 2) (2a) Select the “Social Trail” button when mapping a social trail and move on to step 3. If you have located a social trail spur, use step 2b. Social trails should be mapped as linear features using a “streaming” mapping technique.
- 3) (2b) Select “Spur” when mapping a social trail spur which should be mapped as a point feature. Data will begin collecting automatically for a social trail spur. So once you click “Spur” you can immediately begin entering the characteristic data (condition class, width, human waste, and activity type) by moving on to Step 4.
- 4) Follow the “Procedures” section to map the linear extent of the social trail. Ensuring that the data collected is “streaming” (i.e., collecting points automatically as you walk the social trail).
- 5) After mapping the location of the social trail or social trail spur, fill in the attribute table associated with the feature you just mapped. Refer to the “Procedures” section for a description of the categories for each attribute in the data dictionary.
- 6) Tap “Done” when you have completed mapping the social trail and entering the attribute data.

After Data Collection:

Recreation-grade GPS unit (e.g., Garmin) & Paper Data Collection:

Upon return to the office:

- 1) Manually enter the data from paper data sheets into Excel using the same headings as the column names on the data sheets. See Figure 3 for an example of how data should be entered.
- 2) Once data have been entered, file the data sheets into a safe location in case they need to be cross-referenced at a later time.
- 3) Using the software program provided by the GPS manufacturer download the social trail tracks and social trail spur waypoints from the GPS unit.

Figure 3. Example of data entry in Excel for paper data collection. The comments section can contain other information that managers may find useful.

	A	B	C	D	E	F	G
1	Trail_ID	Spur	Width	CC	Waste	Activity Type	Comments
2	2000-001	No	2	2	0	Scenic	
3	2000 01	No	2	2	0	Follows Dry Stream, Campsite Access	
4	2000 02	Yes	2	2	0	Follows Dry Stream, Campsite Access	
5	2000 03	No	1	2	0	Follows Dry Stream, Campsite Access	
6	2000 04	No	1	2	0	View Access	
7	2000 001	No	1	1	0	Camping	
8	2000 002	Yes	1	1	0	to social trail	
9	2000 003	No	1	1	0	to view	
10	2000 005	No	2	1	0	View Point	
11	2000 006	No	2	1	0	View Point	
12	2000 007	No	2	2	0	View Point	
13	2000 008	No	2	2	0	View Point	
14	2000 009	No	1	1	0	View Point	
15	2000 010	No	2	2	0	Day Use for camp	
16	2000 011	No	2	2	0	Day Use for camp	
17	2000 012	Yes	1	1	0	Campsite Access	
18	2000 013	Yes	1	1	0	Campsite Access	
19	2000 014	Yes	2	2	0	Campsite Access	
20	2000 015	Yes	1	2	0	Campsite Access	
21	2000 016	No	3	2	0	Water Access	
22	2000 017	No	3	2	0	Water Access	
23	2000 018	No	2	2	0	Stock Water Crossing	
24	2000 019	No	2	2	0	Stock Water Crossing	

Mapping-Grade GPS Units (E.g., Trimble GeoXT or Juno) and TerraSync Data Collection:

Upon return to the office:

- 1) Use TerraSync (or a similar program) to import the social trails and social trail spurs into PathFinder Office (or a similar program).
- 2) Export the data as Shapefiles using the appropriate datum and projection.
- 3) Open in mapping software (i.e., ESRI ArcGIS Pro) and define the datum and projection in preparation for data analysis.

Mapping App for Smart Phones and Tablets:

Upon return to office:

****Ensure you have Wi-Fi access in order for data to upload****

- 1) Open app
- 2) Sync your data to the cloud

Be sure to back up all data in multiple locations and maintain any paper-based data sheets.

Before heading back into the field for additional data collection, you may want to upload the social trails layer collected during previous monitoring efforts as a base layer on these devices to prevent remapping of any social trails. The social trails layer should show you which social trails were mapped during previous data collection efforts that season.

It is recommended that spatial data be examined for quality control and quality assurance regularly during the data collection season. It is not advisable to wait to look at the data in GIS.

Data Management and Analysis Guidelines

Data Preparation and Processing

ALWAYS make a backup copy of the social trails shapefiles before beginning any analysis – you should always do your analysis on a copy of the original shapefile in case errors are made or data are lost.

Before any analysis is completed, it is recommended that data be brought into GIS and examined for quality control and quality assurance. After importing the shapefiles into GIS, be sure to examine the data for duplicate social trails or spurs. If duplicates or significant errors (such as mistakenly mapping a large part of a system trail or forgetting to stop data collection after mapping a social trail and mapping while you are searching for other trails) are found in the shapefiles, you can delete these features or edit them. If you are not familiar with these techniques, consult with a GIS specialist.

Extra steps are required for data collected with a recreation-grade GPS unit and associated paper records of characteristics. For all other data collection techniques, the data files should already be in shapefile format, and no additional steps will be needed. The data files can simply be opened directly into a GIS environment. If the data does not display correctly, make sure that the shapefile has the correct projection.

Data Analysis in GIS Environment

This section will highlight specific social trail summaries that may be of interest. Specific steps for how to conduct these analyses are not provided here; please consult with your GIS specialists.

Calculating Length of Social Trails:

Data collected with mapping-grade GPS units or smartphones/tablet applications will already contain the length of the social trails in the attribute table (remember that social trail spurs have no length associated with them, as they are mapped as points). However, the length will be in meters and you may wish to recalculate the length to feet or other units. Data collected with the recreation-grade GPS units will not have the length automatically calculated, and the length will need to be added in a GIS environment.

Displaying Social Trails by Impact Characteristics:

As a good visual way to examine both the extent of social trails and the level of impact, you can create a map that displays the trails and spurs by condition class or other impact characteristics of interest by changing the symbology in GIS.

Calculate Density of Social Trails:

The “Line Density” tool in ArcGIS (or the “Point Density” tool for social trail spurs) – or similar tools in GIS - can be used to identify areas of high densities of social trails and social trail impacts. This may help prioritize management attention to certain locations. For the line density tool, all trails that are used in the density calculation need to be in a single shapefile. A search radius will need to be determined for these analyses.

Data Analysis in Table Format

Exporting Attribute Tables from GIS Environment:

The social trail impact characteristic information (condition class, width category, and human waste) and the newly calculated length for social trails (vs. spurs) will be associated with the shapefiles. Although it is possible to calculate simple statistics and summarize data in GIS, exporting these tables into Excel or a similar spreadsheet program can make the analysis and summary of these impact characteristics much easier.

Tabular Analyses:

Once all the data are in Excel format, you can begin summarizing the social trail impact characteristics. The Excel file can also be used to summarize total length by condition class by sorting and summarizing the Excel file columns by condition class or by using pivot tables. This protocol focuses primarily on data collection protocols and does not go into detail about analysis in Excel or how to use Excel. There are many online resources for using formulas in Excel; please make use of these resources if you are unfamiliar with Excel.

It is important to note that for this protocol calculating means and standard deviations for lengths of social trails is not advised. These values could be misleading since individual social trails may have been mapped in multiple segments due to changes in impact characteristics. Therefore, it is recommended that total lengths by category should be used as the main method to summarize the overall extent of social trails, condition class, and trail width. For the occurrences of human waste, the total number of occurrences within each human waste category should be reported.

See Appendix E for a list of FAQs related to implementing this protocol.

See Appendix F for example tables and figures of potential analysis related to this protocol.

APPENDICES

Appendix A. Glossary

- **Condition Class.** An assessment of the overall condition of the social trail or spur, based on vegetation loss and mineral soil exposure/erosion. Does not take into account trail width, which is tracked separately.
- **Mineral Soil.** Mineral soil is soil that contains no organic material. In forested environments, the when vegetation is lost, the soil that is exposed may be “organic” horizons, consisting of pulverized organic matter or duff. Mineral soil is beneath these organic soil horizons.
- **Social Trail.** Non-system, informal, trails created by visitor use that were not installed and/or not maintained by managers; may also include decommissioned system trails that are still used by recreational visitors. Also called “user trails.”
- **Social Trail Spur.** Segments of social trail that are less than 30 feet in length. Spurs are mapped as points, not linear features.
- **Trail Width.** The average length of a trail or spur’s cross-section.
- **User Trail.** See “social trail.”
- **Vegetation Loss.** This protocol requires assessing the relative loss of vegetation within the trail compared to the surrounding area. Essentially, a determination is made about how much vegetation would have been present if not for trampling by people

Appendix B: Condition Class Rating Examples

(Two Photos for Each Condition Class)

Condition Class 1



Condition Class 1



Condition Class 2



Condition Class 2



Condition Class 3



Condition Class 3



Appendix C: Summary of Social Trail Characteristics -- Field Guide

Can be printed on a small card to be taken into the field

Characteristic	Description	
Trail Width	1	< 12 inches in width
	2	12 - 24 inches in width
	3	> 24 inches in width
Condition Class (compare to adjacent unimpacted areas)	1	Slight vegetation loss, no soil damage, low ecological impact
	2	Significant vegetation loss, no soil damage, moderate ecological impact
	3	Complete loss of vegetation, soil damage, high level of ecological impact
Presence of Human Waste	0	No human waste or toilet paper observed
	1	1 instance of human waste or toilet paper observed
	2	2-3 instance of human waste or toilet paper observed
	3	>3 instance of human waste or toilet paper observed

Appendix E. Frequently Asked Questions

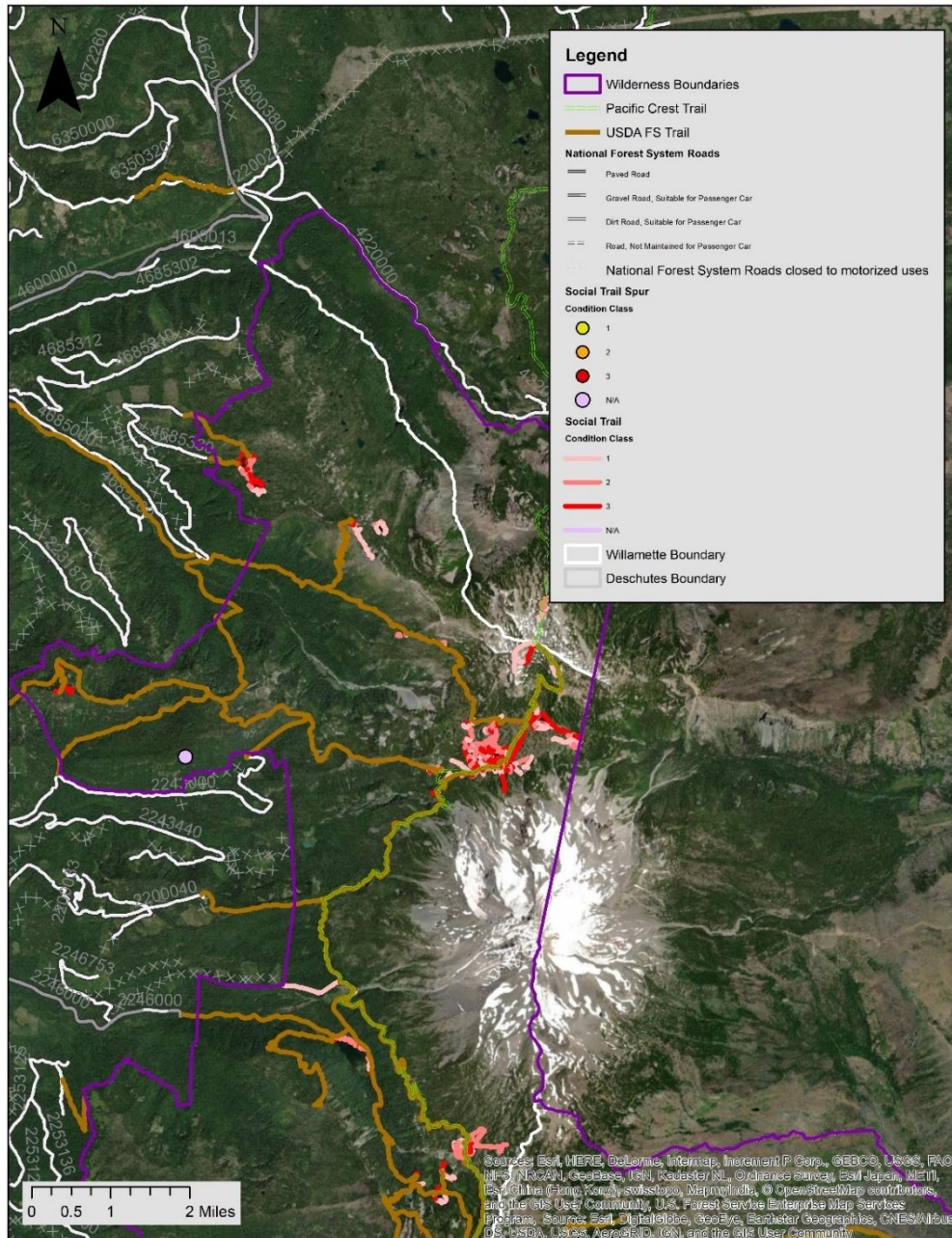
- **How much time will it take to monitor social trails?**
 - The time required for monitoring could vary considerably depending on the size of a park, the extent and distribution of social trails, personnel available, and whether or not personnel are performing other duties at the same time (e.g., visitor contacts and campsite cleanup). A smaller park with relatively low use may only take a couple of days for one or two people. Larger areas with higher visitor use could take several multi-day visits to complete monitoring. It is clear that having at least two people in the field significantly improves efficiency if at least one person can monitor social trails while others complete other duties.
- **What is mineral soil?**
 - Mineral soil has no organic component. Pulverized duff or leaf litter is not mineral soil. (See Appendix A – Glossary.)
- **How do I know when mineral soil exposure is “significant”?**
 - In areas with naturally no vegetation (e.g., sandy washes or cinder cones), user trails can be large and highly visible. However, in these environments, the trails may have little ecological impact. Mineral soil exposure is considered significant when it has impact on the biotic components of ecosystems, such as introducing sediment into water bodies. Therefore, a social trail in unvegetated areas might be evaluated as condition class 1, and the visible aspects of such trails would be captured with the width classification.
- **How do I determine the “average” condition and width of a trail segment?**
 - Visually examine the entire length of the segment or spur. For longer trails, this may require stopping every few meters to assess width, vegetation cover, and mineral soil exposure. Be sure your overall assessment is not biased by a few very impacted or lightly impacted parts of the trail.
- **What do I do if a social trail “disappears” and then picks up again?**
 - In some environments, a social trail may be quite evident (wide with significant vegetation loss) but then essentially disappear for a stretch (in a meadow, for instance). When this occurs, record a separate trail segment for each impacted area and do not record a trail if there is no visible evidence of impact (even if you know people are walking in that area). This protocol only monitors visibly impacted social trails/spurs.
- **Where do I start monitoring a trail at the edge of a campsite?**
 - Where there is a definite edge to the campsite (e.g., a notable change in vegetation cover, a topographic feature, or other boundary) begin recording at that edge. In cases where a major user trail bisects a campsite, continue recording the trail through the site. (Ask yourself, do people use this trail to access some attraction or feature, apart from camping?)
- **How do I monitor vertical climbing routes?**
 - Trails at the base of climbs are monitored like any other social trail or recreation site.
 - Rock faces are not monitored as social trails. If data are needed about the extent and condition of climbs, a different protocol will be needed.

- **Should sections of abandoned system trails be included?**
 - If abandoned system trails (or decommissioned roads) are continuing to receive recreational use, they should be included as social trails.
 - If such trails/roads are not receiving use, it is up to the local unit to decide whether to monitor them. These decisions should be documented in analysis reports.
- **Should I calculate the mean and standard deviation of the trail length?**
 - No – some social trails may have been mapped in segments if the impact characteristics changed across the length of the social trail. Therefore the mean and standard deviation could be misleading and would only provide information about the mean of social trail *segments* not all individual social trails in an area.
 - For this protocol, it is recommended that you calculate total lengths, summarize the total length by the impact characteristics, and report frequencies of the impact characteristics categories (especially true for human waste occurrences). See Kooistra et al. (2016) for examples.
- **Can I change this protocol?**
 - This protocol includes the minimum elements recommended to monitor and assess social trails. However, it is entirely appropriate, and sometimes recommended, that local parks add additional fields, such as activity type. This type of information can be included within the "comments" field or can be added as entirely new fields.

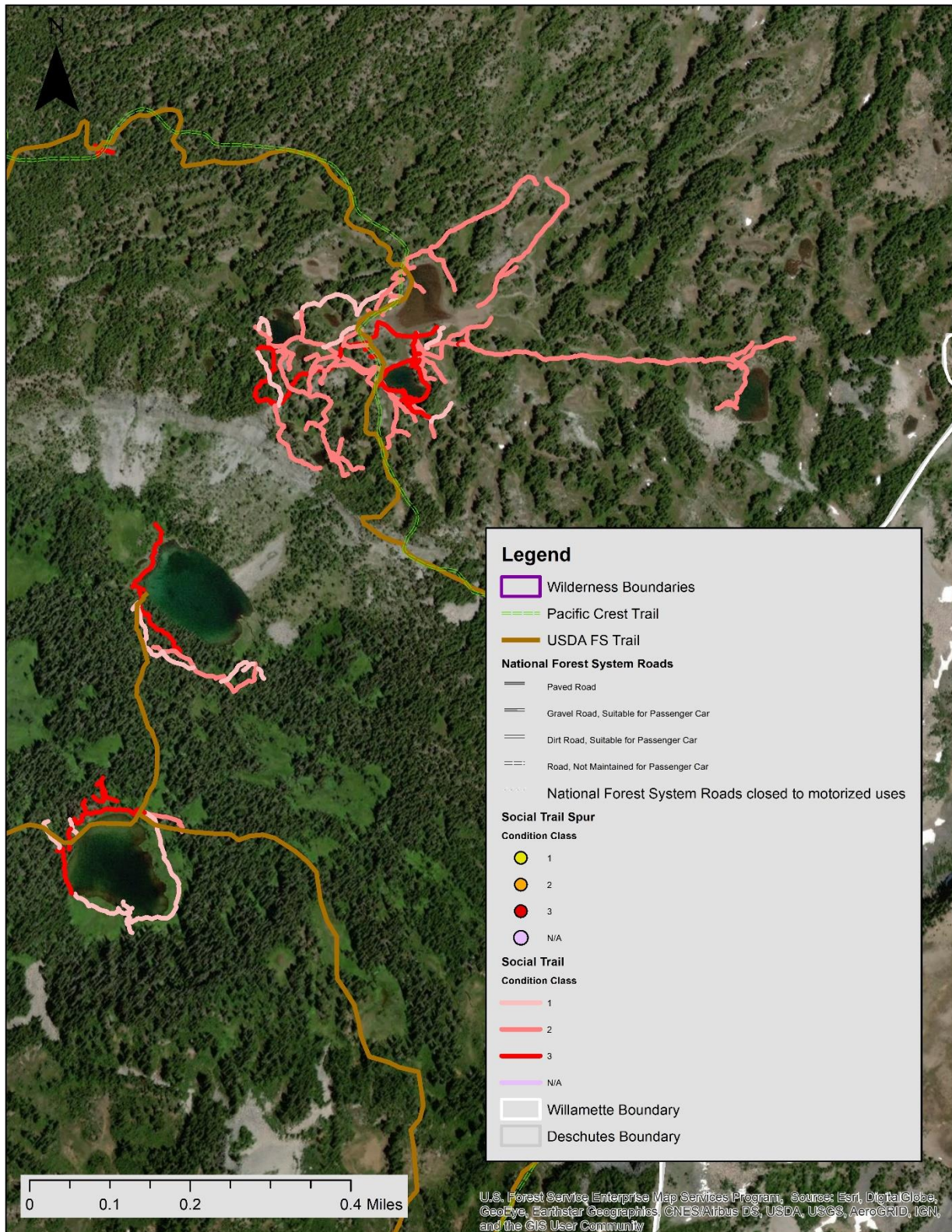
Appendix F. Example Maps and Tables

Examples from: D’Antonio, A. (2018). *Social Trail Monitoring Summary: 2018 Data Collection Mt. Jefferson, Mt. Washington, Three Sisters, and Diamond Peak Wilderness*. Corvallis, Oregon: Oregon State University

Map of the most northern region of Mt. Jefferson Wilderness in Oregon with social trail spurs and trails represented by their condition class ratings.



Hunts Cove and Coyote Lake (Oregon) area social trails and social trail spurs represented by condition class.



Overall summary of number of social trail spurs and number and length (in ft) for social trails mapped in the Mt. Jefferson Wilderness. Social trail spurs have no exact length measure associated with them.

	Social Trail Spurs	Social Trails
Total Number	4	883
Average Condition Class of Segments	1.3	2.1
Average Length (ft)	N/A	291
Total Length (ft)	N/A	257,681

Summary of characteristics recorded for social trails in the Mt. Jefferson Wilderness in Oregon. 'N/A' means this characteristic category was left blank during data collection.

	Total Length (ft)	Total Number	Frequency of Total Trails
Condition Class			
1	67,631	213	24%
2	100,339	368	42%
3	89,701	301	34%
N/A	10	1	0%
Trail Width			
<12"	128,769	460	52%
12" - 24"	103,336	353	40%
> 24"	25,576	69	8%
N/A	10	1	0%
Human Waste			
None	240,293	817	93%
1 instance	11,203	39	4%
2 - 3 instances	4,769	17	2%
>3 instances	603	4	0%
N/A	813	6	1%

RESOURCES

- D'Antonio, A. (2018). *Social Trail Monitoring Summary: 2018 Data Collection Mt. Jefferson, Mt. Washington, Three Sisters, and Diamon Peak Wilderness*. Corvallis, Oregon: Oregon State University
- D'Antonio, A. & Hall, T. (2016). *US Forest Service Minimum Protocol for Social Trail Monitoring in Wilderness*. Corvallis, OR: Oregon State University.

RECOMMENDED PROTOCOL CITATION

D'Antonio, A., Hall, T. E., & Aberg, M. (2023). Social Trail Monitoring. Protocol prepared for the Visitor Use Management Toolkit. Corvallis, OR: Oregon State University, Department of Forest Ecosystems & Society.